SYSTEM ADMINISTRATION GUIDE

Release 9.3-MP3 (April 2020)

StiboSystems
MASTER DATA MANAGEMENT

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System Administration

There are many administrative tasks that are needed to keep a STEP system running at optimum levels. This section of the documentation introduces those responsible to the common tasks, challenges, and issues that often occur when working with administration of a complete STEP system and infrastructure.

Some of the information presented may not be applicable to all systems. Any questions should be directed to your Stibo Systems' representative or the Stibo Systems Technical Support department.

The System Administration section includes the main topics below:

- Infrastructure Requirements
- Installing STEP
- Optimizing Performance
- Patching STEP
- STEP Architecture

Infrastructure Requirements

Meeting the following infrastructure requirements allows you to ensure a successful STEP setup.

- Platform and Software Support is addressed for each release. For example, see the **9.3 Platform and Software Support** topic within the **System Release and Patch Notes / Platform and Software Support** documentation.
- Virtualization and Cloud Support
- Network Requirements
- Storage Performance Requirements
- High Availability Considerations

Virtualization and Cloud Support

This is one of the infrastructure requirements for a successful STEP setup. The full list is defined in the **Infrastructure Requirements** topic.

Supporting STEP via virtualization or cloud involves separate requirements. For details, see the following topics:

- Virtualization Support
- Cloud Support

Virtualization Support

Virtualization of STEP has officially been released on the following platforms:

- VMware ESXi 5+ for the following guest OS platforms:
  - Red Hat Enterprise Linux 7 / 6 x86-64
  - Oracle Enterprise Linux 7 / 6 x86-64
  - Windows Server 2016 / 2012 R2 x86-64
- Microsoft Hyper-V 2016 / 2012 R2 for the following guest OS platforms:
  - Windows Server 2016 / 2012 R2 x86-64 platform.

The only supported virtualization environments are VMware and Hyper-V on x86-64 based platforms.

Scope and Restrictions

Consider the following restrictions regarding virtualization:

- Virtualization of the STEP application uses a supported OS platform, as listed above.
- Virtualization of the STEP Oracle database is supported in non-production environments on all released OS platforms, as indicated above.
- Virtualization of the production database must be evaluated on a case-by-case basis, based on system load and sizing expectations. It is conditional upon a performance test conducted jointly by the parties and finally approved by Stibo Systems.
- Virtualization of a DTP server is supported only on the Windows Server 2016 / 2012 R2 OS platform.

Licensing and Support Using VMware

Regarding licensing of the Oracle Database on the VMware virtualization platform, the VMware host environment must have no license violations. This is independent of the supported OS being used. Oracle does not license at the OS level.

VMware licensing and 'expanded support' when virtualizing the Oracle Database on their platform is described in the document **Understanding Oracle Certification, Support and Licensing for VMware Environments** on the web at http://www.vmware.com/files/pdf/solutions/oracle/Understanding_Oracle_Certification_Support_Licensing_VMware_environments.pdf.

Requirements

The following requirements must be met by the system and infrastructure when considering virtualization using VMware or Hyper-V:

- Hypervisor must be VMware ESXi 5+ or Microsoft Hyper-V 2016 / 2012 R2.
- VMware or Hyper-V servers must be guaranteed to provide a constant capacity in terms of RAM, CPU power and I/O that is equivalent to that of a physical system.

- STEP version must be 7.0 or newer.
- Stibo Standalone application server is based on the Oracle Java SE component.
- Oracle Java 8 (1.8.0_162+).
- Host processor must match (or be similar to) what is recommended in this document. Processors like the Intel low-power CPUs are not supported for production environments.
- Storage and network requirements must be met as described in this document.

If a performance problem occurs and Stibo Systems and the client come to the conclusion that it is caused by the virtualization of the Oracle Database, the client is responsible for resolving the problem. Stibo Systems will assist where possible.

Recommendations for Best VMware Performance

It is critical that VMware is configured correctly for maximum performance.

This is done by following the recommendations in the white paper **Performance Best Practices for VMware vSphere**. Especially the sections on Host Power Management in ESXi and Running Network Latency Sensitive Applications.

This includes:

- Configuring ESXi policy to use 'High Performance' power option
- Reserving CPU and memory resources

The **Performance Best Practices for VMware vSphere** are online, based on versions, as follows:

- v5.5: https://www.vmware.com/pdf/Perf_Best_Practices_vSphere5.5.pdf
- v6.0: https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/techpaper/vmware-perfbest-practices-vsphere6-0-white-paper.pdf
- v6.5: https://www.vmware.com/content/dam/digitalmarketing/vmware/en/pdf/techpaper/performance/Perf_Best_Practices_vSphere65.pdf

Cloud Support

STEP is supported in the following major cloud providers:

- **Amazon Web Services** – AWS
- **Microsoft Azure Cloud** – When deploying STEP in Azure it must be observed that the Azure feature Accelerated Networking is a requirement for servers being part of a STEP environment.
- **Oracle Cloud Infrastructure - OCI** – The DBaaS on VM shapes has not been certified.
- **Oracle Cloud Infrastructure Classic - OCI Classic** – The Database Cloud Service (DBCS) on SSD storage has not been certified.

All requirements (network and storage) must be fulfilled as described and in the Infrastructure Recommendation being generated. These requirements are the same regardless of how and where the environment is hosted, and whether it is a physical or a virtual environment.

Hybrid Setup

A hybrid setup, where some servers are placed on the premises and others in the cloud, is not supported. Such a setup does not fulfill the performance requirements, especially related to network performance.

Oracle Licensing in AWS and Azure

When licensing Oracle in the cloud, see the **Licensing Oracle Software in the Cloud Computing Environment** paper published by Oracle, which describes how licensing works. This paper is available online at http://www.oracle.com/us/corporate/pricing/cloud-licensing-070579.pdf.

Oracle updated this document on January 23, 2018, indicating that within AWS (EC2 and RDS) and Azure, Oracle Standard Edition 2 may only be licensed on instances up to 8 vCPUs. If licensing Database Standard Edition 2 by Named User Plus metric, the minimums are 10 NUP licenses per 8 Amazon vCPUs or 8 Azure vCPUs. Contact your Stibo Systems representative for the latest update on how AWS and Azure handles this.

Network Requirements

This is one of the infrastructure requirements for a successful STEP setup. The full list is defined in the **Infrastructure Requirements** topic.

Network requirements include the following:

- Server-to-Server Connections
- Client-to-Server Connections
- Server-to-External Server Network Requirements
- SSL Certificates

Server-to-Server Connections

This is one of the network requirements for a successful STEP setup. The full list is defined in the **Network Requirements** topic.

All connectivity between servers within each environment must be direct connections. This can be achieved either through dedicated NICs or through point-to-point switches without the interference from any additional hardware and/or software.

The introduction of load balancing or firewall hardware and/or software known to cause the following issues due to limitations and malfunctions in the introduced hardware and/or software:

- degradation of performance
- server instability
- environment instability

Servers must have permanent IP addresses assigned, either by manually configuring network settings on the servers, or by dedicating a specific IP address for each server on the DHCP server. Server IP addresses must not change while the application is in operation. This is particularly important for systems with multiple application and/or database servers.

All application servers in a STEP application cluster must be located on the same network segment / VLAN, so a firewall may never be located between application servers.

It is not uncommon that application and database are placed on different networks, and thus separated by a firewall. This is accepted by Stibo System as long as the network latency requirements mentioned below are still met.

Network Bandwidth Requirement

Minimum requirement is 1 Gbit dedicated network between all servers, except to file servers. For enterprise systems with a heavy workload profile, a 10 Gbit dedicated network is recommended.

Important: Using the STEP In-Memory component requires a 10 Gbit network between application servers and database server.

Network Latency Requirements

The requirements for network latency between application servers in a STEP application cluster and between application server(s) and database server(s) are:

- Maximum 0.2 ms with a 64 bytes packet size
- Maximum 0.4 ms with a 8K packet size
- Maximum 1.-0 ms with a 32K packet size

For more information, see the **Network Latency Measurements and Tools** section of the **Infrastructure Checks** topic.

Server-to-Server Network Requirements

The following table summarizes the inter-server communication requirements:

Source	Target	Protocol	Port	Comment
Application Server	Application Server	Cache coherency	5636	Used for internal STEP application clustering cache. Only relevant when having more than one application server.
Application Server	Application Server	In-Memory	5999	STEP In-Memory data communication / exchange. Only relevant when there is more than one application server and using STEP In-Memory.
Application Server(s)	Database Server	SQL Net	1521	Communication between application and database. 1521 is the default port, so it could be different on any given installation.

Client-to-Server Connections

This is one of the network requirements for a successful STEP setup. The full list is defined in the **Network Requirements** topic.

The following table summarizes the network requirements between the STEP client and the STEP servers per concurrent user (see the **Concurrent User** section below):

Application	Bandwidth	Recommended Max. Latency	Protocol	Port	Encryption Option
STEP Workbench	20 MBit/s *(1)*	25 ms	HTTP	80	HTTPS (Port 443)
STEP Web UI	20 MBit/s *(1)*	25 ms	HTTP	80	HTTPS (Port 443)
STEP Publisher (STEP'n'design) Client	10 MBit/s *(2)*	25 ms	HTTP	80	HTTPS (Port 443)
Stibo Systems Support Client	20 MBit/s	25 ms	HTTP RDP SSH VNC SQL	80 3389 22 5900-5909 1521	HTTPS (Port 443)
Surveillance Agent	~30 MBit/s *(3)*	25 ms	TCP/IP	5666	SSH (Port 22)

(1) May be higher for clients that are uploading images. Any increase of the bandwidth requirement depends on the number and size of the images to be uploaded. The overall upload frequency with which images are uploaded contributes to the requirement as well.

(2) Data is transmitted only when page data is downloaded and saved back. Image data will be downloaded from a local image repository (a 1GBit LAN connection is recommended).

(3) The surveillance agent will be running with only one instance per server and the required bandwidth depends on the individual surveillance agent software. Stibo Systems uses Nagios for server surveillance. For information, see http://www.nagios.org.

Concurrent User

With the knowledge of how the client to server connection works, Stibo Systems defines the term 'concurrent user' as a user that is actively working in STEP by uploading and/or requesting data. This term is important when scaling or predicting network bandwidth for the network infrastructure. Only concurrent users contribute to the overall network load.

For example, the following behaviors constitute a concurrent user:

- Select a product
- Wait 15 sec
- Select another product
- Wait 15 sec
- Select an attribute
- Wait 15 sec
- Change attribute data and save changes
- Wait 15 sec
- …

STEP Workbench and Web UI

The STEP client only opens a connection to the STEP server when the user performs actions on the client. This can be by clicking buttons, browsing the product hierarchy, uploading data, etc. Clients that are only logged on to STEP, but otherwise are idle, do not transmit or receive any data (so there is no network usage).

A typical workbench user is conducting data maintenance tasks, enriching data, and performing import and exports based on the STEP import and export managers, as well as uploading and downloading images.

A typical Web UI user is conducting data maintenance tasks and enriching data as well as uploading and downloading images.

STEP Publisher (STEP'n'design) Client (DTP) Client

This user manually builds pages in Adobe® InDesign® and through the use of STEP Flatplanner. STEP Publisher (also known as STEP'n'design) is the STEP integration with Adobe® InDesign® and allows users to mount database information to an Adobe® InDesign® page.

The DTP client only exchanges data with the STEP system when:

- Loading page data
- Saving page data back to STEP

Important: Image data loaded from a local image repository vastly improves performance for remote users and reduces network usage.

Stibo Systems Support Client

Stibo Systems must be able to access the STEP server(s) hosted by the customer in order to provide support. When publishing is included in the solution, the customer must provide an InDesign client license that is available to the Stibo Systems support / consulting teams.

Surveillance Agent

A surveillance agent will only be installed on customer servers when a DBA agreement is signed between the customer and Stibo Systems.

Server-to-External Server Network Requirements

This is one of the network requirements for a successful STEP setup. The full list is defined in the **Network Requirements** topic.

This table summarizes the network between the STEP server and external servers for additional functionalities:

STEP Server	External Server	Protocol	Port	Comment
Application Server	Mail Server	SMTP	25	Used to send mail from the STEP system.
All STEP Servers	Time Server	UDP NTP	123	Access to time synchronization service.
Application Server	SFTP Server	SFTP	22	Import / Export of STEP and patch data.
Application Server	Stibo Systems Update Server	HTTPS	443	Update service for STEP software: https://updates.stibosystems.com.
Application Server	LDAP Server	LDAP LDAPS	389 636	External authentication using LDAP.
Asset Push File Server	Remote File Servers	RSYNC	873	Image replication / copying to remote locations.
All STEP Servers	Backup Server	?	?	Must be provided by the customer in order to perform system backup.
Bomgar Jumpoint proxy	Bomgar Appliance (Stibo)	HTTPS	443	Bomgar remote support access must be opened to the following addresses: • support.stibo.com - 217.28.168.103 • atl-bomgar.stibo.com – 217.28.163.56
All STEP servers	Bomgar Jumpoint proxy	HTTPS	443	Application and database servers uses the Bomgar Jumpoint proxy to connect to the Bomgar appliance at Stibo Systems.

SSL Certificates

This is one of the network requirements for a successful STEP setup. The full list is defined in the **Network Requirements** topic.

When configuring a STEP solution to use SSL encryption (typically done for external supplier access), it is important to only use certificates from a trusted CA authority, such as Verisign or Thawte.

Self-signed certificates are not supported by the STEP solution.

It is the responsibility of the customer / hosting partner to provide the required SSL certificates.

Storage Performance Requirements

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

Performance of the storage used for the database has been measured when testing scalability of the STEP solution. The I/O performance has been measured as IOPS.

The requirements for the database are:

- up to 2,500 IOPS during normal operations
- up to 5,000 IOPS during peak operations

The STEP Oracle Database uses a block size of 8 KB. The read / write ratio is typically between 60/40 and 70/30.

The application server (including shared storage) requires 500 – 1,000 IOPS.

For more information, see the **CPU and Storage** section of the **Infrastructure Checks** topic.

AWS EBS Storage Considerations

The following elements should be considered:

- EBS bandwidth — Depending on the chosen instance type, the EBS storage bandwidth varies. For example, the r4.4xlarge offers 3000 Mbit/s EBS storage bandwidth, whereas the r4.8xlarge offers 6000 Mbit/s.

  If EBS bandwidth becomes a bottleneck, it is necessary to switch to the larger instance type.

- EBS IOPS (Provisioned IOPS or General Purpose SSD) — Depending on the chosen SSD volume type, it is possible to control how many IOPS that are available, which is important to the database storage performance.

  - Provisioned IOPS SSD (io1) offers 50 IOPS/GB.
  - General Purpose SSD (gp2) offers 3 IOPS/GB and volumes can be striped to achieve higher IOPS than this.

Choose the solution that fulfills the storage performance requirements of 5.000+ IOPS at peak performance as described above.

Azure Storage Considerations

Performance testing of STEP in Azure shows that SSD storage is required for the Oracle database and for the shared storage covering workarea and upload for the application servers. In addition, SSD storage is preferred for the OS and software partitions of application servers as well as database servers. In Azure, SSD storage is referred to as Premium storage. Instance types in Azure that supports the use of SSD storage will have ‘s’ in its name like 'DSv3' or 'ESv3.'

In Azure, asset data can reside on non-SSD storage like Managed Disks or Unmanaged Disks, depending on if data must be highly available by managing replicas in other data centers or not.

High Availability Considerations

This is one of the infrastructure requirements for a successful STEP setup. The full list is defined in the **Infrastructure Requirements** topic.

To achieve system redundancy and an increased amount of system resources for large server solutions, STEP supports the following options for active / active and active / passive clustering.

Active / Active

This option requires both the database and application layer to become fully redundant with at least two (2) active nodes. This can be accomplished via the following ways:

Application

Two or more application servers are configured as an Application Cluster. The cluster is managed by the STEP application (no OS cluster) and will load balance user sessions and processes automatically. In the case of one of the nodes failing, user sessions are automatically transferred and background processes are automatically restarted on the healthy node.

Database

Database clustering is fully managed by Oracle. The active / active clustering option from Oracle is 'Oracle Real Application Cluster' (Oracle RAC).

Active / Passive

Since active / active clustering can be very complex to set up and manage, and has a very high price tag on the Oracle part, an alternative is an active / passive setup, featuring at least two nodes.

Application

An active / passive setup is not directly possible with the application. However, it is possible to setup multiple nodes and configure these for specific purposes. For example, on a three (3) node application setup, the nodes can be dedicated individually for background processes, internal Java client users, and external Web UI users. In case of a breakdown, the system can be reconfigured to use the remaining nodes.

Database

Active / passive clustering on the database is possible with different technologies and setups. The most commonly used is to set up an Oracle 'standby' database server that either shares the database storage with the active node or features its own storage. When using its own storage, the passive node is set up as a standalone database server that must be updated at regular intervals or real-time from the active node. There are multiple ways to update the passive node. The most common way is to use Oracle Dataguard.

Infrastructure Checks

The following tools can be used to verify that infrastructure requirements are met.

Network Latency Measurements and Tools

Use the appropriate option below to measure latency and ensure the results meet the **Network Latency Requirements** defined in the **Server-to-Server Connections** topic.

Measure latency on Linux using ping

Run the following commands from application server to database server (results are in microseconds (ms)):

```
ping -c20 <db-host> |grep rtt
ping -c20 -s8000 <db-host> |grep rtt
ping -c20 -s32000 <db-host> |grep rtt
```

Measure latency on Windows using 'hrping'

Download the tool using SPOT:

```
spot --baseurl=updates:/install/software --download=hrping/windows/hrpingv506.
zip --output=L:/install-software
```

Run the following commands from the application server to database server (results are in microseconds (ms)):

```
hrping -l 64 -n 20 <database-host>
hrping -l 8000 -n 20 <database-host>
hrping -l 32000 -n 20 <database-host>
```

Measure latency using ‘benchnet5.sql’ script in Linux

Executed from the application server against the database, with different package-sizes, to measure any network influence (latency). Results are in seconds (sec).

1. From a Linux server, log on to the application server as 'stibosw'.
2. Copy the following SQL script using the file name 'benchnet5.sql' to `/home/stibosw` on the application server.

set timing on set autotrace traceonly statistics set arrays 5000 set pages 1000 select null from dual connect by rownum < 100000; prompt Small without network influence select null from dual connect by rownum < 100000; set arrays 10 prompt Small with network influence select null from dual connect by rownum < 100000; set arrays 5000 prompt Medium without network influence select '0123456789012345678901234567890123456789012345678901234567890123456789012345678901'||rownum from dual connect by rownum < 1000000; set arrays 100 prompt Medium with network influence select '0123456789012345678901234567890123456789012345678901234567890123456789012345678901'||rownum from dual connect by rownum < 1000000; set arrays 5000 prompt Large without network influence select '0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567

8901234567890123456789012345678901234567890123456789012345678901234567890123456789012345
6789012345678901234567890123456789012345678901234567890123456789012345678901234567890123
4567890123456789012345678901234567890123456789012345678901234567890123456789012345678901
2345678901234567890123456789'||rownum from dual connect by rownum < 1000000; set arrays 100 prompt
Large with network influence select
'0123456789012345678901234567890123456789012345678901234567890123456789012345678901234567
8901234567890123456789012345678901234567890123456789012345678901234567890123456789012345
6789012345678901234567890123456789012345678901234567890123456789012345678901234567890123
4567890123456789012345678901234567890123456789012345678901234567890123456789012345678901
2345678901234567890123456789'||rownum from dual connect by rownum < 1000000;

3. Run the script on the application server:
   ```
   sqlplus stepsys/stepsys
   ```
   ```
   @/home/stibosw/benchnet5.sql
   ```
4. Collect all output and attach it to a Jira issue.

The following table shows the Stibo Systems recommended limits for network influence. The script outputs in msek, limits are seen in sek (seconds).

Size	Including Network Influence	Maximum Recommended Limit
Small	No	00:00:00.15
Small	Yes	00:00:02.00
Medium	No	00:00:08.00
Medium	Yes	00:00:12.00
Large	No	00:00:24.00
Large	Yes	00:00:30.00

CPU and Storage

Use the appropriate option below to measure read, write, and CPU performance, and to ensure the results meet the requirements defined in the **Storage Performance Requirements** topic.

Measure read, write and CPU performance using 'stibo-ts-load-test.pl' script

On a Linux application server, run the following commands (script outputs in msek, limits are in sek (seconds)):

1. Log on to the database server as 'oracle'.
2. Locate db-server-toolbox, for example: `/opt/stibo/step/admin/db-server-toolbox/`
3. Run this command:
   ```
   /opt/stibo/step/admin/db-server-toolbox/stibo-ts-load-test.pl -stepsys-schema
   stepsys -stepsysdata-tbs stepsysdata
   ```

4. Run this command to report results:
```
/opt/stibo/step/admin/db-server-toolbox/stibo-ts-load-test.pl -stepsys-schema
stepsys -stepsysdata-tbs stepsysdata -report
```

Storage Limits

I/O for reads / writes	Classification
< 5 s	very good
< 10s	good
< 20s	moderate

CPU Limits

For CPU, Stibo Systems defines 60 sek (seconds) as the 'standard' level.

Measure IOPS on Storage Devices

Performance on storage devices can be evaluated using 'fio' with results in iops.

Windows

1. Downoad the tool using spot:
```
spot --baseurl=updates:/install/software --download=fio/windows/fio-2.2.10-
x64.zip --output=L:/install-software
spot --baseurl=updates:/install/software --download=fio/windows/fio-
examples.zip --output=L:/install-software
```
2. Configure fio by editing `settings.fio` for your server type.
3. Execute fio:
```
L:\install-software\fio\windows\fio-examples\windows\fio_test.bat
```

Linux

1. Downoad the tool using spot:
```
spot --baseurl=updates:/install/software --download=fio/linux/fio-2.1.7-
1.el7.rf.x86_64.rpm --output=/workarea/install-software
spot --baseurl=updates:/install/software --download=fio/linux/fio-examples.zip
--output=/workarea/install-software
```
2. Log in as a user with admin privilege (root) and install fio using this command:
```
yum install /workarea/install-software/fio/linux/fio-2.1.10-1.el7.rf.x86_64.rpm
```
3. Configure fio by editing `settings.fio` for your server type.
4. Execute fio:
```
/workarea/install-software/fio/linux/fio-examples/linux/fio_test.sh
```

Example

This example is the output from fio, executed with 8k block size:

```
trivial-readwrite-1g: (g=0): rw=randrw, bs=8K-8K/8K-8K/8K-8K,
ioengine=posixaio, iodepth=64
fio-2.1.10
Starting 1 thread
trivial-readwrite-1g: Laying out IO file(s) (1 file(s) / 1024MB)
Jobs: 1 (f=1): [m] [100.0% done] [12122KB/12241KB/0KB /s] [1515/1530/0
iops] [eta 00m:00s]
trivial-readwrite-1g: (groupid=0, jobs=1): err= 0: pid=55096: Tue Dec  6
12:37:25 2016
  read : io=525088KB, bw=11687KB/s, iops=1460, runt= 44928msec
```

Installing STEP

The installation of a STEP system is comprised of multiple components:

- An Oracle 19c RDBMS server software installation is recommended
- A STEP database
- An installation of the Java Runtime Environment that runs the application
- STEP version 9.3 or an Apache HTTP Server 2.4 installation

Important: The complete list of platform and software support is available in the **9.3 Platform and Software Support** section of the **System Release and Patch Notes** documentation.

To install a STEP system you must perform the following steps:

1. Review the system requirements. These requirements can be found in the **System Requirements** section of the documentation.
2. Run all required pre-installation tasks. These tasks are detailed in the **Pre-Installation Tasks** section of the documentation.
3. Run the installation script (install.pl).

Before proceeding with the installation, however, an installation scenario must be decided on that best fits the client's needs. The two primary questions that must be answered are: should you use a Single or a Clustered Application Server setup, and who needs to be involved in the setup?

Single vs. Clustered Application Server Setup

Determine whether the system being installed consists of one or more Application Servers. The installation must be performed on all servers in the setup. For more information, see the **Pre-Installation Tasks** section of the documentation.

Who Needs to be Involved in the Installation?

When running the installation script to install a STEP system (including all third-party software) a number of pre-installation steps are performed before actually installing the software itself.

The pre-installation steps require that the user running the installation scripts is a privileged user. This might be an issue on Linux where certain kernel parameters must be set, and OS groups and users must be created. On Windows, the STEP Installer must be a member of the Administrator group. For more information, see the **System Requirements** section of the documentation.

System Requirements

The system requirements for running STEP on a host machine largely depends on the operating system.

The supported operating systems include:

- Linux
- Windows
- MacOS

The complete list of platform and software support is available in the **9.3 Platform and Software Support** section of the **System Release and Patch Notes** documentation.

Linux System Requirements

The supported operating systems are:

- Red Hat Enterprise Linux 7.5+ 64-bit
- Oracle Enterprise Linux 7.5+ 64-bit

Unless explicitly mentioned, OS prerequisites are implemented by the installation scripts (when run as root or with sudo on Linux).

The install scripts will (if needed):

- Create OS user(s) and group
- Adapt kernel parameters
- Install required RPMs if the server has a connection to Red Hat Network (RHN)

Important: The Infrastructure Recommendations guide provides more detailed information regarding requirements.

User Accounts

The OS user accounts include:

User Account Name	Must Be Member of Group(s)	Description
oracle	dba	Account must be created on the database server and must use the Bash shell. The user is the owner of the Oracle database software. If the user and/or group does not exist, the installation scripts will automatically create them. Group ID (GID) default: 501 User ID (UID) default: 501
stibosw	stibosw	Account must be created on the application server(s) and must use the Bash shell. The user is the owner of the STEP application software.

User Account Name	Must Be Member of Group(s)	Description
		If the user and/or group does not exist, the installation scripts will automatically create them. Group ID (GID) default: 500 User ID (UID) default: 500

Note: The installation scripts are implemented and tested using the Bash shell. Therefore, it is important that this is used if pre-creating the OS user accounts.

Server Setup

In a single server setup, with the database and application server running on one machine, both accounts must be created. This is often the case for test systems.

As indicated in the table above, there might be more than one application server, such as in the case of a clustered system setup. In these instances, the user account must exist on all application servers.

Service Accounts vs. Logon Accounts

If security policies require separation of service and logon accounts, two separate accounts must be created. The service account password may never expire and must not be changed.

User Account Names and IDs

User account names do not need to match what is shown in the table. If required, create account names that adhere to corporate standards.

Group and user IDs must adhere to corporate standards if the default values are not compliant. Properties for these include:

- user.db (username)
- user.db-id
- user.db-primary-group-id
- user.app (username)
- user.app-id
- user.app-primary-group-id

Note: User names are case sensitive.

Windows System Requirements

The supported operating systems are:

- Windows Server 2016 64-bit (Standard or Datacenter Edition)
- Windows Server 2012 R2 64-bit (Essentials, Standard, or Datacenter Edition)

The following accounts are required for a complete STEP installation. The user accounts can either be local accounts (recommended) or domain accounts. The requirements below are valid in both scenarios.

User Account Name	Must Be Member of Group(s)	Description
`oracle`	`Administrators` `Remote Desktop Users`	Account must be created on the database server. This user is the owner of the Oracle database software. If this user does not already exist, it will automatically be created by the installation (local user).
`stibosw`	`Administrators` `Remote Desktop Users`	Account must be created on the application server(s). This user is the owner of the STEP application and HTTP server software. If this user does not already exist, it will automatically be created by the installation (local user).

Password Properties

Because both users act as logon users for Windows services, it is important that the password does not change or expire. Doing so would prevent the required services from starting.

Single Server Setup

In a single server setup, with the database and application server running on one machine, both accounts must be created. This is often the case for test systems.

As indicated in the table above, there might be more than one application server, such as in the case of a clustered system setup. In these instances, the user account must exist on all application servers.

Service Accounts vs. Logon Accounts

If security policies require separation of service and logon accounts, two separate accounts must be created. The service account password may never expire and must not be changed.

Windows OS Services

The installer package is dependent on the 'Windows Management Instrumentation' Windows Service being enabled and started.

MacOS System Requirements

The supported operating systems are:

- MacOS X 10.14
- MacOS X 10.13

User Account Name	Must Be Member of Group(s)	Description
stibosw	stibosw	Account must be created on the DTP server. This user is the owner of the DTP server software.

A server running MacOS X is only required if there is a need for running Adobe InDesign Server on MacOS.

Installation Prerequisites

Before installing a STEP system, the following software must be available on the servers:

- OpenJDK / AdoptJDK Java 1.8.0 (JDK or JRE) 64-bit
- Perl 64-bit
- SPOT foothold distribution file (Stibo software)

Java

The STEP application requires AdoptOpenJDK 1.8 64-bit to run. As part of the STEP deployment (patch procedure), AdoptOpenJDK 1.8 JDK will be downloaded and installed. This Java version is regularly tested and released with the STEP application, but the SPOT tool itself also requires Java. Therefore, OpenJDK / AdoptOpenJDK Java must be installed manually on the servers in order to download and install third-party software and the STEP application.

Java for Windows

For Windows, download AdoptJDK Java JRE 1.8 64-bit from https://adoptopenjdk.net/. It must be 64-bit.

Follow the steps below to install AdoptJDK Java on Windows:

1. Login with an Administrator account.
2. Download AdoptOpenJDK binaries (64-bit) and save it to any directory (see the above URL).
3. Unzip the binaries in the chosen directory (E: is used in the below example commands) by running the following commands in command prompt:
   ```
   unzip -d E:\java OpenJDK%U-jdk_x64_windows_hotspot_%u%b%.zip>
   ```
4. Create a link for the newly unzipped Java binaries to allow for easy update when a newer version is installed:
   ```
   mklink /d E:\java\jre.current E:\java\jdk%u%-b%-jre
   ```
5. Add the following to the System Environment variable PATH:

   ```
   E:\java\jre.current\bin
   ```

Java for Linux

On Linux, OpenJDK 1.8 64-bit can be downloaded using Yum. OpenJDK Java is located in the standard Red Hat and Oracle Linux repositories.

Follow the steps below to install OpenJDK Java on Linux:

1. Login as the root user.
2. Install Java by running the following command in a Terminal:
   ```
   yum install java-1.8.0-openjdk.x86_64
   ```

Perl

Perl for Windows

When running SPOT the first time ActivePerl will be downloaded and the installer will be launched. For more information on installing ActivePerl, see the **Installing ActivePerl on Windows** section of the documentation.

Perl for Linux

As Perl is standard on Linux, nothing has to be done.

SPOT Foothold Distribution

Running the installation requires an Installation Package provided by Stibo Systems. The Installation Package contains all the required third-party software and scripts used to run the installation. For more information, see the **Pre-Installation Tasks** section of the documentation.

The installation package is automatically downloaded to the servers from the Stibo Systems release server using a foothold distribution.

The foothold zip file contains required scripts and customer specific certificates that allow for the download of third-party software from the Stibo Systems release server. The foothold zip can be received via e-mail from Stibo.

Important: All servers must be able to access the Stibo Update Server via HTTPS (port 443): https://updates.stibosystems.com.

Pre-Installation Tasks

Before beginning the installation, the system must have been set up according to the **System Requirements** section of the documentation. Additionally, the installation instructions described below assume that the volumes / partitions have been configured as listed in the **Default Filesystem Layout** section of the documentation.

Important: The foothold distribution file (received by email) is required to get started. The email also includes a required password to unzip the foothold file. This file should be provided by Stibo Systems.

User Account Controls

If using Windows, the Use Account Control must be disabled during installation.

1. Go to **Control Panel** > **User Accounts** > **Change User Account Control settings** and set notification to 'Never notify'.
2. Restart server to activate settings.

Deploying the Installation Package

The foothold distribution file must be placed in a specific directory on the server to get started. This directory is referred to as STEP_HOME.

Important: The steps described in this topic must be executed on all servers included in the setup: Database, Application, and DTP servers.

Create STEP_HOME Directory

On Linux (as a root user)

1. Go to `/opt` directory:
   ```
   cd /opt
   ```
2. Create `stibo/step` directories:
   ```
   mkdir -p stibo/step
   ```

On Windows

1. Go to E: drive
2. Create `stibo\step` directories using Explorer or from command line:
   ```
   mkdir stibo\step
   ```

Unzip Foothold Distribution File

The foothold zip file (`<customer-name>-foothold.zip`) must now be placed in the STEP_HOME folder. This can be done using SCP/SFTP (Linux) and FTP, or copy / paste through RDP (Windows).

On Linux (as root user)

1. Go to the STEP_HOME directory created above:
   `cd /opt/stibo/step`
2. Unzip the foothold file using the supplied password:
   `unzip -P <password> <customer-name>-foothold.zip`

On Windows

1. Go to the STEP_HOME directory created above:
   `E: <enter>`

   `cd stibo\step <enter>`
2. Unzip the foothold file by right-clicking the file and selecting `Extract All`. Enter the supplied password when prompted.

Now that the foothold distribution file has been deployed on all servers, the user can download and install third-party software and the STEP software.

Prepare SPOT and Download Installation Scripts

Prepare SPOT for the first time and download the installation scripts.

On Linux

Run the following commands:

```
[root@test step]# ./spot --wrapper

Generating wrapper /opt/stibo/step/spot with baked in JAVA_
HOME=/usr/lib/jvm/java-1.8.0-openjdk-1.8.0.191.b12-1.el7_6.x86_64/jre

[root@test step]# ./spot --install

To apply this recipe 1 bundle(s) need to be installed.

The prepared recipe was stored as:
/opt/stibo/step/admin/spot/recipes/prepared/2019-01-11-20-19-55.spr
```

On Windows

Run the following commands:

```
E:\stibo\step>spot --wrapper

Generating wrapper E:\stibo\step\spot.bat with baked in JAVA_
HOME=E:\java\jdk8u192-b12


E:\stibo\step>spot --install

To apply this recipe 1 bundle(s) need to be installed.

The prepared recipe was stored as:
E:\stibo\step\admin\spot\recipes\prepared\2019-01-11-20-19-55.spr
```

Results

After the last command has run, the following STEP_HOME/admin folder will be created:

```
STEP_HOME/
        |-- admin/
                |-- install/
                |       |-- apache-http-server/
                |       |-- config/
                |       |-- documentation/
                |       |-- oracle-database-11g/
                |       |-- oracle-database-12c/
                |       |-- oracle-instant-client/
                |       |-- oracle-single-server/
                |       |-- os-prerequisites/
                |       |-- pm/
                |       |-- step-audit
                |       |-- step/
                |       |-- step-database/
                |       |-- toolbox-backup/
                |       |-- toolbox-db/
                |       |-- tools/
                |-- install.pl
                |-- spot/
                |-- var/
                        |-- <servername>/
```

These installation scripts comprise what is known as the Installation Package.

Installation

Once the Installation Package has been deployed, the actual installation can begin. The STEP_HOME/admin folder contains the install.pl (Perl) script, which is used to launch the download and install menu.

For more information on the STEP_HOME directory and the Installation Package, see the **Pre-Installation Tasks** section of the documentation.

The installation of STEP is divided into two phases:

- Downloading the Software
- Installing the Software

Downloading the Software

The software must be downloaded before installation.

Note: The third-party software downloaded and used for the STEP installation can be found as HTML documentation in: `STEP_HOME/admin/install/documentation/html/software.html`

1. Log onto the server (database or application server) as `root` (Linux) or `Administrator` (Windows)
2. In a terminal window / command prompt, go to STEP_HOME/admin:

   On Linux

   ```
   cd /opt/stibo/step/admin
   ```

   On Windows

   ```
   E: <enter>
   cd stibo\step\admin <enter>
   ```

3. Run the install.pl script:

   On Linux

   ```
   ./install.pl
   ```

   On Windows

   ```
   install.pl
   ```

When running the script for the first time, the user is prompted to create a folder to hold the downloaded software.

The `Software folder` defaults to `<workarea>/install-software`. This directory can be created if you select 'y', or you can select 'n' and specify another location:

```
[root@test admin]# ./install.pl
2019-01-14 21:19:53 Info     install.pl -> /opt/stibo/step/admin/install.pl
   -> Arguments:
2019-01-14 21:19:53 Command  install.pl ->
/opt/stibo/step/admin/install/config/fetch-software.pl --
log=/opt/stibo/step/diag/logs/test/install.log
2019-01-14 21:19:53 ERROR    fetch-software.pl -> Default software folder not
found: /workarea/install-software
Do you want to create '/workarea/install-software' [y/n]:
```

Note: The workarea directory defaults to `/workarea` (Linux) and `L:` (Windows). A different location must be specified in the database server, usually, `/opt/install-software` (Linux), or `E:\install-software` (Windows) since `/workarea` and `L:\` are only standard partitions for the application server.

The software directory holds all the downloaded software. The default directory can be changed later by pressing `'c'` and entering a new location.

Sharing the Software Directory Between Servers

If possible, the software directory should be shared between all servers (both database and application servers) in the setup. This way the installation script will be able to see the same directory and install configuration.

It is common for the database and application server(s) to not have a shared filesystem. In these scenarios, you will have to use a local filesystem and replicate the configuration file (install.properties). On the database server, you would only download the database-related software and on the application server(s) you would only download the application related software.

Choosing Software to Download

After the Software folder is created, the following menu is displayed:

```
--------------------------------------------------------------------------------
The following software have been marked for download

Software directory: /opt/install-software
--------------------------------------------------------------------------------
    No software marked for download




--------------------------------------------------------------------------------
Choose software for download by selecting a platform

    Id: Platform
--------------------------------------------------------------------------------
     1: Generic
     2: Linux
     3: Mac
     4: Windows
--------------------------------------------------------------------------------
     c: Change software directory
     d: Download files (if not already downloaded) and exit
     q: Exit without downloading
     a: Switch to advanced mode (not recommended)
--------------------------------------------------------------------------------

Choice:
```

Depending on the role of the server you are connected to, and what platform you are installing on, you now must choose what software to download. This is done by choosing the **Id** (1 – 4) in the menu.

Example (Linux)

In the following example the user is downloading software required for a database server installation on the Linux platform (sub-menu Id=2):

```
-------------------------------------------------------------------------------
Please select software to download for 'Linux'
-------------------------------------------------------------------------------

    Id: Software                                          Action
-------------------------------------------------------------------------------
     a: ** Oracle Database 12c **
        oracle-database-12c                               skip
        oracle-database-12c-patchset-update               skip

     b: ** Oracle Instant Client 12c **
        oracle-instant-client                             skip

     c: ** Oracle tools **
        oracp                                             skip

-------------------------------------------------------------------------------
   a-z: Toggle between 'download' and 'skip'
     0: Back to main menu
-------------------------------------------------------------------------------

Choice:
```

1. Once Linux has been selected, the user would type `'a'` to mark the group 'Oracle Database 12c' for download as this group is required software for the database server.

```
-------------------------------------------------------------------------------
Please select software to download for 'Linux'
-------------------------------------------------------------------------------

    Id: Software                                            Action
-------------------------------------------------------------------------------
     a: ** Oracle Database 12c **
        oracle-database-12c                                 skip
        oracle-database-12c-patchset-update                 skip

     b: ** Oracle Instant Client 12c **
        oracle-instant-client                               skip

     c: ** Oracle tools **
        oracp                                               skip

-------------------------------------------------------------------------------
   a-z: Toggle between 'download' and 'skip'
     0: Back to main menu
-------------------------------------------------------------------------------

Choice: a
```

2. Next, the user would enter `'0'` to return to the main menu which has updated to reflect the previous selections.

```
-------------------------------------------------------------------------------
Please select software to download for 'Linux'
-------------------------------------------------------------------------------

    Id: Software                                            Action
-------------------------------------------------------------------------------
     a: ** Oracle Database 12c **
        oracle-database-12c                                 download
        oracle-database-12c-patchset-update                 download

     b: ** Oracle Instant Client 12c **
        oracle-instant-client                               skip

     c: ** Oracle tools **
        oracp                                               skip

-------------------------------------------------------------------------------
   a-z: Toggle between 'download' and 'skip'
     0: Back to main menu
-------------------------------------------------------------------------------

Choice: 0
```

3. The user also requires a 'starter' database (referred to as STEP standard) which must be downloaded as well. It is located under the Generic sub-menu (Id=1).

```
--------------------------------------------------------------------------------
The following software have been marked for download

Software directory: /opt/install-software
--------------------------------------------------------------------------------
** linux **
    oracle-database-12c
    oracle-database-12c-patchset-update


--------------------------------------------------------------------------------
Choose software for download by selecting a platform

    Id: Platform
--------------------------------------------------------------------------------
     1: Generic
     2: Linux
     3: Mac
     4: Windows
--------------------------------------------------------------------------------
     c: Change software directory
     d: Download files (if not already downloaded) and exit
     q: Exit without downloading
     a: Switch to advanced mode (not recommended)
--------------------------------------------------------------------------------

Choice: 1
```

4. There are multiple versions of the 'starter' database available from the menu. Each choice is compatible with a range of STEP versions. Choose `'c'` if installing the latest version of STEP.

```
--------------------------------------------------------------------------------
Please select software to download for 'Generic'
--------------------------------------------------------------------------------

    Id: Software                                          Action
--------------------------------------------------------------------------------
     a: ** STEP base (>= step-8.1) **
        stepbase-datapump.step-8.1                        skip

     b: ** STEP base (>= step-8.2) **
        stepbase-datapump.step-8.2                        skip

     c: ** STEP base (>= step-8.3) **
        stepbase-datapump.step-8.3                        skip

--------------------------------------------------------------------------------
   a-z: Toggle between 'download' and 'skip'
     0: Back to main menu
--------------------------------------------------------------------------------

Choice: c
```

5. Type `'0'` to return to the main menu.
6. To start the download, type `'d'`.

```
--------------------------------------------------------------------------------
The following software have been marked for download

Software directory: /opt/install-software
--------------------------------------------------------------------------------
** generic **
    stepbase-datapump.step-8.3
** linux **
    oracle-database-12c
    oracle-database-12c-patchset-update




--------------------------------------------------------------------------------
Choose software for download by selecting a platform

    Id: Platform
--------------------------------------------------------------------------------
     1: Generic
     2: Linux
     3: Mac
     4: Windows
--------------------------------------------------------------------------------
     c: Change software directory
     d: Download files (if not already downloaded) and exit
     q: Exit without downloading
     a: Switch to advanced mode (not recommended)
--------------------------------------------------------------------------------

Choice: d
```

7. The download process begins.

```
2019-01-15 18:54:21 Command  fetch-software.pl -> /opt/stibo/step/spot --
baseurl=updates:/install --download=stepbase-datapump/stepbase-datapump-11.zip -
-output=/opt/install-software
Stibo Patch Operations Tool - test - test - test
Downloading [#########################################] 100% 1724/1724 k
/workarea/install-software/stepbase-datapump/stepbase-datapump-11.zip
2019-01-15 18:54:24 Command  fetch-software.pl -> /opt/stibo/step/spot --
baseurl=updates:/install/software --download=oracle-database-
12c/linux/linuxx64_12201_database_1of2.zip,oracle-database-
12c/linux/linuxx64_12201_database_2of2.zip,oracle-database-12c-patchset-
update/linux/p6880880_122010_Linux-x86-64.zip,oracle-database-12c-patchset-
update/linux/p28163133_122010_Linux-x86-64.zip --output=/opt/install-software
Stibo Patch Operations Tool - test - test
Downloading [#########################################] 100% 3856/3856 M
```

The files are downloaded under the chosen `Software folder` which, in this example, is `/opt/install-software`. In an application server installation, this defaults to `/workarea/install-software` (Linux), or `L:\install-software` (Windows).

```
[root@test install-software]# pwd
/opt/install-software
[root@test install-software]# ls -l
total 16
drwxrwxrwx. 3 root root 4096 Jan 15 18:57 oracle-database-12c
drwxrwxrwx. 3 root root 4096 Jan 15 18:57 oracle-database-12c-patchset-update
drwxrwxrwx. 3 root root 4096 Jan 15 18:58 oracle-instant-client
drwxrwxrwx. 2 root root 4096 Jan 15 18:54 stepbase-datapump
```

Installing the Software

Once the software has been downloaded to the `Software folder`, the installation will begin.

Note: All installation properties are documented as HTML documentation in: `STEP_HOME/admin/install/documentation/html/install-properties.html`

Initial Installation Steps

1. The initial installation steps require you to provide the names of the database, application, and DTP servers. This must be the FQDN (Fully Qualified Domain Name) of the server(s).

```
--------------------------------------------------------------------------------
Please enter minimum required properties:
--------------------------------------------------------------------------------
host.application-servers =
   Group 'STEP installation setup'
   Specifies the application server(s) in the STEP system.
   Should be fully qualified hostnames (in lower case).
   NOTE: Comma separated.
   - Default value ''
   - Must match pattern
   '^[a-z0-9-]*(\.[a-z0-9-]+)*(\s*,\s*[a-z0-9-]*(\.[a-z0-9-]+)*)*$'
   - This property is mandatory (not null)

Enter value: <Application Server FQDN>

host.database-servers =
   Group 'STEP installation setup'
   Specifies the database server in the STEP system.
   Should be fully qualified hostnames (in lower case).
   NOTE: Comma separated.
   - Default value ''
   - Must match pattern
   '^[a-z0-9-]*(\.[a-z0-9-]+)*(\s*,\s*[a-z0-9-]*(\.[a-z0-9-]+)*)*$'
   - This property is mandatory (not null)

Enter value: <Database Server FQDN>
```

   In the event that there is more than one application server, specify them all as a comma-separated list. This is the host name(s) of the server(s). If a DTP server is not part of the setup, just leave the property empty.

2. You will be prompted to provide the **step.system-name**. This is a unique name that identifies the system, and must exist in Stibo's internal systems as the license is mapped to this system name. This name must be agreed

upon by the customer and created as a licensed system in Stibo.

Some examples include:

- <customer>-development / <customer>-dev
- <customer>-production / <customer>-prod

```
step.system-name =
   Group 'STEP configuration setup'
   The STEP system name
   - Default value ''
   - This property is mandatory (not null)

Enter value []: test-install
```

3. You will be prompted to provide the **step.takeout-ur**. This is the version of STEP to be installed to the system. Pressing `Enter` will set the value as default, which is the latest version.

```
Enter value [to:step/trailblazer/latest.spr]: [Enter]
```

Installation Menu

After the **step.takeout-ur**is provided and pressing `Enter`, the following installation menu is shown:

```
--------------------------------------------------------------------------------
Date and time              : 2019-01-15 19:16:16
Server                     : testdb.ec2.internal
Server role(s)             : database-server
OS User(s)/OS Group(s)     : oracle:dba
OS Caption                 : Red Hat Enterprise Linux Server release 7.6 (Maipo)
Virtual server             : yes
SPOT is online             : yes
STEP version               : 0.0
Current user               : root
Switch user method         : sudo -u <user> <cmd>
Tablespace (stepsysdata)   : 8192 MB (initial 8192 MB), 1 file(s)
Tablespace (stepsysblob)   : 8192 MB (initial 8192 MB), 1 file(s)

Primary database server    : testdb.ec2.internal
Primary application server : testapp.ec2.internal

Configuration file         : /workarea/install-software/install.properties
Log file                   :
/opt/stibo/step/diag/logs/testdb.ec2.internal/install.log

First/last script          : 1 -> 10
Dry run                    : no
--- -------- ---------------------------------------------------------------
Id  Action   Script description
--- -------- ---------------------------------------------------------------
 1  Run      OS prerequisites
 2  Run      Apply the latest STEP DB Server toolbox
 3  Run      Apply the latest STEP DB Backup toolbox
 4  Run      Install and configure Oracle 12c database software
 5  Run      Install Oracle OPatch and Patch Set Update for Oracle 12c Database
 6  Run      Create database instance with Oracle 12c DBCA
 7  Run      Create STEP database schemas
 8  Run      Create STEP database users
 9  Run      Configure STEP database
10  Run      Import STEP Base database

--- ---------------------------------------------------------------------------
Key Command
--- ---------------------------------------------------------------------------
** DOWNLOAD **
 d  Download third party software, tools etc. required for the installation
 u  Download and install latest install scripts

** CONFIGURATION **
 e  Edit configuration file
 p  List properties by property name
 v  List properties by property value
 c  List properties that differ from default

** INSTALL **
 f  Change first script
 l  Change last script
 i  Start installation
 q  Quit

** HELP/DEBUG **
 h  Help
 n  Toggle dry run mode
 r  Revision log for install package
 s  Show/hide script
 w  Show/hide reason why steps are marked with action 'Skip'
--- ---------------------------------------------------------------------------

Choice:
```

The line `First/last` script indicates which installation scripts are run or skipped. If a script is skipped you can type 'w' to see why this script is being skipped. If you only want to run some scripts, you can use 'f' and 'l' to indicate the first and last script to run.

Default Configuration Properties

The installation consists of a large set of default configuration properties which can be modified by overwriting the defaults in the following file: `<Software folder>/install.properties`.The file can be modified directly from the installation menu by selecting option 'e.' Upon saving the file, the installation process will return to the installation menu.

Options 'p,'v,' and 'c' are optional to list the various available properties. The wildcard '*' can be used with 'p' and 'v' options to show all properties.

The OS user(s) and group(s) are examples of this, and can be changed to match the customer's requirements.

For some examples, see the **Configuration Examples** section of the documentation.

For information on the filesystem layout, see the **Default Filesystem Layout** section of the documentation.

Toggle Dry Run

Option 'n' will toggle dry run mode on or off. The default is off. When dry run mode is enabled, and an installation is started by selecting option 'i,' the installation goes through its install routine based on the supplied properties, and builds a file that self-documents the scripts and commands that will be executed during the installation process without installing any components.

The file created during a dry run is `<STEP_HOME>/logs/<hostname>/dry-run/dry-run.txt`.

Any files that are generated as part of the installation routine will be placed in: `<STEP_HOME>/diag/logs/<hostname>/dry-run/<username>`.

Note: Ensure to toggle dry run to 'off' to start an actual installation that physically installs the components.

Completing the Installation

When ready, typing 'i' will start the installation. If errors are found during installation, they must be solved before the installation can continue. Upon a successful installation, STEP will be started automatically on the application server.

An installation log file is found in `<STEP_HOME>/logs/<hostname>/install.log`.

Note: When installing the database server in Windows, the system administrator will have to run all options (excluding 'OS prerequisites') as the oracle user or equivalent, otherwise the actions will be marked as 'Skip'.

Application Server Prompt Examples

```
--------------------------------------------------------------------------------
The following software have been marked for download

Software directory: /workarea/install-software
--------------------------------------------------------------------------------
** linux **
    oracle-instant-client




--------------------------------------------------------------------------------
Choose software for download by selecting a platform

    Id: Platform
--------------------------------------------------------------------------------
     1: Generic
     2: Linux
     3: Mac
     4: Windows
--------------------------------------------------------------------------------
     c: Change software directory
     d: Download files (if not already downloaded) and exit
     q: Exit without downloading
     a: Switch to advanced mode (not recommended)
--------------------------------------------------------------------------------

Choice: d
```

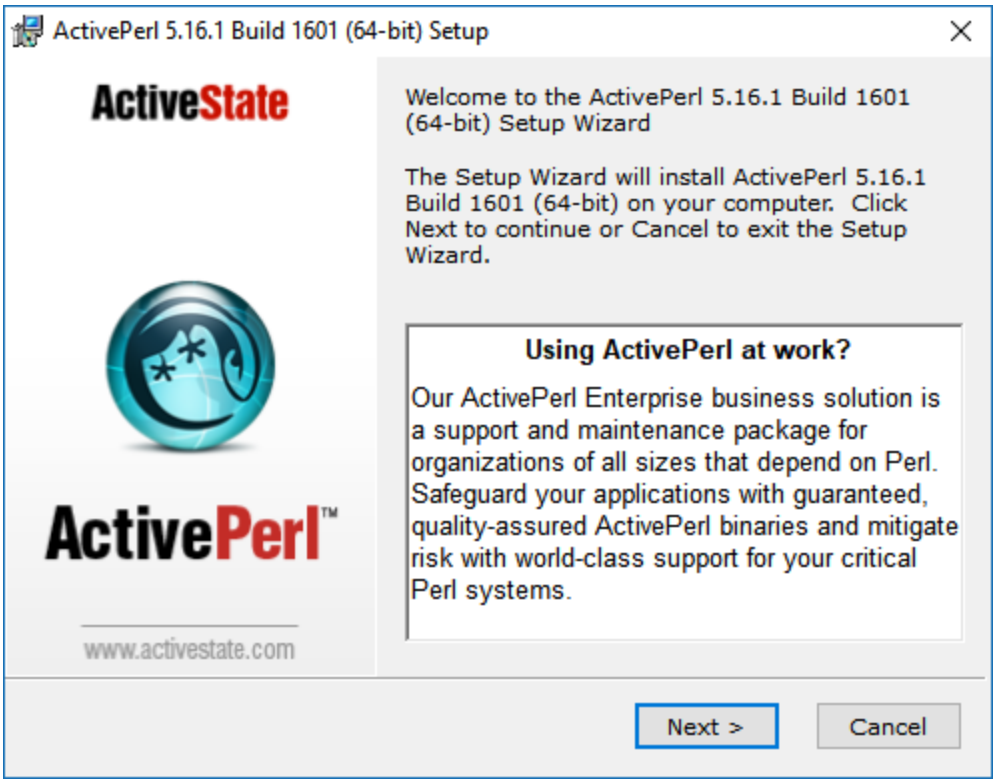
```
--------------------------------------------------------------------------------
Date and time              : 2019-01-22 15:02:28
Server                     : ip-172-31-36-178.ec2.internal
Server role(s)             : application-server
OS User(s)/OS Group(s)     : stibosw:stibosw
OS Caption                 : Red Hat Enterprise Linux Server release 7.6 (Maipo)
Virtual server             : yes
SPOT is online             : yes
STEP version               : 0.0
Current user               : root
Switch user method         : sudo -u <user> <cmd>

Primary database server    : testdb.ec2.internal
Primary application server : testapp.ec2.internal

Configuration file         : /workarea/install-software/install.properties
```

```
Log file                    : /opt/stibo/step/diag/logs/ip-172-31-36-
178.ec2.internal/install.log

First/last script           : 1 -> 4
Dry run                     : no
-------------------------------------------------------------------------------

--- -------- ---------------------------------------------------------------
Id  Action   Script description
--- -------- ---------------------------------------------------------------
 1  Run      OS prerequisites
 2  Run      Install and configure the Oracle instant client software
 3  Run      Install and configure the Apache HTTP server software
 4  Run      Install and configure the STEP software

--- -----------------------------------------------------------------------
Key Command
--- -----------------------------------------------------------------------
** DOWNLOAD **
 d  Download third party software, tools etc. required for the installation
 u  Download and install latest install scripts

** CONFIGURATION **
 e  Edit configuration file
 p  List properties by property name
 v  List properties by property value
 c  List properties that differ from default

** INSTALL **
 f  Change first script
 l  Change last script
 i  Start installation
 q  Quit

** HELP/DEBUG **
 h  Help
 n  Toggle dry run mode
 r  Revision log for install package
 s  Show/hide script
 w  Show/hide reason why steps are marked with action 'Skip'
--- -----------------------------------------------------------------------
```

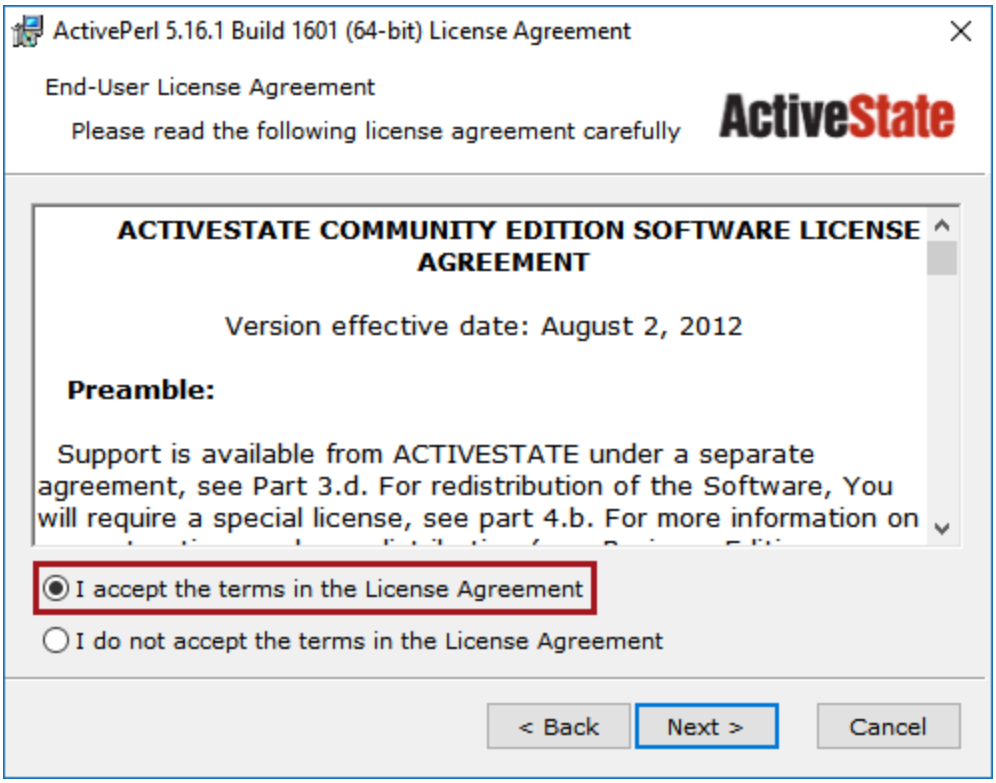
Installing ActivePerl on Windows

The ActivePerl installer is automatically launched when running `STEP_HOME\spot-install` for the first time.

