High Availability for SAP HANA database on Azure using SIOS Protection Suite

for RHEL & SUSE Linux

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Introduction

HANA System Replication is the only supported high availability solution on Azure virtual machines (VMs). SAP HANA Replication consists of one primary node and at least one secondary node. Changes to the data on the primary node are replicated to the secondary node synchronously or asynchronously.

Please refer SAP Note 1662610 Support details for SIOS Protection Suite for Linux

SIOS Protection Suite

SIOS Protection Suite (SPS) for Linux integrates high availability clustering with innovative data replication functionality in a single, enterprise-class solution.

Components of SIOS Protection Suite
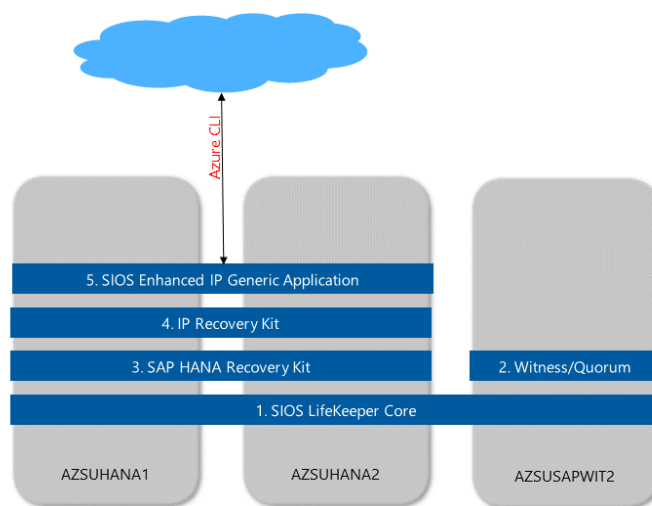
1. **SIOS LifeKeeper Core**
   Provides protection of specific resources on a server

2. **Witness/Quorum**
   Provides functionality in LifeKeeper to prevent multiple nodes from becoming active at the same time

3. **SAP HANA Recovery Kit**
   Provides a mechanism to perform takeover SAP HANA DB from a failed primary server onto a secondary server in a LifeKeeper environment and configure reverse replication

4. **IP Recovery Kit**
   provides a mechanism to recover an IP address from a failed primary server to a backup server in a LifeKeeper environment

5. **IP-Gen-App**
   Provides a mechanism to move azure IP resource from one VM to another VM in a LifeKeeper environment

SIOS LifeKeeper

The LifeKeeper family of products includes software that allows you to provide failover protection for a range of system resources.

Witness/Quorum

The Quorum/Witness Server Support Package for LifeKeeper (steeleye-lkQWK, hereinafter "Quorum/Witness Package") combined with the existing failover process of the LifeKeeper core allows system failover to occur with a greater degree of confidence in situations where total network failure could be common. This effectively means that local site failovers and failovers to nodes across a WAN can be done while greatly reducing the risk of split-brain situations.

SAP HANA Recovery Kit

SAP HANA provides three different mechanisms to increase the availability.

Host Auto-Failover – At least one standby node added to a SAP HANA system. These nodes are configured to work in standby mode (SAP HANA scale-out)

Storage Replication – The storage used on the SAP HANA node replicates all data to another SAP HANA node. This replication works without a control process from the SAP HANA system. The Storage Replication is provided by hardware partners.

System Replication – SAP HANA replicates all data by using their own feature to a secondary SAP HANA node. Data is constantly pre-loaded on the secondary SAP HANA node. (SAP HANA scale-up)

With this SAP HANA Recovery Kit SAP HANA systems can be controlled through an activated system replication in SIOS LifeKeeper.

IP Recovery Kit

The SIOS Protection Suite for Linux Internet Protocol (IP) Recovery Kit provides a mechanism to recover an IP address from a failed primary server to a backup server in a LifeKeeper environment. The IP Recovery Kit can define an IP address that can be used to connect to a LifeKeeper-protected application. As with other LifeKeeper resources, IP resource switchovers can be initiated automatically as a result of a failure or manually by an administrative action.

IP-Gen-App (optional) Provided As-Is

The IP-Gen-App is a generic application recovery kit used in order to actively communicate with the Azure CLI. It is used to switch the Azure layer IP resource from one node to the other in a switchover or failover event.

Support

SAP Support

Support for SAP products is provided by the customer's SAP support agreement directly from SAP. SIOS does not replace the need for an SAP support agreement.

SIOS Support

As a SIOS Technology Corp. customer with a valid Support contract, you are eligible for support as outlined by the SIOS Technical Support Agreement. The SIOS Technical Support Agreement is provided to each customer with the software purchase.

Implementation

Note:

SLES 12 SP4 with SIOS Protection Suite for Linux 9.3.2 is used in this illustration.

Please refer SAP Note 1662610 for other supported operation systems on Azure

This section describes how to deploy and configure the virtual machines, install the cluster framework, and install and configure SAP HANA System Replication. In the example configurations, installation commands, instance number 00, and HANA System ID S4D are used.

Availability Set
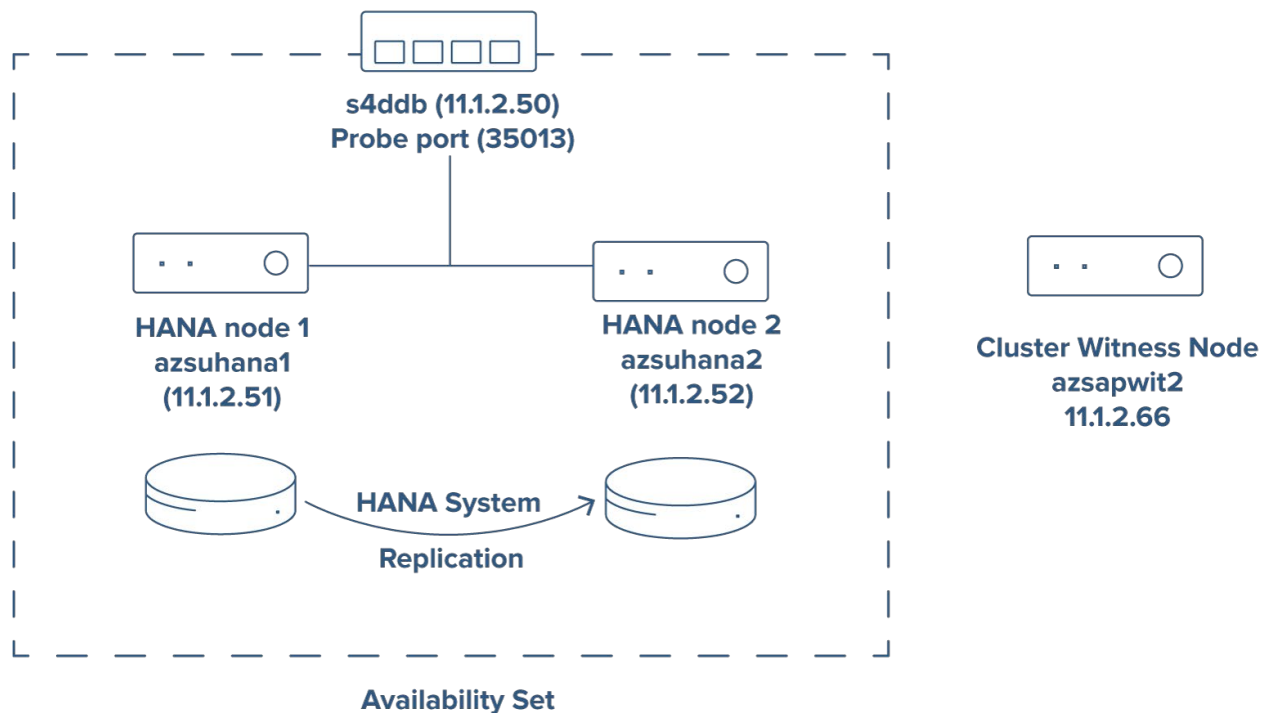
The following list shows the configuration of the HANA & Witness Node IP addresses and Virtual Hostnames configured in DNS.

Components	hostname	IP address	VIP	VHOSTNAME
SAP DB Pool	azsuhana1	11.1.2.51	11.1.2.50	s4ddb
	azsuhana2	11.1.2.52		
SIOS Witness	azsusapwit2	11.1.2.66		

SAP HANA System Replication setup uses a dedicated virtual hostname and virtual IP addresses. On Azure, a load balancer is required to use a virtual IP address. The following list shows the configuration of the load balancer:

The IP address for the front-end configuration is 11.1.2.50 for s4ddb

For the back-end configuration, connect the load balancer to primary network interfaces of all virtual machines that should be part of HANA System Replication

Probe Port: Port 62503

Load-balancing rules: 30313 TCP, 30315 TCP, 30317 TCP

Deploy Infrastructure

Please refer corresponding azure docs to provision you infrastructure, Install HANA and configure HSR

SLES

RHEL

Install SIOS Protection Suite & Recovery Kits

The following SIOS components are installed in respective nodes.

LifeKeeper Core

- azsuhana1
- azsuhana2
- azsusapwit2

Witness/Quorum

- azsusapwit2

Note: - recommended to use 1 witness/cluster

SAP HANA 2.0 Application Recovery Kit & IP Recovery Kit

- azsuhana1
- azsuhana2

Install SIOS Protection Suite

See http://docs.us.sios.com/spslinux/9.3.2/en/topic/installing-the-software

Preparing Installation Media

- download the following media from the FTP link sent by SIOS
- download the SIOS Protection Suite's - sps.img

- download the HANA Application Recovery Kit based on your HANA version - HANA2-ARK.run
- download the Azure IP Recovery kit - SIOS_enhancedAzure_gen_app-02.02.00.tgz

PLEASE NOTE: The file name may vary based on the version

Mount the Installation Media

mkdir -p /DVD

mount /sapmedia/SIOS931/sps.img /DVD -t iso9660 -o loop

mount: /dev/loop0 is write-protected, mounting read-only

Install SIOS Protection Suite - Witness Nodes
cd /DVD

./setup

Please proceed with the installation steps as shown below:
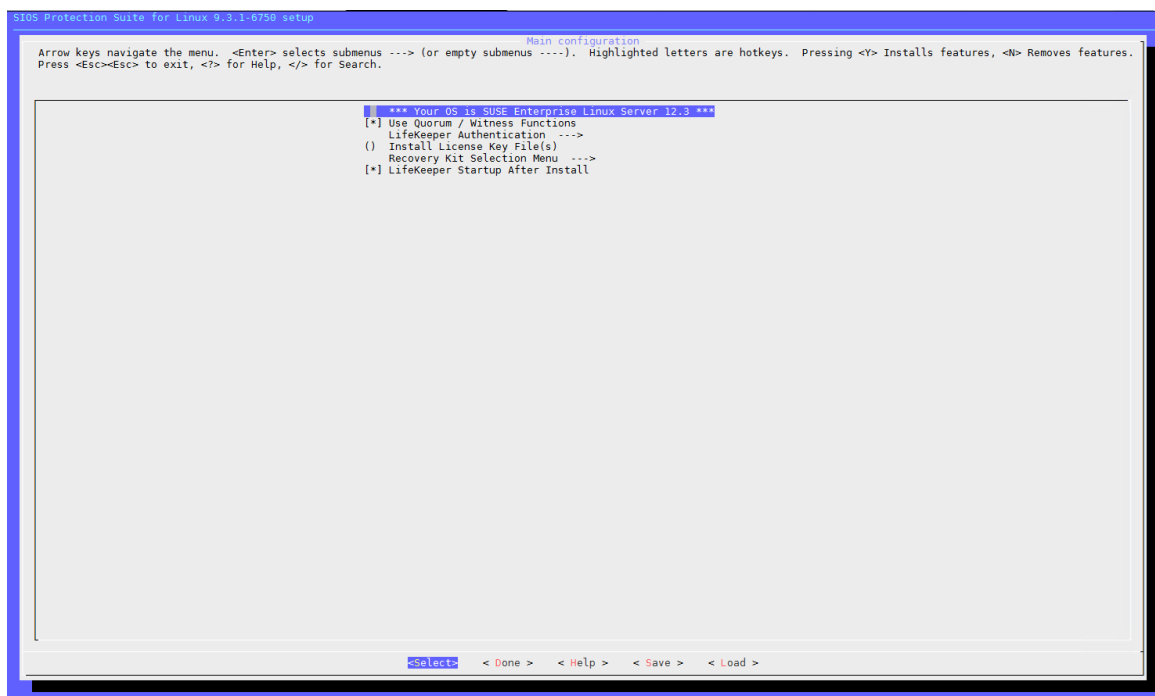
```
azsusapwit1:/DVD # ./setup
SIOS Protection Suite for Linux setup
Collecting system information...............................done.
Preparing configuration information............done.
Performing package installation and updating configuration information for SPS for Linux.
Install LifeKeeper and dependent packages.done.
Configure LifeKeeper management group
Starting LifeKeeper...
Setup complete.
azsusapwit1:/DVD #
```

Please repeat the steps for all witness nodes.

