EXPRESSCLUSTER® X

for Windows SAP NetWeaver

System Configuration Guide

April 17, 2018
1st Edition

Revision History

Edition	Revised Date	Description
1st	Apr 17, 2018	New guide

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Table of Contents

Preface

This document “EXPRESSCLUSTER X for Windows SAP NetWeaver System Configuration Guide” describes how to create and start a cluster for SAP NetWeaver.

Who Should Use This Guide

This Guide is intended for administrators who want to build a cluster system, system engineers who want to provide user support, and maintenance personnel.
This guide introduces software whose operation in an EXPRESSCLUSTER environment has been verified.
The software and setup examples introduced here are for reference only. They are not meant to guarantee the operation of each software product.

How This Guide is organized

This Guide consists of the following two sections.

“EXPRESSCLUSTER X for Windows SAP NetWeaver System Configuration Guide”
“EXPRESSCLUSTER X for Windows SAP NetWeaver Configuration Example”

Conventions

In this guide, **Note**, **Important**, **Related Information** are used as follows:

Note:
Used when the information given is important, but not related to the data loss and damage to the system and machine

Important:
Used when the information given is necessary to avoid the data loss and damage to the system and machine.

Related Information:
Used to describe the location of the information given at the reference destination.

The following conventions are used in this guide.

Convention	Usage	Example
Bold	Indicates graphical objects, such as fields, list boxes, menu selections, buttons, labels, icons, etc.	In **User Name**, type your name. On the **File** menu, click **Open Database**.
Angled bracket within the command line	Indicates that the value specified inside of the angled bracket can be omitted.	`clpstat -s [-h host_name]`
Monospace (`courier`)	Indicates path names, commands, system output (message, prompt, etc.), directory, file names, functions and parameters.	`c:\Program Files\EXPRESSCLUSTER`
Monospace bold (`courier`)	Indicates the value that a user actually enters from a command line.	Enter the following: **`# clpcl -s -a`**
Monospace italic (courier)	Indicates that users should replace italicized part with values that they are actually working with.	`clpstat -s [-h host_name]`

Related documents

EXPRESSCLUSTER X Documentation Set

The EXPRESSCLUSTER X manuals consist of the following four guides. The title and purpose of each guide is described below:

EXPRESSCLUSTER X Getting Started Guide
This guide is intended for all users. The guide covers topics such as product overview, system requirements, and known problems.

EXPRESSCLUSTER X Installation and Configuration Guide
This guide is intended for system engineers and administrators who want to build, operate, and maintain a cluster system. Instructions for designing, installing, and configuring a cluster system with EXPRESSCLUSTER are covered in this guide.

EXPRESSCLUSTER X Reference Guide
This guide is intended for system administrators. The guide covers topics such as how to operate EXPRESSCLUSTER, function of each module, maintenance-related information, and troubleshooting. The guide is supplement to the Installation and Configuration Guide.

EXPRESSCLUSTER X Integrated WebManager Administrator's Guide
This guide is intended for system administrators who manage cluster systems using EXPRESSCLUSTER with Integrated WebManager, and also intended for system engineers who introduce Integrated WebManager. This guide describes detailed issues necessary for introducing Integrated WebManager in the actual procedures.

SAP NetWeaver documents

For details of SAP NetWeaver please refer to the official SAP documentation available at

http://service.sap.com/installnw74/
http://service.sap.com/installnw75/

Make sure to check the "Master Guide" and the "Installation Guide" for NetWeaver according to the database you are installing on.

SAP NOTE

```
#1680045: Release Note for Software Provisioning Manager 1.0
#1710950: Inst. SAP Systems Based on NW 7.1 and higher: Windows
#0066971: Supported SAP GUI platforms
#1732161: SAP Systems on Windows Server 2012 (R2)
#0019466: Downloading SAP kernel patches
#0174911: Determining the hardware key (customer key)
#0181543: License key for high availability environment
#0870871: License key installation
#1031096: Installing Package SAPHOSTAGENT
#1788704: sapstartsrv registration in $(DIR_GLOBAL)
#1841837: Support details for NEC EXPRESSCLUSTER Support on SAP NetWeaver
Systems
#2182373: NEC EXPRESSCLUSTER X: Rolling Kernel Switch in HA environments
#2109662: Windows returns wrong IP address as source IP
#2384179: SAP Systems on Windows Server 2016
```

Note:
Related documents and URL in this guide are subject to change without notice.

Terminology in this guide

Provides information of terminology used in this guide.

Terminology	Description
This product	EXPRESSCLUSTER X for Windows SAP NetWeaver
Configuration Guide	EXPRESSCLUSTER X for Windows SAP NetWeaver System Configuration Guide
Configuration Example	EXPRESSCLUSTER X for Windows SAP NetWeaver Configuration Example
Connecter for SAP	The connecter which links with SAP included in this product.
SAP NW	SAP NetWeaver
ASCS	ABAP SAP Central Services Instance
ERS	Enqueue Replication Server Instance
PAS	Primary Application Server Instance
AAS	Additional Application Server Instance
DA	Diagnostics Agent
Exclusive	Failover group for exclusive control of ASCS/ERS instance

Section I Overview of the cluster system

Chapter 1 Overview of SAP NW Cluster

1.1. Functional Overview

A cluster with the following configuration can be built by combining SAP NW and EXPRESSCLUSTER.

SAP NW cluster configuration using EXPRESSCLUSTER

Set up the following components to EXPRESSCLUSTER as independent active-standby failover groups to perform failover from the active node to the standby node if a failure occurs in order to improve the availability of the SAP NW environment.

- ABAP SAP Central Services Instance (hereafter, ASCS)

Set up the following components as failover groups for a single server configuration in which failover groups operate on each node.

- Enqueue Replication Server Instance (hereafter, ERS)
- Primary Application Server Instance (hereafter, PAS)
- Additional Application Server Instance (hereafter, AAS)
- Diagnostics Agent (hereafter, DA)
- `saphostexec`

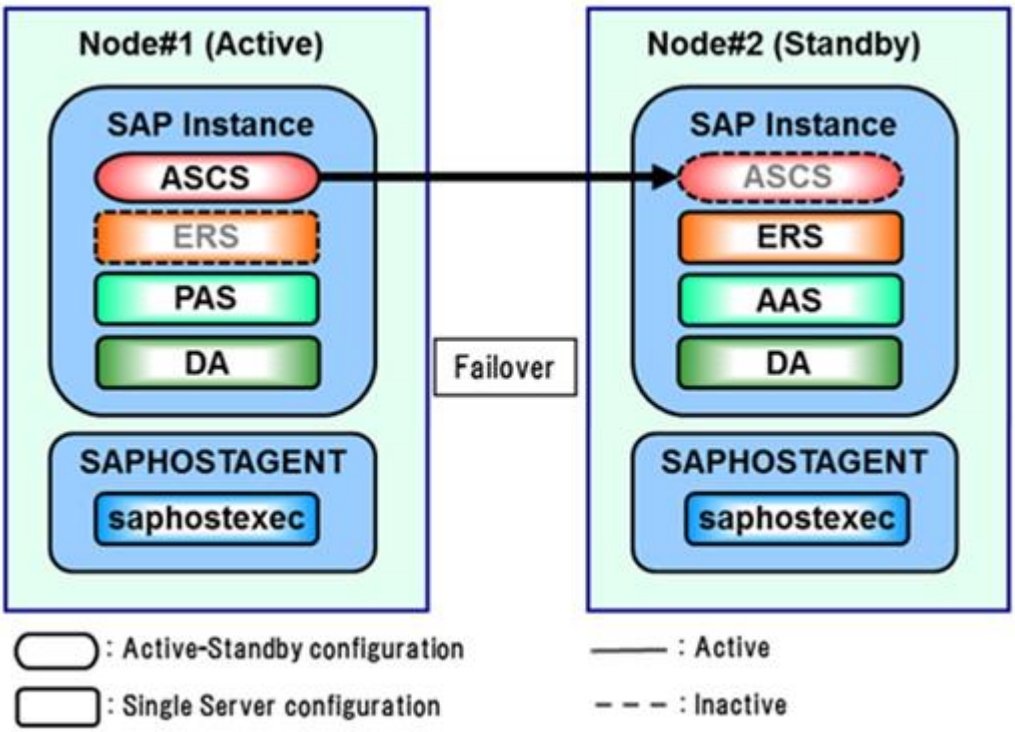


Figure 1.1 Cluster System of SAP NW

Dependency between failover groups

The SAP NW components must be started and stopped in a specific order.
With EXPRESSCLUSTER the order in which the SAP NW components are started and stopped is controlled by specifying dependencies between failover groups.

SAP NW monitoring using EXPRESSCLUSTER

In addition to the monitoring function provided by EXPRESSCLUSTER, the SAP NW cluster system uses a monitoring package that supports the SAP system and an SAP NW-specific monitoring command to monitor the SAP NW components for response errors and hang-ups.

Illustration of linkage between SAP NW and EXPRESSCLUSTER

User requests to SAP NW are sent to EXPRESSCLUSTER via the Connecter for SAP (clp_shi_connector). The EXPRESSCLUSTER cluster is operated by SAP NW.

