# HP Storage Essentials Application Integration Software
## for SAP Adaptive Computing Controller White Paper
### 2nd Edition

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Executive Summary

Every IT organization understands the cost and challenges involved in the administration and maintenance of networking and storage infrastructures. HP offers a unified solution that can reduce IT expenses, streamline processes, and reduce complexity. HP Storage Essentials (HP SE) is a part of the unified IT solutions that HP offers. HP Storage Essentials is an open, standards-based suite of storage software that delivers integrated heterogeneous functionality for storage network (DAS, SAN, and NAS) management, storage resource management, provisioning, and application infrastructure monitoring. HP Storage Essentials monitors the performance of the storage infrastructure that supports key business applications so customers can promptly diagnose the root causes of application performance issues. Another key functionality of HP Storage Essentials is to manage the provisioning of storage devices in a storage area network (SAN).

SAP applications and database are typically stored into and loaded from storage devices in a SAN. SAP’s Adaptive Computing Controller (ACC) virtualizes the applications or services which includes application resources and storage. SAP ACC provides vendor integration to enable virtualized storage management. The HP Storage Essentials Storage Resource Management (SRM) Enterprise Edition 6.0 Microsoft Windows Application Integration Software for SAP Adaptive Computing Controller extends HP SE to support SAP ACC for Storage Area Network (SAN) attached storage from Hewlett-Packard (HP).

This whitepaper describes the implementation of an Adaptive Computing environment for SAP application services. The network used consists of Windows Server 2003- managed nodes running on an HP BladeSystem and HP Integrity servers using an HP StorageWorks XP10000/12000/24000 Disk Array, and an HP StorageWorks EVA 4000/4100/6000/6100/8000/8100. This document provides an overview of the setup, integration, and configuration of the HP-specific implementation.
Adaptive Computing Setup

The Adaptive Computing environment supported by HP Storage Essentials for SAP ACC consists of managed node servers, control stations, and storage disk array(s). Managed nodes are Windows 2003 servers that can host SAP central instances and database instances. Microsoft SQL Server 2005 SP1 is used for database instances. The control stations consist of at least four servers—HP SE, HP SE Provider, SAP Solution Manager, SAP ACC, and DNS server (could be combined with SAP Solution Manager). The servers used for the managed nodes and control stations could either be HP BladeSystem or HP Integrity server. The number of servers used for the control stations can be reduced to four by combining the DNS server with either the SAP Solution Manager or SAP ACC server. The following Figure 1 illustrates a sample implementation of an Adaptive Computing environment.

Figure 1. Adaptive Computing Configuration

In the configuration shown in Figure 1, four services are configured—two database services for SAP system X22 and for SAP System B77 and two central instance services for SAP system X22 and B77. All Application Services use disks which reside on a storage disk array accessible through a storage area network (SAN). In all cases, Microsoft SQL Server 2005 SP1 was used for the database software. Using HP Storage Essentials' integration software for SAP ACC provides the ability to relocate SAP and database services from one managed node to another easily. The services could be combined to run in one node as the case with SAP System B77 or split as in SAP System X22.
Hardware Components

Control Stations

There are at least four control stations (servers) required for Adaptive Computing Controller—HP SE, SAP ACC, SAP Solution Manager, and HP SE Provider server. A fifth server, DNS, could be combined with the SAP Solution Manager server. If the storage disk array used is an EVA, Command View EVA could either be installed on the HP SE Provider server or else an additional server will be necessary. Command View XP software is not required for the XP disk arrays. A blade or non-blade server can be used for the control stations. In the test performed, all control stations used a BL460c blade server. The operating system is 32-bit Windows Server 2003. 60 GB internal disk drives were used but in a customer environment, however HP recommends a minimum of 120 GB for the DNS, SAP ACC, and SAP Solution Manager servers. It is also recommended to have a connection from the control stations to the local SAN storage and utilize the disk space from SAN in a reliable and efficient way. The recommended LAN used for the interconnections between the managed nodes and control stations is at least 100 Mbps. The minimum required memory for each server used in the Adaptive Computing environment is 3 GB. Refer to HP SE documentation for the recommended hardware and software requirements for the HP SE and Provider servers.

