



# **Introscope Version 10.1 Installation Guide For SAP**

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# 1 Installation Overview

This document covers the installation and configuration of Introscope in the context of SAP products in the following chapters:

- [Installation Overview](#)
- [Upgrading previous versions to Introscope 10.1](#)
- [Installing Introscope Enterprise Manager](#)
- [Introscope-enabling SAP J2EE Systems \(Agent Installation\)](#)
- [Optional: Installing Introscope Workstation](#)
- [Optional Additional Installation Options](#)

## ➤ Introscope Overview

Introscope® is an application management solution created to manage Java application performance. Unlike development tools, Introscope® is designed to scale with minimal performance impact. This allows you to monitor and manage your application performance in live production environments.

This guide focuses on the SAP-specific aspects of Introscope. For a full overview on Introscope please check the official product documentation provided by CA: <https://docops.ca.com/ca-apm/10-1/en>. Note, however, that not all features described in the CA documentation will be available to SAP customers as part of the "RTV" delivery.

The Right to View (RTV) version of CA Introscope is a restricted, read-only form of the full product and is bundled with SAP Solution Manager. With the RTV version, support is limited to products that are licensed and supported by SAP. The instrumentation, dashboards, Probe Builder Directives (PBDs), management modules, and Smartstor data contained within the RTV version of CA Introscope as provided by SAP is the intellectual property of SAP. Use of these functions is restricted by SAP and may only be used in an unrestricted manner by licensing SAP Extended Diagnostics by CA, foundation from SAP. Please see SAP Note [2285460](#).

## ➤ Reviewing the Installation and Configuration Process

You will be installing the following Introscope components:

- **Introscope Enterprise Manager** (central server component)  
The Enterprise Manager is typically installed on the Solution Manager host. Alternatively, you can install the Enterprise Manager on a separate host.  
The memory and CPU requirements for the Enterprise Manager mainly depend on the number of Introscope agents that you connect and on the complexity of the monitored systems. Typically, for up to ten agents, the default configuration using

1024MB Java heap will suffice. More details on Enterprise Manager sizing can be found in <http://wiki.scn.sap.com/wiki/display/TechOps/ISHowTo> -> Sizing and Performance Guide.

- **Introscope Java Agent** (on the managed systems)  
The setup of the Java agent is typically done centrally via the managed setup in Solution Manager. Only in exceptional cases manual installation is necessary, as described below. After activation by restarting the Java VM, the agent runs within the Java process of the monitored system.
- **Host-Level Introscope Agent** (on the managed systems)  
The so-called Introscope Host Adapter runs as part of the Diagnostics Agent in the Diagnostics Agent process to collect data on operating system level, e.g., from saposcol, GC logs, ABAP instances, and TREX. The host adapter generates less load on the Enterprise Manager than a normal agent. For this reason, it should not be included with the same weight in the memory sizing calculation above. The host adapter is configured automatically by the managed systems configuration.
- Optionally, you can install the **Introscope Workstation** on the Enterprise Manager host or any client PC. See the next section for recommendations about the user interface for Introscope.

## Deciding About the UI for Introscope

There are three different options to access Introscope:

1. Introscope **Workstation**: Swing-based client user interface, full functionality
  - a. Use Java WebStart to download the Workstation on demand from the Enterprise Manager. No explicit installation of the Workstation is necessary. Java 7 or later must be installed on the client PC, default URL: <http://emhost:8081/workstation>. The workstation will be downloaded only once and is then cached on the client PC. For every new start of the Workstation the cached version is checked against the Enterprise Manager and, if the Enterprise Manager was updated, a new version is downloaded automatically.
  - b. Explicit installation on the client PC on which you want to use it (see Chapter 5).
2. Introscope **WebView**: Browser-based user interface, based on HTML5. In some details limited functionality.

WebView is available by default on the Enterprise Manager (no installation necessary), default URL: <http://emhost:8081/webview>.

In general using the Workstation should be preferred to WebView since it is more powerful. The most convenient option is to use 1a (Launch Workstation via Java Webstart). The binaries are then only downloaded once and after that cached on the client PC. You may also decide to install the workstation explicitly on your client PC (1b).

## Introscope Access

After installation, you can use the following default credentials to access Introscope:

User	Password	Access Rights
<b>Admin</b>	<b>Admin89</b>	<b>read, run_tracer</b>
<b>Guest</b>	<b>guest12</b>	<b>read</b>

Note that the credentials are case-sensitive. Furthermore, you can add `live_agent_control` and `historical_agent_control` permissions to the Admin user if you want. Please refer to the user management section in Chapter 6 for details.

## The Installation Process

The Introscope installation process consists of the following steps:

1. Check SAP Notes [797147](#) and [2285189](#) for latest updates to the installation procedure and to this document.
2. Download installation files from SAP Service Marketplace.
3. Install the Introscope Enterprise Manager on the central monitoring system and add the management modules.
4. Install the Introscope Java agents and host agents on managed systems.
5. Optional: Install the Introscope Workstation.

### ➤ Obtain the Latest File Versions

#### SAP Notes and Wiki

SAP Note [797147](#) is the central entry point for up to date information regarding the installation of Introscope. Review the latest version of this note before you start the installation.

SAP Note [2285189](#) (Introscope 10.1 Release Notes) provides recent information specific to Introscope 10.1 releases like known problems and updates.

The Introscope Wiki section can be found via this URL on the SAP Community Network: [http://wiki.scn.sap.com/wiki/display/TechOps/RCA\\_Introscope\\_Home](http://wiki.scn.sap.com/wiki/display/TechOps/RCA_Introscope_Home)

#### Download Third-Party External Component Package from CA

The Introscope 10.1.0.15 installer requires third-party external component package files. Before starting an installation or upgrade, you must download these files to your network.

**To download the third-party external component package files:**

1. Go to <http://opensrcd.ca.com/ips/osgi/>
2. Download the following files from the subdirectory introscope\_10.1.0.0:
  - eula.txt
  - The osgiPackages archive appropriate for your system:
    - osgiPackages.v10.1.0.15.windows.zip, for a Windows system
    - osgiPackages.v10.1.0.15.unix.tar, for a UNIX system

Save the files in the same directory as the Introscope installer executable. The installer will then automatically locate this file during the installation process.

**Download the Latest Updates from the Service Marketplace**

Download all files listed in SAP Note [2285189](#) from the SAP Service Marketplace. The note explains the exact locations of the files.

# 2 Upgrading from Previous Versions to Introscope 10.1

This chapter explains the options to upgrade an Introscope installation to Introscope 10.1. If you are performing a fresh installation, please proceed to the next chapter.