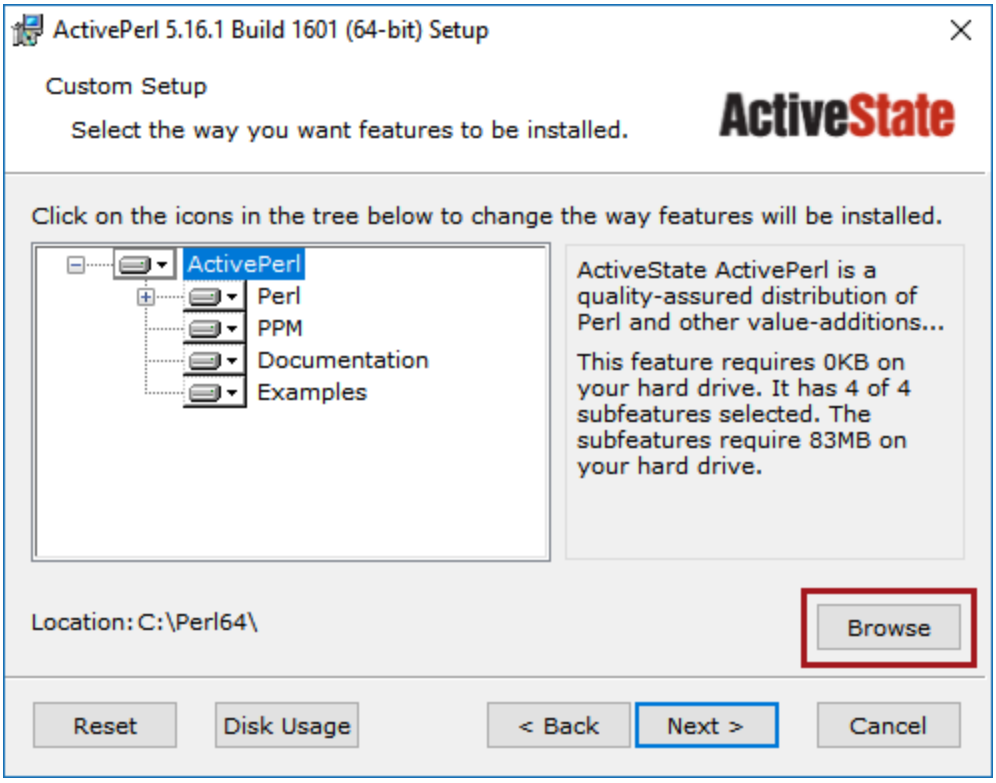
1. Click **Next** to proceed with the installation.



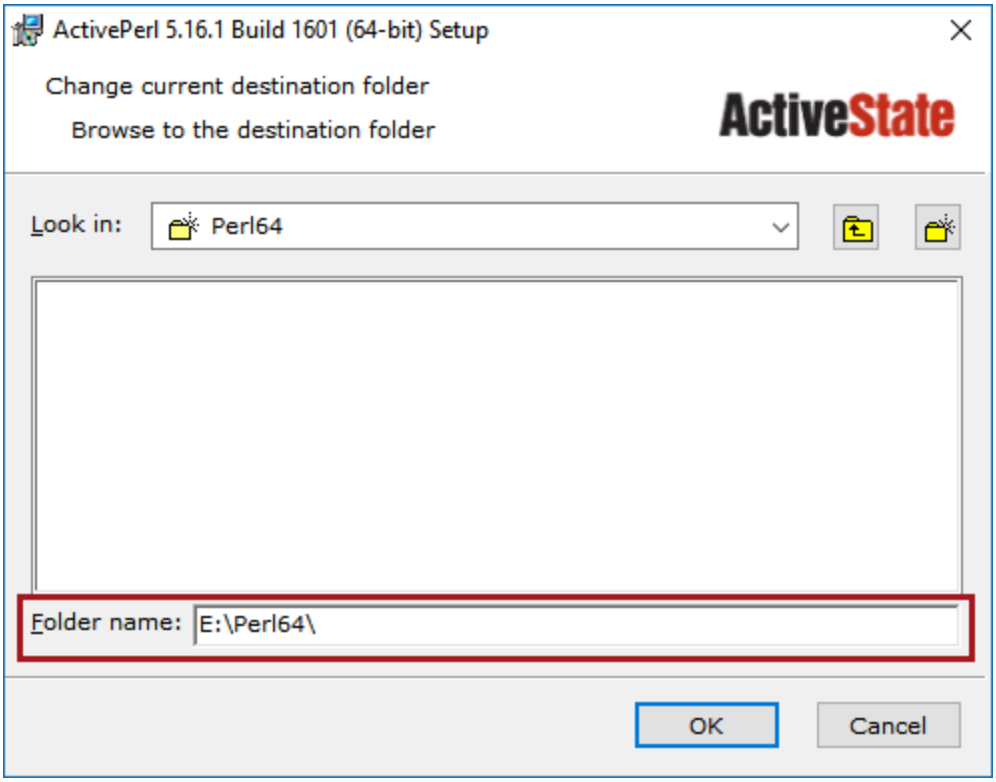
2. Accept the End-User License Agreement and click **Next**.



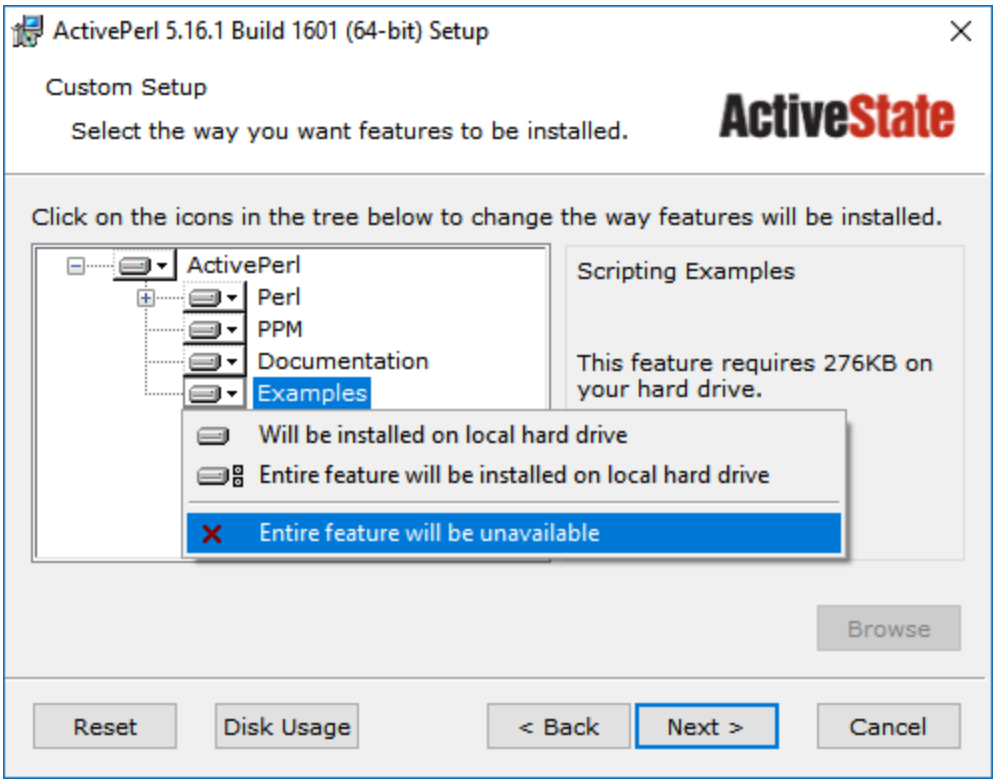
3. Click **Browse** to open the 'Change current destination' folder dialog.



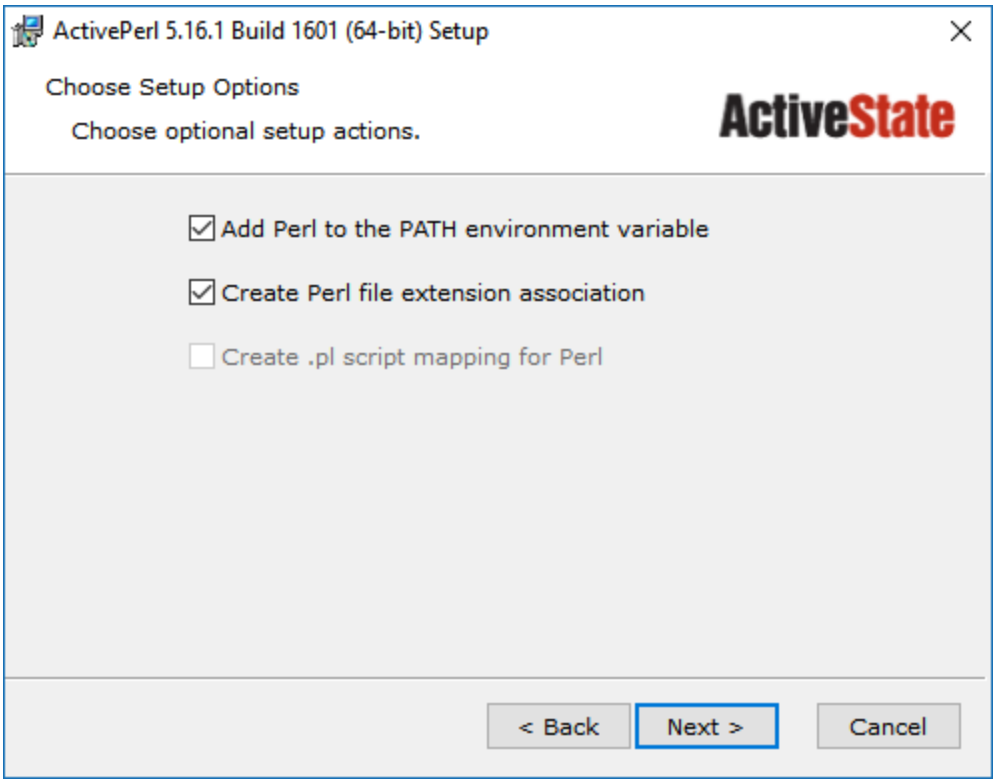
4. Enter the correct path in the 'Folder name' parameter and click **OK**. The location in the image is for example purposes.



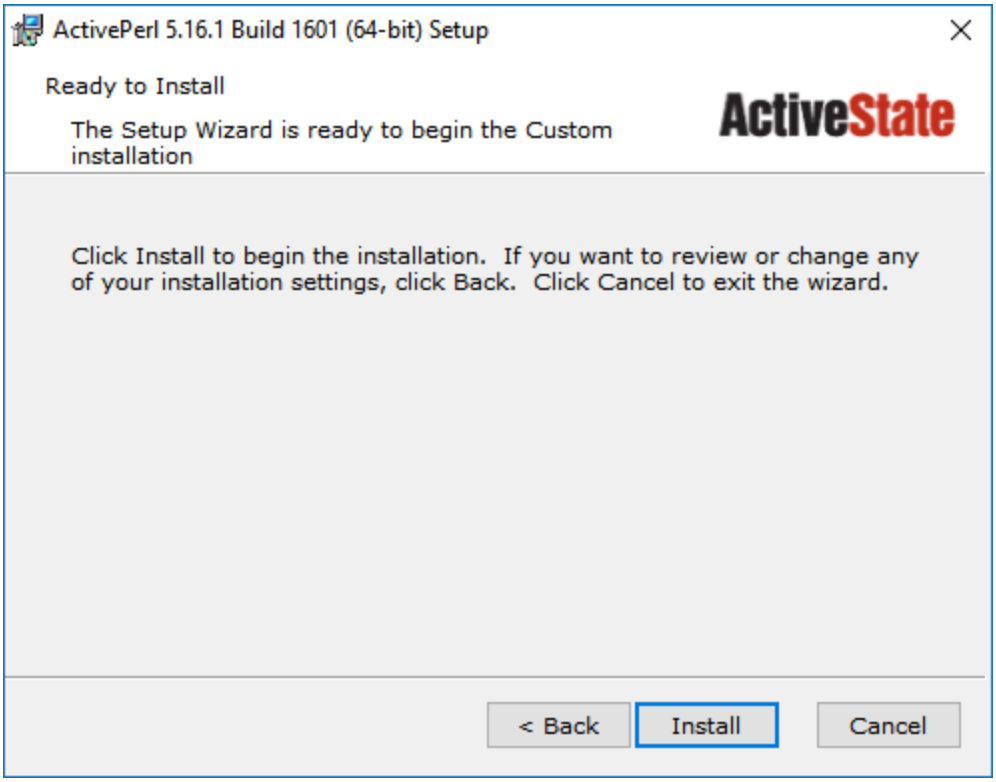
5. Right-click on 'Examples' in the navigation tree, and select 'Entire feature will be unavailable'. Click **Next**.



6. On the 'Choose Setup Options' screen, leave the defaults selected, and click **Next**.



7. On the 'Ready to Install' screen, click **Install**.



8. Once the installation is complete, click **Finish** to exit the installer. You may also check the 'Display the release notes' box if you wish to view the release notes upon closing the installer.

Default Filesystem Layout

The default filesystem layouts expected by the installation scripts are detailed in the tables below.

This information can also be found in the Hardware Recommendations document (provided by Stibo Systems).

Linux

Database Server

Server Internal Storage:

Partition	Description	Size (Net)
/	System	10 GB (or more)
/opt	Software	40 GB
/tmp	Temp file system	10 GB
/var	Variable files	10 GB
/home	Home	5 GB

Server External Storage:

Partition	Description	Size (Net)
/database/dbredo1	Redo1	10 GB
/database/dbredo2	Redo2	10 GB
/database/db1	Database	XX GB
/database/dblog	DB-Log	XX GB
/database/backup	Online Backup	XX GB

Note: The online backup partition (staging area for RMAN) is optional depending on any existing backup solutions on an existing storage setup.

Application Server

Server Internal Storage:

Partition	Description	Size (Net)
/	System	10 GB (or more)
/opt	Software + Application temp	100 GB
/tmp	Temp file system	10 GB
/var	Variable files	10 GB
/home	Home	5 GB

Server External Shared Storage:

Partition	Description	Size (Net)
/workarea	Workarea	100 GB
/upload	Upload	50 GB

Note: In a clustered application server setup, this storage must be shared with read / write access by all application servers.

Windows

Database Server

Server Internal Storage:

Partition	Description	Size (Net)
C:\	System	40 GB
E:\	Software	40 GB

Server External Storage (SAN):

Partition	Description	Size (Net)
F:\	Redo1	10 GB
G:\	Redo2	10 GB
H:\	Database	XX GB
I:\	DB-Log	XX GB
K:\	Online Backup	XX GB

Note: The online backup partition (staging area for RMAN) is optional depending on any existing backup solutions on an existing storage setup.

Application Server

Server Internal Storage:

Partition	Description	Size (Net)
C:\	System	40 GB
E:\	Software + application temp	100 GB

Server External Storage (SAN):

Partition	Description	Size (Net)
L:\	Workarea	100 GB
M:\	Upload	50 GB

Note: In a clustered application server setup, this storage must be shared with read / write access by all application servers.

Cluster SSH Configuration

When configuring a Linux application server cluster, the OS account that runs the STEP software (default 'stibosw') must be able to login via SSH between the application servers without being prompted for a password. This secure access is accomplished by using public key authentication.

SSH Setup

1. Select one machine to be the temporary master. This machine is where the commands will be run.
2. On the master machine, enter the following command with the stibosw account:
   ```
   ssh-keygen -t dsa
   ```

   Note: Accept all defaults.

3. On each other machine in the cluster except the master, enter the following commands with the stibosw account:
   ```
   ssh-keygen -t dsa
   ssh master cat ~/.ssh/id_dsa.pub >> ~/.ssh/authorized_keys
   chmod 600 ~/.ssh/authorized_keys
   ```

   Note: Accept all defaults.

4. The stibosw account on the master machine can now ssh to all other machines using public key authentication. Repeat the above steps so any application server in the cluster can act as the 'master.'
5. Once the ssh keyexchange is done, it is possible for the stibosw user on the cluster to ssh to any other machine using public key authentication.

Configuration Examples

Application Server

The following configuration steps are typically required:

- Specify the fully qualified hostnames of the STEP servers (mandatory).
- Specify the fully qualified hostname of the database server (mandatory).
- Specify the System Name (mandatory).
- Specify a STEP takeout URL.
- Specify a filesystem for software if it differs from the default.
- Specify a filesystem for Workarea and Upload if they differ from default.
- Specify a filesystem for STEP temp-files if it differs from default.
- Specify Java heapsize for STEP if it differs from default.
- Specify database name and/or service if they differ from default step.
- Specify name and/or password for STEP database users if they differ from default.

Examples

```
host.application-servers = stepapp.stibo.com
host.database-servers = stepdb.stibo.com
step.system-name = step-test
#step.takeout-url =
#filesystem.app-software =
#filesystem.app-workarea =
#filesystem.app-upload =
#filesystem.step-temp-files =
#step.applicationserver-maximumheapsize =
#step.applicationserver-initialheapsize =
```

If the name of the STEP OS user differs from the default 'stibosw':

```
user.app = <my-os-app-user>
```

If the service name of the database differs from dbca.db-name:

```
dbca.service-name = <my-db-service-name>
```

If the name and/or password of the stepsys / stepview database user differs from default:

```
database.stepsys-owner = <my-db-stepsys>
database.stepsys-owner-passwd  = <my-db-stepsys-password>
database.stepview-owner = <my-db-stepview>
```

```
database.stepview-owner-passwd = <my-db-stepview-password>
```

Note: Leading blanks are not valid.

Database Server

The following configuration steps are typically required:

- Specify the fully qualified hostnames of the STEP servers (mandatory).
- Specify the fully qualified hostname of the database server (mandatory).
- Specify the System Name (mandatory).
- Specify a filesystem for software if it differs from the default.
- Specify a filesystem for DB-Workarea and DB-Upload if they differ from default, or set to blank if they are not present on the database server (ignored for single server installations).
- Specify filesystems for the database if they differ from default.
- Configure Oracle edition if it differs from default. See the Configure Oracle Server Edition section below for more information.
- Manually specify the amount of memory that is available to the database and/or use memory target. See the Configure Oracle Server Edition section below for more information.
- Specify the size of the tablespaces STEPSYSDATA and STEPSYSBLOB.

Examples

```
host.application-servers = stepapp.stibo.com

host.database-servers = stepdb.stibo.com

step.system-name = step-test

#filesystem.db-software =

filesystem.db-workarea =

filesystem.db-upload =

#filesystem.database =

#filesystem.dblog =

#filesystem.redo1 =

#filesystem.redo2 =

database.stepsysdata-size-gb = 32

database.stepsysblob-size-gb = 320

database.stepsysblob-initial-file-size-gb = 16
```

If the name of the database OS user differs from the default Oracle:

```
user.db = <my-os-db-user>
```

If the name of the database differs from the default step:

```
dbca.db-name = <my-db-name>
```

If the service name of the database differs from dbca.db-name:

```
dbca.service-name = <my-db-service-name>
```

If the instance name of the database differs from dbca.db-name:

```
oracle.sid = <my-instance-name>
```

If the name and/or password of the stepsys / stepview database user differs from default:

```
database.stepsys-owner = <my-db-stepsys>
database.stepsys-owner-passwd = <my-db-stepsys-password>
database.stepview-owner = <my-db-stepview>
database.stepview-owner-passwd = <my-db-stepview-password>
```

If the database is a RAC database, then specify the SCAN name:

```
oracle.database-listener-reference = <scan-name>
```

Note: Leading blanks are not valid.

Configure Oracle Instance Memory

By default, SGA_TARGET and PGA_AGGREGATE_TARGET are used. SGA and PGA are set to 5/6 and 1/6 of the accountable amount of memory for the database instance.

If you want to use MEMORY_TARGET, then you must specify:

```
dbca.use-memory-target = true
host.db-use-hugepages = false  (if Linux)
```

The available amount of memory for the database instance is calculated from either of the following rules (available-host-memory):

- For a dedicated database server, the available amount of memory is set to 2/3 of host.memory-ram.
- For a server which is both an application and database server, the available amount of memory is set to 2/5 of host.memory-ram.

The maximum allowable amount of memory for the database instance (dbca.max-db-memory) is set to 68719476736 (64GB) by default.

The accountable amount of memory for the database instance is calculated from the following rules:

- dbca.max-db-memory < available-host-memory
  - The calculation is based on dbca.max-db-memory
- dbca.max-db-memory >= available-host-memory
  - The calculation is based on available-host-memory
- dbca.max-db-memory is set to 0
  - The calculation is based on available-host-memory

If the amount of available-host-memory is higher than dbca.max-db-memory and you want to use it, raise dbca.max-db-memory or set it to 0 to disable the limit. Alternatively, you can lower the value if you want your database instance to use less than the calculated available-host-memory.

Configure Oracle Server Edition

By default, the Oracle server software is installed as the standard edition (SE). To install the enterprise edition, you must specify:

```
oracle.install-edition-short-name = EE
```

The Oracle enterprise edition has a list of optional components. These components come at an additional cost. All components are installed, but you have the choice to enable / disable specific or all components. By default, the install script is configured to install Oracle enterprise with all optional components disabled.

To disable all optional components:

```
oracle.enterprise-edition-options-selection = true
oracle.enable-enterprise-edition-options-list
```

Note: The options list must be blank.

To enable specific optional components:

```
oracle.enterprise-edition-options-selection = true
oracle.enable-enterprise-edition-options-list = <comp1-name>:version, <comp2-
name>:version
```

The components can also be enabled or disabled after installation by using the command utility chopt.

The optional components are registered in the v$option view.

Upgrading to Oracle Enterprise Edition

To upgrade to the Enterprise Edition, you must be able to install the exact same Oracle server software (including patches). If the required software is unavailable or you want to upgrade to a new Oracle release, you must upgrade both the server software and the database. See the Oracle upgrade guide for instructions.

Note: The Oracle upgrade guide is provided by Oracle's own documentation.

Upgrading in Linux

1. Stop all Oracle services related to the Oracle home you intend to uninstall. Note that the listener may be servicing other Oracle homes.
2. Backup the Oracle home you intend to uninstall.
3. Copy the db-parameter files, password files, listener.ora, tnsnames.ora, and sqlnet.ora from the Oracle home you intend to uninstall, and send them to a location outside Oracle base.
4. Comment out <ORACLE_SID> entries, in /etc/oratab, related to the Oracle home you intend to uninstall.
5. Uninstall the current Oracle server software installation from a location outside the Oracle home you intend to uninstall:
   ```
   $ <ORACLE_HOME-TO-UNINSTALL>/uninstall/uninstall
   ```

   Important: When the program says 'de-configure', the term means to remove. If the list of Oracle databases shown is not empty, then there is something wrong. You should not continue unless you truly want to remove the database.

6. Install the Oracle server software again (including patches).
7. Stop the listener if it is running.
8. Restore db-parameter files, password files, listener.ora, tnsnames.ora, and sqlnet.ora.
9. Start the listener.
10. Start the database.

The database is now upgraded to Enterprise Edition.

Upgrading in Windows

1. Stop all Oracle services related to the Oracle home you intend to uninstall. Note that the listener may be servicing other Oracle homes.
2. Backup the Oracle home you intend to uninstall.
3. Copy db-parameter files, password files, listener.ora, tnsnames.ora, and sqlnet.ora from the Oracle home you intend to uninstall, and send them to a location outside Oracle base.
4. Backup registry settings 'ORA_<ORACLE_SID>_%'.
5. Remove the listener if it has the same name as a listener in another Oracle home. To do this, manually execute Net Configuration Assistant (NETCA) in the Oracle home you intend to uninstall.

6. Delete Windows service 'OracleService<ORACLE_SID>', using ORADIM, belonging to the Oracle home you intend to uninstall.
7. Leave all command prompts and Explorer files that are located in the Oracle home you intend to uninstall.
8. Uninstall the current Oracle server software installation from a location outside the Oracle home you intend to uninstall:
   ```
   $ <ORACLE_HOME-TO-DEINSTALL>\deinstall\deinstall.bat
   ```

   Important: When the program says 'de-configure', the term means to remove. If the list of Oracle databases shown is not empty, then there is something wrong. You should not continue unless you truly want to remove the database.

9. Install the Oracle server software again (including patches).
10. Recreate the listener by executing Net Configuration Assistant (NETCA) in the re-installed ORACLE_HOME.
11. Stop the listener if it is running.
12. Restore db-parameter files, password files, listener.ora, tnsnames.ora, and sqlnet.ora.
13. Start the listener.
14. Recreate Windows service 'OracleService<ORACLE_SID>' using ORADIM. Restore registry settings for the service as needed.
15. Start the database.

The database is now upgraded to Enterprise Edition.

Offline Installations

Customers with strict security policies that prohibit external access to https://updates.stibosystems.com will prevent the standard installation from working, resulting in a failed installation. In these cases, it may be necessary to perform an 'offline' installation of STEP for both Application and Database servers.

An offline installation comprises two steps. The first step is to prepare the relevant installation recipes (install the latest STEP version) as well as creating a software repository of the software required during the installation. This software must be fetched from Stibo System's updates.stibosystem.com server. This step must be performed in a location and on a machine that has access to https://updates.stibosystem.com. The content created during this stage will need to be copied to the target server intended for the installation. The second step is to perform the installation on the target server using the files / content created from the first step using the online machine.

Note: Java JRE 1.8 is required for the tasks listed in the below sections.

Online Machine Tasks

1. Unzip the specific customer foothold.zip file into '<STEPHOME>'
2. `<STEPHOME>/spot --wrapper`
3. `<STEPHOME>/spot --install`
4. `<STEPHOME>/spot --offline-recipe --snapshot=install.spr`
5. `<STEPHOME>/spot --accessmode=offline --prepare=to:step/trailblazer/latest.spr --target=install.spr --output=latest-fullfat.spr`
6. `<STEPHOME>/admin/install/config/fetch-software.pl`

   Download the required 3rd party software (e.g., /workarea/install-software).
7. The following files will need to be transferred to the target server and will be used during the installation of STEP:
   - install.spr
   - latest-fullfat.spr
   - zipped / tarball of directory containing the downloaded software (e.g., workarea/install-software)

Target Server Tasks

1. Unzip the specific customer foothold.zip file into '<STEPHOME>'
2. `<STEPHOME>/spot --wrapper`
3. `<STEPHOME>/spot --apply=install.spr --sync`
4. `<STEPHOME>/admin/install.pl --swdir=<SWDIR>`

Note: When prompted for the 'step.takout-url' property, enter `latest-fullfat.spr` including the full path to the file.

5. The installation will continue to process as normal.

Note: During the installation of the STEP software, an error will be thrown testing a connection to the Stibo Updates server. Press ‘c’ to ignore and continue with the installation.

Optimizing Performance

Perceived bad performance of the STEP system is seldom the result of a single cause. Usually, a wide range of improvements, in a variety of areas, will result in an improved performance of the system. Therefore, it is impossible to predict which recommendations will result in a particular performance improvement percentage.

Note: Optimizing one area of the system may negatively affect performance in another area. Consider system-wide testing before and after making optimization changes to verify the end result meets your expectations.

This section includes the following recommended data gathering methods and performance improvement tactics:

1. **Performance assessment** involves analyzing the system from a performance perspective, identifying the pain points, and giving actionable recommendations to optimize performance.
2. **Performance troubleshooting** involves methods defined to troubleshoot performance issues.
3. **Technical performance recommendations** involve client computers, internet connection, and STEP application and database server setup and connections.
4. **Functional performance recommendations** involve configuring the data mode and the recommended use of application features.
5. **Healthcheck performance recommendations** involve identifying and resolving system and performance issues. The tests available are defined in the **Healthcheck** section of the **Administration Portal** documentation.
6. **Monitoring performance recommendations** involve managing the status of external systems used to process data as well as identify possible problem areas of the STEP application server. The monitoring sensors available are defined in the **Monitoring** section of the **Administration Portal** documentation.

Additionally, the In-Memory Database Component for STEP allows the system to take advantage of the availability of inexpensive memory to read all data into memory, and then read data from the In-Memory database instead of querying Oracle. For more information, see the **In-Memory Database Component for STEP** topic in the **Resource Materials** section of online help.

Technical Performance Recommendations

This topic describes the data gathering methodologies and performance recommendations from a technical infrastructure viewpoint for the server machines:

- Infrastructure Performance Recommendations
- Client Environment Recommendations
- Server Environment Recommendations
- Server Hygiene

Infrastructure Performance Recommendations

This is one of the technical infrastructure data gathering methodologies and performance recommendations. The full list is defined in the **Technical Performance Recommendations** topic.

Stibo Systems provides the STEP Infrastructure Recommendation document to describe how STEP environments should be set up to meet performance and scalability requirements.

The document should be updated when the load on the STEP environments has significantly increased after the infrastructure recommendation was delivered. For example, a significant increase of the load could include a significant increase in the number of STEP users, or a significant increase of the number of objects in STEP. As part of this engagement, review the loads documented in the original infrastructure recommendation document and contact your Stibo Systems account manager or partner manager if that needs to be updated before the start of the engagement.

For details, see the **Infrastructure Requirements** section within this documentation.

Client Environment Recommendations

This is one of the technical infrastructure data gathering methodologies and performance recommendations. The full list is defined in the **Technical Performance Recommendations** topic.

This topic describes the data gathering methodologies and performance recommendations for the client machines using workbench and Web UI, including:

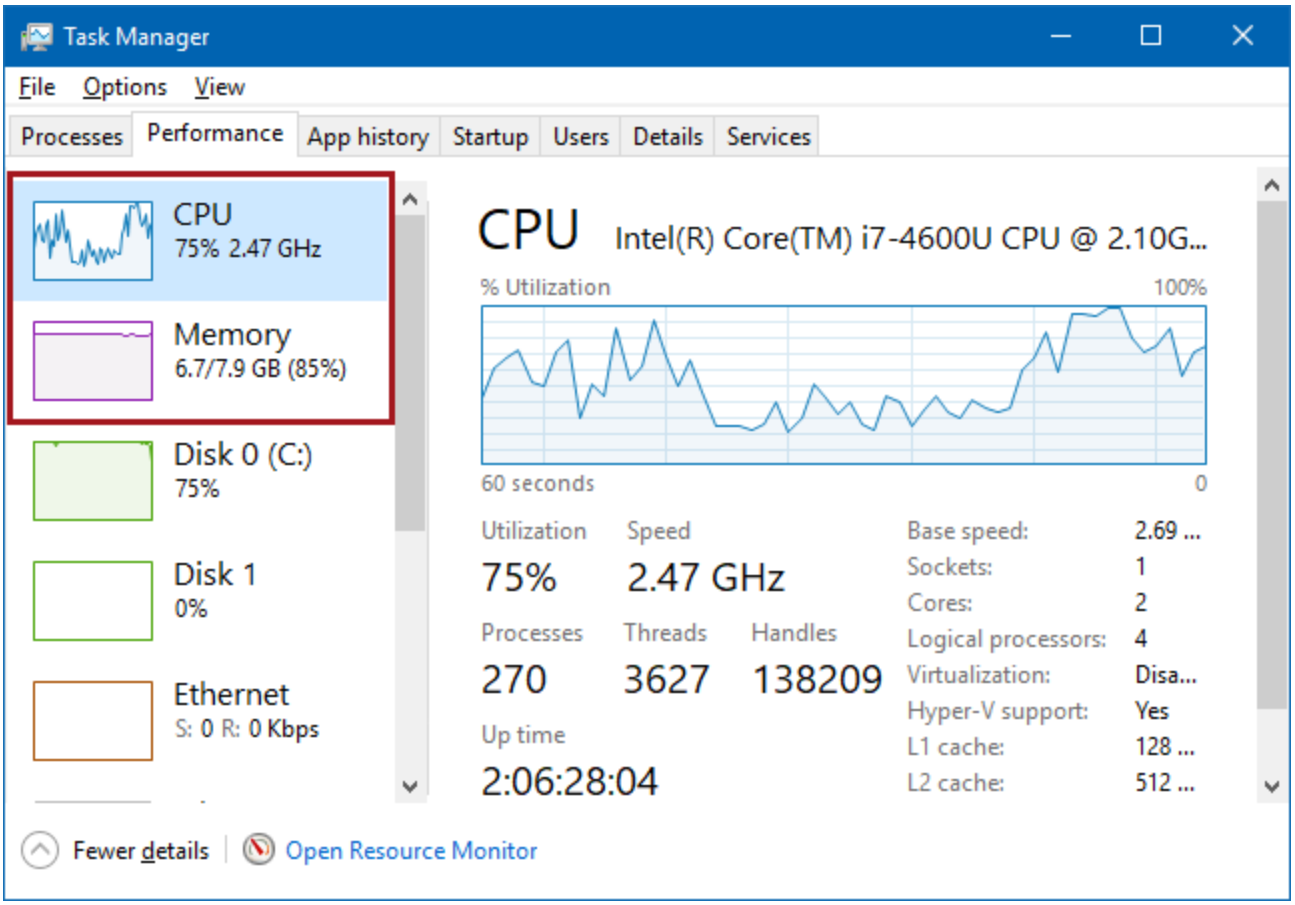
- Client computer
- Client internet browser
- Client internet connection

Client Computer

Poor performance in workbench and Web UI can be caused by a client computer that runs slowly.

Check the performance of a Windows computer using the following steps:

1. On the keyboard, press the following three keys simultaneously: **Ctrl**+**Alt**+**Delete**.
2. Click the **Task Manager** option.
3. On the Performance tab, analyze the client computer **CPU** utilization and **Memory** usage.



Recommendation

If the CPU and/or Memory percentage stays high (near 100%), the client computer is generally slow. Workbench and Web UI do not perform well on a slow computer. Consult your IT department for assistance.

Client Internet Browser

Poor performance of an internet browser can hinder the performance of workbench and Web UI. An internet browser can perform slowly due to plug-ins or an outdated version.

Check internet browser performance using the following steps:

1. Verify that the browser version being used is supported by the installed version of STEP. Search online help for the relevant Platform and Software Support topic.
2. Verify that the browser version being used is included in the Infrastructure Recommendations.
3. Open the browser and view a number of website, observing the response time.
4. If the browser is slow, try a different supported browser for comparison.

Recommendation

Update the internet browser version, disable plug-ins, or install a different browser. Consult your IT department for assistance.

Client Internet Connection

A slow or unstable internet connection can cause poor performance in workbench and Web UI. This check can be performed from a Windows machine via a command prompt, or from the workbench regardless of the machine type. The response times of the ping and/or network latency check should meet normal internet connection figures.

For example, if the application server has a high response time (such as 125 milliseconds), the internet connection from the client computer to STEP is about the same speed as a dial-up connection.

Important: You can estimate an additional 1 millisecond in network latency for every 100 kilometers the data travels. So, if the application server is in Venlo, Netherlands and the client is in Seattle, USA (a distance of about 8,000 km), then a response time of about 30 milliseconds from client to application server corresponds with a response time of about 110 milliseconds from client in Seattle, USA to application server in Venlo, Netherlands.

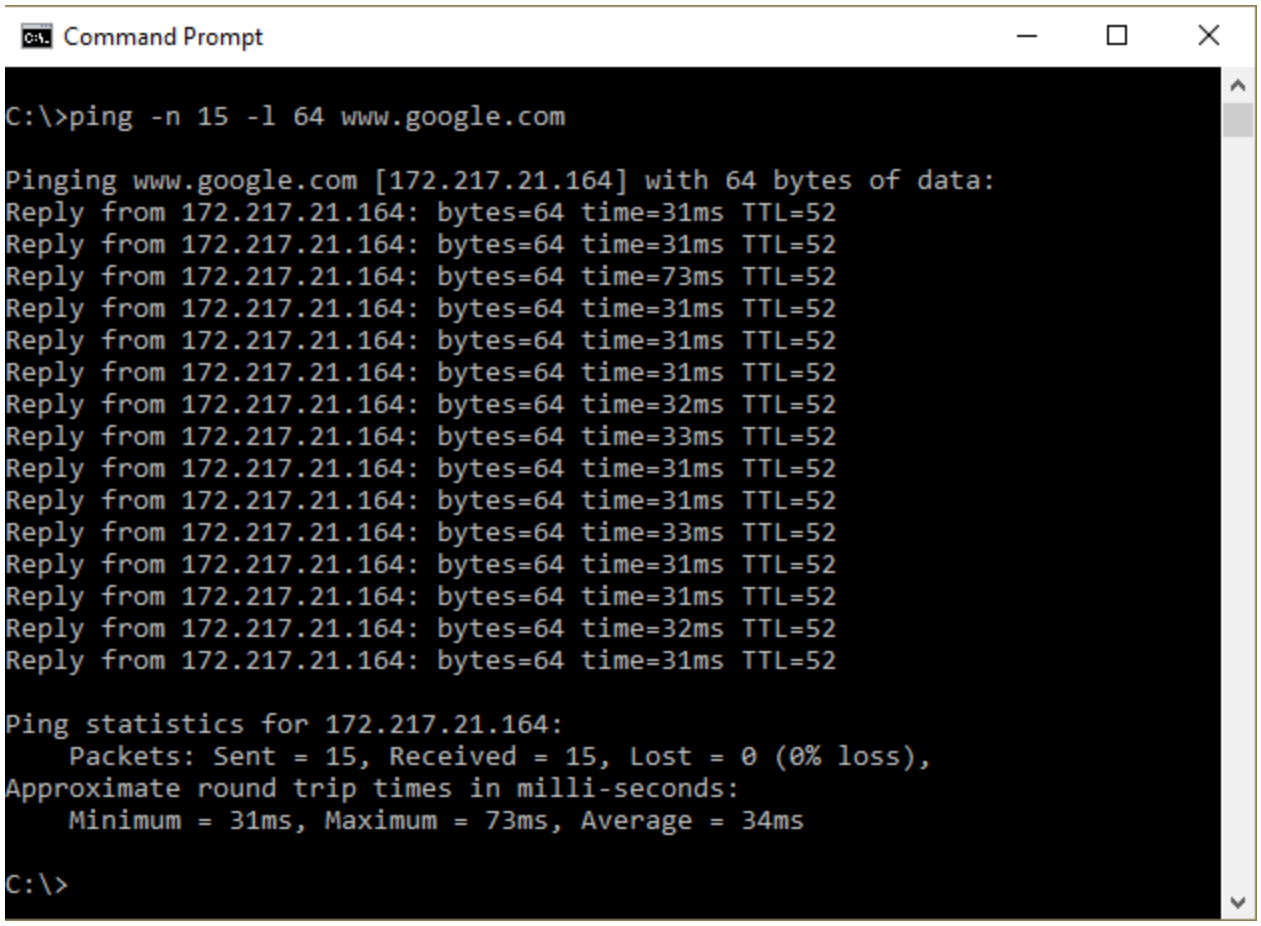
Windows Command Prompt Check

Check internet connection performance using the following steps:

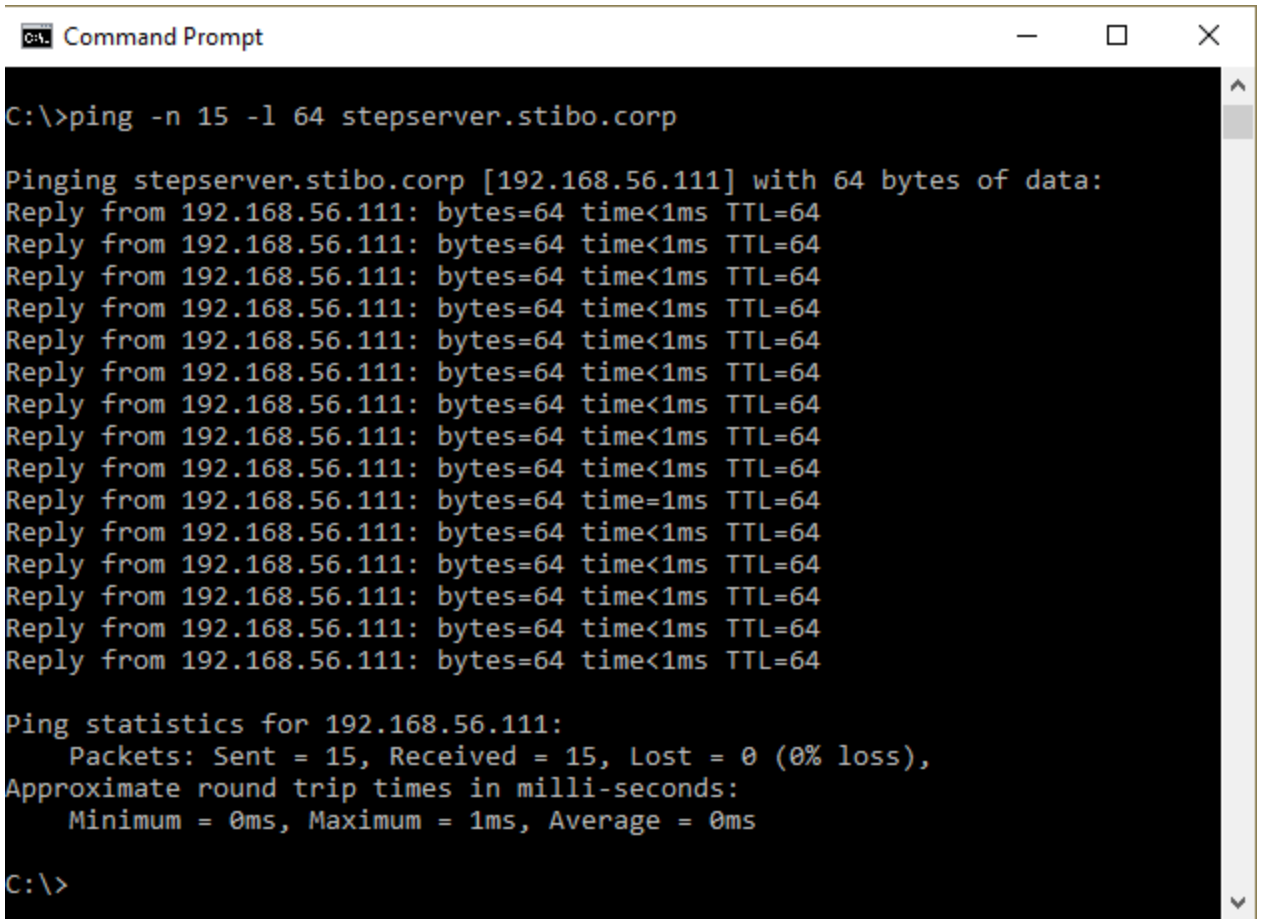
1. On a Windows machine, click **Start** and then type 'cmd' to display the Command Prompt option.
2. In the command prompt dialog, type the following command to 'ping' the Google website.

   ```
   ping -n 15 -l 64 www.google.com
   ```

   In this command, '-n 15' means 15 echo requests instead of the default 4; and '-1 64' means 64 bytes requests instead of the default 32 bytes.



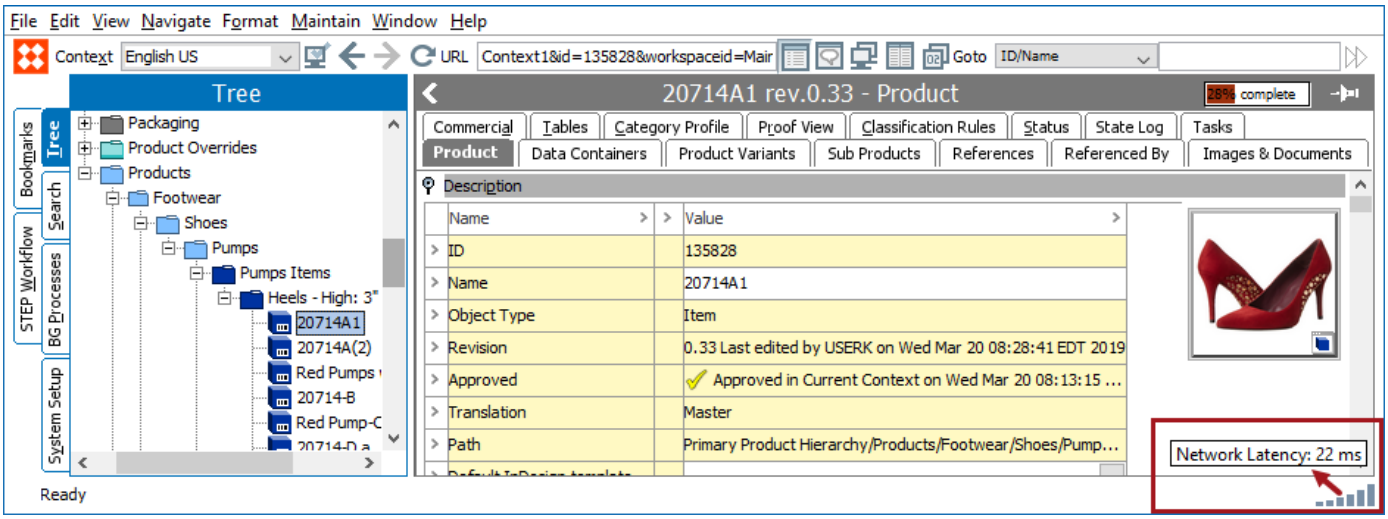
3. In the command prompt dialog, type the following command to 'ping' the application server.
   `ping -n 15 -l 64 [STEP_SERVER_NAME]`



Workbench Check

Check internet connection performance using the following steps:

1. Log in to the workbench.
2. Hover over the icon on the bottom right corner to display the Network Latency value.



Recommendation

The easiest way to improve a bad internet connection is to connect via a wired (cable) connection instead of wireless Wi-Fi. If the client machine still experiences a bad internet connection with response times frequently above 125 milliseconds, then the internet connection should be improved. Consult your IT department for assistance.

Server Environment Recommendations

This is one of the technical infrastructure data gathering methodologies and performance recommendations. The full list is defined in the **Technical Performance Recommendations** topic.

This topic describes the data gathering methodologies and performance recommendations from a technical infrastructure viewpoint for the server machines:

- Server Configuration File
- Server Virtualization
- Server Network Latency
- Folders as Shared Locations
- Server Log File Settings
- Components
- Application Server Load
- Database Long-Lasting SQL Queries
- Database Server Redo Log
- Database Server Alert Log
- Database Server Oracle Adaptive Features
- Database Server Oracle Statistics
- Database Server Oracle DataGuard
- DTP Server
- Custom Extensions

Server Configuration File

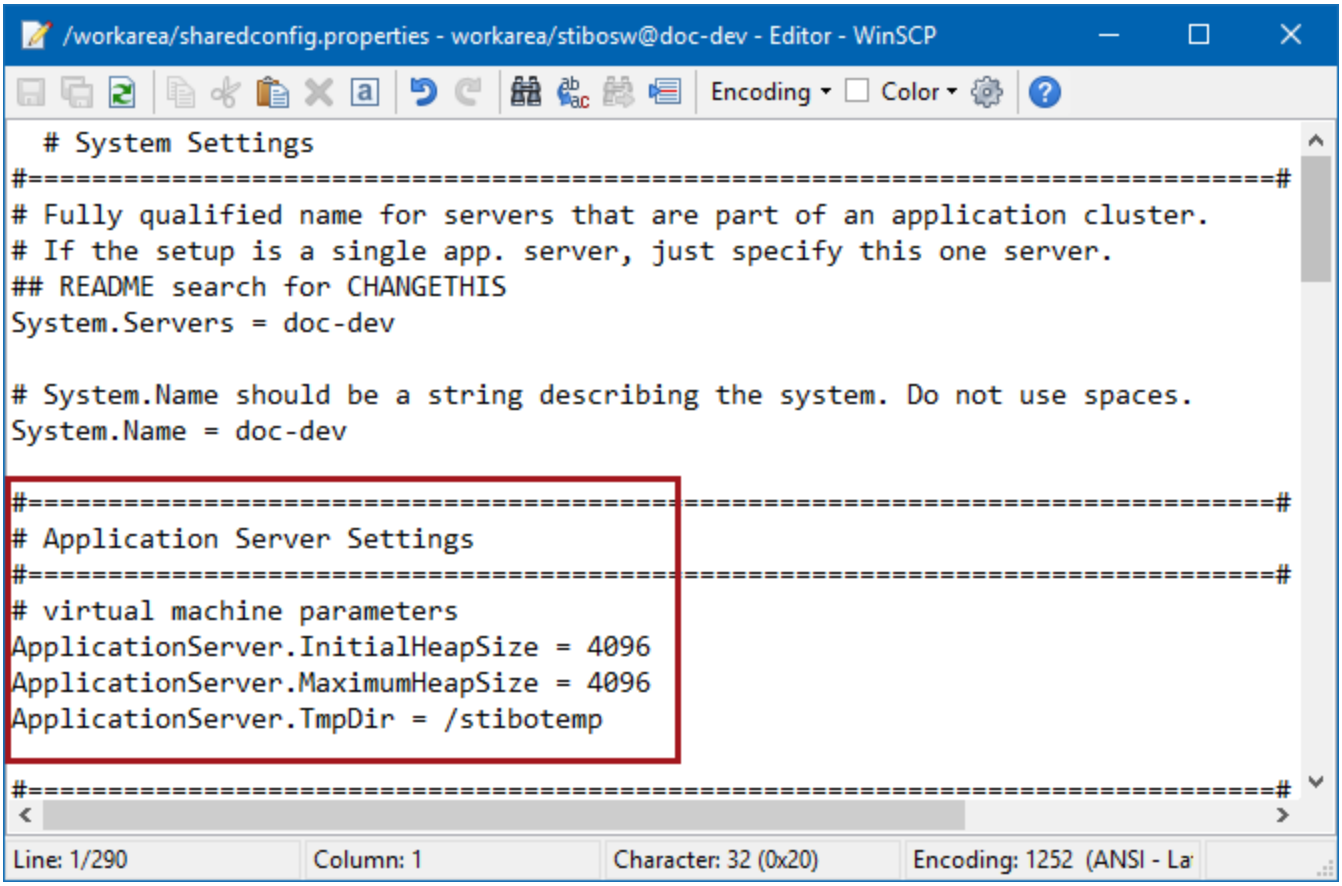
This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

The server configuration settings are defined by Stibo Systems. For example, the initial and maximum heap sizes are set by Stibo Systems and should remain unchanged.

Note: Before modifying the server configurations in the sharedconfig.properties file, first consult your Stibo Systems representative.

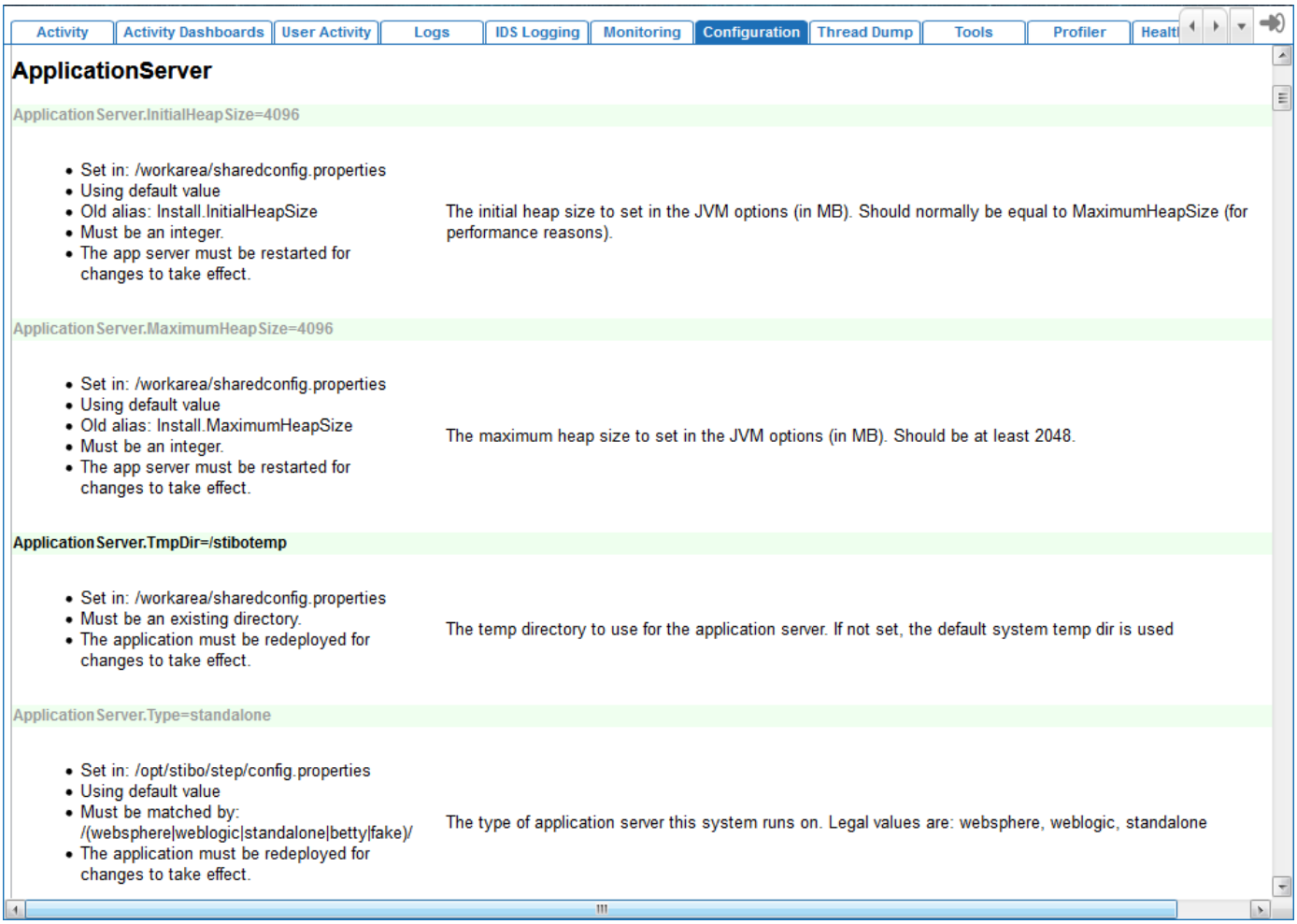
To check the server configurations, view the ApplicationServer settings in the sharedconfig.properties file settings using one of these options:

- On the application server, locate and view the **sharedconfig.properties** file and locate the application server section.



- From the Start Page, click the STEP System Administration button and supply the log in credentials. On the Configuration tab, click the **Fetch data** button to load the current system configuration values. Under the

'**ApplicationServer**' section, review the active and inactive settings. Active configurations are in black text, inactive configurations are shown in gray. For more information, see the **Configuration** topic in the **Administration Portal** documentation.