Managed Landscape

The managed landscape or adaptive managed nodes used in the reference system shown in Figure 1 consists of three BL460c blade servers with Windows Server 2003 x64 operating system and three HP rx2600 Integrity servers with Windows Server 2003 IA64 operating system. HP Storage Essentials agent, MS SQL database, and MPIO software are installed on the managed nodes. All managed nodes need to have the supported Fibre Channel host bus adapters (HBA) for SAN connectivity. Internal disks are used for central operating system and database operations while the SAN is used exclusively for storing database data files and SAP data.

Storage

All files for the application and database services reside on physically-mounted partitions from SAN attached storage via Fibre Channel to the managed nodes. Every physical I/O to data files, transaction logs, and SAP files are directed to the physically attached SAN disks.

The current implementation of the Adaptive Computing concept is based on an “OS dynamic disk provisioning” method (not to be confused with the supported Windows disk configuration of Basic disks only). HP Storage Essentials SRM Application Integration software for SAP ACC is responsible for the storage virtualization. The integration software currently supports HP StorageWorks XP10000/12000/20000/24000 and HP StorageWorks EVA 4000/4100/6000/6100/8000/8100 storage disk arrays.

Software Components

Operating System

The supported operating system on the managed nodes is Windows Server 2003 x64 R2 SP2 and Windows Server 2003 IA64 SP2. On the control station servers, the operating system used is Windows Server 2003 x86 R2 SP2. All servers are configured on an Active Directory Domain using Roaming Profiles. Registry edits are necessary for all managed nodes in order to support virtual hostnames.
HP Storage Essentials

The supported version on the SAP ACC environment is HP SE 6.0 Enterprise Edition. Once HP SE is fully configured, the software for SAP ACC integration can be installed on top of it. No other software or configuration is necessary to setup the integration software besides the HP SE and HP SIM7 credentials and port information inputs provided during its installation.

SAP Software

There are two main SAP control station servers—the SAP ACC Server and SAP Solution Manager. Solution Manager Version 3.2 SP15 and ACC version 1.0 SP14 were configured. The managed nodes already have Java installed since that is required to install an instance of SAP. For Windows x64, there is a specific Java version for SAP that should be used instead of downloading the standard version available online. Refer to SAPNote 725397 for further information. In the tested configuration, the Unicode version of SAP was tested with ABAP-only instances.

Database

Microsoft SQL Server 2005 SP1 is the supported database for SAP in this release. Only the database engine needs to be installed in all the managed nodes. The database itself is created during the SAP installation. Unless a central management station is used for SQL servers, it is recommended that the SQL Management Studio be installed on the managed node(s). The SQL Management Studio can be used to configure the SQL files on the managed node(s) for the database to successfully relocate from one node to another.

Multipathing

If dual path is configured for storage, all managed nodes need the fully-featured HP MPIO DSM for XP version 2.00.01 installed for the XP disk array or HP MPIO DSM for EVA disk array version 2.01.00. The latest version is downloadable from the HP Support website. This software is not necessary if using a single path.

Preparation of OS for Adaptive Computing

Certain configuration tasks need to be performed initially to establish an Adaptive Computing environment. Active Directory domain, hostnames and IPs (virtual and physical), and roaming profiles need to be configured.

Active Directory Domain

All configurations of users, groups, or services shall be centrally managed by Active Directory Services. It is recommended that a dedicated server is used. To manage all activities, some operations have to be centralized in the environment. All user and managed nodes must be a member of an Active Directory domain. The user profiles of the SAP users must be centrally hosted on a central server and made available through shares.

Hostnames and IP Addresses

All managed nodes shall be configured to use physical and virtual hostnames and joined to the Adaptive Computing Windows domain.