## ➤ **Version Compatibility and Upgrade Sequence**

The Introscope Enterprise Manager supports Introscope agents of older releases. In other words, you can connect with agents of different versions (e.g. version 8.x, 9.x) to Enterprise Manager Version 10.1 at the same time. Connecting a new version 10.1 agent to an older Enterprise Manager does **not** work.

Workstation and Enterprise Manager must always have the same version and patch level.

When using older agents with a newer Enterprise Manager, some charts on the Console may remain empty because the SAP customizing assumes that agents and Enterprise Manager have the same version.

Due to this version dependency we recommend to upgrade sequence:

1. Upgrade Enterprise Manager and Workstation first. This can be done without impact on any monitored systems. Since WebView is running as part of the Enterprise Manager an explicit upgrade of WebView is not needed.
2. Then upgrade the Introscope agents in the monitored systems at your convenience. Upgrading the agents will require a restart of the monitored systems.

## ➤ **Enterprise Manager Upgrade**

There is no tool support for an in-place upgrade of the Enterprise Manager. If you want to keep the performance database (SmartStor) of the previous version or any other configuration settings follow the procedure as described in

<http://wiki.scn.sap.com/wiki/display/TechOps/ISHowTo> -> IntroscopeEMUpgrade.

## ➤ **Agent Upgrade**

All agent installations and upgrades can (and should) be done centrally by the administration tools of Solution Manager. The only manual steps are to restart the managed systems after any configuration change.

In case you want to do a manual upgrade: To get rid of any obsolete files we recommend performing a fresh installation, e.g. by moving the old agent installation to a different directory. Since some agent files are locked while the monitored system is running, the monitored system must be down for the agent upgrade.

**Note:** Introscope Java Agent 10.1 only supports Java6 and newer.



# 3 Installing the Introscope Enterprise Manager

To install the Introscope Enterprise Manager you will run the installer file and add some SAP customization (management modules, scripts, etc.).

## ➤ Installation User

You should run the installer with the same user account that will be used later on for running the Enterprise Manager. In particular, on Unix operating systems **do not use the root** account to launch the installer. A common best practice is to use the *sidadm* user of the Solution Manager installation to install and run the Enterprise Manager. For Solution Manager 7.2 please review the installation master guide: A Diagnostics Agent must be installed on the host of the Enterprise Manager and it must have write access to the EM installation.

## ➤ Choose the Enterprise Manager Installer File

Depending on the operating system on which you want to install the Enterprise Manager, different installation files must be chosen. The first table below lists the platforms for which a platform specific installer with a bundled Java VM is available. If you find your operating system listed here, download the file `WILYISEM*.zip` from the corresponding folder on the Service Marketplace (see Note [2285189](#) for the exact location). The file names listed below may vary slightly for patch updates to the Enterprise Manager.

Operating System	Installer Filename
AIX 64bit	introscope10.1.0.15aix64SAP.bin
Linux on x86_64 64bit	introscope10.1.0.15linuxAMD64SAP.bin
Solaris on SPARC 32bit Solaris on SPARC 64bit*	introscope10.1.0.15solarisSAP.bin
Windows x86_64 64bit	introscope10.1.0.15windowsAMD64SAP.exe

\* For Solaris SPARC only 32-bit installers are available. If you want to run the Enterprise Manager on a 64 Java VM, you can exchange the Java VM after the installation. See below for details.

## ➤ Platform Independent Introscope Installer

If you do not find your operating system in the table above, you can use the generic installer for the operating systems listed below. Installation includes one additional step then:

1. Install a Java 8 VM
2. Launch the OS-independent installer

The operating system independent installer is contained in the file WILYISEM\*.zip of the folder *#OS independent* on the Service Marketplace.

Operating System	Java 8 VM Download Link
Linux on Power 64bit	<a href="http://www.ibm.com/developerworks/java/jdk/linux/download.html">http://www.ibm.com/developerworks/java/jdk/linux/download.html</a> , select 64-bit IBM POWER in column Java SE Version 8
Linux on zSeries 64bit	<a href="http://www.ibm.com/developerworks/java/jdk/linux/download.html">http://www.ibm.com/developerworks/java/jdk/linux/download.html</a> , select 64-bit System z in column Java SE Version 8
Solaris on x86_64 64bit	<a href="http://www.oracle.com/technetwork/java/javase/downloads/index.html">http://www.oracle.com/technetwork/java/javase/downloads/index.html</a> , click on "Java SE Download ". Select Solaris x64 Platform

## ➤ Enterprise Manager Installation

### Extract the Introscope Installer

Extract the zip file `WILYISEM*.zip`

As a result you will find four files:

1. The file `installer.properties` which configures the installation procedure
2. an installer file as mentioned above, depending on your platform
3. File `ca-eula.txt` which is the CA End User License Agreement
4. File `version.txt` showing the version of the Enterprise Manager.

The Introscope installer will perform an automated install of Introscope components. The Introscope installer is invoked from the command line and runs "silently", getting its input

from the response file `installer.properties`. The installer runs in the background as it installs Introscope components.

After installation, you can check the results in the installer logs.

When launching the installer, make sure the `installer.properties` file is in the same directory as the installer `.exe`, `.bin` or `.jar` file.

### Optional: Configuring the Installation Directory

The installation of the Enterprise Manager by default goes to the following directories:

- Windows: `C:\\usr\\sap\\ccms\\apmintroscope\\`
- Unix: `/usr/sap/ccms/apmintroscope/`

If you want to change this directory, e.g., because your SAP installation is located on a different Windows drive, use one of the following alternatives.

**Note:** The Installation Directory must not contain blanks in the path.

### Alternative 1: Set the Installation Directory via Command Line Option

1. Open a command prompt and go to the directory where the installer file and the file `installer.properties` are located.
2. Add the option `-DUSER_INSTALL_DIR=<installation directory>` to the invocation of the installer (see below), e.g.,  

```
introscope10.1.0.15windowsSAP.exe
-DUSER_INSTALL_DIR=d:\\usr\\sap\\ccms\\apmintroscope\\
```

### Alternative 2: Edit `installer.properties`

1. Open the file `installer.properties` in a text editor.
2. Locate the `USER_INSTALL_DIR` property.  
 To change the install directory location, enter the desired location in the `USER_INSTALL_DIR` property.

**Note:** The instructions in this guide will use examples relative to the default installation directory.

## Add the External Component Package

### Copy the External Component Package

Copy the two files that you downloaded from CA's FTP server to the directory which contains the installer (see Chapter 1, **Download Third-Party External Component Package from CA**). The following files should be copied:

- `eula.txt`
- The `osgiPackages` archive appropriate for your system:
  - `osgiPackages.v10.1.0.15.windows.zip`, for a Windows system

- o `osgiPackages.v10.1.0.15.unix.tar`, for a UNIX system

## Accept the Licenses

Open the file `eula.txt` in a text editor, read the license, and modify the last line to read `LGPL=accept`. If the license is not accepted installation will fail.