Install SIOS Protection Suite - SAP Recovery Kit

Install SAP Recovery Kit in HANA Nodes change directory to SIOS installation media which was mounted as /DVD

```
cd /DVD
./setup
```
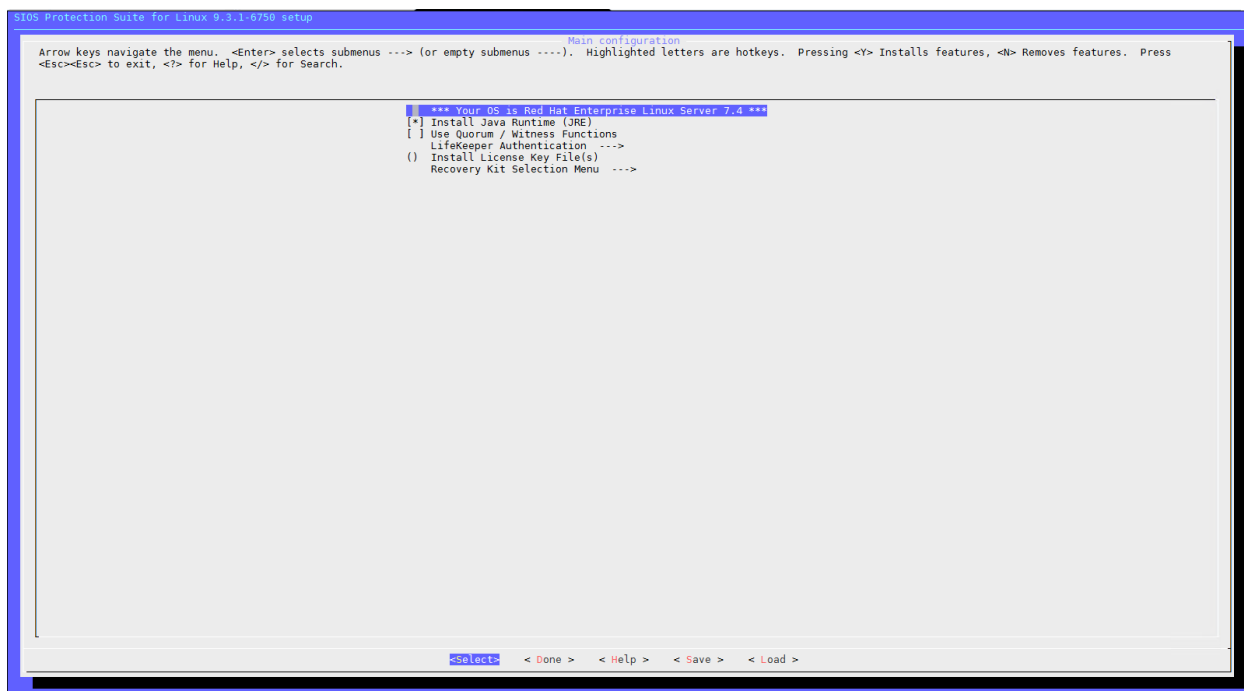
FIGURE 1 - SELECT "INSTALL LICENSE KEY"
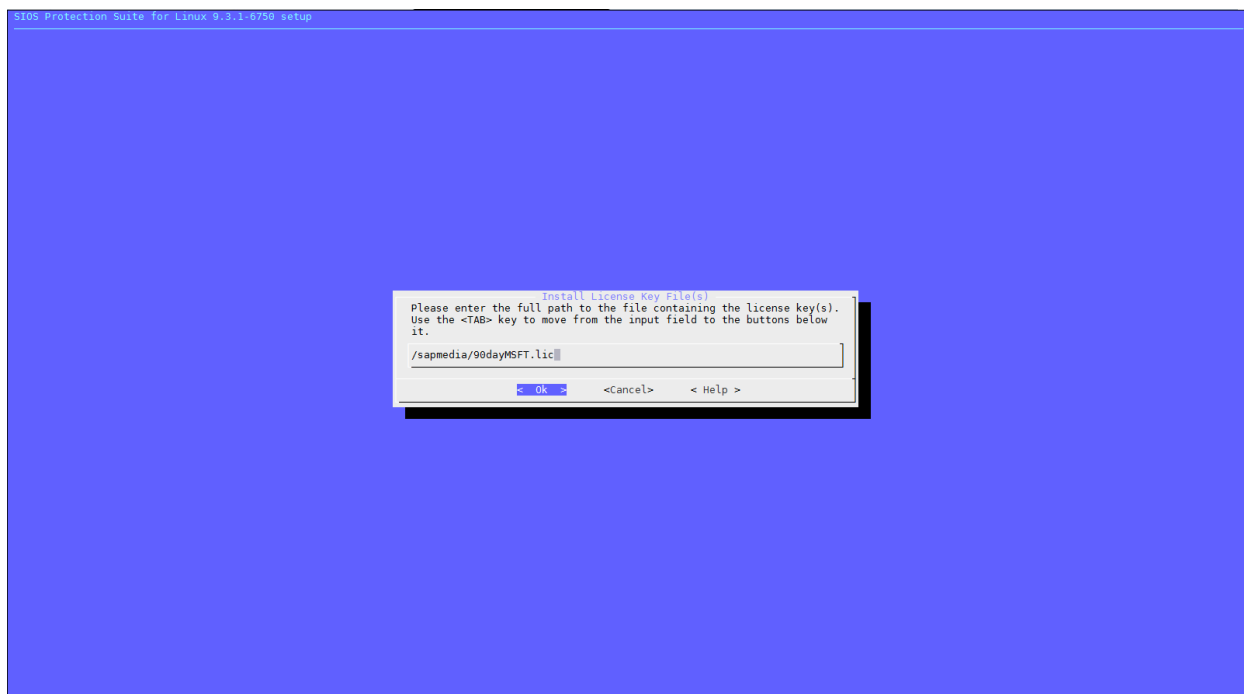
FIGURE 2 - ENTER THE LICENSE PATH & CLICK "OK"
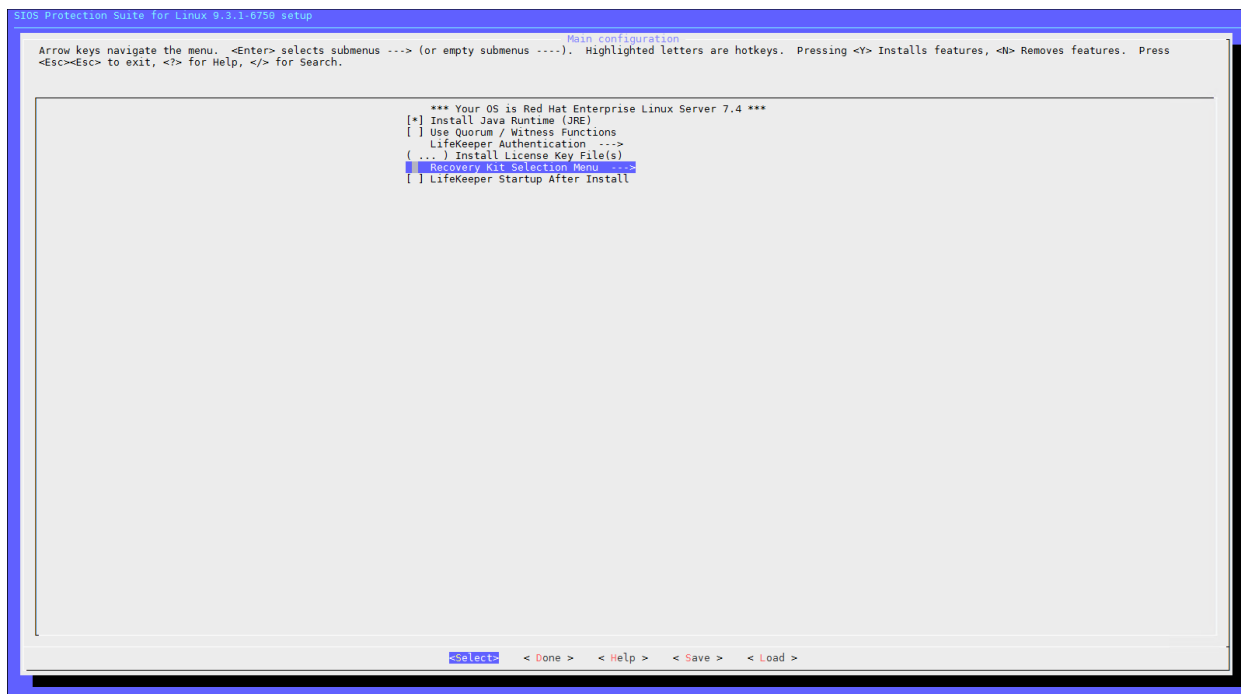
FIGURE 3 - SELECT "RECOVERY KIT SELECTION MENU"
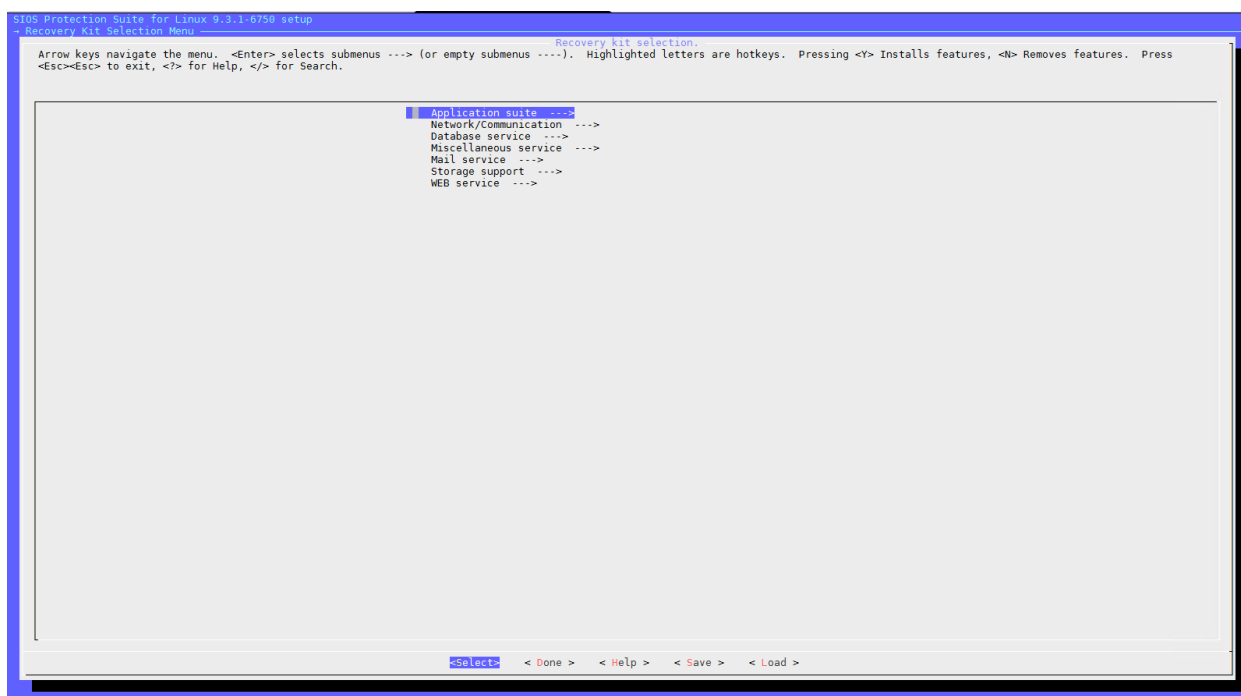
FIGURE 4 - SELECT "APPLICATION SUITE"

Application suite kits list

Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty submenus ----). Highlighted letters are hotkeys. Pressing <Y> Installs features, <N> Removes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.