- The physical IP and (short) hostname must be added to the Windows hosts file.
- SAP ACC activates the virtual IP/hostname on the managed node that is running the SAP application service and database. The following table (Table 1) lists the registry entries necessary to support virtual hostname to get activated by SAP ACC on the managed nodes. Before updating the registry, please read the Microsoft whitepaper regarding the use of SQL 2005 with SAP R/3.
Table 1. Registry edits for Virtual Hostname support

<table>
<thead>
<tr>
<th>KEY</th>
<th>NAME</th>
<th>TYPE</th>
<th>DATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>HKLM\SYSTEM\CurrentControlSet\Control\Lsa</td>
<td>DisableLoopbackCheck</td>
<td>DWORD</td>
<td>1</td>
</tr>
<tr>
<td>HKLM\SYSTEM\CurrentControlSet\Control\Lsa\MSV1_0</td>
<td>BackConnectionHostnames</td>
<td>MULTI_SZ</td>
<td>Virtual Hostnames</td>
</tr>
<tr>
<td>HKLM\SYSTEM\CurrentControlSet\Services\lanmanserver\parameters</td>
<td>OptionalNames</td>
<td>MULTI_SZ</td>
<td>Virtual Hostnames</td>
</tr>
</tbody>
</table>

Roaming Profiles

Designate a server to be used to save the roaming profiles. In the test setup, the SAP ACC server was selected. Every SAP installation has an associated system ID (SID). The SID is a 3-character alphanumeric description of the SAP install, e.g. X22 or B77. When SAP is installed, two key users, SIDadm and SAPServiceSID, are created. Roaming profiles must be created for these users. After that, they need to be initialized on the managed nodes where the SAP SID will be relocated to by logging in as such usernames.

Adaptive Computing Files

SAP has the latest Adaptive Computing files available from download online. Extract the SAR file into the managed node directory, %SYSTEMDRIVE%\usr\sap\adaptive. There are two libraries required to support Adaptive Computing. The first library is the platform library named libsapacosprep.dll while the other library is the partner-specific library named libsapacosprep_<partnerID>.dll. For the Windows operating system, SAP provides the platform library. The partner specific library, libsapacosprep_hp.dll, is provided by HP. It gets installed on the managed node using the HP SE Integration software for SAP ACC.

OpenSSH

SAP ACC uses Secure Shell (SSH) to communicate to the managed nodes. OpenSSH software is deployed to the managed nodes through HP System Insight Manager (HP SIM). Once it is deployed, updates to the SSH config file to allow for password-free RSA Authentication communication between the SAP ACC server and the managed node.

SAP start/stop scripts

Once the disks containing SAP and database files are presented and mounted on the managed node, SAP application services must be started remotely through an SSH call to a start script from the SAP ACC server. The same requirement goes for a stop script to deactivate the SAP application services prior to unmounting and unpresenting of disks on the managed node. SAP currently does not have the start and stop scripts available for the Windows OS and SQL Server database. HP can provide customers sample scripts for reference and/or further customization.

Adaptive-Enabled Managed Nodes

Once SAP Application Services and database are fully configured on the managed nodes, they need to be activated to support Adaptive Computing. The activation is triggered using SAP Solution Manager. For details, please refer to the SAP Adaptive Computing Implementation document. Only Adaptive-enabled servers are visible on the SAP ACC GUI.
HP Storage Essentials Storage Virtualization

Storage in the Adaptive Computing infrastructure is virtualized by HP SE. HP SE is storage management software used to centrally manage and monitor resources in a Storage Area Network. HP SE can store all information about hosts and disks available in one or more SANs.

While start (attach), stop (detach) and relocation (relocate) of application services are controlled from the SAP ACC server, each managed node has a number of local services that perform the required work on the respective managed node. Generally, the stack of installed components for the adaptive managed nodes is illustrated in the following Figure 2.

Figure 2. Adaptive Computing stack of installed components

The sapacosprep service is used to prepare the environment of an application service upon start and removes the established environment upon stop of this service. Besides this service, there is an agent called sapacoscol which is also installed into the OS during the deployment phase. The sapacoscol service reads data, that is, hostnames, OS version, CPU utilization, and so on, out of the shared memory and transfers it to SAP ACC. For further details, refer to the SAP ACC implementation guide.

The SAP services preinstalled in each managed node will reside in the adaptive directory called %SYSTEMDRIVE%\usr\sap\adaptive. The platform library required to communicate with HP SE integration library and perform resource allocation will also reside in the same adaptive directory.
Additionally, the two start and stop sample scripts provide by HP have to be copied into the SAP ACC adaptive directory.