Also open file `ca-eula.txt` in a text editor, read the license, and modify the last line to read `CA-EULA=accept`. If the license is not accepted installation will fail.

## Prepare the silent installation

The silent installation needs to know where you copied the `osgiPackages`. Therefore you have to provide the path to this packages file for property "externalComponentPackage" within file `installer.properties` e.g.

`externalComponentPackage=osgiPackages.v10.1.0.15.windows.zip`, for a Windows system

## Start the Installer

The minimum disk space for the temporary directory of the user running the installer is typically three times the size of the installation file (~2GB). See <https://docops.ca.com/ca-apm/10-1/en/installing/apm-installation-and-upgrade/system-information-and-deployment/enterprise-manager-system-information#EnterpriseManagerSystemInformation-SpecifyanAlternateTemporaryDirectory> how to specify an alternate temporary directory if needed.

1. Launch the installer for your platform using the appropriate command:

- For Windows, double-click on the installer executable e.g. `introscope10.1.0.15windowsAMD64SAP.exe`, or launch it from command-line with the suitable command e.g.

```
introscope10.1.0.15windowsAMD64SAP.exe
```

- For any other platform-dependent installer, use the command in the following example. You may have to set the right permission before you can launch the installation:

```
./introscope10.1.0.15linuxAMD64SAP.bin -Djava.awt.headless=true
```

**Note:** Parameter `-Djava.awt.headless=true` has to be set to avoid the need of having an X server.

- For the platform independent installer that does not contain a bundled Java VM use the following command. `/some_path/java` refers to the Java 8 VM that you installed as described above:

```
/some_path/java -classpath introscope10.1.0.15otherUnixSAP.jar install
```

**Note:** In any case, the configuration file `installer.properties` must be located in the current directory where you launch the installer. You can avoid copying the installation file itself by using the complete path to the executable.

2. Verify installation using instructions in the following section, Verifying Installation.

## Verifying Installation

The installer give confirmation of successful installation on the console. Anyway to confirm installation was successful:

1. Verify that the Introscope directory exists at:
  - `<drive>:\usr\sap\ccms\apmintroscope (Windows)`
  - `/usr/sap/ccms/apmintroscope (Unix)`

OR the location you specified.
2. Open the file,  
`/usr/sap/ccms/apmintroscope/install/Introscope_<version>_InstallLog.log`
3. Verify that the following lines appear in the file:

```
Summary
-----

Installation: Successful.

1468 Successes
0 Warnings
0 NonFatalErrors
0 FatalErrors
```

**Note:** The number of successes may be different than what is shown in this example.

## Adapt Java VM and Java VM Parameters

Depending on the startup mode the Java VM and the Java VM parameters are adapted in different locations:

`<EM_HOME>/bin/EMService.conf`: Used when Enterprise Manager is running as Windows Service on Windows platforms. The property `wrapper.java.command` defines the Java VM to use. Increase the value of `wrapper.java.maxmemory` to increase the Java heap (corresponds to `-Xmx`).

`Introscope_Enterprise_Manager.lax`: Enterprise Manager launched with script `<EM_HOME>/bin/EMCtrl.sh` (typically only on Unix). Adapt `lax.nl.current.vm` to the full path of the VM to use (if you want to change the default) and use `lax.nl.java.option.additional` to modify Java VM parameters.

The following Java VM parameter changes should be considered:

- Increase the heap size (`-Xmx`) of the Enterprise Manager if you have more than ~10 agents.
- Enter the absolute path to a Java 8 VM if you want to use a Java VM that is not bundled with the installer. In particular, you have to do this in two cases:

- Enter the path of a separately installed 64 bit Java 8 VM for platforms on which by default only a 32 bit VM is provided:
  - Solaris on SPARC
- Enter the path of a separately installed Java 8 VM for platforms where you used the platform independent installer.
- Set the Java VM parameter `-Djava.awt.headless=true` for all platforms. Otherwise, the Enterprise Manager will need an X server, i.e., the `DISPLAY` environment variable must point to a valid X Windows server.
- More details:
  - <http://wiki.scn.sap.com/wiki/display/TechOps/Introscope+Troubleshooting#IntroscopeTroubleshooting-RecommendedJavaVMparametersforEnterpriseManager>.

## Install the SAP Management Modules

Extract the file `WILYISM*.zip` in the home directory of the Enterprise Manager installation, e.g., `/usr/sap/ccms/apmintroscope`.

As a result you will find one or more `.jar` files in the subdirectory `config/modules`, some `.js` files in the subdirectory `scripts`, and some other files distributed over the Enterprise Manager installation.

The newly installed management modules only become active after the Enterprise Manager is (re-)started. For Windows installations the Enterprise Manager is typically automatically launched as Windows Service. This means you will have to restart the Windows Service for the Enterprise Manager.

**Note:** Please read SAP Note [1579474](#) regarding Management Modules.

## Launch Enterprise Manager as Windows Service

To launch the Enterprise Manager automatically at system restart, it is registered as Windows service (on Unix you should run it as background process). To check, perform the following:

1. Open the Services Control Panel (Start Menu → Control Panel → Administrative Tools → Services) and check that the service "Introscope Enterprise Manager" has been created.
2. Start the service if it is not yet running.

## Running the Enterprise Manager on UNIX

On Unix platforms a shell script is provided to start and stop the Introscope Enterprise Manager.

Go to the subdirectory `bin` of the Enterprise Manager installation and issue the following command to launch the Enterprise Manager. Make sure to use the correct user account when launching the EM:

```
./EMCtrl.sh start
```

The shell script launches the Enterprise Manager in background mode (via nohup). It is not necessary to explicitly use nohup for EMCtrl.sh.

Consider launching the Enterprise Manager automatically at system startup. Typically, you will have to hook it into one of the operating system specific init scripts.

### ➤ Check that Introscope is Running Properly

After you have launched the Enterprise Manager, check that it is running properly.

1. Locate the Enterprise Manager log at  
`<EM_Home>/logs/IntroscopeEnterpriseManager.log`.
2. Check that the Enterprise Manager has started. Look for the following line in the logfile:

```
03/28/16 10:54:36 AM CET [INFO] [Manager] Introscope Enterprise  
Manager started.
```

3. Check the TCP port that Introscope Enterprise Manager is using for agent connections. Look for lines similar to the following in the logfile:

```
[INFO] [Manager.PostOfficeHub] Server listening for incoming default  
socket connections on port 6001
```

In this case, the Enterprise Manager agent port is 6001 (default value).

# 4 Introscope-Enabling SAP J2EE Systems

After you have installed the Enterprise Manager, you are ready to install and configure the Introscope agent and Introscope-enable your Java applications.