[ ] LifeKeeper Websphere MQ/MQSeries Recovery Kit
[*] LifeKeeper SAP Recovery Kit

<Select>   < Done >   < Help >   < Save >   < Load >
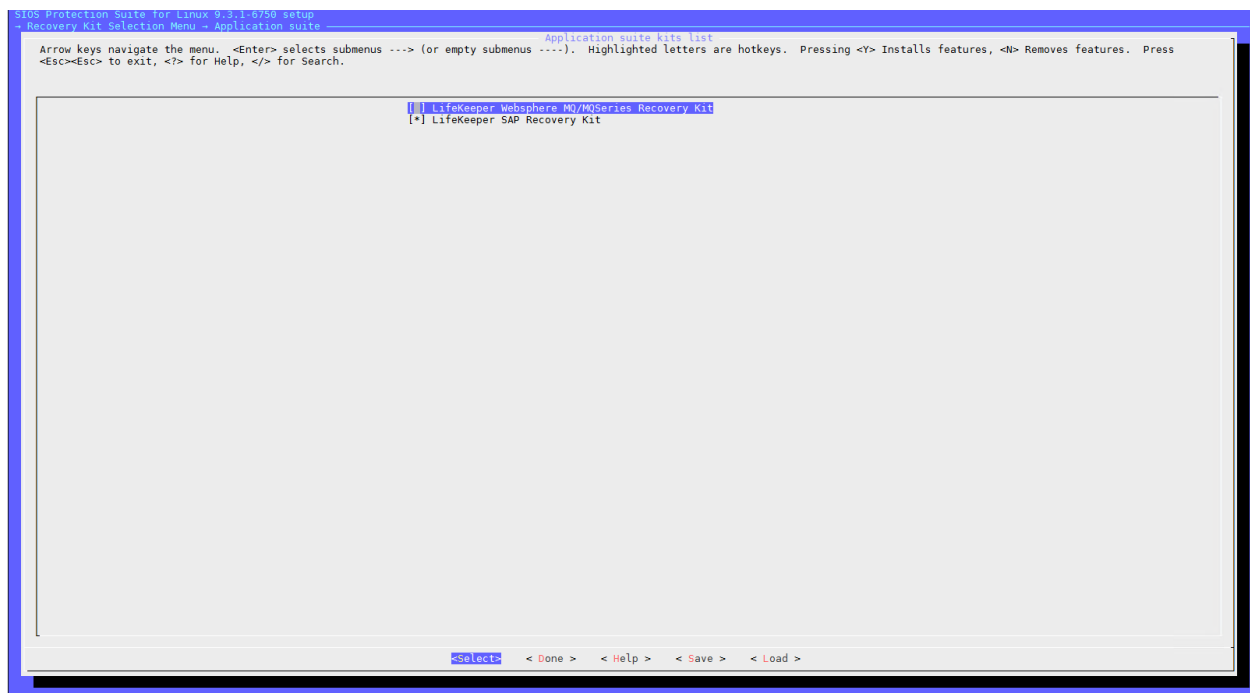
FIGURE 5 - SELECT "LIFEKEEPER SAP RECOVERY KIT"

Main configuration

Arrow keys navigate the menu. <Enter> selects submenus ---> (or empty submenus ----). Highlighted letters are hotkeys. Pressing <Y> Installs features, <N> Removes features. Press <Esc><Esc> to exit, <?> for Help, </> for Search.

*** Your OS is Red Hat Enterprise Linux Server 7.4 ***
[*] Install Java Runtime (JRE)
[ ] Use Quorum / Witness Functions
    LifeKeeper Authentication --->
(...) Install License Key File(s)
    Recovery Kit Selection Menu --->
[*] LifeKeeper Startup After Install

<Select>   < Done >   < Help >   < Save >   < Load >

FIGURE 6 - SELECT "LIFEKEEPER STARTUP AFTER INSTALL" & SELECT "DONE"
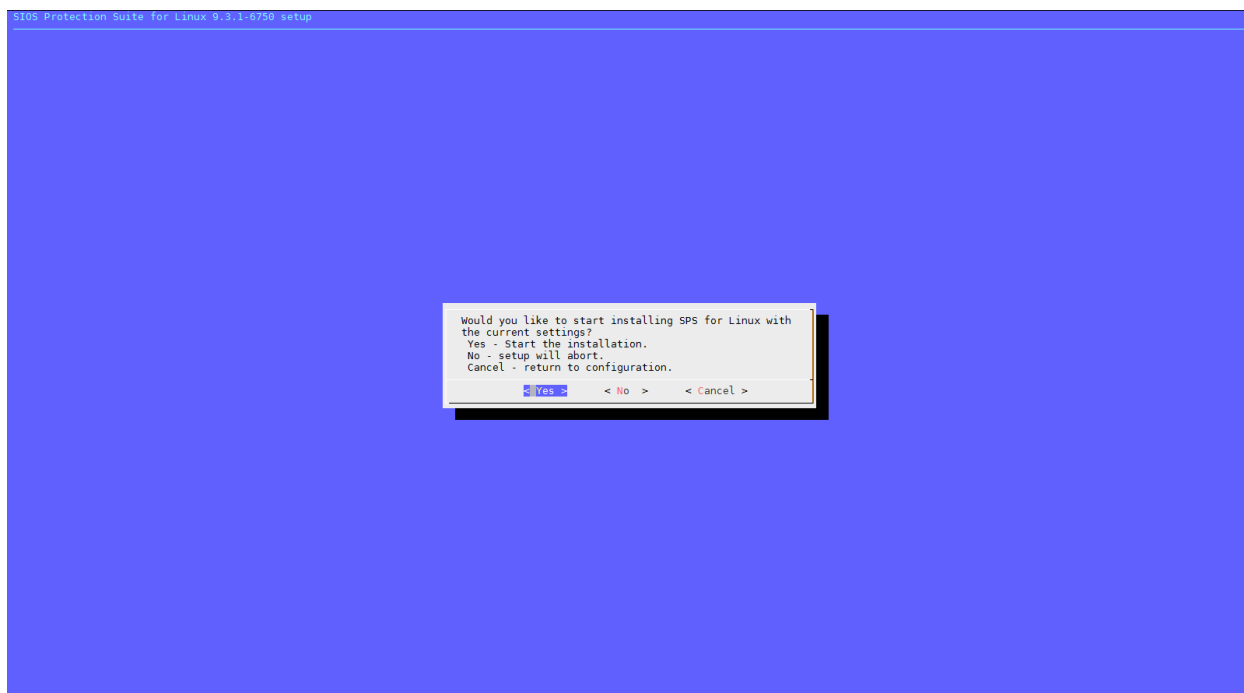
FIGURE 7 - SELECT "YES" & PRESS "ENTER"
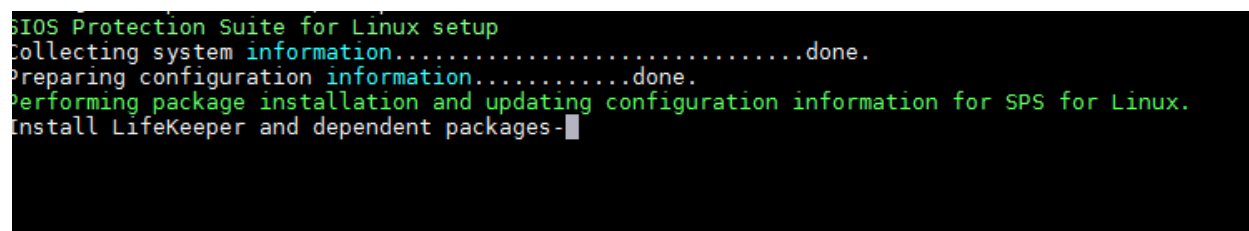
FIGURE 8 - INSTALLATION COMPLETED

FIGURE 9 - LICENSE CHECK MESSAGE

Please repeat the steps on all cluster nodes

Install SAP HANA Application Recovery Kit

Install the rpm downloaded into the /tmp directory.

rpm -ivh /tmp/steeleye-lkHOTFIX-HANA-SP1-9.1.0-6538.noarch.rpm

See http://docs.us.sios.com/spslinux/9.4.0/en/topic/sap-hana-installation-and-configuration

Install SIOS Enhanced Azure IP Gen Application (Optional) *Provided as is
You will receive the FTP link to download the tgz file.

- Use gunzip to unzip the tar file.

- Use command "tar -xvf" to untar the file.

- Run the setup program.