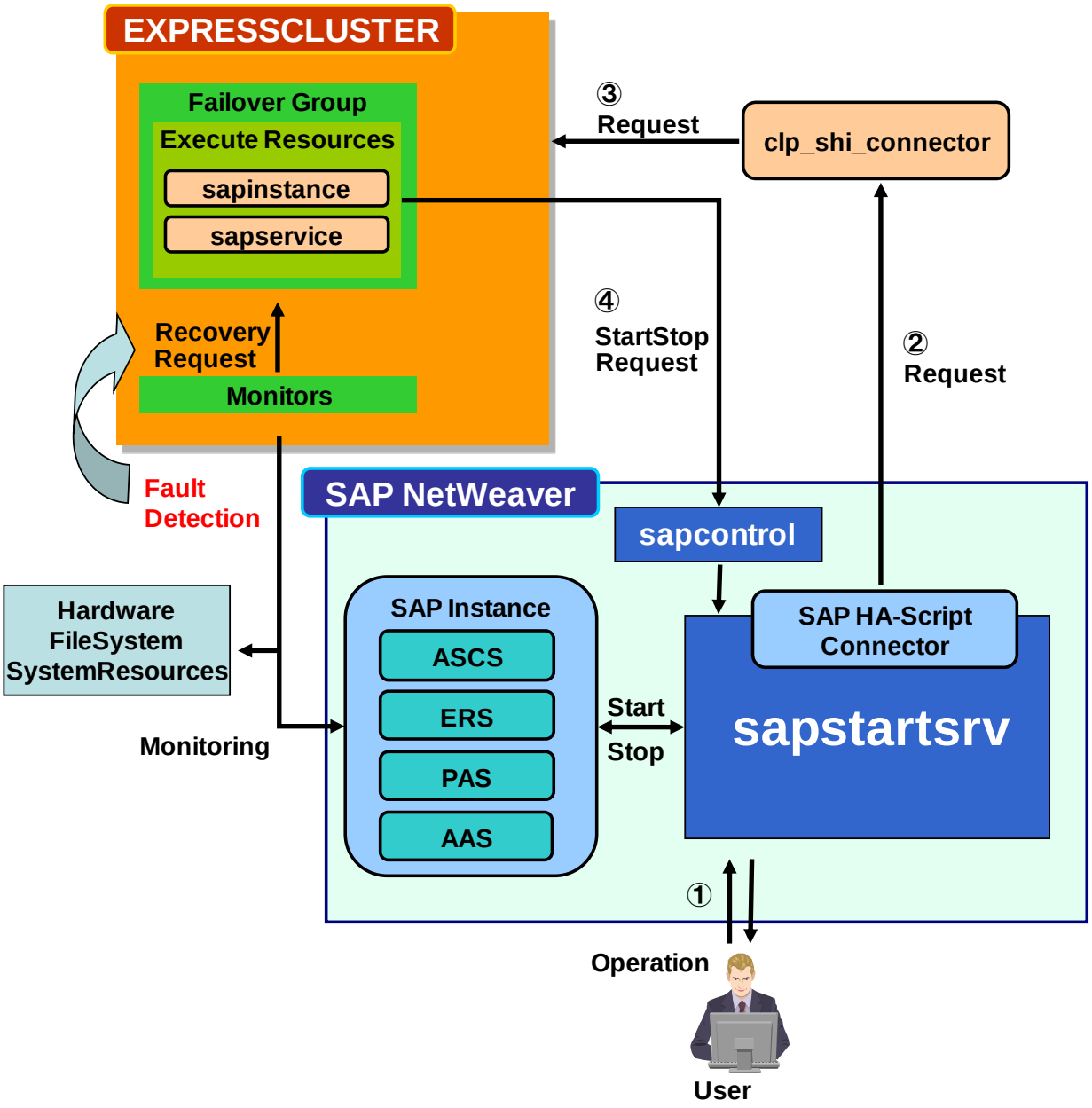


Figure 1.2 Cooperation System

Illustration of exclusive control of ASCS/ERS instance by EXPRESSCLUSTER

EXPRESSCLUSTER handles the exclusive control of ASCS/ERS instance that is required for SAP NW, as follows.

1. Start ASCS instance and ERS instance on different nodes. Start ERS instance on only one node. Start the failover group for exclusive control on all nodes except the node which ERS instance starts.

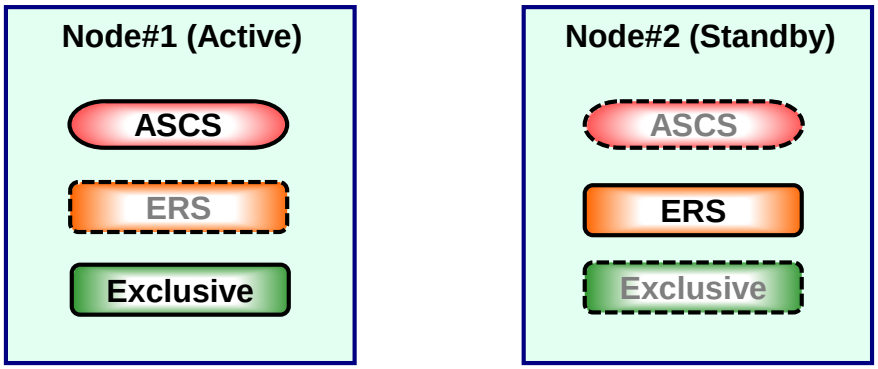


Figure 1.3 Startup Cluster

EXPRESSCLUSTER handles failover process of ASCS instance as follows.

2. Failover ASCS instance to the node where ERS instance starts.

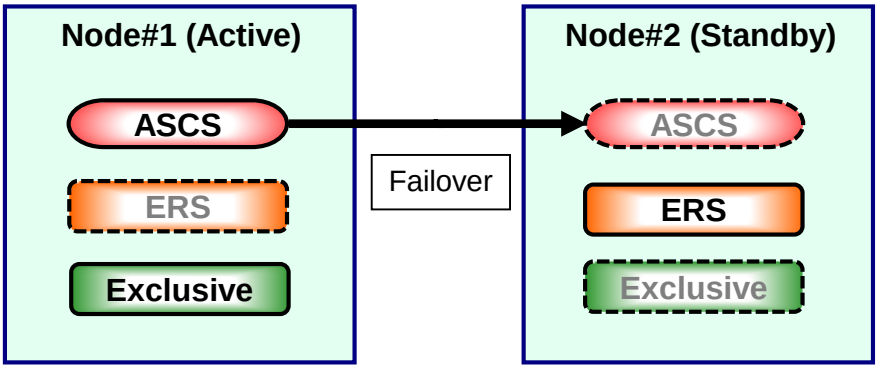


Figure 1.4 Failover ASCS Instance

3. After failover of ASCS instance, ASCS instance terminates ERS instance automatically.

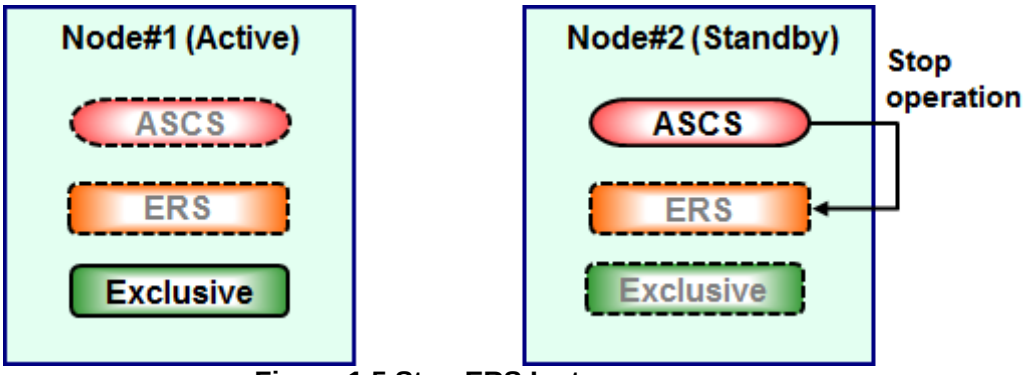


Figure 1.5 Stop ERS Instance

4. Once ERS instance got stopped, then EXPRESSCLUSTER works as follows.
   Start the failover group for exclusive control on the node where ASCS instance was moved to.
   Start ERS instance on the node that ASCS instance is not working.
   Stop the failover group for exclusive control on the node where ERS instance starts.

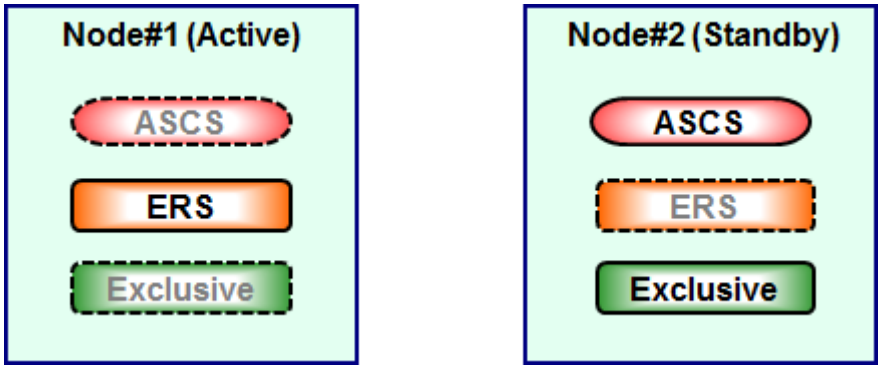


Figure 1.6 Startup ERS Instance on Other Node

The above mechanism of exclusive control of ASCS/ERS instances by EXPRESSCLUSTER works similarly in the case of more than 3 nodes.

Note on manual operation of the ERS instance

1. The ERS instance is used for the replication of the lock table from the ASCS instance. To ensure its redundancy the ERS instance must work on the node where the ASCS instance is not running. The ERS instance should not even manually be launched on the node where the ASCS instance is running. Additionally the ERS instance should not be launched on more than two nodes at same time.

2. The failover group of the ERS instance is not restarted automatically, when the node where the ERS instance was working recovers from a failure. After validating the health of the node a manual restart of the ERS instance failover group is required.

1.2. Operating Environment

This section describes the OS and SAP NW versions on which the operation of the Connector for SAP has been verified.

x86_64

NW Version	EXPRESSCLUSTER Version	OS	Cluster Configuration	Remarks
7.4	11.32 or later	Microsoft Windows Server 2012 Microsoft Windows Server 2012 R2	SAN connection, shared disk type, mirror disk type	
7.5	11.33 or later			
	11.35 or later	Microsoft Windows Server 2016	SAN connection, shared disk type, mirror disk type	
7.5	12.00 or later	Microsoft Windows Server 2012 Microsoft Windows Server 2012 R2 Microsoft Windows Server 2016	SAN connection, shared disk type, mirror disk type	

For the hardware and software requirements of SAP NW, see the SAP NW manuals.

1.3. Building Procedure

The flow of building the SAP NW cluster is shown below.

(1) Installation and basic setup of Windows OS
(2) Setup of disk and network
(3) Installation of EXPRESSCLUSTER
(4) Building of a cluster having CIFS resources and floating IP
(5) Installation of SAP NW
(6) Setup of EXPRESSCLUSTER

1.4. HA Database for SAP NW

Since SAP NW can run on several database technologies, e.g. SAP HANA, SAP MaxDB, IBM DB2, Oracle, Microsoft SQLSERVER, this guide assumes there is already a high available database setup in place. If you need help how create an HA setup for your database scenario please follow related EXPRESSCLUSTER documents on http://www.nec.com/en/global/prod/expresscluster/.
Throughout this document the HA database setup will be referred to as “database”.

Chapter 2 OS Installation and basic settings

For the software that needs to be set up and installed before installing SAP NW on Node#1 and Node#2 please refer to the installation guide of SAP NW:

For SAP NOTE about the operating systems, refer to the following:

Microsoft Windows Server 2012

```
#1730102: Release Restrictions for SAP NetWeaver 7.4
#1732161: SAP Systems on Windows Server 2012 (R2)
#0855498: Installation Prerequisite Checker
#2109662: Windows returns wrong IP address as source IP
```

Microsoft Windows Server 2016

```
#2384179: SAP Systems on Windows Server 2016
```

For examples of settings in this manual refer to the chapter “1.3 An example of setting OS” in the supplied *Configuration Example* document.

Chapter 3 Setting of Shared Disk and Network

This manual describes a configuration, where Node#1 is the active node, Node#2 is the standby node, and a shared disk is used to provide a shared file system.

3.1. Setup of a Shared Disk

Set up the shared disk that can be accessed from each node before installing SAP NW.

In this manual, the shared disk is set up so that the disk resource in EXPRESSCLUSTER is used to switch the disk during failover.

Please refer to “1.1 Shared Disk” in the *Configuration Example* document for further details.

3.2. Network Settings

Assign the floating IPs shown below before installing SAP NW.
In addition, the host names associated with the floating IP addresses for ASCS instances must be able to be resolved.

Prepare the following three floating IP addresses:

- For EXPRESSCLUSTER WebManager
- For ASCS instance

Please refer to “1.2 Floating IP” in the *Configuration Example* document for further details.

When creating a cluster on a cloud environment such as AWS and Microsoft Azure, use the AWS virtual ip resources and Azure DNS resources instead of the Floating IP resources. Note that name resolution must be possible for host names associated with virtual IPs for ASCS instances by the AWS virtual ip resource.