## Note:

- **The Introscope Java Agent 10.1 does NOT support applications running on Java 1.4 and Java 1.5. This means you should use Java Agent 10.1 only for Netweaver starting of version 7.2. For older Netweaver versions on Java 1.4 stick to the Java Agent 8. Java Agent 9.7 would be preferred for Java 1.5. You can deploy agent 8 and 10.1 versions to Solution Manager. The managed system setup then chooses automatically which agent to use.**
- **The recommended procedure to install and customize the Introscope Java Agent is to use the setup wizard provided in Solution Manager. If you do not have Solution Manager available follow the manual procedure described in the second section of this chapter below.**

## Automated Installation of the Introscope Agent via Solution Manager

The Solution Manager provides an application that performs the setup of the Introscope byte code agent for Java automatically. This section explains the steps to run the setup. Before you can run the Introscope agent setup, the setup wizard for the managed system must have been executed.

1. Enable Maintenance Mode on Solution Manager.
2. Deploy ISAGENTJ5\*.SCA which is the Introscope Java Agent 10.1 to Solution Manager. You may need to deploy also ISAGENT\*.SCA which is Introscope Java Agent 8.
3. Disable Maintenance Mode on Solution Manager.
4. Launch the Introscope Setup application: SAP Solution Manager Configuration → Managed Systems Configuration → Finalize Configuration → Automatic Activity "Byte Code Adapter Installation" → "Open Java URL" (only available in edit mode). Your screen will look similar to the image below:



**Introscope Agent Settings**

System:

Enterprise Manager: DEWDFGLP00804.wdf.sap.corp running on port 6008, version 10100

Selected	Host	Instance	DiagAgent	IS Agent Profile	IS Agent Name	IS Agent Version	IS Agent State	Online	License
<input type="checkbox"/>	Idcifj	J00		FLJ_IntroscopeAgent.profile	FLJ_J00_{elemName}	ISAGENT.10.1.0.15-2016-06-10	Running		<input type="checkbox"/>

**J2EE Node Information Details**

**Introscope Full License Support**

If you have a full Introscope license, specify the "Unified Loader" file to unlock the agent. It must match instrumentation version:ISAGENT.10.1.0.15-2016-02-24

File:

**Introscope Agent Setup**

The buttons below enable you to change the Introscope Agent settings. Ensure that you select the relevant J2EE nodes first.

**Last Operation Results**

Operation	Message
Information retrieval from FLJ~JAVA	Operation succeeded
Get Introscope Agent settings: Idcifj - J00	Operation succeeded

5. Check the *Enterprise Manager Settings* at the top of the screen. These are the connection parameters that will be used by the agent to connect to the Enterprise Manager.
6. In the pane *Introscope Agent Settings*, select the system that you want to instrument with the agent. Check "select all" and click "Retrieve Current Settings". This will display the current status of the agent setup.
7. To initially setup or update the agents, click *Configure Introscope Agent Setup ...*. This will open the setup dialog as shown below. The agent version is pre-selected and you can choose the profile.
8. Next, check the desired instrumentation with clicking on button "Autoprobe Directives". Solution Manager flags the instrumentation files according to the available software on the managed system.  
NOTE: What you see here is NOT the current effective instrumentation but the proposed instrumentation that is applied with the setup run.
9. Finally, hit "Apply" to perform the necessary changes in the agent configuration. Agent config files will be adapted and the Java VM parameters will be set as required for the managed system.

10. For Netweaver 7.1: You may see a dialog asking to manually set the JVM parameters via the ConfigTool. Use the Configtool to set the parameters as described.  
For Netweaver versions other than 7.1, this dialog should not show up.
11. If the setup was successful, restart the managed system at your convenience, e.g. in the next maintenance window. After the restart, the agent will be active and should show up in the Introscope UIs.

**Introscope Agent Setup**

Select the Introscope Agent version and profile that you want to apply to the selected J2EE nodes.

Instrumentation Version: ISAGENT.10.1.0.15-2016-06-10

Instrumentation Profile: IntroscopeAgent.profile

**Autoprobe Directives**

**Autoprobe Directives Selection**

Optional autoprobe directives may also be selected.

Selected	Directive	Comment	Delete	Download
<input checked="" type="checkbox"/>	sap_typical.jar	Main instrumentation set for SAP Netweaver. Includes support for generic Netweaver functionality, like database, JCO, Web Services.		
<input type="checkbox"/>	sap_ep.jar	Portal specific instrumentation.		
<input type="checkbox"/>	sap_ep_iviews.jar	Portal instrumentation: One node per iView - should be preferred for installations with many roles or when collaboration rooms are used. Requires sap_ep.jar		
<input type="checkbox"/>	sap_ep_iviews_rolename.jar	Portal instrumentation: One node per iView/rolename combination - may lead to a high number of metrics for portals with a lot of content. Requires sap_ep.jar		
<input type="checkbox"/>	sap_xi_typical.jar	Default and mandatory instrumentation file for XI.		
<input type="checkbox"/>	sap_xi_full.jar	Extended instrumentation for XI. Some of these metrics might have a performance impact.		
<input type="checkbox"/>	sap_xi_adapters.jar	Extended instrumentation for XI adapters		
<input type="checkbox"/>	sap_bo_enterprise.jar	SAP Business Objects Enterprise instrumentation 3.x.		
<input type="checkbox"/>	sap_boe_webapp.jar	SAP Business Objects Enterprise Web Application instrumentation 4.0.		
<input checked="" type="checkbox"/>	sap_sapvm.jar	SAP JVM and Netweaver 7.1 specific instrumentation. Only activate this if SAP JVM is actually used.		
<input checked="" type="checkbox"/>	sap_smd.jar	Solution Manager Diagnostics instrumentation for self-monitoring.		
<input type="checkbox"/>	sap_duet.jar	SAP Duet specific instrumentation		
<input type="checkbox"/>	sap_mdm.jar	Additional SAP MasterDataManagement Java API instrumentation to measure performance of outgoing calls to MDM Server. Enable if the SAP J2EE Engine performs calls to MDM Server.		
<input type="checkbox"/>	sap_compliance.jar	SAP Compliance (SAP GRC, SAP EC, SAP REACH, ...)		
<input type="checkbox"/>	sap_epm.jar	SAP EPM (SAP SSM, ...)		
<input type="checkbox"/>	sap_retail.jar	SAP Retail (SAP POS, SAP Triversity...)		
<input type="checkbox"/>	sap_srm_crm.jar	SAP SRM & SAP CRM (SAP Convergent Charging, SAG Frictionless e-Commerce, ...)		
<input type="checkbox"/>	sap_manufacturing.jar	SAP Manufacturing (SAP SAP Manufacturing Execution, SAP xMII, ...)		
<input type="checkbox"/>	sap_partner.jar	Additional instrumentation for SAP partner products (see SAP Note 1579474)		

## Manual Installation of the Introscope Agent 10.1

This section describes the **manual** configuration of Introscope bytecode agent for Java. These steps are only required if the automated installation, described in the previous section, could not be applied. The following instructions are valid for Netweaver versions 7.1 and higher.