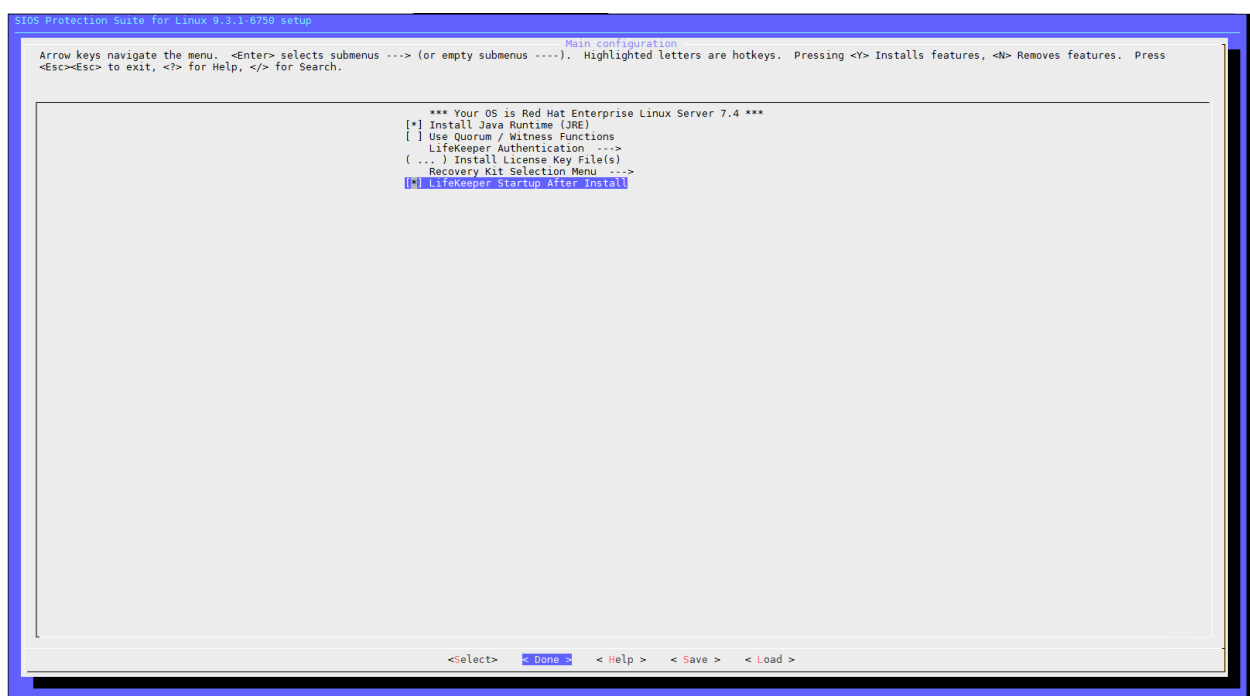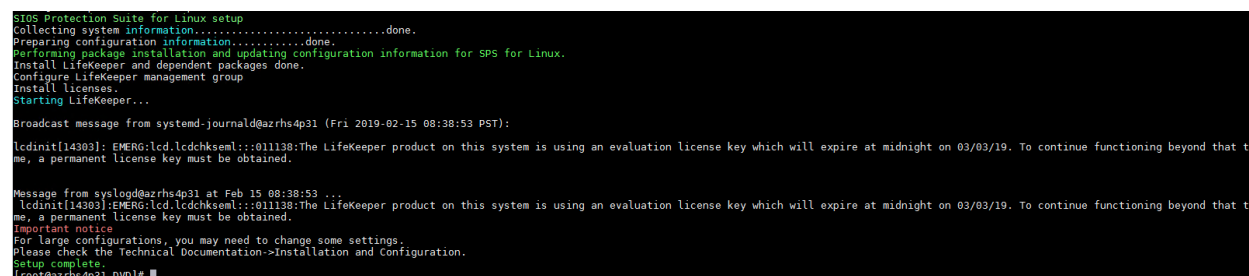- NOTE: Make sure you put the files in a folder that is safe to execute. On some installations, programs need to be authorized to execute from certain folders. You can make sure that the setup program has execute permission (chmod +x setup.)

- Repeat these steps on the other node.

- Note the folder where the files are stored (e.g. /root/folder)

Configure HANA System Replication
Backup HANA Database

Back up the databases as <hanasid>adm:

hdbsql -d SYSTEMDB -u SYSTEM -p "passwd" -i 00 "BACKUP DATA USING FILE ('initialbackupSYS')"
hdbsql -d S4D -u SYSTEM -p "passwd" -i 00 "BACKUP DATA USING FILE ('initialbackupS4D')"

Copy the system PKI files to the secondary site:

scp /usr/sap/S4D/SYS/global/security/rsecssfs/data/SSFS_S4D.DAT
azsuhana2:/usr/sap/S4D/SYS/global/security/rsecssfs/data/
scp /usr/sap/S4D/SYS/global/security/rsecssfs/key/SSFS_S4D.KEY
azsuhana2:/usr/sap/S4D/SYS/global/security/rsecssfs/key/

Create the primary site:

hdbnsutil -sr_enable --name=left

Configure System Replication on the second node:

Register the second node to start the system replication. Run the following command as <hanasid>adm :

```
sapcontrol -nr 00 -function StopWait 600 10
hdbnsutil -sr_register --remoteName=left --remoteHost=azsuhana1 --remoteInstance=00 --
replicationMode=syncmem --operationMode=logreplay --name=right
```

Create HANA Cluster Resource

Create Communication Path between Cluster Nodes and Witness

A communication path or comm path is a key part of the SIOS Protection Suite fault detection mechanism. The comm path defines the path over which SIOS sends periodic heartbeat signals between servers. This regular heartbeat signal tells each connected server, as defined by the comm paths, that the other server is still alive and active. Comm paths can be tuned via parameters to increase the heartbeat interval or detection interval, see the SIOS Parameters documentation.
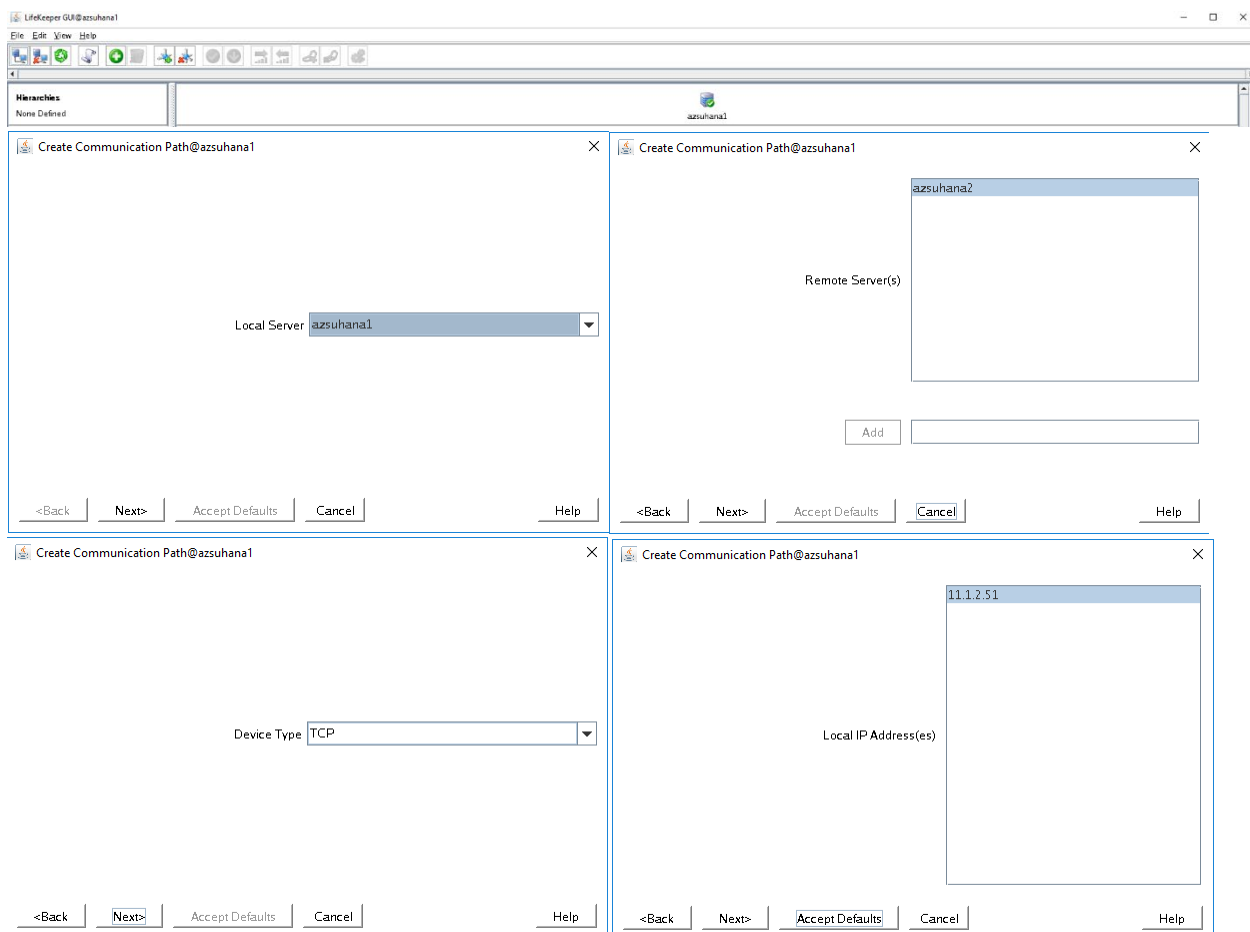
Create Communication Path@azsuhana1

Local Server: azsuhana1
Local IP: 11.1.2.51
Remote Server: azsuhana2

Remote IP Address | 11.1.2.52

`<Back` `Next>` `Accept Defaults` `Cancel` `Help`

Create Communication Path@azsuhana1

Local Server: azsuhana1
Local IP: 11.1.2.51
Remote Server: azsuhana2

Priority | 1

`<Back` `Create` `Accept Defaults` `Cancel` `Help`

Create Communication Path@azsuhana1

Local Server: azsuhana1
Local IP: 11.1.2.51
Remote Server: azsuhana2

Creating TCP Communication Path between azsuhana1 (11.1.2.51) and azsuhana2 (11.1.2.52)
Creating Communication Path from azsuhana1 to azsuhana2
Successfully created network connection
        to machine "azsuhana2" (11.1.2.52)
of type "TCP"
        from azsuhana1 (11.1.2.51).
Creating Communication Path from azsuhana2 to azsuhana1
Successfully created network connection
        to machine "azsuhana1" (11.1.2.51)
of type "TCP"
        from azsuhana2 (11.1.2.52).

`<Back` `Next>` `Accept Defaults` `Cancel` `Help`

Create Communication Path@azsuhana1

It may take a few seconds while a communication path is initializing before the state of the communication path shows that it is ALIVE and functioning normally.

`<Back` `Done` `Accept Defaults` `Cancel` `Help`

Create Communication Path@azsuhana1

Remote Server(s)

azsuhana2

`Add` | 11.1.2.66

`<Back` `Next>` `Accept Defaults` `Cancel` `Help`

Create Communication Path@azsuhana1

Device Type | TCP

`<Back` `Next>` `Accept Defaults` `Cancel` `Help`

Create Communication Path@azsuhana1

Local IP Address(es)

11.1.2.51

`<Back` `Next>` `Accept Defaults` `Cancel` `Help`

Create Communication Path@azsuhana1

Local Server: azsuhana1
Local IP: 11.1.2.51
Remote Server: azsusapwit2

Remote IP Address | 11.1.2.66

`<Back` `Next>` `Accept Defaults` `Cancel` `Help`

Create Communication Path@azsuhana1

Local Server: azsuhana1
Local IP: 11.1.2.51
Remote Server: azsusapwit2

Priority 1

<Back   Create   Accept Defaults   Cancel   Help

Create Communication Path@azsuhana1

Local Server: azsuhana1
Local IP: 11.1.2.51
Remote Server: azsusapwit2

Creating TCP Communication Path between azsuhana1 (11.1.2.51) and azsusapwit2 (11.1.2.66)

Creating Communication Path from azsuhana1 to azsusapwit2
Successfully created network connection
                to machine "azsusapwit2" (11.1.2.66)
of type "TCP"
                from azsuhana1 (11.1.2.51).
Creating Communication Path from azsusapwit2 to azsuhana1
Successfully created network connection
                to machine "azsuhana1" (11.1.2.51)
of type "TCP"
                from azsusapwit2 (11.1.2.66).

<Back   Next>   Accept Defaults   Cancel   Help

Create Communication Path@azsuhana1

It may take a few seconds while a communication path is initializing before the state of the
communication path shows that it is ALIVE and functioning normally.

