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CONTENTS

Compaq On-Line Recovery Option with Lotus Domino Server on Windows NT 3.51/4.0

Compaq has developed a number of products to minimize downtime for business-critical application servers like those running Lotus Notes Domino R4.5. Several features like redundant power supply, backup processor, ECC memory, hot-pluggable disks, and disk array fault tolerance make the likelihood of a server failure extremely low. In addition, Compaq continues to increase the availability and dependability of its platforms and has released two new products that further guarantee the reliability of Compaq platforms: On-Line Recovery Server and Standby Recovery Server.

On-Line Recovery Server

The Compaq On-Line Recovery Server offers a cost effective means of increasing the availability of business critical applications for customers operating in the Windows NT environment. Two independently operating ProLiant or ProSignia servers are paired as on-line, active partners for each other. The On-Line Recovery Server allows software to take advantage of this high-availability environment providing a fully automated switchover.

The On-Line Recovery Server option allows users from one server to be supported by the other server in the event of a failure, allowing applications to be up and running after a hardware failure with minimal interruption. The option is designed to work with the comprehensive alert features of Compaq Insight Manager.

Standby Recovery Server

The Compaq Standby Recovery Server offers minimum downtime for customers with Lotus Notes where on-site technical expertise is not available. With the Compaq automated switchover process, a second identically configured server becomes the active server and is back on-line in a matter of minutes.

In the Standby Recovery Server configuration, two Compaq ProLiant servers or a ProSignia 500, ProSignia 300 server pair are attached to a Compaq ProLiant Storage System containing a copy of Microsoft Windows NT 3.51/4.0 operating system and the Notes application software. If the physical server fails, the ProLiant Storage System automatically switches to the recovery server. The recovery server then boots and the system is back on-line in minutes without administrator intervention.

COMPAQ

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OVERVIEW

The purpose of this white paper is to help customers using Lotus Notes on Windows NT 3.51/4.0 Compaq server platforms benefit from the Compaq On-Line Recovery Server solution. This paper addresses specific Lotus Notes issues that customers are likely to encounter while setting up their platform. Information extracted from other Compaq white papers and technical documentation is included in this paper as appropriate. The level of detail explains the technical concepts fully and provides information on implementing the concepts in practical situations.

This section provides a detailed overview of the On-Line Recovery Server hardware, system configuration requirements, and operation. The glossary at the back of the paper contains additional information you may find helpful.

Terminology Conventions

The following terminology conventions are used throughout this document:

Compaq Recovery Agent is referred to as CRA

Lotus Notes 4.5 and Domino are used interchangeably

On-Line Recovery Server is referred to as ORS

Switchover and failover/takeover are used interchangeably

Configuration Options

Both the Standby and On-Line Recovery Server solutions require the installation of the Recovery Server Switch, an electrically controlled SCSI switch, in each switchable Compaq ProLiant Storage System. The Recovery Server Switch allows selected storage devices to be switched dynamically from the failed server to the surviving server. The following table summarizes the differences between the two recovery server configurations.

On-Line:	Standby:
Two network identities	Single network identity
Two active servers	Single active server
Switchover restores only switched disks	Switchover restores operating system
Benefits specific applications	Benefits all applications
Local disks to contain at least the operating system required	

Comparison of On-Line and Standby configuration options

System Requirements for the On-Line Recovery Server

The table below summarizes system requirements for the various components of the On-Line Recovery Server.

TABLE 1: ORS SYSTEM REQUIREMENTS

System Component::	Requirement:	Installation Notes:
Operating System	Microsoft Windows NT 3.51 or 4.0	All files must be stored in local, non-switched storage
Application Software	The On-Line Recovery Server can support any application for which an appropriate application launcher is available	Lotus Notes will successfully use the generic application launcher, cpqrsgl.exe, provided with the Compaq Recovery Agent software on SSD for Windows NT v1.19b or later
Recovery Server Option Kit	One kit for each switchable ProLiant Storage System.	See the Recovery Option User Guide for the contents of this kit and installation instructions.
Servers	Two Compaq ProLiant or ProSignia servers: Two ProLiant 5000 servers Two ProLiant 2500 servers Any combination of these models: ProSignia 300 or 500; ProLiant 4500, 4500R, 4000, 4000R, 2000, 2000R, 1500, or 1500R	The two servers need not have identical hardware configurations. They must, however, be located within 12 feet (2.73 meters) of each other.
ProLiant Storage System	A minimum of one switchable ProLiant Storage System between the paired server.	
Compaq SMART or SMART-2 SCSI Array Controllers	The number required depends on the configuration. Primary and Recovery Controllers in the On-Line Recovery Server configuration must be Compaq SMART or SMART-2 SCSI Array Controllers. Use of SMART or SMART-2 Array Controllers with local storage disks is optional. Each SMART or SMART-2 Array Controller can support up to two ProLiant Storage Systems. However, it must be dedicated to only one function; either Primary Controller or Recovery Controller.	The array accelerator on the SMART Array Controller must be disabled. For the On-Line Recovery Server, the EISA System Configuration Utility forces the array accelerators to be disabled for SMART controllers attached to switchable disks. The Array Configuration Utility is used to set the Array Accelerator on SMART-2 controllers to the 100% read cache setting.
Disk Controllers	One for each server to support its local disk drives (non-switched, internal or external drives).	Compaq 32-Bit SCSI-2 Controllers or SMART or SMART-2 Array Controllers may be used with local storage disks.
Internal hard drives in server	Can be used only as local disk drives. They are non-switchable.	For internal CD-ROM and tape drives, integrated controllers may be used.

Continued

TABLE 1: ORS SYSTEM REQUIREMENTS (CONTINUED)

System Component::	Requirement:	Installation Notes:
COM port	One serial port (COM Port 1, 2, 3 or 4) on each server for communication between paired servers.	The same COM port need not be used on both servers.
External SCSI cables	Standard-to-wide or wide-to-wide cables required to connect Primary and Recovery Controllers in each server to the Recovery Server Switch in the associated storage systems.	See the *Recovery Server Option User Guide* for cabling requirements.

Supported Hardware

The On-Line Recovery Server supports the following Compaq servers in both tower and rack mount configurations:

ProLiant 5000

ProLiant 4500

ProLiant 4000 - Retired

ProLiant 2500

ProLiant 2000 - Retired

ProLiant 1500

ProSignia 500

ProSignia 300

To allow for automated switchover, all switchable disk drives must be in external ProLiant Storage Systems. A Compaq Recovery Server Switch must be installed in each switchable ProLiant Storage System, and the switch must be connected to a Compaq SMART or SMART-2 SCSI Array Controller in each of the paired servers. The operating system (OS) must be stored on a non-switchable internal or external disk drive (local storage).

A variety of system configurations are possible with the On-Line Recovery Server; therefore, the Recovery Server Option Kit does not contain SMART or SMART-2 Array Controllers. They are ordered separately as needed by the configuration plan.

The On-Line Recovery Server requires the following hardware:

- Two Compaq ProLiant or ProSignia Servers, tower or rack-mountable, located within 12 feet (2.73 meters) of each other (the maximum length of the Recovery Server Interconnect). The paired servers are not required to have identical hardware configurations because each will operate independently and have its own local boot disk. However, they must be sized to perform at an acceptable level should a switchover occur. In other words, each server must have sufficient processor and RAM capacity to run the additional applications necessary to access data stored on the switchable storage disks of the other server in the pair.
- A minimum of one local storage disk for each Compaq server. Local disks can be either internal or external to the server. The operating system is booted on each Compaq server from its own local storage. The customer may choose to have multiple local storage disks for storing application software and files that are not business-critical and therefore need not be switched over if the server should fail. Choosing to have only business-critical applications switched over plays an important role in sizing the servers.

- A minimum of one switchable ProLiant Storage System between the paired server. In the On-Line Recovery Server configuration, one or both servers of the on-line pair may have switchable disks, depending on the customer's needs. High availability data must be stored on a switchable ProLiant Storage System. Application software associated with that data may also be stored on switchable disks. The ProLiant Storage Systems supported by the On-Line Recovery Server configuration are listed in Table 2.
- One Recovery Server Switch installed in each switchable Proliant Storage System.
- Compaq SMART or SMART-2 SCSI Array Controllers. Each switchable ProLiant Storage System must be physically attached to two SMART or SMART-2 Array Controllers: a Primary Controller and a Recovery Controller that are in different servers (see Figure 1). Each SMART or SMART-2 Array Controller has two connection ports, so it can support either one or two switchable storage systems. However, a single SMART or SMART-2 Array Controller cannot serve as a Primary Controller for one storage system and as a Recovery Controller for another. Each SMART or SMART-2 Array Controller must be dedicated to one of the two functions. The Primary Controller and the Recovery Controller for a given switchable ProLiant Storage System must be the same type of controller, either both SMART Array Controllers or both SMART-2 Array Controllers.
- A disk controller connecting each server to its non-switchable local disk drive(s). Compaq Fast SCSI-2 Controllers, Fast-Wide SCSI-2 Controllers, SMART Array Controllers, or SMART-2 Array Controllers may be used as local disk controllers.