The instructions in the following section work on both Windows and Unix systems, but the examples show Windows convention (backslashes in the paths).

**Note:** Always use forward slashes (/) as path separators for Introscope config files and for JVM parameters on all platforms including Windows. This avoids the need to escape the Windows path separator backslash (\) by doubling it.

The following steps are required to install and configure the Introscope Agent to report information to the Enterprise Manager:

1. Extract the Introscope Agent files
2. Configure the Introscope Agent
3. Introscope-enable the application code by setting Java VM parameters

### Extract the Introscope Agent

To install the Introscope Agent:

1. Extract the agent installer file `ISAGNTJ5STD*.zip` into the Netweaver CCMS directory, usually: `<drive>:\usr\sap\ccms`.
2. Confirm the Agent was installed correctly by checking for the existence of the `wily` directory in the `<drive>:\usr\sap\ccms` directory.

### Configuring Introscope Agent Settings

The following section details how to configure the Introscope Agent. The Agent configuration settings are found by default in the file `<drive>:\usr\sap\ccms\wily\core\config\IntroscopeAgent.profile`. This guide will refer to the file `IntroscopeAgent.profile` as the **Agent profile**. Note that this file contains SAP-specific customization. Furthermore, depending on the monitored solution you need to choose different profiles:

#### *Choose the Right Agent Profile*

SAP provides agent profiles for different use cases. For all applications running on the SAP Netweaver use `IntroscopeAgent.profile`. Other profiles for IBM WebSphere Application Servers, Oracle WebLogic Application Servers and Tomcat are available. All profiles adhere to the name pattern `IntroscopeAgent*.profile`.

File Name	Applications Covered
IntroscopeAgent.profile	SAP Netweaver (Java stack)
IntroscopeAgent_tomcat.profile	Tomcat 4.1.x and higher
IntroscopeAgent_websphere.profile	IBM WebSphere Application Server 6 and 7
IntroscopeAgent_weblogic.profile	Oracle WebLogic Server 9.0.x, 9.2, 10.x, 10.3.x, 12c
IntroscopeAgent_smp.profile	SAP Mobile Platform
IntroscopeAgent_smdagent.profile	SAP Diagnostics Agent
IntroscopeAgent_hilo.profile	SAP Visual Intelligence
IntroscopeAgent_sapcm.profile	SAP Partner Product Convergent Mediation by DigitalRoute
IntroscopeAgent_hadoop.profile	SAP Hadoop

You will need to configure the host name or IP address and port of the machine where the Enterprise Manager resides.

To configure the Introscope Agent:

1. Open the Agent profile, e.g. file  
`<drive>:\usr\sap\ccms\wily\core\config\IntroscopeAgent.profile`

2. Locate the property,  
`introscope.agent.enterprisemanager.transport.tcp.host.DEFAULT`

Enter either the host name or IP address of the machine where Enterprise Manager resides.

3. Locate the property,  
`introscope.agent.enterprisemanager.transport.tcp.port.DEFAULT`

The value should be the port on which the Enterprise Manager listens for Agent connections.

Default setting is 6001.

4. Save changes to the Agent profile.

### ***Choose the Right Instrumentation Packages***

The instrumentation is split into several JAR packages. You can customize the list of packages by modifying the property `introscope.autoprobe.directivesFile`. By default, the following packages are active:

introscope.autoprobe.directivesFile=sap\_typical.jar,sap\_ep.jar,sap\_ep\_iview  
s.jar,sap\_xi\_typical.jar

This instrumentation covers standard SAP Netweaver (e.g. Servlets, database/JDBC, JCO/RFC, web services, user management, etc.), Portal, and PI functionality. There are additional instrumentation sections which are not active by default. You can add entries to the property, separated by comma:

sap_typical.jar	Main instrumentation set for SAP Netweaver. Includes support for generic Netweaver functionality, like database, JCO, Web Services. <b>This jar is always mandatory.</b>
sap_sapvm.jar	For SAP Netweaver 7.10 and higher with JDK5 or higher. Specific instrumentation, e.g. memory allocation. <b>Do not activate for Java 1.4!</b>
sap_bo_enterprise.jar	SAP Business Objects Enterprise 3.x instrumentation
sap_boe_webapp.jar	SAP Business Objects Enterprise 4.x instrumentation
sap_ep.jar	SAP Portal specific instrumentation
sap_ep_iviews.jar	SAP Portal instrumentation: One node per iView - should be preferred for installations with many roles or when collaboration rooms are used. Requires sap_ep.jar
sap_ep_iviews_rolename.jar	Re-activate metrics for each iView/rolename combination. <b>Activate only one of these 2: sap_ep_iviews.jar or sap_ep_iviews_rolename.jar!</b>
sap_duet.jar	SAP Duet specific instrumentation
sap_hybris.jar	Instrumentation for Hybris.
sap_smp.jar	Instrumentation for SAP Mobile Platform.
sap_omnichannelbanking.jar	SMP instrumentation extension for Omni Channel Banking
sap_xi_typical.jar	Default and mandatory instrumentation file for PI
sap_xi_adapters.jar	Extended instrumentation for PI adapters.
sap_xi_passport.jar	Extended PI instrumentation to detect passport propagation.
sap_xi_full.jar	Extended instrumentation for PI. Some of these metrics might have a

	performance impact
sap_smd.jar	Solution Manager self-monitoring
sap_mdm.jar	SAP Master Data Management
sap_compliance.jar	SAP Compliance (SAP GRC, SAP EC, SAP REACH, ...)
sap_epm.jar	SAP EPM (SAP SSM, ...) instrumentation
sap_retail.jar	SAP Retail (SAP POS, SAP Triversity...)
sap_hilo.jar	SAP Visual Intelligence instrumentation
sap_srm_crm.jar	SAP SRM & SAP CRM (SAP Convergent Charging, SAG Frictionless e-Commerce, ...)
sap_manufacturing.jar	SAP Manufacturing (SAP SAP Manufacturing Execution, SAP xMII, ...)
Sap_hadoop.jar	SAP Hadoop instrumentation
sap_partner.jar	Instrumentation for SAP partner products. See SAP Note 1852015.
sap_tomcat_typical.jar	Default and mandatory instrumentation file for Apache Tomcat
sap_tomcat_full.jar	Extended instrumentation for Apache Tomcat
sap_websphere_typical.jar	Default and mandatory instrumentation file for IBM WebSphere Application Servers
sap_websphere_full.jar	Extended instrumentation for IBM WebSphere Application Servers
sap_weblogic_typical.jar	Default and mandatory instrumentation file for Oracle WebLogic Server
sap_cem_integration.jar	Instrumentation for integration with CA product CEM (only for SED)

### Check the Agent Log File Location

By default, the Introscope agents write log files to the subdirectory `logs` of the agent installation (e.g. `<drive>:\usr\sap\ccms\wily\logs`). On Unix systems, make sure that the monitored systems (user `sidadm`) have read and write access to this directory (write permission for group `sapsys`). As an alternative, you can change the properties `introscope.autoprobe.logfile` and `log4j.appender.logfile.File` to some other directories where the monitored systems have write access.