<Back   Done   Accept Defaults   Cancel   Help

Create Communication Path@azsuhana1

Local Server azsuhana2

<Back   Next>   Accept Defaults   Cancel   Help

Create Communication Path@azsuhana1

Remote Server(s)

azsuhana1
azsusapwit2

Add

<Back   Next>   Accept Defaults   Cancel   Help

Create Communication Path@azsuhana1

Device Type TCP

<Back   Next>   Accept Defaults   Cancel   Help

Create Communication Path@azsuhana1

11.1.2.52

Local IP Address(es)

<Back   Next>   Accept Defaults   Cancel   Help

Create Communication Path@azsuhana1

Local Server: azsuhana2
Local IP: 11.1.2.52
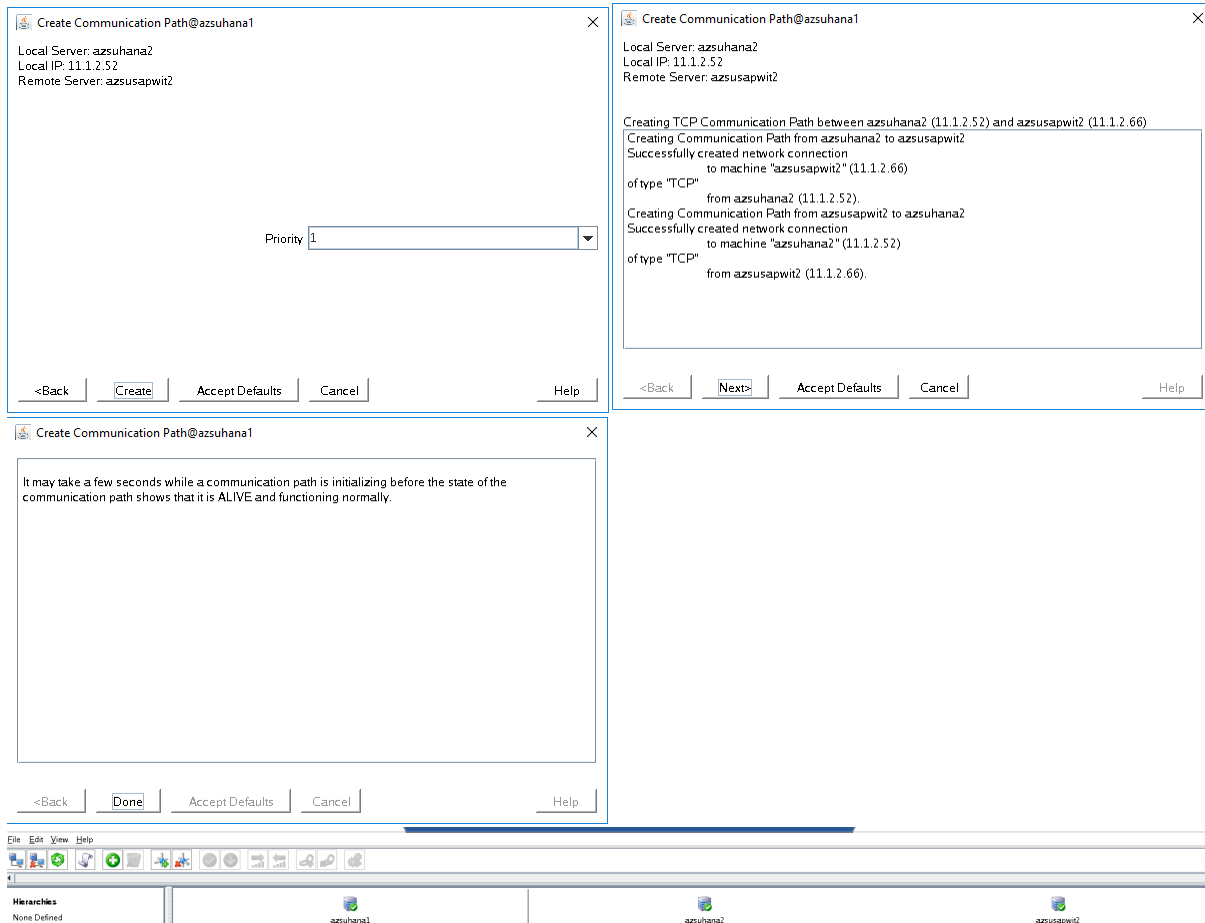Remote Server: azsusapwit2

Remote IP Address 11.1.2.66

<Back   Next>   Accept Defaults   Cancel   Help

Create Communication Path@azsuhana1   ✕

Local Server: azsuhana2
Local IP: 11.1.2.52
Remote Server: azsusapwit2

Priority 1

<Back   Create   Accept Defaults   Cancel   Help

Create Communication Path@azsuhana1   ✕

Local Server: azsuhana2
Local IP: 11.1.2.52
Remote Server: azsusapwit2

Creating TCP Communication Path between azsuhana2 (11.1.2.52) and azsusapwit2 (11.1.2.66)

Creating Communication Path from azsuhana2 to azsusapwit2
Successfully created network connection
            to machine "azsusapwit2" (11.1.2.66)
of type "TCP"
            from azsuhana2 (11.1.2.52).
Creating Communication Path from azsusapwit2 to azsuhana2
Successfully created network connection
            to machine "azsuhana2" (11.1.2.52)
of type "TCP"
            from azsusapwit2 (11.1.2.66).

<Back   Next>   Accept Defaults   Cancel   Help

Create Communication Path@azsuhana1   ✕

It may take a few seconds while a communication path is initializing before the state of the
communication path shows that it is ALIVE and functioning normally.

<Back   Done   Accept Defaults   Cancel   Help

File   Edit   View   Help

Hierarchies
None Defined   azsuhana1   azsuhana2   azsusapwit2
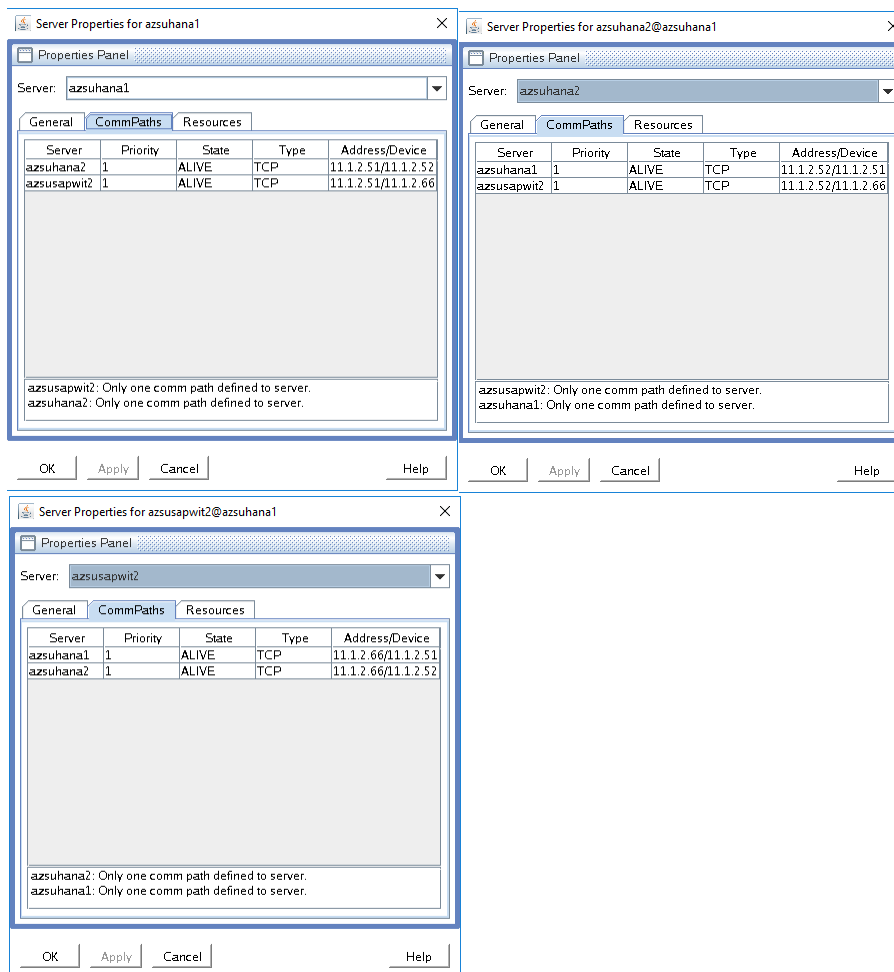
Create Azure IP Gen App for HANA (Optional)

Install Azure CLI

Install Azure CLI on the (A)SCS cluster nodes which is a pre-requisite for SIOS Enhanced Azure IP GenApp. Please refer to the installation procedure respective to OS

- RHEL
- SLES
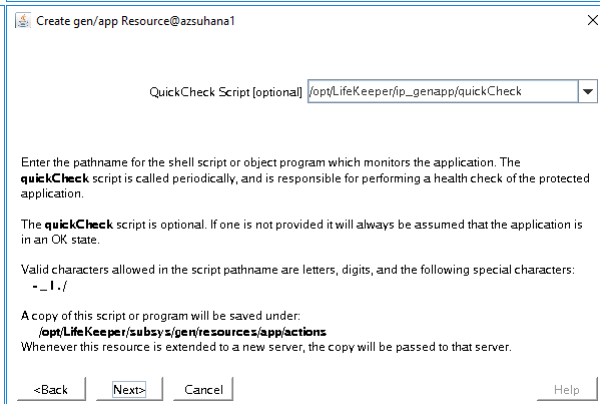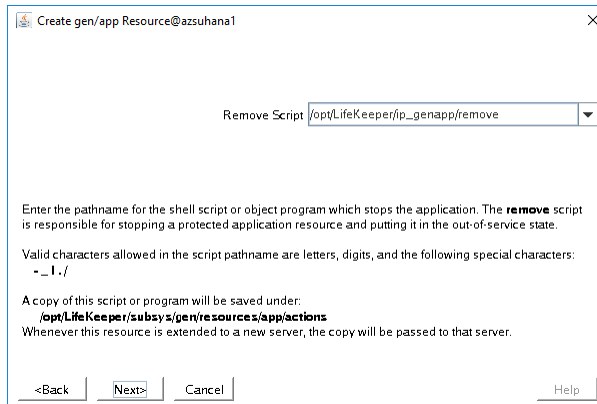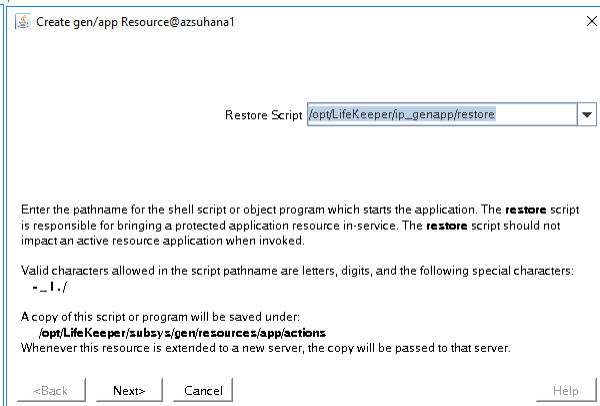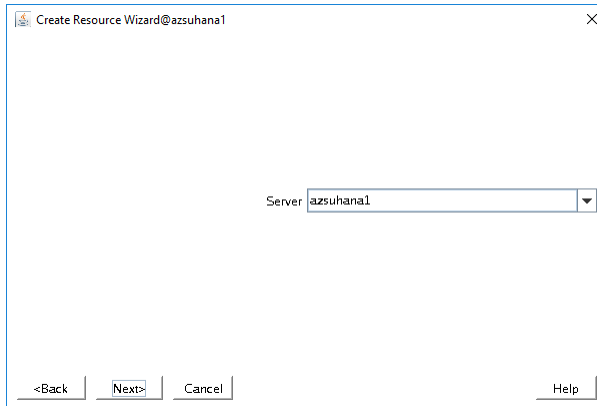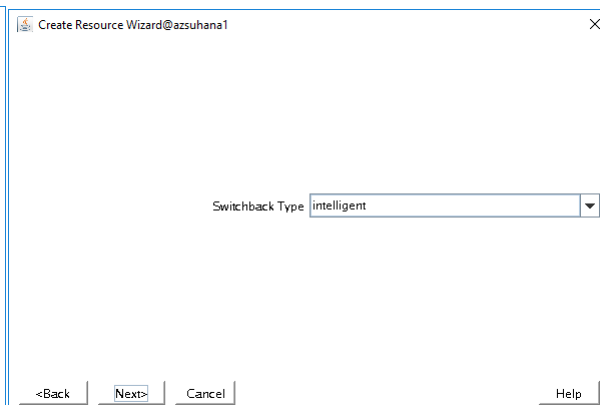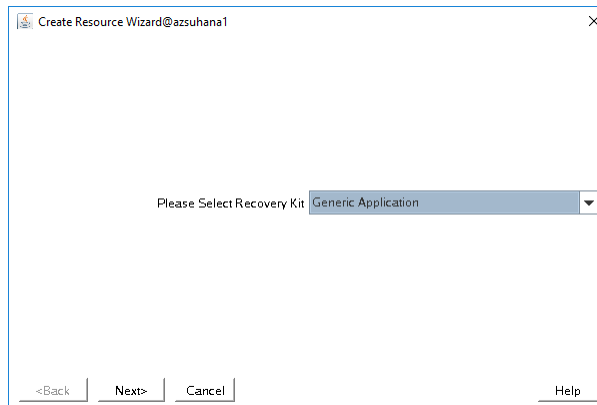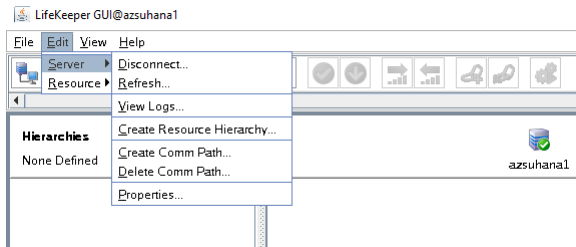
Please login to portal.azure.com from the server.

```
az login --use-device-code
```