TABLE 2: COMPAQ PROLIANT STORAGE SYSTEMS

North American Part No.:	International Part No.:	Chassis:	Interface:
146700	146750	tower	Fast SCSI-2
197100	197150	tower	Fast SCSI-2
189600	189640	tower	Fast-Wide SCSI-2
163750	163755	rack-mountable	Fast SCSI-2
189900	189905	rack-mountable	Fast-Wide SCSI-2

How the On-line Recovery Server Works

A variety of configurations are possible with the On-Line Recovery Server, but all configurations work in a similar fashion. To understand how the On-Line Recovery Server works, consider the configuration shown in Figure 1, in which both the paired servers have switchable external storage. Note that the configuration for the minimum number of external storage units required resembles the Standby Recovery Server option; however both servers would be on-line versus one server on-line with a second server idle using the Standby Recovery Server solution.

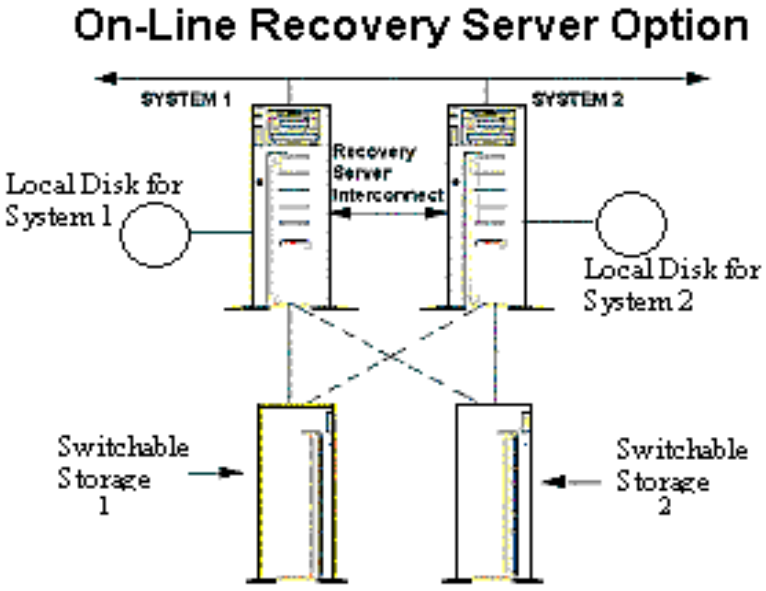


Figure 1

An ORS solution consists of a pair of Compaq servers attached using components in the Compaq On-Line Recovery Server Option kit as shown in Figure 1. Each Compaq server has the Windows NT 3.51/4.0 OS on its local disk and the application software is on the Compaq ProLiant switchable storage unit.

Compaq System 1 is electrically connected (solid line) to the switchable ProLiant Storage System 1 and inactively connected to switchable ProLiant Storage System 2 (dotted line). Compaq System 2 is electrically connected to switchable ProLiant Storage System 2 (solid line) and inactively connected to switchable ProLiant Storage System 1 (dotted line). It is important to note two things: first, the ProLiant Storage Systems are not shared by the two servers. That is, they are not electrically connected to both servers at any time. Second, a Recovery Server Switch must be installed in each switchable ProLiant Storage System. One is contained in each Compaq Recovery Server Option Kit.

In Figure 1, each server in the on-line pair contains two SMART Array Controllers:

- A Primary Controller (PC) that connects the server to its own switchable ProLiant Storage System(s) during normal operation.
- A Recovery Controller (RC) that electrically connects the server to the switchable ProLiant Storage System(s) of the paired server when a switchover occurs.

It is important to note that each SMART Array Controller has two ports for SCSI connectors and can therefore support either one or two ProLiant Storage Systems. Note also that for each Primary Controller in a given server, there must be an associated Recovery Controller in the paired server.

Therefore, if one or both servers in an on-line pair have more than two switchable ProLiant Storage Systems, additional SMART Array Controllers will be required. ProLiant servers have sufficient slots to accommodate several SMART Array Controllers. The actual number of available slots (and therefore the number of ProLiant Storage Systems that can be supported) may vary, since some slots support other uses, such as network interface cards.

The Recovery Server Interconnect cable connects a serial port on Compaq System 1 to a serial port on Compaq System 2. Each server runs a Compaq Recovery Agent (CRA), software that communicates with its counterpart in the other server via this cable. The CRA periodically transmits a heartbeat message to the CRA in the paired server as an indication that the server is still on-line and operating normally. Each CRA listens for heartbeats from the other server. If it receives the expected heartbeat, the CRA transmits an acknowledgment message to the other CRA. If the expected heartbeat is not received within the time-out interval defined in the system configuration, the CRA assumes that the other server has failed and initiates a switchover.

An LED indicator placed behind the ProLiant Storage System indicates whether a switchover has occurred. During normal operation the LED glows green. It changes to amber if the storage system is switched over to the other server.

Detectable Faults

The On-Line Recovery Server can detect only those faults that cause loss of the heartbeat messages from a server. For example, loss of the CPU power supply will be detected. Failure of the Windows NT operating system will also be detected, assuming that the failure prevents the CRA from producing the heartbeat message. Failure of a network interface card, on the other hand, will not be detected unless it stops the CRA that sends the heartbeat message.

Startup

Once the On-Line Recovery Server hardware and software have been installed and configuration is complete, the on-line server pair is ready for startup. When all ProLiant Storage Systems and both servers have been turned on, the CRA in each server listens for an "all is well" heartbeat message from its counterpart in the other server. If the expected heartbeat message arrives at both CRAs within the startup time-out value specified during installation, then the server immediately shifts into normal operation. However, if that heartbeat message does not reach one of the CRAs within the startup time-out value, one of two things will happen:

- If the startup time-out was not enabled during installation, the CRA that did not receive the heartbeat message will wait indefinitely for a heartbeat before beginning normal operation.
- If the startup time-out was enabled during installation, the CRA that did not receive the heartbeat message will initiate a switchover. This allows one server to come on-line handling its own workload and supporting the ProLiant Storage System(s) switched over from the other server.

In setting configuration parameters, the customer decides which of these options will occur. See the *Recovery Server Option User Guide* provided in the Recovery Server Option Kit for instructions on installation and system configuration.

Normal Operation

Figure 1 illustrates a server pair in the On-Line Recovery server configuration during normal operation of both systems. The CRA in each server monitors heartbeat messages. If one of the CRAs does not detect an expected heartbeat within the time-out period, the CRA assumes that the paired server has failed and then initiates a switchover sequence.

Cable Fault

During normal operation, the CRAs monitor the status of the Recovery Server Interconnect. If a CRA detects a cable fault, the fault is noted in the Windows NT Event Log and the CRA sends a cable fault message to the Compaq Insight Manager console, if you have configured Insight Manager on your server. The most likely cause of a cable fault is an unplugged cable. Other possibilities are failure of a serial port, a software problem preventing transmission of the heartbeat message, or physical damage to the cable.

Power Loss to Both Servers

If power is lost to paired servers at roughly the same time and then is restored to both at roughly the same time, the CRAs will respond exactly as they do at system startup. For details see the "Startup" section above.

Switchover

To simplify the explanation of how a switchover occurs, refer to Figure 1 and assume the following:

- The heartbeat from Compaq Server 1 has been lost, and
- The CRA in Compaq Server 2 (CRA-2) is ready to initiate a switchover.

CRA-2 sends a switchover command to the Recovery Controller in Server 2 (RC-2). RC-2 then sends a command to the Recovery Server Switch in ProLiant Storage System 1, causing it to toggle the electrical connection of Storage System 1 from the Primary Controller in Server 1 (PC-1) to RC-2 in Server 2. Note that in Figure 1, solid line SCSI cables denote active electrical connections and dotted line SCSI cables denote inactive connections.

CRA-2 commands the operating system on Server 2 to mount the switchable drives of Storage System 1. CRA-2 assigns new drive letters to the switched disk drives. When that is done, normal operation resumes with RC-2 controlling communication between server 2 and the switched disk drives in ProLiant Storage System 1. Notice of the switchover is entered into the Windows NT Event Log and the CRA monitor and sent to the Compaq Insight Manager console.

Application Notification

The On-Line Recovery Server includes an Application Notification for the Application Program Interface (API). This Compaq API allows software provided by the customer to register with the CRA. When a switchover occurs, registered software is immediately informed of the switchover and notified of the new drive letter the CRA has assigned to the switched disks drives.

Software whose primary purpose is to launch another application or applications is termed an *application launcher*. Applications to be launched after switchover may reside either on the local disk(s) of the surviving server or on the switched ProLiant Storage Systems. Once a registered application has been started on the surviving server, clients of the failed server can log on to the surviving server and resume their work. Use of the application notification and launcher capabilities of the On-Line Recovery Server significantly reduces the time required for clients of the failed server to regain access to business critical programs and data after a switchover.

Compaq supplies a generic Windows NT application launcher on the SSD included in the On-Line Recovery Server Kit. This launcher (CPQRSGL.EXE) allows customers to execute a batch command file when a switchover occurs. This batch command file can be used to set up execution environments and start other applications on the surviving server using the new drive letters.