### Activating the Agent: Set Java VM Parameters

You have to add Java VM options to enable the agent. Typically, you will only want to activate the agent on the SAP J2EE *server* nodes, not on dispatchers.

Note that for class path and directory paths, you can use forward slashes (/) on all platforms, even on Windows. For SAP J2EE 6.40, you even cannot use backslash (\) on Windows. Furthermore, note the difference between Unix and Windows in the class path: The entries are separated by `;` on Windows, but by `:` on Unix.

## Agent Name

You should assign a unique name to each SAP J2EE node that is Introscope-enabled. This so-called agent name is assigned by an additional Java VM option (referred to as `<AgentName>` below). SAP suggests the following naming convention for the agent name. This is also generated by the automated setup via Solution Manager Diagnostics:

`<AgentName>=SID_Instance_Nodename`

Where the placeholders mean the following:

Placeholder	Explanation	Examples
SID	SystemID	EPP, EPQ, EPD
Instance	Name of the instance	JC00, J01, DVEBMGS00
Nodename	J2EE node name / directory	server0, server1, ...

Example for AgentName: EPP\_J01\_server0

**Note:** It is not necessary to integrate the host name into the agent name, since the host name is assigned automatically to the agent.

Using a unique naming convention for all agent installations helps to group agents that belong to the same installation together.

## Set Java VM Parameters for Netweaver versions based on the Java 5 VM or higher (Netweaver 7.10 and up, Netweaver CE)

For Netweaver 7.1 and up there are no node-specific Java VM parameters. For this reason, the *nodename* part of the agent name must be calculated dynamically by using the variable `$_[elem/Name]`. At run time, this will be filled in with the node name. In the example below, variables are also used for the SID and the instance name. They will be replaced automatically if you use the string exactly as written below.

Example: Enter `$_{SYSTEM_NAME}_$_{INSTANCE_NAME}_$_[elem/Name]` in the Configtool. For the first node, it will be replaced with e.g. EPP\_JC00\_server0.

1. Run the SAP J2EE Configtool.
2. Navigate to **Instance/VM Parameters/System** and enter the following new parameters (Windows example):



Name	Value
com.wily.introscope.agent.agentName	\${SYSTEM_NAME} \${INSTANCE_NAME} \${elem/Name}
com.wily.introscope.agentProfile	<drive>:/usr/sap/ccms/wily/core/config/IntroscopeAgent.profile

3. Navigate to **Instance/VM Parameters/Additional** and enter the following new java parameter (Windows example):

`-javaagent:<drive>:/usr/sap/ccms/wily/Agent.jar`

Note that for Netweaver on Windows, the slashes for these java parameters must go forwards.

Unix example:

**Instance/VM Parameters/System:**

Name	Value
com.wily.introscope.agent.agentName	\${SYSTEM_NAME} \${INSTANCE_NAME} \${elem/Name}
com.wily.introscope.agentProfile	/usr/sap/ccms/wily/core/config/IntroscopeAgent.profile

**Instance/VM Parameters/Additional:**

Name
-javaagent:/usr/sap/ccms/wily/Agent.jar

4. Click the disk button to save.
5. Repeat steps 2 - 4 for each instance.
6. Restart the SAP instance.
7. To verify that Config tool changes were made, open the file:

`<drive>:\usr\sap\<SID>\<instance>\j2ee\cluster\instance.properties`

8. Check for a line beginning with `ID<server_id>.JavaParameters`, and see if it contains the lines you entered in the step above.

### **Set Java VM Parameters for Tomcat**

The procedure to add JVM options for Tomcat Server to enable Introscope is described in SAP Note [1438005](#).

### **Set Java VM Parameters for IBM WebSphere Application Server**

The procedure to add JVM options for IBM WebSphere Application Server to enable Introscope is described in SAP Note [1418638](#).

## Checking that the Agent is Running

1. Check that the SAP J2EE nodes start up correctly after the restart and that the J2EE applications are available as before.
2. Search for an Agent log file in the `logs` subdirectory of the Introscope agent directory, e.g., in the directory `<drive>:\usr\sap\ccms\wily\logs`. The file will be named `IntroscopeAgent.<AgentName>.log`, where `<AgentName>` is the name that you assigned via the JVM parameter above. Open the text file with a text editor and check the last lines. You will probably find warnings that the connection to the Enterprise Manager failed – since you have not yet started the Enterprise Manager.

The last few lines of the agent log file should similar to the following:

```
16/02/06 01:41:46 PM CET [INFO] [IntroscopeAgent.IsengardServerConnectionManager]
Connected Agent to the Introscope Enterprise Manager at
emhost:6001,com.wily.isengard.postofficehub.link.net.DefaultSocketFactory. Host =
"emhost", Process = "SAP Netweaver", Agent Name = "EPP_JC00_server0".
```

## Check that the Agent is Running

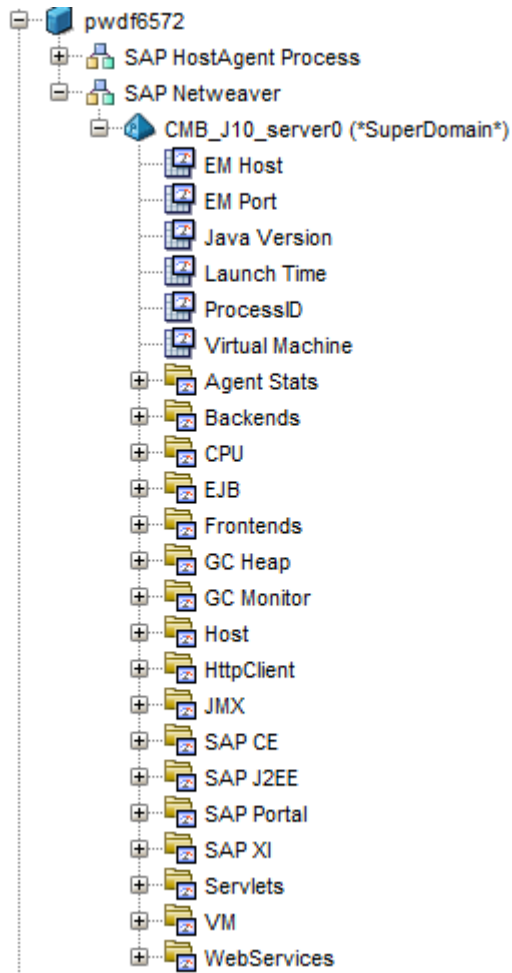
Launch the Introscope Workstation to check if the data provided by the agent arrives at the Enterprise Manager. For this purpose, launch the Workstation in a browser with e.g. <http://emhost:8081/workstation>

You should get a login prompt as shown below. Use login credentials from the table in Chapter 1 to authenticate. As an alternative, you can also launch a Workstation that you explicitly installed or WebView (e.g. <http://emhost:8081/webview>).