Section II Installation of EXPRESSCLUSTER and SAP NW

- Chapter 4 Configuration of EXPRESSCLUSTER
- Chapter 5 Setup of SAP NW Environment
- Chapter 6 Setup of EXPRESSCLUSTER
- Chapter 7 Connector for SAP

Chapter 4 Configuration of EXPRESSCLUSTER

Please refer to the "Installation and Configuration Guide" for additional information how to build an EXPRESSCLUSTER environment.

Create a cluster environment with two nodes in the order shown below.

Completely install EXPRESSCLUSTER, build a cluster with a CIFS resource and a floating IP, and start EXPRESSCLUSTER before installing SAP NW.

Preparations before installing SAP NW
- Installation of EXPRESSCLUSTER
- License Registration
- Create a cluster
  - Create a cluster
  - Create failover groups
  - Add additional group resources
- Specify dependencies between failover groups

For details of the settings used in this manual please refer to "2.1 An example of setting EXPRESSCLUSTER" in the supplied *Configuration Example* document.

After completing the above processes continue with "Chapter 5 Setup of SAP NW Environment," and then "Chapter 6 Setup of EXPRESSCLUSTER."

4.1. Installation of EXPRESSCLUSTER

Install EXPRESSCLUSTER on Node#1 and Node#2.

For details about the installation of EXPRESSCLUSTER please refer to the following document:

"Installation & Configuration Guide"
- "Installing EXPRESSCLUSTER"

After installing EXPRESSCLUSTER please install the Connector for SAP. Unzip the Connector for SAP media (`clp_shi_connector.zip`), and then copy the following files.

```
<Zip folder>\clp_shi_connector\bin\clp_shi_connector.exe
  → C:\Program Files\EXPRESSCLUSTER\bin\clp_shi_connector.exe
<Zip folder>\clp_shi_connector\bin\clp_shi_rsc.exe
  → C:\Program Files\EXPRESSCLUSTER\bin\clp_shi_rsc.exe
<Zip folder>\clp_shi_connector\etc\clp_shi_connector.conf
  → C:\Program Files\EXPRESSCLUSTER\etc\clp_shi_connector.conf
```

4.2. License Registration

You must register the EXPRESSCLUSTER licenses to use EXPRESSCLUSTER.

For details about how to register the EXPRESSCLUSTER licenses please refer to the following document:

“Installation & Configuration Guide”
- “Registering the license”

This product consists of the following three licenses.

License Product Name
EXPRESSCLUSTER X for Windows
EXPRESSCLUSTER X Database Agent for Windows
EXPRESSCLUSTER X System Resource Agent for Windows

4.3. Create a cluster

Create a cluster from EXPRESSCLUSTER WebManager (hereafter referred to as “WebManager”).

For details about how to create a cluster please refer to the following document:

“Installation & Configuration Guide”
- “Creating the cluster configuration data” - “Creating a cluster”

Set up the HBA to connect the shared disk by using WebManager or Builder.
For details, refer to the following document:

“Reference Guide”
- “Functions of the Builder” - “Servers Properties” - “HBA tab”

4.4. Create failover groups

Create the failover groups to which each node will belong by using WebManager.

For details about how to create a failover group please refer to the following document:

“Installation & Configuration Guide”
- “Creating the cluster configuration data” - “Creating a failover group”

In this section, the following failover groups are created:
- For the ASCS instance
- For the ERS1 instance
- For the ERS2 instance
- For the PAS instance
- For the AAS instance
- For the DA1 instance
- For the DA2 instance
- For hostexec1
- For hostexec2
- For Exclusive1
- For Exclusive2

For Node#1, specify “ ERS1” for ERS, “ DA1” for DA, “ hostexec1” for saphostexec, and “ Exclusive1” for Exclusive.
For Node#2, specify “ ERS2” for ERS, “ DA2” for DA, “ hostexec2” for saphostexec, and “ Exclusive2” for Exclusive.

Note:
The failover group name must not contain any spaces.

The group startup attribute of the ERS instance failover group must be set to manual startup.
The group startup attribute of other failover groups must be set to automatic startup.

The name of the failover group that exclusively controls the ASCS and ERS instances must consist of the failover group name common to all nodes and a number as shown below.
The number following the name must be set in the order of the nodes to which the ERS1 and ERS2 instances have been installed.

<Common failover group name><Number>

Setting examples in this guide:
Exclusive-Group1 (Node#1)
Exclusive-Group2 (Node#2)

Note:
If the name the failover group that exclusively controls the ASCS and ERS instances does not conform to the naming conventions, exclusive control cannot be normally performed.

For details about how to control the ASCS and ERS instances exclusively please refer to “Illustration of exclusive control of ASCS/ERS instance by EXPRESSCLUSTER” in “1.1 Functional Overview.”

4.5. Add additional group resources

Add floating IP resources, disk resources and CIFS resources to the failover groups created in the previous section.

For details about how to add group resources please refer to the following document:

"Reference Guide"
- "Understanding floating IP resources"
- "Understanding disk resources"
- "Understanding CIFS resources"

In this section, the following group resources are added to each failover group.

ASCS instance group	• Add floating IP resources, and then assign the IP address that was set in Section 3.2. • Add disk resources. • Add CIFS resources.

For examples of the settings in this manual please refer to "2.1 An example of setting EXPRESSCLUSTER" in the supplied *Configuration Example* document.

4.6. Specify dependencies between failover groups

Set up the dependency among the failover groups.

The following shows the dependency (startup order) among SAP NW instances.

(1)		(2)		(3)
				ERS
Database	→	ASCS	→	PAS
				AAS

Be sure to stop the instances in reverse order.

Note:
As outlined in chapter 1.4 it is assumed there is a database available. This database is a prerequisite for the above dependencies and needs to be available initially. If this is not the case, then you cannot continue from here.

Note:
It is not necessary to set up the dependency for DA and hostexec.

For details about how to set up the dependency among failover groups in EXPRESSCLUSTER please refer to the following document:

"Reference Guide"
- "Starting and stopping a group resource"
- "Understanding the settings of dependency among group resources (common to group resources)"

Chapter 5 Setup of SAP NW Environment

Terminology used in Chapter 6, Chapter7, and Chapter 8.

Terminology	Description
SID	SAP System ID
DASID	Diagnostics Agent System ID
INO	Instance Number

The installation path and installation procedure for the product files of SAP NW may vary depending on your configuration.

For how to build the SAP NW environment please refer at least to the following document:

Master Guide
"Master Guide for SAP NetWeaver 7.4"
"Master Guide for SAP NetWeaver 7.5"

Installation Guide
The installation guide for each database and OS type supported by SAP NW can be downloaded from the following URL:
http://service.sap.com/installnw74/
http://service.sap.com/installnw75/
Please make sure to review the appropriate guide for environment in detail.

Create the environment for SAP NW in the order shown below.

(1) Preparing the installation (Section 5.1)
(2) Create Operating System Users and Groups (Section 5.2)
(3) Changing the ASCS instance host name registry (Section 5.3)
(4) Installation of ASCS Instance (Node#1) (Section 5.4)
(5) Add sapstartsrv definition (Node#2) (Section 5.5)
(6) Installation of ERS Instances (Node#1 and Node#2) (Section 5.6)
(7) Installation of Database Instance (Node#1) (Section 5.7)
(8) Installation of PAS Instance (Node#1) (Section 5.8)
(9) Installation of AAS Instance (Node#2) (Section 5.9)
(10) Installation of DA Instances (Node#1 and Node#2) (Section 5.10)
(11) Addition of Symbolic Links (Node#1 and Node#2) (Section 5.11)
(12) Registration of the SAP License registration (Section 5.12)
(13) Changing the SAP Service Settings (Section 5.13)
(14) Disabling Auto Startup for the SAP Instances (Section 5.14)
(15) Enabling Auto Stop for the ERS Instance (Section 5.15)
(16) Change start parameters for SAP Enqueue Server (Section 5.16)

Sections 5.4 through 5.10 describe the procedure for installing SAP NW on Node#1 and Node#2.
Section 5.11 describes the procedure for adding symbolic links on Node#1 and Node#2.
Section 5.12 describes the procedure for registering the SAP license.
Section 5.13 describes the procedure for changing the SAP service settings.
Section 5.14 describes the procedure for disabling Auto Startup for the SAP instances.
Section 5.15 describes the procedure for enabling Auto Stop for the ERS instances.
Section 5.16 describes the procedure for changing start parameters for SAP Enqueue Server.

For an example of setting up the instance name and instance number in this manual, refer to "1.4 SAP NW Setting Example" in the supplied *Configuration Example* document.

Note:
The SAP NW instance number must be unique across the cluster nodes. If some SAP NW instances have duplicate numbers, starting and stopping of SAP NW instances cannot be normally controlled.

For how to update SAP NW, refer to “Chapter 8 SAP NW Update”.

5.1. Preparing the installation

Before installing SAP NW be sure to start EXPRESSCLUSTER and activate the floating IP resources and CIFS resources on Node#1.

The location to save the SAP software logistics tool including the sapinst command described later depends on your environment and the installation media used (DVD-ROM or downloaded files). The sapinst command is a command used to install SAP NW.

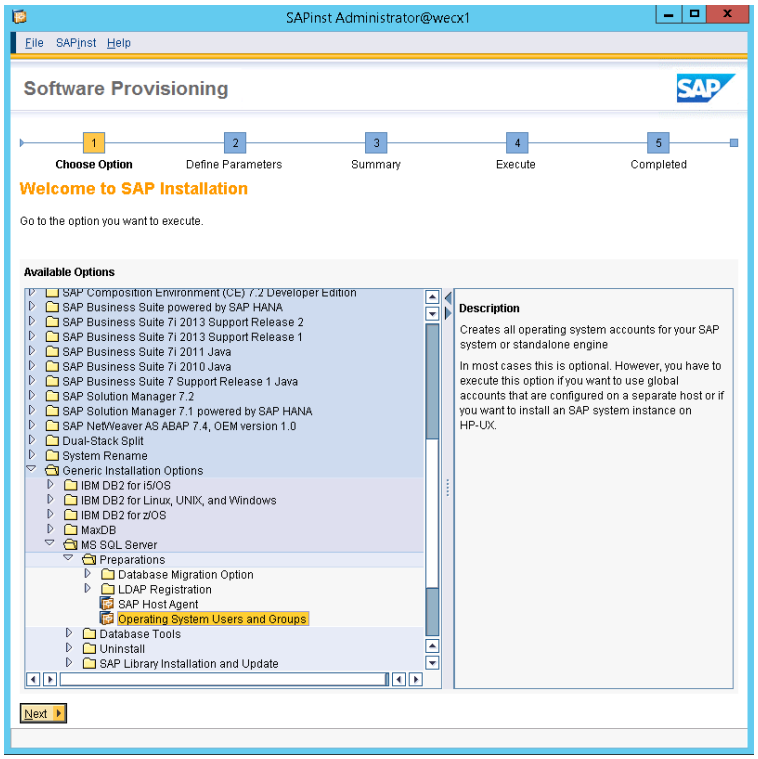
5.2. Create Operating System Users and Groups

Perform this work on Node#1 and Node#2.

Run `sapinst`.

```
> sapinst
```

In the Software Provisioning tool select **Generic Installation Options** > <your database> > **Preparations** > **Operating System Users and Groups** to create the OS users and groups.



In this guide NEC is used as SID and DBSID, and only ABAP is selected for Software.