**Storage Resource Identifier (SRID)**

Since the implementation of the Adaptive Infrastructure on UNIX supports NFS mounts as well as SAN mounts, the configuration of file systems in the SAP ACC should reflect the type of file system. As differentiation between NFS and SAN mounts, the syntax in the following Table 2 is used. HP Storage Essentials supports NTFS SRID type.

<table>
<thead>
<tr>
<th>STORAGE TYPE</th>
<th>SRID</th>
<th>SRID TYPE</th>
<th>PARTNER ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>SRID</td>
<td>CI_X22_SRID</td>
<td>NTFS</td>
<td>hp</td>
</tr>
</tbody>
</table>

An SRID does not necessarily represent a single disk. It represents a group of disks that belong to an SAP or database service. HP SE takes care that all disks are cleanly attached/detached and mounted/unmounted on the file system.

Virtual Disks are grouped by HP SE Integration software for SAP ACC in disk configurations. Each disk configuration is assigned an SRID. The SRID is used by the Adaptive Computing Controller to refer to the virtual disks belonging to a specific SAP or DB service. In the reference system shown in Figure 1 earlier, the CI_<SID>_SRID convention for the data of the SAP instance and DB_<SID>_SRID convention for the disks belonging to the database were used. Any string format is acceptable as long as it matches what is specified in the SAP ACC configuration for the particular SID. HP SE checks and attaches/detaches all disks belonging to an SRID on a specific target node. For each SRID that can be activated or deactivated on a chosen pool node, HP SE keeps an entry in an XML file. For every SRID, HP SE stores the name, location, WWID of the disks, LUNs, and the reparse points to be used when attaching to a pool node. Any changes to the XML files should only be performed using HP SE SRM Application Integration Software for SAP ACC configuration user interface.
Adaptive Computing Operations

There are 3 operations provided by SAP ACC—attach, detach, and relocate. The attach operation is the process of presenting and mounting SAP storage resources, and starting of SAP applications on a managed node. The detach operation is the process of stopping the SAP applications and unmounting, and unpresenting of SAP storage resources on a managed node. The relocate operation is a combination of the detach operation from one managed node followed by an attach operation to another managed node of SAP. The following Figure 3 depicts the interaction between SAP ACC and HP SE. Following the diagram are the step by step details of the operations.

Figure 3. Interaction between HP SE and SAP ACC

Attach Operation

Refer to Figure 3 for the steps described on the attach operation.

1. An attach operation is invoked from the SAP ACC Server which calls sapacosprep on the managed node to activate the virtual IP via an SSH call.
2. SAP ACC makes another call to sapacosprep which passes the SRID information of what is to be attached to the partner-specific library on the managed node.
3. The managed node processes the SAP ACC attach request by passing the SRID information to the integration software.
4. Based on the SRID, HP SE can determine which virtual disk to present and mount to the managed node. HP SE communicates to the SVP Web Console on an XP disk array. On the other hand, HP SE communicates to Command View EVA on an EVA disk array.
5. The HP SE Provisioning call to the storage disk array will cause the appropriate virtual disk to be presented to the managed node. Once presented, HP SE mounts it and sends a message to the corresponding OS-agent to mount the disks on the target system’s file system. HP SE checks and creates reparse points for the disks to be attached on the managed nodes. The same happens to all the SAP sapmnt directory structure.

6. After a successful mount, SAP ACC calls the start script to run the SAP or DB application service.

**Detach Operation**

Refer to Figure 3 again for the detach operation steps described below:

1. A detach operation is invoked from the SAP ACC Server which calls the script to stop the SAP or DB application services.

2. SAP ACC calls `sapacosprep` on the managed node which passes the SRID information of what is to be detached to the partner-specific library on the managed node.

3. The managed node processes the SAP ACC detach request by passing the SRID information to the integration software.

4. Based on the SRID, HP SE can determine which virtual disk to dismount and unpresent on the managed node. HP SE passes this information to the Web Console of the XP disk array or Command View of the EVA disk array.

5. HP SE unmounts the virtual disk then makes a provisioning call to the storage disk array that causes the appropriate virtual disk to be unpresented from the managed node.