Open the *Investigator* (*Workstation* menu → *New Investigator*) to display a tree of all connected hosts and agents. Click the plus signs to open subtrees. For each connected agent, you should find a subtree *\*SuperDomain\** → *host* → *SAP Netweaver* → *AgentName* in the Investigator that looks similar to the screenshot below. Depending on the type of the managed system, some tree nodes may be missing.

Please check the following:

- If your managed system is running SAP J2EE, you should at least have tree node SAP J2EE.
- Some tree nodes will only appear after first use. For example, Servlets will only appear after the first servlet has been executed.



# 5 Workstation Installation

If you decide to explicitly install the Introscope Workstation on Client PCs, proceed as described in this section. Note that the workstation can always be downloaded on demand from the Enterprise Manager using Java WebStart, as described in Chapter 1.

Installers are available for the following platforms:

- Windows 32bit
- Windows x86\_64
- Linux 32bit
- Linux x86\_64

The installation is described here for Windows. If you want to install it on Linux, remember to set the DISPLAY before launching the installer.

1. Extract the downloaded Workstation installer from file `WILYWORK*.zip`.
2. Copy the two files that you downloaded from CA's FTP server to the directory which contains the installer (see Chapter 1, **Download Third-Party External Component Package from CA**). These are the same files that were used for the Enterprise Manager installation. The following files should be copied:
  - a. `eula.txt`
  - b. The `osgiPackages` archive appropriate for your system:
    - i. `osgiPackages.v10.1.0.15.windows.zip`, for a Windows system
    - ii. `osgiPackages.v10.1.0.15.unix.tar`, for a LINUX system
3. Launch the installer. If you keep the file `installer.properties` in the directory where you launch the installer, the installation will proceed silently. Alternatively, remove the file `installer.properties`. Then you will be guided through the installation by a wizard.
  - a. (Silent installation) By default, the installation will be placed in the folder `c:\usr\sap\ccms\apmintroscope`. If desired, pass a different target directory as a command line parameter:
 

```
introscopeWorkstation10.1.0.15windowsSAP.exe
-DUSER_INSTALL_DIR=d:/usr/sap/some/dir
```
  - b. (installation with wizard) Select a target installation directory of your choice. Keep *No* for *Configure VM Settings* and enter the host name of the Enterprise Manager in the field *Workstation Default Host*. Finally, click *Install* to launch the installation.

4. Launch the Workstation:
  - a. via the Start Menu: CA APM → Introscope 10.1.0.15 → Introscope Workstation
  - b. by directly starting the file Introscope Workstation.exe in the installation directory.

# 6 Additional Installation Options

This chapter covers additional customizing steps of the Introscope Installation:

- [Changing the agent port from 6001 to other values](#)
- [Uninstalling Introscope](#)
- [Setting up domains](#)
- [User Management](#)
- [Enable Single Sign On from Solution Manager](#)
- [Enterprise Manager Cluster Setup](#)

## ➤ Change the Agent Port

The Enterprise Manager by default listens on TCP port 6001 for agent connections. You can change this value to any desired port:

1. Open the file, `<EM_Home>/config/IntroscopeEnterpriseManager.properties`.
2. Change the value of property `introscope.enterprisemanager.port.channell` to the desired port.
3. Save changes and close the file.
4. Remember to change the property in the `IntroscopeAgent.profile` to the same port.

## ➤ Uninstalling Introscope

### Uninstalling Introscope Agents

1. Remove the Java VM options for Introscope from the J2EE nodes that you instrumented before. The following options should be removed:
  - a. `-javaagent:<some path>/wily/Agent.jar`
  - b. `-Dcom.wily.introscope.agentProfile=<some path>/wily/core/config/IntroscopeAgent.profile`
  - c. `-Dcom.wily.introscope.agent.agentName=<AgentName>`
2. Restart the affected J2EE instances for the changes to become effective.
3. Delete the directory `<some path>/wily` (or wherever you put the agent files).

## Uninstalling the Enterprise Manager

1. Windows only: Call the batch file EMCtrl64.bat to remove the Windows Service
2. Windows only: Call the wizard to uninstall Introscope: Start → Control Panel → Add or Remove Programs; Select Introscope and click change/remove to launch the Wizard. Click Next to continue the uninstall.
3. Remove any remaining files from /usr/sap/ccms/apmintroscope.

### ➤ Setting up Introscope Domains

Introscope agents can be organized into so-called domains. You can use this feature to group agents which are correlated, e.g. belonging to the same domain.

Domains are defined in the Enterprise Manager by the configuration file `<EM_HOME>/config/domains.xml`. By default, there is only one domain, the `SuperDomain`, which contains all agents. You can pick agents for a domain based on the host name and on the agent name. Too many domains may, however, impact the Enterprise Manager performance since the management modules are replicated for each domain. For this reason, make sure you do not have more than 10 domains.

Example: Assume you want to create two domains EPP and EPQ for the productive and the QA Enterprise Portal. Your agent names contain the System id (also EPQ, EPP).

Step 1: Adapt the domains.xml file on the Enterprise Manager:

```
<?xml version="1.0" encoding="UTF-8"?>
<domains xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:
noNamespaceSchemaLocation="domains0.2.xsd" version="0.2">
  <domain name="EPP" description="Productive Enterprise Portal">
    <agent mapping=".*EPP.*"/>
    <grant user="Admin" permission="read"/>
  </domain>
  <domain name="EPQ" description="Enterprise Portal QA System">
    <agent mapping=".*EPQ.*"/>
    <grant user="Admin" permission="read"/>
    <grant user="Admin" permission="run_tracer"/>
  </domain>
  <SuperDomain>
    <agent mapping="(.*)" />
    <grant user="Admin" permission="read"/>
    <grant user="Admin" permission="run_tracer"/>

    <grant user="Guest" permission="read"/>
    <grant user="sapsupport" permission="full"/>
  </SuperDomain>
</domains>
```

Step 2: Replicate the management modules:

Step 2a: In the directory `<EM_HOME>/config/modules`, create one subdirectory for each domain. The folder name must be the domain name (in the example, folders EPP, EPQ).