SID	DBSID	Based On AS
NEC	NEC	ABAP

5.3. Changing the ASCS Instance Host Name Registry

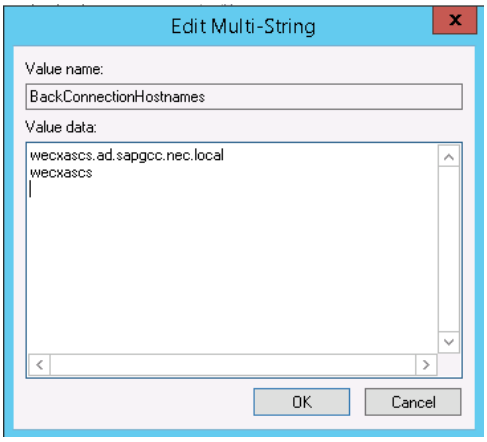
Change the ASCS instance host name registry.

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\LanmanServer\Parameters
DisableStrictNameChecking(<DWORD value>)
```
Value: `0x1`

Example:
```
[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\services\LanmanServer\Parameters]
"DisableStrictNameChecking"=dword:00000001
```

```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Lsa\MSV1_0
BackConnectionHostNames(<multi-line string value>)
```
Value:
<ASCS_Hostname (shortname)>
<ASCS_Hostname (FQDN)>
*Enter SAP Virtual instance Host associated with the floating IP of ASCS instance in shortname.
*Enter SAP Virtual instance Host associated with the floating IP of ASCS instance in FQDN.
*Enter the shortname and the FQDN on separate lines.

Example:




```
HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Lsa
DisableLoopbackCheck(<DWORD value>)
```
Value: `0x1`

Example:
```
[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\Lsa]
" DisableLoopbackCheck "=dword:00000001
```

5.4. Installation of ASCS Instance (Node#1)

Perform this work on Node#1.

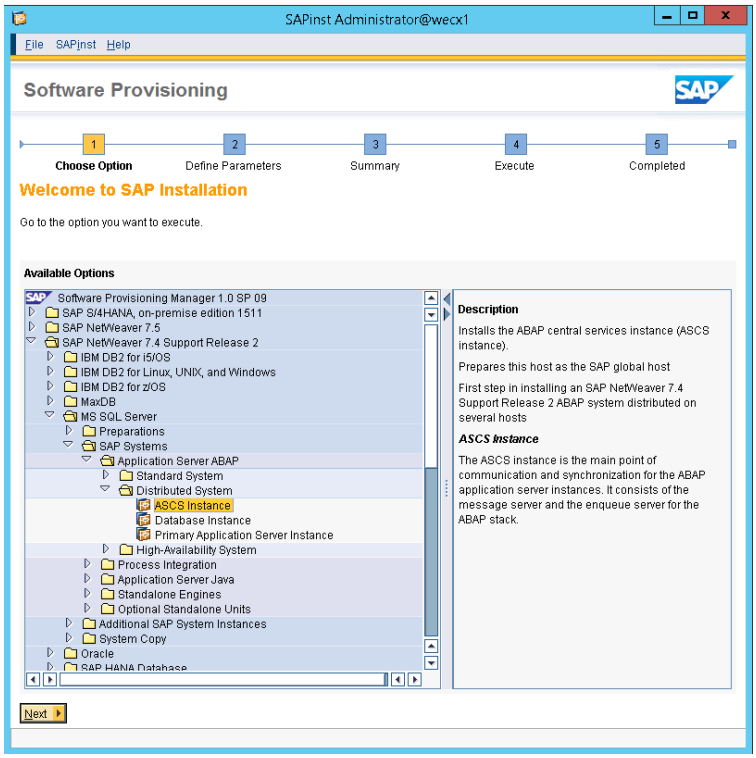
Run `sapinst` with specifying a host name associated with the floating IP of ASCS instance for the environment variable `SAPINST_USE_HOSTNAME`.

```
> sapinst SAPINST_USE_HOSTNAME=<ASCS_Hostname>
```

Note:

Specify a host name associated with the floating IP of ASCS instance for *<ASCS_Hostname>*.

In the Software Provisioning tool select <SAP NW to be installed> > <your database> > **SAP Systems** > **Application Server ABAP** > **Distributed System** > **ASCS Instance** to install the ASCS.



The SID (SAP System ID) and INO (instance number) for the ASCS specified during installation are used in 6.1.1 (ASCS).

In this manual, SID and INO are set as follows:

Instance	SID	INO	Instance name
ASCS	NEC	10	ASCS10

5.5. Add sapstartsrv definition (Node#2)

Perform this work on Node#2.

Step 1. Copy the `C:\Windows\System32\drivers\etc\services` file of Node#1 to Node#2. This file includes the following port number definitions according to the parameters set at installation. Both nodes of the cluster must share this file.

```
    :
saphostctrl   1128/tcp      # SAPHostControl over SOAP/HTTP
saphostctrl   1128/udp      # SAPHostControl over SOAP/HTTP
saphostctrls  1129/tcp      # SAPHostControl over SOAP/HTTPS
saphostctrls  1129/udp      # SAPHostControl over SOAP/HTTPS
sapmsNEC      3610/tcp      # SAP System Message Server Port
sapdp00       3200/tcp      # SAP System Dispatcher Port
sapdp01       3201/tcp      # SAP System Dispatcher Port
sapdp02       3202/tcp      # SAP System Dispatcher Port
    :
```

Step 2. Add the ASCS10 sapstartsrv definition to Node#2.

Add the sapstartsrv service to Node#2 by referring to the service definition of Node#1.
Use the following command to check the service definition.

```
C:\>sc qc SAP<SID>_<INO>
[SC] QueryServiceConfig SUCCESS

SERVICE_NAME: SAP<SID>_<INO>
    TYPE               : 10  WIN32_OWN_PROCESS
    START_TYPE         : 3   DEMAND_START
    ERROR_CONTROL      : 1   NORMAL
    BINARY_PATH_NAME   : "S:\usr\sap\<SID>\ASCS<INO>\exe\sapstartsrv.exe"

pf="\\<ASCS_Hostname>\sapmnt\<SID>\SYS\profile\<SID>_ASCS<INO>_<ASCS_Hostname>"
    LOAD_ORDER_GROUP   :
    TAG                : 0
    DISPLAY_NAME       : SAP<SID>_<INO>
    DEPENDENCIES       : RPCSS
                       : LanmanServer
    SERVICE_START_NAME : AD\SAPService<SID>
```

Note:

Specify the SID and INO of the ASCS instance for *<SID>* and *<INO>*, respectively.

Specify a host name associated with the floating IP of ASCS instance for *<ASCS_Hostname>*.

By referring to the displayed service definition, run the following command on Node#2 to add the same service definition to Node#2.

```
C:\>sc create SAP<SID>_<INO>                                    \
binpath= "\"S:\usr\sap\<SID>\ASCS<INO>\exe\sapstartsrv.exe\"   \
pf=\"\\<ASCS_Hostname>\sapmnt\<SID>\SYS\profile\<SID>_ASCS<INO>_<ASCS_Hostname>\""
\
type= own start= demand depend= "RPCSS/LanmanServer"           \
obj= AD\SAPService<SID> password= "********"
[SC] CreateService SUCCESS
```

Note:

Specify the SID and INO of the ASCS instance for *<SID>* and *<INO>*, respectively.

Specify a host name associated with the floating IP of ASCS instance for *<ASCS_Hostname>*.

Reference: http://support.microsoft.com/kb/251192

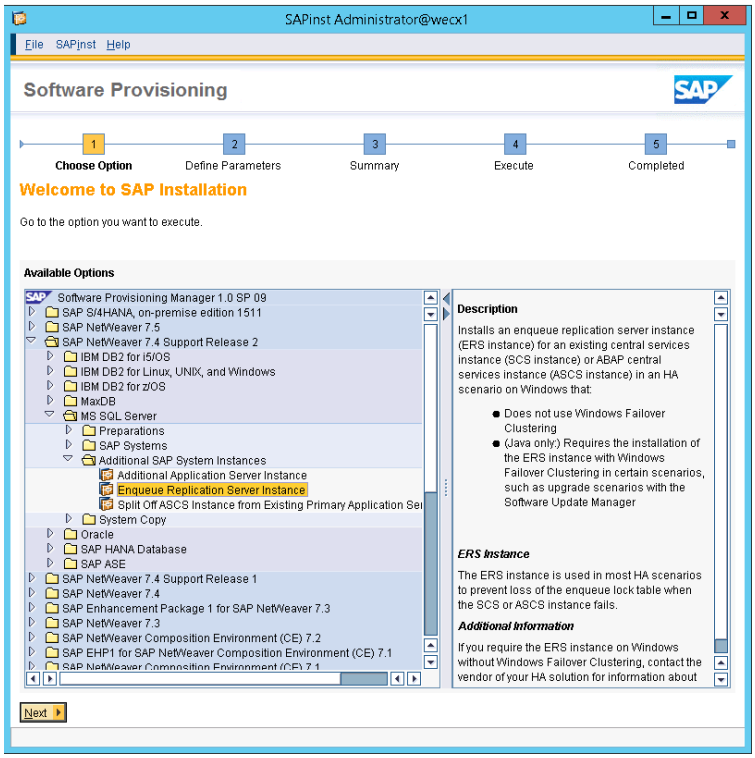
5.6. Installation of ERS Instances (Node#1 and Node#2)

Perform this work on Node#1 and Node#2.

Run `sapinst`.

```
> sapinst
```

In the Software Provisioning tool select <SAP NW to be installed> > <your database> > **Additional SAP System Instances > Enqueue Replication Server Instance** to install the ERS.



The SIDs (SAP System IDs) and INOs (instance numbers) for ERS specified during installation are used in 6.1.2 (ERS1) and 6.1.3 (ERS2).

In this manual, SID and INO are set as follows:

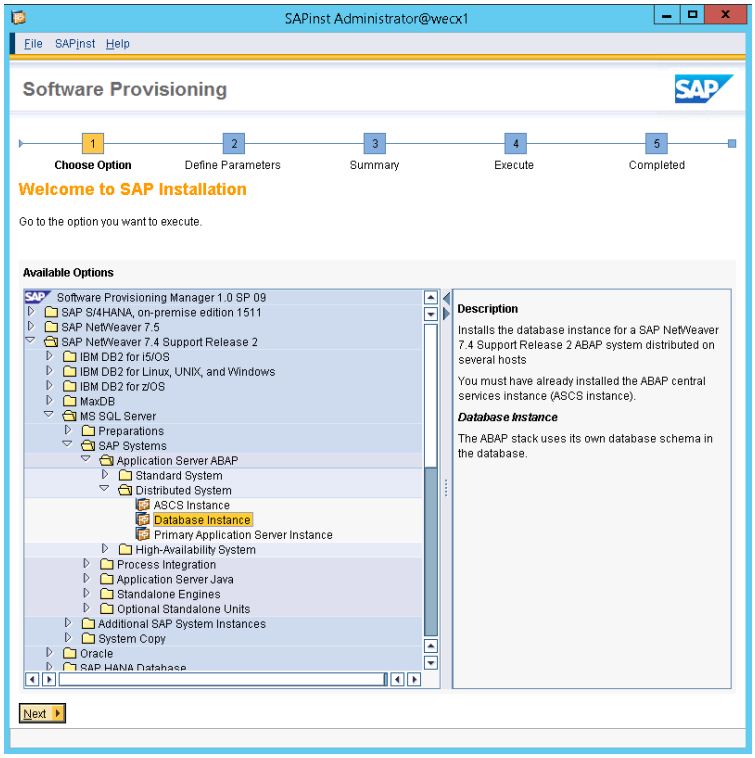
Instance	SID	INO	Instance name
ERS1	NEC	21	ERS21
ERS2	NEC	22	ERS22

5.7. Installation of Database Instance (Node#1)

Perform this work on Node#1.