6. After a successful unmount, SAP ACC deactivates the virtual IP on the managed node.

**Relocate Operation**

SAP ACC has a third operation called relocate that combines both attach and detach operation into one operation call. When this operation is selected, a detach operation is called first on the original node. If that is successful, the attach operation is called to the new node. Note that if a relocate is to be implemented to/from the same node, there is an SAP ACC specific key required to activate this feature. Without this key, relocate is only supported from one node to a different node.

**SAP Installation**

There are two ways to install SAP instances on a managed node—Default and Multi-instance Stacking. The Default installation only allows one instance of SAP to run on the managed node. The Multi instance stacking installation on the other hand allows multiple SAP instances to run simultaneously on the same managed node. These two installations are described in detail below.

**Default SAP Installation**

The default installation of SAP installs the instance under the `\usr\sap\<SID>` directory. Figure 4 shows the typical mount structure of a managed node with SAP central instance (CL_X22_SRID) and the database (DB_X22_SRID) mounted using the default SAP installation. Reparse points are used and do not make use of any drive letters, thus avoiding any conflicts with already used drive letters. In this example, the systemdrive of the managed node resides locally.

The advantage of this installation is that it is simple and straightforward. The disadvantage is that only one instance at a time can run on the managed node.
Multi-instance Stacking Installation

In order to allow multiple SAP instances to run on a managed node, the SAP mountpoints need to be at the same level as the main \usr\sap directory. SAP instances are initially installed on the default location as described earlier and on another mountpoint in the \usr\sap<SID> directory. In other words, the same virtual disk (LUN) is visible in two mountpoints. After the installation, the mountpoint under the default \usr\sap<SID> location is deleted. Then adjustments to the SAP start and stop profiles specific to the SID needs to be done pointing to the new location. Figure 5 shows the typical mount structure of a managed node with SAP central instances (X22 and B77) and the database (X22 and B77) mounted. Notice that the database directory level is the same as in the default installation.

The advantage of this installation is that it allows for multiple instances to run on one managed node instead of just a single instance. The disadvantage is that it is a more complicated install and will require a server with more memory and processing resources to accommodate multiple instances.
Advantages of the HP Storage Essentials Solution

The following list discusses the advantages of the HP Storage Essentials Windows Application Integration Software for SAP ACC solution. The SAP ACC integration software:

1. Enhances and expands the functionality of HP Storage Essentials in storage virtualization.
2. Lights-out relocation of SAP and Database application services from one server to another.
3. Provides a single point of control allowing customers to operate, observe, and manage an adaptive business solution. HP Storage Essentials’ integration software allows HP customers running SAP to realize the advantages provided by SAP ACC.
4. Improves cost savings from the ongoing maintenance and administration of storage.
5. Enhances the ability to troubleshoot complex problems that span server and storage infrastructure.
6. Provides a single source for server and storage asset information.
For more information

HP

1. HP Unified Infrastructure Management
   http://www.hp.com/go/unified
2. HP StorageWorks Storage Essentials
   http://www.hp.com/go/storageessentials
3. HP BladeSystem
   http://www.hp.com/go/blades
4. HP StorageWorks XP disk array
   http://www.hp.com/go/xp
5. HP StorageWorks EVA disk array
   http://www.hp.com/go/eva
6. HP Services Mission Critical Support
   http://www.hp.com/hps/mission
7. HP System Insight Manager
   http://www.hp.com/go/hpsim

SAP

8. SAP
   http://www.sap.com/
9. SAP Service Marketplace
   This website contains technical information about SAP. A free registered account needs to be created in order to access the information.
   http://service.sap.com/
10. SAP Adaptive Computing Controller
    One level above the SAP Service Marketplace URL is the SAP ACC website. From this location, the most current SAP ACC library could be downloaded.
    http://service.sap.com/adaptive/
11. Relevant SAP Notes from the SAP Service Marketplace
    SAP Note 725397  Main SAP Note for Adaptive Computing
    SAP Note 908533  Prerequisites in a Windows Adaptive Computing landscape

Others

12. Sun Microsystem link for the Windows 2003 x64 Java version specific for SAP
    http://java.sun.com/j2se/1.4.2/SAPsite/download.html/
13. Microsoft whitepaper regarding the use of SQL Server 2005 with SAP R/3
    http://www.microsoft.com/technet/itshowcase/content/sql2005sap.mspx/