Step 2b: copy all management modules from `<EM_HOME>/config/modules` to each subdirectory.

Step 3: Restart the Enterprise Manager to activate the changes.

Step 4: Check the Investigator in Workstation or WebView to see if the domains appear and if the agents are assigned to the right domain.

Note that the SuperDomain must always be the last entry in the domains file.

## ➤ User Management

User accounts must be maintained in the file `users.xml`, located in the subdirectory `<EM_HOME>/config/` of the Enterprise Manager. Permissions are controlled by the file `domains.xml` in the same directory. To create a new user `X` with password `Y`, proceed as follows:

1. Generate the SHA-encoded password by the script `tools/SHA2Encoder`:

```
SHA2Encoder Y
```

```
Y:57cec4137b614c87cb4e24a3d03a3e0
```

2. Add a new line to `users.xml` before the final `</users>` line, using the generated password string (the part after ``:``) as password:

```
<user name="X" password="
  abcdef15bcd349db90dfce73e1256e881c4416fc1f2d3a4946418349d9a"
 />
```

3. Add permissions for the user to the Superdomain in the `domains.xml` file:

```
<grant user="X" permission="read" />
<grant user="X" permission="run_tracer" />
<grant user="X" permission="historical_agent_control" />
<grant user="X" permission="live_agent_control" />
```

### Note:

- All XML tags are case-sensitive.
- If there are any syntax or other errors in the `domains.xml` file, the Enterprise Manager does not start

## Available Permissions

### *read*

Users or groups can view all agents and business logic in the domain.

This permission includes tasks such as:

- Viewing Investigator tree (which shows agents in the domain user has access to)



- Viewing dashboards in the Console
- Viewing metric and element data in the Investigator Preview pane, including default Top N Filtered Views for certain resources in the Investigator tree
- Viewing any management module, agent, or element settings
- Viewing alert messages
- Refreshing historical data in a historical Data Viewer, and zoom in and out
- Changing historical date range options for historical Data Viewer
- Showing/Hiding metrics in a graph
- Moving metrics in a Data Viewer to the back or front
- Changing group and user preferences (setting a home dashboard, displaying management module names with dashboard names)

**Note:** Users or groups with read permission are able to see all commands in the Workstation. However, the commands that they do not have access to are disabled.

### *write*

A user or group with write permission can do everything permitted by read permission can, and can also:

- view all agents and business logic in the domain
- create and edit dashboards (Please see SAP Note [2285460](#) about SED.)
- edit all monitoring logic in a domain (Please see SAP Note [2285460](#) about SED.)

### *run\_tracer*

Users or groups can start a Transaction Trace session for an agent.

**Note:** This permission also requires the assignment of read permission.

### *historical\_agent\_control*

Users or groups can mount and unmount agent/s.

**Note:** This permission also requires the assignment of read permission.

### *live\_agent\_control*

Users or groups can shut off reporting for metrics, resources, and agents within a domain

**Note:** This permission also requires the assignment of read permission.

### *dynamic\_instrumentation*

User or group can perform dynamic instrumentation.

For information about dynamic instrumentation, see the Introscope Java Agent Guide or Introscope .NET Agent Guide.

### *thread\_dump*

User or group can see and use the Thread Dumps tab.

For information about using and configuring thread dumps, see the Introscope Workstation Guide and the Introscope Java Agent Guide.

**Note:** This permission must include an underscore "\_" between "thread" and "dump".

### *full*

Users or groups have all possible permissions for the domain.

**Note:** If you do not have a full license for Introscope, you cannot use permission="full" or "write" here! Please see SAP Note [2285460](#) about SED.

## ➤ Enable Single Sign On from Solution Manager

The Enterprise Manager web server can accept single sign on tickets from Solution Manager systems. To enable this feature, the certificates from the ABAP / Java stack of the Solution Manager system have to be copied to the directory <EM\_HOME>/sap/TrustedCerts in the Enterprise Manager. Currently, no automated procedure is available to perform these steps. For jump-in from Solution Manager Diagnostics, only the Java certificate have to be exported.

### Copy the Certificate from the Java Stack

1. Open the Visual Administrator
2. Navigate to Server → Services → Key storage
3. Choose *TicketKeystore* in the Views menu.
4. Choose the *export* button. Please choose the cert format.

### Copy the Certificate from the ABAP Stack

1. Call transaction STRUST
2. Double click the "Own Certificate" in the System PSE part of the screen such that it appears in the Certificate pane.
3. Click export to save the certificate as <hostname>.der.

## Add the Certificates to the Enterprise Manager

Copy the exported certificates to the Enterprise Manager directory `<EM_HOME>/sap/TrustedCerts`. No restart is required. All authenticated users will be mapped to the Introscope user *Admin*.

### ➤ Enterprise Manager Cluster Setup

If the scalability limit of a single Enterprise Manager (clustering mode: **Standalone**) is reached, you have to set up additional EMs. You can either keep each EM isolated and connect it to Solution Manager, or connect multiple EMs to a cluster, appearing virtually as one EM. In this cluster, an additional EM acts as “Manager of Managers” (**MOM**). Only the MOM accepts Workstation and Solution Manager connections, whereas the other EMs in the cluster act as “**Collectors**”. Only collectors accept agent connections. To configure an EM cluster, proceed as follows:

1. Make sure the prerequisites are met:
  - a. Strict clock synchronization between all involved hosts (e.g. via NTP).
  - b. Fast LAN connection between all EMs
2. Configure the collector EMs.  
In `<EM_HOME>/config/IntroscopeEnterpriseManager.properties`, set `introscope.enterprisemanager.clustering.mode=Collector`
3. Configure the MOM.  
In `<EM_HOME>/config/IntroscopeEnterpriseManager.properties`, set `introscope.enterprisemanager.clustering.mode=MOM`

List connection data for all collector EMs, e.g.

```
introscope.enterprisemanager.clustering.login.em1.host=myhost1
introscope.enterprisemanager.clustering.login.em1.port=6001
introscope.enterprisemanager.clustering.login.em1.publickey=internal/server
/EM.public
introscope.enterprisemanager.clustering.login.em2.host=myhost2
introscope.enterprisemanager.clustering.login.em2.port=6001
introscope.enterprisemanager.clustering.login.em2.publickey=internal/server
/EM.public
```

## Available Cluster Modes

**StandAlone:** Enterprise Manager runs in the stand alone mode

**Collector:** Enterprise Manager runs as a Collector

**MOM:** Enterprise Manager runs as a Manager

**CDV:** Enterprise Manager runs as a Cross-Cluster Data Viewer (not supported by Solution Manager)

## Cluster Tuning

After setting up the cluster tuning should be done according to <http://wiki.scn.sap.com/wiki/display/TechOps/Performance+Tuning+for+EM+cluster>.