```
> sapinst
```

In the Software Provisioning tool select <SAP NW to be installed> > <your database> > **SAP Systems** > **Application Server ABAP** > **Distributed System** > **Database Instance** to install the database instance.



The DBSID (Database ID) specified during installation is used in 3.1 and 3.2 in the supplied *Configuration Example* document.

In this manual, DBSID is set as follows:

Data Base	DBSID
SQL Server	NEC

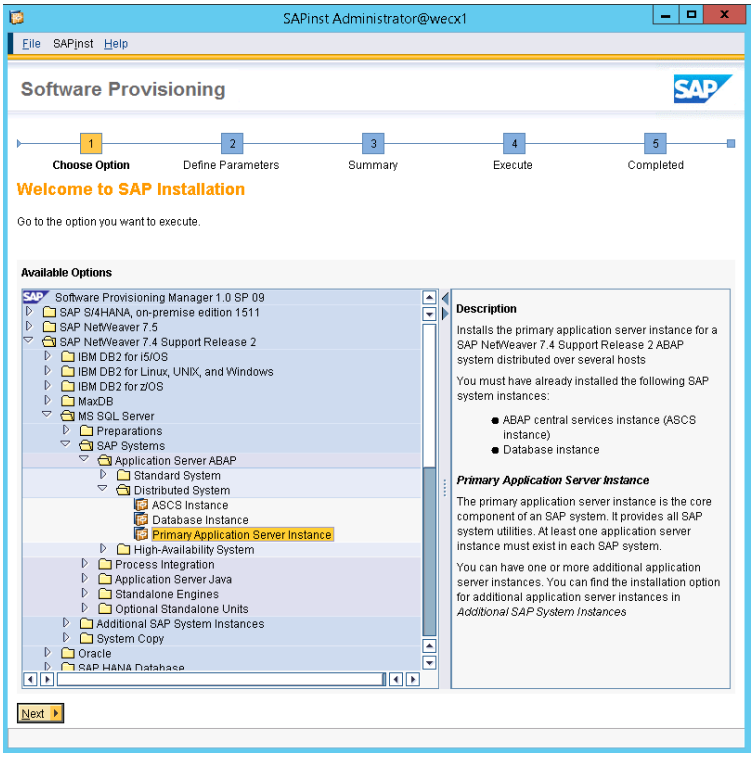
5.8. Installation of PAS Instance (Node#1)

Perform this work on Node#1.

Run `sapinst`.

```
> sapinst
```

In the Software Provisioning tool select <SAP NW to be installed> > <your database> > **SAP Systems** > **Application Server ABAP** > **Distributed System** > **Primary Application Server Instance** to install the PAS.



The SID (SAP System ID) and INO (instance number) for PAS specified during installation are used in 6.1.4.
The DASID (Diagnostics Agent System ID) and INO (instance number) for DA specified during installation are used in 6.1.6 (DA1).

In this manual, SIDs and INOs are set as follows:

Instance	SID	INO	Instance name
PAS	NEC	31	DVEBMGS31
DA1	DAA	97	SMDA97

Note:

Depending on the version of SAP Software Provisioning Manager / SWPM the DA instance (Diagnostics Agent) may or may not be installed within the PAS instance installation. If it is not installed within this step, then please manually install as described later, otherwise skip the manual installation.

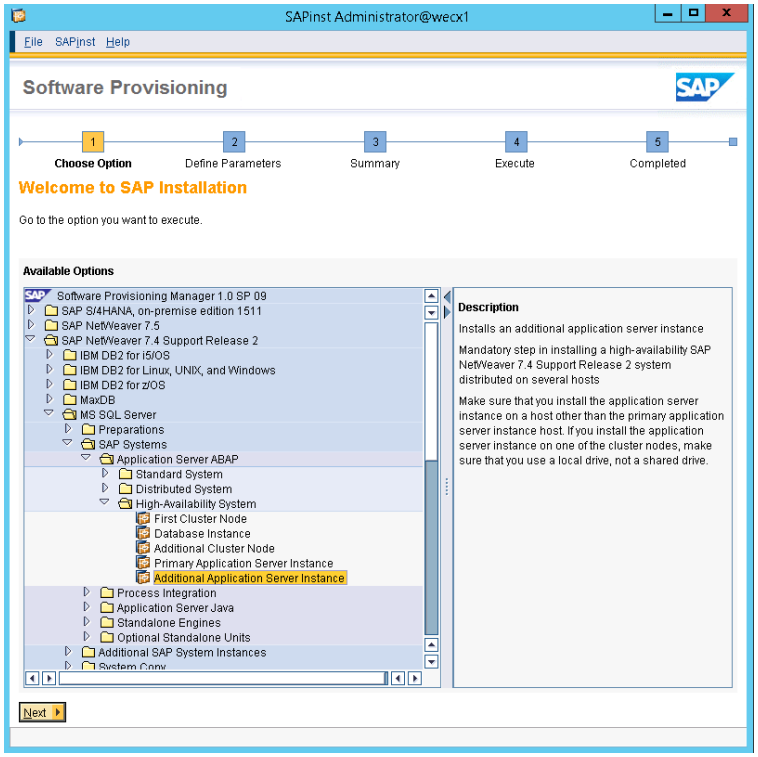
5.9. Installation of AAS Instance (Node#2)

Perform this work on Node#2.

Run `sapinst`.

```
> sapinst
```

In the Software Provisioning tool select <SAP NW to be installed> > <your database> > **SAP Systems** > **Application Server ABAP** > **High-Availability System** > **Additional Application Server Instance** to install the AAS.



The SID (SAP System ID) and INO (instance number) for AAS specified during installation are used in 6.1.5.
The DASID (Diagnostics Agent System ID) and INO (instance number) for DA specified during installation are used in 6.1.7 (DA2).

In this manual, SIDs and INOs are set as follows:

Instance	SID	INO	Instance name
AAS	NEC	32	D32
DA2	DAA	96	SMDA96

Note:

Depending on the version of SAP Software Provisioning Manager / SWPM the DA instance (Diagnostics Agent) may or may not be installed within the AAS instance installation. If it is not installed within this step, then please manually install as described later, otherwise skip the manual installation.

5.10. Installation of DA Instances (Node#1 and Node#2)

Perform this work on Node#1 and Node#2.

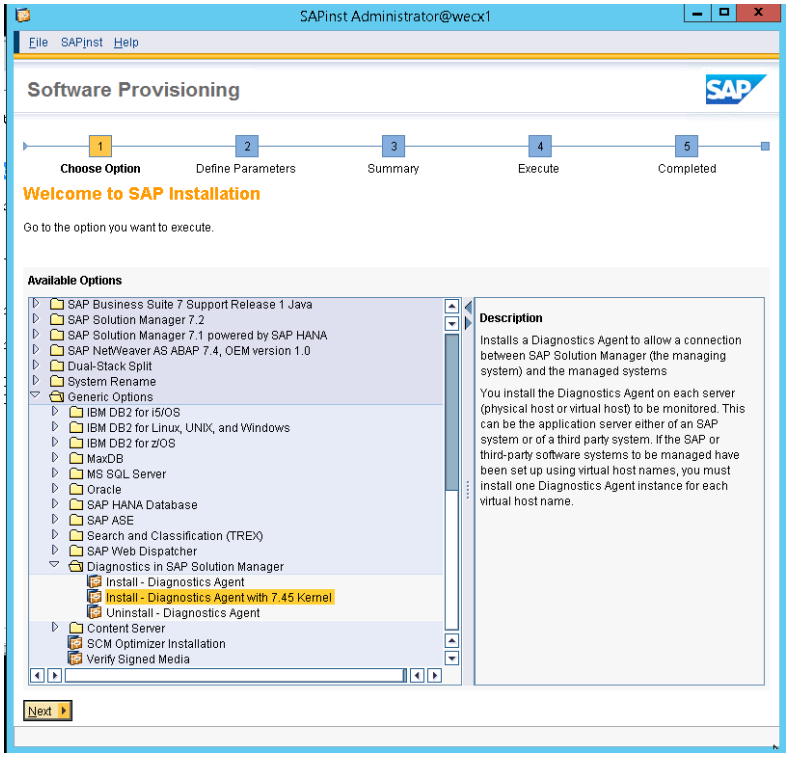
Note:

Perform this step only if sapinst did not offer the installation of DA instances during the PAS / AAS installation as described in the previous two chapters. If the DA instances already got installed, then please skip this chapter and proceed to the next item.

Run `sapinst`.

```
> sapinst
```

In the Software Provisioning tool select <Diagnostics Agent to be installed> > **Install Diagnostics Agent with 7.45 Kernel** to install the DA.



In this manual, SIDs and INOs are set as follows:

Instance	SID	INO	Instance name
DA1	DAA	97	SMDA97
DA2	DAA	96	SMDA96

5.11. Addition of Symbolic Links (Node#1 and Node#2)

Perform this work on Node#1 and Node#2.
Add symbolic links as shown below.

For details, refer to the installation guide of SAP NW.

A setting example in this manual is shown below.

```
> mklink /d C:\usr\sap\NEC\SYS \\<ASCS_Hostname>\sapmnt\NEC\SYS
> mklink /d C:\usr\sap\trans \\<ASCS_Hostname>\sapmnt\trans
```

Note:

Specify a host name associated with the floating IP of ASCS instance for <*ASCS_Hostname*>.

5.12. Registration of the SAP License

For details about how to register the SAP license, refer to the installation guide of SAP NW.

5.13. Changing the SAP Service Settings

Perform this work on Node#1 and Node#2.

Change the startup type of SAP related processes to manual, because each process of SAP instances should be started by EXPRESSCLUSTER.

1. Select **Start Button** > **Control Panel** > **Administrative Tools** > **Services**.
2. If **Startup Type** is **Automatic** for the following services, open **Properties**, and then change **Startup Type** to **Manual**.
   SAPHostControl
   SAPHostExec
   SAP<*SID*>_<*INO*>
   SAP<*DASID*>_<*INO*>

5.14. Disabling Auto Startup for the SAP Instances

Perform this work on Node#1 and Node#2.

To disable auto startup by the SAP interface for the ERS and DA instances, change the relevant configuration in the profile of these instances.

The ERS instance profile is placed in the following location.

```
<shareddisk>:\usr\sap\<SID>\SYS\profile\<SID>_ERS<INO>_<hostname>
```

The DA instance profile is placed in the following location.

```
C:\usr\sap\<DASID>\SYS\profile\<DASID>_SMDA<INO>_<hostname>
```

Change the `Autostart` value in each profile to 0.

```
Autostart=0
```

5.15. Enabling Auto Stop for the ERS Instance

Perform this work on Node#1 and Node#2.

To enable auto-stop feature of the ERS instance when ASCS had a failover to the node where the ERS instance is working.

The ERS instance profile is placed in the following location.