Server Virtualization

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

Stibo Systems recommends to set up server virtualization according to the provided STEP Infrastructure Recommendation document and/or Platform and Software Support document. Furthermore, Stibo Systems recommends taking the following white paper for virtualization on VMware into consideration for latency-sensitive systems.

Search the web for relevant details regarding dealing with latency-sensitive applications while running in a VMware environment. For example, technical white papers on the https://www.vmware.com website.

Server Network Latency

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

The flexibility of STEP gives rise to a potentially large number of ad-hoc requests between the application server and the database server. Network influence (latency) and bandwidth between the application and database servers are important because STEP performance is negatively impacted when the network latency is not stable and frequently above the latency requirements.

The ability to synchronize across the application server cluster is crucial. In an environment with two application servers, to avoid 'Optimistic Locking' errors, a data change via one application server needs to be reflected as close to instantly as possible.

Although full network recommendations are stated in the Infrastructure Recommendation document and/or Platform and Software Support document, of particular interest on this topic are:

- Network bandwidth requirements: Minimum requirement is 1 gigabit dedicated network between all STEP servers except to file servers; the recommended requirement is 10 gigabit for enterprise systems with a heavy workload profile.
- Network latency requirements: The requirements for network latency between application servers in an application cluster and between application server(s) and database server(s) are:
    - Maximum 0.2 milliseconds with a 64 bytes packet size
    - Maximum 0.4 milliseconds with an 8K packet size
    - Maximum 1.0 milliseconds with a 32K packet size

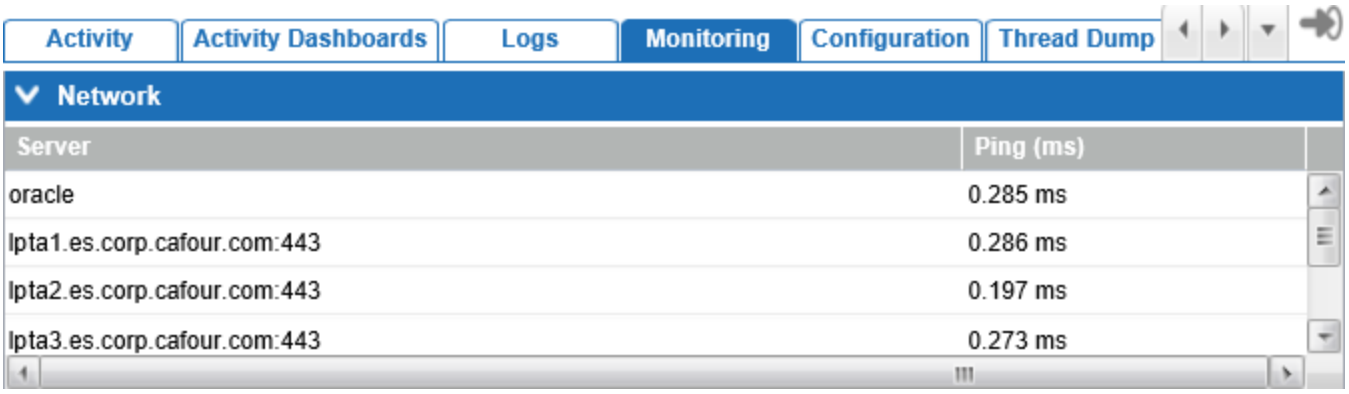
Network latency can be analyzed using the options defined below. If network latency is not stable and/or is frequently above the latency requirements, consult your IT department for optimization.

Network Latency Analysis via STEP

From the Start Page, click the **STEP System Administration** button and log in.

1. Click the **Monitoring** tab to view an instant indication of the network latency between the application and database servers. This is a near real-time check of the latency between the servers. For more information, see the **Monitoring** topic in the **Administration Portal** documentation.

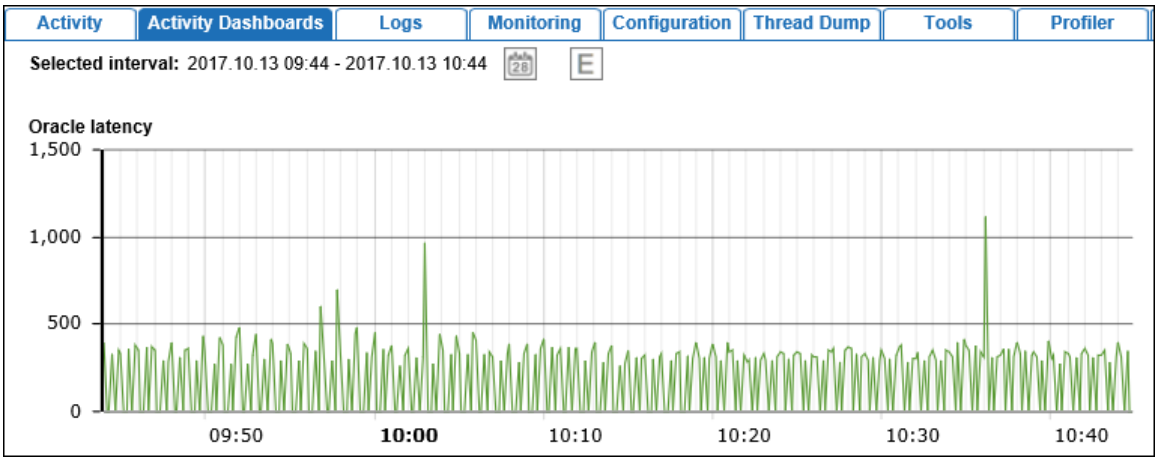
   The following example shows a network latency which is not significantly above the 0.2 milliseconds and therefore indicates a good network latency:



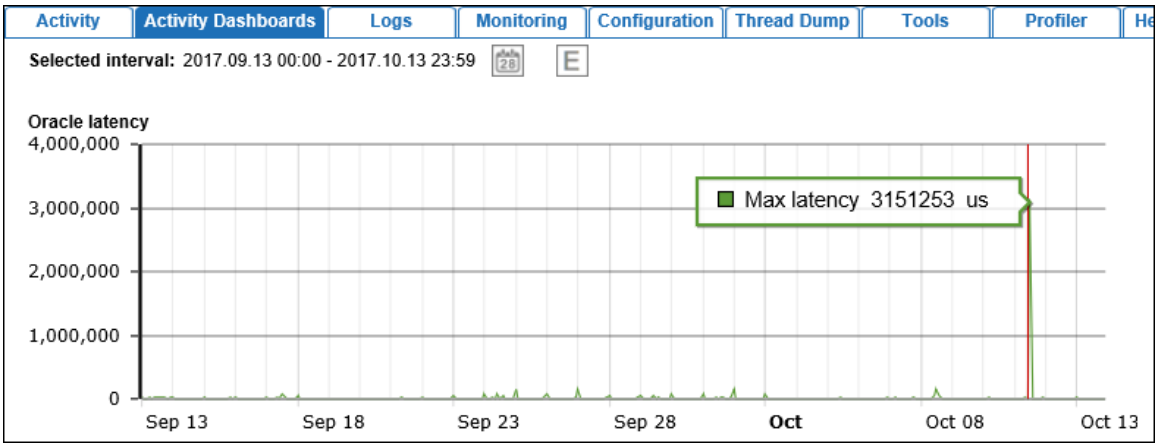
2. Click the **Activity Dashboard** tab to view a historic network latency analysis. This graphic provides the average time it takes to execute 10 simple database requests. High latency numbers can indicate network issues, but can also indicate the database server is having trouble keeping up with the number of requests. For more information, see the **Activity Dashboard** topic in the **Administration Portal** documentation.

   The following images provide historic insights in the network latency:

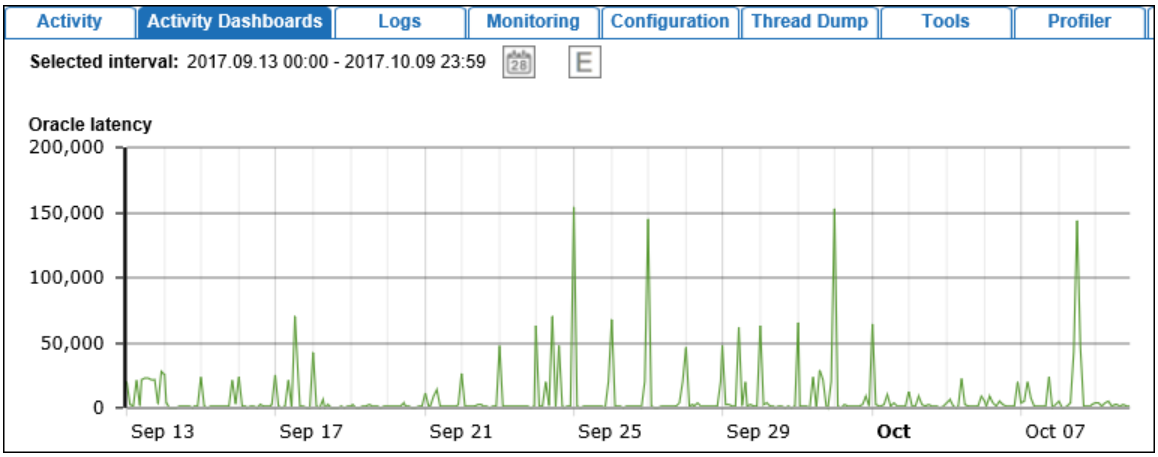
   - The time interval 'last hour' shows that latency had a couple of spikes near to the 1 millisecond, which is something to be concerned about.



   - The time interval 'last thirty days' shows a large spike around October 10 of about 3 seconds which is concerning.



- The time interval before the spike above shows many other spikes, frequently above the 50 milliseconds, which is concerning as well.



Network Latency Analysis via Ping

Based on your type of server, use ping to measure network latency between application server(s) and database server(s) in an application cluster, as defined below.

- On a Linux server, run the following ping commands from application server to database server:

```
ping -c20 <db-host> |grep rtt
ping -c20 -s8000 <db-host> |grep rtt
ping -c20 -s32000 <db-host> |grep rtt
```

- On a Windows server, run the following hrping commands from application server to database server:

```
hrping -l 64 -n 20 <database-host>
hrping -l 8000 -n 20 <database-host>
hrping -l 32000 -n 20 <database-host>
```

Network Latency Analysis via Script

A script executed from the application server against the database and with different package-sizes can be used to measure any network latency.

1. From a Linux server, log on to the application server as 'stibosw'.
2. Copy the following SQL script using the file name 'benchnet5.sql' to `/home/stibosw` on the application server.

set timing on set autotrace traceonly statistics set arrays 5000 set pages 1000 select null from dual connect by rownum < 100000; prompt Small without network influence select null from dual connect by rownum < 100000; set arrays 10 prompt Small with network influence select null from dual connect by rownum < 100000; set arrays 5000 prompt Medium without network influence select '0123456789012345678901234567890123456789012345678901234567890123456789012345678901'||rownum from dual connect by rownum < 1000000; set arrays 100 prompt Medium with network influence select '0123456789012345678901234567890123456789012345678901234567890123456789012345678901'||rownum from dual connect by rownum < 1000000; set arrays 5000 prompt Large without network influence select '0123456789'||rownum from dual connect by rownum < 1000000; set arrays 100 prompt Large with network influence select '0123456789'||rownum from dual connect by rownum < 1000000;

3. Run the script on the application server:
   ```
   sqlplus stepsys/stepsys
   @/home/stibosw/benchnet5.sql
   ```
4. Collect all output and attach it to a Jira issue.

Folders as Shared Locations

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

Shared locations on other servers can be used as STEP folders. For example, using a server other than the STEP application server to house the hotfolders for import files. However, placing STEP files on shared locations can be unpredictable, depending on the latency of the network. Therefore, if STEP files are on shared locations, then the infrastructure setup should comply with the Infrastructure Recommendation document and/or Platform and Software Support document, and the latency of the network should meet the stated recommendations.

For example, if the application server has a high response time, such as 220 milliseconds, then this means the internet connection from the client computer to STEP is about the same speed as a dial-up connection.

Important: You can estimate an additional 1 millisecond in network latency for every 100 kilometers the data travels. For example, consider that the application server and the database server are both located in Amsterdam in the Netherlands and the latency between both is 0.2 milliseconds on average, which is an optimal latency. The shared file location, however, is located in Seattle, USA, which is 8,000 km away. In this case, an additional 80 milliseconds needs to be added to the network latency, resulting in a drastic decrease of the optimal network latency of 80.2 milliseconds instead of 0.2 milliseconds.

To check network latency from a browser, see the **Network** section of the **Monitoring** topic in the **Administration Portal** documentation.

Windows Check

Check the internet connection performance on a Windows application server machine as follows:

In a command prompt dialog, type the following command to ping the shared file location:

```
ping -n 15 -l 64 shared.file.location
```

In this command, '-n 15' means 15 echo requests instead of the default 4; and '-1 64' means 64 bytes requests instead of the default 32 bytes.

Command Prompt

```
C:\>ping -n 15 -l 64 stepserver.stibo.corp

Pinging stepserver.stibo.corp [192.168.56.111] with 64 bytes of data:
Reply from 192.168.56.111: bytes=64 time<1ms TTL=64
Reply from 192.168.56.111: bytes=64 time<1ms TTL=64
Reply from 192.168.56.111: bytes=64 time<1ms TTL=64
Reply from 192.168.56.111: bytes=64 time<1ms TTL=64
Reply from 192.168.56.111: bytes=64 time<1ms TTL=64
Reply from 192.168.56.111: bytes=64 time<1ms TTL=64
Reply from 192.168.56.111: bytes=64 time<1ms TTL=64
Reply from 192.168.56.111: bytes=64 time<1ms TTL=64
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Reply from 192.168.56.111: bytes=64 time<1ms TTL=64
Reply from 192.168.56.111: bytes=64 time<1ms TTL=64
Reply from 192.168.56.111: bytes=64 time<1ms TTL=64
Reply from 192.168.56.111: bytes=64 time<1ms TTL=64

Ping statistics for 192.168.56.111:
    Packets: Sent = 15, Received = 15, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

Linux Check

Check the internet connection performance on a Linux application server machine as follows:

```
ping -c 15 -s 64 shared.file.location
```

In this command, '-c 15' means 15 echo requests instead of the default 4; and '-s 64' means 64 bytes requests instead of the default 32 bytes.

stibosw@stepserver:~/step

File Edit View Search Terminal Help

```
[stibosw@stepserver step]$ ping -c 15 -s 64 localhost
PING localhost.localdomain (127.0.0.1) 64(92) bytes of data.
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=1 ttl=64 time=0.013 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=2 ttl=64 time=0.018 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=3 ttl=64 time=0.013 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=4 ttl=64 time=0.016 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=5 ttl=64 time=0.051 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=6 ttl=64 time=0.011 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=7 ttl=64 time=0.022 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=8 ttl=64 time=0.016 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=9 ttl=64 time=0.014 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=10 ttl=64 time=0.018 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=11 ttl=64 time=0.014 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=12 ttl=64 time=0.018 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=13 ttl=64 time=0.011 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=14 ttl=64 time=0.032 ms
72 bytes from localhost.localdomain (127.0.0.1): icmp_seq=15 ttl=64 time=0.025 ms

--- localhost.localdomain ping statistics ---
15 packets transmitted, 15 received, 0% packet loss, time 14009ms
rtt min/avg/max/mdev = 0.011/0.019/0.051/0.010 ms
[stibosw@stepserver step]$
```

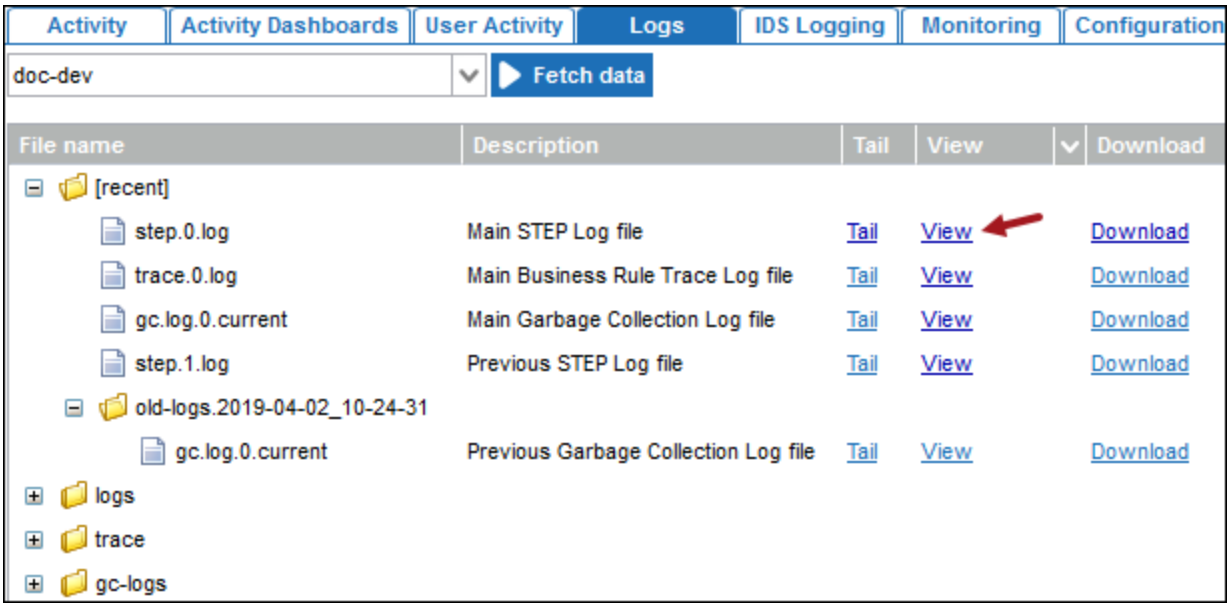
Server Log File Settings

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

STEP uses a powerful logging subsystem tool to provide troubleshooting information if the system is not working as expected. For more information, see the **Logs** topic in the **Administration Portal** documentation.

View Main STEP Log File

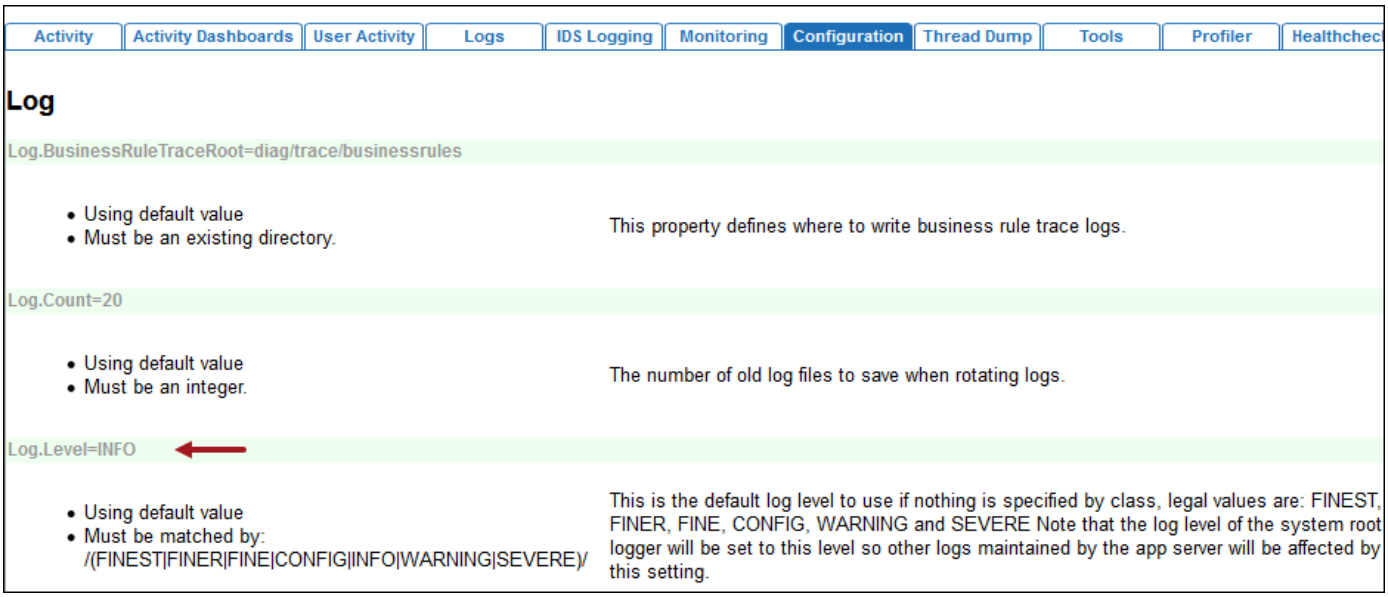
From the Start Page, click the **STEP System Administration** button and supply the login credentials. On the Logs tab, click the **Fetch data** button to load the logs. On the **Main STEP Log file** row, click the **View** link.



Logging Levels

The Log.Level configuration property in the sharedconfig.properties file controls the level of detail generated in the logs. A high level log contains only the most important messages while a low level provides more detail. Each level implicitly logs all other levels above that level as well.

To determine the current level being logged, from the Start Page, click the **STEP System Administration** button and supply the login credentials. On the Configuration tab, search for Log.Level.



Important: Log level detail FINE, FINER, and FINEST can create a large number of log entries in a short period of time. Typically these levels are not used for the whole system.

The available logging levels are:

- SEVERE: Errors where the program is unable to recover and continue in a normal manner, such as a workflow looking for a property that does not exist.
- WARNING: Conditions which are possible errors or where the program is able to recover and continue in a normal manner.
- INFO: Messages indicating normal progress of the program, the default setting. These entries can be of interest to the end user.
- CONFIG: Messages not generally of interest to the end user, but often useful for diagnosing issues on a running system.
- FINE: Messages of interest to most developers.
- FINER: Messages of interest to only a few developers.
- FINEST: Messages of interest to only a very few developers. This can be extremely verbose.

Recommendation

The log file settings typically differ per environment, as follows:

- On development (STEP DEV) and test (STEP TEST) environments, set the log to FINE to trace errors. This log level assists in identifying potential issues during development and testing. If there is an error and the current level log file setting does not provide enough detail, set the log to FINER or FINEST.
- On a QA environment (STEP QA), set the log to INFO or WARNING.
- On a production environment (STEP PROD), the log level is typically set to log SEVERE issues during normal operation. This avoids the risk of clogging the production system with large log files.

Package-Specific Logging

Set a logging level for a package to allow a more granular log for a specific area. In the sharedconfig.properties file, add the name of the package to the end Log.Level property.

For example, the setting **Log.Level.com.stibo.centralhotfolder=FINE** will set the level of everything under com.stibo.centralhotfolder to FINE.

Stack Trace Information

In the event of an error, the log will commonly have a stack trace of some sort. While the stack trace data is mostly of interest to developers, it is a good indicator of the most interesting log messages. The following is an example log entry with a stack trace. Real log entries and stack traces will look somewhat different and will not have identifying information trimmed out as is in this illustration.

```
Feb 18, 2009 6:28:33 PM com.stibo.servicemanager.beans.CentralHotFolder doRun
SEVERE: Unable to handle [trimmed] exception message Couldn't rename [trimmed]
to [trimmed]
java.lang.RuntimeException: Couldn't rename [trimmed] to [trimmed]
at com.stibo.customer.[trimmed].moveFile([trimmed].java:143)
at com.stibo.customer.[trimmed].handleFile([trimmed].java:76)
at com.stibo.servicemanager.beans.CentralHotFolder.doRun
(CentralHotFolder.java:277)
at com.stibo.servicemanager.beans.CentralHotFolder$4$1.run
(CentralHotFolder.java:211)
...
```

- The first line shows the date and time as well as what part of the program the message was logged from, namely the doRun method in com.stibo.servicemanager.beans.CentralHotFolder.
- The next line gives the error message where the cause was one file not being able to be renamed and the error happened in a specific customer hotfolder.

Components

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

STEP components include:

- Core functionality: the STEP version, e.g., STEP 7.5, STEP 8.2, etc.
- Hotfixes (optional)
- Monthly Patches (optional)
- Custom Extensions (optional)

Run the './spot --components' command to display the applied components, as shown below:

```
This STEP system has the following software installed:

Baselines:
        sdl-with-framework-8.3
        step-9.0-mp2-2018-06-28-17-26-22

Components installed in addition to baseline:
        restapiv2-7.0.1
        mongodbadapter-7.0.48
        integration-amazon-sqs-7.0.3
        fda-esignature-7.0.1
        assetdownload-7.0.1
        assetanalyzer-7.0.1
        acrolinx-7.0.2
```

Considerations

- The DTAP street needs to be based on the same components. The Development, Test, Acceptance, and Production system should be based on the same components and versions. If not, at a minimum, ensure the baseline is the same on all environments.
- Consider that there can be unnecessary components on the STEP system after an upgrade. It may well be that after an upgrade, some of the hotfixes are not needed anymore. Read the Release Notes carefully to be sure that all unnecessary components are removed.

Application Server Load

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

The load of the systems in the cluster can be analyzed using the STEP Admin Portal.

- When the STEP server load is high, the performance is degraded and further actions are required.
- When the STEP environment is a cluster environment, and one of the systems in the cluster is not balanced, performance is degraded and further actions are required.

Use these steps to analyze the CPU and Memory load and distribution of the STEP Application Servers:

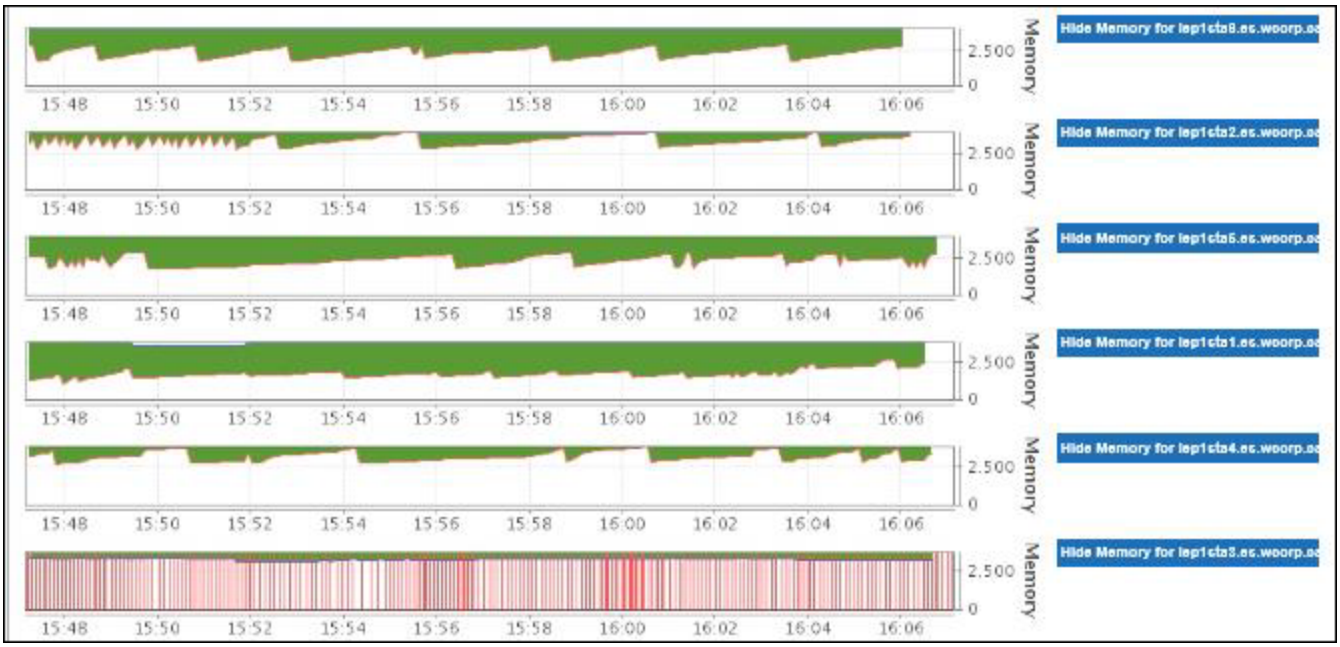
1. From the Start Page, click the **STEP System Administration** button.
2. Supply the login credentials and click the **Login** button.
3. On the **Activity** tab, click the **Fetch data** button to load CPU, Memory, and Thread data.

   For more information, see the **Activity** topic in the **Administration Portal** documentation.

For example, the CPU load of the servers may look like the following image:

The CPU load reported above is unbalanced on the different servers as part of the cluster. Mainly, the last server lep1sta3.es, is doing all the work and the rest of the servers are hardly loaded.

In another example, the Memory load of the servers may look like the following image:



The memory load reported above is unbalanced on the different servers as part of the cluster. Mainly, the last server lep1sta3.es is doing all the work and the rest of the servers are hardly loaded.

In these examples, the server lep1sta3.es is running back-to-back garbage collection due to the high load, potentially combined a too small heap-allocation. So, in this example, the recommendation is to analyze the heap size further and see if it is configured correctly.

Additionally, there seems to be incorrect load balancing between the servers in the cluster for the background processes. The system selects which of the application servers should handle the background processes. Therefore, it is also recommended to further analyze the load balancing.

Database Long-Lasting SQL Queries

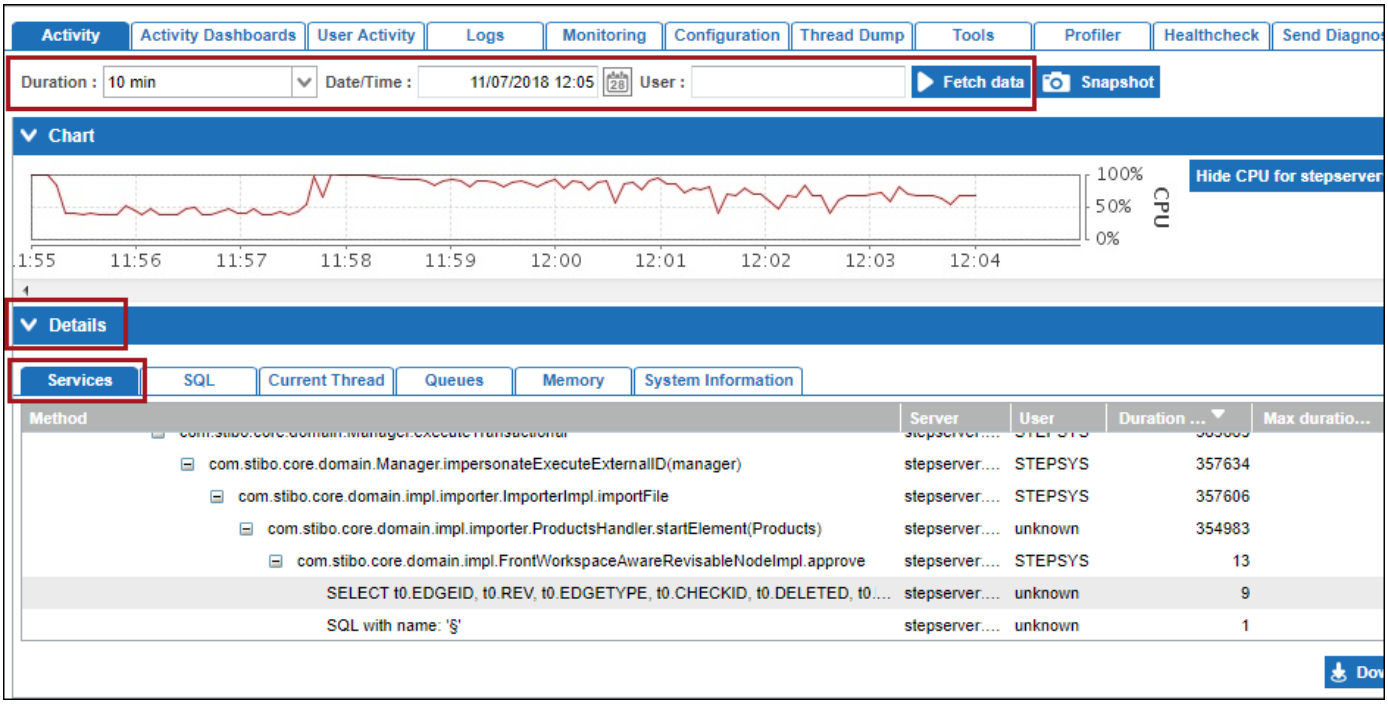
This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

Any long-lasting SQL queries that reach the hundreds of milliseconds or more indicate that the application server is waiting for the Oracle database. Waiting for the Oracle database can be caused by latency issues, optimistic locking issues, etc. The cause should be analyzed further.

For more information, see the **Activity** topic in the **Administration Portal** documentation.

Analyze Long-Lasting SQL Queries

1. From the Start Page, click the **STEP System Administration** button and supply the login credentials.
2. On the **Activity** tab, set the Duration and Date / Time parameters according to when the performance issues were noticed.
3. Click the **Fetch data** button to load the data.

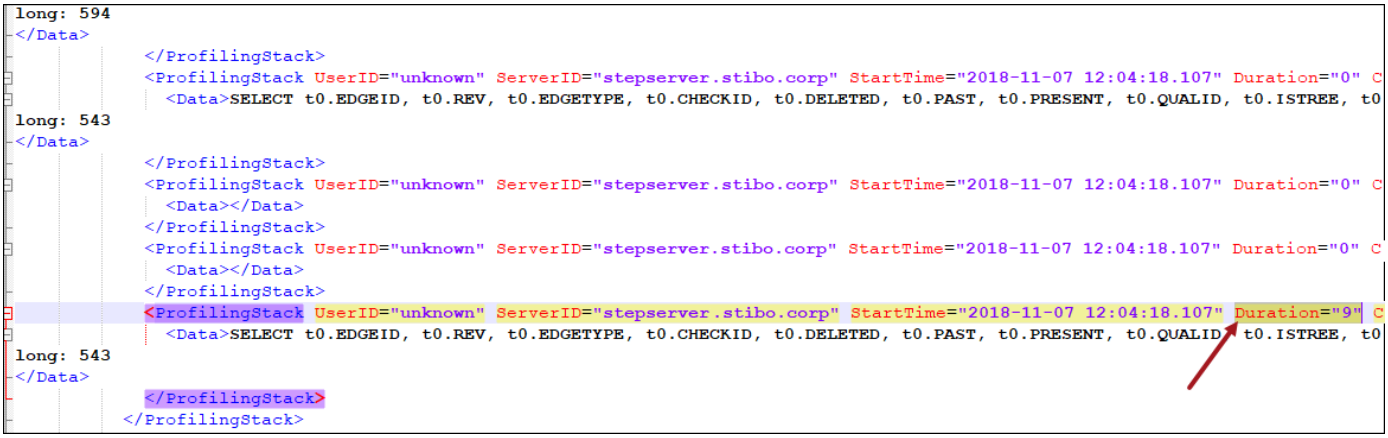


4. Click the Details heading to display the Services tab.
5. Click the Services tab and drill down to the level where the SQL queries are visible to determine if the SQL query is long-lasting, specifically, more than hundreds of milliseconds.
6. Compare the longest-lasting SQL query with the longest-lasting SQL query under the **SQL** tab using the 'Max duration' column.

In this example, the maximum duration of a SQL query was 9 milliseconds, which is fast. Nevertheless, if long-lasting SQL queries are found with hundreds of milliseconds, then this indicates that the solution is waiting for the Oracle database and further analysis is necessary.

Alternatively, you can download the profiling data and look up the longest-lasting query in the XML, as follows:

1. Click the **Download data** button.
2. Open the downloaded file.
3. Search for the largest duration which was displayed under the 'Max Duration' column in the SQL tab.



Database Server Redo Log

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

The STEP database has a redo log for recovery operations. The redo log consists of two or more pre-allocated files that store all changes made to the database as they occur. Every instance of the database has an associated redo log to protect the database in case of an instance failure.

Every time the database performs, a redo log switch triggers a database checkpoint, which brings the database to a halt while the checkpoint runs. The general performance of the database is impacted if the redo log switch is performed too often.

Important: The database should perform a redo log switch of about 50 times per day (every 30 minutes) and the redo log switches per day should be stable.

Follow these steps to analyze the redo log file of the database via the DB ToolBox:

1. On the application server, go to the DB ToolBox, which is typically saved in the '/opt/stibo/step/admin/app-server-toolbox/' folder.
2. Start the ToolBox using one of these commands:
   - `./db-toolbox.pl`
   - `perl db-toolbox.pl`
3. Execute DB ToolBox number 42: 'Show redolog history'

Example

This database performed a redo log switch 2-to-3 times per minute in several days over the last 28 days. That negatively impacts the general performance of the database. Additionally, over the last 28 days, the redo log switch varies from about 20 times per day to about 500 times per day.

The redo log file size is 256 MB.

```
Redolog groups, members and sizes
+++++++++++++++++++++++++++++++++

    GROUP# MEMBER                                                MB_SIZE
---------- ------------------------------------------------- ----------
         1 /database/dbredo1/oradata/step/redo01a.log                256
         1 /database/dbredo2/oradata/step/redo01b.log                256
         2 /database/dbredo1/oradata/step/redo02a.log                256
         2 /database/dbredo2/oradata/step/redo02b.log                256
         3 /database/dbredo1/oradata/step/redo03a.log                256
         3 /database/dbredo2/oradata/step/redo03b.log                256
         4 /database/dbredo1/oradata/step/redo04a.log                256
         4 /database/dbredo2/oradata/step/redo04b.log                256
         5 /database/dbredo1/oradata/step/redo05a.log                256
         5 /database/dbredo2/oradata/step/redo05b.log                256
         6 /database/dbredo1/oradata/step/redo06a.log                256
         6 /database/dbredo2/oradata/step/redo06b.log                256
```

The statistics of the number of redo log switches per day are as follows:

```
Redolog switches per day (last 28 days)
+++++++++++++++++++++++++++++++++++++++

DAY               COUNT(*)
--------------- ----------
20170930                60
20171001                75
20171002               149
20171003                84
20171004                81
20171005                99
20171006               407
20171007               445
20171008               351
20171009               459
20171010               389
20171011               500
20171012                49
20171013               113
20171014               384
20171015               419
20171016               384
20171017               344
20171018               324
20171019               431
20171020               453
20171021               142
20171022                24
20171023                79
20171024                49
20171025                98
20171026                70
20171027                23
```

In this example, the recommendation is to increase the size of the redo log files, and to minimize the number of redo log switches to one every half hour. This will positively impact the database performance and can be achieved by:

- Increasing the size of the redo log files from 256 MB to 5 GB.
- Setting the database parameter ARCHIVE_LAG_TARGET=1800, which will make it switch log files every 30 minutes.

Database Server Alert Log

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

The DB Toolbox includes options for many troubleshooting tools.

Show DB Alert Log

If the alert log feature is enabled in the database, the database alert log can be analyzed via DB ToolBox, as follows:

1. On the application server, go to the DB ToolBox, which is typically saved in the '/opt/stibo/step/admin/app-server-toolbox/' folder.
2. Start the ToolBox using one of these commands:
   - `./db-toolbox.pl`
   - `perl db-toolbox.pl`
3. Execute DB ToolBox number 36: 'Show DB alert-log'.

Show Tablespace Usage Report

Determine the size of the TEMP tablespace using the DB Toolbox as follows:

1. On the application server, go to the DB ToolBox, which is typically saved in the '/opt/stibo/step/admin/app-server-toolbox/' folder.
2. Start the ToolBox using one of these commands:
   - `./db-toolbox.pl`
   - `perl db-toolbox.pl`
3. Execute DB ToolBox number 1: 'Show tablespace usage report'.

Example

Use the DB ToolBox and run the 'Show DB alert log' on the database to show out-of-space errors for the TEMP tablespace.

```
07-OCT-2017 02:01:03 ORA-1652: unable to extend temp segment by 128 in
tablespace TEMP
07-OCT-2017 02:07:05 ORA-1652: unable to extend temp segment by 128 in
tablespace TEMP
07-OCT-2017 02:12:52 ORA-1652: unable to extend temp segment by 128 in
tablespace TEMP
07-OCT-2017 02:18:21 ORA-1652: unable to extend temp segment by 128 in
tablespace TEMP
07-OCT-2017 02:24:35 ORA-1652: unable to extend temp segment by 128 in
tablespace TEMP
```

This mainly occurs every weekend, but has also happened several times during weekdays. These errors indicate that important STEP tasks are failing, and should therefore be avoided.

Running the 'Show tablespace usage report' shows the current size of TEMP tablespace is one file of 32 GB.

```
Tablespace usage report
++++++++++++++++++++++

Number in parantheses specifies instance number

TBS                 TYPE            MB_MAXTBS_SIZE MB_FILE_SIZE    MB_USED   MB_AVAIL
----------------- --------------- -------------- ------------ ---------- ----------
UNDOTBS1 (1)        UNDO                    15357        15360      15302         55
USERS               PERMANENT                  99          100          4         95
PATROL              PERMANENT                  97           98          1         97
SYSTEM              PERMANENT                1499         1500        689        810
SYSAUX              PERMANENT                8191         8192       6071       2120
TEMP                TEMPORARY               30719        30720        131      30588
STEPSYSDATA         PERMANENT              399256       399360     362848      36408
STEPSYSBLOB         PERMANENT              139104       139264      80960      58144
                                                     ------------ ----------
sum                                                       594594     466006

8 rows selected.
```

In this example, the recommendation is to add at least one extra file of 32 GB, so the total size of the TEMP tablespace will be increased to 64 GB.

Additionally, other database alter log errors may include, for instance:

- ORA-00060 errors: deadlock detected
- ORA-01555 errors: snapshot too old

The further recommendation would be to involve a Stibo Systems system architect to analyze, recommend, and execute on the database alert errors, as well as on generic infrastructure and system setup.

Database Server Oracle Adaptive Features

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

Oracle version 12.1.0.2. includes a known issue (bug) in which a 'directive' is used. For some queries, this means a poor execution plan, and response times go from milliseconds to seconds.

This has quite an unfortunate impact on performance, and when displaying execution plans for SQL queries, shows up as an 'adaptive plan' by Oracle.

Recommendation

- In Oracle version 12.1.0.2, the parameter should be set to FALSE.
- Once Oracle is upgraded to 12.2.0.1 or greater, reassess the parameter setting.

Database Server Oracle Statistics

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

After upgrade, the Oracle data statistics should be renewed for STEP in order to collect a complete new set of statistics for all indices / tables in STEPSYS schema.

The following information is about STEP and the way database statistics are maintained for the STEPSYS schema:

- STEP has its own database job (GATHER_STATS_STEP) which, by default, is executed (executing the function stepsys.adminpck.table_manage) every night at 23.30h. This job collects new statistics on indices / tables in STEPSYS schema, where more than 10 percent of rows has been inserted / updated / deleted since last time, statistics were collected on the given object.
- The normal Oracle built-in scheduled job for collecting statistics on all indices / tables in the database must be configured to only collect statistics for Oracle's own objects (SYS schema). Therefore, the parameter AUTOSTATS_TARGET, must be set to ORACLE.
- Some core tables in the STEPSYS schema are locked and without any statistics. This because the number of rows in the tables change too frequently, and the statistics would therefore never be up to date. In order to make Oracle choose the right path of execution, when executing queries against these tables, STEP instead uses the built-in Oracle feature 'dynamic samplic' (Oracle init parameter DYNAMIC_SAMPLING=2), which makes Oracle generate some statistics for the given object at runtime.

Collect a complete new set of statistics for all indices / tables in STEPSYS schema as follows:

1. Log onto the database as user STEPSYS (or sqlplus, or the like).
2. Execute the following command:
   ```
   Exec adminpck.analyze(true);
   ```

Database Server Oracle DataGuard

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

The Oracle database can run with DataGuard protection and is configured with 'SYNC AFFIRM' (Maximum Availability mode).

However, running with DataGuard introduces an overhead on the STEP system, namely:

- The database must run in 'Force Logging' mode. This ensures that ALL writings performed on Primary database are mirrored correctly to Standby database. STEP uses some internal tables for building up temporary result sets for searches and exports, and these are created with 'nologging' in order to reduce impact on performance. Data stored in these tables is considered as interim and not important in a restore / recover scenario.
- DataGuard can be configured to run with different levels of protection, depending on the SLA requirements. Choosing 'SYNC AFFIRM' means going for nearly the highest protection level. With this level, all writings (even a write of a temporary data set built for a search) has to be written to the other site in order to keep the two databases in sync. 'SYNC AFFIRM' also means that the writing will have to be written to the disk on secondary database server (Standby) before the Primary database server can send back an acknowledgment to the App server.

A test is recommended where the protection level is lowered and the results in performance are analyzed.

For more information, see the **High Availability Implementation** topic.

DTP Server

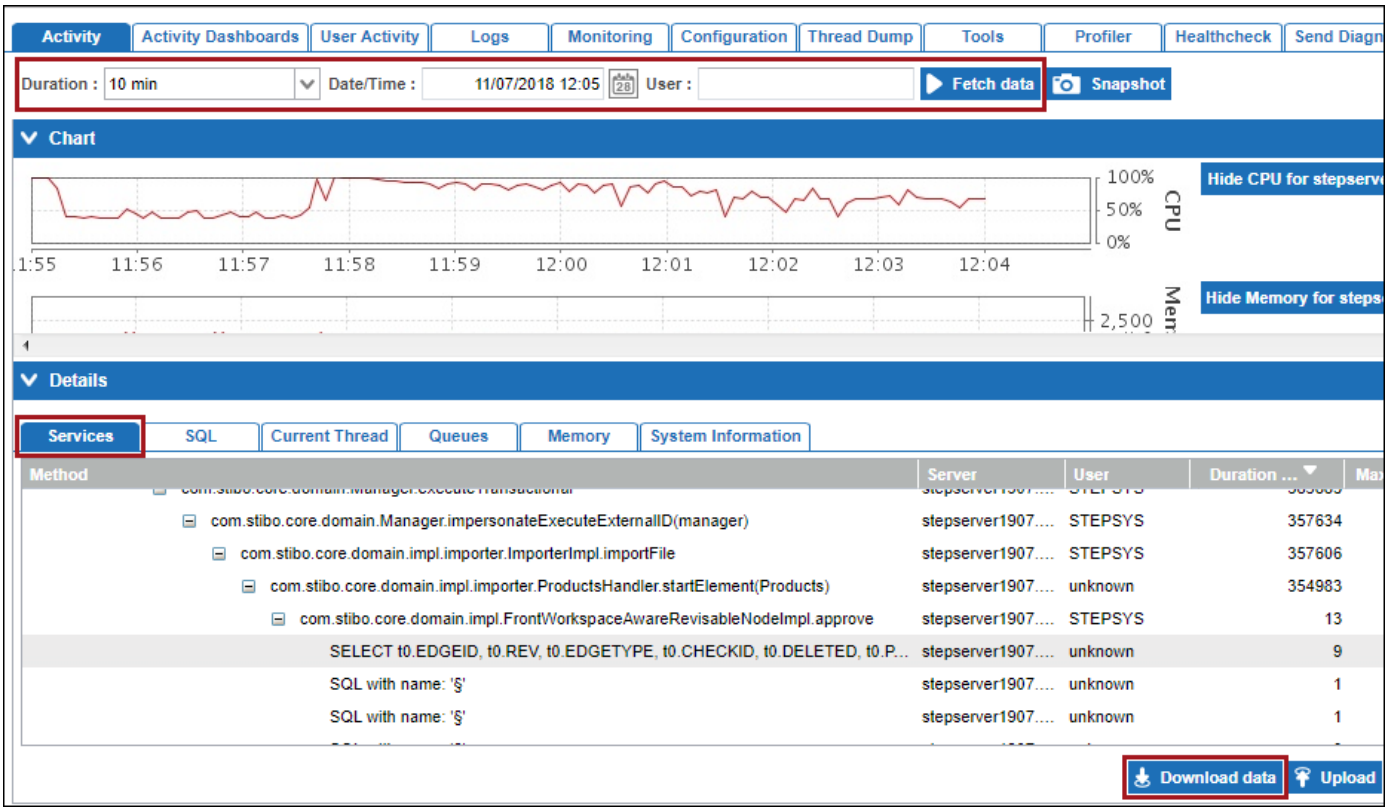
This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

A DTP server can cause performance loss when the application server is waiting for the DTP server, for example, due to latency issues. The cause should be analyzed further.

For more information, see the **Activity** topic in the **Administration Portal** documentation.

Analyze the DTP server waiting as follows:

1. From the Start Page, click the **STEP System Administration** button and supply the login credentials.
2. On the **Activity** tab, set the Duration and Date / Time parameters according to when the performance issues were noticed.



3. Click the **Fetch data** button to load the data.
4. Click the Details heading to display the Services tab.
5. Click the **Download data** button.
6. Open the downloaded XML file.
7. Search for the 'com.stibo.ddsconnector' or 'com.stibo.idsconnector' service calls.

8. Determine if the duration is significantly longer than expected. If so, consult Stibo Systems to look into the DTP Server.

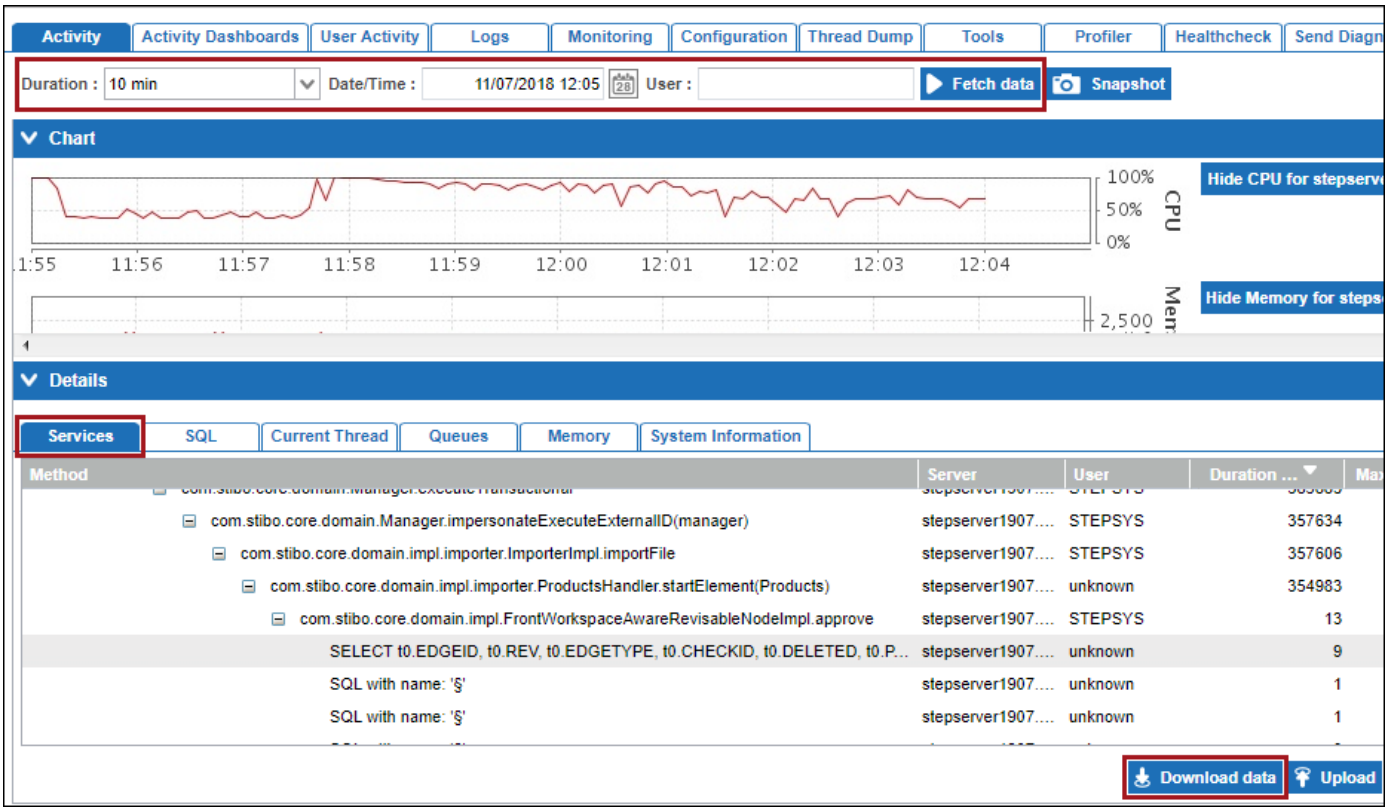
Custom Extensions

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server machines. The full list is defined in the **Server Environment Recommendations** topic.

Custom extensions can cause performance loss. For example, this can occur when custom extensions are relatively old, were delivered for an out-of-date STEP version, and if STEP has been upgraded to newer versions many times.

Long-lasting custom extensions can be analyzed via the STEP Admin Portal.

1. From the Start Page, click the **STEP System Administration** button and supply the login credentials.
2. On the **Activity** tab, set the Duration and Date / Time parameters according to when the performance issues were noticed.



3. Click the **Fetch data** button to load the data.
4. Click the Details heading to display the Services tab.
5. Click the **Download data** button.
6. Open the downloaded XML file.
7. Search for the 'com.stibo.customer' service call.

8. Determine if the duration is significantly longer than expected. If so, consult Stibo Systems to look into the DTP Server.

Server Hygiene

This is one of the technical infrastructure data gathering methodologies and performance recommendations. The full list is defined in the **Technical Performance Recommendations** topic.

This section describes the data gathering methodologies from a technical infrastructure viewpoint for the clean up of the STEP servers.

- Analyze Application Server Disk Space
- Clean Up Import Files
- Clean Up Unnecessary Files
- Analyze Background Processes
- Create a Background Processes Maintenance Plan
- Clean Up Background Processes

Analyze Application Server Disk Space

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server hygiene. The full list is defined in the **Server Hygiene** topic.

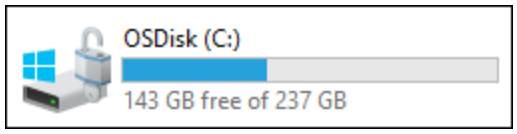
When the system is generally slow, it can be caused by an over-burdened system.

Analyze every application server for ample available disk space as follows:

1. Based on the type of server, check the available disk space on every application server:
   - For a Linux application server, use the `df -h` command.