How the Compaq Generic Application Launcher Works

- The customer writes a batch command file using dummy parameters for the drive letters (d1, d2, ...dn) to start the application or applications. (The On-Line Recovery Server Kit contains a sample batch file that illustrates the use of these parameters.)
- CPQRSGL, the Compaq generic application launcher, is a Windows NT command line application that accepts a single command line parameter. This command line parameter is the name of the batch file that will be invoked when a switchover occurs.
- When CPQRSGL begins execution, it registers with the CRA; and further execution is blocked until a switchover occurs.
- When the switchover occurs, CPQRSGL resumes execution and the filename (.CMD or .EXE) specified in CPQRSGL.EXE command line parameter is invoked with a set of parameters that include the newly assigned drive letters and other status information that can be used by the batch file. The batch file typically contains commands to launch the desired application(s) that will process data on the disks that have been switched over to the surviving server.
- When a switchover is complete, a status screen appears. Refer to the latest version of the On-Line Recovery Server documentation for a detailed explanation of these error codes.

Drive Letter Mapping

An important consideration when planning an On-Line Recovery Server configuration is drive letter mapping between the system that owns the switchable drives during normal system operation and the system that owns the drives after a switchover.

On-Line Recovery Server offers features to aid in the management of drive letter mapping during a switchover. The first feature is a program called CPQRSMAP. The CPQRSMAP utility is normally run at system startup. Its purpose is to create a \CPQRSYS.RSO file for each drive letter that is mapped to a switchable disk. This file contains the current drive letter mapped to that partition while it is connected to the Primary disk controller.

After a switchover occurs, the \CPQRSYS.RSO file contents are read to determine the drive letter that was used to map the partition prior to the switchover. If that drive letter is available on the surviving system, it will be assigned to that partition. If it is not available or if the \CPQRSYS.RSO files were not created, then the next drive letter available on the surviving server will be assigned. Thus, it is important to consider how drive letters are assigned on both systems so that the desired mapping of the switchable drives will occur after a switchover.

Auto Launch Command File: CPQRSYS.CMD

When the On-Line Recovery Server software is installed, a file named CPQRSYS.CMD is created. To aid in automatically starting an application launcher or other program, the Compaq Recovery Agent service executes this file when it begins execution. The commands in the file are executed after the Compaq Recovery Agent has completed its initialization activities and before it attempts to receive the heartbeat message from its partner server.

The CPQRSYS.CMD file is located in the %SystemRoot%\System32 directory. The installed CPQRSYS.CMD file contains no commands. The user can edit this file or create one of the same

name. This file can be used to start an Application Launcher automatically. Because the programs executed from CPQRSYS.CMD will execute before any user has logged into the system, there will be no window or command line environment in which the programs can display output.

If CPQRSYS.CMD is not present, no error will occur. However, the Compaq Recovery Agent will put an informational message in the Windows NT event log to indicate that CPQRSYS.CMD is not present.

Additional details regarding Compaq On-Line Recovery Server and Compaq Standby Server can be found in the following Compaq technical publications at
www.compaq.com/productinfo/systems/spd/rso/index.html:

Compaq Standby Recovery Server (document number 286A/1196)

Compaq On-Line Recovery Server (document number 287A/1196)

You can also find details in the *Recovery Server Option User Guide* (part number 213818-002), which is delivered with the Recovery Server Option Kit and is also available as an independent product.

Operating System

The On-Line Recovery Server supports only the Microsoft Windows NT 3.51 and 4.0 operating systems.

ORS AND LOTUS NOTES

As a "demo of concept," we tested a server host named Rocky failing over to a server host named Apollo. Regarding our choice of network configuration, we acknowledge that there is an array of possible setups for networks having components such as Windows NT 4.0 server, DNS, DHCP and WINS.

The information in this white paper covers two scenarios:

TABLE 3: LOTUS NOTES SCENARIOS FIT FOR ORS

Scenario:	Lotus Notes Environment:
I. Environment with 1 Lotus Notes Server	Notes 4.x on Windows NT Server 3.51/4.0
II. Environment where a Notes server farm is deployed, whether in an enterprise network or an ISP	Domino Partitioned servers on Windows NT 3.51/4.0

ORS provides minimal downtime by having two servers paired, with both ready to serve as a takeover if the partner server fails. As noted in the introduction, both servers are on-line and are being accessed by client software.

Since you must pair servers in an ORS setup, please note that Lotus Notes 4.x will run only one instance of the Notes Server program per physical server unless you upgrade to Lotus Notes Domino 4.5 and use the Advanced Partitioned Server feature. Given these two distinct Notes Server configurations, the presumption is made that a customer will have only one Lotus Notes Server or a Notes Server farm.

To use ORS with Lotus Notes successfully, read Section I if you are a customer using a single Lotus Notes Server. Read Section II if you are using a Lotus Notes Server farm.

Steps To Complete After Hardware Installation

1. Install the Compaq Recovery Server software contained in the SSDs for Windows NT 3.51/4.0. You must use the Software Support Diskettes for Windows NT 3.51/4.0 v1.19b or later.

   Note: the CRA software creates a CRA icon in the Control Panel. It also includes a help file.

2. Ensure that the two servers in the on-line pair do not use the same drive letters.

   As noted in the section *Drive Letter Mapping*, the Compaq Recovery Agent is able to reassign an "orphaned" storage unit's drive letter on the partner server during a switchover with the aid of the execution of CPQRSMAP.EXE on each server in an on-line pair.

   Example:
   See Figure 1

   Compaq switchable ProLiant Storage 1 is assigned drive letter i:

   Compaq switchable ProLiant Storage 2 is assigned drive letter k:

   With the Compaq Recovery Agent software installed, and from the operating system command line on ProLiant Storage 1, switch to drive i: and execute CPQRSMAP. It will create a text file with extension .rso on the i: drive. For example,

   At the i: drive, type:

   cpqrsmap

   The system returns the message:

   Creating primary map file i:\cpqrsys.rso

3. Assign a second IP address to your network interface card (NIC) on both servers in the on-line pair.

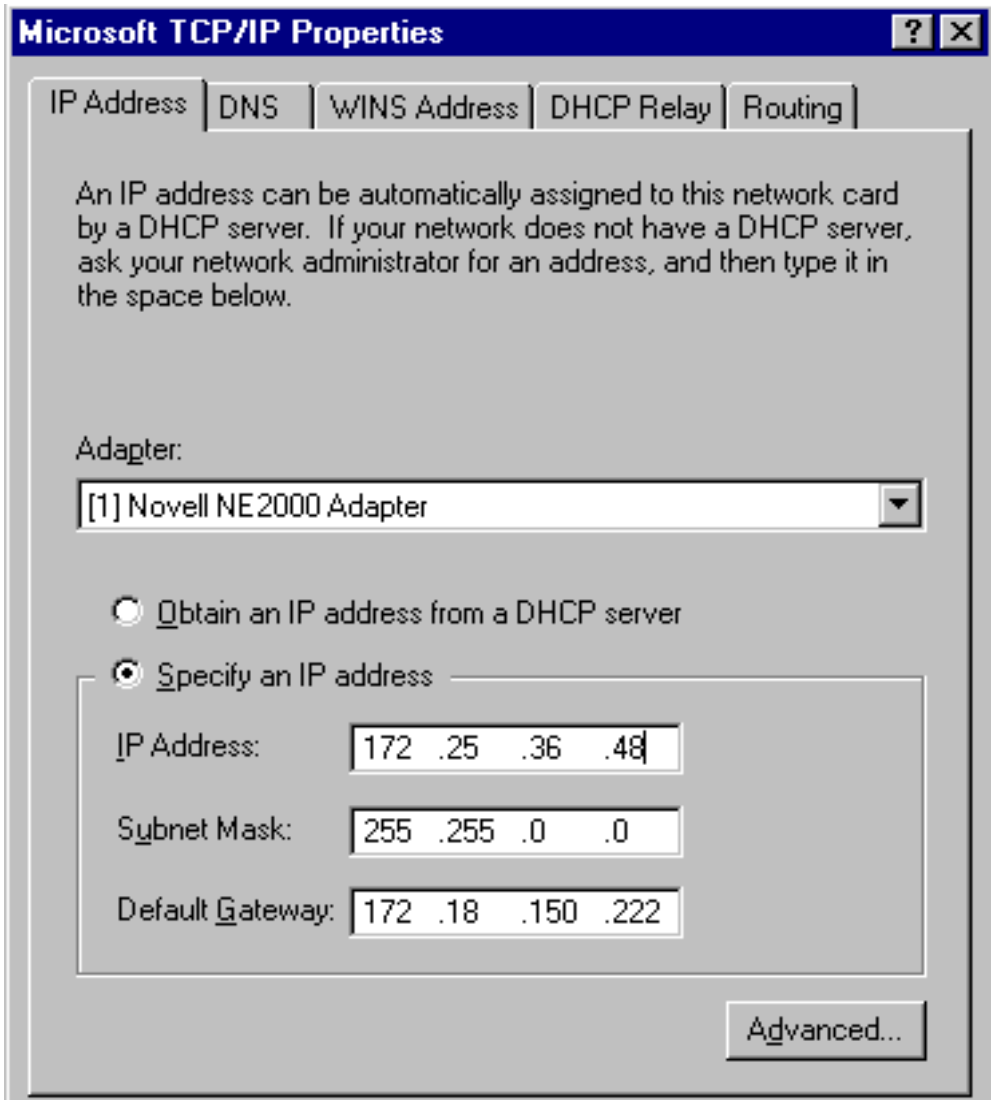
   This IP address does not have to be a "real" IP address. During switchover, the takeover server host will invoke CPQIPSET.EXE to write over this dummy address using the failed server's IP address. You should, however, use the same NETID for this dummy IP address as the NETID of your actual IP addresses. For example, if you have a Class B IP address such as 172.25.36.46 on your host, then assign a second IP address with 172.25.a.b as your dummy IP address, where a and b are any number between 0 and 255 .