```
<shareddisk>:\usr\sap\<SID>\SYS\profile\<SID>_ERS<INO>_<hostname>
```

Change the `enque/enrep/poll_interval` value in each profile to 0.

```
enque/enrep/poll_interval=0
```

Add the `enque/enrep/hafunc_implementation = script` value in each profile.

```
enque/enrep/hafunc_implementation = script
```

Comment out the line `Restart_Program_03 = local $(_ER) pf=$(_PFL) NR=$(SCSID)` in each profile.
Add `Start_Program_03 = local $(_ER) pf=$(_PFL) NR=$(SCSID)` in each profile.

```
#Restart_Program_03 = local $(_ER) pf=$(_PFL) NR=$(SCSID)
Start_Program_03 = local $(_ER) pf=$(_PFL) NR=$(SCSID)
```

5.16. Change start parameters for SAP Enqueue Server

Perform this work on Node#1.

To enable proper detection of failures in the Enqueue Server (part of ASCS) and trigger switchover correctly, the following parameter in the ASCS instance profile needs to be changed:

The ASCS instance profile is placed in the following location.

```
<shareddisk>:\usr\sap\<SID>\SYS\profile\<SID>_ASCS<INO>_<hostname>
```

Comment out the line `Restart_Program_03 = local $(_EN) pf=$(_PFL)` in the profile.
Add `Start_Program_03 = local $(_EN) pf=$(_PFL)` in the profile.

```
#Restart_Program_03 = local $(_EN) pf=$(_PFL)
Start_Program_03 = local $(_EN) pf=$(_PFL)
```

Chapter 6 Setup of EXPRESSCLUSTER

6.1. Setup of Resources

Add the exec resource to the failover groups created in 4.4.

Set up the exec resource to control starting and stopping of each instance.

A script to control starting and stopping of various SAP instances is available.
To control starting and stopping of each SAP instance using this script, set up the exec resource.
Since the scripts that control starting and stopping an instance use resource names as keys for control, so it is necessary to specify resource names appropriate to the control target.

Include the following string in the resource name:

```
instance_<SID>_<INO>
```

The words in <> indicate the following items:
SID: SAP System ID
INO: Instance number

Note:
The resource name must not contain any spaces.

Note:
If the resource name does not conform to the naming conventions, starting and stopping of SAP NW instances cannot be normally controlled.

For setting examples in this manual, refer to "2.1 EXPRESSCLUSTER Setting Example" and "3.1 Script Resources" in the supplied *Configuration Example* document.

The script specified for the script resource is included in the installation media of this product.

Note:
Modify the supplied scripts according to your environment.

For how to add the exec resource, refer to the following document:
"Reference Guide"
- "Understanding script resources"

6.1.1. Setting up the ASCS resource

Add the following two script resources to the group for which the floating IP for ASCS is specified.
- Add the script resource for controlling SAP services.
- Add the script resource for starting SAP instances.
  * Include the SID (SAP System ID) and INO (instance number) specified in 5.4 in the resource name.
  Example in this manual
  `script-ascs-SAP-instance_NEC_10`

6.1.2. Setting up the ERS1 (Node#1) resource

Add the following two script resources for the group for ERS1.
- Add the script resource for controlling SAP services.
- Add the script resource for starting SAP instances.
  * Include the SID (SAP System ID) and INO (instance number) specified in 5.6 in the resource name.
  Example in this manual
  `script-ERS1-SAP-instance_NEC_21`

6.1.3. Setting up the ERS2 (Node#2) resource

Add the following two script resources for the group for ERS2.

- Add the script resource for controlling SAP services.
- Add the script resource for starting SAP instances.
  * Include the SID (SAP System ID) and INO (instance number) specified in 5.6 in the resource name.
  Example in this manual
  `script-ERS2-SAP-instance_NEC_22`

6.1.4. Setting up the PAS resource

Add the following two script resources for the group for ERS2.

- Add the script resource for controlling SAP services.
- Add the script resource for starting SAP instances.
  * Include the SID (SAP System ID) and INO (instance number) specified in 5.8 in the resource name.
  Example in this manual
  `script-PAS-SAP-instance_NEC_31`

6.1.5. Setting up the AAS resource

Add the following two script resources for the group for AAS.

- Add the script resource for controlling SAP services.
- Add the script resource for starting SAP instances.
  * Include the SID (SAP System ID) and INO (instance number) specified in 5.9 in the resource name.
  Example in this manual
  `script-AAS-SAP-instance_NEC_32`

6.1.6. Setting up the DA1 (Node#1) resource

- Add the script resource for controlling SAP services.
- Add the script resource for starting SAP instances.
  * Include the SID (SAP System ID) and INO (instance number) specified in 5.8 in the resource name.
  Example in this manual
  `script-DA1-instance_DAA_97`

6.1.7. Setting up the DA2 (Node#2) resource

- Add the script resource for controlling SAP services.
- Add the script resource for starting SAP instances.
  * Include the SID (SAP System ID) and INO (instance number) specified in 5.9 in the resource name.
  Example in this manual
  `script-DA2-instance_DAA_96`

6.1.8. Setting up the hostexec1 (Node#1) resource

Add the following script resource for the group for hostexec1.

- Add the script resource for controlling saphostexec.

6.1.9. Setting up the hostexec2 (Node#2) resource

Add the following script resource for the group for hostexec2.

- Add the script resource for controlling saphostexec.

6.1.10. Setting up the Exclusive1 (Node#1) resource

- Add no group resources.

6.1.11. Setting up the Exclusive2 (Node#2) resource

- Add no group resources.

For examples of setting up in this manual, refer to “2.1 An example of setting EXPRESSCLUSTER” and “3.1 A exec resource” in the supplied *Configuration Example* document.

Note:

Specify a resource name that conforms to the naming conventions for the exec resource that controls starting and stopping of SAP NW instances. If the resource name does not conform to the naming conventions, starting and stopping of SAP NW instances cannot be normally controlled.

6.2. Setup of Monitor Resources

Add the following monitor resources to the group resources created in the previous section.

- Custom monitor resource
- Disk TUR monitor resource
- CIFS monitor resource

For examples of setting in this guide please refer to “2.1 An example of setting EXPRESSCLUSTER” and “3.2 A Custom monitor” in the supplied *Configuration Example* document.

The script specified for the custom monitor resource is included in the installation media of this product.

Note:
Modify the supplied scripts according to your environment.

6.2.1. Adding custom monitor resources

For how to add the custom monitor resources please refer to the following document:

“Reference Guide”
- “Understanding custom monitor resources”

6.2.1.1. Setting up the SAP NW instance monitor resources

The custom monitor resource is used to monitor SAP NW instances.

Specify the script included in this product for the custom monitor resource to monitor the following instances:
- ASCS
- ERS1
- ERS2
- PAS
- AAS
- DA1
- DA2

6.2.2. Setting up the SAP NW instance service monitor resources

The custom monitor resource is used to monitor SAP NW instance services.

Specify the script included in this product for the custom monitor resource to monitor the following instance services:
- ASCS
- ERS1
- ERS2
- PAS
- AAS
- DA1
- DA2
- hostexec1
- hostexec2

6.2.3. Adding disk TUR monitor resources

The disk TUR monitor resource is used to monitor the shared disk described in this manual.

For how to add the disk TUR monitor resources, refer to the following document:

"Reference Guide"
- "Understanding disk TUR monitor resources"

This resource is automatically registered when a disk resource is added. The disk TUR monitor resource corresponding to each disk resource is automatically registered.
The disk TUR monitor resource has default values. If necessary change them to appropriate values.

Note:
This resource cannot be used for a disk or disk interface (HBA) that does not support SCSI Test Unit Ready. Even if your hardware supports it, check the driver specifications because the driver may not support it.

6.2.4. Adding a CIFS monitor resource

Add a CIFS monitor resource for ASCS.

For how to add the CIFS monitor resources please refer to the following document:

"Reference Guide"
- "Understanding CIFS monitor resources"

Note:
This monitor resource is automatically registered when a CIFS resource is added. The CIFS monitor resource corresponding to each CIFS resource is automatically registered.

Note:
When access check is performed, the specified access method must be permitted for the local system account in the CIFS resource to be monitored.

Chapter 7 Connector for SAP

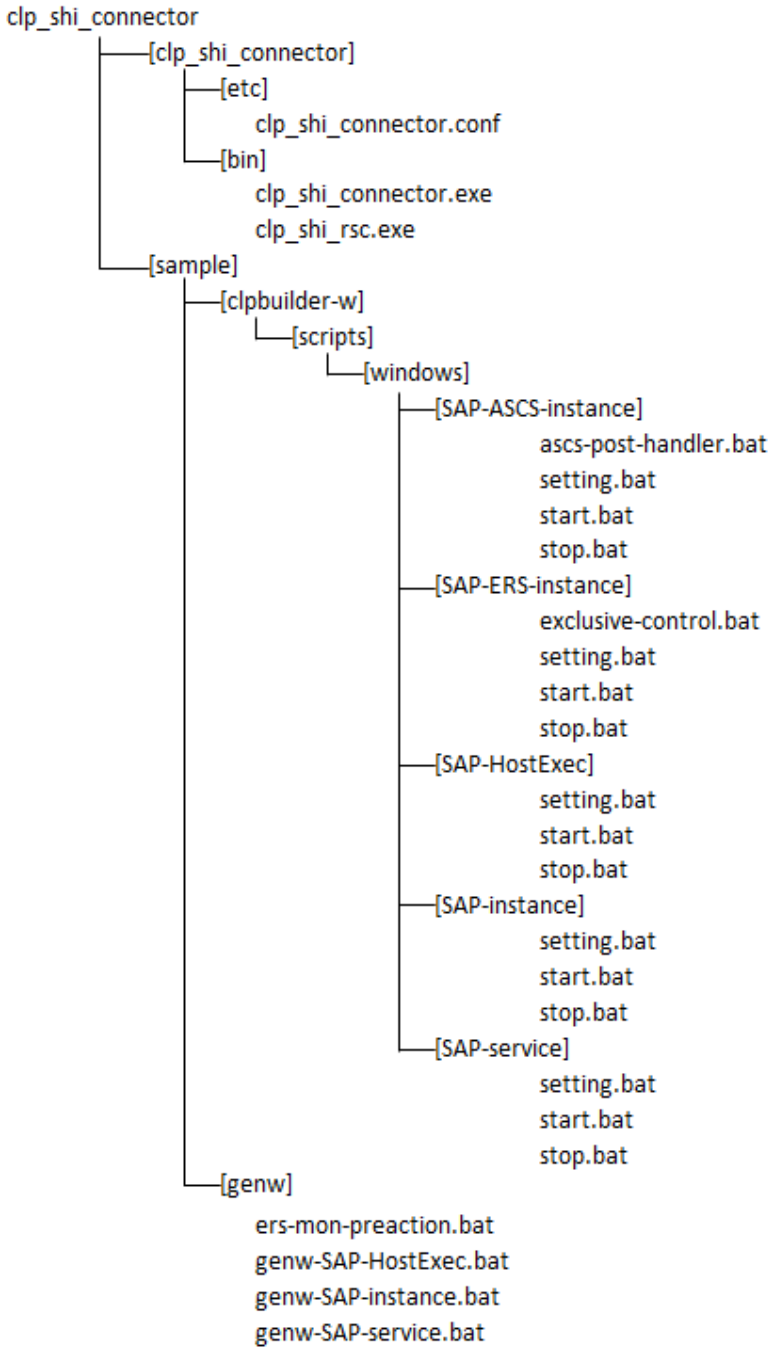
7.1. Installation of Connector for SAP

Perform this work on Node#1 and Node#2.

The Connector for SAP is contained in the installation media.