```
Filesystem            Size  Used Avail Use% Mounted on
/dev/mapper/vg_vsv1g186-lv_root
                       50G  8.5G   39G  19% /
tmpfs                 7.8G   72K  7.8G   1% /dev/shm
/dev/sda1             477M   42M  410M  10% /boot
/dev/mapper/vg_vsv1g186-lv_home
                       25G   45M   24G   1% /home
/dev/mapper/vg_vsv1g186-lvstiprd01
                       40G   13G   26G  33% /opt/stibo
10.1.1.150:stibosw    2.9T   65G  2.8T   3% /opt/stiprd
```

   - For a Windows application server, use Windows File Explorer.



Note: If the analysis shows 90 percent or more of the volume is used, it is a good indication that the system is overloaded.

2. From the Start Page, click the STEP System Administration button and supply the log in credentials.
3. On the Logs tab, click the **Fetch data** button to load the logs.
4. On the **Main STEP Log file** row, click the **View** link.
5. Search for the following error message:
   `… FileUtils.copyFile(): failed to copy file (tried multi) …`

Note: If this error is found, a folder has reached its maximum limit of files and the system is overloaded.

6. If the system is overloaded, continue with the **Clean Up Import File** topic to analyze and resolve the issue.

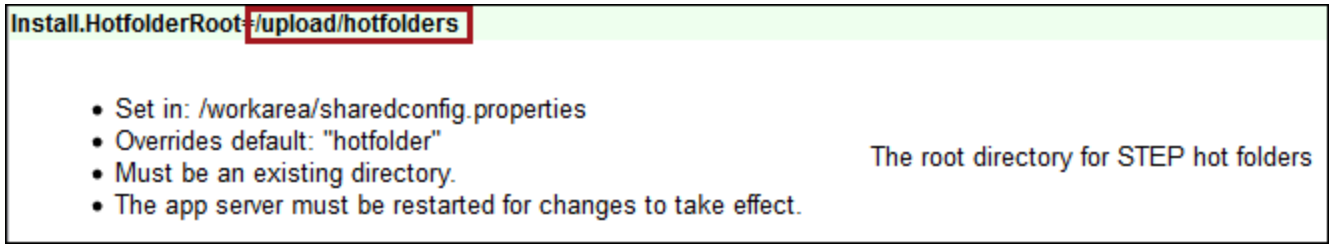
Clean Up Import Files

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server hygiene. The full list is defined in the **Server Hygiene** topic.

When the STEP application server is overloaded, it can be caused by the number of import files in hotfolders. Furthermore, large import files can also cause the system to be slow.

Analyze the import files situation as follows:

1. Determine where the import files are stored. On the Start Page, click the **STEP System Administration** button and supply the login credentials.
2. On the Configuration tab, click the **Fetch data** button to load the data.
3. Search for 'Install.HotfolderRoot' and note the hotfolder location.

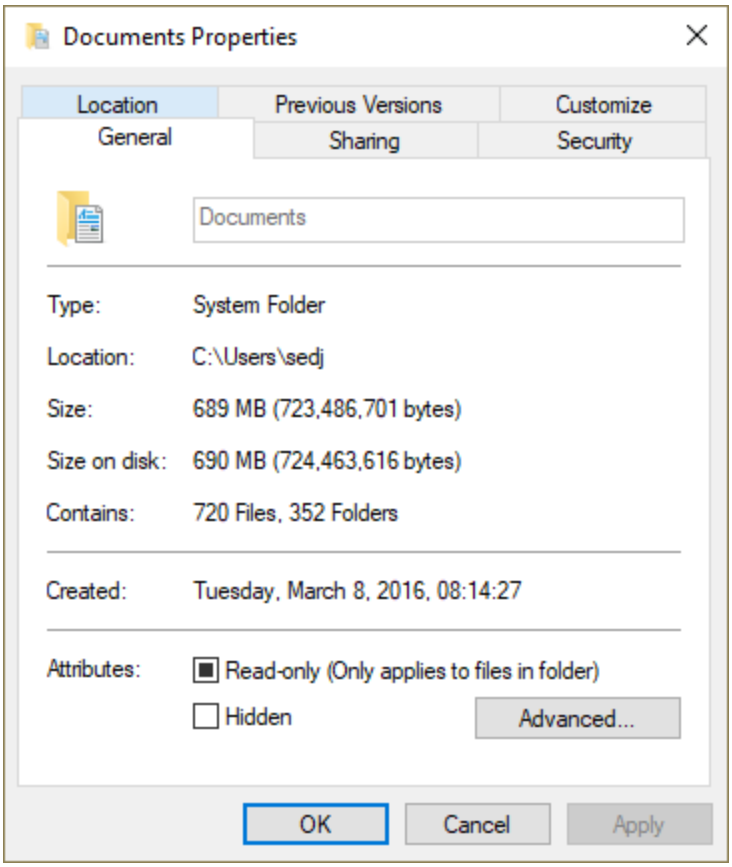


4. Find the number of import files in the hotfolder location.
   - For a Linux application server, use the following command:

     ```
     cd /upload
     find hotfolders/ -type f | wc -l
     ```

     ```
     [stibosw@euuktestepapp01p upload]$ find hotfolders/ -type f | wc -l
     find: `hotfolders/ZippedTest': Permission denied
     456580
     ```

   - For a Windows application server, open the Windows File Explorer, and go to the '/upload' location. Right-click the directory and click **Properties**.

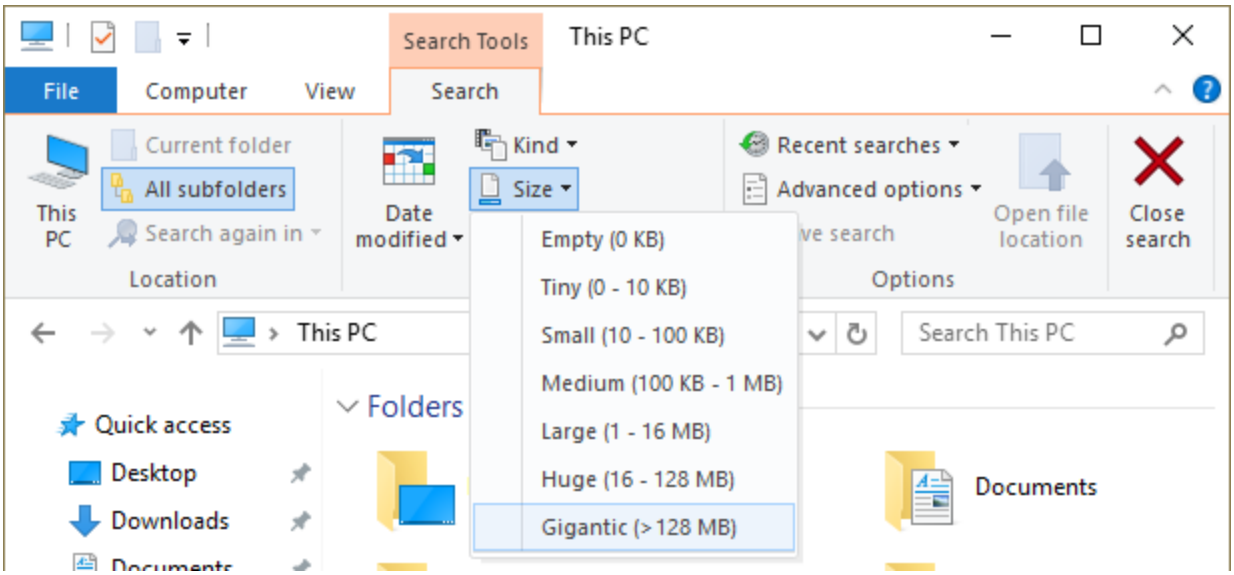


5. Find the size of import files in the hotfolder location.
   - For a Linux application server, use the following command:

     ```
     cd /upload
     du -hsx * | sort -rh | head -10
     ```

     ```
     [stibosw@euuktestepapp01p upload]$ du -hsx * | sort -rh | head -10
     du: cannot read directory `hotfolders/ZippedTest': Permission denied
     du: cannot read directory `lost+found': Permission denied
     69G     hotfolders
     16K     lost+found
     0       test2
     ```

   - For a Windows application server, open the Windows File Explorer, and go to the '/upload' location and view the size as shown in the following image.



Identify the Causes

If the number of import files in the hotfolder is in the hundreds of thousands (e.g., 250k files), or if the size of the import files is too large, continue with the following activities to determine the cause.

IIEP 'Keep file after load'

Review the active hotfolder and REST Receiver IIEPs and verify that they are configured to automatically clean up the import files. Set the 'Keep file after load' parameter to 'No' to remove import files after success import. For more information, see the **Hotfolder Receiver** topic of the **Data Exchange** documentation.

IIEP failed or completed with errors

Review the IIEPs for those that regularly complete with errors, or fail. In these cases, the import process is saved along with the imported file for error tracing. When the import process errors, the accompanying background processes are not removed. This means neither the import files nor the background processes are not being removed. When an IIEP successfully completes without errors, both the background processes and the import files can be deleted.

IIEPs that encounter Optimistic Locking errors can result in background processes that fail or 'complete with errors.' In this case, consider setting the 'Reference Target Lock Policy' to 'Relaxed' on the object types for which the long transaction applies. For more information, see the **Reference Target Lock Policy on Object Types** topic in the **System Setup / Super User Guide** documentation.

IIEP non-standard configuration

IIEPs are created with a standard import directory structure as illustrated below. Modifying that structure can prevent the removal of the imported files after successful import and processing.

Folder	Example of Standard Config	Description
root	/upload/hotfolders/products/	
in	/upload/hotfolders/products/in	import files reside, and are removed after processing
save	/upload/hotfolders/products/save	import files remain when they are imported and when configured to keep the import files after successful processing
error	/upload/hotfolders/products/error	import files remain when the import process completed with errors
failed	/upload/hotfolders/products/failed	import files will remain when the import process failed

Remove Import Files

Based on the reason for the excess import files, follow the steps below to remove them manually:

1. If the import files were not removed because the 'Keep file after load' was previously set to 'Yes,' use the following directions to remove the files from the 'save' folder:
   - For a Linux server, use the command in the save folder holding the excess files:
     ```
     rm -rf *
     ```
   - For a Windows server, open Windows File Explorer and delete the files from the 'save' folder.
2. If the import files were not removed for a reason other than the 'Keep file after load' setting, this indicates the import files are tied to background processes.

   Remove the background processes of the IIEP, which also removes the corresponding import files. See the **Clean Up Background Processes** topic for details.

   Important: Removing these import files by deleting them directly from the file system will not delete the corresponding background processes.

Clean Up Unnecessary Files

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server hygiene. The full list is defined in the **Server Hygiene** topic.

When the application server is overloaded and it is not due to too many and/or too large import files, it can be caused by large number of leftover or temporary files, e.g., from previous migrations. A large number of these unnecessary files can also cause the system to be slow.

There is no single location for these unnecessary files to reside on the application server. However, sometimes unnecessary files are located in temporary directories such as tmp, temp, or temporary.

Important: Be careful with temporary files the STEP system does use, such as the temporary files in the **step/diag** folder or in the **step/admin/cache** folders. These temporary files must not be removed.

Analyze Background Processes

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server hygiene. The full list is defined in the **Server Hygiene** topic.

When a process ends in either 'failed' or 'completed with errors' state, by design, old background process log information is not deleted automatically. The retained information can be used for manual processing, which allows the background process owner to address the errors before deleting the background process log information manually.

However, keeping many background processes can slow down the system, because each background process creates a sub-directory on the file system, which over time, can overload the system. If the number of background processes are excessive, such as hundreds of thousands, then these background processes should be deleted.

Note: The number of background processes in the database and on the application server file system may differ. This typically happens when background processes are not removed properly from the application server.

Check the number of background processes in the database and on the application server as follows:

1. On the application server, go to the DB ToolBox, which is typically saved in the '/opt/stibo/step/admin/app-server-toolbox/' folder.
2. Start the ToolBox using one of these commands:
   - `./db-toolbox.pl`
   - `perl db-toolbox.pl`
3. Execute DB ToolBox number 38: 'Show background process information.'

```
Background processes status summary
+++++++++++++++++++++++++++++++++++


STATUS                 COUNT_BG
-------------------- ----------
aborted                     558
completedwitherrors        1060
failed                      456
running                       2
succeeded                  8864
waiting                      25
                       ----------
sum                        10965
```

4. On the application server file system, determine the number of files in directory 'background-processarea' recursively, based on your server type:
   - On a Linux server, run the command:
     `find background-processarea/ -type f | wc -l`

```
[stibosw@lep1sta1 workarea]$ find background-processarea/ -type f | wc -l
1196277
```

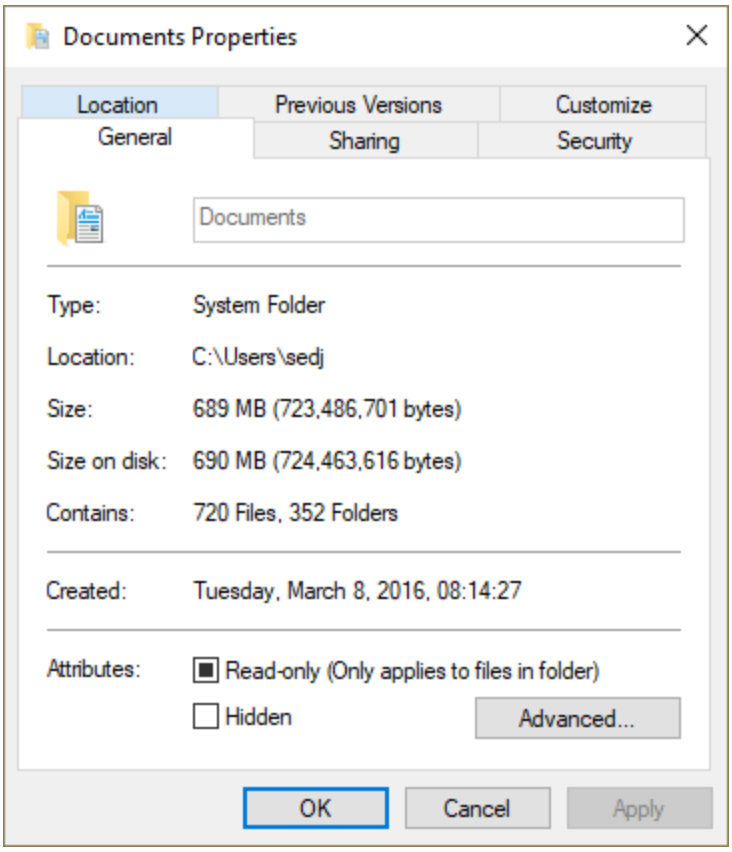
Optionally, analyze the sub-directories as well. Use the following command to see the files created last:

```
ls -lat
```

And this command to see the largest files:

```
du -hsx * | sort -rh | head -10
```

- On a Windows server, open the Windows File Explorer, go to the 'background-processarea' directory, right-click and select the Properties option.



Once you determine that there is an excessive number of background processes in the database and/or on the application server file system, the recommendation is to create a maintenance plan to ensure the number will be controlled and clean up the existing background processes. For more information, see the **Create a Background Processes Maintenance Plan** in this guide.

Create a Background Processes Maintenance Plan

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server hygiene. The full list is defined in the **Server Hygiene** topic.

Settings on IEPs and on background process allow configuration of automatic clean-up activities.

IEP Auto Delete Settings

Use the following parameters to configure automatic deletion of background processes on IIEPs and OIEPs:

Inbound Integration Endpoint | Background Processes | Statistics

Configuration

Pre-Processor	No pre-processing
Process Engine	Asset Importer
Post-Processor	No post-processing
Error reporter	Not Defined
Schedule	Not scheduled
Queue for endpoint	InboundQueue
Queue for endpoint processes	In
Transactional settings	None
Maximum number of old processes	100
Maximum age of old processes	1 week

Outbound Integration Endpoint | Configuration | Event Trigge

Configuration

Process Engine	STEP Exporter
Error reporter	Not Defined
Schedule	Start every minute
Queue for endpoint	OutboundQueue
Queue for endpoint processes	Out
Transactional settings	Strict
Number of threads	1
Maximum number of old processes	1000
Maximum age of old processes	1y
Contexts	English US, Global, Spain
Workspace	Approved

- **Maximum number of old processes**: Specify the number of ended processes the system will keep. Succeeded and ended processes are deleted when the number exceeds the specified limit. The oldest processes are deleted first. Setting this number too high may eventually degrade performance.

  For example, if 'Maximum number of old processes' is set to '1000,' a maximum of 1000 succeeded and ended background processes will be retained. The oldest background processes are deleted automatically when the number exceeds the specified limit of 1000.

- **Maximum age of old processes**: Specify the maximum age of ended processes that the system will keep. Ended processes are deleted when the maximum age is exceeded. Setting this number too high may eventually degrade performance.

  For example, if 'Maximum age of old processes' is set to '1 y,' the background processes older than 1 year are deleted automatically.

Ensure the configurations represent a realistic situation as demonstrated below:

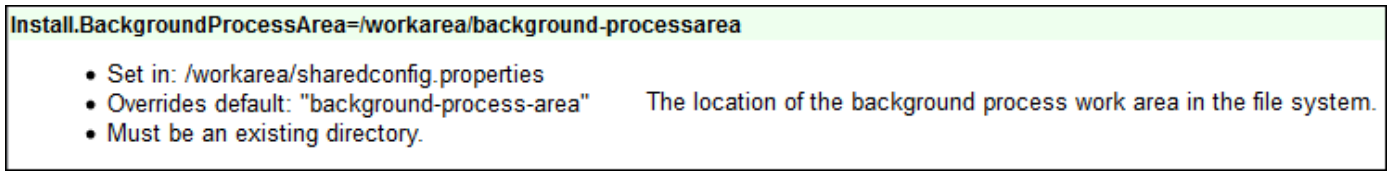
- In an environment with a large number of small imports and exports, use '1000' as a maximum number of old processes and '1 w' as a maximum age of old processes.

- In an environment with small number of large imports and exports, use '50' as a maximum number of old processes and '1 m' as a maximum age of old processes.

Background Process Auto Delete Settings

Automatic deletion of background processes is also managed in the sharedconfig.properties file. The configuration defines the number of hours after the background processes ends that it will be deleted, and is based on the specified background process template.

1. Determine the location of the background processes on the application server as follows:
   - From the Start Page, click the **STEP System Administration** button and supply the login credentials.
   - On the **Configurations** tab, set the Duration and Date / Time parameters according to when the performance issues were noticed.
   - Click the **Fetch data** button to load the data.
   - Search for the 'Install.BackgroundProcessArea' parameter and note the location. In the following image, the location is '/workarea/background-processarea.'



2. On the application server, use the following commands to see the available process templates.