   In our lab, we used 172.25.36.46 as the actual IP address of the server host Apollo and 172.25.36.48 as a dummy address. When server host Rocky fails having IP address 172.25.36.45, the switchover process invokes command CPQIPSET.EXE. CPQIPSET.EXE overwrites dummy IP address 172.25.36.48 on Apollo with address 172.25.36.45, the IP address of server host Rocky.

   Important: Make certain the dummy IP address is the first one assigned to the NIC as shown below. To setup the actual IP address that the host will be mapped to in your DNS or local host files, go into the *Advanced* tab and assign it there.

IMPORTANT!
Using different drive letters ensures that when a switchover occurs, the CRA will not encounter a conflict in drive letters when the surviving server takes over the failed server's storage unit. More importantly, your re-launched application will be able to resume utilizing the same drive letter(s) it had on the failed server. This is especially important in the case of Lotus Notes where drive letter assignment is critical.

IMPORTANT!
If instead you are returned message "No drive letters connected to primary controller," go to Control Panel and start the Recovery Agent program. Look at the bottom of the user interface where it reads ***Primary Drives****:. This should indicate the drive letter assigned to your switchable storage unit. If there is no drive letter showing, then reboot the system and go into the System Configuration Utility to make sure that the SMART Array controller attached to the ProLiant Switchable Storage unit has been enabled as the Primary in the field On-line Recovery Status.*



1. Test your ORS configuration.

   To verify that the system is operating properly in the On-Line Recovery Server configuration, follow these steps:

   a) Shut down and restart both Windows NT systems.

   b) Run the Windows NT Services Control Panel applet to verify that the ORS Recovery Agent service is started and running.

   c) Run the Configuration and Control (CC) panel applet on both systems and make certain that both systems are enabled for switchover.

   d) When these steps have been completed on both servers, go to the Windows NT Adminstrative Tools program group and start the ORS monitoring application on both servers.

   e) If the system is operating properly, the ORS monitoring application should display a status of :

      Normal State: Serial interconnect heartbeat is being received.

Note: To set up the actual IP address that the host will be mapped to in your DNS or local host files, go into the *Advanced* tab and assign it there.

Verification of Network Connectivity

If you have enabled the Network Connectivity check, its operation must be verified. Do this by running the Configuration and Control (CC) applet and selecting *Test Network Connectivity*.

If the Network Connectivity check is successful, the following displays:

Network Connectivity Check Successful

If the Network Connectivity check is *not* successful, the following displays:

Network Connectivity Check Failed

Verify Switchover

It is important to verify proper system operation by testing the switchover function. The Configuration and Control (CC) applet provides a command that causes an immediate switchover. Before using this command, Compaq recommends that you perform a normal system shutdown on the partner server before the disks are switched to the other system.

For example, assuming that both servers are up and running Windows NT, verify switchover by following these steps:

1. Perform a normal Windows NT system shutdown on the Primary Server.
2. On the Recovery Server run the CC applet and select *Perform immediate switchover*.
1. Observe the On-Line Recovery server monitoring application. In a short time, it should indicate that switchover occurred and display the new drive letters that were assigned to the switched drives.
2. Use the File Manager or another application to verify that the drives were successfully switched.
3. Shutdown both servers and all external storage units.
4. Cycle the power and perform the same sequence on the Recovery Server.

NOTE:
If you have installed Compaq Insight Manager, each switchover sends an alarm to the Compaq Insight Manager console. This indicates that a switchover event has occurred and is either successful or unsuccessful.

Restoring the Configuration

After you verify the switchover, restore the On-Line Recovery Server configuration by following these steps:

1. Shut down both Windows NT systems. This will restore the initial configuration.
2. Power cycle all components, both servers and the ProLiant Storage Systems.

   Power cycling the ProLiant Storage Systems resets the Recovery Server Option switches to their default setting. Port 1 is connected to the drives.
3. Start both Windows NT systems.
4. Use the On-Line Recovery Server monitoring application on both systems to verify proper operation.

SECTION I. USING ORS WITH LOTUS NOTES (NON-PARTITIONED NOTES SERVER)

The first step is to configure the Compaq On-Line Recovery Server Option hardware. As noted earlier, there is a variety of ways to configure your hardware. Therefore, refer to the *Recovery Server Option User Guide* provided in the kit and plan carefully.

Lotus Notes Installation and Configuration in Lab

The following ORS hardware configuration was used in the lab:

TABLE 4: ORS HARDWARE SETUP IN COMPAQ LAB

System Component:	Compaq Lab Setup:	Installation Notes:
Operating system	MS Windows NT Server 4.0	All files stored in local, non-switched storage
Application software	Lotus Notes Domino 4.5 Advanced Server	Lotus Notes is designed to behave predictably upon system failure and re-launch.
Recovery Server Option Kit (part no: 213817-001)	One kit for each switchable storage unit - 2	See the *Recovery Server Option User Guide* for the contents of this kit and installation instructions.
Compaq Software Support Diskettes for Windows NT 3.51/4.0 v1.20a or later.	v1.20a contains Compaq On-Line Recovery Agent software.	Installs all Compaq Recover Agent files to c:\winnt\system32; you can obtain from www.compaq.com/support/files/desktops/softpaqs/pages/supportsoftwinnt.html
Servers	Two Compaq ProLiant 4500 rack-mountable servers	The two servers need not have identical hardware configuration; however these did and they must be within 12 ft. of each other.
Compaq SMART or SMART-2 SCSI Array Controllers	The number required depends on your config. Basically, you need one recovery SMART or SMART-2 controller for every primary SMART or SMART-2 controller. We used a total of 4 SMART controllers.	Make sure you upgrade the ROM on the server and the controllers. The Recovery Server Option Kit (part no: 213817-001) provides firmware on diskette. Use the same type of controller as your primary and recovery in a given server.
Disk controller	One for each server to support its local disk drive	
Internal server hard drive	Non-switchable	
Switchable external disk storage	We used 2 Compaq ProLiant Storage Systems with 2 hot-pluggable fast-wide SCSI drives, however minimum required is 1.	See *Recovery Server Option User Guide* NOTE: If you are using 2 Compaq ProLiant Storage Systems, make sure you assign each one a unique drive letter.
Memory	128 meg	
Disk Storage	Each server had a 2 disk array with Mirroring enabled	

TABLE 5: LOTUS NOTES 4.X SERVER CONFIGURATION USED

System Component:	Compaq Lab Setup:	Installation Notes:
Application	Lotus Notes Domino Server 4.5	See Lotus Notes *Install Guide for Servers*. Install all Notes program files and data directories on ProLiant Storage System. The install program will copy msvcrt40.dll msvcrt20.dll msvcirt.dll msvcrt.dll to the c:\winnt\system32 directory of the designated LN server; these files must be installed on the partner server's local drive in the same location for use by LN server's client in event of a failover.
IP network	We used MS DNS Server for host name resolution with static IP addresses for servers and clients; however, you have other options, e.g. DHCP clients with static IP servers.	Host Apollo is the DNS Manager.
Rocky	Lotus Notes has been setup on host Rocky as Rocky/Servers/Cpqlab. Rocky's primary storage system, Storage 1, houses Lotus Notes on assigned drive letter e:\ in path e:\notes\data	Since we used 2 storage units, each unit had a unique drive letter assigned and we used CPQRSMAP.EXE, a CRA file, to maintain drive letter assignments in event of a switchover.

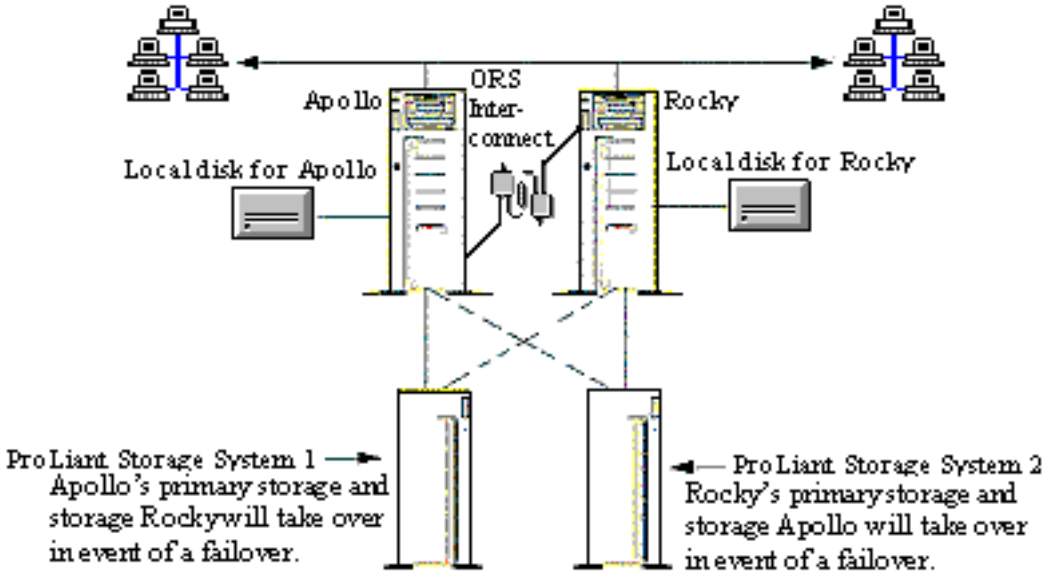


Figure 2

Rocky - Host name for Windows NT 4.0 server; NIC is configured with one IP address 172.25.36.45; OS on local drive; Lotus Notes application on ProLiant storage unit.