To sign in, use a web browser to open the page https://microsoft.com/devicelogin and enter the code "B3D42JUFD" to authenticate

Create Azure IP Gen App

Create gen/app Resource@azsuhana1

Local Recovery Script [optional] `/opt/LifeKeeper/ip_genapp/recover`

Enter the pathname for the shell script or object program which will attempt to recover a failed application on the local server. This may require stopping and restarting the application.

The **local recovery** script is optional - if you do not want to provide one, simply clear the entry field. If no **local recovery** script is provided, the protected application will always fail over to the target when a **quickCheck** error occurs.

Valid characters allowed in the script pathname are letters, digits, and the following special characters:
- _ ! . /

A copy of this script or program will be saved under:
   /opt/LifeKeeper/subsys/gen/resources/app/actions
Whenever this resource is extended to a new server, the copy will be passed to that server.

`<Back` `Next>` `Cancel` `Help`

Create gen/app Resource@azsuhana1

Application Info [optional] `C_APP-azsuhana2 11.1.2.52 11.1.2.50 eth0 S4DDB`

Enter any optional data for the application resource instance that may be needed by the **restore** and **remove** scripts.

The valid characters allowed for the data field are letters, digits, and the following special characters:
- _ . / = [space]

`<Back` `Next>` `Cancel` `Help`

Create gen/app Resource@azsuhana1

Bring Resource In Service `Yes`

This field allows the user to specify if the resource should be brought in-service following a successful create.

- A user may want to select **No** if the dependent resources have not been created and the **restore** command would fail. If **No** is selected, the resource will be created but will not be brought in-service. The resource cannot be extended until the hierarchy has been placed in-service.
- Selecting **Yes** will cause the user provided **restore** script to be invoked after the resource has been created.

`<Back` `Next>` `Cancel` `Help`

Create gen/app Resource@azsuhana1

Creating gen/app resource az-ip-11.1.2.50 on azsuhana1

```
/opt/LifeKeeper/lkadm/subsys/gen/app/bin/creapphier azsuhana1 /opt/LifeKeeper/ip_genapp/restore
/opt/LifeKeeper/ip_genapp/remove az-ip-11.1.2.50 SIOS-SUSE NIC_APP-azsuhana1 11.1.2.51
NIC_APP-azsuhana2 11.1.2.52 11.1.2.50 eth0 S4DDB intelligent /opt/LifeKeeper/ip_genapp/quickCheck
/opt/LifeKeeper/ip_genapp/recover Yes
BEGIN create of "az-ip-11.1.2.50"
creating resource "az-ip-11.1.2.50"
resource "az-ip-11.1.2.50" successfully created
restoring resource "az-ip-11.1.2.50"
BEGIN restore of "az-ip-11.1.2.50"
INFORMATION: BEGIN restore of az-ip-11.1.2.50 on azsuhana1

Note: This process could take up to 2 minutes
```

Messages produced while creating **az-ip-11.1.2.50** will be displayed in this dialog and the output panel (if open), and logged on **azsuhana1**.

`<Back` `Next>` `Cancel` `Help`

Create gen/app Resource@azsuhana1

Creating gen/app resource az-ip-11.1.2.50 on azsuhana1

```
NIC_APP-azsuhana2 11.1.2.52 11.1.2.50 eth0 S4DDB intelligent
/opt/LifeKeeper/ip_genapp/quickCheck /opt/LifeKeeper/ip_genapp/recover Yes
BEGIN create of "az-ip-11.1.2.50"
creating resource "az-ip-11.1.2.50"
resource "az-ip-11.1.2.50" successfully created
restoring resource "az-ip-11.1.2.50"
BEGIN restore of "az-ip-11.1.2.50"
INFORMATION: BEGIN restore of az-ip-11.1.2.50 on azsuhana1

Note: This process could take up to 2 minutes

INFORMATION: END successful restore of az-ip-11.1.2.50 on azsuhana1
END successful restore of "az-ip-11.1.2.50"
resource "az-ip-11.1.2.50" restored
END successful create of "az-ip-11.1.2.50"
```

Messages produced while creating **az-ip-11.1.2.50** will be displayed in this dialog and the output panel (if open), and logged on **azsuhana1**.

`<Back` `Next>` `Cancel` `Help`

Pre-Extend Wizard@azsuhana1

Target Server `azsuhana2`

You have successfully created the resource hierarchy az-ip-11.1.2.50 on azsuhana1. Select a target server to which the hierarchy will be extended.

If you cancel before extending az-ip-11.1.2.50 to at least one other server, LifeKeeper will provide no protection for the applications in the hierarchy.

`<Back` `Next>` `Accept Defaults` `Cancel` `Help`
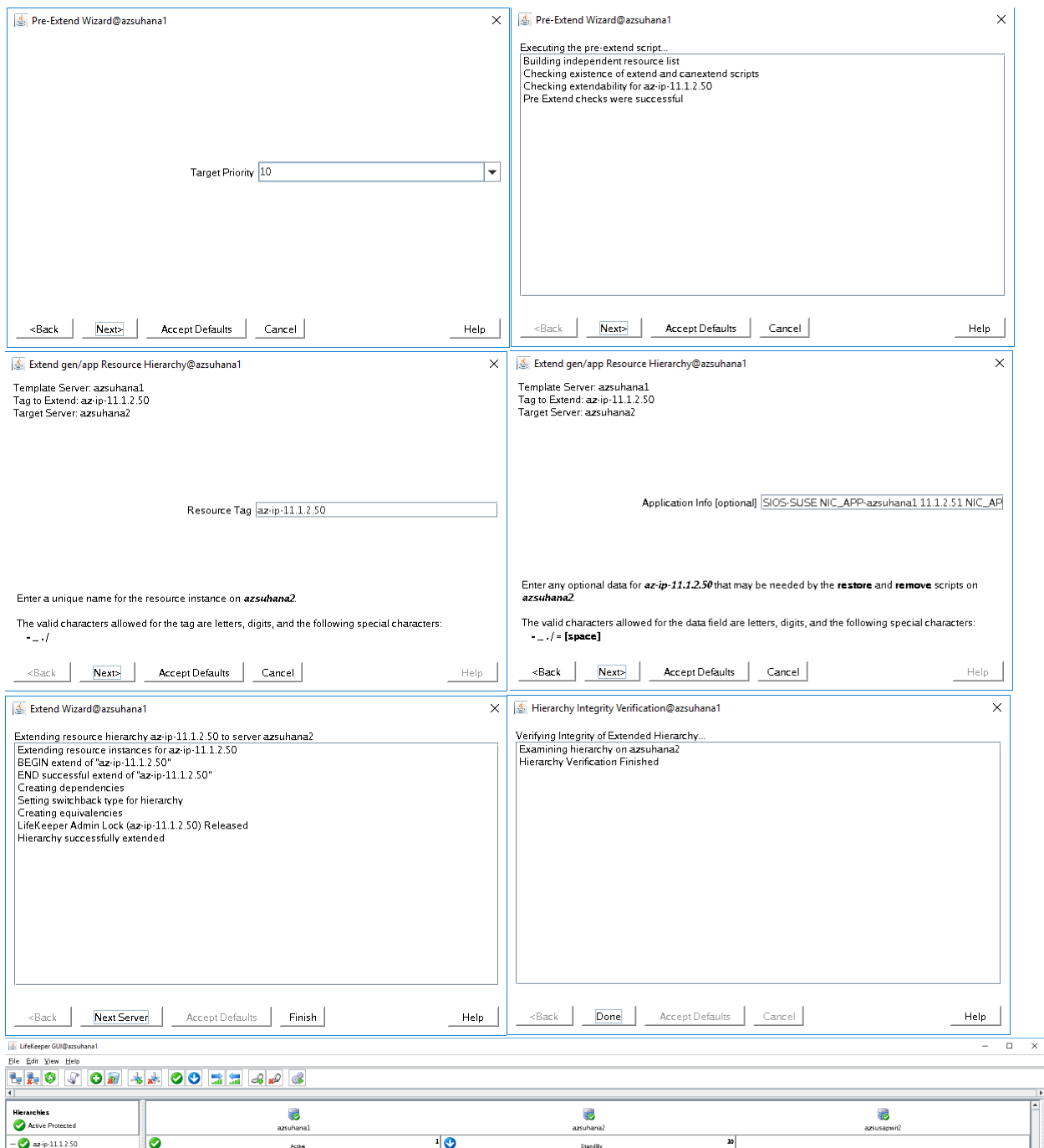

Pre-Extend Wizard@azsuhana1

Switchback Type `intelligent`

`<Back` `Next>` `Accept Defaults` `Cancel` `Help`

Pre-Extend Wizard@azsuhana1

Template Priority `1`

`<Back` `Next>` `Accept Defaults` `Cancel` `Help`

Pre-Extend Wizard@azsuhana1

Target Priority [10 ▼]

<Back   Next>   Accept Defaults   Cancel   Help

Pre-Extend Wizard@azsuhana1

Executing the pre-extend script...
Building independent resource list
Checking existence of extend and canextend scripts
Checking extendability for az-ip-11.1.2.50
Pre Extend checks were successful

<Back   Next>   Accept Defaults   Cancel   Help

Extend gen/app Resource Hierarchy@azsuhana1

Template Server: azsuhana1
Tag to Extend: az-ip-11.1.2.50
Target Server: azsuhana2

Resource Tag [az-ip-11.1.2.50]

Enter a unique name for the resource instance on **azsuhana2**.