```
cd /workarea/background-processarea

ls -l
```

```
[stibosw@lep1sta1 ~]$ cd /workarea/
[stibosw@lep1sta1 workarea]$ cd background-processarea/
[stibosw@lep1sta1 background-processarea]$ ls -l
total 2960
drwxrwxr-x    3 stibosw stibosw    4096 Oct  9 20:43 AnalyzeChangePackage
drwxrwxr-x    2 stibosw stibosw    4096 Oct  4 15:35 ApproveRecursive
drwxrwxr-x    3 stibosw stibosw    4096 Oct 10 11:13 AssetDownload
drwxrwxr-x  166 stibosw stibosw  131072 Oct 15 07:35 BulkUpdate
drwxrwxr-x    2 stibosw stibosw    4096 Oct  6 13:59 CreateColFromFile
drwxr-xr-x    2 stibosw stibosw    4096 Jun 13 12:49 DataProfiler
drwxrwxr-x   15 stibosw stibosw    4096 Oct 13 13:03 DownloadReport
drwxrwxr-x    2 stibosw stibosw    4096 Oct 13 16:35 EmptyRecycleBin
drwxrwxr-x    2 stibosw stibosw    4096 Oct 13 16:01 EventProcBGP
drwxrwxr-x    2 stibosw stibosw    4096 Jul  5  2016 Event Queue Delete
drwxrwxr-x   78 stibosw stibosw   12288 Oct 14 13:04 ExcelExportDownload
drwxrwxr-x  498 stibosw stibosw   69632 Oct 13 17:41 Exporter
drwxrwxr-x 4990 stibosw stibosw  397312 Oct 13 15:12 Importer
drwxrwxr-x 7338 stibosw stibosw 1970176 Oct 15 06:46 Inbound
drwxrwxr-x    2 stibosw stibosw    4096 Sep 14 19:30 InboundPoller
drwxrwxr-x    2 stibosw stibosw    4096 Oct  4 19:36 InstallChangePackage
drwxrwxr-x    2 stibosw stibosw    4096 Sep 14 14:31 NodeListToCollection
drwxrwxr-x 3107 stibosw stibosw  294912 Oct 15 07:40 Outbound
drwxr-xr-x    2 stibosw stibosw    4096 Sep  4 09:52 OutboundPoller
drwxrwxr-x    2 stibosw stibosw    4096 May 12  2016 PortalDownload
drwxrwxr-x   37 stibosw stibosw    8192 Mar 22  2016 PortalUpload
drwxrwxr-x    2 stibosw stibosw    4096 Oct 14 01:30 PurgeRevisions
drwxrwxr-x    2 stibosw stibosw    4096 Oct  5 10:37 Refresh Node Collection
drwxrwxr-x    2 stibosw stibosw    4096 Feb 10  2017 RemoveFromSTEPWorkflow
drwxrwxr-x    2 stibosw stibosw    4096 Oct 12  2016 Report
drwxrwxr-x    2 stibosw stibosw    4096 Feb 13  2017 RepublishService
drwxrwxr-x    2 stibosw stibosw    4096 Jun 22 13:23 ReviveRecursive
drwxrwxr-x   10 stibosw stibosw    4096 Jul 17 20:37 Schedule
drwxrwxr-x    2 stibosw stibosw    4096 Mar  1  2017 SealChangePackage
drwxrwxr-x   59 stibosw stibosw   20480 Oct 13 18:11 SheetImporter
drwxrwxr-x    2 stibosw stibosw    4096 Oct 14 23:06 StateflowDeadline
```

3. Configure the auto-delete hours of the background process templates as follows:
   - Open the sharedconfig.properties file.
   - Search for a section that holds the case-sensitive parameter(s), where the name of template and number of hours should be replaced by the placeholders indicated in the brackets:

     `AutoDeleteBackgroundProcess.AgeInHours.[template]=[hours]`

   - Add or edit the templates to define the number of hours that should elapse prior to the automatic deletion of the template's background process.

     For example, the most important templates are generally Exporter, Importer, Outbound, Inbound, and WebPublisher. The parameter for Exporter can be configured as follows:

     ```
     AutoDeleteBackgroundProcesses.AgeInHours.Exporter = 168
     ```

Clean Up Background Processes

This is one of the technical infrastructure data gathering methodologies and performance recommendations for server hygiene. The full list is defined in the **Server Hygiene** topic.

The configurations for automatically removing the background processes (BGPs) only apply to the succeeded background processes. The 'Failed' or 'Completed with errors' background processes are not deleted automatically to allow for analysis. Once analyzed, these background processes should be removed. The following procedures are available for removing BGPs and each is defined below:

- Remove a small number of BGPs
- Remove a large number of BGPs via Search
- Remove a large number of IEP BGPs via Copy
- Remove a large number of BGPs via Script

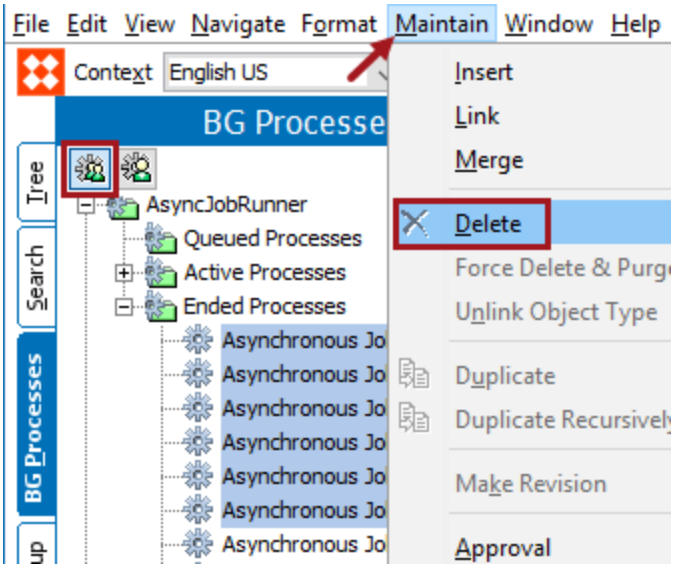
Remove a Small Number of BGPs

If only a small number of BGPs need to be removed, use the following procedures:

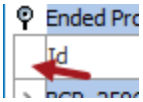
1. For non-IEP processes, in workbench open the BG Processes tab.
2. Click the Background Process View option to display all BGPs ( ), instead of only the BGPs run by the current user.
3. Open a node, open an 'Ended Processes' folder, and select one or more background processes.

   Note: The 'Queued Processes' and 'Active Processes' background processes should not be deleted.

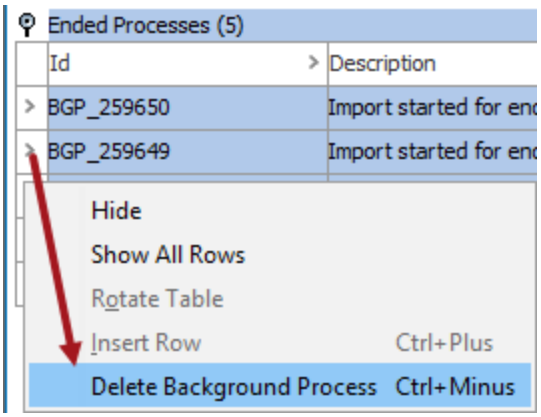
4. Click the Maintain menu and select **Delete** to remove the ended processes.



5. For the IEP processes, on the System Setup tab, select an IEP and open the Background Processes tab.
6. Open the 'Ended Processes' flipper, select the row to be deleted, or select all rows by clicking the empty title on the first row as shown.



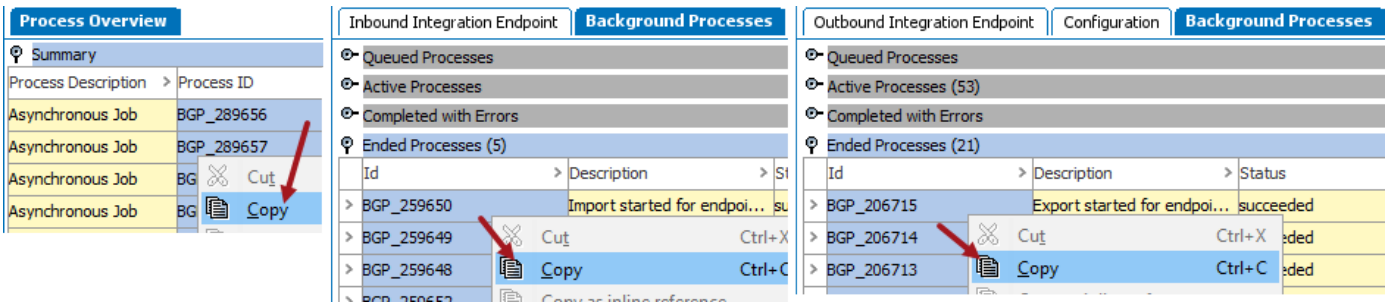
7. Right-click on the first column and select the **Delete Background Processes** option.



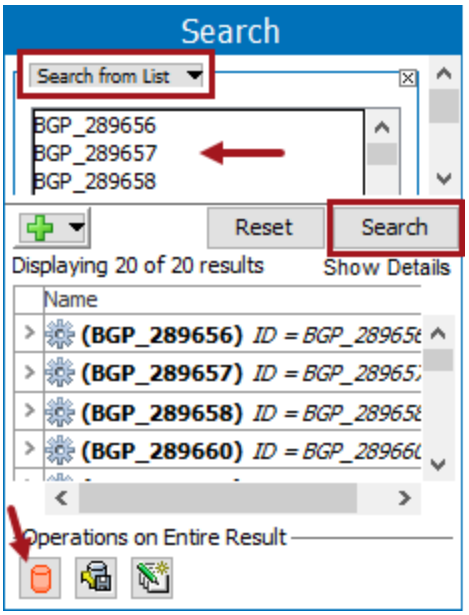
Remove a Large Number of BGPs via Search

The workbench Search and Collection features can be used to delete a large number of BGPs, using the following procedures.

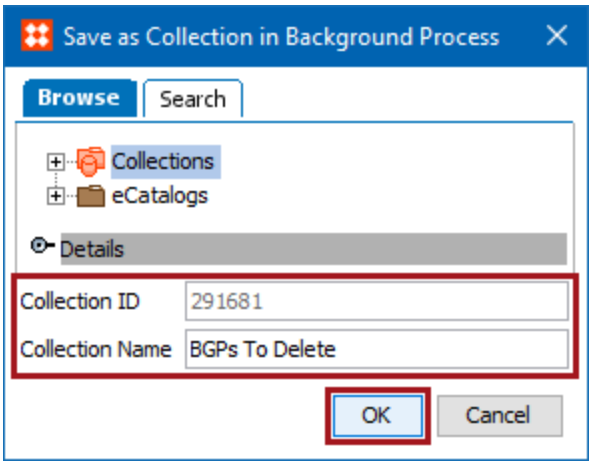
1. Display the BGPs to be deleted, either on the BG Processes tab or within an IEP (all shown below).
2. Click the header of the ID column (sometimes labeled Process ID) to select all of the BGPs to be deleted.
3. Right-click within the selected column and click **Copy** from the menu to copy the list to the clipbaord.



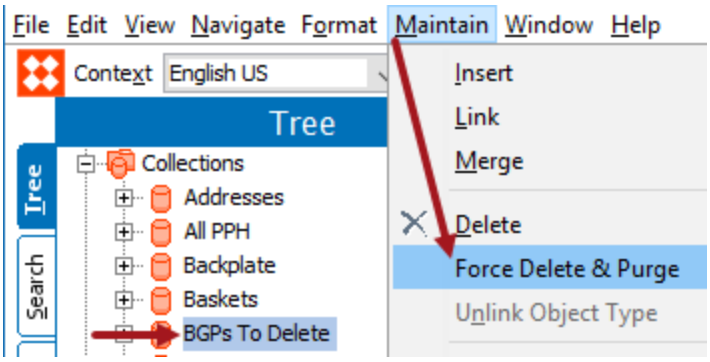
4. Paste the copied list to a text file, for example, in Notepad.
5. On the Search tab, use the dropdown to choose 'Search from List' option.
6. Paste the copied list into the text box and click the **Search** button.



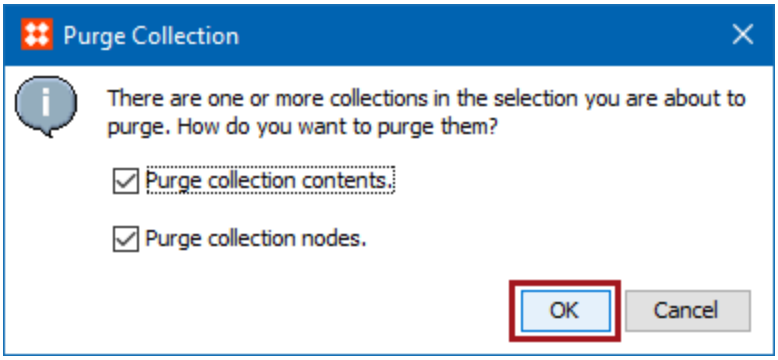
7. Click the collection button ( ) at the bottom of the search panel to add the search results to a collection.
8. Select a folder for the collection, add a collection ID and name, click **OK**. This image shows that ID are auto-generated, so it is automatically supplied by the system.



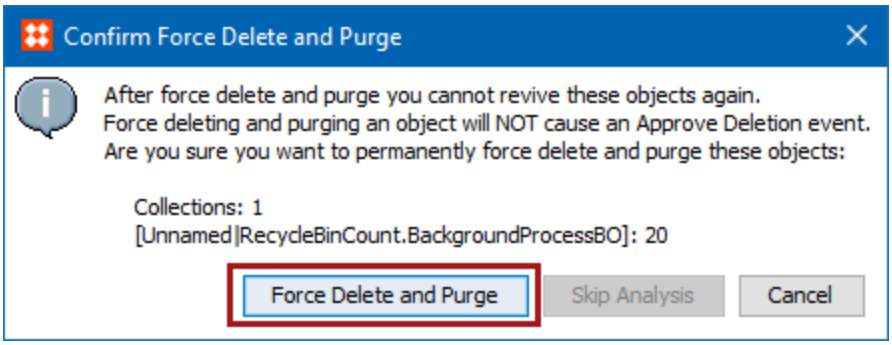
9. On the Tree tab, select the new collection, click the Maintain menu, and click the **Force Delete and Purge** option.



10. On the Purge Collection dialog, check both checkbox options and click **OK**.



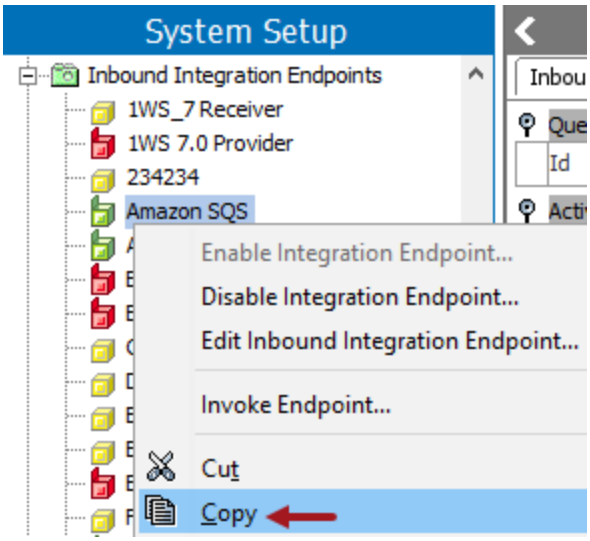
11. On the Confirm Force Delete and Purge dialog, click the **Force Delete and Purge** button. The collection and the listed BGPs are deleted from the system.



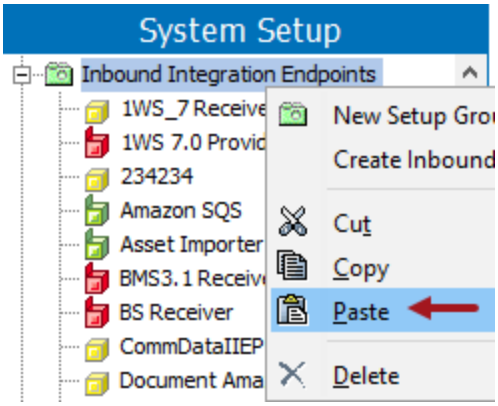
Remove a Large Number of IEP BGPs via Copy

The workbench Copy feature can be used with IEPs to delete a large number of BGPs, using the following procedures:

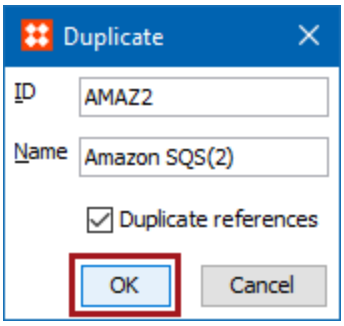
1. On the System Setup tab, select an IEP with a large number of BGPs to be deleted.
2. Right-click the IEP and click **Copy** from the menu.



3. Click the parent IEP folder, right-click and then click **Paste** from the menu.



4. On the Duplicate dialog, add an ID and Name, then click **OK**.



5. When successfully pasted, enable and invoke the new IEP as defined in the **Running an Inbound Integration Endpoint** topic of the **Data Exchange** documentation.
6. Select the original endpoint, right-click and click **Delete** from the menu. The original IEP and the related BGPs are deleted.

Remove a Large Number of BGPs via Script

If the previous methods for removing BGPs are not feasible due to the large number, consult your Stibo Systems representative for assistance in creating a script to remove them.

Functional Performance Recommendations

This section describes the data gathering methodologies from a technical infrastructure viewpoint for the clean up of the STEP servers.

- Base Setup Recommendations
- Business Rule Recommendations
- Export Recommendations
- Event Processor and Event Queue Recommendations
- Import Recommendations
- Matching and Linking Recommendations
- Optimistic Locking Recommendations
- Privilege Recommendations
- Profiling Recommendations
- Revision Control Recommendations
- Scheduled Process Recommendations
- Search Recommendations
- Web UI Configuration Recommendations

Base Setup Recommendations

This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

The base setup of the contexts and dimensions, product and entity data model, assets and classifications are based on business requirements. Nevertheless, the base setup should also be designed based on performance since a complex base setup can have a negative impact on general performance.

An analysis of the base setup is worthwhile, as changes on the base setup for performance reasons usually have a great impact.

For example, changing the data model may impact attributes and references, but can also impact business rules, workflows, Web UI configurations, exports, and imports.

Important: Always weigh the pros and cons of changing the base setup prior to making the change, and test the effects on a lower system before making change on a production system.

- Asset Recommendations
- Attribute and Attribute Group Recommendations
- Calculated Attribute Recommendations
- Classification Recommendations
- Data Model Recommendations
- Dimension and Context Recommendations
- Global Count of Object and Attribute Recommendations
- LOV Filtering Recommendations
- Manually Sorted Recommendations
- Reference Recommendations

Asset Recommendations

This is one of the data gathering methodologies and recommendations for base setup improvement. The full list is defined in the **Base Setup Recommendations** topic.

Note: These recommendations are valid for systems without In-Memory. The performance costs are different with In-Memory. For more information, see the **In-Memory Database Component for STEP** section of the **Resource Materials** in online help.

Digital assets are media files like images, videos, documents, etc. In STEP, these are asset objects which can hold attributes (metadata) and have a reference to the actual asset (binary file).

Storage Location

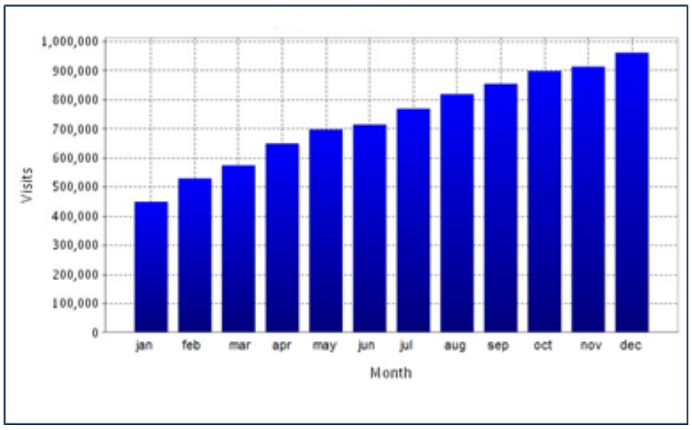
The asset binaries can be stored outside STEP in an external DAM system. The storage of the asset binary can also be stored on the file system or in the STEP database. While storing the asset binaries in the database might seemingly allow faster access, accessing many asset binaries in the database also results in higher database traffic. Therefore, asset binary storage in the file system or in the STEP database does not determine the performance of STEP.

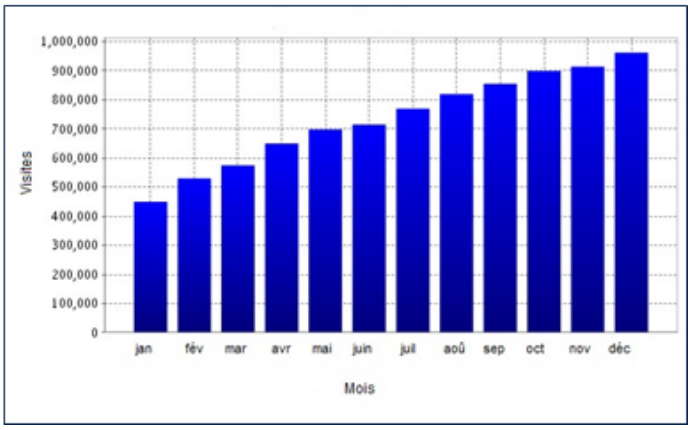
Dimension Dependency

Dimension dependency on assets should be avoided when it is not required. In workbench, on System Setup, asset dimension dependency is defined in the Users & Groups node under the Image & Document Settings.

Image & Document Settings	
Dimension Dependencies	
Store assets and DTP documents in	Database
DTP asset source	Asset Push
Pregenerate thumbnail cache on upload	Yes
Disable auto-cleanup of thumbnail cache	No
Transformation Lookup Tables follow asset dimension dependency	N
Asset Import Compatibility Mode	Simple

The Dimension Dependencies option is used if there is a requirement to store images or documents in different contexts. For example, you may have a requirement store an image that has English labels in the image and the same image with French labels, as seen in the examples below.





To set up, click in the Dimension Dependencies value row, then click on the ellipses **[...]** button. Select the Language option. Now the image in English can be stored in the English context and the image in French can be stored in the French context.

Note: In the image examples used above, both must have the same image ID when loading into STEP and the appropriate dimension point must be selected for each image.

Import and Export

STEP allows for asset transformations during import and export. Asset transformations require system resources and therefore should be avoided unless necessary. For more information, see the inbound and outbound sections of the **Digital Assets** documentation.

Attribute and Attribute Group Recommendations

This is one of the data gathering methodologies and recommendations for base setup improvement. The full list is defined in the **Base Setup Recommendations** topic.

Note: These recommendations are valid for systems without In-Memory. The performance costs are different with In-Memory. For more information, see the **In-Memory Database Component for STEP** section of the **Resource Materials** in online help.

Configured attributes are:

- Specification or description
- Of a certain value type (text, list of value, number, date, etc.)
- Multi-valued or single valued
- Associated with a unit of measure or not.

While none of these configurations independently have a direct impact on performance, some attribute group and attribute configurations can influence performance.

Note: A review of the configured attribute groups and attributes is a good start in analyzing the configuration. Export the attribute groups to a STEPXML file and the attributes to an Excel file for review.

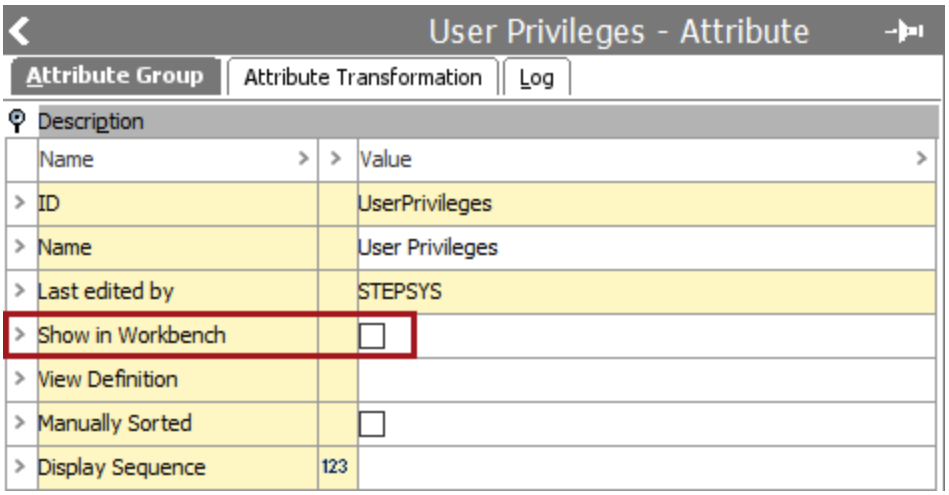
Attribute Groups

The following parameters can affect performance and apply to attribute groups:

- Show in Workbench
- Manually Sorted

Show in Workbench

In System Setup, the 'Show in Workbench' parameter on an attribute allows the groups to be included or excluded from the workbench display. Showing many attribute values in the workbench requires additional processing power, and can become expensive in terms of performance, especially for the values of calculated attributes. Disable the 'Show in Workbench' option to prevent the attribute group from being displayed.



For better performance, set the 'Show in Workbench' parameter as enabled only for attribute groups that need to be displayed in the workbench.

Manually Sorted

'Manually Sorted' adds complexity and can cause performance issues. See the **Manually Sorted Recommendations** topic for more information.

Attributes

The following parameters can affect performance and apply to attributes:

- Full Text Indexable
- Dimension Dependencies
- Large Lists of Values (LOVs)

Full Text Indexable

In System Setup, the 'Full Text Indexable' parameter can be set on an attribute with a Validation Base Type of 'text' so you can search for words within 'text' values. For example, it allows the user to search for objects based on a word, or set of words, in a sentence within an attribute value. Without the full text indexable option, you can still search for values.

When an attribute is made as Full Text Indexable, performance can be negatively affected. For more information, see the **Full Text Indexable Attributes** topic in the **System Setup / Super User Guide** documentation.

Attribute | References | Attribute Transformation | Validity | Profile | L

Description

Name	Value
ID	Consumer Description
Name	Consumer Description
Last edited by	2018-01-25 10:43:29 by STEPSYS
Full Text Indexable	No
Externally Maintained	No
Completeness Score	
Hierarchical Filtering	None
Calculated	No
Type	Specification
Dimension Dependencies	Language;
Mandatory	Yes

For better performance, set the 'Full Text Indexable' parameter to 'Yes' only if needed.

Dimension Dependencies

Dimension Dependencies add complexity and cause performance issues, and should only be used on attributes when necessary. See the **Dimension and Context Recommendations** topic for more information.

Attribute | References | Attribute Transformation | Validity | Profile | L

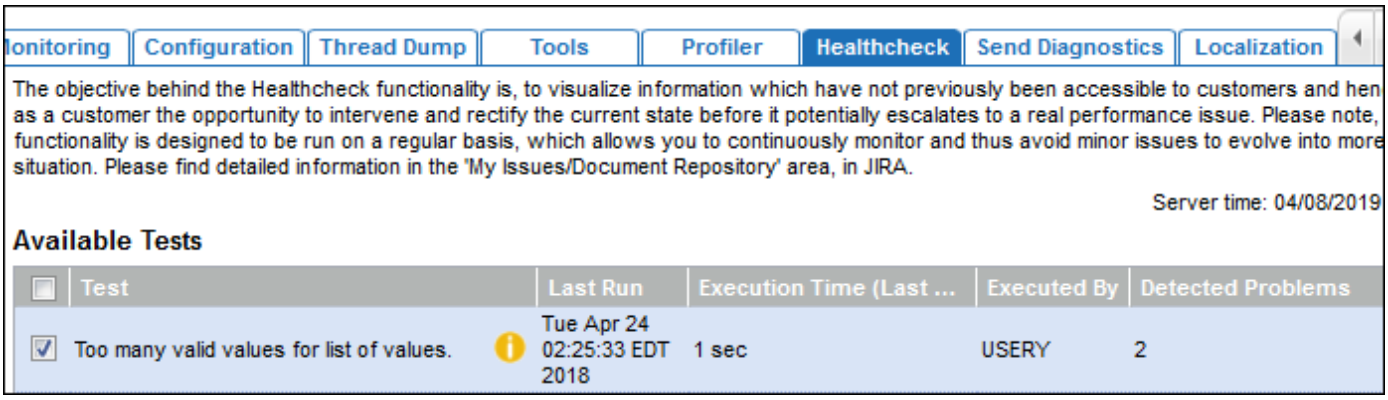
Description

Name	Value
ID	Consumer Description
Name	Consumer Description
Last edited by	2018-01-25 10:43:29 by STEPSYS
Full Text Indexable	No
Externally Maintained	No
Completeness Score	
Hierarchical Filtering	None
Calculated	No
Type	Specification
Dimension Dependencies	Language;
Mandatory	Yes

Large Lists of Values (LOVs)

Special attention is required for attributes with large List Of Values (LOVs)—those with thousands of values. LOVs with many values can lead to performance degradation. Additionally, from a usability perspective, large LOVs should be avoided.

Use the Healthcheck in the Admin Portal to find LOVs with too many values. For more information, see the **Healthcheck** topic in the **Administration Portal** documentation.



For better performance, split large LOVs into smaller LOVs, or use a text field instead of an LOV.

Calculated Attributes

Calculated attributes provide a lot of flexibility, but they also have a direct impact on downstream deliveries. Additionally, calculated attributes can degrade performance. For more information, see the **Calculated Attribute Recommendations** topic in this documentation.

Calculated Attribute Recommendations

This is one of the data gathering methodologies and recommendations for base setup improvement. The full list is defined in the **Base Setup Recommendations** topic.

Note: These recommendations are valid for systems without In-Memory. The performance costs are different with In-Memory. For more information, see the **In-Memory Database Component for STEP** section of the **Resource Materials** in online help.

Overview

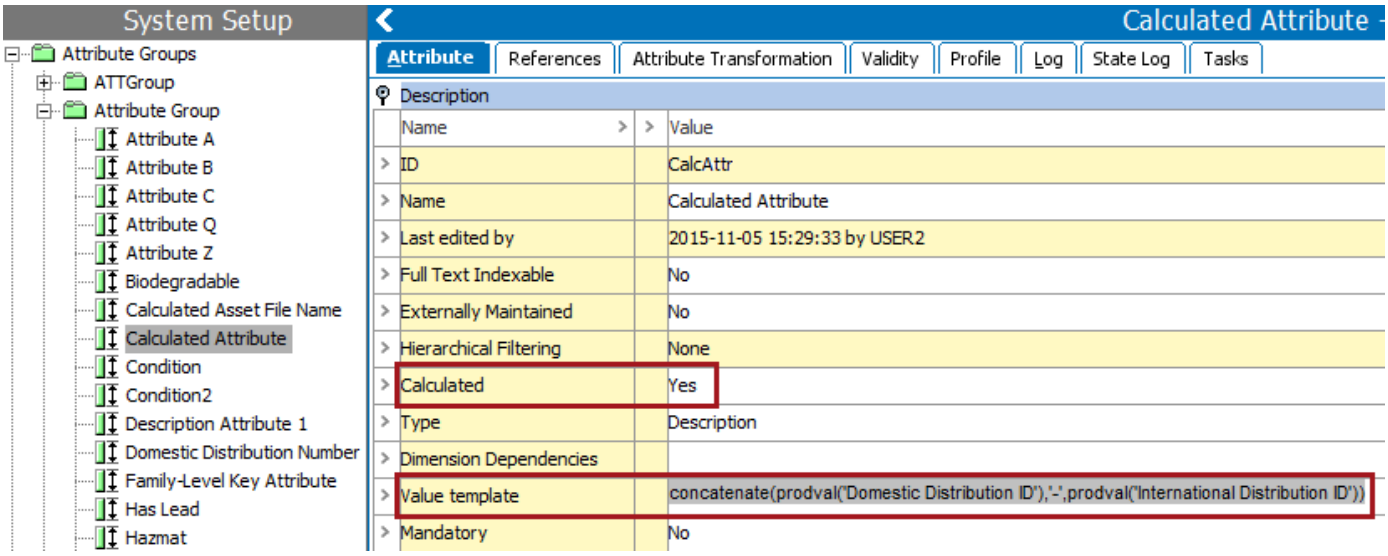
Calculated attributes are a special type of attributes whose values are not written in the database, but are calculated on the fly, based on other data in the system. The foundation for a calculated attribute is a functional programming language very similar to the language used for defining functions in Excel.

For assistance in determining if a calculated attribute is the most efficient way to meet your requirements, see the **Calculated Attribute Considerations** topic in the **Calculated Attributes** section of the **System Setup / Super User Guide** documentation.

The value of a calculated attribute is determined by a value template which can be written in the Function Editor. Many functions can include an argument, which specifies the STEP data to be accessed. Functions can access information from references, compare data between objects, round numbers, modify text, and many other options. For a step-by-step guide to creating a calculated attribute, see the **Creating a Calculated Attribute** topic in the **Calculated Attributes** section of the **System Setup / Super User Guide** documentation.

As an example, the following functions and arguments are included in the workbench image below:

- The 'concatenate' function takes a comma-delimited list of arguments. In this example, the three (3) arguments are: prodval('Domestic Distribution ID'), '-', and prodval('International Distribution ID').
- The 'prodval' function takes an argument of an attribute ID and retrieves the value of the attribute identified. In this example, the two (2) attribute IDs are: 'Domestic Distribution ID' and 'International Distribution ID'.
- Assuming that the 'Domestic Distribution ID' value is 1234 and the 'International Distribution ID' value is 5678, the result of this 'Value template' would be 1234-5678.



For additional use cases for calculated attributes, see the **Calculated Attribute Use Cases** topic.

In Web UI, calculated attributes can be identified and their values can be overridden on the Attribute Management screen as described in the **Calculated Attributes in Web UI** section of the **Web User Interfaces** documentation.

Considerations

Calculated attributes provide a lot of flexibility, but they also have a direct impact on downstream deliveries. Additionally, calculated attributes can degrade performance as defined below.

- The cross-context exporter does not impact the performance significantly when extracting normal (non-calculated) attributes in many contexts compared a single context. However, the time it takes to extract calculated attribute values grows in a nearly linear way with the number of contexts. STEP is not able automatically detect whether the formula that expresses the calculation is dimension dependent or not, which means that the introduction of new contexts to a downstream delivery that includes many calculated attributes can result in a significant performance degrade.
- Locality refers to the distance between the values required by a calculation and the calculated attribute. Calculated attributes that only access values on the local object can be very efficient, but calculated attributes that navigate to other objects (via references and/or hierarchy links) are more expensive in terms of performance. Therefore, calculated attributes that navigate to other objects should be carried out in a controlled and limited manner.
- Calculated attributes that cross transitive closures that potentially grow very large cause performance to degrade. For example, a calculated attribute that involves all children of a large (and growing) entity or product hierarchy.
- Chained calculated attributes depend on other calculated attributes and can make performance unpredictable.
- Calculated attributes are calculated each time they are viewed.

Generally, business actions are preferred to calculated attributes with the understanding that the value is not always up-to-date, typically immediately following approval.

Recommendations

Find calculated attributes in the system by exporting all attributes to Excel and filter on 'Attribute Calculated.' Then analyze the calculated attributes one-by-one in STEP and evaluate the following:

- If the calculated attribute is included in cross-context exports, consider performing the calculation on approval via a business action, and then copy the result to a normal (non-calculated) attribute.
- Check the locality of calculated attributes and consider replacing with business actions instead.
- Avoid calculated attributes across transitive closures that potentially grow very large.
- Avoid having chained calculated attributes and use business actions for better performance.
- Consider In-Memory to optimize the performance of reading data on complex data models via calculated attributes which navigate references. For more information, see the **In-Memory Component** section of the **Resource Materials** section of online help.

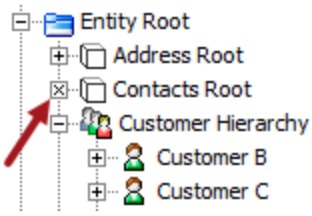
Classification Recommendations

This is one of the data gathering methodologies and recommendations for base setup improvement. The full list is defined in the **Base Setup Recommendations** topic.

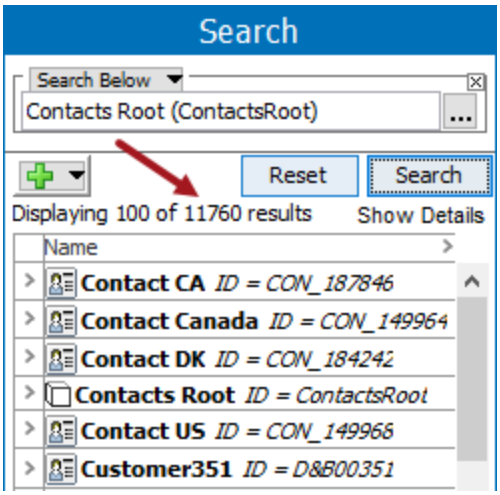
Note: These recommendations are valid for systems without In-Memory. The performance costs are different with In-Memory. For more information, see the **In-Memory Database Component for STEP** section of the **Resource Materials** in online help.

STEP allows for setting up one primary hierarchy (blue folders) and multiple classifications (yellow folders). However, many children in a level of a hierarchy is expensive from a performance perspective. The built-in STEP unique name check means that having many items in one node of the hierarchy can degrade performance.

In Tree, after attempting to expand a hierarchy with 'too many' children, the node is identified with ⊠ (shown in the image below). Nodes that cannot be expanded are automatically set to non-readable and cannot be browsed. 'Too many' for workbench is determined by the case-sensitive property **Workbench.TreeNode.MaxNumberOfChildrenToShowInTree** and for Web UI, the case-sensitive property **Portal.TreeNode.MaxNumberOfChildrenToShowInTree**, both are displayed by accessing the STEP System Administration button on the Start page. For more information, see the **Configuration** topic in the **Administration Portal** documentation.



For nodes that cannot be expanded, Search Below can be used to analyze how many children are in the hierarchy. For example, searching below the 'Contacts Root' hierarchy shows it has 11,760 children.



Recommendations

Use the following recommendations to optimize performance:

- Avoid classification hierarchies with too many children by organizing and categorizing children in subhierarchies which allow you to manage millions of child nodes.
- Instead of a functional classification, use an alphanumeric classification naming structure to accelerate the listing of many objects.

Data Model Recommendations

This is one of the data gathering methodologies and recommendations for base setup improvement. The full list is defined in the **Base Setup Recommendations** topic.

Note: These recommendations are valid for systems without In-Memory. The performance costs are different with In-Memory. For more information, see the **In-Memory Database Component for STEP** section of the **Resource Materials** in online help.

The data model of STEP is very flexible and allows for complex data model setups. While the data model is designed and set up based on business requirements, the data model should also avoid unnecessary complexity and ensure optimal performance. A complex data model can have a negative impact on the general performance.

Important: For performance reasons, do not over-design the data model since a complex data model requires more extensive processing. Also, use the 'Manually Sorted' parameter on product objects and entities sparingly. For more information, see the **Attribute Groups** topic in the **System Setup / Super User Guide** documentation.

The following example data models highlight the strengths of various approaches for achieving the business requirements.

Data Containers

Consider a required 'Company' entity that has a visiting and distribution address with country, city, street, and zip code. The addresses can be defined using one of the following methods:

- Attributes directly on the 'Company' entity, such as visiting address street, visiting address city, distribution address zip code, etc.
- A separate 'Address' entity for each address type (e.g., 'visiting address' and 'distribution address'), street, city, zip code, etc., and reference the 'Company' to the 'Address.'
- Two data containers 'Visiting Address' and 'Distribution Address' with country, city, street, zip code, etc.

The preferred data model to use is likely the data containers, since:

- Reusing the same address over multiple companies is minimal. Therefore, the data model with the 'Address' as a separate entity is unnecessarily complex.
- Some companies might not have a 'Distribution Address,' making the usage of separate attributes on 'Company' somewhat inflexible.

Product References

Consider that a product belongs to one product family in most cases, but in some exceptional cases might also belong to another product family. The products can be defined using one of the following methods:

- The product in the blue hierarchy belongs to a parent product family in the blue hierarchy. For the exceptional cases (where the product also belongs to another product family), a product reference is used where the

product is also related to the other product family.

- The product-override is used where the product-overrides are alternate versions of products and product families that may have differing values, references, links, and structures. Attributes and values applied to the product family are inherited to the product-override and can be replaced with local values and references on the product-override.

The preferred data model to use is likely the product reference, when inheritance of the second product family is not required, since it is less complex.

Dimension and Context Recommendations

This is one of the data gathering methodologies and recommendations for base setup improvement. The full list is defined in the **Base Setup Recommendations** topic.

Note: These recommendations are valid for systems without In-Memory. The performance costs are different with In-Memory. For more information, see the **In-Memory Database Component for STEP** section of the **Resource Materials** in online help.

The setup of contexts and dimensions is flexible and is often designed and configured based on business requirements. Ideally, the setup of contexts and dimensions should be based on avoiding unnecessary complexity and optimal performance as well, since a complex setup can have a negative impact on general performance.

Usually, in multilingual setups, two dimension points are defined by:

- Country
- Language

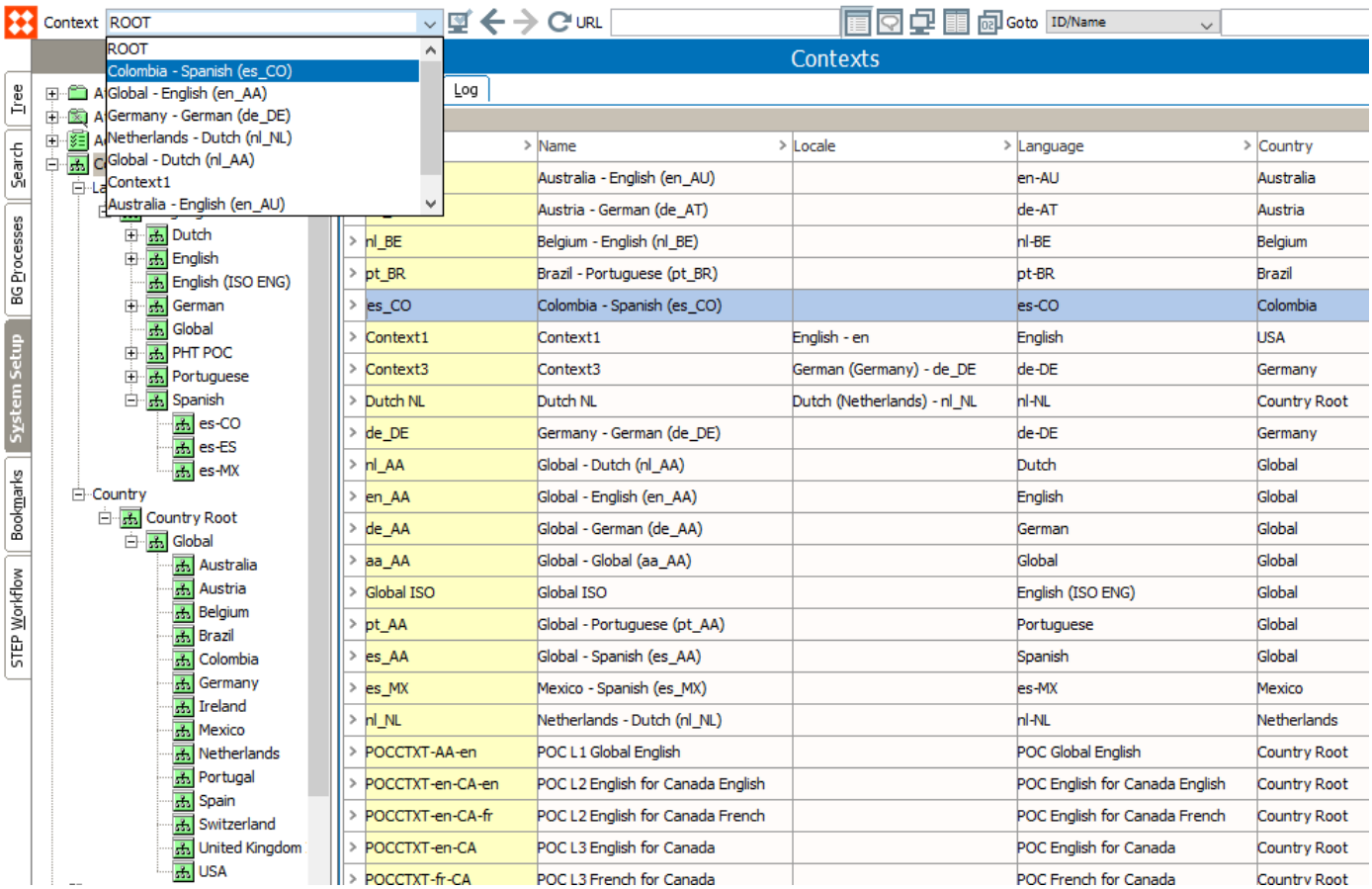
For this example, every object (both entities and products) can have a country and a language dimension:

- The country dimension allows differences in countries, such as different accessories of the product in different countries via suppressing a reference.
- The language dimension allows translations in different languages where the same object has an English, German, Spanish, etc., translation of the data.

The context defines the combination between the defined dimension points.

For example, the context **Colombia - Spanish (es_CO)** is defined with:

- Country = Colombia for Colombia (es-CO)
- Language = Spanish for Columbia (es-CO)



Important: The dimensions allow setup in a hierarchy using inheritance. This means that the dimension point inherits the data from its parent unless it has its own data. For example, the language 'Spanish for Colombia (es-CO)' is setup below the language 'Spanish (es).' This means that all data in the language 'Spanish for Colombia (es-CO)' is inherited from the language 'Spanish (es)' until local data in the language 'Spanish for Colombia (es-CO)' is set.

Once the dimensions and contexts are configured, then attributes, references, etc., can be configured to be dimension dependent.

For example, an attribute 'Consumer Description' can be configured to be language dependent.

Attribute | References | Attribute Transformation | Validity | Profile

Description

Name	Value
ID	Consumer Description
Name	Consumer Description
Last edited by	2018-01-25 10:43:29 by STEPSYS
Full Text Indexable	No
Externally Maintained	No
Completeness Score	
Hierarchical Filtering	None
Calculated	No
Type	Specification
Dimension Dependencies	Language;
Mandatory	Yes

And a reference such as 'Accessory' can be configured to be country dependent.

Reference Type | Validity | Log

Description

Name	Value
ID	SI-Accessory
Name	Accessories for Sales Items
Last edited by	2017-06-02 10:09:24.0 by STEPSYS
Externally Maintained	No
Dimension Dependencies	Country;
Completeness Score	

Recommendations

The following scenarios should be considered when determining the necessary dimension points for the system:

- Setting more than one dimension on an object can result in a complex situation and should be avoided. For instance, if a metadata attribute for an asset is defined to be language and country dependent, then it is possible to have a translated metadata attribute on the asset in different languages, and have a different metadata attribute value for different countries. It is hard to predict values when making an attribute multi-dimensional, such as when the metadata attribute inherits the values from its parents (e.g., from language Spanish and from country Global).
- Only define two dimensions (e.g., language and country) and only configure dimension dependency when required. For example, if the objects do not differ much in the countries, then only define a language dimension.

  The more dimensions defined, the more complex the solution will be. A complex dimension setup requires more extensive processing in imports, exports, bulk updates, running business rules, etc.

The number of dimension points (e.g., number of languages) is of less importance, as well as the number of contexts.

For more information, see the **Dimensions, Dimension Points, and Contexts** topic in the **System Setup / Super User Guide** documentation.

Global Count of Object and Attribute Recommendations

This is one of the data gathering methodologies and recommendations for base setup improvement. The full list is defined in the **Base Setup Recommendations** topic.

Note: These recommendations are valid for systems without In-Memory. The performance costs are different with In-Memory. For more information, see the **In-Memory Database Component for STEP** section of the **Resource Materials** in online help.

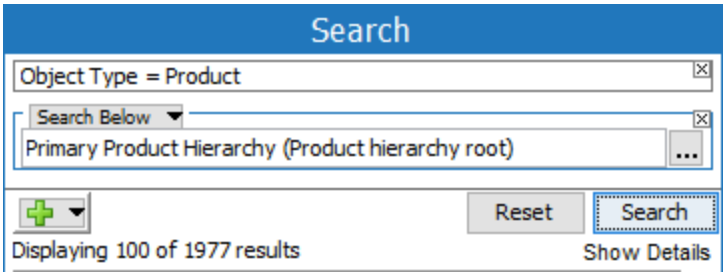
This paragraph provides examples of using search to count the number of objects in STEP. The search displays the total number of results found.

An example is included for the following types of counts:

- Products
- Products by object type
- Entities
- Entities by object type
- Assets
- Attributes

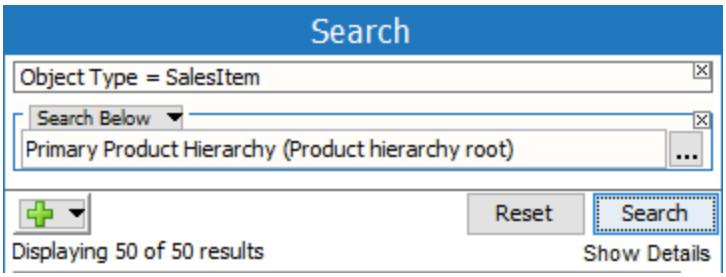
Count the number of products

Search criteria: 'Object Type = Product' and 'Search Below = Primary Product Hierarchy'



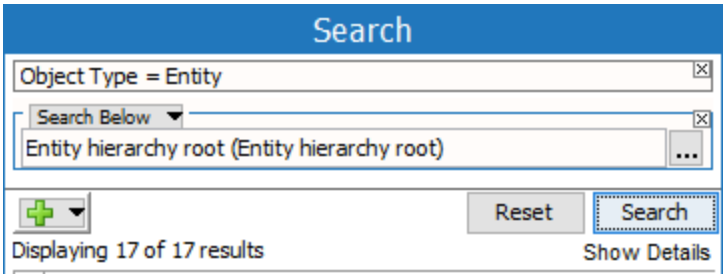
Count the number of products by object type

Search criteria: 'Object Type = [*Product Object Type*]' and 'Search Below = Primary Product Hierarchy'



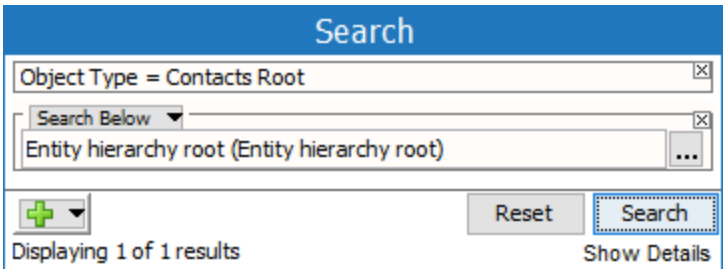
Count the number entities

Search criteria: 'Object Type = Entity' and 'Search Below = Entity Hierarchy Root'



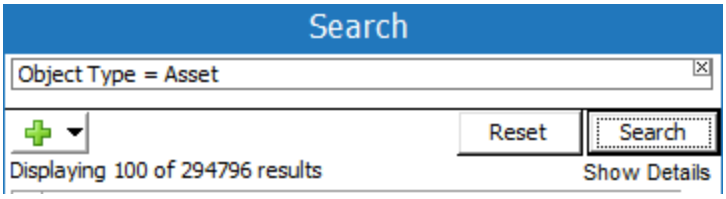
Count the number entities by object type

Search criteria: 'Object Type = [*Entity Object Type*]' and 'Search Below = Entity Hierarchy Root'



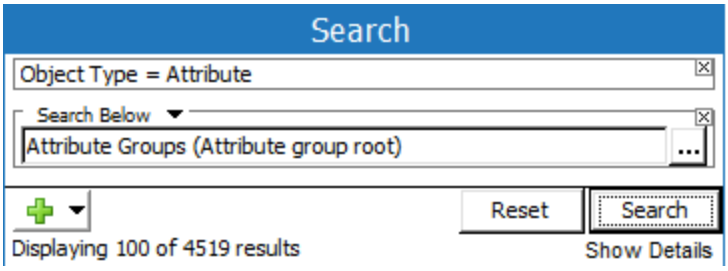
Count the number of assets

Search criteria: 'Object Type = Asset'



Count the number of attributes

Search criteria: 'Object Type = Attribute' and 'Search Below = Attribute Groups'



LOV Filtering Recommendations

This is one of the data gathering methodologies and recommendations for base setup improvement. The full list is defined in the **Base Setup Recommendations** topic.

Note: These recommendations are valid for systems without In-Memory. The performance costs are different with In-Memory. For more information, see the **In-Memory Database Component for STEP** section of the **Resource Materials** in online help.

Filtering a List of Values (LOV) can eliminate duplicate LOV values, while restricting the values available for selection based on the location of an object in the hierarchy, or based on the attribute using the LOV. However, this functionality can result in poor performance and be difficult to manage.

Avoid using LOV filters to enforce data population as the functionality is intended to support filtered end user selection rather than globally restricted data population. Specifically, when LOV filters are implemented, users are prevented from manually selecting values outside of the applicable filter.

For more information, see the **Filtering LOVs** topic in the **System Setup / Super User Guide** documentation.

The following section discuss filters for LOVs that are set on the LOV itself or using the LOV attribute and hierarchical filtering.

Filtering on the LOV

The LOV itself, via the 'Value Filter' on the List Of Values, as defined in the **Filtering LOV Values** topic in the **System Setup / Super User Guide** documentation and shown in the table below. This enables you to define legal values based on the attribute using the LOV.

'Color' LOV Values	Legal Values for Attribute 1	Legal Values for Attribute 2
• Green • Red • Yellow • Blue • White	Filter Includes • Green • Yellow • White	Filter Includes • Green • Red • Blue

Filtering on the LOV attribute and hierarchical filtering

The LOV attribute, via the Hierarchical Filtering parameter, as defined in the **Filtering by Hierarchy on LOV Attributes** topic in the **System Setup / Super User Guide** documentation and shown in the table below. This enables you to define legal values based on product and/or classification hierarchies.

'ColorLOV' Values	Legal Values for the 'Color' attribute on the Plastic Products Node	Legal Values for the 'Color' attribute on the Wood Products Node
• Green • Red • Yellow • Oak • Mahogany	Filter Includes • Green • Red • Yellow	Filter Includes • Oak • Mahogany

Recommendations

Avoid hierarchical filtering on product and classification hierarchy where possible since hierarchical filtering in both product and classification hierarchies can negatively affect performance.

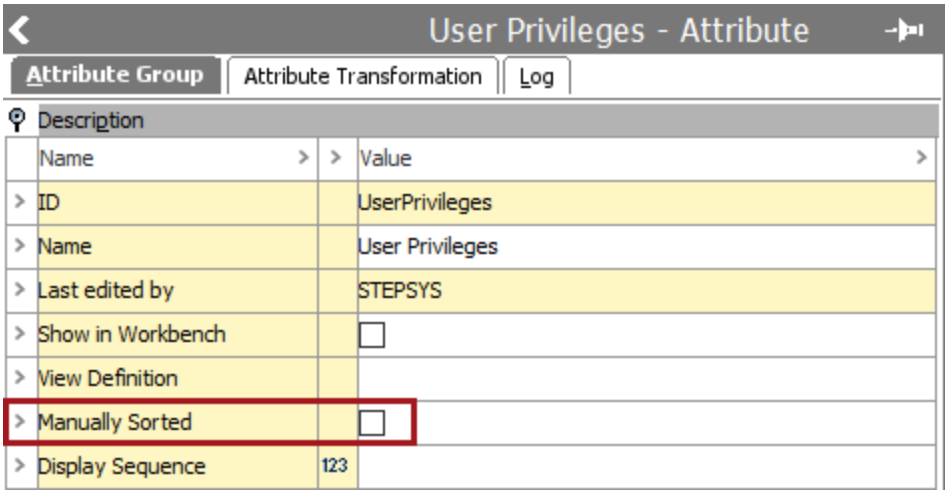
Additionally, using the 'Ignore LOV filters' option on the relevant product-to-classification link types restricts which parts of the classification hierarchies are used for LOV filter inheritance. However, this is not recommended because it can become difficult to manage.

Manually Sorted Recommendations

This is one of the data gathering methodologies and recommendations for base setup improvement. The full list is defined in the **Base Setup Recommendations** topic.

Note: These recommendations are valid for systems without In-Memory. The performance costs are different with In-Memory. For more information, see the **In-Memory Database Component for STEP** section of the **Resource Materials** in online help.

The Manually Sorted option requires additional processing power, and can have an impact on performance when using extensively.



The limitations are:

- Manual sequence is only set up in the workbench.
- Manual sequence can only be enabled for attribute groups that have no sub-groups.
- Manual sequence is only supported for attributes. Sequencing of 'tag groups,' LOV groups and reference types below an attribute group are not supported.

For more information, see the Manually Sorted section of the **Attribute Groups** topic in the **System Setup / Super User Guide** documentation.

Recommendations

Use the Manually Sorted option only when required to sequence the attributes in their attribute group.

Reference Recommendations

This is one of the data gathering methodologies and recommendations for base setup improvement. The full list is defined in the **Base Setup Recommendations** topic.

Note: These recommendations are valid for systems without In-Memory. The performance costs are different with In-Memory. For more information, see the **In-Memory Database Component for STEP** section of the **Resource Materials** in online help.

A few of the flexible elements of references include:

- Ability to configure with multiple different sources and targets (reference and reference by)
- Are of a certain type (product, asset, classification, etc.)
- Can have metadata attributes

None of these reference configurations independently have a direct impact on performance.

However, objects with many references can have a negative impact on performance since the object needs to be re-approved every time a reference changes. Also, since the approval of an object checks each reference, when the object has thousands of references, approval can become costly in performance.

Inheritance also has an impact on performance because the hierarchy is navigated to identify valid values.

Additionally, navigation across a reference to another object, to fetch attribute values and/or references, is expensive on performance. This is because another database access, and potentially another disk access, is required. For example, navigation via references in business rules to resolve values, resolving calculated attributes, or resolving references during export.

Recommendations

When encountering either of the cases above:

- Verify that references are owned by the object type that requires the fewest number of approvals. An object that owns many references carries the load of the approval process, including verifying approval for all referenced objects.
- Limit the usage of references in business rules, calculated attributes and during export.

Business Rule Recommendations

This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

Business rules allow extension of the STEP functionality with customer-specific business logic. Business rules provide a flexible way to tailor the core functionality in a very precise manner and can be tied to, e.g., bulk updates, events, imports and IIEPs, approval processes, workflows, Web UI screens, etc.

Important: The system load of the business rule execution can have effect on the performance of STEP. Running a lot of complex business rules degrades performance while STEP is processing the business rules.

The available types of business rules, and the purposes for which each is optimized, are defined in the **Business Rules** topic in the **Business Rules** documentation.

Details about where business rules can be used are defined in the **Using Business Rules in STEP** topic in the **Business Rules** documentation.

Optimizing performance in business rules involves the following:

- Business Rule Analysis
- Business Rule Elements to Use
- Business Rule Elements to Avoid

Extending STEP Functionality

If the business rule recommended practices have been implemented, and additional performance improvement is required, consider the following additional ways to extend STEP functionality.

Scripting API	Allows customers and partners to expand STEP functionality with JavaScript Business Rules. Involves a low level of customization and extended functionality.
Extension API	Allows customers and partners to extend STEP functionality with development of plug-ins and components. Involves a moderate level of customization and extended functionality.
Custom Extensions	Allows Stibo Systems to extend STEP functionality with development of custom extensions. Involves a high level of customization and extended functionality.

Using a Java extension can sometimes improve performance over a JavaScript business rule.

For example, this provides the ability to develop a custom extension instead of executing many complex business rules on import of data.

Note: Only cases where extreme amounts of logic are executed should be considered for this solution. In such cases, consider why it is necessary to run such complex logic.

The possible benefits of using a custom extension include:

- Event batching is used by the processor to ensure that business logic is executed exactly once per product per batch, even if multiple imports were executed for a single product.
- Optionally, the example plugin uses the parallel processing framework to maximize performance. This can potentially allow a 'strict' transaction endpoint to still benefit from parallelization in that rule execution can be multi-threaded while still ensuring data integrity.
- Resolve optimistic locks and deadlocks in cases where the locks are caused not by the import itself, but by logic that accesses and writes to objects shared among parallel import processes.

  A common example of this occurs with tree structures. If parallel imports are executing on children of a common parent, each of which executes business logic causing an update to the parent, the result is deadlocks and sever performance degradation.

  Another performance-related issue with this pattern is that the business logic is executed once per child. However, if the import logic is changed to republish the parent to the event queue instead of each child, event batching will result in a single update to the parent object, regardless of the number of children imported.

- The same concept can be applied using an OIEP configured with a business rule pre-processor. Execute import business logic in the pre-processor, then discard the event so that no exports are produced by the endpoint. Since endpoints do not use multi-threading while executing the pre-processor, the execution time may be longer than if a custom extension is used.

This solution also has some consequences:

- There will be a delay between importing data onto the object, and the business rule running. If timing is an issue, consider other options.
- The object cannot be inspected in both its previous and current form as easily, the business rules running in such a processor will have less information available than the same rule running during import.

Business Rule Analysis

This is one of the recommendations for performing analysis on business rule to improve performance. The full list is defined in the **Business Rule Analysis** topic.

Business rules are units of business logic that are stored as objects in System Setup. Business rules are used for many different purposes in STEP and come in three variants:

	Input	Output	Side effects allowed
Business actions	Current object, current event batch, etc. provided by the context in which the action is executed. For more on business actions, see the **Business Actions** topic.	None	Yes
Business conditions	Current object, current event, etc. provided by the context in which the condition is evaluated. For more on business conditions, see the **Business Conditions** topic.	Boolean result of evaluating the condition and a message for the user	No
Business functions	Input parameters defined by the function and provided by the functionality evaluating the function. For more on business functions, see the **Business Functions** topic.	Result of evaluating the function	No

A fourth type of business rule, **business library**, allows users to define JavaScript library functions that can be called from other JavaScript-based business rules. For more information on business libraries, see **Business Libraries** topic documentation.

For more information on differentiating between scenarios where one business rule is more useful than another, see the **Business Rule Common Use Cases** topic in the **Business Rules** documentation.

Using Business Rules in STEP

Wherever business rules are used within STEP, they are always tested or executed in relation to one object at a time, and in a specific context / workspace. The most common places to use business rules are included in the list below.

- **Approvals** - Conditions can be tested when approval is attempted on an object under revision control, and the condition can allow or prevent the approval. Actions executed on approval and can modify data in STEP (typically data on the object being approved), send emails etc. related to the approval.

  For more information, see **Business Rules on Approval** documentation.

- **Automatic Classifications** - Actions can be executed to automatically classify objects, and can be applied, for example, on approval, during an import, or as a part of a workflow.

  For more information, see **Using Automatic Classification with Business Actions** documentation.

- **Bulk Updates** - Conditions can be tested as a precondition for executing an action. Actions can be executed.

  For more information, see **Run Business Rule Operation** documentation.

- **Conditional Attributes** - The JavaScript business action 'Conditionally Invalid Values' bind resolves to a set of all values.

  For more information, see **Business Rules with Conditional Attributes** documentation.

- **Data Profiles** - Conditions can be tested against all objects in a category (for example, a part of the Product hierarchy), and the result of the tests can be displayed on the Profile Dashboard.

  For more information, see **Business Conditions in Data Profiling** documentation.

- **Event Processors** - Actions can determine when and how to act upon the events from the event processor. This is useful when changes occur on objects and custom actions need to occur.

  For more information, see **Execute Business Action Processing Plugin Parameters and Triggers** documentation or **Execute Business Action for Event Batch Processing Plugin Parameters and Triggers** documentation.

- **Gateway Integration Endpoints** - Accessed from JavaScript in business rule conditions and actions, the bind can work with a variety of the REST methods.

  For more information, see the **Gateway Integration Endpoint Bind** documentation in the **Resource Materials** online help.

- **GDSN** - Actions can be used in a variety of ways in the GDSN component, for example, to send out messages, update status, and start workflows. The following describes how to use GDSN specific business actions and how to run business actions when receiving messages from GDSN.

  For more information, see **Business Rules with GDSN** documentation.

- **Imports and Inbound Integration Endpoints** - Conditions can be tested during imports, and the condition can allow or prevent the creation or update of objects. Actions executed during import can modify the objects being imported, apply actions to objects being imported, send emails, and start workflows, etc.

  For more information, see **Business Rules in an Import Configuration** documentation.

- **Matching, Linking, and Merging** - Actions and Conditions can be used to normalize the data for comparison to identify the duplicate products in STEP. Actions can also be used in relation to Golden Records Survivorship Rules.

  For more information, see **Matching, Linking, and Merging JavaScript Binds** documentation or **Golden Records Survivorship Rules** documentation.

- **Outbound Integration Endpoint** - Conditions can be used as event filters for an event-based OIEP. Actions can be executed via a pre-processor for any OIEP, or as a event generator to generate derived events to export or publish for an event-based OIEP.

  For more information, see **OIEP - Event-Based - Event Triggering Definitions Tab** documentation or **OIEP - Pre-Processor - Business Action** documentation.

- **Web UI** - Actions can be executed using 'Run Business Action' component to update the object. Conditions can be evaluated using 'Initiate Business Condition Action' component.

  For more information, see **Business Conditions in Web UI** documentation.

- **Workflows** - Conditions can be tested within workflows to allow or prevent transitions from one state to another. Actions can be executed when entering a state, when leaving a state, when performing a specific transition, and when a deadline is met. Actions can also modify the object being tracked by the workflow, modify other objects in STEP, modify the workflow behavior, send email, start other workflows, etc.

  For more information, see **Business Rules in Workflows** documentation.

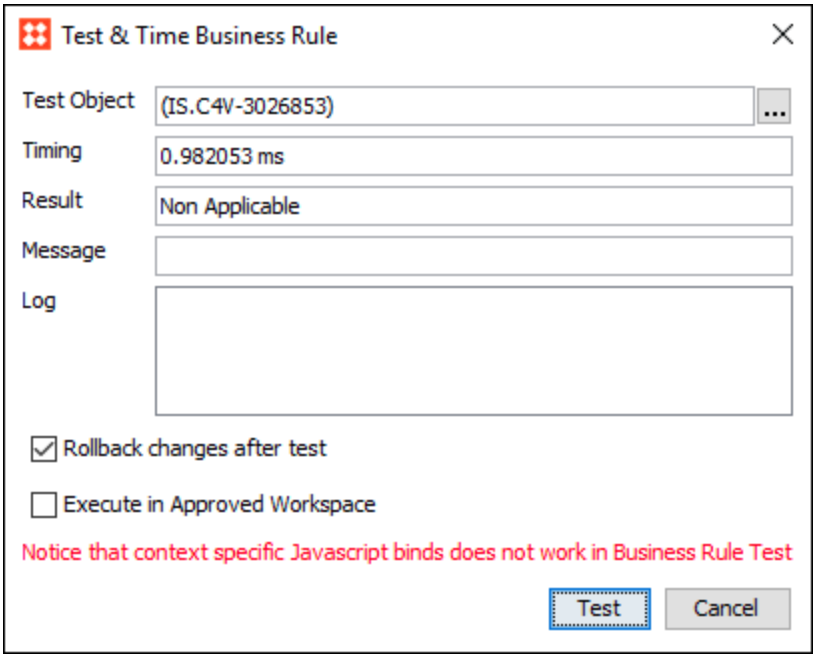
Test & Time Business Rule

Use the 'Test & Time Business Rule' dialog, as defined in the **Testing a Business Rule** topic of the **Business Rules** documentation. This option gives a first indication of the performance of the business rule for a certain item.

Test a business rule multiple times against objects that will either fail or pass and analyze the performance timing.

Test a long-running business rule to verify the performance timing.

For example, the business rule shown below took about 0.98 milliseconds to complete for the selected object. The same business rule may take more or less time for other objects.

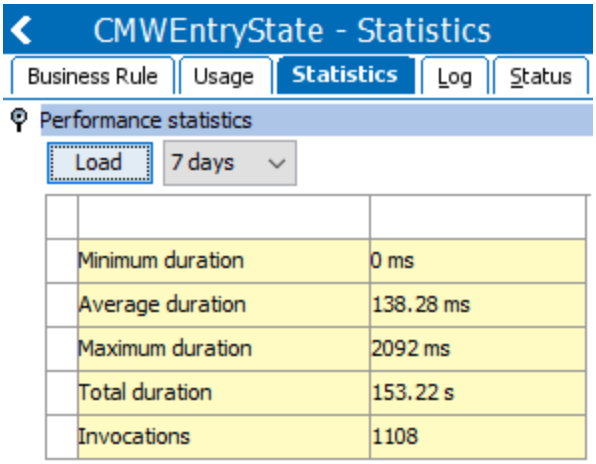


Business Rules Statistics

Use the business rule 'Statistics' tab, as defined in the **Maintaining a Global Business Rule** topic of the **Business Rules** documentation. This tab shows the performance of the business rule over time.

The minimum, maximum, average, and total duration of the business rule, as well as the number of invocations per selected period are displayed. The period can be configured to be between an hour up to a week.

For example, the image below shows the same business rule was invoked more than 100 times during the last 7 days. That average duration was about 138 ms. Click on the maximum duration of about 2092 milliseconds to show which item the business rule took longest to execute.

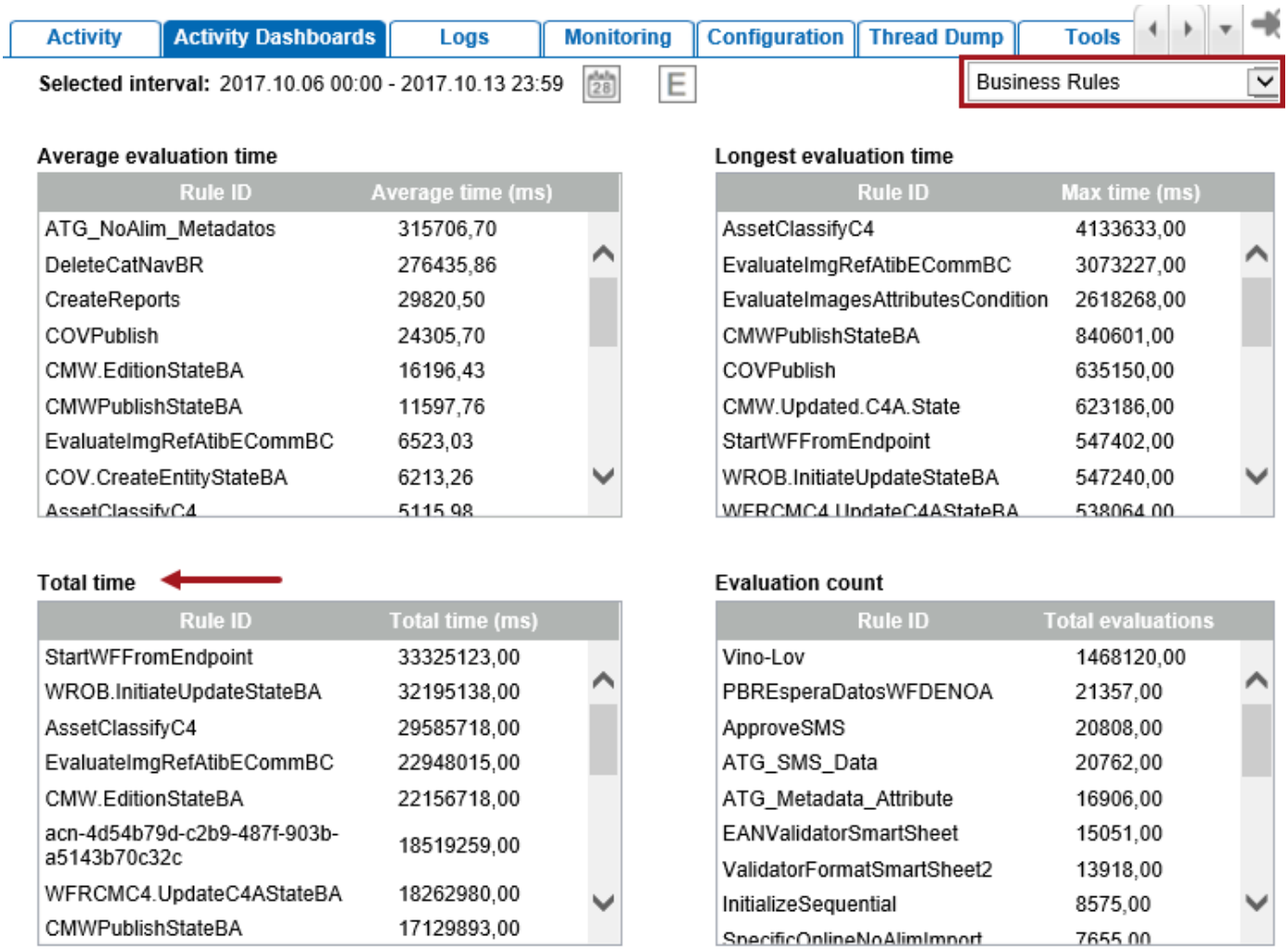


Admin Portal Business Rule Activity Dashboard

Use the Admin Portal 'Activity Dashboards' tab to display business rules information, as defined in the **Activity Dashboards** topic of the **Administration Portal** documentation. This option allows you to track and trace the most demanding business rules performance over a given period.

The dashboard shows the top business rules over the configured period, with the longest average evaluation time, the longest maximum evaluation time, the longest total time, and the number of invocations.

Start with the 'Total time' section to review the business rules with the longest average evaluation time and the most number of invocations.



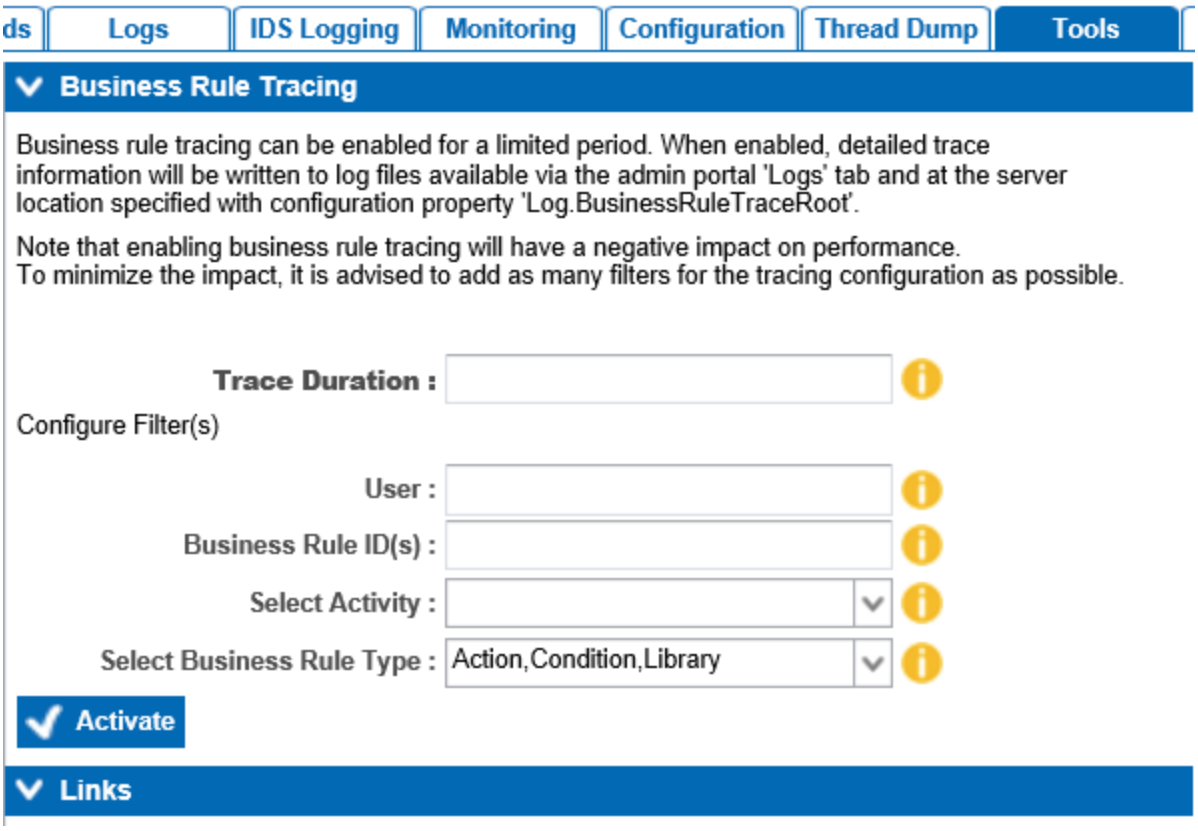
Admin Portal Business Rule Tracing

Use the Admin Portal 'Tools' tab to run the Business Rule Tracing functionality. When enabled, business rule tracing writes to log files.

Important: Enabling business rule tracing has a negative impact on performance. To minimize the impact, leave it enabled for a limited time and add as many tracing configuration filters as possible.

Define the location of the tracing log files by setting the case-sensitive property **Log.BusinessRuleTraceRoot** in the sharedconfig.properties file.

To enable business rule tracing, click the yellow information icon next to each parameter for a description of the parameter / filter. Supply the relevant information and click the **Activate** button. Then within the 'Trace Duration' time frame, from workbench, trigger the business rule(s) being traced.



Tracing stops when the system is stopped or restarted, and when the Trace Duration expires. Once a trace is activated a stop button (Stop) is displayed, which allows a user to manually stop tracing.

Business Rule Elements to Use

This is one of the recommendations for performing analysis on business rule to improve performance. The full list is defined in the **Business Rule Analysis** topic.

The following list includes business rule elements known to assist system performance. This list can be used to troubleshoot existing long-running business rules, and can also be reviewed prior to writing new business rules to prevent performance problems.

Use Exception Handling

If an error occurs during approval, an exception is thrown from the domain layer. If this exception is caught in a business rule but not re-thrown, it will not reach the exception approval handler. In this case, objects can be inconsistently approved (some parts are approved and other parts are not). This behavior also has a negative effect on the performance of the business rule.

When writing JavaScript business rules, it is important that 'try…catch' statements are designed correctly. 'Try...catch' statements should not swallow (catch and ignore) exceptions that should cause changes made by the script to be rolled back and cause the business rule to fail.

Important: Carelessly swallowing exceptions will lead to derived errors, which usually makes it very hard to determine the root cause.

The sample code in the table below demonstrates a way to log exceptions in JavaScript without swallowing those that should be handled by the framework.

Correct	Incorrect

`try {`
`  // Some code`
`} catch (e) {`
`  logger.info(e);`
`  throw(e); // REQUIRED`
`}`
	`try {`
	`  // Some code`
	`} catch(e) {`
	`  logger.info(e);`
	`}`

The only types of JavaScript exceptions that may be caught and handled locally are:

- Checked exceptions thrown by an invoked method (including any subclasses of the specified checked exception) (see the example below)
- Exceptions not generated by calls to the STEP API

Important: Any other exception must always be re-thrown if caught, or not caught at all.

Correct Handling of Checked Exceptions

The code snippet below exemplifies how a checked exception can be caught and handled locally. Notice the necessary Rhino specific '**e.javaException**' notation.

```
try {
  currentObject.createReference(targetAsset, primaryImageRefType.getID());
  } catch (e) {
    if (e.javaException instanceof com.stibo.core.domain.UniqueConstraintException) {
    logger.info("Reference could not be created");
  } else {
    throw(e); // All other exceptions MUST be re-thrown
  }
}
```

Proper exception handling correctly re-throws the exception when using 'try-catch' in business rules and avoids inconsistent objects.

Use Logging Carefully

Warnings and errors encountered while executing business rules can be written in the Main STEP Log File. While logging many details can have a negative impact on performance, using the correct logging level can aid in troubleshooting and resolving unexpected outcomes.

The following case-sensitive entries in the sharedconfig.properties file are used to refine the logging level:

- **BusinessRule.Warning.Threshold** - a threshold in milliseconds for business action execution. If it takes longer to execute or test a given business action, a warning is posted in the Main STEP Log File.

  For example, BusinessRule.Warning.Threshold=10000 means write a warning to the STEP log file whenever a business rule execution takes longer than 10 seconds.

- **Log.Level** - specifies the level of detail for logging business rules results. The values are ALL, FINEST, FINER, FINE, CONFIG, INFO, WARNING, SEVERE, and OFF. Setting a level includes logging for the lower levels.

  For example, Log.Level = INFO would include log entries for info, warning, and severe.

For more details about the log levels, see the **Server Log File Settings** topic in this guide.

Recommendation

Log the result of business rules during development on the development server, but turn off the logging when deploying to the test, quality, and production servers. To control logging, set a debug flag in the business rule code, as illustrated below.

```
//Debug 'flag' DO NOT use unless you develop or test
//When doing tests DO NOT test on large amount of products
//REMEMBER to set to 'false' when development and testing phases are complete
var isDebug = false;

//Function to handle whatever logging of debug information should occur or not
function logDebug(message) {
if(isDebug) {logger.info(message)}
}
...
logDebug("Here's a message for the log file")
...
```

Use Arrays, Not Multiple Read Calls

Business rules repeatedly using calls to the database for large sets of data significantly degrades performance. Instead, use one call to get the data, and push it into arrays and work from there. Minimizing the number of calls to the database aids performance.

When multiple business rules are executed sequentially (e.g., as part of an approval process), and these business rules fetch the same data from the database multiple times, it is beneficial to rewrite the business rules to fetch the data once, and push the data into (multi-dimensional) arrays.

In-Memory

In-Memory can improve performance of the business rules because it provides faster operations on complex data models where business rules navigate references.

In-Memory may improve performance on business rules that still perform poorly after implementing the recommended practices for business rules. For more information, see the **In-Memory Component** section of the **Resource Materials** section of online help.

Consider Using an Extension

An extension should be considered when additional performance improvement on business logic in the system is required and all previous recommendations on business rules are implemented (including In-Memory). Some of the code using in JavaScript (business rules) might run faster in Java (extensions).

Important: Only cases where extreme amounts of logic are executed should be considered for this solution. And in such cases, first consider why it is necessary to run such complex logic.

For example, you could develop a custom extension instead of executing many complex business rules on import of data. The possible benefits of such a solution are:

- Event batching is used by the processor to ensure that business logic is executed exactly once per product per batch, even if multiple or many imports are executed for a single product.

- The example plugin optionally uses the parallel processing framework to maximize performance. Potentially, this allows a 'strict' transaction endpoint to benefit from parallelization in that rule execution can be multi-threaded while still ensuring data integrity.
- Optimistic locks and deadlocks can be resolved in cases where the locks are caused not by the import itself, but by logic that accesses and writes to objects shared among parallel import processes.

  A common example of this occurs with tree structures. If parallel imports are executing on children of a common parent, each of which executes business logic causing an update to the parent, deadlocks (and sever performance degradation) will result.

  Another performance-related issue with this pattern is that the business logic is executed once per child. However, if the import logic is changed to republish the parent to the event queue instead of each child, event batching will result is a single update to the parent object, regardless of the number of children imported.

- For STEP 7.4+ solutions, the same concept can be applied using an outbound integration endpoint configured with a business rule pre-processor. First, execute import business logic in the pre-processor, then discard the event so that no exports are produced by the endpoint.

  Note: Endpoints do not use multi-threading while executing the pre-processor so the execution time may be longer than if a custom extension is used.

  However, a pre-processor solution also has some consequences:

  - There will be a delay between importing data onto the object and the business rule running. If timing is an issue, consider another option.
  - Running business rules in a pre-processor does not allow the object to be inspected in both its previous and current form as easily as running the same rule running during import.

Business Rule Elements to Avoid

This is one of the recommendations for performing analysis on business rule to improve performance. The full list is defined in the **Business Rule Analysis** topic.

The following list includes business rule elements known to degrade system performance. This list can be used to troubleshoot existing long-running business rules, and can also be reviewed prior to writing new business rules to prevent performance problems.

Avoid Large Transactions

Business actions involve a transaction which allows you to manipulate data in STEP. Business actions with long-running transactions degrade the performance. Additionally, since STEP runs with optimistic locking policy, large transactions increase the probability of optimistic locking failures when running the business action simultaneously. For more information, see the **Optimistic Locking Recommendations** topic.

Keeping business rule transactions small means it is necessary to develop business rules while considering the worst-case scenario. This includes the following recommendations:

- Avoid traversing a substantial percentage of the complete data range.
- Keep changes to data local (to the nodes nearest your main data object).
- Avoid business rules that follow and potentially change the objects of transitive closures of referential structures, such as everything underneath a high-level folder in the product hierarchy containing thousands of children. Instead, use a bulk update or a customer specific background process.

If it seems that the business rule transactions cannot follow these recommendations, see the **'Reference Target Lock Policy' Parameter** section of the **Optimistic Locking Recommendations** topic.

Avoid Large Business Rule Libraries

On each execution, JavaScript libraries are compiled. Each dependency is stacked into a script which is also compiled using the ScriptEngine.eval() method before each execution of the business rule.

For example, Script S depends on Library A and Library B. Library A depends on B. In this case, the script is stacked as follows:

- A::script
- A::B::script
- B::script
- S::bindings
- S::script

STEP caches the scripts instead of reloading them from the database. By default, 100 business rules are cached. Generally, it takes about 500 milliseconds to compile about 8,500 lines of code at each business rule execution.

Important: Be aware that libraries are compiled every time the business rule is executed, which is especially burdensome to performance when libraries depend on each other, and are used in many business rules. Dividing a large library into multiple libraries, but keeping the dependencies, does not resolve the issue.

To improve performance, consider making the library functions local to the business rule.

Avoid Infinite Loops

Infinite loops lead to severe degradation of system performance on the affected application server(s). Ultimately, an infinite loop can make the entire STEP installation unresponsive.

Analyze business rules to determine if infinite loops exist.

Avoid the 'getChildren' Function with Many Nodes

Business rules that use 'getChildren' on a large number of children (more than 10,000) can cause memory problems because the function reads all the children. Instead, use 'queryChildren' function, which limits the number of children affected.

Analyze business rules to determine if 'getChildren' is used on a selection with more than 10,000 children, and update the 'queryChildren' function as needed.

Avoid Updating Data via Business Conditions

Business conditions are optimized for determining the true / false result of read-only scenarios. For details, see the **Business Conditions** topic in the **Business Rules** documentation.

Export Recommendations

This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

One of the primary goals of most STEP implementations is to reduce the time to market required by the flow of data from STEP to external systems such as ERP systems and e-commerce systems.

Important: Optimizing the export performance may adversely affect the performance of the system as a whole. For example, multithreading can increase export performance, although it may have a negative impact on the overall system performance.

The available tools for exporting data are defined in the **Data Exchange** documentation.

Optimizing performance in exports involves the following:

- Export Elements to Use
- Export Elements to Limit

Export Elements to Use

The following list includes export elements known to minimize impact on system performance. This list can be used to troubleshoot existing exports, and can also be reviewed prior to creating new exports to prevent performance problems.

To ensure maximum export performance, the usual strategy is to limit the amount of information exported, or limit the number of times the same node is exported with the same data.

For general information on exports, see the **Data Exchange** documentation.

Optimize Object Type Triggering Definitions

Ensure that only required objects are exported using the Triggering Object Types flipper on the outbound integration endpoint (OIEP) Triggering Definitions tab. For example, when exporting to an e-commerce system, only the product itself is potentially relevant. Triggering on other object types risks spending time exporting objects which would be irrelevant downstream.

For more information, see the **OIEP - Event-Based - Event Triggering Definitions Tab** topic of the **Data Exchange** documentation.

Optimize Attribute and Reference Triggering Definitions

Applying triggering definitions can ensure that objects are only exported when necessary (based on the attributes changed) and minimize performance issues. On the outbound integration endpoint (OIEP) Event Triggering Definitions tab, set the object types in the Triggering Object Types flipper. For example, an e-commerce system is probably only interested when certain attributes, like the description, of a product object changes. So the Triggering Object Type is set to 'product' and the Triggering Attributes is set to 'description.'

Additionally, set the OIEP triggering definitions specifically for the export recipient. Create attribute groups specifically for export channels, and then trigger attributes specified by attribute group. For example, the attribute 'WebsiteAttribute' contains only the attribute relevant for the website export channel.

For more information, see the **OIEP - Event-Based - Event Triggering Definitions Tab** topic of the **Data Exchange** documentation.

Optimize Event Filter and Event Generator Triggering Definitions

Event filters and event generators are business rules that are executed during export.

For example, consider that inheritance affects changes to attributes residing higher up the hierarchy, and can result in a significant number of products if all child products are exported. In this case, replacing a single high-level attribute change event with multiple child-level events is recommended. Using the event filter / event generator options means the significant volume of events can be handled in multiple batches, which enables output files to be kept to a reasonable size. It also allows exporting multiple batches in parallel reducing overall export times.

Typically, the 'approval' mechanism should not determine if data is suitable for publishing since approval is much earlier within the product lifecycle. Often, it is desirable to limit the data exported to just 'published' objects. The event filter and pre-processor functionality can meet both of these requirements, although they operate in slightly different ways. Alternatively, all data can be exported downstream (related to the underlying events) and a middleware-based solution can determine which data to route to which target system.

For more information, see the **OIEP - Event-Based - Event Triggering Definitions Tab** topic of the **Data Exchange** documentation.

Use Multiple Dedicated OIEPs

In many cases, a single OIEP is used to monitor all product changes, i.e., both attribute and reference changes.

In this case, it is easy to see how the assignment of many products to a classification, e.g., 'Christmas Gifts' can cause a significant volume of data to be exported, delivered, and processed by the receiving system, even though no actual product data has changed.

This issue can be avoided through the use of multiple OIEPs:

- One OIEP listens for traditional product (attribute) changes and outputs all data for the product.
- Another OIEP listens for reference changes and outputs minimal data, e.g., product ID and target ID.

Note: Generally speaking, the performance gain can be degraded if using more than 10 OIEPs.

For more information, see the **Creating an Event-Based Outbound Integration Endpoint** topic of the **Data Exchange** documentation.

Use Multithreading

Increasing the number of threads for a given OIEP can increase export performance.

Multithreading is effective when a large amount of data goes to a downstream system on a regular basis and the downstream system can handle the load.

Consider the following points before increasing the number of threads to more than one:

• The STEP system hardware should have enough resources to perform multithreading.

• The downstream (receiving) system must be able to handle parallel events.

Although multithreading can increase export performance, it may have a negative impact on the overall system performance when a large amount of data is involved. Therefore, run the settings in a test environment, starting with a small amount of data and then increasing it, before implementing it in your production system.

It’s recommended to consider using multithreading when there is a large amount of data going to a downstream system on a regular basis to improve export performance. However, multithreading may cause overall system performance degradation. Therefore, it’s necessary to test it before implementing it in your production system.

For more information, see the **Event-Based OIEP Multithreading Support** topic of the **Data Exchange** documentation.

Optimize the Batch Size

The appropriate batch size is typically based on the size of messages and downstream system processing capabilities:

- Use a smaller batch size for larger messages.
- Use a larger batch size for smaller messages.

For individual OIEPs, the batch size is set using the 'Number of events to batch' parameter on the Event Queue Configuration flipper. For more information, see the **OIEP - Event-Based - Event Queue Configuration Flipper** topic of the **Data Exchange** documentation.

Note: Use the system-wide case-sensitive **OutboundExportService.BatchEventsMaxSize** property, set in the sharedconfig.properties file, to limit the number of events included within any batch. When the batch size in the workbench is greater than this setting, this setting overrides the workbench to limit data exported in a single export invocation.

Small Batch Size Considerations

A small batch-size, or no batching at all, invokes the export engine and surrounding framework many times (once per batch), incurring a significant overhead. A small batch-size can also cause the same product to be exported multiple times in cases where a product has been approved multiple times in quick succession, or there have been changes to externally maintained data (in this case one event will be created for each external change).

Note: While setting the batch size = 1 may appear to deliver the required results, in practice, there are problems associated with this approach as defined above. Generally, small batch sizes should be avoided.

Large Batch Size Considerations

A large batch-size (e.g., 1,000 - 10,000 events) invokes the export engine and associated framework fewer times incurring less overhead and reduces the amount of duplicate product data exported.

Use Cross-Context Exports

One way to limit how much data is being exported, is to export cross-context STEPXML on an endpoint rather than having multiple endpoints, each exporting in their own context. This is because having multiple endpoints also means exporting the non-context sensitive data multiple times.

Do not configure multiple OIEPs each outputting product details for a single context. Instead, for significantly faster overall export time, use a single OIEP configured with multiple contexts. Subsequently, the context splitter post processor can be used if separate context output files are required.

For more information, see the 'Contexts' parameter section on the **OIEP - Configuration Flipper** topic of the **Data Exchange** documentation.

Use Event-Based Exports Over Static Exports

While static exports can be used, it is usually much more efficient to use event messaging via event-based exports.

In reality, for a larger STEP system with several million products, an event-based integration is the only viable approach. Not only from a STEP perspective (the time taken from the STEP side to export all data), but also from the receiving system perspective (the time to import the all data).

It is recommended to use event-based exports over selection-based exports whenever possible.

For more information, see the **Outbound Integration Endpoints** topic in the **Data Exchange** documentation.

Use Separate Queues for Important Integrations

'Queue for endpoint' is the name for the queue that is used by the OIEP Background Process to poll the endpoint. The background process handles the actual export. The first time you activate the endpoint, a queue with the specified name is created if it does not already exist. Typically, high-priority integrations and integrations with long-running processes should have their own queue for endpoint processes.

STEP allows you to define multiple queues. 'Queue for endpoint processes' is the name for the queue that is used by the background processes started by the endpoint to handle the actual export. The queue is automatically created on the system if it does not already exist. High priority integrations or integrations with long-running processes should typically have their own queue, for example, including the ID in the queue name.

Consider In-Memory for Exports

In-Memory can improve export performance because In-Memory provides faster read operations. This is beneficial for complex data models, such as export configurations with data aggregations and export configurations with data that navigates references.

For more information, see the **In-Memory Database Component for STEP** topic in the **Resource Materials** section of online help.

Export Elements to Limit

The following list includes export elements known to degrade system performance. This list can be used to troubleshoot existing exports, and can also be reviewed prior to creating new exports to prevent performance problems.

To ensure maximum export performance, the usual strategy is to limit the amount of information exported, or limit the number of times the same node is exported with the same data.

For general information on exports, see the **Data Exchange** documentation.

Limit Event-Based OIEPs

Event-based outbound integration endpoints (OIEPs) can adversely affect the performance of the system as a whole. The number of OIEPs can adversely affect the approval / external attribute change process because each change must be checked against the triggering definitions on all OIEPs to determine if any is interested in that specific change. A general guide is to have no more than 10 event-based OIEPs.

For more information, see the **Outbound Integration Endpoints** topic in the **Data Exchange** documentation.

Limit the Volume of Exported Data

Advanced STEPXML makes it possible to define what data to export while leaving out the other data. For example, only include the export attribute groups instead of including all attributes. The CSV export format and the Generic XML format allow configuring only the data that is needed.

In the following image, the Advanced STEPXML exports only the 'Accessory' reference type:

```
<ProductCrossReference IncludeInheritedReferences="*" Type="Accessory">
        <Entity Referenced="true">
                <Name/>
                <Values IncludeInherited="true">
                        <Value Derived="true" AttributeID="Training"/>
                </Values>
        </Entity>
</ProductCrossReference>
```

For more information, see the **Advanced STEPXML Format** topic and the **Data Formats** topic, both in the **Data Exchange** documentation.

Limit Unnecessary Data

Consider the impact of additional objects and determine if they are required, as many additional objects slows the export process. Generally, limit unnecessary data in the export using these methods:

- An event generator can be used to add additional objects via derived events, as defined in the **Generate Event** section of the **OIEP - Event-Based - Event Triggering Definitions Tab** topic within the **Data Exchange**

documentation.

- A pre-processor can add additional objects to the export set associated with the event batch, as defined in the **Configure the Pre-processor and Post-processor** section of the **OIEP - Event-Based - Output Templates Flipper** topic within the **Data Exchange** documentation.
- The Advanced STEPXML template can include additional objects, for example, via references. For more information, see the **Filter References in STEPXML** topic within the **Data Exchange** documentation.

Limit Multiple Output Templates

Multiple output templates can be associated with a single outbound integration endpoint (OIEP) enabling the OIEP to handle different types of objects / events, each having the ability to be output in a different format. This flexibility allows the user to change how data is exported for different kinds of objects.

Important: While STEP allows multiple output templates per OIEP, it can have a severe impact on performance since a new batch is created each time a new output template is required.

Alternate approaches include:

- When possible, use different OIEPs to handle the 'family' and 'item' changes separately. This is not an option if the events need to be processed in sequence since the 'item' change could be exported, and delivered, before the 'family' change.
- Use STEPXML to easily contain the 'family' and 'item' data in the same file.

For more information, see the **OIEP - Event-Based - Output Templates Flipper** topic within the **Data Exchange** documentation.

Event Processor and Event Queue Recommendations

This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

Event processors and queues are used for asynchronous processing, such as auto-purging revisions on schedule or performing a delayed approval after import. Warnings and/or critical issues in asynchronous processing can have an influence on the performance of the system.

For general information on event processors and event queues, see the **Event Processors** documentation and **Event Queues** documentation.

For more information, see the **Monitoring** section of the **Administration Portal** documentation.

Pay attention to number of events to batch

Analyze Processing

Analyze the state of asynchronous processing using the 'Sensors for external monitoring' option as follows.

1. On the Start page, click the **STEP System Administration** button, and supply the login credentials.
2. On the **Monitoring** tab, open the Additional Links section and click the 'Sensors for external monitoring' link to display the list of monitors.
3. For each sensor with a 'Warning' or 'Critical' status, click the sensor name link to display the details of the status.
4. Resolve the issue indicated in the sensor log.

For example, the following sensor has a 'Critical' status.

Sensor	Status	Message
EventQueueSensor-DynamoDBEvents	**Critical**	1649000 events have been queued, which is more than the scheduled limit of100000

The details show that event queue 'DynamoDBEvents' has too many events queued.

Sensor status for EventQueueSensor-DynamoDBEvents

Plugin	EventQueueSensor
Sensor	DynamoDBEvents
Status	**Critical**
Created	Wed Oct 31 12:49:15 UTC 2018 (0 seconds ago)
TTL	30 seconds
Short message	1810000 events have been queued, which is more than the scheduled limit of100000

Performance data

Name	Value	Unit	Warning	Critical	Min	Max
Estimated number of unread events	1810000.0					

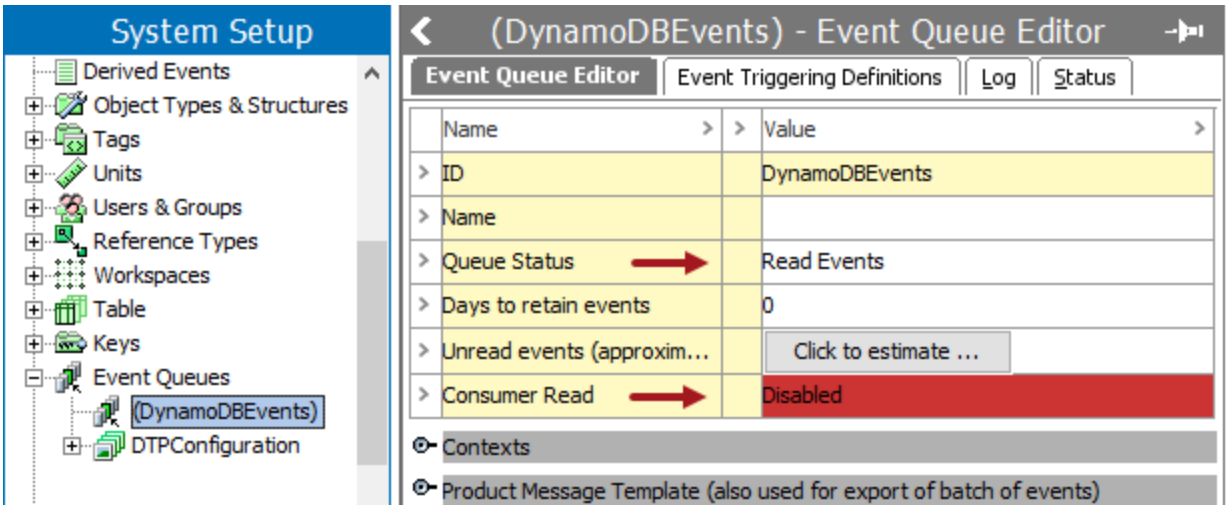
Formats

The status shown on this page is also available in the following machine-friendly formats:

- A simple status string, Possible values: OK, WARNING, CRITICAL, UNKNOWN.
- Nagios plugin output, output formatted for easy integration with Nagios.
- Full xml all available data in xml for easy parsing by ad-hoc monitoring tools.

Please do not rely on the output of this page for automated monitoring, use one of the formats above.

Looking at this event queue in the workbench shows that the event queue is disabled but it still reads events. Because the latest change on this event queue is months ago, and it is on the production environment, the event queue is no longer being used and could be removed.



Import Recommendations

This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

Bulk data imports can be executed manually or automatically on a schedule via an inbound integration endpoint (IIEP). Bulk data imports can vary from fast to slow, depending on the expectations and on following the recommendations for imports described in this section.

A clean, simple, optimized import that does no processing can process about a hundred records per second, whereas a complex import with complex processing may only process one record per second, or perhaps be even slower.

A slow import could be problematic based on the situation. Slow import performance of about one record per second, for example, is fine when a small number of records are imported on a daily basis. However, if the import contains a large number of records and it will take weeks to finalize, then this is likely a problem. This illustrates why it is important to clearly describe the use cases for imports.

If the STEP system suffers from perceived bad performance during import, these recommendations should be considered to optimize performance.

The available tools for importing data are defined in the **Data Exchange** documentation.

Optimizing performance in imports involves the following:

- Import Elements to Use
- Import Elements to Avoid
- Importing for Migration

Import Elements to Use

The following list includes import elements known to minimize impact on system performance. This list can be used to troubleshoot existing imports and can also be reviewed prior to creating new imports to prevent performance problems.

For general information on imports, see the **Data Exchange** documentation.

Use Term Lists for Price Data

The structure of the import file can be optimized for maximum import performance by using commercial data (also called terms lists) for price data where appropriate. Especially for complex, time-limited / quantity limited price data, terms lists can speed up imports.

For more information, see topics in the **Commercial Data** section of the **STEP Publisher (InDesign)** documentation.

Use Business Rules Designed for Import Performance

If business rules are required on import, carefully map the business rule execution of each import (especially endpoints) to understand the full impact of the configurations. Ensure any business rules running on import (via approval, import actions, or through a workflow), has acceptable performance.

Review the following items to ensure business rules are used efficiently:

- Simplify complex business rule JavaScript logic being executed on the import.
- When possible, move business actions running on the import to event processors. This only applies if the actions can be performed asynchronously from import.
- Business rules that read or update objects other than the one being imported (reference sources or targets, parents, children, etc.) will reduce performance because only the imported product is likely to be resident in cache at the time. Business rules that iterate through children of the imported product are particularly common, but very expensive performance-wise.
- Consider if it is possible to ensure that no business conditions exist, allowing a logical exception or a lock contention. Business rule execution for the purpose of automation or transformation is secondary and should be treated as fail-tolerant. This means that the criticality of a rule failure is far less than that of the import operation itself. In the event of an exception, rules can be fixed and executed again, whereas import records that are skipped can be difficult to rectify on a busy system.

For more information, see the **Business Rule Recommendations** topic.

Use Workflow Initiations Designed for Import Performance

When a product is initiated into a workflow, or a state transition is triggered by an import, all business rules configured on exit of an existing state, transition between, or entry to the next state execute as part of the import process.

The following scenarios can heavily impact the import performance:

- If workflow initiations and/or transitions are necessary, consider if the business rules trigger on entry or exit. The import performance may be heavily impacted by the executing of these transitions.
- If business rules initiate more workflows or auto submit to other states, a single workflow submission may cascade into hundreds (or even thousands) of lines of executed business rule logic.
- When a workflow business rule conditions fails, the current transaction is rolled back.

Use Approvals Designed for Import Performance

If approvals are necessary at import, then consider which approval conditions and actions will be executed.

Ensure that endpoints are importing externally-maintained data, since it requires no approvals. In this scenario, consideration for approval conditions and actions is not required. Also, externally-maintained data has no revision history. Therefore, revision history growth is not a consideration.

Use Event-Based Exports Designed for Import Performance

When importing externally maintained data, or importing and approving, all changes must be checked against any event-based outbound integration end points (OIEPs), to verify if an event should be generated.

Consider which approval events are queued on OIEPs and which event filter / generator rules will be triggered. If a large number of OIEPs exists, and if these have Event Triggering Definitions on attribute groups, for each check, the system must check if the attribute exists under the given attribute group. This can lead to performance degradation.

Ensure that the OIEPs are triggered to as specific and few attributes as possible. For more information, see the **Creating an Event-Based Outbound Integration Endpoint** topic in the **Data Exchange** documentation.

Use Parallel Imports for the Same IIEP

Under some conditions, configuring the inbound integration endpoint (IIEP) so that the files are imported in parallel can improve the import performance. For example, importing many separate import files via the same IIEP can increase the performance.

However, if the import files include the following types of data, parallel imports are not advised:

- If separate import files include the same objects, parallel imports can result in optimistic locking errors which will degrade import performance.
- If many products or entities reference a single shared target object (excluding classification link targets), lock failures will occur because by default STEP will take a row lock on the reference target during import.

In these scenarios, resolve or reduce this issue on the object types that have many reference sources by setting the reference target lock policy to 'Relaxed' as defined in the **'Reference Target Lock Policy' Parameter** section of the **Optimistic Locking Recommendations** topic.

Note: While parallel imports can improve import performance, they can also cause performance degradation across the rest of the system.

Configuration

The parallel import configuration will include the following parameter settings on the Configure Endpoint step of the IIEP:

- Transactional settings is set to 'None' - this allows data to process in parallel processes, without any transactional restrictions or data dependencies. This is useful, for example, when processing assets.
- Queue for endpoint processes is set to {*a separate endpoint process queue created for this IIEP*} - This allows the queue size to be larger than one. Data is not processed in a strict order, and if one background process fails, the endpoint continues to process data in the next background process in the queue.

Set the size of the queue created for this IIEP in the sharedconfig.properties file using the following case-sensitive property:

```
BackgroundProcess.Queue.{endpoint process queue created for this IIEP}.Size
```

For example, the following setting determines that the queue named 'Migration' allows 10 files to be processed at the same time.

```
BackgroundProcess.Queue.Migration.Size=10
```

For details about setting a parallel import, see the **Integration Endpoint Transactional Settings** topic in the **Data Exchange** documentation.

Optimize STEP Setup for Import Performance

Use the following setup recommendations to optimize import performance.

- Remove inactive and unused IIEPs on operational production environments. When an IIEP is removed, the corresponding background processes are also removed.
- Set IIEPs to remove files after import, as defined in the **IIEP 'Keep file after load'** section of the **Clean Up Import Files** topic.
- Set IIEPs to limit the number of background processes kept after import, as defined in the **IEP Auto Delete Settings** section of the **Create a Background Processes Maintenance Plan** topic.
- Use the standard asset importer, instead of the legacy asset importer is used, as defined in the **Importing Assets** topic within the **Digital Assets** documentation.
- Assets and other objects are not imported into a single folder, as defined in the **Hierarchy Builder** topic within the **Digital Assets** documentation.
- Balance the import schedules of all imports to balance the STEP system load.
- Review high-priority integrations and integrations with long-running processes. Typically, these integrations should have their own queue for endpoint processes where the background process handles the actual import. The queue is automatically created on the system if it does not already exist. For more information, see the **IIEP - Configure Endpoint** topic within the **Data Exchange** documentation.
- Consider In-Memory to improve import performance, as defined in the **In-Memory Database Component for STEP** topic in the **Resource Materials** section of online help.
- Limit the number of OIEPs listening on modify events to avoid excessive checking of event validity, as defined in the **Events** topic of the **System Setup / Super User Guide** documentation.
- Use the 'Relaxed' locking policy for commonly-referenced products to improve performance of imports, as defined above.

- Use parallel imports only as needed, considering the performance degradation to the rest of the system, as defined above.

Import Elements to Avoid

The following list includes import elements known to degrade system performance. This list can be used to troubleshoot existing imports and can also be reviewed prior to creating new imports to prevent performance problems.

For general information on imports, see the **Data Exchange** documentation.

Avoid Typical Import Errors

The following errors are typical for imports:

- Invalid attribute values - These errors can be caused by the attribute setup parameter in the import not matching the parameter in the system. For example, the attribute's validation type, mask, minimum and maximum values, maximum length, LOV, the object's own object type, and so on.
- Object type validity - Even if you load attribute values for an object, not all values will be automatically available in STEP. Attributes must be made valid for an object before the values can be accessed via references. STEP will always load attribute values if the object's type is valid for the attribute, and the attribute values meet the validity criteria. But, the attribute itself must be a valid attribute for that object, that is, linked somewhere in the object hierarchy or classification hierarchy where the object resides.
- Inaccurate STEPXML statements - Performance degrades when the STEPXML import file has the wrong case for the property 'UserTypeID' (such as 'UserTypeId'). If the STEPXML import file has no Parent IDs for the products, then new products are not imported. To skip importing new products, add the reject new product tag in the file header (RejectNewProducts="true") to avoid the missing Parent ID error.

Background Process (BGP) progress and the number of errors and warnings are shown on the Background Processes tab under the Execution Report flipper as follows:

- For manual imports using Import Manager - on the BG Processes tab under the 'Import Manager Pipeline' node
- For IIEPs - on the Background Processes tab click the BGP link to display information for this particular background process. In both cases, on the Background Processes tab, open the Execution Report flipper to are also displayed as shown below.

For a list of common errors, see the **Import Error Messages** topic and the **Import Error Message Examples** topic in the **Data Exchange** documentation.

Avoid Missing Reference Targets

Ensure that import files do not have reference nodes that are missing in the file (missing reference targets).

If the reference target does not exist in the import file, then the target does not exist at the time of import. The importer skips the product and triggers a second import pass after the initial completion (testing to see if the target exists later in the same file). If the reference target does not exist in the system at the time of the second import pass, the background process logs an error due to a missing reference target. A second import pass caused by missing targets bears a heavy performance impact.

This type of error illustrates the importance of the sequence of nodes in the import file. See also the **Avoid Forward Declarations** section below.

Avoid Forward Declarations

The structure of the import file can be optimized for import performance by ensuring that referenced nodes are not being created in the file after they are needed (forward declaration).

If the reference target exists later in the same import file, then the target does not exist at the time of import. The importer skips the product and triggers a second import pass after the initial completion. The reference target will exist in the system at the time of the second import pass, which will allow the import to succeed.

A second import pass caused by missing targets bears a heavy performance impact. This illustrates the importance of the sequence of the nodes in the import file. See also the **Avoid Missing Reference Targets** section above.

Avoid Multiple Updates of Same Object

The structure of the import file can be optimized for maximum import performance by ensuring that the same product or entity is not updated several times in a single file or in multiple files.

- When creating import files, structure the files by modified nodes, not by attribute. It is faster to update a single node with 10 attributes once, than to update each attribute individually.
- Update the same node with all relevant information in one file, rather than splitting it over multiple files or imports. Thus, understand the data patterns of busy endpoints and attempt to structure import files so that any given product or entity appears in the fewest number of import files as possible.

  If a given product or entity is distributed across several import files instead of consolidated into one, this will cause duplicate execution of business rules, approvals and cache load. It also has the potential to dramatically increase revision history, which is a performance detriment of its own.

  Updating the same product or entity at the same time across multiple imports can result in Optimistic Lock failures.

Avoid Unnecessary Business Rules on Import

Using business rules on imports is a powerful tool, but like all powerful tools comes with some risks. Complex JavaScript business actions add execution time to imports.

Review the following items to ensure business rules are used efficiently:

- Are automated actions *required* on import? The fewer automated actions on import, the faster the import performs.
- Does the business process *require* actions on import? When possible, design your solution so imports can run free of any business actions. An event processor can be used to perform business actions that are not necessary to be run on import.
- Are the business rules running on import via workflows or approvals *required*? While extremely useful, all of these options impact performance.

Once it is determined that a business rule is required, verify that there are no unnecessary business actions being preformed, such as:

- Are there duplicate executions? For example, an approval triggered in a global business rule as well as in a local state transition rule.
- Are business rules reading or updating objects other than the one being imported (reference sources or targets, parents, children, etc.)? This reduces performance because only the imported product is likely to be resident in cache at the time. Business rules that iterate through children of the imported product are particularly common but very expensive performance-wise.
- Do the business conditions allow a logical exception or lock contention? Verify business rule execution for the purpose of automation or transformation is secondary and is fail tolerant. This means that the criticality of a rule failure is far less than that of the import operation itself. In the event of an exception, rules can be fixed and executed again, whereas import records that are skipped can be difficult to rectify on a busy system.

For more information, see the **Business Rule Recommendations** topic.

Avoid Optimistic Locking in Business Rules on Import

If business rules on import are determined to be required, minimize the risk of optimistic locking caused by business actions on import:

- Business actions that execute on tree structures or commonly referenced objects may contribute to optimistic locking or even deadlock failures.
- Any business action that triggers an approval inside of a try / catch block can cause an optimistic lock (as well as subsequent retries and eventual failure) if an approval condition failure is caught and the original exception is not re-thrown.
- Any action that throws an error with the word 'exception' in the error message results in the importer functioning as if an optimistic lock occurred, resulting in retries and eventual failure.

For more information, see the **Business Rule Recommendations** topic and the **Optimistic Locking Recommendations** topic.

Avoid Complex Privileges on Import

When importing, all privileges are checked for each piece of information imported, even when the data is not imported. For example, when performing a hierarchy check (e.g., is the product below a certain root node), performance can be impacted significantly for large imports.

To avoid excessive privilege-checking and improve performance dramatically, the import user should have as broad and as few privileges as possible. For IIEPs, this applies only to the user configured on the endpoint.

Importing for Migration

The import recommendations apply to operational scenarios on production environments. However, the recommendations can also be applied to migration scenarios, although the migration scenarios are usually performed on a separate environment where the results are copied to a production environment via database copies.

Initial data migration is typically handled differently from standard imports because it is a one-time operation and the volume of data is generally far greater than a typical import would be expected to process. It is also generally expected that a greater level of effort will be invested in preparing the import messages or files so that the migration can be completed over a reasonable period.

When preparing migration data files consider the following:

- Transformation business rules may be required specifically for migration. Attempt to avoid using rules that read from or write to many related objects or children. Business rules should, wherever possible, only transform data on the object being imported.
- With serial endpoints, attempt to load products in the smallest number of import files possible. For example, load each product exactly once, providing full attribution. This reduces the number of times each product must read / flush from cache.
- If necessary, set the migration endpoint to parallel processing to use multiple concurrent background processes.
- If there are many references between objects, optimistic locks or deadlocks may occur. Even in the absence of actual locking errors in the logs, you may find that performance is slower than expected due to the lock waits required to update reference targets.
- Consider using two passes. The first set of import files is loaded for an IIEP running parallel and contain all information about the products except for references. The second set of import files is loaded for a separate serialized IIEP and contain only references. Start the product information import IIEP first and allow it to progress enough to load the products being referenced by the second set of files. Both endpoints can run at the same time as long as the products are not being processed by the two IIEPs at the same time.
- When using parallelized endpoints, avoid business rules that update products other than the one being loaded. This scenario can produce optimistic locking errors. If this type of business rule is required, consider using bulk updates to execute the logic after import is complete.

Matching and Linking Recommendations

This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

Matching and Linking functionality relies on three underlying components:

- Match Codes: define a string of attributes to compare, such as name, address, birth date, and email for customer data; or GTIN, EAN, part number, and SAP entity for product data.
- Matching Algorithm: evaluates match codes for potential duplicates and displays a percentage to indicate if they are the same record (via auto threshold) or likely the same record (requiring clerical review). The matching algorithm also defines how the duplicates are handled, such as merge or generate a golden record. Survivorship rules of the matching algorithm determine which attributes are copied to the golden record (name, attributes, references).
- Event Processor: triggers events which can be acted upon by the matching and linking business rules or matching and linking outbound integration endpoint.

Match codes limit the number of comparisons that the matching algorithm must make, and an event processor launches the associated business rule or OIEP. The system load of matching and linking can have a negative effect on the performance of STEP, especially if there are a lot of supplier items imported, if the matching and linking process is complex, or if the approval of the golden record is part of the process. For more information, see the **Matching, Linking, and Merging** documentation.

While the matching and linking and golden record functionalities are designed and based on business requirements, use the following recommendations when a matching and linking process performs poorly.

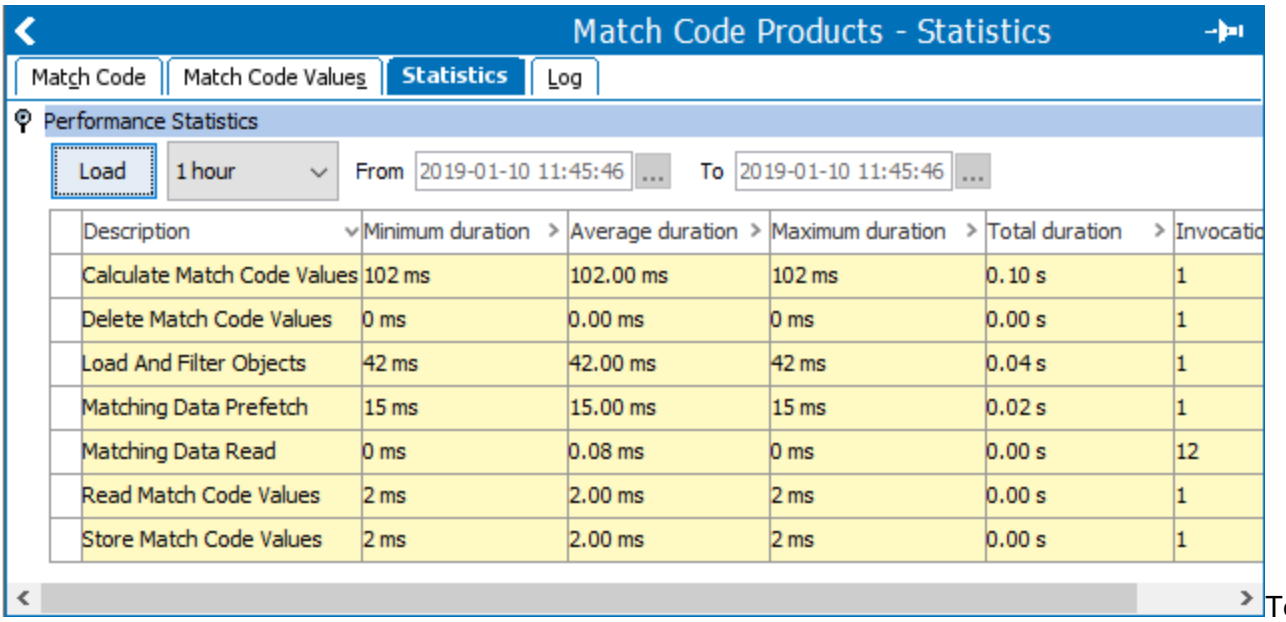
Optimize Match Codes and Matching Algorithm

For details on match codes and matching algorithms, see the **Generating Match Codes and Running a Matching Algorithm** topic within the **Matching, Linking, and Merging** documentation.

- Evaluate the performance of match code generation via the 'Maintain Match Code Values' option by reviewing the Match Code object's Statistics tab 'Performance Statistics' flipper details. Modify the items reported to have poor performance.
- Evaluate the performance of the matching algorithm execution via the 'Generate Events for Matching' option by reviewing the Matching Algorithm object's Statistics tab 'Performance Statistics' flipper details. Modify the items reported to have poor performance.

Statistics on Match Codes Generation

The performance of the generation of the Match Codes can be measured in STEP. The Match Code Statistics tab allows you to verify the Match Codes are performing well and identify performance problems.



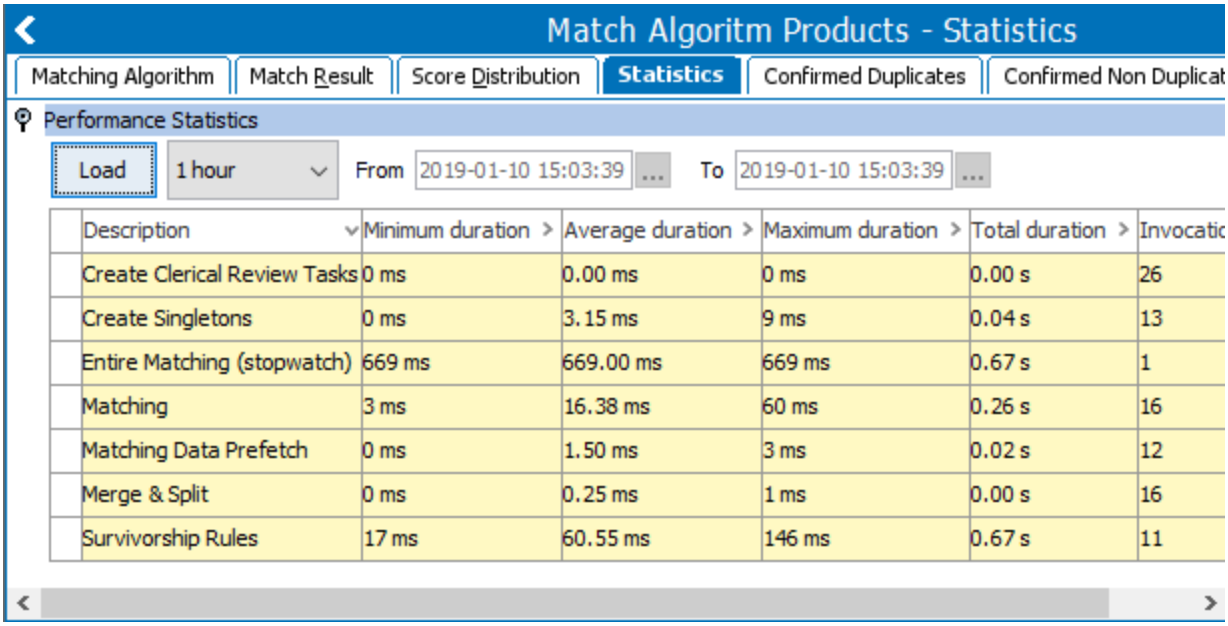
Description	Minimum duration	Average duration	Maximum duration	Total duration	Invocatic
Calculate Match Code Values	102 ms	102.00 ms	102 ms	0.10 s	1
Delete Match Code Values	0 ms	0.00 ms	0 ms	0.00 s	1
Load And Filter Objects	42 ms	42.00 ms	42 ms	0.04 s	1
Matching Data Prefetch	15 ms	15.00 ms	15 ms	0.02 s	1
Matching Data Read	0 ms	0.08 ms	0 ms	0.00 s	12
Read Match Code Values	2 ms	2.00 ms	2 ms	0.00 s	1
Store Match Code Values	2 ms	2.00 ms	2 ms	0.00 s	1

Te

For detailed information on the 'Maintain Match Code Values' option and the 'Match Code Values' tab, see the **Generating Match Codes and Running a Matching Algorithm** topic of the **Matching, Linking, and Merging** documentation.

Statistics on Running the Matching Algorithm

The performance of the running of the Matching Algorithm can be measured in STEP. The Matching Algorithm Staticstics tab allows you to verify that Matching Algorithm generation is performaning well and identify performance problems.



Description	Minimum duration	Average duration	Maximum duration	Total duration	Invocatic
Create Clerical Review Tasks	0 ms	0.00 ms	0 ms	0.00 s	26
Create Singletons	0 ms	3.15 ms	9 ms	0.04 s	13
Entire Matching (stopwatch)	669 ms	669.00 ms	669 ms	0.67 s	1
Matching	3 ms	16.38 ms	60 ms	0.26 s	16
Matching Data Prefetch	0 ms	1.50 ms	3 ms	0.02 s	12
Merge & Split	0 ms	0.25 ms	1 ms	0.00 s	16
Survivorship Rules	17 ms	60.55 ms	146 ms	0.67 s	11

For detailed information, see the **Generating Match Codes and Running a Matching Algorithm** topic of the **Matching, Linking, and Merging** documentation.

Limit Attributes Promoted to Golden Records

Attributes can be promoted to golden records via the 'Trusted Source Value' survivorship rule. When the attributes belong to an attribute group with thousands of attributes (or more), such as an ETIM attribute group, the golden record process can degrade performance significantly. To avoid this performance issue, limit the number of attributes in the attribute group that is subject for promotion.

In most cases, this can be achieved by defining an attribute group that includes a limited set of attributes.

If the number of attributes in the attribute group cannot be limited (such as ETIM attribute groups), use a business action during the survivorship rules, instead of using the 'Trusted Source' option.

Approve Golden Records Outside of Matching and Linking

Golden records can be approved within the matching and linking process, separate from the process, or not approved at all.

When approving the golden record is required, for recommended performance, use an event processor trigger to run a bulk update after the matching and linking process is complete.

Avoid Multi-Context Survivorship Rules

STEP allows multi-context survivorship rules for context specific names, context specific attribute values, context specific image references, and context specific web-hierarchy links.

However, when a multi-context survivorship rule is executed and the global value is not available, the matching and linking process continues through all contexts to find an attribute value in a local context. Ultimately, the local value is copied to the golden record in that local context. This process negatively effects performance.

In legacy STEP versions, the multi-context survivorship rules (available via a custom extension) are called 'Merging Contexts' as shown below.

Survivorship Rules
Criterion
Name: Trusted Source Name (Merging Contexts)
Golden record kramp only promotion: Trusted Source Value (Merging Contexts)
Golden record all source promotion: Trusted Source Value (Merging Contexts)
007 - Technical information: Trusted Source Value (Merging Contexts)

Now multi-context survivorship rules are standard and are called 'Multi Context' as shown below.

Multi Context Trusted Source Value

If multiple languages are defined, then a multi-context survivorship rule for a language-dependent name, attribute values, primary image references, or web-hierarchy links attempts to promote the correct value of the supplier record in the right language of golden record.

By default the 'Allow values from …' checkbox is selected, and allows sub-dimension point to be updated from less trusted sources.

The following examples illustrates this effect:

Assume the name is language dependent and the trusted sources are 'SLRV' and 'CNET,' in that order.

- The SLRV source (silver record) only has a name for 'All Language' context.
- The CNET source has a name for 'English' context (which is a sub-dimension point to 'All Languages').

The English name will only be allowed to be promoted to the golden record if the checkbox is checked.

Optimistic Locking Recommendations

This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

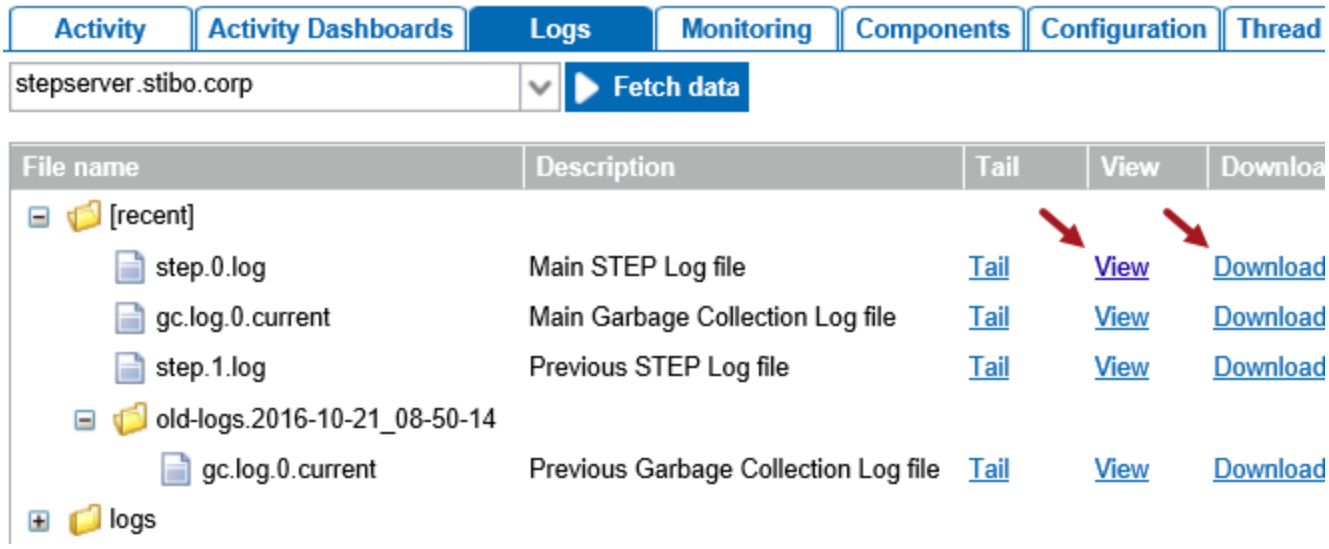
STEP runs with optimistic locking policy. Optimistic locking errors can be caused by long transactions (for example, imports, exports, asset push, business rules, etc.). The longer a transaction takes, the higher the probability of introducing an optimistic locking failure when an additional long transaction runs.

A transaction is put on hold when optimistic locking occurs, and after some time, an attempt is made to process the transaction again. Optimistic locking errors degrade the performance of imports, exports, asset push, business rules, etc., and degrade the performance of the system.

Analyze Optimistic Locking Failures

Use the STEP Admin Portal to analyze optimistic locking errors.

1. From the Start Page, click the STEP System Administration button and supply the login credentials.
2. On the **Logs** tab, click the **Fetch data** button to load the data.
3. Select the **Main STEP Log File** and click either the **View** link or the **Download** link to review the log.



4. Search the log for the instance of 'optimistic locking' text.

```
2017/10/23-09:52:10     6d7b|R3404828|PRT|c4userportal  com.stibo.core.domain.impl.state.scxmlimpl.StateFlowImpl evaluateConditionNoThrow WARNING
Business Condition failed for item "C4A-1957171" in state "ModeCommerce" : Wrapped kodo.util.OptimisticVerificationException: Optimistic locking
2017/10/23-09:52:10     6d7b||PRT|c4userportal  com.stibo.portal.engine.server.util.ExceptionConverter convertRuntimeException SEVERE: RuntimeExc
```

5. Determine the cause of the optimistic locking error.

Examples

Optimistic locking errors are caused by long transactions and may be an import, export, business rule, asset push, etc. The following examples illustrate how to identify what caused the optimistic locking errors.

- Warning for optimistic locking caused by Asset Push

```
2017/10/25-16:34:07 9e8e com.stibo.services.assetpush.beans.AbstractServiceBean
wrapUnexpectedException

WARNING Caught unexpected: kodo.util.OptimisticVerificationException:
Optimistic locking errors were

detected when flushing to the data store. This indicates that some objects were
concurrently modified

in another transaction. Failed objects: [AssetPO@7caa505: 3615004291612_1,
AssetPO@526cb477:

3615004302998_3, AssetPO@3c0fccc3: 3615004302998_pantone, AssetPO@3bd3211d:
3615004291612_3,

AssetPO@696359ef: 3615004302998_1, AssetPO@5e9b87b8: 3615004291612_pantone,
AssetPO@1cb0217c:

3615004302998_2, AssetPO@3e49203e: 3615004291612_2] [java.util.ArrayList]
```

- Severe optimistic locking error caused by a Web UI transaction in Web UI 'C4userportal'

```
2017/10/17-12:34:59 795|L3022356|PRT|C4userportal
com.stibo.portal.engine.server.util.ExceptionConverter

convertExceptionSerializeAndLocalize SEVERE Type: Error no esperado, Message:
Optimistic locking errors

were detected when flushing to the data store. This indicates that some objects
were concurrently

modified in another transaction. Failed objects: [ProductPO@21d744cc: C4A-
305195, Value7PO@5b8b4f21,

valno: 231765818, qualifier: -5, rev: 0, Value7PO@344dc391, valno: 231765817,
qualifier: -5, rev: 0,

Value7PO@3f2b8947, valno: 231765815, qualifier: -5, rev: 0, Value7PO@5478ad23,
valno: 231765816,

qualifier: -5, rev: 0, com.stibo.core.persistence.NodeStatePO@36bc02a7]
[java.util.ArrayList]
```

- Warning for optimistic locking caused by business condition transaction in state 'ModeCommerce' in Web UI 'C4userprotal'

```
2017/10/23-09:52:10 6d7b|R3404828|PRT|c4userportal
com.stibo.core.domain.impl.state.scxmlimpl.StateFlowImpl

evaluateConditionNoThrow WARNING Business Condition failed for item "C4A-
1957171" in state

"ModeCommerce" : Wrapped kodo.util.OptimisticVerificationException: Optimistic
locking errors were
```

```
detected when flushing to the data store. This indicates that some objects were
concurrently modified

in another transaction. Failed objects: [ProductPO@3c0b71a7: C4V-1957172,
ProductPO@2f9030b2:

C4V-1038657, ProductProductReferencePO@284a0999, edgeid: 23130110, rev: 0]
[java.util.ArrayList]

(Script#305) in Script at line number 25 at column number 0
```

'Reference Target Lock Policy' Parameter

Setting the 'Reference Target Lock Policy' parameter for the asset, entity, classification, and product object types manages how objects should be locked while they are being referenced. When a reference between two objects is being created, the target object is locked to ensure that it is not being deleted while the reference is being created. This means that only one process or user can edit it at a time.

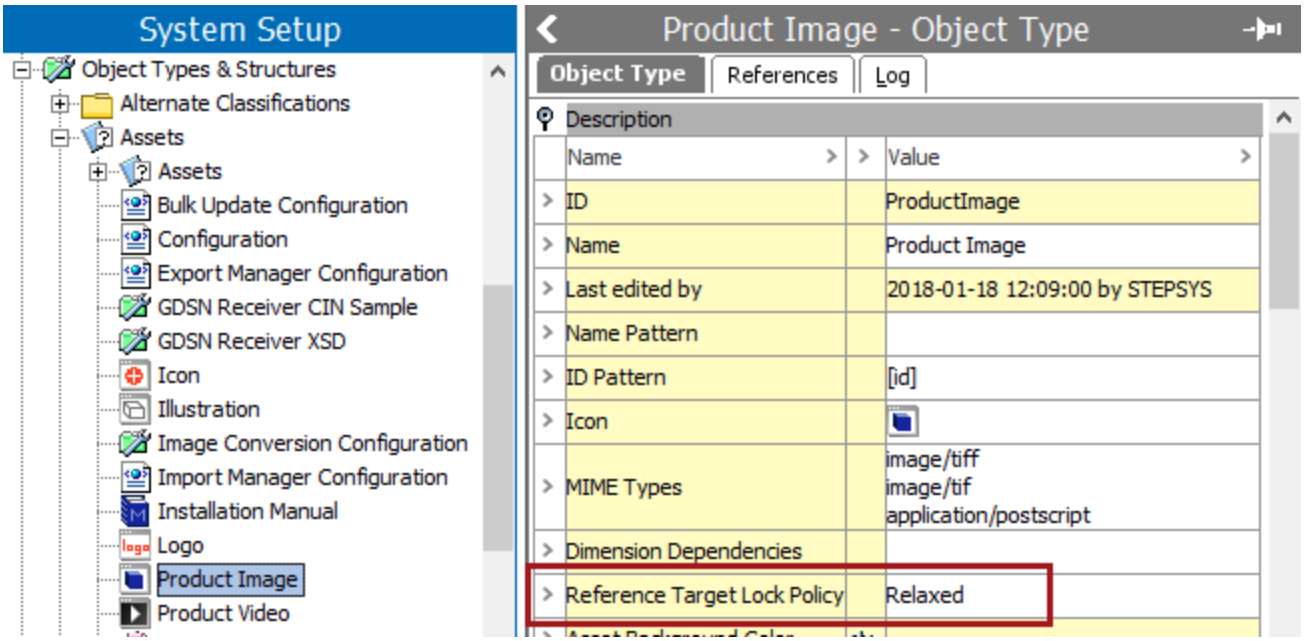
In most of these cases, deletion of the object is not a deletion from the database, but the deletion that occurs due to revision control when an insert of a new history entry occurs. This can be a major issue when running parallel imports where the first import locks the object type being referenced, and the second import eventually stops running because it cannot access the locked object. Although STEP continues to retry the import, this can cause inbound feeds to be negatively affected.

The default setting for this property is 'Strict.' When long-running transactions cannot be simplified easily, consider setting the 'Reference Target Lock Policy' parameter to 'Relaxed' on the object types to which the long transaction applies.

Important: The 'Relaxed' setting should NOT be used on an object type for objects that are often deleted as this can result in poor performance, and risks locks and deadlocks.

The 'Relaxed' setting on the property puts a less restrictive lock on the reference target objects being edited so that they can be updated concurrently by more than one process and/or user, with a full lock being employed only in the case that a deletion is attempted. This setting, when used with object types that are frequently referenced but rarely deleted, will improve the performance and stability of parallel inbound imports, bulk updates, and users concurrently creating references to the same objects.

For example, the following image shows the 'Reference Target Lock Policy' for object type Product Image (ProductImage) since the many of the optimistic locking errors in the asset push apply to this object type.



Recommendations

- **Optimize large transactions** - keep transactions small to limit the probability of introducing an optimistic locking failure by optimizing the business rules and functions used at e.g., imports, exports, bulk updates.
- **Set reference target policy** - set the parameter to 'Relaxed' when all of these points are true:
    - optimistic locking failures occur frequently in the log file
    - transactions cannot be optimized
    - the object types that are frequently referenced are rarely deleted

Privilege Recommendations

This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

While STEP allows a very granular privilege system and privilege setups, complex privilege models can lead to a degradation in performance. Running STEP as a user with a large number of very specific privileges influences the performance of any action in STEP that goes across a large number of nodes, values, or references. This performance hit includes export, import, bulk update, recursive approval, matching, and 'multi views' like task list and multi editor.

For more information, see the **Privilege Rules** topic in the **System Setup / Super User Guide** documentation.

Privilege Configurations

Privileges are additive only, which means that whenever a basic action is executed, STEP looks for the first privilege that provides the permission.

In terms of performance, the most expensive privilege check is attempting a task for which the user does not have access. The least expensive privilege check is when a user has global permission to everything.

Additionally, consider the following when setting privileges:

- Very specific and granular permissions result in a longer search for the appropriate privilege.
- Assigning privileges on a group of objects (and using the hierarchy to access these objects) provides a less expensive listing than assigning privileges on each object separately.
- Avoid excessive privilege checking to improve performance.

Privileges at Imports and Exports

When importing and exporting data, all privileges are checked for each piece of information imported or exported.

Ensure that any imports / exports happen as a user with as broad and few privileges as possible to avoid excessive privilege-checking and improve the performance dramatically. Only the user configured on the endpoint as the importer / exporter is relevant, this user should generally have relatively few permissions.

Privileges in the Web UI

A typical Web UI screen fetches all attribute values from the attribute group defined in the Web UI screen. The screen then filters out the attributes based on validity for the product type and based on user privileges.

When the Web UI user has complex privilege settings, the filtering of the data based on these settings is excessive, which can have a negative impact on the loading time of the screen.

Additionally, privilege restrictions can be set in the Web UI configuration itself. Use this functionality carefully since excessive privilege checking in the Web UI XML configuration can degrade performance. For example, privilege restrictions can be recognized in the following Web UI XML file image (by searching for 'restrict=').

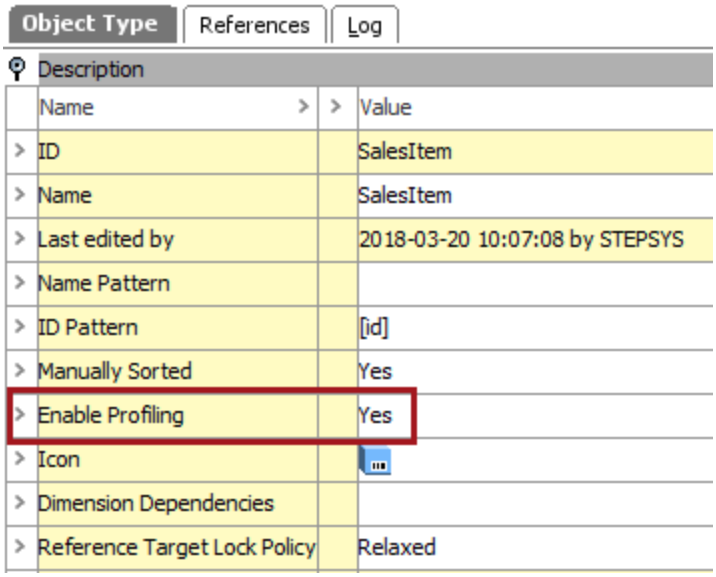
```
<component id="Actions" restrict="Messaging,Normal user,Read Only,AssetManager,Data Stewar
  <parameter id="ButtonLabel" value="i18n.stibo.DeleteAction.Label"/>
  <parameter id="DeleteFromWorkflow" value="false"/>
  <parameter id="ApproveDeletion" value="false"/>
  <parameter id="ButtonType" value="ICON_AND_TEXT"/>
  <parameter id="CssClass" value="DeleteButton"/>
</component>
```

Profiling Recommendations

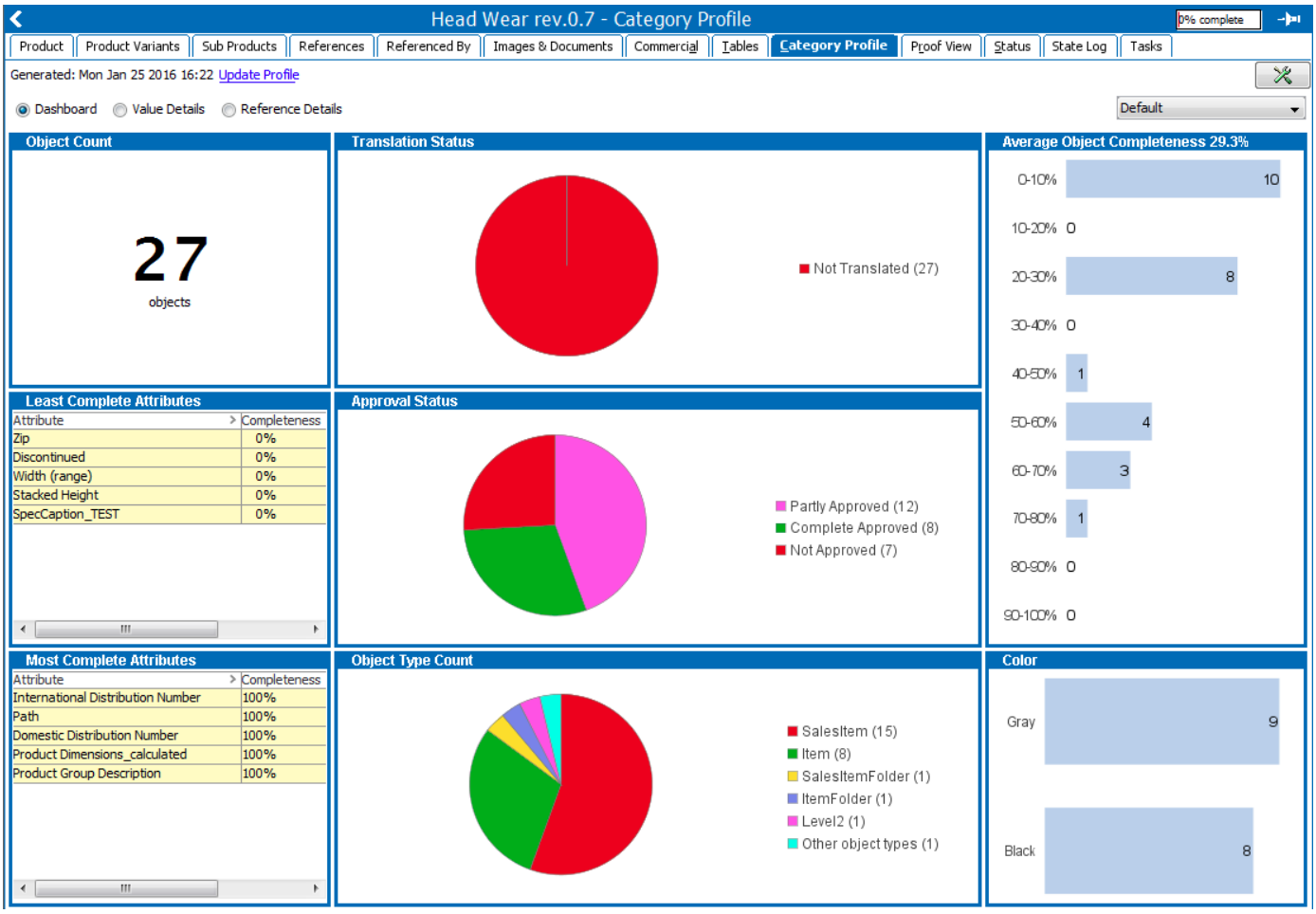
This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

The Category Profile and Data Profile functionality provides a detailed overview of data in a specific branch of the hierarchy in Tree. However, when large categories are profiled, the system uses a lot of memory which can have a negative impact on system performance.

Profiling is enabled in System Setup, using the 'Enable Profiling' parameter with the Object Types & Structures node.



When a profile is run, information about the data is displayed as follows and provides access to correct data errors:



For more information, see the **Data Profiling** documentation.

Recommendations

- **Only enable profiling when required**.
- **Limit memory usage when profiling is enabled** via the following case-sensitive sharedconfig.properties:

  DataProfile.MaxDistinctAttributeValuesConsideredDuringProfileGeneration - Sets the maximum number of distinct attribute values per attribute considered during profile generation. The default setting is 100. When the limit is reached, the following happens:

  - Frequent value counts can become inaccurate. STEP uses a counting implementation dedicated for counting in big data collections with a limited memory usage from Clearspring Analytics.
  - The rare value count is disabled because only a frequent count can be maintained. In the profile, the frequent and rare values cells for attributes with too many distinct values are displayed with a light red background color. The attribute completeness and count, and the value instance counts for profiled attributes are correct.

  DataProfile.MaxDistinctTargetsConsideredDuringProfileGeneration - Sets the maximum number of distinct targets for the reference or link type that is profiled. The default setting is 100.

Revision Control Recommendations

This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

'Revisions' in STEP are historical versions of objects. A revision represents a historical 'snapshot' of an object. Major data objects in STEP (i.e., products, assets, classifications, entities, etc.) are under revision control. This means that previous versions of an object can be viewed, compared, and revived.

For more information, see the **Revisions** topic and the **Generating Revisions** topic in the **System Setup / Super User Guide** documentation.

Storing many revisions can have a negative impact on system performance. Use the following recommendations to keep the number of revisions under control and to remove unnecessary revisions.

Optimizing performance in revision control involves the following steps and each is defined below:

- Setting the revision threshold
- Maintaining object revisions
- Maintaining integration endpoint revisions

Setting the Revision Threshold

By default, revisions on objects are created when a user makes a change to the object and the number of hours set in the threshold is exceeded (starting when the object was first touched after the last revision was made).

This is particularly useful in cases where an object is primarily maintained by a single user and would only be made by that user choosing to do so manually. The threshold functionality ensures that changes are recorded, without creating an excessive number of revisions, which can have a negative effect on system performance.

In workbench, the revision threshold parameter is in the System Setup 'Users & Groups' node under the Revisability Settings flipper. For details about this threshold, see the **Revisability Settings** topic within the **System Setup / Super User Guide** documentation.

To avoid excessive creation of the revisions, keep the default setting (168 hours) for the threshold parameter.

Maintaining Object Revisions

As the revision history grows, it impacts the time it takes to retrieve the front revision of the object, including its name, attribute values, and references. This may have a negative effect on the system performance.

To reduce poor system performance due to excessive revisions, define a revision policy as follows:

1. Manually delete revisions that are no longer needed. This creates a baseline for ongoing maintenance.
2. Automatically purge old revisions via one or more event processors to keep the number of revisions under control (i.e., schedule the event process to run monthly, and to delete revisions older than one month).

For details about purging old revisions manually, see the **Maintaining Revisions** topic in the **System Setup / Super User Guide** documentation.

For details about purging old revisions automatically, see the **Creating an Event Processor** topic and the **Revision Management Processing Plugin Parameters and Triggers** topic in the **System Setup / Super User Guide** documentation.

Maintaining Integration Endpoints Revisions

Integration endpoints (IIEP and OIEP) with revisions in the thousands (or more) can have a negative impact on system performance and IEPs open very slowly. Typically, this is a result of the IEP poller being started by a different user than the one configured in the IEP.

Identify IEPs with different users

1. Run the Administration Portal Healthcheck for pollers started by a different user than the one configured in the IEP to identify the scenario.
1. From the Start Page, click the **STEP System Administration** button and supply the login credentials.
2. On the **Healthcheck** tab, open the Data Error section and select the 'Pollers started by a different user than the one configured in the IEP' test.
3. Click the Run Selected Tests button (

).
4. When the 'Last Run' column for the test shows today's date / time, review the results in the Detected Problems area at the bottom of the screen.

For more information, see the **Healthcheck** topic in the **Administration Portal** documentation.

Update IEPs to resolve different users

1. Log in to the workbench and open an IEP that was reported in the Healthcheck above.
2. Identify the user on the IEP and, if necessary, log in to workbench again as that user.
3. Disable the IEP.
4. Enable the IEP again to set the same user under Revisions (on the Status tab) and the User parameter.

Purge old IEP revisions

After verifying the excessive number of revisions will no longer be created, remove the old IEP revisions that exist in the database.

Use the 'Purge old revisions' option to delete revisions for 'Inbound Integration Endpoint Type' and 'Outbound Integration Endpoint Type' as defined in the **Generating Revisions** topic in the **System Setup / Super User Guide** documentation.

Important: Purging a large number of revisions on IEPs can require an index rebuild in the database. Contact your database administrator or your Stibo Systems representative.

Scheduled Process Recommendations

This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

Scheduled processes can negatively influence system performance, for example, if the search query to fill the collection is not optimized. Analyze scheduled processes and optimize searches and business rules to potentially improve performance.

In workbench, view the scheduled processes on the BG Processes tab under the Scheduled Processes node.

Optimizing performance in scheduled processes involves the following:

- Business Rule Recommendations
- Search Recommendations
- Structured Translation - Excel or XML can be used for active structured translations, which can be configured to automatically send translation requests, as defined in the **Starting a Structured Translation** topic of the **Translations** documentation. Within the Request Translation wizard, the 'Later and Repeat' option sets a recurring schedule for exporting translation requests. When many of these scheduled processes exist (such as 25 or more), and the schedule is set to minutes (instead of hours or days), performance issues are likely. It is recommended to determine if this automated schedule is necessary, and if so, verify the schedule is not set to minutes.

Search Recommendations

This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

Searches can be optimized to improve performance with the following recommendations.

Optimizing performance in searches involves the following:

- Search Elements to Use
- Search Elements to Avoid

Search Elements to Use

The following list includes search elements known to minimize impact on system performance. This list can be used to troubleshoot existing searches, and can also be reviewed prior to creating new searches to prevent performance problems.

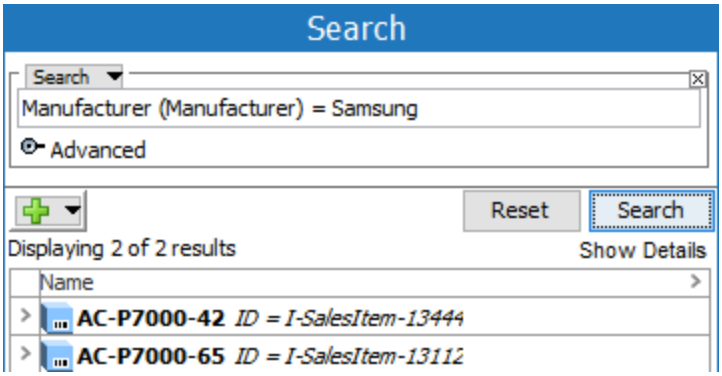
For general information on searches, see the **Search** topic in the **Getting Started / User Guide** documentation.

Basic Searches

When possible, use the following syntax to achieve the best search performance. Searching for a value without specifying the attribute, ID, or name searches for the value in all attribute values, IDs, and names.

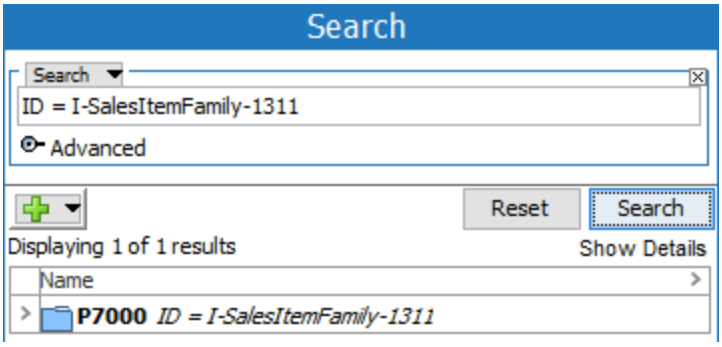
Attributes

Search using 'Attribute-ID = value' to search in values of this one specified attribute only. For example, search for the 'Samsung' value only in the Manufacturer attribute, rather than in all attributes.



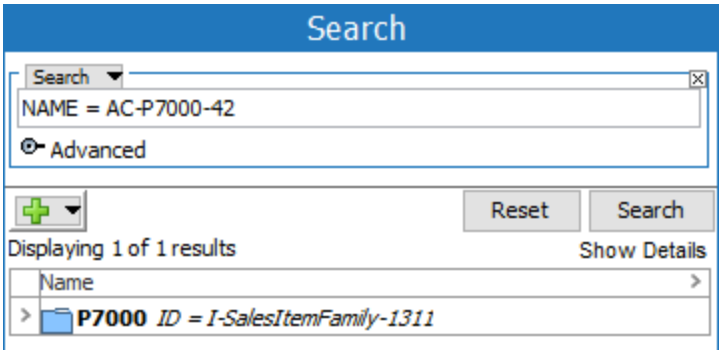
Objects by ID

Search using 'ID = value' to search for objects by looking in the ID parameter only. For example, search for the '-SalesItemFamily-1311' value only in the ID field.



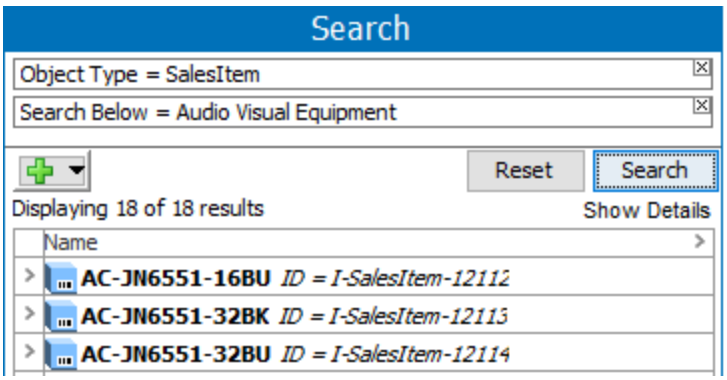
Objects by Name

Search using 'Name = value' to search for objects by looking in the Name parameter only. For example, search for the 'AC-P7000-42' value only in the Name field.



Use Specific Search Criteria

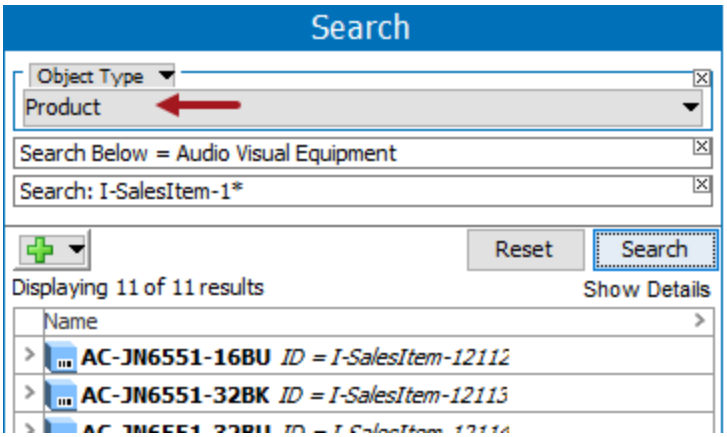
When searching a database with many objects, use as specific a search criteria as possible. For example, specifying the object type to search for in a specific hierarchy (as shown below) is faster than searching for all object types in all hierarchies.



Use Object Super Types

The search function performs slightly better when specifying the object super type (such as product, entity, asset, classification, and so on) instead of using the specific object type below the main object types. For more information, see the **Object Super Types** topic in the **Getting Started / User Guide** documentation.

In the example shown below, the product super object type is used, instead of SalesItem (which is an object type below the product super type).

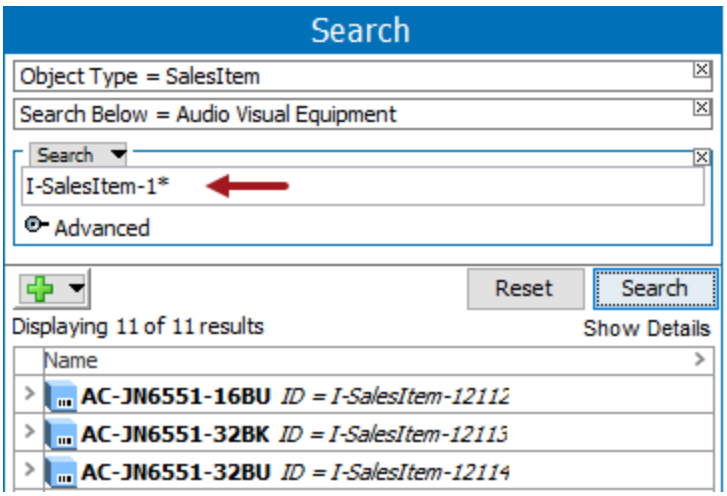


Searches with Wildcards

Specify as many characters as possible before using a wildcard (*) to optimize search performance results.

Important: Specifying a wildcard as first character prevents the use of the database indexing query, which means the search must traverse all objects in the database. This is a dramatic performance impact.

For example, use a wildcard (*) after more than three characters, as shown below.



Optimize Search Below with a Configuration Property

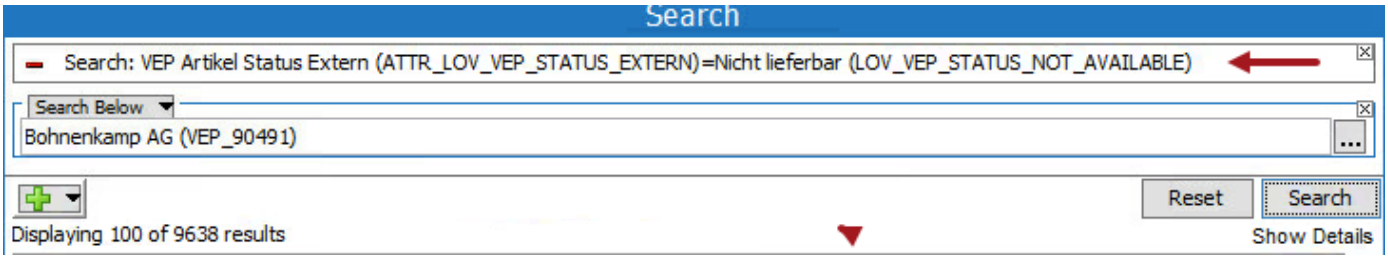
In some cases, a bad execution plan is implemented by Oracle when using the 'Search Below' criteria. The following case-sensitive entry in the sharedconfig.properties file will improve the search performance:

```
Domain.BelowCriteria.UseRecursiveWith=true
```

Setting this property to 'true' forces Oracle to choose another (and in some cases better) exclusion plan, and may have a positive effect on search performance.

Optimize Combined Search Below and Value Search

Combining the 'Search Below' criteria with a value search criteria may not perform well. However, this type of search can be optimized by first doing a value exclusion search, and then combining the result with the 'Search Below' criteria. For example, see the image below:



In-Memory

Consider In-Memory to improve import performance, as defined in the **In-Memory Database Component for STEP** topic in the **Resource Materials** section of online help.

Search Elements to Avoid

The following list includes import elements known to degrade system performance. This list can be used to troubleshoot existing imports, and can also be reviewed prior to creating new imports to prevent performance problems.

For general information on searches, see the **Search** topic in the **Getting Started / User Guide** documentation.

Avoid Full Text Indexable

The 'Full Text Indexable' setting on attributes allows for searching for individual words in the text value of an attribute. This option can be considered when searching for words, or set of words, in attribute values. However, applying full text indices on one or more attributes has a system-wide negative impact on performance because it is much more expensive to read, write and query such values.

For more information, see the **Full Text Indexable Attributes** topic in the **System Setup / Super User Guide** documentation.

Avoid Inherited Values and Regular Expressions

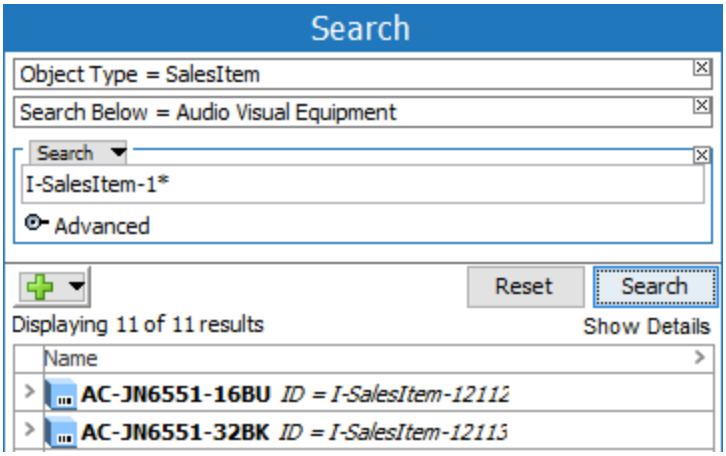
Advanced searches in the workbench and Web UI should avoid the following options to achieve the recommended performance:

- 'Include Inherited Values' - only use when required.
- 'Regular Expression' - disables database indexing, only use when required.

Avoid Root Hierarchies in Search Below

The 'Search Below' option should be used with caution and only when necessary to achieve the required result. Specifying many root nodes in Web UI searches is specifically not recommended.

For example, use a granular hierarchy node instead of searching the full primary product hierarchy.



Web UI Configuration Recommendations

This is one of the data gathering methodologies and recommendations for functional performance improvement. The full list is defined in the **Functional Performance Recommendations** topic.

The Web UI Designer is flexible and can configure a Web UI in many ways. However, not all configurations perform equally well. Therefore, it is important to consider performance when configuring a Web UI. A screen with little data and limited functionality will load faster than a screen with lots of data and functionality.

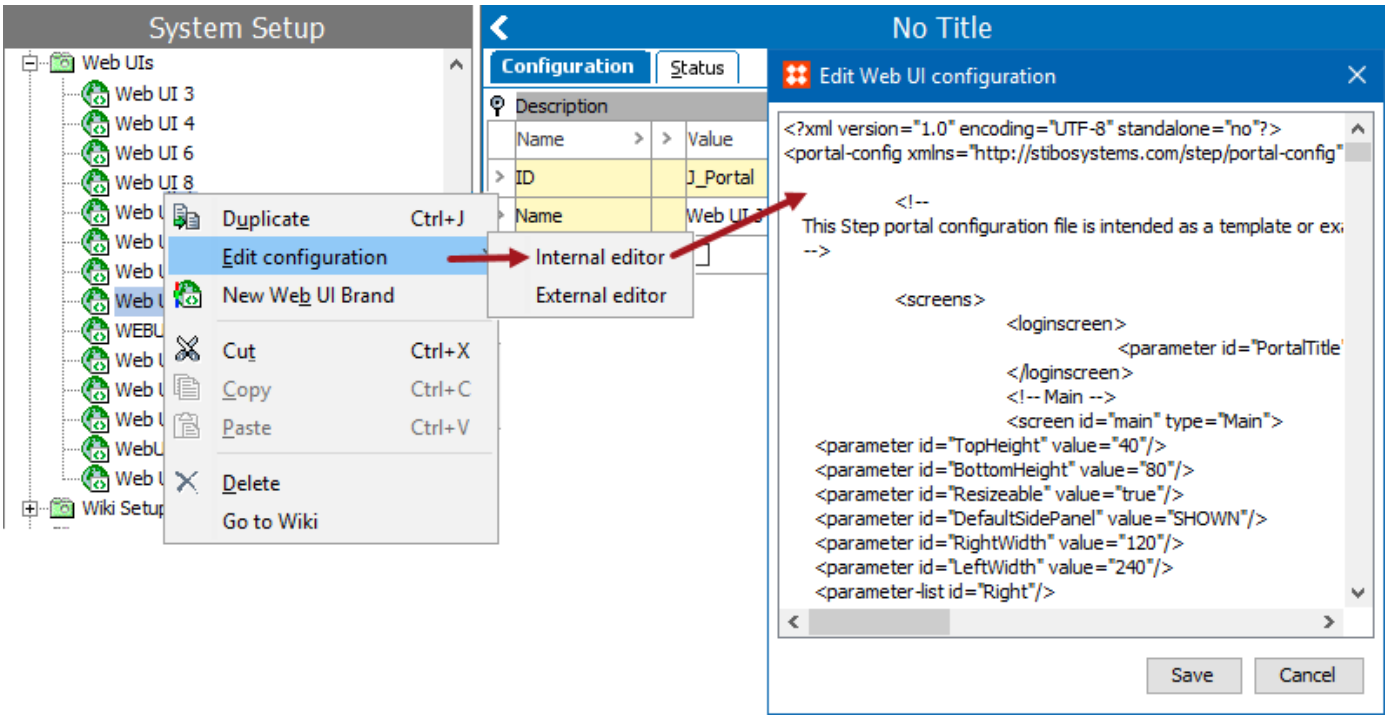
For more information, see the **Healthcheck** section of the **Administration Portal** documentation.

The following actions can limit the performance hits while using Web UI:

- Use multiple Web UIs
- Use small dedicated Web UI screens
- Avoid using images in multi-select Web UI screens
- Use 'lazy' loading for Web UI screens
- Use type ahead for LOVs in Web UI screens
- Correctly configure status selectors in Web UI
- Consider In-Memory for Web UI screens

Use Multiple Web UIs

Web UI configurations are stored in System Setup under the Web UIs node. When a user logs into the Web UI and opens the homepage, the corresponding configuration XML file is loaded. If the Web UI configuration XML file is large, then the Web UI homepage takes additional time to load. Edit the Web UI configuration to view the XML, as shown below.



For more information, see the **Managing Web UI Configurations** topic in the **Web User Interfaces / Web UI Setup and User Guide** documentation.

Recommendation

When the Web UI configuration XML is more than 25,000 lines, split the configuration into separate Web UIs where each is used for a specific purpose.

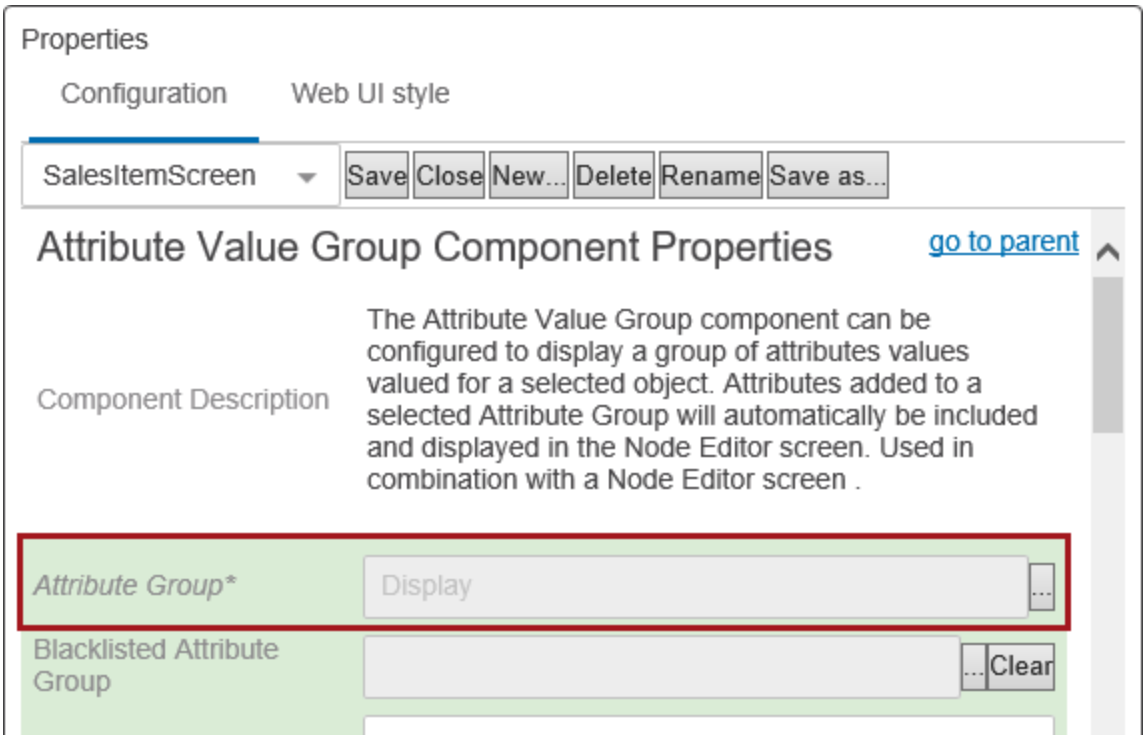
Use Small Dedicated Web UI Screens

A typical Web UI screen fetches all attribute values from the attribute group defined in the Web UI screen. The screen then filters out the attributes based on the validity of the product type and user privileges.

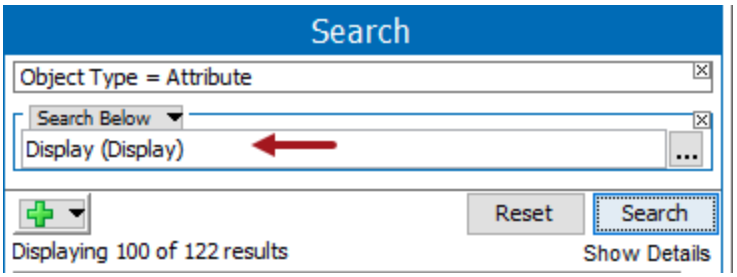
Configuring attribute groups for the Web UI screen which contain a large number of attributes can have a negative impact on the loading time of the screen because it involves:

- fetching all attributes from the attribute groups, and then
- filtering out attributes for display based on the validity of the product type and user privileges.

To reduce the screen load time, first determine which attribute groups are used in the Web UI screen, as shown below.



Then analyze how many attributes each attribute group contains, using the Search Below option.



Recommendation

Avoid using attribute groups with more than 100 attributes. When configured attribute groups contain more than 100 attributes, consider creating attribute groups specifically for Web UI display. Organize the attributes to be displayed on the Web UI screens into these specific attribute groups.

Avoid Using Images in Multi-Select Web UI Screens

A multi-select screen displays a selection of items in a table. The table view also allows for thumbnails of the items to be displayed. However, loading many items with their thumbnails naturally requires fetching these thumbnails from the file system or database, which may have a negative impact on the load time of the screen.

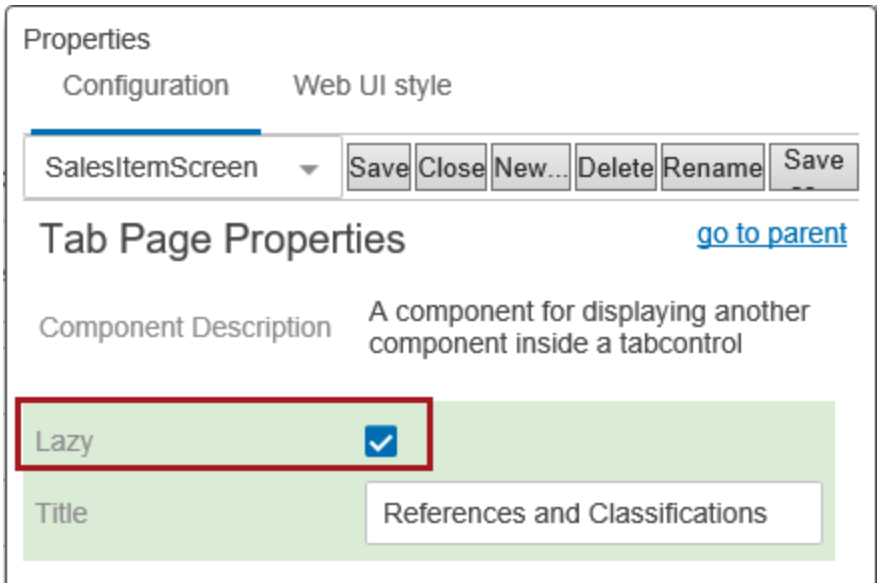
Recommendation

Reconsider displaying thumbnails (or no images at all) in multi-select screens when many items are displayed and load time of the screen is considered slow.

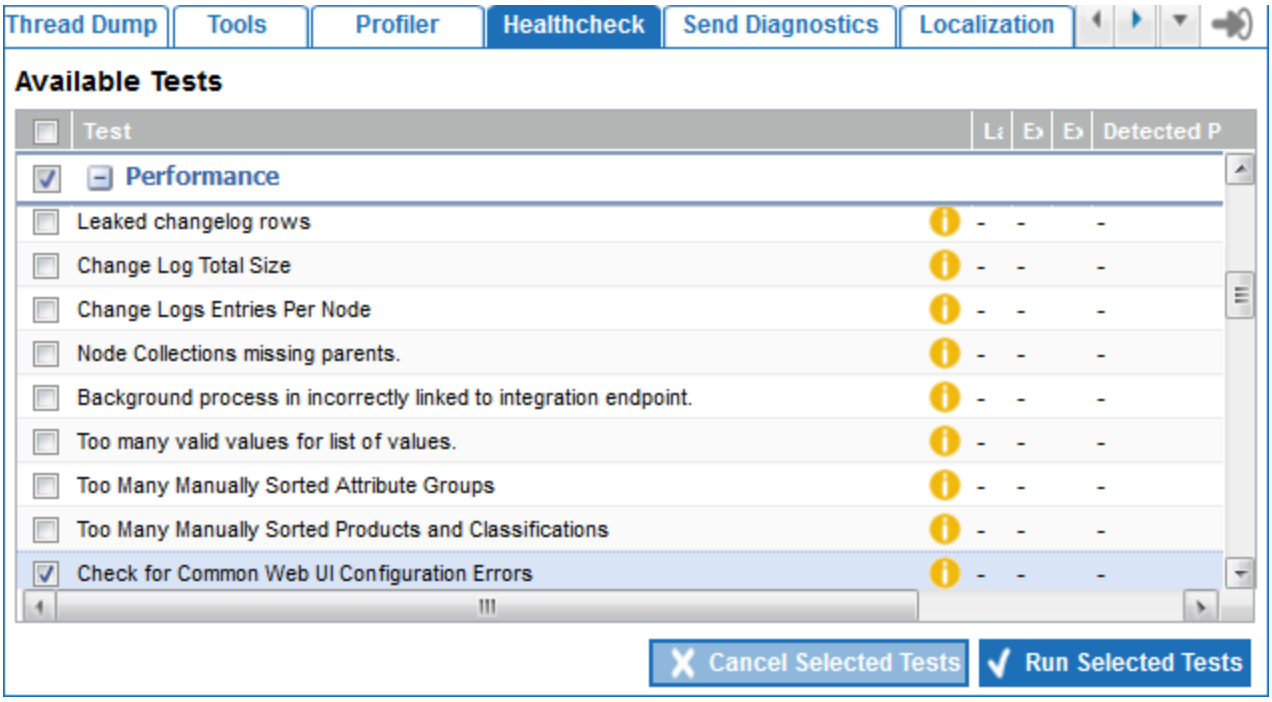
Use 'Lazy' Loading for Web UI Screens

For Web UI tasks where the user needs to inspect many aspects of an item, the recommendation is to split the information out into multiple tabs. However, by default, the Web UI loads the screen including all tabs, which may result in a slow loading time for the Web UI screen.

In Web UI designer, the 'Lazy' parameter allows you to apply 'lazy loading' on these Tab Page screens. When enabled, components are 'lazy loaded' and rendered only when a tab is displayed, which can reduce screen load time.



Use the Performance section of the STEP Health Check in the Admin Portal to analyze which Web UI screens can be lazy loaded by running the 'Check for Common Web UI Configuration Errors' healthcheck shown below.



For more information, see the **Healthcheck** topic in the **Administration Portal** documentation.

Recommendation

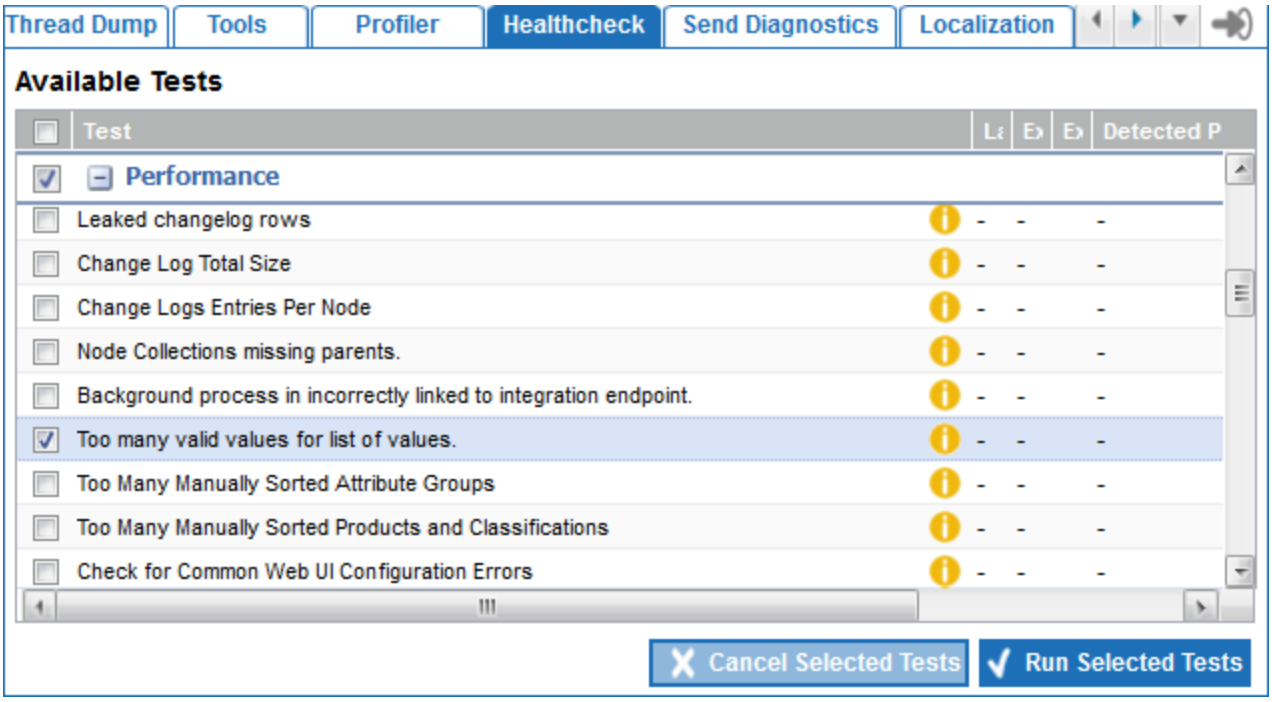
When possible, lazy load data on tabs.

Use Type Ahead for LOVs in Web UI Screens

Web UI screens using attributes with a large list of values (LOVs), the load time of the Web UI screen can become slower. The following LOV type-ahead sharedconfig.properties are available to optimize the Web UI screen load time:

- **Portal.ValueGroup.LOV.ForceTypeahead** forces type-ahead for all LOVs in the Web UI. Set this property when there are attributes used in Web UI screens and many of the LOVs used are large.
- **Portal.ValueGroup.LOV.ForceTypeahead.Exclude** forces type-ahead for certain LOVs in the Web UI. Certain specific LOVs can be configured not to be forced to user type-ahead functionality. Use this for the LOVs with small number of values and for the LOVs which are required to not be typed-ahead.

Analyze which LOVs have more than 5,000 values by running the 'Too many valid values for list of values' healthcheck. Also review Web UI screens to find where large LOVs with fewer than 5,000 values are being used.



For more information, see the **Healthcheck** topic in the **Administration Portal** documentation.

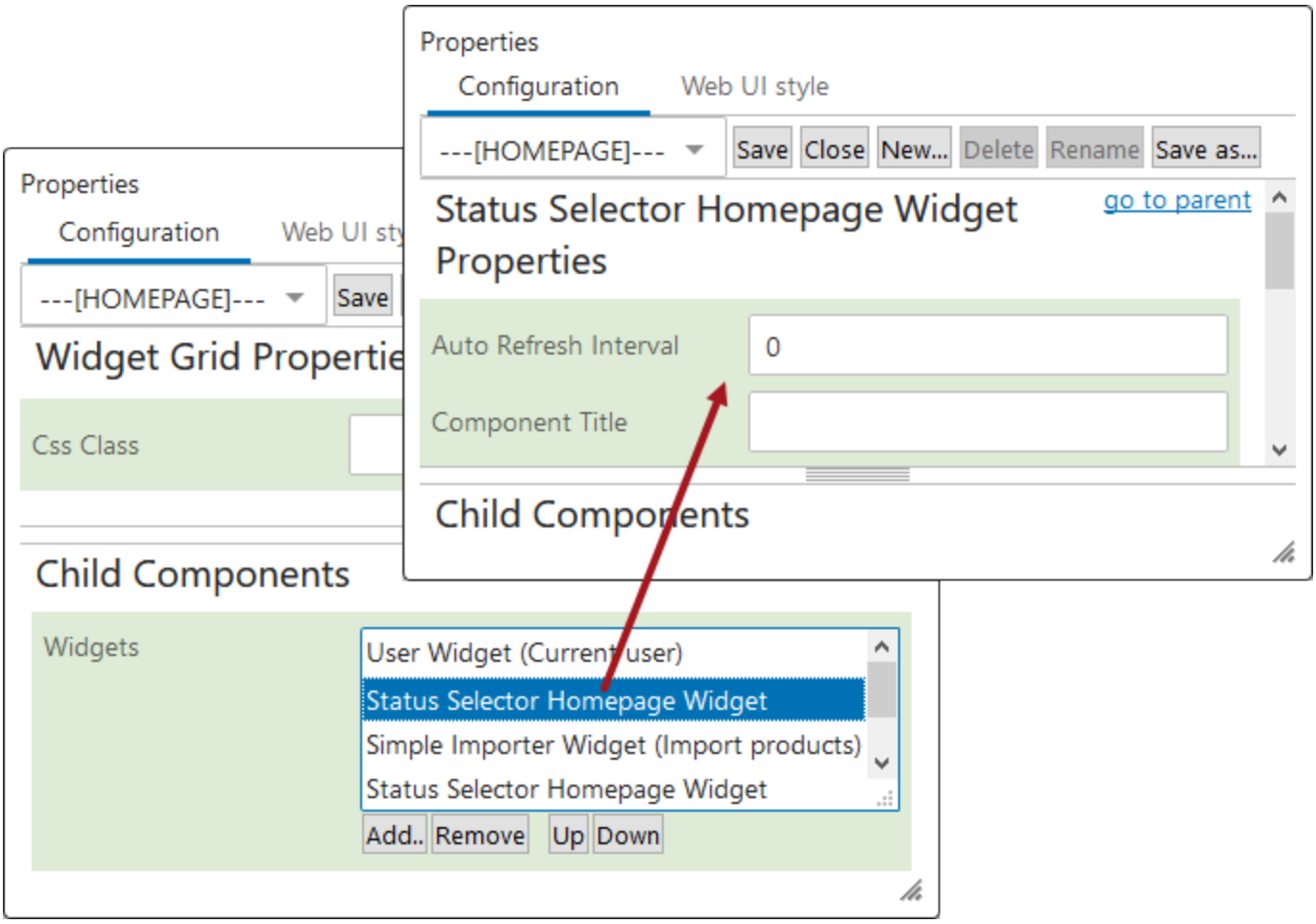
Recommendation

Set up typeahead for large LOVs.

Correctly Configure Status Selectors in Web UI

The workflow Status Selectors Homepage Widget is configured to poll for updates in the background. The statuses are updated whenever the user submits an item. However, if there are many status selectors and/or the update polling is set very fast, the Web UI Homepage screen may suffer from poor performance.

In design mode, double-click the Status Selector Homepage Widget to display the 'Auto Refresh Interval' parameter. The recommended value is 60 seconds. Disable the refresh interval by setting the value to 0.



For more information, see the **Status Selector Homepage Widget** topic in the **Web User Interfaces / Web UI Getting Started** documentation.

Recommendation

Limit the number of status selectors, generally no more than 25 status selectors on the Homepage screen.

Do not set the Status Selector Homepage Widget 'Auto Refresh Interval' parameter to less than 60 seconds.

Including many nodes in a workflow being calculated in the Status Selector may increase loading times.

To reduce load times, on the Web UI designer for the Status Selector Homepage Widget properties screen, Advanced section, check the 'Use Content Indicator' parameter. This shows a button to manually load the count, instead of displaying the exact count automatically.

Consider In-Memory for Web UI Screens

In-Memory can improve performance of the Web UI screens. In-Memory makes the Web UI more responsive in general, but especially when the Web UI screens include multi-object display, complex data models, and/or data with a long history of writes.

For more information, see the **In-Memory Component** section of the **Resource Materials** section of online help.

Performance Assessment

The goal of the STEP performance assessment is to analyze the system from a performance perspective, identify the pain points, and give actionable recommendations to optimize performance.

Performance testing is highly recommended and is expected to be part of the implementation process and release. You should perform the testing, or hire a recommended third-party who is skilled at the process.

STEP provides the means to perform some performance testing, such as measuring import and export execution time (background process times), and measuring the execution of business rules.

Prerequisites

1. Run each of the health checks available from the Administration Portal, as defined in the **Healthcheck** topic of the **Administration Portal** documentation.
2. Define the goal of the performance test including a good test result and a bad test result. Typically, the absolute results of the performance tests do not represent realistic behaviors, but performance test results should be compared with previous performance test results to interpret the STEP system behavior over time.

Assessing Performance

Review the following topics for information on performance:

- Performance Assessment Process
- Non-Functional Performance Requirements
- Large Scale Performance Testing

Troubleshooting Performance Issues

Use the following topics to assist in resolving issues:

- Performance Troubleshooting
- Troubleshooting Checklists

Optimizing Performance

For information on improving performance, see the following topics:

- Functional Performance Recommendations
- Technical Performance Recommendations

Performance Assessment Process

The following process is recommended to analyze STEP from a performance perspective:

1. Contact your Stibo Systems representative to begin the process for executing a performance assessment.
2. Complete the provided template for identifying the main performance problems, non-functional performance requirements, and performance use cases.
3. Schedule an online call (approximately 2 hours) to discuss the completed template and establish performance goals.
4. Your Stibo Systems representative uses the template to reproduce the performance problems off-site and performs the analysis. This step can take three (3) days.
5. Your Stibo Systems representative schedules a 2-day on-site visit which includes:
   - Presenting the initial performance results of the off-site analysis.
   - Determining the most important recommendations with you.
   - Implementing the most important recommendations as feasible.
   - Executing the defined performance use cases again and discussing the improvements.
   - Determining the next steps.
6. Your Stibo Systems representative writes the conclusions of the performance assessment. This can take one (1) day.
7. Your Stibo Systems representative schedules an online call (approximately 2 hours) to hand over the final assessment results document.

Non-Functional Performance Requirements

Defining non-functional requirements allow you to indicate what is expected from a STEP performance perspective.

Each non-functional performance requirement must be supported by one or more use cases. Each use case will include step-by-step instructions to verify the non-functional requirement.

For example, the following tables shows a requirement and the use case to verify it.

Performance Requirement	Use Case
Import 'Supplier A (SupplierA)' via Excel; complete within 3 hours	1. Log in to workbench 2. Run import using 'Import Supplier A' configuration and Excel sheet 'Import Supplier A' 3. Wait for import to complete

Large Scale Performance Testing

Large scale performance testing can be performed by you or your Stibo Systems representative using NeoLoad. For more information, search the web.

Prerequisite

Before running large-scale performance testing, run each of the health checks available from the Administration Portal, as defined in the **Healthcheck** topic of the **Administration Portal** documentation.

Test Guidelines

Large-scale performance testing must respect the following basic rules for a realistic test:

1. A good representative and realistic data set must be in place on a system, observing all hardware requirements specified by Stibo Systems.
2. Each time a performance test has run the database has to be reset, which allows every test to start from the same point. For example, manually deleting what is thought to be the test data is not sufficient; there must be a restore from backup which holds the agreed test data.
3. Simulating the behavior of multiple users working in parallel will require that the data being worked is parameterized. For example, it is not a good idea to start 1,000 users working on the same product.
4. If a test robot is used to perform the user scenarios, delays between consecutive user actions must reflect realistic user behavior. For example, a human being does not make multiple mouse-clicks per millisecond.
5. Consider carefully how to start the test. For example, it is not advised to start 1,000 users within the same millisecond in bulk.
6. Running strongly parallel bulk updates or imports requires careful planning so that the test does not end up in massive updates of the same resources leading to massive and not very realistic locking in the database, leading to terrible performance timings.
7. Gather relevant monitoring data from the test. At a minimum, have a complete copy of the STEP 'diag' folder for every test run. It is useful to collect Oracle data statspack/awr and OS information sar/nmon. It is a good idea to keep this data at least until a few more tests have been completed.

Performance Troubleshooting

Use the methods defined in the following table to troubleshoot performance issues. When all data is gathered, include the information on a Jira ticket assigned to R&D.

Performance Test	Windows	Linux / Solaris
IO usage	Process Explorer	sar - d sar - d - f /var/adm/sa/sa dd *(where dd is the day of month)* iostat - zdxnk 2
CPU usage	Process Explorer Task Manager	sar - u sar - f /var/adm/sa/sa dd *(where dd is the day of month)* top , mpstat - P - ALL 2
Memory usage	Process Explorer	v mstat sar - r - f /var/adm/sa/sa dd *(where dd is the day of month)*
Ping	ping dbserver ping – l 8000 dbserver ping – l 32000 dbserver	ping – c5 dbserver ping – c5 – s8000 dbserver ping – c5 – s32000 dbserver

Latency Requirements

- Max 0.2ms with a 64 bytes packet size
- Max 1.0ms with a 32K packet size

Additional latency information is included in the **Server Network Latency** topic.

Identify the Problem Layer

1. From the Start Page, click the **STEP System Administration** button and supply the login credentials.
2. On the **Profiler** tab, set the **From** and **To** date / time parameters to define when the performance issues were noticed.
3. Click the **Generate** button to load the data.
4. In the results section, expand the service methods to determine the issue:
   - 'com.stibo.customer' indicates that Custom Solutions should be involved.
   - a long-running SQL statement indicates that it is waiting for the Oracle database. See the **Database Server** section below.
   - 'com.stibo. ddsconnector' or 'com.stibo.idsconnector' indicates it is waiting for the DTP server. See the **DTP Server** section below.
   - a problem that occurs for only one specific user or group of users indicates that the problem is related to the user or workstation. See the **User Interface / Client Application** section below.
   - If none of the previous scenarios fit your issue, consider that the problem might be on the application server. See the **Application Server** section below.

Database Server

After reviewing the profiling data (as defined above), when the issue is a long-running SQL statement, follow these steps.

1. From the Start Page, click the **STEP System Administration** button and supply the login credentials.
2. On the **Activity** tab, set the Duration and Date / Time parameters according to when the performance issues were noticed.
3. Click the **Fetch data** button to load the data.
4. In the **Details** section, on the **SQL** tab, identify the same SQL statement with the same duration.
5. Attach the SQL statement, including the execution plan, to the Jira issue.

For more information, see the **Database Long-Lasting SQL Queries** topic.

Additional Steps

With the DB ToolBox (typically saved in the '/opt/stibo/step/admin/app-server-toolbox/' folder), you may be able to access the additional information outlined below.

- Check if the system waits for locks in the database.
- Check the CPU usage of the database server.
- Check the I/O usage on the database server.
- Examine the alert log for errors, as defined in the **Database Server Alert Log** topic.

Record this information using the **Technical Support Tasks** table in the **Troubleshooting Checklists** topic.

DTP Server

Perform the following checks:

- Check that the configuration for QuarkXPress Server / Adobe InDesignServer is using asset push. For more information, see the **Asset Push** topic in the **Digital Assets** documentation.
- Check the logging configuration. The debug level should only be used when required as it will have a negative performance impact. For more information, see the **Server Log File Settings** topic.
- Compare the number of DTP server renders with license, hardware, and user load.

In case of emergency, use the restart action command: restart dtp-servers.

Services representing sidecars can be restarted or even the server itself. Services should be checked after a restart.

Record this information using the **Technical Support Tasks** table in the **Troubleshooting Checklists** topic.

Application Server

Perform the following checks:

- Check the sensor warnings and critical errors, as defined in the **Monitoring** topic within the **Administration Portal** documentation.
- Check the memory graph, as defined in the **Activity** topic within the **Administration Portal** documentation.

  If constantly high with only small 'garbage collections'

  - Consider increasing heap memory.
  - Check for heap dumps on the server and put them in a location in garm.stibo.dk (default stibosw log on).
- Check the CPU usage via Task Manager as well as the admin portal, as defined in the **Activity** topic in the **Administration Portal** documentation.

  If CPU usage is high, check if image GraphicsMagick processing (gm.exe, etc.) are starting and stopping. If so, this can be caused by excessive image conversions. Increasing the sizes of image caches can potentially fix this.

- Check the thread graph, as defined in the **Activity** topic in the **Administration Portal** documentation.

  Compare the number of threads to the number of CPU cores in the application server. If the number of threads is higher, processes will queue and waits are experienced.

- Ping the database server using ping command via the **Help Desk Tasks** table.
- Trace route to dbserver to look for unwanted network equipment.
- Check the number of background processes, as defined in the **Analyze Background Processes** topic.
- Examine the IO usage of the application server. If it is high:
  - Check if the memory on the server is used up, i.e., more memory in use than real memory available will make the server swap.
  - Check if log files are filling up quickly. If so, check if debug logging is enabled, as defined in the **Server Log File Settings** topic.

Add all of this information to the **Technical Support Tasks** table in the **Troubleshooting Checklists** topic.

User Interface / Client Application

Perform the following checks:

- Examine task manager on the user workstation while reproducing the problem.
  - If the java process has high CPU usage > 90 percent. If so, the problem might be in the UI.
  - Do other processes have a high CPU usage? If so, ask the user to shut down these processes and attempt to reproduce.
  - Does the system have a memory usage beyond the real memory in the system? If so, shutdown the other processes until the usage is below real memory and ask the user to reproduce.
  - Reboot the PC and start only STEP on the PC to see if it can still be reproduced.
- Check the Network Latency indicator in the lower right corner of the STEPworkbench client. If it is above 125ms, examine the network.
- Open the Java Control Panel and enable 'Show console' and reproduce. Attach the console output to the Jira issue.

If these checks and adjustments do not solve the problem, add this information to the **Technical Support Tasks** table in the **Troubleshooting Checklists** topic.

Troubleshooting Checklists

Use the following checklists to verify you have the appropriate information for a Jira ticket.

Help Desk Tasks	Initials	Date	Comments
Is the problem tied to one specific user or a group of users?			
Is the problem reproducible?			
What is the expected duration of the operation?			
What date / time did the problem occur?			
When was the last time the system was patched?			
Can this be reproduced on a test system?			
Is Stibo Systems allowed to reproduce the problem?			

Technical Support Tasks	Initials	Date	Comments
Symptom Clarification			
What are the specific events (user ID, BGP ID, date / time)?			
Every time? Periodic? Rare?			
Database Server			
Waiting for locks?			
Is CPU usage - normal / high?			
Is IO usage - normal / high?			
Are there Alert log errors?			
DPT Server			
Is DPT server using Asset Push?			
Is debug logging enabled?			
Is the number of renders OK?			
Application Server			
Are there sensor warnings or critical errors?			
Is Memory usage normal / high?			
Are heap dumps available?			
Is CPU usage of JVM normal / high?			
Is CPU usage of server normal / high?			
Is the number of threads higher than number of CPU cores?			
What are ping times?			

Technical Support Tasks	Initials	Date	Comments
What is the total number of BGPs?			
Swapping?			
Is excessive debug logging enabled?			
User Interface / Client Application			
Is CPU usage normal/ high?			
Is memory usage too high / swapping?			
What is network latency to application server?			

Patching STEP

The system architecture of the STEP platform is split up into separate components, each of which may access other components through a set of component APIs. This component-based architecture satisfies the otherwise contradictory requirements for longer time between releases and fast introduction of new improvements. Customers can choose to upgrade specific components in order to take advantage of new features and important updates, whilst keeping the core of STEP and other unrelated components unchanged. This approach reduces the risk and workload involved in testing new updates.

When upgrading components individually, the customer may choose not to upgrade to the newest STEP release. If the feature is available in a new component, that component can be installed on its own. If the feature is available as an upgrade to an existing component, that component may be upgraded while keeping other components as they are.

Note: Available component updates are made visible on a STEP system similarly to the way updates are to mobile phone apps, i.e., with release notes detailing the new features and fixes available relative to the current installation, and with instructions on how to perform the update.

Components have separate release cycles limited only by the dependencies introduced when one component uses another component. Each component declares its dependency on other components through principles where a given component version may depend on a specified range of versions of another component.

For additional information on patching STEP components, see the following topics within this documentation:

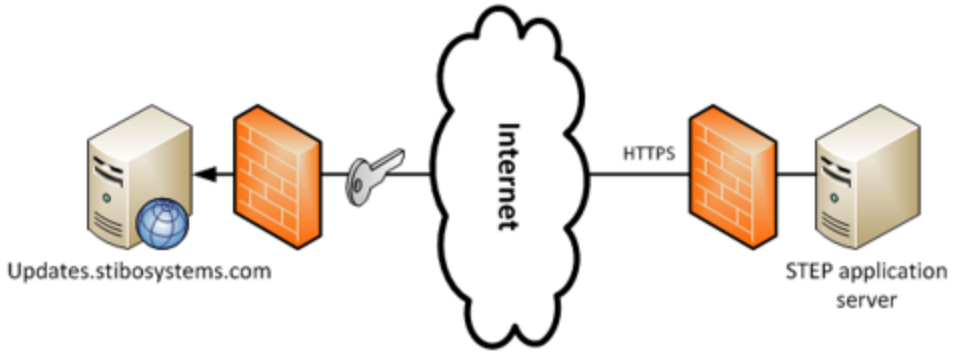
- Patching Methods
- SPOT Program
- STEP Patching Procedures
- Patching Security
- Configuring a Private Updates Mirror

Patching Methods

Patch operations in the STEP system are defined by the specific component(s) being installed / upgraded. These component updates are downloaded either directly from one of the Stibo Systems Global Updates Mirrors (Release Server) or from a private updates mirror at the customer can be used to execute these operations. The connection to either of the two uses an encrypted network connection over HTTPS. Connections are always initiated from the customer side. The update mirror will at no time initiate a connection to the STEP environment.

Direct Connection to Release Server

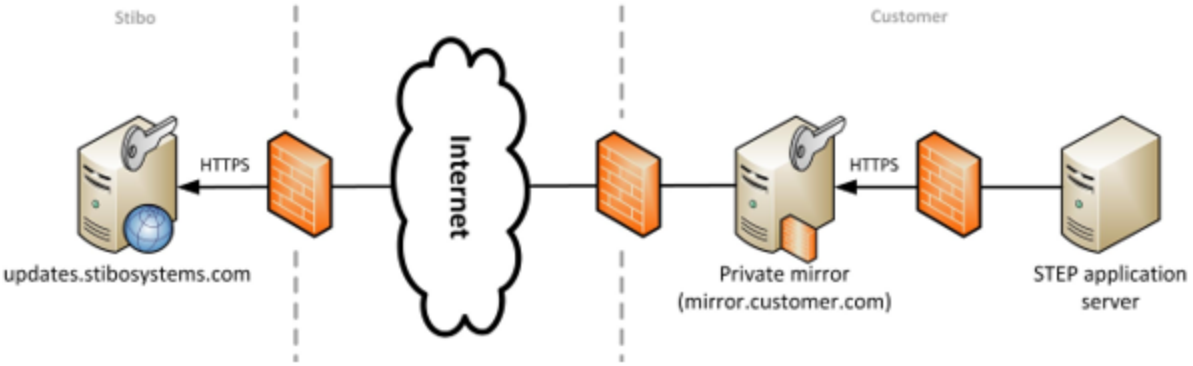
Downloading updates directly from a Release Server is the default method for patching. Using this method, the STEP environment is configured to allow an encrypted connection by HTTPS to the release server. This method offers the best security.



Advantages to using the Direct Connection method include: faster support from Stibo Systems by providing complete version information and a simplified infrastructure.

Private Updates Mirror

As an alternative to accessing the release server directly, it is possible to set up a Private Updates Mirror and configure SPOT on the internal STEP servers to use the mirror instead.



Advantages

The advantages of using the Private Updates Mirror method are:

- If the internet connection or the global updates server breaks down, the already downloaded files will still be available.
- The internet connection bandwidth consumed is reduced by avoiding repeated downloads.
- The network configuration is simpler as only the mirror needs to access the updates server, while the individual SPOT instances can be configured to talk only to the private mirror on the internal network.

Requirements

To run a private mirror server, you need:

- A 64-bit Linux host, not shared with STEP.
- java 8 64-bit (and updated version will be installed by SPOT, so the OS version is okay for bootstrapping).
- Enough storage to hold the entire mirror (400 GB will suffice).
- Outgoing internet access to the Stibo Systems updates servers on port 443.
- Incoming aces from the private network on port 443 for the SPOT hosts.
- A DNS entry on the local network that can be expected to never change, so *mirror.customer.com* would be preferable to *pc2016-02-13-room7-linux-test-dl120g9.dhcp.customer.com*.

Upstream Root Mirrors

The root mirrors that the private mirror connects to can be listed using `spot --mirrors`, but these are the current hosts:

- *dk1.updates.stibosystems.com*: Primary root mirror.
- *dk2.updates.stibosystems.com*: Secondary root mirror.
- *updates.stibosystems.com*: Fail-over mirror on a shared IP between the two root mirrors.

Outgoing TCP access on port 443 must be allowed to each of the root mirror IP addresses from the private mirror, this way the mirror has more upstream mirrors to pick from if one fails.

SPOT Program

The Stibo Patch Operations Tool (SPOT) program initiates an encrypted exchange between the customer site and the update mirrors at Stibo Systems. This program runs off either the STEP application server or on a dedicated SPOT support installation PC.

The communication sequence between the SPOT program and the update mirror is as follows:

1. SPOT stores the current thin snapshot of version information to updates.stibosystems.com.
2. SPOT fetches the desired recipe of the software bundles to download.
3. SPOT downloads the actual bundles.
4. SPOT stores the updated thin snapshot of the version information to updates.stibosystems.com.

Storing the thin snapshots to updates.stibosystems.com serves two purposes. It enables:

- Stibo Systems to support the STEP environment by providing complete version information.
- Easy creation of the exact software configuration for additional Test / QA environments and in the case of disaster recovery.

Both the metadata (including the thin snapshot) and the bundle recipe, together with the actual bundles, are cached by SPOT and only the files that are actually needed are ever downloaded, so the amount of data transferred is as low as possible.

The SPOT program can be found in the home directory of the STEP installation on the application server. On a Linux server, this will typically be in `/opt/stibo/step`. On a Windows server, this will typically be in `E:\stibo\step`.

Using the Upgrade Command

To help simplify the analysis process and make it easier to work with components, the `--upgrade` command can be executed to look for possible upgrades to the components installed on a STEP system. Users can also run the command to search for a component not already installed to verify availability and compatibility with their version of STEP.

The `--upgrade` (or `-u`) command is used to calculate the newest possible version of the listed components that can be installed given different restrictions on how large of an upgrade is allowed. This command never changes the STEP system or performs any automatic upgrading.

To further facilitate the process, the upgrade options output that is displayed upon running the `--upgrade` command includes a recipe file that can later be applied to the system.

Outlined below are the different upgrade command options with examples. The name of the actual component(s) should be used in place of what is shown in the examples.

Upgrade Options	Examples
Upgrading one component	To upgrade the Experian component, use: `--upgrade=experian`
Upgrading several components	To upgrade both Experian and Loqate, use: `--upgrade=experian,local-loqate`
Upgrading the baseline (the STEP version such as 9.0, 9.1)	The baseline can also be upgraded by using the component name *step*: `--upgrade=step` Pick the release of the baseline by specifying a prefix: `--upgrade=step:9.1` When a prefix is specified, the newest version matching the prefix will be tried.

Installation candidates (components that have not yet been installed) can also be found by using the `--upgrade` command, as described above.

Upgrade levels

The calculation used to determine upgrades can potentially produce suggestions for up to five levels of upgrade. Only the upgrades that bring newer versions of the listed components will be shown in the result. Below, the options shown are sorted by how aggressive the update would be with regard to introducing new component versions.

Level	Description
Listed	This is the most conservative upgrade possible where only the listed components are touched.
Dependents	This level allows upgrading of: • The listed components • The components that depend on the listed components
Dependencies	This level, listed with `DEPENDENCIES_BUT_NOT_BASELINE` in the file name, allows upgrading of: • The listed components • The components that depend on the listed components • The components that the listed components depend on, but not STEP baseline

Level	Description
Baseline within Maintenance Patch	This level, listed with `BASELINE_WITHIN_MP` in the file name, allows upgrading of all components, including the STEP baseline, but only to the latest maintenance patch of the same release as the one currently installed. For example, if the system has step-8.2-mp1 installed, then this level would look for the newest MP of that release, possibly 8.2-mp3, but not 8.3.
Baseline	This is the least conservative upgrade level, which allows upgrading of all components, including the STEP baseline to the latest released version.

The upgrade options are shown on screen with the upgrade file recipes listed. Users can use standard commands to view a detailed change log, prepare for an installation, and to apply changes to their STEP system.

For example: `--upgrade=inmemory`

```
Found 3 possible upgrades to choose from:
=====================================================================
Option 1: Upgrade only the listed components
Components:
       * assetloader: Keep at 7.0.14 (newest available: 7.0.24)
       * inmemory: Upgrade from 7.0.10 (newest available: 7.0.23)
       * spot: Keep at 7.0.48 (newest available 7.0.65)
File: /home/step/admin/spot/recipes/upgrade/upgrade.LISTED.2017-11-01-15-24-
28.spr
=====================================================================

Option 2: Upgrade to latest maintenance patch within the same STEP release
+ All components
Components:
       * assetloader: Keep at 7.0.14 (newest available: 7.0.24)
       * inmemory: Upgrade from 7.0.10 to 7.0.15 (newest available: 7.0.23)
       * spot: Keep at 7.0.48 (newest available 7.0.65)
       * step: Upgrade from 8.0-mp3-2016-09-06-14-12-00 to 8.0-mp4-2016-10-04-10-10-
27 (newest available: 8.2-mp3-2017-11-02-07-39-51)

File: /home/step/admin/spot/recipes/upgrade/upgrade.BASELINE_WITHIN_MP.2017-11-
01-15-24-28.spr

=====================================================================

Option 3: Upgrade to latest STEP release (full upgrade)
+ All components
Components:
       * assetloader: Keep at 7.0.14 (newest available: 7.0.24)
```

```
      * inmemory: Upgrade from 7.0.10 to 7.0.14 (newest available: 7.0.23)
      * spot: Keep at 7.0.48 (newest available 7.0.65)
      * step: Upgrade from 8.0-mp3-2016-09-06-14-12-00 to 8.1-mp5-2017-10-02-16-10-
00 (newest available: 8.2-mp3-2017-11-02-07-39-51)


File: /home/step/admin/spot/recipes/upgrade/upgrade.BASELINE.2017-11-01-15-24-
28.spr
```

If the system is ignoring any components or if the system cannot find a way to upgrade the components specified, the applicable messaging will be shown on the screen. All ignored versions will not be considered when trying to find an upgrade.

Starting with STEP 8.3 and with all subsequent versions, the `--upgrade` command can be used in place of the installation commands. For example, `--upgrade=wikimetadata` or `--upgrade=acrolinx`.

STEP Patching Procedures

All commands listed are valid for any STEP environment, counting single application server setups and clusters.

Back Up the STEP Database and Application

Before patching STEP, a fallback procedure should be developed to mitigate any risk. Ideally, full back ups of the STEP database should be maintained, and the option to restore the database to a specific point in time should be available.

Note: The requirement for each individual patch may vary. Refer to the relevant release note for more information.

Back ups of the STEP application should also be maintained, including all files provided in STEP_HOME/config.properties and a snapshot of the STEP system itself.

To take a snapshot of the STEP system:

```
cd /opt/stibo/step
./spot --snapshot=/workarea/<snapshot-env-date>.spr
```

Prepare the Patch

The patch should be downloaded in advance to avoid unnecessary downtime for deployment.

A STEP core patch may look like the following command:

```
./spot --prepare=to:step/trailblazer/step-trailblazer-<release>.spr
```

Sometimes, customers have their own components in addition to the STEP core, and the command could look something like this:

```
./spot --prepare=to:step/trailblazer/step-trailblazer-
<release>.spr,to:customer/<customer>/<customer>-addon/7.0/<customer>-addon-
7.0.x.spr
```

Install the Patch

The patch should be installed by the following command:

```
./spot --apply=to:step/trailblazer/step-trailblazer-<release>.spr
```

With customer components included, the command looks like this:

```
./spot --apply=to:step/trailblazer/step-trailblazer-
<release>.spr,to:customer/<customer>/<customer>-addon/7.0/<customer>-addon-
7.0.x.spr
```

STEP will automatically stop and start during the patch session.

In case of any deprecated parameters in the configuration, follow the instructions on the screen that explain how to correct and restart STEP.