Apollo- Host name for Windows NT 4.0 server running DNS Manager; NIC is configured with two IP addresses, 172.25.36.46 (the actual IP address used in DNS and/or local host files) and 172.25.36.48 (the dummy IP address to be overwritten by CPQIPSET.EXE) OS on local drive; Netscape Directory Server on ProLiant storage unit.

ProLiant Storage 1 - Drive f:, houses other applications and associated files.

ProLiant Storage 2 - Drive e:, houses Lotus Notes Domino execs and data.

General Lab Setup Review

Both Compaq ProLiant storage units have the Compaq recovery switch installed; the Compaq Recovery Option Kit provides this switch along with SCSI ports to install on the back side of the ProLiant storage units.

Rocky and Apollo each have two Smart Array controllers installed and the Compaq Recovery Agent software installed.

Rocky

One Smart Array controller is installed in slot 2 and designated the Primary Controller using the System Configuration Utility. It is connected via SCSI cables to Port 1 of the primary ProLiant Storage System.

The second Smart Array controller is in slot 5 and is designated the Recovery Controller using the System Configuration Utility. It is connected via SCSI cables to Port 3 of Apollo's primary ProLiant Storage System.

Lotus Notes has been installed on server host Rocky on the e:\ drive and certified as Rocky/Servers/Cpqlab. The following files are installed by the install program to c:\winnt\system32 of server host Rocky's local drive; copy these files into the same directory on the partner server:

msvcrt40.dll
msvcrt20.dll
msvcirt.dll
msvcrt.dll

Apollo

One Smart Array controller is installed in slot 2 and is designated the Primary Controller using the System Configuration Utility. It is connected via SCSI cables to Port 1 of the primary ProLiant Storage System.

The second Smart Array controller is in slot 5 and designated the Recovery Controller using the System Configuration Utility. It is connected via SCSI cables to Port 3 of Apollo's primary ProLiant Storage System.

Apollo has two IP addresses assigned to its NIC; one is the actual IP address referenced in DNS and local host files and the other is a dummy address which will be overwritten by CPQIPSET.EXE during a switchover.

Apollo is a DNS server with a DNS database of:

Host Name:	IP Address:	Record Type:
Apollo	172.25.36.46	A
Rocky	172.25.36.45	A

NOTE:
This local host file does not need to contain records of all IP hosts, only those hosts in an ORS pair. In addition, this local host file should be located on both servers of an ORS pair.

In addition, Apollo contains a local host file in c:\winnt\system32\drivers\etc with the same two host records noted above. As of this writing , the Compaq Recovery Agent command CPQIPSET.EXE works only with local host files.

In the event that Rocky fails, Rocky's primary ProLiant storage system will be switched to Apollo thereby becoming Apollo's recovery ProLiant storage unit. Apollo will re-launch the application that has been shut down on Rocky. The latter is executed through simple command utilities provided with the Compaq Recovery Server software on the Windows NT SSD v1.20 a.

Lotus Notes Normal Operation

Notes Client

Notes client with Lotus Notes software loaded on Win95.

Uses static IP address referencing DNS server, Apollo, for host name resolution.

Notes Public Name & Address Book Server Document

You can use host name, Rocky, for field '*Net Address*' under defined TCP/IP port in PAB network document or alternatively you can use the IP address assigned to the physical host of the Lotus Notes server which will move between hosts (172.25.36.45) with command CPQIPSET.EXE during a switchover.

Failover/Takeover Events

For testing purposes and prior to switchover on Apollo, we opened a DOS session and from c:\winnt\system32 ran commands CPQRSGL.EXE and RCVRNTS.BAT.

Next, while Rocky was up and running, we abruptly shut Rocky off to invoke the switchover. Recall that gracefully shutting down Windows NT will not invoke a switchover.

Server Rocky fails

↓

Compaq Recovery Agent on Apollo times out

↓

Compaq Recovery Agent on Apollo invokes switchover

↓

Compaq Recover Agent on Apollo calls CPQRSYS.EXE

↓

CPQRSYS.EXEcalls the Compaq generic launcher CPQRSGL.EXE

↓

CPQRSGL.EXEcalls any command file or batch file specified

TABLE 6: FILES CALLED BY COMPAQ RECOVERY AGENT

File Name:	File Contents:	Notes:
CPQRSSS.CMD	cpqrsgl rcvrnts.bat All CRA files are installed to the c:\winnt\system32 directory which is in the system path.	We remarked out the contents due to the fact that CRA executes this file upon system startup as opposed to system failure. It is designed to aid in automatically starting an application launcher or other program, but Lotus Notes works successfully with the generic application launcher CPQRSGL.EXE. We had a DOS session open with CPQRSGL.EXE RCVRNT.BAT executed on Apollo; the DOS session waits for a swithover to occur and when the switchover does occur, the DOS session will contain a status of the switchover as noted in the Application Notification section.
RCVRNYS.BAT	c: cpqipset -I 172.25.36.45 e: cd\ cd notes\data Start e:\notes\nserver.exe	Cpqipset.exe is a critical step. This command takes the IP address specified and overwrites the "dummy" IP address assigned to the NIC on the partner server. Syntax is: cpqipset.exe -i ip_address [-s subnet_mask -g default_gateway -a adapter] Cpqipset is what allows the surviving server to reinstate the failed server's network identity, i.e. IP address, on himself.

Rocky

Once switchover is complete, Notes Server Rocky/Servers/Cpqlab will be launched by RCVRNTS.BAT.

Rocky will have his original IP address, 172.25.36.45, assigned to NIC on host Apollo by CPQIPSET.EXE. Apollo's dummy IP address will be overwritten with an IP address specified by CPQIPSET.EXE, in this case - 172.25.36.45.

Client Behavior

Client tries to access Rocky.

If switchover is in progress, client receives Notes message 'Server not responding'.

Once switchover is complete and Notes consistency checks are complete on re-launched Notes server Rocky/Servers/Cpqlab, client will be able to access Rocky/Servers/Cpqlab on host Apollo.

Caveats of Compaq Recovery Agent files

The command CPQIPSET.EXE provided with the Compaq Recovery Agent software only works with local host files; however, this does not mean you can not implement ORS in a DNS or NIS environment.

If your clients are using DNS for name resolution, you do not have to include any of the clients' IP to host name mappings in the above mentioned local host file; however, at the very least, you must have the fully qualified domain names, and if you wish an alias, of the hosts serving the Notes server.

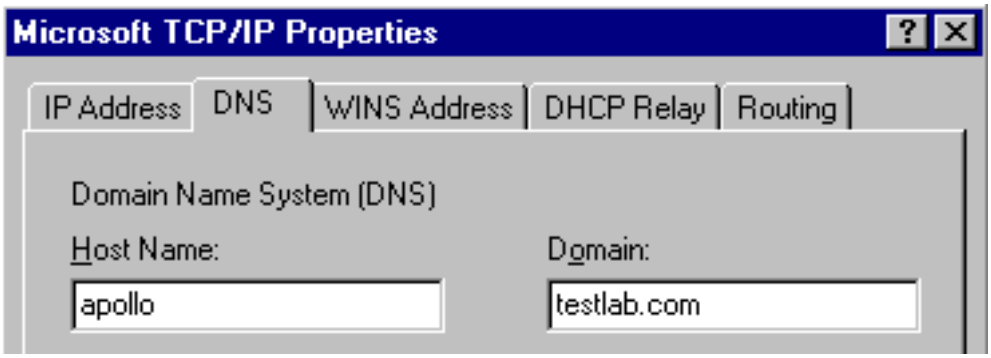
For example:

rocky.testlab.com rocky

172.25.36.46 apollo.testlab.com apollo

If you are not deploying DNS nor NIS, then you are probably already using local host files for name resolution, therefore this does not apply to you.

The command utility CPQIPSET.EXE changes the takeover server's host name when executed on the takeover server during ORS switchover. This does not affect client access after the Notes server launches on the surviving partner server; however it does affect server replication if you are using Domino partitioned servers and one or more of the Domino partitioned servers is using or aliasing the physical server's host name as the Domino partitioned server's canonical name. Simply go into the MS Win TCP/IP DNS properties tab and rename the server's host name to what it should be and click on *Apply*.



SECTION II. USING ORS WITH DOMINO PARTITIONED SERVERS

This section is presented for customers having a Lotus Notes server farm.

The Lotus Notes Domino 4.5 Advanced Server offers the following:

Notes server clusters. A notes cluster is a group of up to six Notes servers in the same domain connected by a local area network. Clusters support large numbers of users and provide high availability of databases and services.

Notes partitioned servers. A Notes partitioned server shares the resources of a single computer with other Notes servers. You can run up to six partitioned servers on a single computer.