The valid characters allowed for the tag are letters, digits, and the following special characters:
- _ ./

<Back   Next>   Accept Defaults   Cancel   Help

Extend gen/app Resource Hierarchy@azsuhana1

Template Server: azsuhana1
Tag to Extend: az-ip-11.1.2.50
Target Server: azsuhana2

Application Info [optional] [SIOS-SUSE NIC_APP-azsuhana1 11.1.2.51 NIC_AP]

Enter any optional data for **az-ip-11.1.2.50** that may be needed by the **restore** and **remove** scripts on **azsuhana2**.

The valid characters allowed for the data field are letters, digits, and the following special characters:
- _ ./ = [space]

<Back   Next>   Accept Defaults   Cancel   Help

Extend Wizard@azsuhana1

Extending resource hierarchy az-ip-11.1.2.50 to server azsuhana2
Extending resource instances for az-ip-11.1.2.50
BEGIN extend of "az-ip-11.1.2.50"
END successful extend of "az-ip-11.1.2.50"
Creating dependencies
Setting switchback type for hierarchy
Creating equivalencies
LifeKeeper Admin Lock (az-ip-11.1.2.50) Released
Hierarchy successfully extended

<Back   Next Server   Accept Defaults   Finish   Help

Hierarchy Integrity Verification@azsuhana1

Verifying Integrity of Extended Hierarchy...
Examining hierarchy on azsuhana2
Hierarchy Verification Finished

<Back   Done   Accept Defaults   Cancel   Help

LifeKeeper GUI@azsuhana1

File   Edit   View   Help

Hierarchies			
Active Protected	azsuhana1	azsuhana2	azsusapwit2
az-ip-11.1.2.50	Active 1	Standby 10	

Create IP Resource for HANA

File Edit View Help

Hierarchies	azsuhana1	azsuhana2	azsusapwit2
Active Protected			
— az-ip-11.1.2.50	Active 1	StandBy 10	

Create Resource Wizard@azsuhana1

Please Select Recovery Kit | IP |

<Back Next> Cancel Help

Create Resource Wizard@azsuhana1

Switchback Type | intelligent |

<Back Next> Cancel Help

Create Resource Wizard@azsuhana1

Server | azsuhana1 |

<Back Next> Cancel Help

Create comm/ip Resource@azsuhana1

IP Resource | 11.1.2.50 |

Enter the IP address or symbolic name to be switched by LifeKeeper. This is used by client applications to login into the parent application over a specific network interface. If a symbolic name is used, it must exist in the local /etc/hosts file or be accessible via a Domain Name Server (DNS). Any valid hosts file entry, including aliases, is acceptable. If the address cannot be determined or if it is found to be already in use, it will be rejected. If a symbolic name is given, it is used for translation to an IP address and is not retained by LifeKeeper. Both IPv4 and IPv6 style addresses are supported.

<Back Next> Cancel Help

Create comm/ip Resource@azsuhana1

Netmask | 255.255.255.0 |

Enter or select a network mask for the IP resource. Any standard network mask for the class of the specified IP resource address is valid (IPv4 or IPv6 style addresses).
Note: The choice of netmask, combined with the address, determines the subnet to be used by the IP resource and should be consistent with the network configuration.

<Back Next> Cancel Help

Create comm/ip Resource@azsuhana1

Network Interface | eth0 |

Enter or select the network interface that will be used for the IP resource being placed under LifeKeeper protection. The network interface must support the class of the IP address being protected (IPv4 or IPv6 style addresses). The default value is the first valid network interface that LifeKeeper finds on the target server that supports the class of the address being protected. Valid choices will depend on the existing network configuration and the values chosen for the IP resource address and netmask.

<Back Next> Cancel Help

Create comm/ip Resource@azsuhana1

IP Resource Tag `vip-11.1.2.50`

Enter a unique name that will be used to identify this IP resource instance on **azsuhana1**. The default tag includes the protected IP address. The valid characters allowed for the tag are letters, digits, and the following special characters:
- _ . /

[<Back] [Create] [Cancel] [Help]

Create comm/ip Resource@azsuhana1

Creating comm/ip resource...
BEGIN create of "vip-11.1.2.50"
LifeKeeper application=comm on azsuhana1.
LifeKeeper communications resource type= ip on azsuhana1.
Creating resource instance with id IP-11.1.2.50 on machine azsuhana1
Resource successfully created on azsuhana1
BEGIN restore of "vip-11.1.2.50"
END successful restore of "vip-11.1.2.50"
END successful create of "vip-11.1.2.50".

[<Back] [Next>] [Cancel] [Help]

Pre-Extend Wizard@azsuhana1

Target Server `azsuhana2`

You have successfully created the resource hierarchy vip-11.1.2.50 on azsuhana1. Select a target server to which the hierarchy will be extended.

If you cancel before extending vip-11.1.2.50 to at least one other server, LifeKeeper will provide no protection for the applications in the hierarchy.

[<Back] [Next>] [Accept Defaults] [Cancel] [Help]

Pre-Extend Wizard@azsuhana1

Switchback Type `intelligent`

[<Back] [Next>] [Accept Defaults] [Cancel] [Help]

Pre-Extend Wizard@azsuhana1

Template Priority `1`

[<Back] [Next>] [Accept Defaults] [Cancel] [Help]

Pre-Extend Wizard@azsuhana1

Target Priority `10`

[<Back] [Next>] [Accept Defaults] [Cancel] [Help]

Pre-Extend Wizard@azsuhana1

Executing the pre-extend script...
Building independent resource list
Checking existence of extend and canextend scripts
Checking extendability for vip-11.1.2.50
Pre Extend checks were successful

[<Back] [Next>] [Accept Defaults] [Cancel] [Help]

Extend comm/ip Resource Hierarchy@azsuhana1

Template Server: azsuhana1
Tag to Extend: vip-11.1.2.50
Target Server: azsuhana2

IP Resource `11.1.2.50`

The IP address or symbolic name to be protected by the IP resource on the target server. The same value that was used on the template server is used for the IP resource on the target server. Therefore, this value cannot be changed. The IP resource is used by client applications to login into the parent application over a specific network interface. If a symbolic name is used, it must exist in the local /etc/hosts file or be accessible via a Domain Name Server (DNS). Any valid hosts file entry, including aliases, is acceptable. If the address cannot be determined or if it is found to be already in use, it will be rejected. If a symbolic name is given, it is used for translation to an IP address and is not retained by LifeKeeper. Both IPv4 and IPv6 style addresses are supported.

[<Back] [Next>] [Accept Defaults] [Cancel] [Help]

Extend comm/ip Resource Hierarchy@azsuhana1

Template Server: azsuhana1
Tag to Extend: vip-11.1.2.50
Target Server: azsuhana2

Netmask | 255.255.255.0

Enter or select a network mask for the IP resource. Any standard network mask for the class of the specified IP resource address is valid (IPv4 or IPv6 style addresses).
Note: The choice of netmask, combined with the address, determines the subnet to be used by the IP resource and should be consistent with the network configuration.

<Back | Next> | Accept Defaults | Cancel | Help

Extend comm/ip Resource Hierarchy@azsuhana1

Template Server: azsuhana1
Tag to Extend: vip-11.1.2.50
Target Server: azsuhana2

Network Interface | eth0

Select a network interface to be used by the IP resource on the target server. The network interface must support the class of the IP address being protected (IPv4 or IPv6 style addresses). The default value is the first valid network interface that LifeKeeper finds on the target server that supports the class of the address being protected. Valid choices will depend on the existing network configuration and the values chosen for the IP resource address and netmask.

<Back | Next> | Accept Defaults | Cancel | Help

Extend comm/ip Resource Hierarchy@azsuhana1

Template Server: azsuhana1
Tag to Extend: vip-11.1.2.50
Target Server: azsuhana2

IP Resource Tag | vip-11.1.2.50

Enter a unique name that will be used to identify this IP resource instance on *azsuhana2*. The valid characters allowed for the tag are letters, digits, and the following special characters:
- _ . /

<Back | Extend | Accept Defaults | Cancel | Help

Extend Wizard@azsuhana1

Extending resource hierarchy vip-11.1.2.50 to server azsuhana2
Extending resource instances for vip-11.1.2.50
Creating dependencies
Setting switchback type for hierarchy
Creating equivalencies
LifeKeeper Admin Lock (vip-11.1.2.50) Released
Hierarchy successfully extended

<Back | Next Server | Accept Defaults | Finish | Help

Hierarchy Integrity Verification@azsuhana1

Verifying Integrity of Extended Hierarchy...
Examining hierarchy on azsuhana2
Hierarchy Verification Finished

<Back | Done | Accept Defaults | Cancel | Help

Create HANA Cluster Resource

Create Resource Wizard@azsuhana1 ✕

Please Select Recovery Kit `Generic Application` ▼

`<Back` `Next>` `Cancel` `Help`

Create Resource Wizard@azsuhana1 ✕

Switchback Type `intelligent` ▼

`<Back` `Next>` `Cancel` `Help`

/opt/LifeKeeper/HANA2-ARK/restore.pl

/opt/LifeKeeper/HANA2-ARK/remove.pl

/opt/LifeKeeper/HANA2-ARK/quickCheck.pl

/opt/LifeKeeper/HANA2-ARK/recover.pl

Create gen/app Resource@azsuhana1 ✕

Restore Script `/opt/LifeKeeper/HANA2-ARK/restore.pl`

Enter the pathname for the shell script or object program which starts the application. The **restore** script is responsible for bringing a protected application resource in-service. The **restore** script should not impact an active resource application when invoked.

Valid characters allowed in the script pathname are letters, digits, and the following special characters:
   - _ | . /

A copy of this script or program will be saved under:
   /opt/LifeKeeper/subsys/gen/resources/app/actions
Whenever this resource is extended to a new server, the copy will be passed to that server.

<Back   Next>   Cancel   Help

Create gen/app Resource@azsuhana1 ✕

Remove Script `/opt/LifeKeeper/HANA2-ARK/remove.pl`

Enter the pathname for the shell script or object program which stops the application. The **remove** script is responsible for stopping a protected application resource and putting it in the out-of-service state.

Valid characters allowed in the script pathname are letters, digits, and the following special characters:
   - _ | . /

A copy of this script or program will be saved under:
   /opt/LifeKeeper/subsys/gen/resources/app/actions
Whenever this resource is extended to a new server, the copy will be passed to that server.

<Back   Next>   Cancel   Help

Create gen/app Resource@azsuhana1 ✕

QuickCheck Script [optional] /opt/LifeKeeper/HANA2-ARK/quickCheck.pl ▼

Enter the pathname for the shell script or object program which monitors the application. The **quickCheck** script is called periodically, and is responsible for performing a health check of the protected application.

The **quickCheck** script is optional. If one is not provided it will always be assumed that the application is in an OK state.

Valid characters allowed in the script pathname are letters, digits, and the following special characters:
   - _ I ./

A copy of this script or program will be saved under:
   /opt/LifeKeeper/subsys/gen/resources/app/actions
Whenever this resource is extended to a new server, the copy will be passed to that server.

[<Back] [Next>] [Cancel]   [Help]

Create gen/app Resource@azsuhana1 ✕

Local Recovery Script [optional] /opt/LifeKeeper/HANA2-ARK/recover.pl ▼

Enter the pathname for the shell script or object program which will attempt to recover a failed application on the local server. This may require stopping and restarting the application.

The **local recovery** script is optional - if you do not want to provide one, simply clear the entry field. If no **local recovery** script is provided, the protected application will always fail over to the target when a **quickCheck** error occurs.