```
./spot --start
```

Fallback

In the event of errors during patching, it may be necessary to restore STEP to a previous state.

Depending on the contents of the patch the following steps should be completed when reverting the patch:

1. Stop STEP
   ```
   ./spot --stop
   ```
2. Restore database
3. Restore configuration files
4. Redeploy STEP using a snapshot
   ```
   ./spot --apply=/workarea/<snapshot-env-date>.spr --sync --syncmode=delete
   ```

Using the snapshot and the above `--sync --syncmode=delete` command will entirely recover STEP and delete any files related to a failed patch-session.

Note: Refer to the relevant release note to check if restoring the database is required for the patch in question.

Patching Security

Stibo Systems only distributes software via the updates.stibosystems.com server or one of the official mirrors.

The update mirror web server is configured to only communicate via HTTPS (never plain HTTP) on port 443, with only the high security cipher suites using the Apache SSLCipherSuite 'HIGH' option and only communicating with clients which have a proper client certificate issued by the build system certificate authority (CA) of Stibo Systems. This Stibo-specific CA was created solely for the purpose of certifying various STEP-related infrastructures.

Unlike a standard website where an external CA-signed certificate is used for ease of access by multiple clients (users), the updates server has only one client that is allowed to communicate with it: the SPOT client. For this reason, Stibo Systems believes this to be a safer and stronger security approach – over using an external CA certificate – as it is not possible for a cyberattacker to use a fake certificate from a compromised external CA to gain access.

By taking this approach, some auditing tools may register a false positive and flag the server's certificate as self-signed. Because of this, security teams should configure these tools to trust Stibo Systems' CA to certify *stibosystems.com* domains

The client certificate required for communicating with the update mirror is included in the STEP installation package, and is used by the SPOT program to fetch both the software required for the initial installation and future application updates. Only the certificate used by the updates server will be trusted by SPOT for downloading these installation bits and updates.

All the certificates involved use 2048-bit RSA keys, so the system is considered secure against any man-in-the-middle attacker for the foreseeable future. Even with a valid client certificate, the operations allowed are severely limited to downloading only the licensed software produced by Stibo Systems and to saving customer-specific thin snapshots that do not contain software, so a compromised client would not be able to affect other customers or compromise other clients.

The SPOT program caches all files locally and validates contents using a SHA-1 hash before using the cached files, so the amount of traffic is kept as low as possible while ensuring the integrity of the cached files.

At no point will the STEP software communicate customer data back to the update mirrors at Stibo Systems. The thin snapshots uploaded to the release server contain only a list of versions of the installed STEP software components and they are only used by Stibo Systems to provide the best support to the STEP system.

Configuring a Private Updates Mirror

Requirements for running a private mirror server include:

- A 64-bit Linux host, not shared with STEP.
- 64-bit Java 8 (an updated version will be installed by SPOT, so the OS version is okay for bootstrapping).
- Enough storage to hold the entire mirror (currently 400 GB will suffice).
- Outgoing internet access to the Stibo Systems updates servers on port 443.
- Incoming access from the private network on port 443 for the SPOT hosts.
- A DNS entry on the local network that can be expected to never change, so *updates.example.com* would be preferable to *pc2016-02-13-room7-linux-testdl120g9.dhcp.example.com*.

The root mirrors that the private mirror connects to can be listed using `spot --mirrors`, but these are the current hosts:

- *dk1.updates.stibosystems.com*: Primary root mirror.
- *dk2.updates.stibosystems.com*: Secondary root mirror.
- *updates.stibosystems.com*: Fail-over mirror on a shared IP between the two root mirrors.

Outgoing TCP access on port 443 must be allowed to each of the root mirror IP addresses from the private mirror, this way the mirror has more upstream mirrors to pick from if one fails.

The mirror server listens on three ports:

- *10080*: The Admin port of dropwizard, which is used to serve HTTP requests that allow monitoring the health of the server. The init script uses this port to check if the server is running.
- *10081*: The stop port of Jetty. The init script uses this port to shut down the server in an orderly fashion. This port should not be accessed from outside the machine itself.
- *10082*: The HTTPS service port that serves the actual mirror. This port should not be accessed from outside the machine itself.

These ports are all internal to the host that the server runs on and external systems should not connect directly to them (with the possible exception of having a monitoring system talking to port 10080.)

Important: Do not configure any STEP systems to talk to the mirror on port 10082. Port redirection (as described in the next section) must be set up.

IPTables Rules

It is impossible to listen to port 443 when running the Java process as an unprivileged user. To account for this, a set of iptables rules must be used.

There are two ways to install the required rules: either run the mirror script as root when starting the server or set up iptables at the OS level. If the init script is called by root, then it will install the needed port redirection, but if the administrator tasked with maintaining the mirror does not have sudo access to this script, then the rules can be inserted into the */etc/sysconfig/iptables* config file, allowing the OS to load the rules at boot time.

These rules redirect all incoming requests to TCP port 443 over to port 10082 where the server listens.

To configure iptables on the server, switch to the root user and run the following command to view the current settings:

```
[root@mirror mirror]# /sbin/iptables -L -n --line-numbers
Chain INPUT (policy ACCEPT)
num  target     prot opt source      destination
1    ACCEPT     all  --  0.0.0.0/0   0.0.0.0/0   state RELATED,ESTABLISHED
2    ACCEPT     icmp --  0.0.0.0/0   0.0.0.0/0
3    ACCEPT     all  --  0.0.0.0/0   0.0.0.0/0
4    ACCEPT     tcp  --  0.0.0.0/0   0.0.0.0/0   state NEW tcp dpt:22
5    REJECT     all  --  0.0.0.0/0   0.0.0.0/0   reject-with icmp-host-
prohibited

Chain FORWARD (policy ACCEPT)
num  target     prot opt source       destination
1    REJECT     all  --  0.0.0.0/0    0.0.0.0/0   reject-with icmp-host-
prohibited

Chain OUTPUT (policy ACCEPT)
num  target     prot opt source       destination
```

In the output, there will be a line that displays `REJECT` as the `INPUT` type, and in its first column `(num)`, the line number is shown ('5' in the above example.) This line number will be the starting line for adding entries to the iptables configuration.

Once this information is known, run the following commands to add the needed port-opening entries:

```
[root@mirror mirror]# /sbin/iptables -I INPUT <line_number> -p tcp -m tcp --dport
443 -j ACCEPT
[root@mirror mirror]# /sbin/iptables -I INPUT <line_number> -p tcp -m tcp --dport
10082 -j ACCEPT
```

In the example above, the line number shown is '5', and therefore, the commands would look like the following commands:

```
[root@mirror mirror]# /sbin/iptables -I INPUT 5 -p tcp -m tcp --dport 443 -j
ACCEPT
[root@mirror mirror]# /sbin/iptables -I INPUT 6 -p tcp -m tcp --dport 10082 -j
ACCEPT
```

Afterwards, add the entries for redirection by executing these commands:

```
[root@mirror mirror]# /sbin/iptables -t nat -A PREROUTING -p tcp -m tcp --dport
443 -j REDIRECT --to-ports 10082
[root@mirror mirror]# /sbin/iptables -t nat -A OUTPUT -o lo -p tcp -m tcp --dport
443 -j REDIRECT --to-ports 10082
```

Once that has been done, the added entries can be checked by running the commands that follow:

```
[root@mirror mirror]# /sbin/iptables -L -n --line-numbers
Chain INPUT (policy ACCEPT)
num  target     prot opt source       destination
1    ACCEPT     all  --  0.0.0.0/0    0.0.0.0/0   state RELATED,ESTABLISHED
2    ACCEPT     icmp --  0.0.0.0/0    0.0.0.0/0
3    ACCEPT     all  --  0.0.0.0/0    0.0.0.0/0
4    ACCEPT     tcp  --  0.0.0.0/0    0.0.0.0/0   state NEW tcp dpt:22
5    ACCEPT     tcp  --  0.0.0.0/0    0.0.0.0/0   tcp dpt:443
6    ACCEPT     tcp  --  0.0.0.0/0    0.0.0.0/0   tcp dpt:10082
7    REJECT     all  --  0.0.0.0/0    0.0.0.0/0   reject-with icmp-host-prohibited

Chain FORWARD (policy ACCEPT)
num  target     prot opt source       destination
1    REJECT     all  --  0.0.0.0/0    0.0.0.0/0   reject-with icmp-host-prohibited

Chain OUTPUT (policy ACCEPT)
num  target     prot opt source       destination
```

```
[root@mirror mirror]# /sbin/iptables -L -n --line-numbers -t nat
Chain PREROUTING (policy ACCEPT)
num  target     prot opt source       destination
1    REDIRECT   tcp  --  0.0.0.0/0    0.0.0.0/0    tcp dpt:443 redir ports 10082

Chain INPUT (policy ACCEPT)
num  target     prot opt source       destination

Chain OUTPUT (policy ACCEPT)
num  target     prot opt source       destination
1    REDIRECT   tcp  --  0.0.0.0/0    0.0.0.0/0    tcp dpt:443 redir ports 10082

Chain POSTROUTING (policy ACCEPT)
num  target     prot opt source       destination
```

If everything looks to be correct, save the configuration so that it will be loaded each time the system reboots using these commands:

```
[root@mirror mirror]# /sbin/service iptables save
[root@mirror mirror]# /sbin/service iptables stop
[root@mirror mirror]# /sbin/service iptables start
```

Important: If the mirror server is a RHEL 7.x system, the above `/sbin/service iptables stop` and `/sbin/service iptables start` commands should be replaced with the following: `/bin/systemctl stop iptables` and `/bin/systemctl start iptables`.

Once complete, the */etc/sysconfig/iptables* config file should look similar to the following:

```
# Generated by iptables-save v1.4.7 on Tue Jun 21 14:16:10 2016
*nat
:PREROUTING ACCEPT [4595:497811]
:INPUT ACCEPT [1:28]
:OUTPUT ACCEPT [0:0]
:POSTROUTING ACCEPT [0:0]
-A PREROUTING -p tcp -m tcp --dport 443 -j REDIRECT --to-ports 10082
-A OUTPUT -o lo -p tcp -m tcp --dport 443 -j REDIRECT --to-ports 10082
COMMIT
# Completed on Tue Jun 21 14:16:10 2016
# Generated by iptables-save v1.4.7 on Tue Jun 21 14:16:10 2016
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [434:47393]
-A INPUT -m state --state RELATED,ESTABLISHED -j ACCEPT
-A INPUT -p icmp -j ACCEPT
-A INPUT -i lo -j ACCEPT
-A INPUT -p tcp -m state --state NEW -m tcp --dport 22 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 443 -j ACCEPT
-A INPUT -p tcp -m tcp --dport 10082 -j ACCEPT
-A INPUT -j REJECT --reject-with icmp-host-prohibited
-A FORWARD -j REJECT --reject-with icmp-host-prohibited
COMMIT
# Completed on Tue Jun 21 14:16:10 2016
```

Installing a Private Mirror

1. Satisfy all requirements mentioned above.
2. Make a note of the DNS name which all the SPOT hosts will be using. In this example we will call it *mirror.customer.com*.
3. Contact Stibo Systems Technical Services and request that a system name is created for the mirror. This must be human readable and unique. The system name in this example is *your-mirror*.
4. Create a directory for the mirror.
5. Unzip the SPOT foothold (must be newer than the March 2016 release).
6. Run: `./spot --enroll=mirror:your-mirror:mirror.customer.com`.
7. Run: `./spot --apply=to:updates/mirror/latest.spr`.
8. Edit the *mirror.yaml* file and review the options in the file. Some of them, particularly those dealing with mailing of errors, will need to be changed.

9. Run: `./mirror start`.
10. Your mirror should now be running on *mirror.customer.com*.
11. On a system with STEP installed, run the following command:
    `./spot --updates=https://mirror.customer.com --ping`
12. As `root`, create a symlink to the mirror script into the appropriate sysv init directories using a command similar to the following:
    `ln -s <mirror_home>/mirror /etc/rc3.d/S90stibo-updatesmirror`

For example:

```
ln -s /home/mirror/mirror /etc/rc3.d/S90stibo-updatesmirror
```

Important: Do not run any of these commands as `root`. Make sure an unprivileged user exists for this mirror — e.g., `mirrorsw`.

Once the private mirror has been configured, it can be verified by running the following command on the STEP application server as the `stibosw` (or equivalent) user:

```
[stibosw@app1 step]$ ./spot --mirrors
Stibo Patch Operations Tool
Priority Id          Name                          Url                                [X]
100      <customer>  <customer> local mirror       https://mirror.customer.com         X
30       global      Auto failover mirror          https://updates.stibosystems.com
20       dk1         Primary mirror in Aarhus DK   https://dk1.updates.stibosystems.com
10       dk2         Secondary mirror in Aarhus DK https://dk2.updates.stibosystems.com

Please use spot --mirrors --updates={Url} to set the upstream mirror
```

The mirror can also upgrade itself using the init script by running: `./mirror upgrade`. The upgrade command calls the `spot --apply=to:updates/mirror/latest.spr` and `./mirror restart` commands.

If the iptables' rules have been added to the RHEL config file, the init script no longer needs root access and can be started by an unprivileged user. This is done by editing said user's *crontab* entries (such as `crontab -e`) and adding the following line:

```
@reboot <mirror_home>/mirror start
```

For example:

```
@reboot /home/mirror/mirror start
```

Preemptive Download

The mirror server can download files before the STEP systems ask for them. Doing this allows most files to be served from the local mirror without waiting for the upstream mirror, so better performance can be expected. This comes at the cost of more disk space being utilized and the possibility of downloading files that end up never being needed.

The download option has three possible values:

- `download: HISTORIC`: Downloads all the files available from the upstream mirror, regardless of age. This requires about 1.5 TB of space.
- `download: RELEASED`: Downloads newly released code as soon as it becomes available, this is the default and will steadily consume space. About 2 GB are consumed per month.
- `download: ON_DEMAND`: Nothing is downloaded until a client asks for it.

Note: When new content (e.g., monthly maintenance patches, add-on components, hotfixes, etc.) is downloaded to the mirror, it will be saved to the server's `<mirror_home>/content/takeout` directory (e.g., `/home/mirror/content/takeout`).

As no user is actively waiting for the preemptive downloads to complete and because the downloads can be quite large, the bandwidth consumed by the background downloads can be limited via the `bulkDownloadSpeedInMbitPerSecond` configuration option. The default limit is 10 Mb/s, so the expected lag after a release of STEP until the mirror is in sync should be less than an hour.

The bulk download speed limit is applied to the download of newly released files and historically released files separately, so if a historic download is running, then the two bulk processes can consume twice the speed limit in total.

If downloads take a long time to complete, it could be because the network or the upstream mirror is overloaded. To avoid contributing to the problem the bulk download threads will sleep for a while after completing a download. The amount of time to sleep after a download can be specified using the `bulkBackoffFactor` option, which defaults to '1.5'.

For example, if a download takes two seconds then a *bulkBackoffFactor* of '1.5' means that the process will sleep three seconds before downloading the next file.

STEP Architecture

This section is intended to be used by experienced Information Technology Professionals. An intermediate-to-advanced understanding of technical architecture is assumed. This is a guide but does not address all situations. Consult your implementation team or your Stibo Systems representative for further information.

This section describes the architecture of STEP and addresses the following questions that are vital for successful implementation of the Master Data Management (MDM) solution:

- What options allow STEP to integrate with other systems in the infrastructure?
- What issues must be considered before making final decisions about fundamental topics, such as hardware, network design, backup and recovery, clustering, and security?
- What is required to maintain a STEP installation that is fail-safe and scalable, and that behaves in a predictable manner even in a worst-case scenario?
- What are the recommended procedures for keeping the STEP software and any third-party software, up-to-date?

Architecture Elements

For more information, see the following topics:

- Architecture Layout
- Integration
- Storing Asset Content Externally
- Business Process Management
- Clustering
- High Availability Implementation
- Network Consideration
- Security

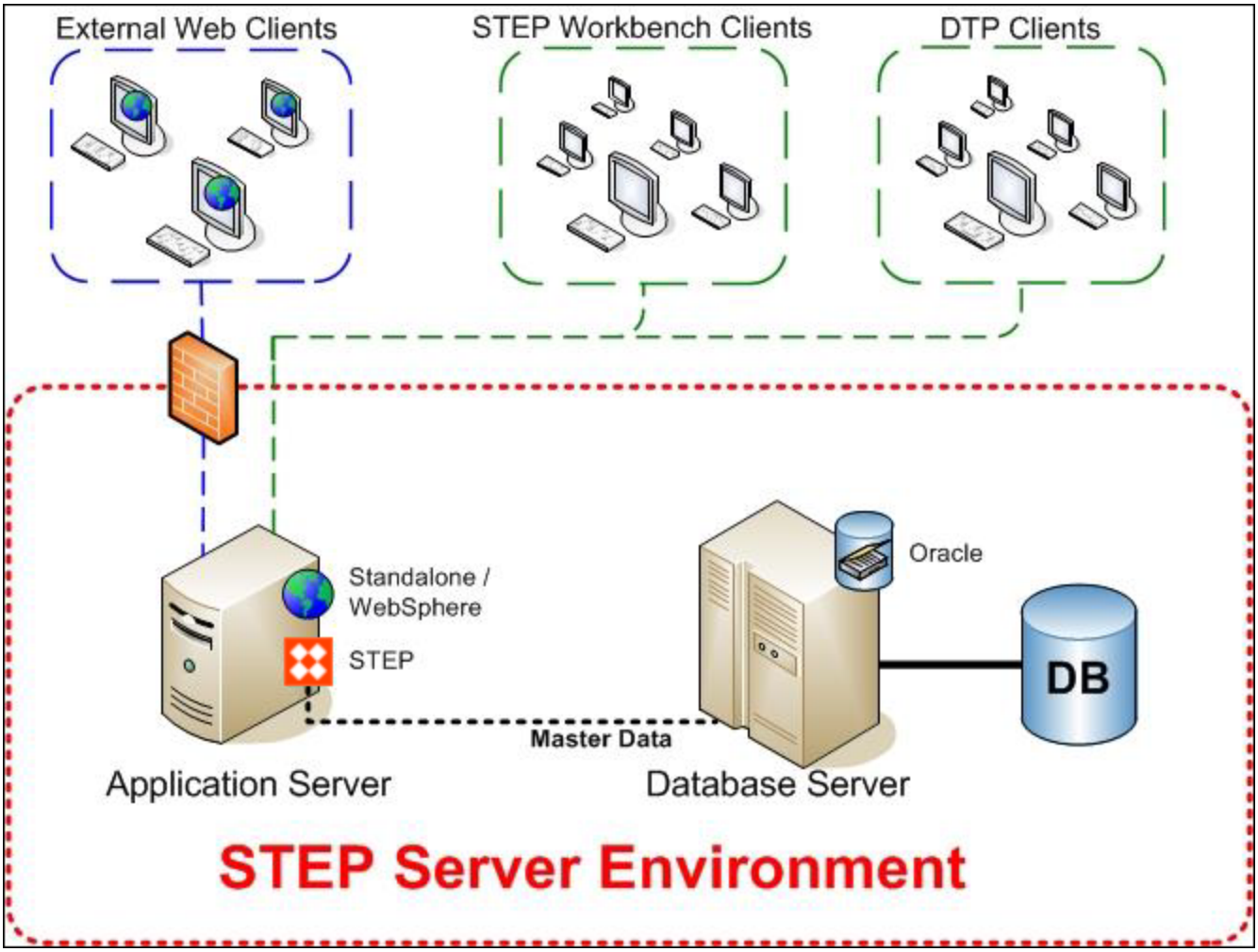
Additionally, platform and software support is addressed for each release. For example, see the **9.3 Platform and Software Support** topic within the **System Release and Patch Notes / Platform and Software Support** documentation.

Architecture Layout

This is one of the topics that describes the architecture of the STEP solution. The full list is defined in the **STEP Architecture** topic.

STEP Architecture

This illustration shows a simple STEP system setup with one application server and one database server.



The Application Server is a physical server running either standalone (on Oracle Java) or a WebSphere Server. Within the application server, an instance of the STEP application is running, supporting three types of clients. The STEP Workflow component supporting business process management is part of the STEP application.

The Oracle Database Server provides the primary storage for all information to be stored persistently by the STEP system.

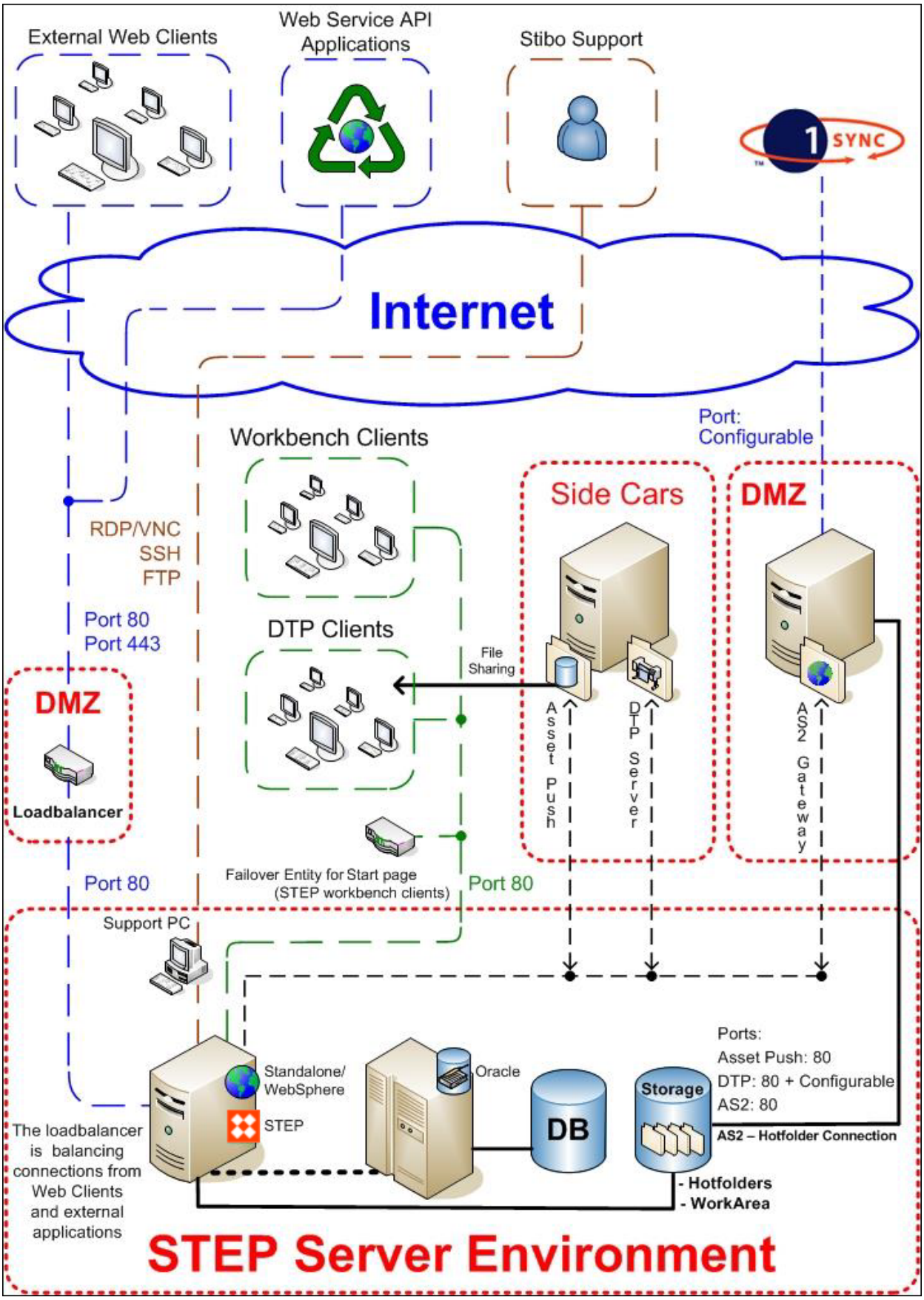
These types of clients are represented:

- STEP Workbench Client is a cross-platform, Java client providing the full set of functionality of the STEP application.
- External Web Client is an internet browser-based client providing functionalities used by users, suppliers, and vendors.
- Desktop Publishing (DTP) Client represents the InDesign application extended with a STEP DTP plug-in which allows the DTP application to communicate with STEP via a dedicated Web Service API.

Enterprise Architecture

The following comments apply to the illustration below which shows how the STEP system relates to its immediate surroundings.

- External applications communicate with the STEP system using the Web Service API or, as an alternative, the REST API. Additionally, other ways to integrate with the system are mentioned in the **Integration** topic.
- For simplicity, STEP is only represented as a single box. See the **STEP Architecture** section above for more details.
- Sidecars denote a number of applications supporting the STEP Enterprise application functionality, such as:
  - DTP server (either InDesign or QuarkXPress) provides operations such as proof views and PDF renderings of the DTP documents for users without DTP clients. It is possible to install multiple, physical DTP servers for load balancing and fail over.
  - Asset Push Client listens for creation and updates of assets stored in STEP and automatically extracts a configurable version and subset of these assets to the file system. To allow DTP clients and servers faster access to images and further performance improvements, the output images can be synchronized to a file server near the DTP users if they are far away from the STEP system.
- AS2 gateway handles the AS2 communication with 1Sync. It can either be the OpenAS2 side car supplied by Stibo Systems or a customer-supplied (and perhaps pre-existing) AS2 gateway. The AS2 gateway should be placed in a separate DMZ for tighter control on the network traffic, so only incoming traffic from 1Sync is allowed on the configured port.
- DB represents the disks necessary for storing the data of the Oracle database being part of STEP.
- Failover Entity ensures that the Start page of the workbench does not become a single point of failure. The workbench application handles load balancing and failover directly and does not use this device once started, (see the **Clustering** topic). The entity can either be a dedicated piece of hardware or a computer running an Apache web server with an appropriate proxy configuration.
- Loadbalancer provides an additional point of entry for external users (through the internet) accessing STEP. This point of entry is either a network box or a physical server capable of performing URL filtering together with session affinity, ensuring that the same session goes to the same server until the session times out. In effect, this box will perform load balancing and failover tasks for the STEP Web Client.
- For Stibo Systems Technical Support to be able to assist with troubleshooting problems, configure a remote connection from Stibo Systems to the customer hosting the system. This can be a Citrix-based connection or a direct VPN connection to a Support PC in the customer's network.


External Web Clients
Web Service API Applications
Stibo Support
1 SYNC
Internet
Port: Configurable
Workbench Clients
Side Cars
DMZ
RDP/VNC
SSH
FTP
Port 80
Port 443
DTP Clients
File Sharing
Asset Push
DTP Server
AS2 Gateway
DMZ
Loadbalancer
Port 80
Failover Entity for Start page (STEP workbench clients)
Port 80
Support PC
Ports:
Asset Push: 80
DTP: 80 + Configurable
AS2: 80
Standalone/ WebSphere
STEP
Oracle
DB
Storage
AS2 – Hotfolder Connection
The loadbalancer is balancing connections from Web Clients and external applications
- Hotfolders
- WorkArea
STEP Server Environment

Integration

This is one of the topics that describes the architecture of the STEP solution. The full list is defined in the **STEP Architecture** topic.

The components listed below all contribute to the data exchange between STEP and external sources / applications. Together, these components create a suite that exposes the STEP system as an open ended and flexible system, which easily integrates with an existing infrastructure.

Inbound Integration Endpoints

Inbound integration endpoints (IIEPs) read from a queue to retrieve data from an external system. When active, an IIEP tracks errors, measures throughput and latency times. For more information, see the **Inbound Integration Endpoints** section of the **Data Exchange** documentation.

IIEPs allow a variety of receiver methods, as defined in the **IIEP Receiver Methods** topic of the **Data Exchange** documentation.

Outbound Integration Endpoints

Outbound integration endpoints (OIEPs) sends data via a queue to an external system. For more information, see the **Outbound Integration Endpoints** section of the **Data Exchange** documentation.

OIEPs allow a variety of delivery methods, as defined in the **OIEP Delivery Methods** topic of the **Data Exchange** documentation.

Export Manager

The Export Manger wizard allows the user to export STEP data via a background process. For more information, see the **Export Manager** section of the **Data Exchange** documentation.

Export Manager can export data via a number of formats, as defined in the **Export Manager - Select Delivery Method** topic of the **Data Exchange** documentation.

Import Manager

The Import Manger wizard allows the user to import STEP data via a background process. For more information, see the **Import Manager** section of the **Data Exchange** documentation.

Import Manager can import data via a number of formats, as defined in the **Import Manager - Select Format** topic of the **Data Exchange** documentation.

Web Service API

Custom applications can be built using the STEP Web Services API to read, update and delete data in the STEP PIM. The communication takes place via a standard SOAP protocol providing a maximum of decoupling between the external applications and STEP. For more information, click the **STEP API Documentation** button on the STEP Start Page.

REST API

REST (Representational State Transfer) covers simple transfer of data over HTTP by using URLs to identify the data, the same way typing a URL into a web browser returns HTML which is rendered by the web browser. With the REST API, the URL points to data in a STEP system. The STEP system returns the data in STEPXML format, which enables viewing and navigating data in STEP via a web browser. The same can be done by programs that want to integrate with STEP by issuing an HTTP GET request and parsing XML. It is also possible to issue an HTTP PUT request to update and approve STEP data. There is also an option to apply an XSL stylesheet stored in STEP to the data before it is returned. This enables easy creation of web content proofing by storing XSL and CSS stylesheets as assets in STEP. For more information, click the **STEP API Documentation** button on the STEP Start Page.

SQL API

The SQL API can be used to generate customized reports and extractions. The API consists of a series of views and stored packages. These structures can be accessed via SQL, PL/SQL, or other database-enabled programming languages such as Visual Basic or Java in order to extract data. To secure the read-only property of the API, all of the API components are installed under a separate Oracle user account. This user is granted limited rights, excluding update, insert, or delete rights on the tables underlying the views. For more information, click the **STEP API Documentation** button on the STEP Start Page.

GDSN Integration

Data can be imported from and exported to the data pool 1SYNC, a subsidiary of GS1 US, which is a Global Data Synchronization Network (GDSN)-certified Data Pool that offers a range of data synchronization solutions that eliminates costly data errors, increases supply chain efficiencies, and provides a foundation for the implementation of technologies, such as the Electronic Product Code™ (EPC) and Radio Frequency Identification (RFID).

Imports are configured as 'subscriptions' in STEP with different criteria. These subscriptions are sent to 1SYNC and if products in 1SYNC match a subscription, STEP receives an import file with the product data included. This synchronization of product data continues until the data receiver or the data provider wishes to stop it.

Exports of STEP products can also be registered with the 1SYNC GDSN data pool. These products may subsequently be published to a specific trading partner via the GDSN network while tracking the status inside STEP. Updates to published products are tracked so that the products may be re-published.

For more information, see the **GDSN Provider** documentation, the **GDSN Receiver** documentation, and the **Product Data Syndication** section of the **Data Integration** documentation.

Storing Asset Content Externally

This is one of the topics that describes the architecture of the STEP solution. The full list is defined in the **STEP Architecture** topic.

The following options are available to store asset content externally:

- External File Structure (EFS)
- External Digital Asset Management (DAM)

Business Process Management

This is one of the topics that describes the architecture of the STEP solution. The full list is defined in the **STEP Architecture** topic.

The following support is available to model and integrate data management processes tailored towards specific business needs.

Background Processing

Complex and time consuming processes can be run as background processes (BGPs). Examples of fundamental core features that are implemented as background processes are import, export, translation, approve recursive, and report generation. BGPs can be started from the workbench and are passed onto a JMS-based queue system. The jobs in the queue are then processed in FIFO order, allowing processes to run in parallel to the extent defined by an adjustable queue configuration. For example, a system can be set up to have two separate queues (one for imports and one for exports) and the 'size' of the queues can be configured so that three (3) imports and six (6) exports max are allowed to run in parallel. For more information, see the **Background Processes and Queues** section of **System Setup / Super User Guide** documentation.

Business Rules

Many business processes necessitate the ability to pass approved data automatically from STEP to other systems. This poses extra requirements on the validity of data - otherwise data will possibly be rejected by the receiving system. In order to ensure validity, STEP provides an opportunity to add business rules that are applied at the time of approval. Such business rules may perform a check across all data defined on an object and reject or accept approval. In addition, STEP has support for creating approve triggers that are also executed as an integral part of the approval process. While business rules are designed for read-only validity checks on data before and after approval, the approve triggers are able to change data as an integral part of the approval process. If any business rule fails, approval does not take place, and the user is notified. Business rules can be written using a subset of the Java-based Core Domain API. For more information, see the **Business Rules** documentation, and also review the API documentation by clicking the **STEP API Documentation** button on the STEP Start Page.

Workflows

The workflow functionality is used for modeling processes where tasks are moved between people. Workflows are 'data-centric' which means that a 'workflow instance' is defined as the relation between a workflow definition and an object in the database. For more information, see the **Workflows** documentation.

Clustering

This is one of the topics that describes the architecture of the STEP solution. The full list is defined in the **STEP Architecture** topic.

Clustering creates a STEP system with high availability (HA) and scalability. In a clustered setup, the load is distributed so that all members of a cluster take a fair part of the load. A successful cluster setup requires accurate configuration of many parameters: number of servers, bandwidth, network latency, etc. A fail-over strategy must be available for all of the essential components of the system.

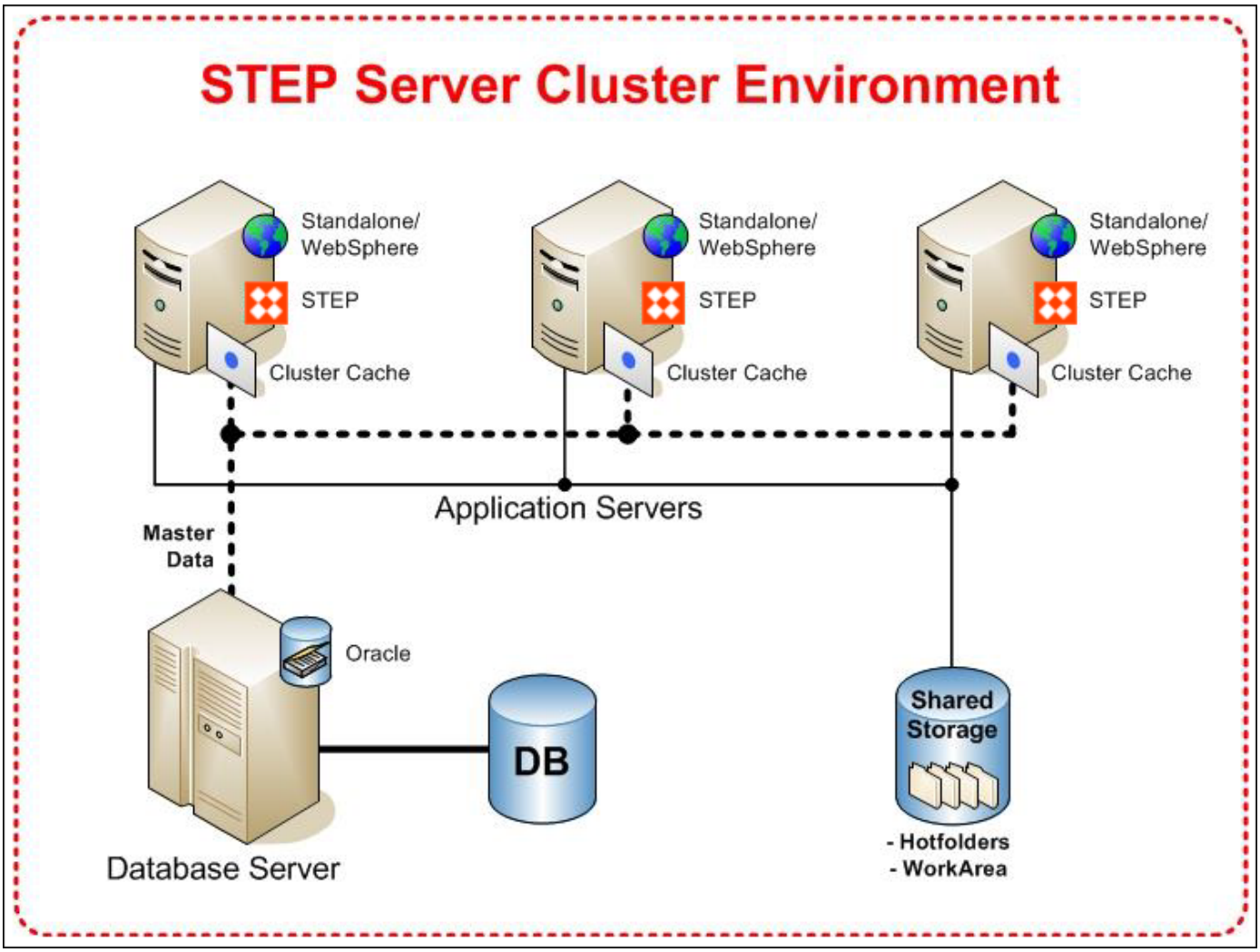
Homogenous cluster nodes are recommended in a cluster setup. The simplest type of cluster is created by adding an additional application server that does everything the first application server does. It is recommended that clustered applications servers are set up as clones and kept on identical hardware.

Important: Clustering a STEP system is handled by the STEP application itself. It does not use clustering technology provided by a commercial application server.

Architecture

The following comments apply to the illustration below which shows a STEP system running as a cluster setup with three application servers.

- Application Servers are physical servers running either standalone (using Oracle Java) or a WebSphere Server. Within each of the application servers, an instance of STEP is running, supporting all three types of clients mentioned earlier (workbench clients, web clients and DTP clients). Each application server computer has a cache of its own that is synchronized whenever write operations take place.
- Oracle Database Server provides the primary storage for all information to be stored persistently by the STEP system. Optionally, this can be an Oracle Real Application Cluster setup to compensate for the risk of failure in the underlying hardware.
- Shared Storage is a file system that is shared by all nodes in the cluster. The 'step/workarea' folder contains, for example, an image cache where thumbnails of images are generated. It also stores intermediate files generated by the STEP Workflow component and files used by background and batch processes. The hotfolders are dynamic folders that automatically process files based on a hotfolder configuration. A good example is uploading assets, where the assets are dropped into a folder and automatically imported into STEP. The hotfolders can be exposed directly on the internet making it possible to place content for import directly, for example, via FTP (not shown).



Application Server Roles

Application Servers in the cluster can be configured as a server for any of the following services:

- Background services
- Workbench client services
- Web client services

The preferred setup is that all servers handling a specific type of service handle the same set of services. For instance, a single server should not handle background processing and workbench client processing, while another server handles only workbench client processing. In this case, the load balancer may not recognize the differences between the two servers and may put equal numbers of workbench clients on both servers even though one of them also serves background services.

Implementation

Running STEP in a cluster means that one instance of the application is running on each application server. Each of the application instances maintains a cache residing in memory on the corresponding application server in order to minimize the number of database requests on repetitive read operations. Whenever a client or a background batch process changes data via one clustered application instance, all of the other application instances must know about it and update their caches accordingly. The mechanism used for this cache synchronization is implemented in the JDO (Java Data Object) layer of the application and basically relies on the same implementation no matter what application server software is being used. In other words, the cluster implementation used by STEP does not use any of the application server specific clustering facilities provided by WebSphere.

Load Balancing

As shown on the architecture diagram in **Architecture Layout** topic, the Web Client is load-balanced through a hardware load balancer. Such a load balancer must support session affinity to ensure that the same session goes to the same server until the session times out. This is important since session state is not replicated among servers and a user directed to a different server will be asked to log on again.

In contrast, the workbench client has built-in load balancing capabilities building on the CPU load on each server. Once connected to a server, the client will keep using that server unless the client GUI has been idle for 15 minutes. The standard configuration for this applies for most setups. STEP needs to be provided with the list of server names as known by clients in the STEP configuration file.

The workbench client has no session state on the server, thus moving from one server to the other is not a problem, except for performance reasons (the caches on the server the user last accessed is most likely to contain the data the user will request next). The system will ensure that any writes to the database are viewed consistently across all application servers in the cluster.

Scalability

STEP is designed to support both large, initial deployments and the growth of smaller systems through horizontal scalability. A cornerstone of the design is to provide a cost-effective solution that supports both. Regardless if the number of users, the amount of data, or both should grow significantly, STEP is not likely to be the system that limits activities.

Serious and resource-demanding tests have been and are continuously executed to prove that the scalability potential of STEP meets these goals.

High Availability Implementation

This is one of the topics that describes the architecture of the STEP solution. The full list is defined in the **STEP Architecture** topic.

STEP can be set up in a way that allows it to quickly and automatically recover from most types of failures as they occur. Running multiple application servers in a cluster is just one of the cornerstones towards achieving high availability (HA).

Elements

Technically, the key elements of a HA implementation are:

- Eliminating single points of failure.
- Applying multi-pathing by creating redundant physical path components (such as adapters, cables, switches, and interfaces) to create logical 'paths' between the server and the storage device.
- Using load balancing to ensure that servers are not overwhelmed to the point of being unable to function properly.

Considerations

Consider the following items when performing a cost / benefit analysis when considering or planning for high availability:

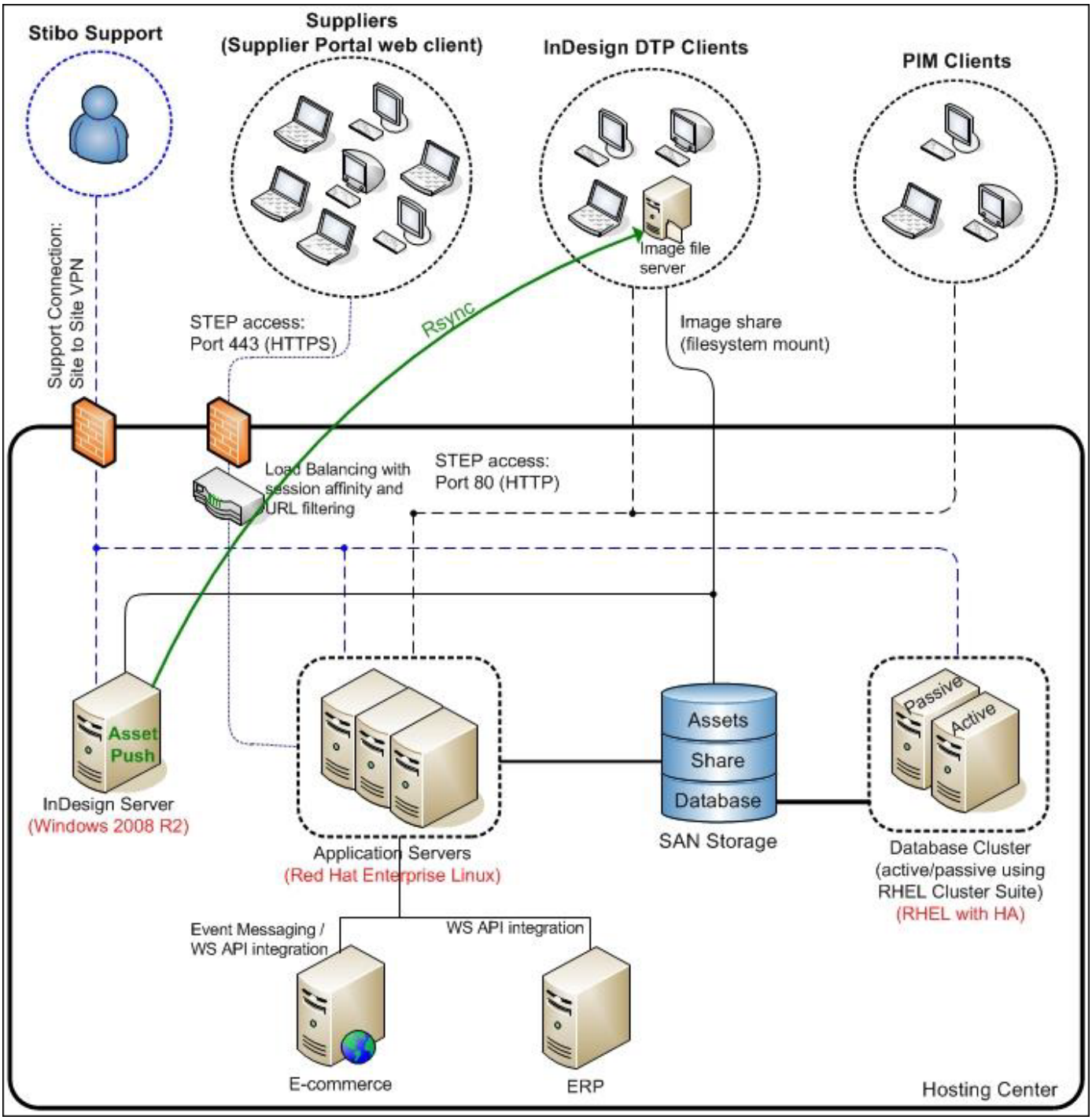
- Any HA option can lead to higher complexity, which may introduce new risks of instability and change maintenance requirements.
- Choosing a large number of smaller servers versus a small number of large servers (horizontal vs. vertical scaling).
- Business need for a level of performance while one of the cluster nodes is down.

In general, servers with more resources (faster CPU, more memory etc.) are better, but larger hardware is also more expensive. Therefore it is common to choose several smaller servers. Stibo Systems has performed scalability tests with 1-, 2- and 4-server setups that show that STEP scales almost linearly with the number of servers (horizontal scaling).

The following sections focus on HA options for each of the main software and hardware components that contribute to the broad range of services provided by STEP.

Two other factors impact high availability but are not considered in these options:

- Human failure - when a user mistakenly deletes vital parts of the data stored in the system.
- Planned downtime for system maintenance.



Application Server

If one of the application servers goes offline, STEP will continue operation on one of the other servers without needing a server restart.

Web client users may see an HTTP error (or other error) if a server is unavailable, depending on the load balancer in use. The user will have to log in again since the session state is not replicated between servers (for performance reasons). They will subsequently be able to continue working.

Workbench users may see an internal error message if a server is unavailable. After ignoring this, they can continue working. No additional log in is necessary as the workbench client is stateless, in the sense that application servers have no session state on behalf of a workbench client.

Failover handling does not handle the case where a server stops answering the client. In this case, the user must log in again (possibly after terminating his client). Upon log in, the system disregards servers not responding in a timely fashion to the log in request, but such servers will delay the log in slightly until resolved (either by taking the server down or resolving the issue).

If an application server running background services goes down, the background services will automatically be rerun when the other servers discover that the server has failed (this may take a while). No tasks are lost, but execution of the task may be delayed. In general, it is difficult to ensure that a server failure is noticed by the other servers, since it can have stopped processing the single task but keeps answering to ping requests, etc. In that case, there is no way to automatically detect the failure.

Oracle Database Server

Oracle provides these options to support clustering and/or failover of the database:

- Oracle Real Application Cluster (RAC)
- Oracle Data Guard

Oracle RAC provides fault tolerance, load balancing, and scalability. In an Oracle RAC environment, two or more computers (each with one instance) concurrently access a single database. This allows the application to connect to either computer and have access to a single, coordinated database. When one of the nodes in the cluster fails, the database is still available through one or more other nodes.

Oracle RAC is supported on both Oracle Standard Edition and Enterprise Edition.

The Standard Edition includes these limitations:

- The maximum number of CPUs defined by the license is for the entire cluster; it is not a per node maximum.
- Automatic Storage Management (ASM) based on RAW or block devices must be used to manage all database-related files. Third-party volume managers and file systems are not supported for this purpose. Stibo Systems does not provide support for ASM on RAW devices; this is the responsibility of the customer.

The Enterprise Edition does not have these limitations, therefore Stibo Systems recommends using Oracle RAC only on Oracle Enterprise Edition.

The Oracle Data Guard solution provides high availability, data protection, and disaster recovery. DataGuard uses a standby database, which is a copy of the production database. The standby database is kept up-to-date by applying redo log data from the production database. If the production database fails, DataGuard will switch to the standby database so this now becomes the production database.

Data Guard is only available with the Oracle Enterprise Edition. For more information, see the **Database Server Oracle DataGuard** topic.

Oracle and third-party software alternatives

The Oracle Enterprise Edition and the extra cost options mentioned above are expensive and other solutions exist. Using Oracle RAC provides close to 100 percent uptime, but if minimal downtime is tolerated by the business, these solutions are worth considering as they do not require the Enterprise Edition and are much less expensive to implement.

Possible solutions for implementing high availability are:

- Red Hat Enterprise Linux 6 with High Availability Add-On
- Windows Server 2012 R2 with Microsoft Cluster Server and Oracle Failsafe

Both of these solutions use an active / passive setup as illustrated in the image above. If the active database node fails, the clustering functionality will failover the database storage to the passive node and start up the database instance. The passive node is now the active node.

An alternative to Oracle DataGuard for disaster recovery using a standby database is 'DBvisit standby.' For more information, see the web at www.dbvisit.com.

DTP Server Failover

The STEP application load balances across the DTP servers that are online. A DTP server crash affects only the users who are executing an operation against that particular DTP server. These users will subsequently be able to redo the failing operation. The STEP application will dispatch to another DTP server that is still online, and the operation can complete.

Shared Storage

Disk crashes can be handled in a RAID setup, allowing a crashed disk to be hot swapped with a new one without leading to any system breakdown. To get even better protection against unexpected accidents, an IP-Storage Area Network (IP-SAN) can establish two instances of the same storage at two different locations, thereby achieving box-to-box redundancy. One storage instance is the active one and the other one is passive. In the event of irrecoverable failure of the active system, the passive instance becomes the active one. A variety of advanced techniques are available for keeping the active and passive storage in sync.

Network Consideration

This is one of the topics that describes the architecture of the STEP solution. The full list is defined in the **STEP Architecture** topic.

Barriers set up for security reasons but that are not aligned with the STEP system requirements can result in a non-functional system or a very poorly performing system. While STEP is not particularly demanding, the following rules must be observed for the system to work properly.

Network Boundaries and Firewalls

Several distinct network realms are involved in the STEP system. It is assumed that firewalls only exist at the boundaries between the networks, so network traffic is only defined at those boundaries.

As the architecture diagram hints, most application traffic happens as plain HTTP on port 80 from workbench, web browsers, and other clients, directly to the application servers. There are other requirements for network connectivity that depend on the particular configuration of the system. Examples of such connection requirements are:

- Incoming SSH or RDP (depending on system platform) to allow administrators to manage the systems in the cluster.
- Incoming FTP for file upload if hotfolders are used.
- Outgoing HTTPS to the Stibo Systems update server, so new software can be downloaded.
- Outgoing HTTP on a configurable port to the DTP sidecar.
- File exchange with the AS2 gateway if 1SYNC integration is used.

Important: The exact configuration of the network boundaries can only be determined after the specific features needed on a particular system are known.

Contact your Stibo Systems account manager or partner manager to determine the latest port requirements.

Intra-Cluster Network: One Switch, One VLAN

The application servers access the database using JDBC connections. The communication is a combination of small requests and larger batches that can take hours to process. The process of sending a lot of small requests will be very sensitive to latency in the network, while timeouts may kill the large batch jobs. Therefore, any latency, TCP timeouts, or incorrect configuration in the intra-cluster network can severely impact performance, stability, and functionality of the system, and additionally can be difficult to detect and debug. Generally, it is important to keep the network that binds the cluster together as simple as possible. The application servers and the database servers must all be located on the same switch with no filtering or routing between them.

In a standard implementation, it is assumed that no firewalls exist between the application server(s) and the database server.

Redundancy in the Network Infrastructure

The principle that simple components are less prone to failure than complex ones is important when implementing network infrastructure. For example, the network switch is not expected to fail very often, and if it does, it can be swapped out. If the network infrastructure needs to be made redundant, the standard tools (such as STP or OSPF with multiple NICs in each server) are needed. For more information, search the web.

Security

This is one of the topics that describes the architecture of the STEP solution. The full list is defined in the **STEP Architecture** topic.

This section briefly covers the main aspects of security in relation to STEP.

Authentication

Authentication of users in STEP can be configured in the following ways:

- Default user database maintained internally in the STEP database
- LDAP
- LDAP with Kerberos

The LDAP authentication methods allow STEP to be integrated with any existing user authentication infrastructure. The advantages are that users do not need to maintain an extra password for STEP and that the password policies of the central authentication mechanism are inherited to STEP.

Data Protection

The access to data in STEP is under fine-grained control by the application servers and is configured via the workbench client. User actions are set up and attached to user groups and the specific users then get permissions due to membership of one or more of these groups. Granting of permissions is positive in the sense that the user actions specify what the users are allowed to do (not what they are not allowed to do). If a user is a member of two different user groups with overlapping sets of privileges, the resulting set of privileges will be the union of the two groups. For more information, see the **Users and Groups** section of **System Setup / Super User Guide** documentation.

Network Security Considerations

The STEP cluster consists of the Oracle database server and the application servers which must be on the same physical network with no firewalls between them. For more information, see the **Network Consideration** topic.

Local OS Security

As with any secure system, only trusted users should be granted access to any of the servers in the cluster (Oracle database and the application servers). This protects against local privilege escalation attacks which can be numerous and hard to guard against, but also limits the possibility for performance interference.