Notes billing. The Notes billing feature enables a Notes server to track specific Notes activities. The Notes billing server task collects this information and records the data for billing purposes.

In order to implement ORS in an environment which has a Lotus Notes server farm, you **must** upgrade your Notes servers to Lotus Notes Domino 4.5 and install your servers with the Advanced Partition. Lotus Notes will not run two instances of the Notes server program on one physical box. Domino Partitioned servers will allow up to 6 Notes servers on the same box.

NOTE:
Partitioned Servers on Windows NT require an additional 100 MB for each additional server installed. Partitioned servers on Windows NT can only run with the TCP/IP and X.PC protocols. Recall that ORS supports only Windows NT 3.51 Windows NT 4.

The first step is to configure the Compaq On-Line Recovery Server Option hardware. As noted earlier, there is a variety of ways to configure your hardware, therefore you should refer to the *Recovery Server Option User Guide* provided in the kit and plan carefully.

Note: If *Recovery Server Option User Guide* reads *'Second Edition'* printed on the first page, you must obtain the white paper entitled *Compaq On-Line Recovery Server* which has more detail on the Compaq Recovery Agent and its associated files. It can be found at www.compaq.com/productinfo/systems/spd/rso/index.html.

Lotus Notes has been setup on server hosts Apollo and Rocky with the Advanced Partitioned Server feature which allows server partitions as described in *Lotus Notes Administrator's Guide*.

The first time you select to install a Notes partitioned server through the Custom install, you will select the drive and directory for execs and data files, e.g. f:\notes\data.

The next time you run the Custom install and select to install another partitioned server, the Install program will detect the existing Notes directory structure and install *only* the data files in f:\notes\data2. This will be the directory structure for up to six partitioned servers with the data directory incrementing by 1 for each additional partitioned server.

For example:

f:\notes\data

f:\notes\data2

f:\notes\data3...

NOTE:
For purposes of ORS switchover, do not setup more than three partitioned Notes servers per physical server in a Compaq On-Line server pair. For example, Rocky can have three partitioned Notes servers and Apollo can have three partitioned Notes servers. This way, if either server fails, the surviving server will be able to launch up to the limit of partitioned Notes servers.

This means all Notes partitioned servers run from one set of program files, except in the case where a Domino partitioned server fails over to a surviving host where you could actually have the Domino partitioned server start with the program files that exist on his storage unit.

Keep in mind the hardware requirements for every additional partitioned server.

Steps To Complete After Hardware Installation

1. Install the Compaq Recovery Server software contained in the SSDs for Windows NT 3.51/4.

   You must use the Software Support Diskettes for Windows NT 3.51/4 v1.19b or later.

   Note: the CRA software creates a CRA icon in the Control Panel. It also includes a help file.

2. Ensure that the two servers in the on-line pair do not use the same drive letters.

   As noted in the section *Drive Letter Mapping*, the Compaq Recovery Agent is able to reassign an "orphaned" storage unit's drive letter on the partner server during a switchover with the aid of the execution of CPQRSMAP.EXE on each server in an on-line pair.

   ### Example

   See Figure 1

   Compaq switchable ProLiant Storage 1 is assigned drive letter i:

   Compaq switchable ProLiant Storage 2 is assigned drive letter k:

   With the Compaq Recovery Agent software installed, and from the operating system command line on ProLiant Storage 1, switch to drive i: and execute CPQRSMAP. It will create a text file with extension .rso on the i: drive. For example,

   At the i: drive, type:

   cpqrsmap

   The system returns message:

   Creating primary map file i:\cpqrsys.rso

3. Assign a second IP address to your network interface card (NIC) on both servers in the on-line pair.

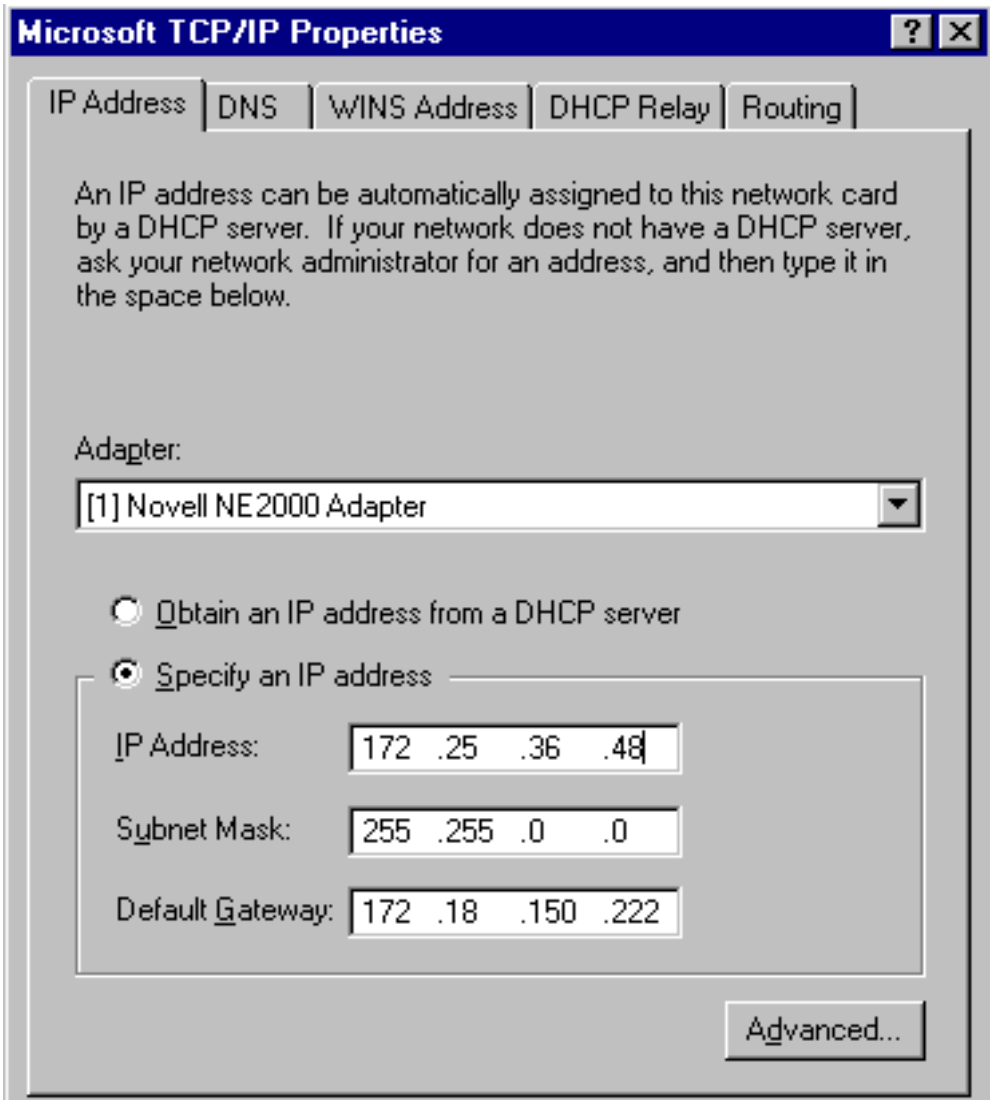
   This IP address does not have to be a "real" IP address. During switchover, the takeover server host will invoke CPQIPSET.EXE to write over this dummy address using the failed server's IP address. You should, however, use the same NETID for this dummy IP address as the NETID of your actual IP addresses. For example, if you have a Class B IP address such as 172.25.36.46 on your host, then assign a second IP address with 172.25.a.b as your dummy IP address, where a and b are any number between 0 and 255 .

   In our lab, we used 172.25.36.46 as the actual IP address of the server host Apollo and 172.25.36.48 as a dummy address. When server host Rocky fails having IP address 172.25.36.45, the switchover process invokes command CPQIPSET.EXE. CPQIPSET.EXE overwrites dummy IP address 172.25.36.48 on Apollo with address 172.25.36.45, the IP address of server host Rocky.

   Important: Make certain the dummy IP address is the first one assigned to the NIC as shown below. To setup the actual IP address that the host will be mapped to in your DNS or local host files, go into the *Advanced* tab and assign it there.

NOTE:
Using different drive letters ensures that when a switchover occurs, the CRA will not encounter a conflict in drive letters when the surviving server takes over the failed server's storage unit. More importantly, your re-launched application will be able to resume utilizing the same drive letter(s) it had on the failed server. This is especially important in the case of Lotus Notes where drive letter assignment is critical.

NOTE:
If you receive the message "No drive letters connected to primary controller," go to Control Panel and start the Recovery Agent program. Look at the bottom of the user interface where it reads ***Primary Drives****:. This should indicate the drive letter assigned to the switchable storage unit. If there is no drive letter showing, then reboot the system and go into the System Configuration Utility to make sure that the SMART Array controller attached to the ProLiant Switchable Storage unit has been enabled as the Primary in the field On-Line Recovery Status.*



To setup the actual IP address that the host will be mapped to in your DNS or local host files, go into the *Advanced* tab and assign it there.

4. Test your ORS configuration.

   With both servers in the on-line pair running, abruptly shut off one of the servers. Do not gracefully shut down NT, for this will not perform a switchover.

   After you have tested failover and takeover from one server to the other, you can proceed with Lotus Notes Advanced Partition Servers.