Valid characters allowed in the script pathname are letters, digits, and the following special characters:
   - _ I ./

A copy of this script or program will be saved under:
   /opt/LifeKeeper/subsys/gen/resources/app/actions
Whenever this resource is extended to a new server, the copy will be passed to that server.

[<Back] [Next>] [Cancel]   [Help]

Create gen/app Resource@azsuhana1 ✕

Application Info [optional] S4D 00 syncmem left logreplay

Enter any optional data for the application resource instance that may be needed by the **restore** and **remove** scripts.

The valid characters allowed for the data field are letters, digits, and the following special characters:

  - _ . / = [space]

<Back   Next>   Cancel   Help

Create gen/app Resource@azsuhana1 ✕

Bring Resource In Service Yes ▼

This field allows the user to specify if the resource should be brought in-service following a successful create.

- A user may want to select **No** if the dependent resources have not been created and the **restore** command would fail. If **No** is selected, the resource will be created but will not be brought in-service. The resource cannot be extended until the hierarchy has been placed in-service.
- Selecting **Yes** will cause the user provided **restore** script to be invoked after the resource has been created.

<Back   Next>   Cancel   Help

Create gen/app Resource@azsuhana1 ✕

Resource Tag `HANA-S4D` ▼

Enter a unique name for the resource instance on **azsuhana1**. The valid characters allowed for the tag are letters, digits, and the following special characters:

- _ . /

| <Back | Create Instance | Cancel | Help |

Create gen/app Resource@azsuhana1 ✕

Creating gen/app resource HANA-S4D on azsuhana1

```
/opt/LifeKeeper/HANA2-ARK/recover.pl Yes
BEGIN create of "HANA-S4D"
creating resource "HANA-S4D"
resource "HANA-S4D" successfully created
restoring resource "HANA-S4D"
BEGIN restore of "HANA-S4D"
restore for HANA-S4D started
SAP host agent is running on node azsuhana1
sapstartsrv for instance S4D_00 is running on node azsuhana1
The node azsuhana1 is already PRIMARY Master
HANA-DB S4D_00 is already running on node azsuhana1
Restore for resorce HANA-S4D finished
END successful restore of "HANA-S4D"
resource "HANA-S4D" restored
END successful create of "HANA-S4D"
```

Messages produced while creating **HANA-S4D** will be displayed in this dialog and the output panel (if open), and logged on **azsuhana1**.

| <Back | Next> | Cancel | Help |

Pre-Extend Wizard@azsuhana1 ✕

Target Server [azsuhana2 ▾]

You have successfully created the resource hierarchy HANA-S4D on azsuhana1. Select a target server to which the hierarchy will be extended.

If you cancel before extending HANA-S4D to at least one other server, LifeKeeper will provide no protection for the applications in the hierarchy.

[<Back] [Next>] [Accept Defaults] [Cancel]   [Help]

Pre-Extend Wizard@azsuhana1 ✕

Switchback Type [intelligent ▾]

[<Back] [Next>] [Accept Defaults] [Cancel]   [Help]

Pre-Extend Wizard@azsuhana1 ✕

Template Priority [1 ▼]

<Back Next> Accept Defaults Cancel Help

Pre-Extend Wizard@azsuhana1 ✕

Target Priority [10 ▼]

<Back Next> Accept Defaults Cancel Help

Extend gen/app Resource Hierarchy@azsuhana1   ✕

Template Server: azsuhana1
Tag to Extend: HANA-S4D
Target Server: azsuhana2

Resource Tag | HANA-S4D

Enter a unique name for the resource instance on **azsuhana2**.

The valid characters allowed for the tag are letters, digits, and the following special characters:
-_./

<Back | Next> | Accept Defaults | Cancel | Help

Extend gen/app Resource Hierarchy@azsuhana1   ✕

Template Server: azsuhana1
Tag to Extend: HANA-S4D
Target Server: azsuhana2

Application Info [optional] | S4D 00 syncmem right logreplay

Enter any optional data for **HANA-S4D** that may be needed by the **restore** and **remove** scripts on **azsuhana2**.

The valid characters allowed for the data field are letters, digits, and the following special characters:
-_./ = [space]

<Back | Next> | Accept Defaults | Cancel | Help

Extend Wizard@azsuhana1

Extending resource hierarchy HANA-S4D to server azsuhana2

```
Extending resource instances for HANA-S4D
BEGIN extend of "HANA-S4D"
END successful extend of "HANA-S4D"
Creating dependencies
Setting switchback type for hierarchy
Creating equivalencies
LifeKeeper Admin Lock (HANA-S4D) Released
Hierarchy successfully extended
```

<Back   Next Server   Accept Defaults   Finish   Help

Hierarchy Integrity Verification@azsuhana1

Verifying Integrity of Extended Hierarchy...

```
Examining hierarchy on azsuhana2
Hierarchy Verification Finished
```

<Back   Done   Accept Defaults   Cancel   Help

Create Dependency to HANA & IP Resource

Operations

Cluster Failover Test

Controlled failover

LifeKeeper GUI@azsuhana1

File Edit View Help

Hierarchies
Active Protected

HANA-S4D
vip-11.1.2.50
az-ip-11.1.2.50

azsuhana1   azsuhana2   azsusapwit2

Active 1 StandBy 10
Active 1 StandBy 10
Active 1 StandBy 10

In Service@azsuhana1

Bringing HANA-S4D in service on azsuhana1
Put resource "HANA-S4D" in-service
BEGIN restore of "az-ip-11.1.2.50"
INFORMATION: BEGIN restore of az-ip-11.1.2.50 on azsuhana1

Note: This process could take up to 2 minutes

Running command (az network nic ip-config create --resource-group SIOS-SUSE --nic-name NIC_APP-azsuhana1 --private-ip-address 11.1.2.50 --name S4DDB > /dev/null 2>&1) on azsuhana2
INFORMATION: END successful restore of az-ip-11.1.2.50 on azsuhana1
END successful restore of "az-ip-11.1.2.50"
BEGIN restore of "vip-11.1.2.50"
END successful restore of "vip-11.1.2.50"
BEGIN restore of "HANA-S4D"
restore for HANA-S4D started
SAP host agent is running on node azsuhana1
sapstartsrv for instance S4D_00 is running on node azsuhana1
Takeover of System Replication started on node azsuhana1
Node azsuhana1 is now PRIMARY master
Takeover of System Replication finished successful on node azsuhana1
HANA-DB S4D_00 is already running on node azsuhana1
DEBUG[0524]: getRemoteHostParmName: set profileHostName=azsuhana1. dflt=azsuhana1
Replication mode on node azsuhana2 is now syncmem
Reenable system replication on node azsuhana2 finished successful
Node azsuhana2 is now registered in system replication mode syncmem at node azsuhana1
SAP host agent is running on node azsuhana2
sapstartsrv for instance S4D_00 is running on node azsuhana2
Starting HANA-DB S4D_00 on node azsuhana2
Start of HANA-DB S4D_00 on node azsuhana2 successful
Restore for resorce HANA-S4D finished
END successful restore of "HANA-S4D"

<Back   Done   Cancel   Help

LifeKeeper GUI@azsuhana1

File Edit View Help

Hierarchies
Active Protected

HANA-S4D
vip-11.1.2.50
az-ip-11.1.2.50

azsuhana1   azsuhana2   azsusapwit2

Active 1 StandBy 10
Active 1 StandBy 10
Active 1 StandBy 10

In Service@azsuhana1

Bringing HANA-S4D in service on azsuhana1
BEGIN restore of "az-ip-11.1.2.50"
INFORMATION: BEGIN restore of az-ip-11.1.2.50 on azsuhana1

Note: This process could take up to 2 minutes

Running command (az network nic ip-config create --resource-group SIOS-SUSE --nic-name NIC_APP-azsuhana1 --private-ip-address 11.1.2.50 --name S4DDB > /dev/null 2>&1) on azsuhana2
INFORMATION: END successful restore of az-ip-11.1.2.50 on azsuhana1
END successful restore of "az-ip-11.1.2.50"
BEGIN restore of "vip-11.1.2.50"
END successful restore of "vip-11.1.2.50"
BEGIN restore of "HANA-S4D"
restore for HANA-S4D started
SAP host agent is running on node azsuhana1
sapstartsrv for instance S4D_00 is running on node azsuhana1
Takeover of System Replication started on node azsuhana1
Node azsuhana1 is now PRIMARY master
Takeover of System Replication finished successful on node azsuhana1
HANA-DB S4D_00 is already running on node azsuhana1
DEBUG[0524]: getRemoteHostParmName: set profileHostName=azsuhana1. dflt=azsuhana1
Replication mode on node azsuhana2 is now syncmem
Reenable system replication on node azsuhana2 finished successful
Node azsuhana2 is now registered in system replication mode syncmem at node azsuhana1
SAP host agent is running on node azsuhana2
sapstartsrv for instance S4D_00 is running on node azsuhana2
Starting HANA-DB S4D_00 on node azsuhana2
Start of HANA-DB S4D_00 on node azsuhana2 successful
Restore for resorce HANA-S4D finished
END successful restore of "HANA-S4D"
Put "HANA-S4D" in-service successful

<Back   Done   Cancel   Help

LifeKeeper GUI@azsuhana1

File Edit View Help

Hierarchies
Active Protected

HANA-S4D
vip-11.1.2.50
az-ip-11.1.2.50

azsuhana1   azsuhana2   azsusapwit2

Active 1 StandBy 10
Active 1 StandBy 10
Active 1 StandBy 10

Kernel Panic

Enter the following command

```
echo c > /proc/sysrq-trigger
```

Appendix

Important reads

Read the following SAP Notes and papers first: SAP Note 1662610 Support details for SIOS Protection Suite for Linux

SAP Note 1928533, which has:

The list of Azure VM sizes that are supported for the deployment of SAP software.

Important capacity information for Azure VM sizes.

The supported SAP software, and operating system (OS) and database combinations.

The required SAP kernel version for Windows and Linux on Microsoft Azure.

SAP Note 2015553 lists the prerequisites for SAP-supported SAP software deployments in Azure.

SAP Note 2205917 has recommended OS settings for SUSE Linux Enterprise Server for SAP Applications.

SAP Note 2009879 has SAP HANA Guidelines for Red Hat Enterprise Linux

SAP Note 1944799 has SAP HANA Guidelines for SUSE Linux Enterprise Server for SAP Applications.

SAP Note 2178632 has detailed information about all of the monitoring metrics that are reported for SAP in Azure.

SAP Note 2191498 has the required SAP Host Agent version for Linux in Azure.

SAP Note 2243692 has information about SAP licensing on Linux in Azure.

SAP Note 1984787 has general information about SUSE Linux Enterprise Server 12.

SAP Note 1999351 has additional troubleshooting information for the Azure Enhanced Monitoring Extension for SAP.

SAP Note 401162 has information on how to avoid "address already in use" when setting up HANA System Replication.

SAP Community WIKI has all the required SAP Notes for Linux.

SAP HANA Certified IaaS Platforms

Azure Virtual Machines planning and implementation for SAP on Linux guide.

[Azure Virtual Machines deployment for SAP on Linux](#) (this article).

[Azure Virtual Machines DBMS deployment for SAP on Linux guide](#).

[SUSE Linux Enterprise Server for SAP Applications 12 SP3 best practices guides](#)

Setting up an SAP HANA SR Performance Optimized Infrastructure (SLES for SAP Applications 12 SP1). The guide contains all the required information to set up SAP HANA System Replication for on-premises development. Use this guide as a baseline.

Setting up an SAP HANA SR Cost Optimized Infrastructure (SLES for SAP Applications 12 SP1)