```
<media>:\Windows\<version>\common\tools\x64\clp_shi_connector.zip
```

Extract the zip file in any folder. The file constitution of the zip file is shown below.



Copy the extracted Connector for SAP to the following locations in the EXPRESSCLUSTER installation folder.

```
C:\Program Files\EXPRESSCLUSTER\bin\clp_shi_connector.exe
C:\Program Files\EXPRESSCLUSTER\bin\clp_shi_rsc.exe
C:\Program Files\EXPRESSCLUSTER\etc\clp_shi_connector.conf
```

7.2. Activation of Connector for SAP

Perform this work on Node#1 and Node#2.

Perform the following setup to use the Connector for SAP

7.2.1. Setting up the SAP profiles

Add the following specification to the default profile for SAP instances (DEFAULT.PFL) and the instance profile for each SAP instance to activate the SAP HA Connector and combine it with EXPRESSCLUSTER.

A setting example in this manual is shown below.

The path and a setting example of the default profile

<*shareddisk*>:\usr\sap\<*SID*>\SYS\profile\DEFAULT.PFL

```
service/halib_cluster_connector = C:\Program
Files\EXPRESSCLUSTER\bin\clp_shi_connector.exe
```

The path and a setting example of the instance profile of ASCS instance

<*sharedisk*>:\usr\sap\<*SID*>\SYS\profile\<*SID*>_ASCS<*INO*>_<*ASCS_Hostname*>

```
service/halib = <sharedisk>:\usr\sap\<SID>\ASCS<INO>\exe\saphascriptco.dll
```

Note:
Specify a host name associated with the floating IP of ASCS instance for <*ASCS_Hostname*>.

The path and a setting example of the instance profile of ERS instance

<*sharedisk*>:\usr\sap\<*SID*>\SYS\profile\<*SID*>_ERS<*INO*>_<*hostname*>

```
service/halib = C:\usr\sap\<SID>\ERS<INO>\exe\saphascriptco.dll
```

The path and a setting example of the instance profile of PAS instance

<*sharedisk*>:\usr\sap\<*SID*>\SYS\profile\<*SID*>_DVEBMGS<*INO*>_<*hostname*>

```
service/halib = C:\usr\sap\<SID>\DVEBMGS<INO>\exe\saphascriptco.dll
```

The path and a setting example of the instance profile of AAS instance

<*sharedisk*>:\usr\sap\<*SID*>\SYS\profile\<*SID*>_D<*INO*>_<*hostname*>

```
service/halib = C:\usr\sap\<SID>\D<INO>\exe\saphascriptco.dll
```

The path and a setting example of the instance profile of DA instance

c:\usr\sap\<*DASID*>\SYS\profile\<DASID>_SMDA<INO>_<hostname>

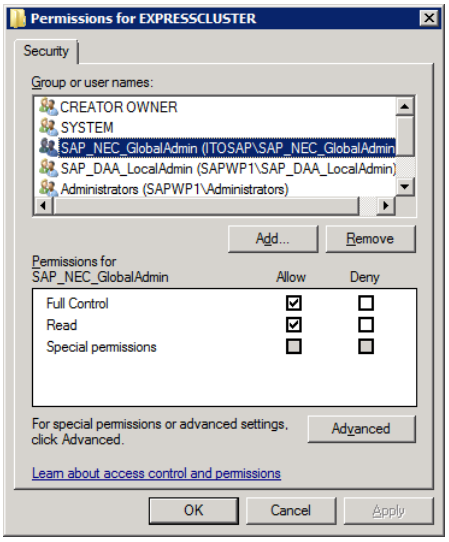
```
service/halib = c:\usr\sap\<DASID>\SYS\exe\uc\NTAMD64\saphascriptco.dll
service/halib_cluster_connector = C:\Program
Files\EXPRESSCLUSTER\bin\clp_shi_connector.exe
```

Note:
The SAP services need to be restarted after the setting is changed. Restart the cluster for instance.

7.2.2. Granting administrator permissions to SAP NW users

To make SAP HA Connector executable, give full control permissions to the following registry to SAP NW users (SAP_<*SID*>_GlobalAdmin, SAP_<*DASID*>_LocalAdmin).

```
HKEY_LOCAL_MACHINE\SOFTWARE\NEC\EXPRESSCLUSTER
```



Note:
To combine SAP NW and EXPRESSCLUSTER, give full control permissions to the specified registry to the group that was automatically created when SAP NW was installed. If full control permissions to the registry are not given to SAP NW users, starting and stopping of SAP NW instances cannot be normally controlled.

7.3. Configuration File

This section describes the configuration file for the Connector for SAP.

The configuration file for the Connector for SAP is placed in the following location. Edit this file using a text editor.

```
C:\Program Files\EXPRESSCLUSTER\etc\clp_shi_connector.conf
```

7.3.1. Setting items

For the Connector for SAP the following parameters in the configuration file can be changed to configure the log level, log size, and group resources for which to refuse the start/stop request from the SAP interface.

Notes:
Only one-byte characters can be used in the configuration file.
Set each setting item in the key=value format.
If a key which can be set only once is set more than once, the last setting value is effective.
Any lines beginning with a string other than the valid keys, and any blank lines are skipped.
Any spaces and tabs before and after the key/value are skipped.
The maximum length of one line is 1023 bytes.
If there is no configuration file or setting values are invalid, the default values are used.

Parameter name	Setting value	Description
LOGLEVEL	ERROR WARNING INFO TRACE (default: INFO)	Specify the output log level. ERROR: Output logs of the error level and information level. WARNING: Output logs of the warning level and information level. INFO: Output logs of the information level. TRACE: Output logs of the internal trace and information level.
LOGSIZE	1 to 2147483647 (default: 1000000)	Specify the log size in bytes. If the size of the current log file exceeds the specified log size, log rotation is performed. The number of log file generations is two (the current log and the log of the previous generation).
REFUSE_START_GROUP_RESOURCE	Group resource name in EXPRESSCLUSTER (default: None)	As the setting value (*group resource name in EXPRESSCLUSTER*), specify the name of the script resource that controls a SAP instance for which to refuse the start request from the SAP interface. To set more than one group resource name, set more than one REFUSE_START_GROUP_RESOURCE parameter.
REFUSE_STOP_GROUP_RESOURCE	Group resource name in EXPRESSCLUSTER (default: None)	As the setting value (*group resource name in EXPRESSCLUSTER*), specify the name of the script resource that controls a SAP instance for which to refuse the stop request from the SAP interface. To set more than one group resource name, set more than one REFUSE_STOP_GROUP_RESOURCE parameter.
GVI_CHECKCOUNT	1 - 60 (default: 30)	The number of retries EXPRESSCLUSTER will try to obtain product information when the cluster is started. The interval between these attempts is set by GVI_CHECK_INTERVAL as stated below. Even if the count does not reach to the setting, obtaining product information finishes when one attempt succeeded.
GVI_CHECKINTERVAL	1 - 60	The interval in seconds between EXPRESSCLUSTER attempts

	(default: 10)	to obtain product information. If obtaining product information will be done only once (GVI_CHECKCOUNT=1), then this value will be ignored.
FRA_CHECKCOUNT	1 - 60 (default: 30)	The number of retries to check the status of the group resource when the Rolling Kernel Switch is done. The interval between the check is set by FRA_CHECK_INTERVAL as stated below. Even if the count does not reach to the setting, the status check finishes when one attempt succeeded.
FRA_CHECKINTERVAL	1 - 60 (default: 10)	The interval in seconds between checks of the status of the group resource. If the status check will be done only once (FRA_CHECKCOUNT=1), then this value will be ignored.

Note:
Obtaining product information of EXPRESSCLUSTER when the cluster is started may fail due to a timing issue, as well as checking the group resource status when performing a Rolling Kernel Switch. In such a case adjust timing values and repetition count for GVI and FRA parameters.

Note:
Set the REFUSE_START_GROUP_RESOURCE and REFUSE_STOP_GROUP_RESOURCE parameters when starting and stopping of SAP should only be controlled via EXPRESSCLUSTER, that is start and stop requests from the SAP interface need to be refused.

A configuration example is shown below. This example sets the log level to INFO and the log size to 1000000 bytes, and makes settings so that starting and stopping from the SAP interface are refused for ASCS, ERS1, ERS2, PAS, and AAS.

```
LOGLEVEL=INFO
LOGSIZE=1000000
REFUSE_START_GROUP_RESOURCE=script-ASCS-SAP-instance_NEC_10
REFUSE_START_GROUP_RESOURCE=script-ERS1-SAP-instance_NEC_21
REFUSE_START_GROUP_RESOURCE=script-ERS2-SAP-instance_NEC_22
REFUSE_START_GROUP_RESOURCE=script-PAS-SAP-instance_NEC_31
REFUSE_START_GROUP_RESOURCE=script-AAS-SAP-instance_NEC_32
REFUSE_STOP_GROUP_RESOURCE=script-ASCS-SAP-instance_NEC_10
REFUSE_STOP_GROUP_RESOURCE=script-ERS1-SAP-instance_NEC_21
REFUSE_STOP_GROUP_RESOURCE=script-ERS2-SAP-instance_NEC_22
REFUSE_STOP_GROUP_RESOURCE=script-PAS-SAP-instance_NEC_31
REFUSE_STOP_GROUP_RESOURCE=script-AAS-SAP-instance_NEC_32
```

7.4. Log Files

This section describes the log file used for the Connector for SAP.

For information about the logs in EXPRESSCLUSTER, refer to the following document:

“Reference Guide”
- “Section III Maintenance information”

7.4.1. Log files

The Connector for SAP log is output to the following location:

```
C:\Program Files\EXPRESSCLUSTER\log\clp_shi_connector0.log
C:\Program Files\EXPRESSCLUSTER\log\clp_shi_connector1.log
```

`clp_shi_connector0.log` is always the current log file; `clp_shi_connector1.log` is the log file of the previous generation.

7.4.2. Log format

The format of a log output from the Connector for SAP is shown below.

Log format