The following On-Line Recovery hardware configuration was used:

TABLE 7: ORS HARDWARE USED IN LAB

System Component:	Compaq Lab Setup:	Installation Notes:
Operating system	MS Windows NT Server 4.0	All files stored in local, non-switched storage
Application software	Lotus Notes Domino 4.5 Advanced Server	Lotus Notes is designed to behave predictably upon system failure and re-launch.
Recovery Server Option Kit (part no: 213817-001)	One kit for each switchable storage unit - 2	See the *Recovery Server Option User Guide* for the contents of this kit and installation instructions.
Compaq Software Support Diskettes for Windows NT 3.51/4.0 v1.20a	v1.20a contains Compaq On-Line Recovery Agent software.	Installs all Compaq Recover Agent files to c:\winnt\system32; you can obtain from www.compaq.com
Servers	Two Compaq ProLiant 4500 rack-mountable servers	The two servers need not have identical hardware configuration; however these did and they must be within 12 ft. of each other.
Compaq SMART or SMART-2 SCSI Array Controllers	The number required depends on your config. Basically, you need one recovery SMART or SMART-2 controller for every primary SMART or SMART-2 controller. We used a total of 4 SMART controllers.	Make sure you upgrade the ROM on the server and the controllers. The Recovery Server Option Kit (part no: 213817-001) provides firmware on diskette. Use the same type of controller as your primary and recovery in a given server.
Disk controller	One for each server to support its local disk drive	
Internal server hard drive	Non-switchable	
Switchable external disk storage	We used 2 Compaq ProLiant Storage Systems with 2 hot-pluggable fast-wide SCSI drives, however minimum required is 1.	See Recovery Option User Guide **Note:** If you are using 2 Compaq ProLiant Storage Systems, make sure you assign each one a unique drive letter.
Memory	128 meg	You need an additional 32 meg for every partitioned server on physical box.
Disk Storage	Each server had a 2 disk array with Mirroring enabled	**Note**: You need an additional 100 meg of disk space for every partitioned server on physical box.

TABLE 8: LOTUS NOTES DOMINO 4.5 CONFIGURATION USED IN LAB

System Component:	Compaq Lab Setup:	Installation Notes:
Appplication	Lotus Notes Domino 4.5	See Lotus Notes Domino 4.5 Administrator's Guide
IP network	We used MS DNS Server for host name resolution with static IP addresses for servers and clients; however, you have other options, e.g. DHCP clients with static IP servers.	Domino Advanced Server only supports IP and X.PC protocols
Domino Advanced Server IP Addresses	Apollo server's NIC configured with 2 IP addresses; IP port mapping for Domino Servers with one IP address under normal operations as described in Lotus Administrators Guide. The second IP address is a "dummy" to be overwritten with failed partitioned server's IP address when launched on surviving partner server using CPQIPSET.EXE command.	
ROCKY	Lotus Notes has been setup on host Rocky with the Advanced Partition feature as partitioned Domino server Rocky/Servers/Cpqlab. Rocky's primary storage system, Storage 1, houses Lotus Notes on assigned drive letter e:\ in path e:\notes\data	notes.ini must contains IP address parameter shown below in order to allow Rocky/Servers/Cpqlab to maintain his network identity in the event of a switchover where he will be launched by partner server, Apollo. In our case, we added: TCPIP_TcpIpAddress=0,172.25.36.45:1352
APOLLO	Apollo is host for Domino partitioned servers Apollo/Servers/Cpqlab & Apollo_2/Servers/Cpqlab. Apollo's primary storage system, Storage 2, houses Lotus Notes on assigned drive letter f:\ in path f:\notes\. The data files for Domino partitioned server Apollo/Servers/Cpqlab are in f:\notes\data. The data files for Domino partitioned server Apollo_2/Servers/Cpqlab are in f:\notes\data2; Each data directory contains a notes.ini file for its corresponding partitioned Notes server. In addition, the partitioned Notes server's server.id file will be in its corresponding data directory. We used IP port mapping and designated Apollo/Servers/Cpqlab as the port mapper simply because his common name is the same as the physical box's host name.	**Note**: The Lotus Notes 4.5 Administrators guide cites two ways to configure partitioned servers for TCP/IP: Use unique IP addresses-one unique IP address for each partitioned server Use unique TCP/IP port numbers-one unique port number for each partitioned server that shares an IP address. In addition, Lotus Notes 4.5 *Administrator's Guide* recommends setting up one of your partitioned servers as an IP port mapper *if* you choose to use IP port mapping as the method. **Note**: f:\notes\data3 was manually created after deciding on configuration of 2 Notes partitioned servers on Apollo and 1 on Rocky. If, e.g. you choose to install 2 Notes partitioned servers on each physical host, then you must manually create the data directories for the partitioned servers that will be taken over in event of a failover. In f:\notes**data3** on Storage 2, there are only 2 files: nserver.bat and nclient.bat.
	Apollo_2's IP address is being port mapped by Apollo/Servers/Cpqlab in f:\notes\data\notes.ini as such: f:\notes\data\notes.ini ß Data directory for Apollo on Storage 2 Line n1	

TCPIP_TcpIpAddress=0,172.25.36.46:1352

Line n2

TCPIP_PortMapping00=CN=Apollo_2/OU=Servers/
O=Cpqlab,172.25.36.46:13520

Apollo_2/Servers/Cpqlab then references his port mapped IP address in his notes.ini in f:\notes\data2 as such:

TCPIP_TcpIpAddress=0,172.25.36.46:

13520

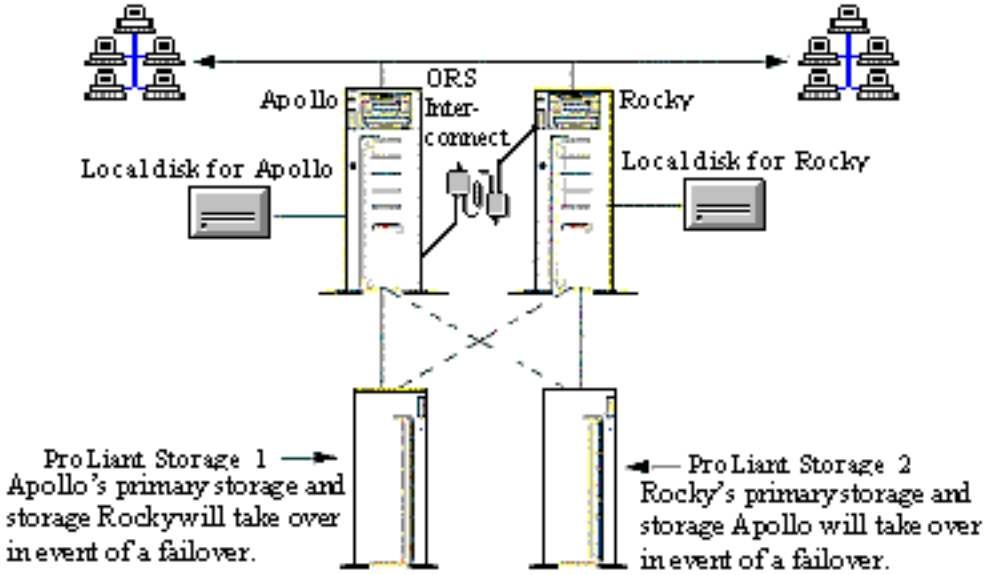


Figure 3. On-Line Recovery Server Pair with Domino Partitioned Servers

Rocky - Host name for Windows NT 4.0 server; NIC is configured with one IP address 172.25.36.45; OS on local drive; Lotus Notes installed as a Domino Partitioned Server on ProLiant storage unit

Apollo- Host name for Windows NT 4.0 server running DNS Manager; NIC is configured with two IP addresses, 172.25.36.46 (the actual IP address used in DNS and/or local host files) and 172.25.36.48 (the dummy IP address to be overwritten by CPQIPSET.EXE), OS on local drive.

ProLiant Storage 1 - Drive f:; Lotus Notes Domino Partitioned Servers Apollo/Servers/Cpqlab and Apollo_2/Servers/Cpqlab

ProLiant Storage 2 - Drive e:, houses Lotus Notes Domino Partitioned Server Rocky/Servers/Cpqlab

General Lab Setup Review

Both Compaq ProLiant storage units have the Compaq recovery switch installed. The Compaq Recovery Option Kit provides this switch along with SCSI ports to install on the back side of the ProLiant storage units.

Rocky and Apollo each have two Smart Array controllers installed and the Compaq Recovery Agent software installed.

Rocky

One Smart Array controller is installed in slot 2 and designated the Primary Controller using the System Configuration Utility. It is connected via SCSI cables to Port 1 of his primary ProLiant Storage System.

The second Smart Array controller is in slot 5 and designated the Recovery Controller using the System Configuration Utility. It is connected via SCSI cables to Port 3 of Apollo's primary ProLiant Storage System.

Lotus Notes has been installed on server host Rocky on the e:\ drive and certified as Rocky/Servers/Cpqlab.