```
yyyy/MM/dd HH:mm:ss.SSS LEVEL[P:PID][T:THREADID] __FILE__:__LINE__ FUNCTION
MESSAGE
```

7.4.3. Error messages

Error messages that the Connector for SAP outputs to the log file are described below.

Message	Description	Action
GetModuleFileName() failed. (%1)	`GetModuleFileName()` failed. (%1: error code)	Check whether EXPRESSCLUSTER is correctly installed.
%1 does not exist. (%2)	The configuration file is not found. (%1: file path, %2: error code)	Check whether *C:\Program Files\EXPRESSCLUSTER*\etc\clp_shi_connector.conf exists.
fopen() failed (errno=%1).	The file could not be opened. (%1: error code)	Check the following possible causes: • SAPservice<*SID*> has no access permission for the configuration file. • The file system is corrupted.
fclose() failed (errno=%1).	The file could not be closed. (%1: error code)	Check whether the file system is corrupted.
Length of line exceeds maximum length. see line %1	The line is too long. (%1: line number)	Check the indicated line in the configuration file.
Value of LOGLEVEL is false. see line %1	The value for LOGLEVEL is invalid. (%1: line number)	Check the indicated line in the configuration file.

Message	Description	Action
LOGSIZE is not in the setting range. see line %1	The value for LOGSIZE is out of the valid range. (%1: line number)	Check the indicated line in the configuration file.
Value of LOGSIZE is false. see line %1	The value for LOGSIZE is invalid. (%1: line number)	Check the indicated line in the configuration file.
The number of REFUSE_START_GROUP_RESOURCE exceeds the maximum number. see line %d	The number of REFUSE_START_GROUP_RESOURCE parameters is too many. (%1: line number)	Check the indicated line in the configuration file.
The number of REFUSE_STOP_GROUP_RESOURCE exceeds the maximum number. see line %d	The number of REFUSE_STOP_GROUP_RESOURCE parameters is too many. (%1: line number)	Check the indicated line in the configuration file.
Hyphen could not be used at beginning and end of group resource name. see line %d	Hyphen "-" cannot be used at the beginning and end of the group resource name. (%1: line number)	Check the indicated line in the configuration file.
Length of group resource name exceeds the maximum length. see line %d	The group resource name is too long. (%1: line number)	Check the indicated line in the configuration file.
Invalid character is used in group resource name. see line %d	The group resource name contains an invalid character. (%1: line number)	Check the indicated line in the configuration file.
Failed to get module file path.	The module path could not be acquired.	Check whether EXPRESSCLUSTER is correctly installed.
Failed to combine path.	Paths could not be combined.	Check whether EXPRESSCLUSTER is correctly installed.
Invalid options.	Options for the Connector for SAP are invalid.	Correctly specify the option referring to the usage.
Module not found.	The module is not found.	Check whether EXPRESSCLUSTER is correctly installed.
Cluster commands are not installed correctly. (%1)	EXPRESSCLUSTER is not correctly installed. (%1: error code)	Check whether EXPRESSCLUSTER is correctly installed.
Error during detection of cluster status. (%1)	An error has occurred during detection of cluster status. (%1: error code)	Check whether EXPRESSCLUSTER is correctly installed, as well as whether the cluster configuration information is correct.
Cluster commands are installed correctly but cluster framework is not running. (%1)	EXPRESSCLUSTER is correctly installed, but the cluster is not running. (%1: error code)	Start the cluster.
Failed to initialize apicl. (%1)	apicl could not be initialized. (%1: error code)	Check whether EXPRESSCLUSTER is correctly installed.
Failed to connect to the server. (%1)	The server could not be connected. (%1: error code)	Check whether the cluster configuration information is correct.

Message	Description	Action
Failed to get group resource status. (%1: %2)	The group resource status could not be acquired. (%1: error code, %2: group resource name)	Check whether the cluster configuration information is correct, as well as whether the group resource name conforms to the naming conventions.
Group resource status is abnormal. (status: %1)	The group resource status is abnormal. (%1: status)	Check whether the cluster configuration information is correct.
Failed to get server names. (%1)	The server name could not be acquired. (%1: error code)	Check whether the cluster configuration information is correct.
Failed to get hostname. (%1)	The host name could not be acquired. (%1: error code)	Check whether the cluster configuration information is correct.
Failed to get cluster group names. (%1)	The group name could not be acquired. (%1: error code)	Check whether the cluster configuration information is correct.
Cluster group does not exist.	The group is not found.	Check whether the cluster configuration information is correct.
Failed to get group resource names. (%1)	The group resource name could not be acquired. (%1: error code)	Check whether the cluster configuration information is correct, as well as whether the group resource name conforms to the naming conventions.
Failed to get cluster group status. (%1: %2)	The group status could not be acquired. (%1: error code, %2: group name)	Check whether the cluster configuration information is correct.
Failed to start group resource %1. (%2)	The group resource could not be started. (%1: group resource name, %2: error code)	Check the following possible causes: high system load, memory shortage, and OS resource shortage.
Start action to group resource %1 was canceled because this group resource is specified in REFUSE_START_GROUP_RESOURCE.	Because the group resource is specified by REFUSE_START_GROUP_RESOURCE, starting of the group resource was canceled. (%1: group resource name)	_
Failed to start group resource %1 because group resource is not OFFLINE.	Because the group resource was not offline, the group resource could not be started. (%1: group resource name)	Check the status of the group resource.
Failed to stop group resource %1. (%2)	The group resource could not be stopped. (%1: group resource name, %2: error code)	Check the following possible causes: high system load, memory shortage, and OS resource shortage.
Stop action to group resource %1 was canceled because this group resource is specified in REFUSE_STOP_GROUP_RESOURCE.	Because the group resource is specified by REFUSE_STOP_GROUP_RESOURCE, stopping of the group resource was canceled. (%1: group resource name)	_
Failed to stop group resource %s because group resource is not ONLINE.	Because the group resource was not online, the group resource could not be stopped. (%1: group resource name)	Check the status of the group resource.

Message	Description	Action
Failed to create cluster resource name. (res: %1)	The group resource name could not be generated. (%1: group resource name)	Check whether the cluster configuration information is correct, as well as whether the group resource name conforms to the naming conventions.
Failed to create cluster resource name. (SID: %1, INO: %2)	The group resource name could not be generated. (%1: SAP System ID, %2: instance number)	Check whether the cluster configuration information is correct, as well as whether the group resource name conforms to the naming conventions.
Failed to get resource status. (%1: %2)	The group resource status could not be acquired. (%1: error code, %2: group resource name)	Check whether the cluster configuration information is correct, as well as whether the group resource name conforms to the naming conventions.
Not found resource name. (name: %1)	The group resource name is not found. (%1: group resource name)	Check whether the cluster configuration information is correct, as well as whether the group resource name conforms to the naming conventions.
Not found ONLINE server index.	The online server index is not found.	Check whether the cluster configuration information is correct.
Resource %s is not ONLINE.	The group resource is not online. (%1: group resource name)	Check the status of the group resource.
Failed to get all server status. (%1)	The status of all servers could not be acquired. (%1: error code)	Check whether the cluster configuration information is correct.
Failed to open output file. (filename: %1)	The output file could not be opened. (%1: output file)	SAPservice<*SID*> has no access permission for the output file. The file system is corrupted.
Failed to write file. (filename: %1, message; %2:%3:%4:)	Writing to the file failed. (%1: output file, %2: group resource name, %3: group name, %4: current node)	Check whether the disk is running out of space.
Failed to write file. (filename: %1, message; <separate>)	Writing to the file failed. (%1: output file)	Check whether the disk is running out of space.
Failed to write file. (filename: %1, message; %2)	Writing to the file failed. (%1: output file, %2: active node)	Check whether the disk is running out of space.
Failed to write file. (filename: %1, message; %2:%3:%4:%5:)	Writing to the file failed. (%1: output file, %2: SAP System ID, %3: instance number, %4: group resource name, %5: group name)	Check whether the disk is running out of space.

Message	Description	Action
Failed to open log file. (%1, %2)	The log file could not be opened. (%1: error code, %2: log file)	Check the following possible causes: • SAPservice<*SID*> has no access permission for the log file. • The file system is corrupted.
Failed to set the file pointer to the end of log file. (%1)	The file pointer could not be moved to the end of file. (%1: error code)	The file system may be corrupted. Check it.
Failed to rotate logfile.	Log rotation could not be performed.	Check the following possible causes: • SAPservice<*SID*> has no access permission for the log file. • The file system is corrupted.
Failed to get log file size. (%1)	The log file size could not be acquired. (%1: error code)	Check the following possible causes: • SAPservice<*SID*> has no access permission for the log file. • The file system is corrupted.
Failed to delete old log file. (%1)	The old log file could not be deleted. (%1: error code)	Check the following possible causes: • SAPservice<*SID*> has no access permission for the log file. • The file system is corrupted. • The old log file is locked.
Failed to rename log file. (%1)	The log file could not be renamed. (%1: error code)	Check the following possible causes: • SAPservice<*SID*> has no access permission for the log file. • The file system is corrupted. • The old log file exists. • The current log file is locked.

Section III Miscellaneous

- Chapter 8 SAP NW Update
- Chapter 9 Notes and Restrictions

Chapter 8 SAP NW Update

To update SAP NW, use Software Update Manager (hereafter referred to as SUM). The update procedure with SUM involves restarting SAP instances and therefore it may interfere with EXPRESSCLUSTER which tries to keep the SAP components available. To avoid such interference with EXPRESSCLUSTER, suspend EXPRESSCLUSTER's monitoring for all SAP components that SUM has to restart.

Please select from the following two options to suspend EXPRESSCLUSTER's monitoring.

- Suspending the whole cluster
- Suspending monitor resources related to SAP instances and services

Update SAP NW with SUM while the cluster or the monitor resources are suspended. After the update is completed, resume the suspended cluster or the suspended monitor resources.

For how to suspend and resume a cluster or a monitor resource, please refer to the following document.

"Reference Guide"
- "Chapter 1 Functions of the WebManager"
  - "Operations from the WebManager"

Chapter 9 Notes and Restrictions

- Notes on starting/stopping groups
  Refer to the following sections in the *Reference Guide*:
  "Group resource details"
  → "Attributes common to group resource"
  → "Group start dependence and group stop dependence"
  → "Notes"
- Restriction of using spaces
  A node name , a failover group and a resource name must not contain any spaces. If they contain some spaces, starting and stopping of SAP NW instances cannot be controlled correctly.
- Naming conventions for failover groups
  Specify a failover group name according to the naming conventions for the failover group for exclusive control of ASCS/ERS instance. If the failover group name does not follow the naming conventions, exclusive control of ASCS/ERS instance cannot function correctly.
- Naming conventions for script resources
  Specify a resource name according to the naming conventions for the exec resource that controls starting and stopping of SAP NW instances. If the resource name does not follow the naming conventions, starting and stopping of SAP NW instances cannot be normally controlled.
- SAP NW instance number
  The SAP NW instance number must be unique across the cluster nodes. If some SAP NW instances have duplicate numbers, starting and stopping of SAP NW instances cannot be controlled correctly.
- Note on manual operation of ERS instance
  The ERS instance replicates the lock table from the ASCS instance. The ERS instance must work on the node where the ASCS instance is not performing, to ensure its redundancy.
  ERS instance should not be launched on the node where ASCS instance is performing even if it is manual operation.
  Additionally the ERS instance should not be launched on more than two nodes at same time.
- Attention when one node recovers
  When the node where ERS instance was working gets recovered and joins the cluster, then the failover group of the ERS instance is not restarted automatically.
  You need to validate the node is working healthy and then restart the failover group of ERS instance manually.
  When the node where the ASCS instance was previously running on crashed and recovers, it may display that it is still sharing the <shareddisk>:\sapmnt directory. However this share is locally inaccessible since it is running on the node, which is currently running the ASCS failover group. In this case it is necessary to manually delete this inaccessible share on the recovered node, otherwise a failback of the ASCS group to this node will fail.
- Restriction of using virtual computer name resource
  A virtual computer name resource must not be used with this product. If a virtual computer name resource is used, starting and stopping of SAP NW instances cannot be controlled correctly.
- When the disk resource for ASCS is failed over or stopped, the following warning message may be output to WebManager. Ignore this message.

```
Type: Warning
Module name: sdfunc
Event ID: 3201
Message: Disconnection of disk %1 is being retried. The disk may be
          in use. Check the disk.
```