TABLE 9: NOTES SERVER ROCKY\SERVERS\CPQLAB RECOVERY FILES ON APOLLO'S MANUALLY CREATED F:\NOTES\DATA3 DIRECTORY

File Name:	File Contents:	Notes:
nserve.bat	e: cd\ cd notes\data Start e:\notes\nserver.exe	Note the drive letter, e:, remains the same after a switchover. This is possible through use of CPQRSMAP.EXE.
nclient.bat	e: cd notes\data SET NotesServerPartition=3 Start e:\notes\notes.exe	

Apollo

One Smart Array controller is installed in slot 2 and designated the Primary Controller using the System Configuration Utility. It is connected via SCSI cables to Port 1 of his primary ProLiant Storage System.

The second Smart Array controller is in slot 5 and designated the Recovery Controller using the System Configuration Utility. It is connected via SCSI cables to Port 3 of Apollo's primary ProLiant Storage System.

Apollo has two IP address assigned to his NIC; one is the actual IP address referenced in DNS and local host files and the other is a dummy which will be overwritten by CPQIPSET.EXE during a switchover.

Apollo is a DNS server with a DNS database of:

Host Name:	IP Address:	Record Type:
Apollo	172.25.36.46	A
Rocky	172.25.36.45	A

NOTE:
This local host file does not need to contain records of all IP hosts, only those hosts in an ORS pair. In addition, this local host file should be located on both servers of an ORS pair.

In addition, Apollo contains a local host file in c:\winnt\system32\drivers\etc with the same two host records noted above. As of this writing, the Compaq Recovery Agent command CPQIPSET.EXE works only with local host files.

Notice the dummy IP address is not included in the host file and in incidentally is not included in the DNS database either.

Under normal operations, Rocky is exclusively reading and writing to disks in his primary ProLiant Storage System and Apollo is reading and writing to disks in his primary ProLiant Storage System.

In the event that Rocky fails, Rocky's primary ProLiant Storage System will be switched to Apollo thereby becoming Apollo's recovery ProLiant storage unit. Apollo will re-launch the application that has been shut down on Rocky. The latter is executed through simple command utilities provided with the Compaq Recovery Server software on the Windows NT SSD v1.20 a.

Lotus Notes Normal Operation

Notes Client Station 1

Notes client with Lotus Notes software loaded on Win95.

Uses static IP address referencing DNS server, Apollo, for host name resolution.

Notes Public Name & Address Book Server Document

We used the physical server's host names, Apollo and Rocky for field '*Net Address*' under defined TCP/IP port in PAB network document.

Domino server Apollo_2/Servers/Cpqlab was installed on server host Apollo, and since Apollo/Servers/Cpqlab is port mapping Apollo_2/Servers/Cpqlab's IP address in Apollo/Servers/Cpqlab's notes.ini in data directory: f:\notes\data, Apollo_2/Servers/Cpqlab's PAB network document's 'Net Address' field lists Apollo.

If you wish, you can alternatively enter the Notes servers' host IP address in *'Net Address'* field. But if you are using partitioned servers with one NIC and one IP address and are port mapping, you have to include the port number of the IP address in the *'Net Address'* field as shown:

Basics

Server name:	Apollo_2/Servers/Cpqlab
Server title:	
Domain name:	Compaq
Cluster name:	
Master address book name:	

Server Location Information

Network Configuration

Port	Notes Network	Net Address
TCPIP	Lab_IP	172.25.36.46:13520

Basics

Server name:	Apollo_2/Servers/Cpqlab
Server title:	
Domain name:	Compaq
Cluster name:	
Master address book name:	

Server Location Information

Network Configuration

Port	Notes Network	Net Address
TCPIP	Lab_IP	172.25.36.46:13520

Failover - Takeover Events

For testing purposes and prior to switchover on Apollo, we opened a DOS session and from c:\winnt\system32 ran commands CPQRSGL.EXE and RCVRNTS.BAT. The following lists the chain of events:

Server Rocky fails - Abruptly shut off for testing

↓

Compaq Recovery Agent on partner server, Apollo, times out

↓

Compaq Recovery Agent on Apollo invokes Storage 2, Rocky's storage, takeover

↓

Compaq Recover Agent calls CPQRSYS.EXE

↓

CPQRSYS.EXE calls CPQRSGL.EXE

↓

CPQRSGL.EXE calls any command file or batch file specified, in our case RCVRNTS.BAT

↓

RCVRNTS.BAT executes CPQIPSET.EXE which re-instates the IP address of the failed server host Rocky on the recovery server host Apollo

Table 10 lists the contents of file RCVRNTS.BAT.

TABLE 10: FILES CALLED BY COMPAQ RECOVERY AGENT

File Name:	File Contents:	Notes:
CPQRSYS.CMD	c:\winnt\system32\cpqrsgl rcvrnts.bat	We remarked out the contents due to the fact that CRA executes this file upon system startup as opposed to system failure. It is designed to aid in automatically starting an application launcher or other program, but Lotus Notes works successfully with the generic application launcher CPQRSGL.EXE. We had a DOS session open with CPQRSGL.EXE RCVRNTS.BAT executed on Apollo; the DOS session waits for a swithover to occur and when the switchover does occur, the DOS session will contain a status of the switchover as noted in the *Application Notification* section.
Rcvrnts.bat	c: cpqipset -I 172.25.36.45 f: cd\ cd notes\data3 SET NotesServerPartition=3 nserve.bat (see Table 9)	Cpqipset.exe is a critical step. This command takes the IP address specified with -I parameter and overwrites the "dummy" IP address assigned to the NIC on the partner server. Type cpqipset/? for additional parameters. Cpqipset is what allows the surviving server host to reinstate the failed server host's network identity, i.e. IP address, on himself.

Rocky

Once switchover is complete, Notes Server Rocky/Servers/Cpqlab will be launched by RCVRNTS.BAT on server host Apollo.

Rocky will have his IP address reinstated by CPQIPSET.EXE. Apollo's second assigned NIC address will be overwritten with IP address specified by CPQIPSET.EXE.

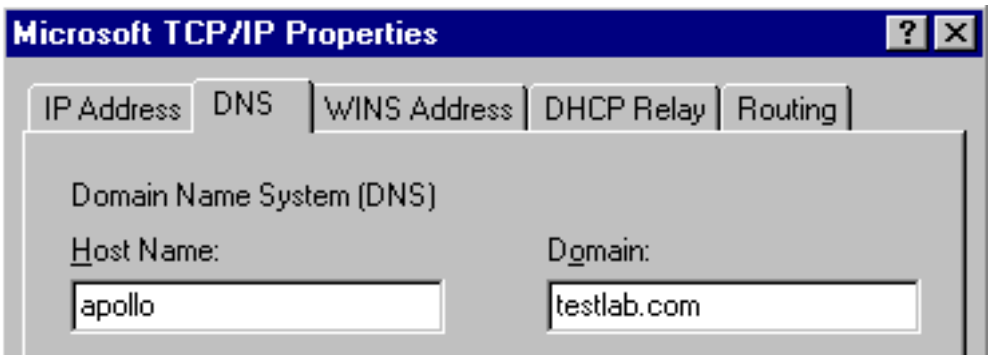
Apollo

CPQIPSET.EXE renames the surviving host's name with that of the failed server.

In our case, Rocky is the host name of the server which fails and Apollo is the host name of the server which survives and hence re-launches Domino Partitioned server Rocky/Servers/Cpqlab.

The renaming of Apollo's host name doesn't affect the clients; however, if you have other Domino partitioned servers which run on the surviving server host, as we did with Apollo/Servers/Cpqlab and Apollo_2/Servers/Cpqlab, their replication with the newly re-launched Domino partitioned server will be affected. The newly re-launched Domino partitioned server, however, is able to replicate with the other Domino partitioned servers on the shared host.

To solve this issue, simply go into MS Win TCP/IP DNS properties tab and rename the server's host name to what it should be and click on *Apply*.



Notes Client Behavior

If client is accessing Rocky/Servers/Cpqlab in the middle of server host Rocky's failure, client will be returned with 'Server not responding'.

The switchover should take between 5-7 minutes and client can resume access.

If switchover is in progress, client receives Notes message 'Server not responding'

Once switchover is complete and Notes consistency checks are complete, client will be able to access Rocky/Servers/Cpqlab on host Apollo.

CONCLUSION

The On-Line Recovery Server is an effective, high availability solution offered by Compaq for business-critical applications. It can provide a cost-effective means of increasing capacity and availability of business-critical applications for customers with numerous servers operating in the Windows NT 3.5x/4.0 environment. It pairs two independently operating ProLiant or ProSignia servers, server to server, as "hot standby" partners for each other while maintaining the necessary level of service to their own clients. It also supports a variety of configuration options.

Combined with Lotus Notes, ORS provides high availability in both single Note server and Notes server farm environments as shown in this paper.

Determining whether the On-Line Recovery Server in a Notes environment is the right Compaq choice requires a thorough analysis of the operating environment, existing hardware and need for increased availability. If it is, then careful planning is needed to define the optimal configuration.

GLOSSARY

Application Launcher	Software that registers with the Compaq Recovery Agent (CRA) Application Notification Interface and whose function is to initiate execution of another application or applications after switchover has occurred. Application launchers will use the information provided by the CRA, such as the drive letters of the newly acquired disk drives, to prepare the execution environment for the application that they will initiate. Compaq supplies a generic Windows NT application launcher with the On-Line Recovery Server. It can be used to invoke a batch command file after a switchover has occurred.
Application Notification Interface (API)	A Compaq API for the On-Line Recovery Server. The purpose of this API is to allow an application to register with a Compaq Recovery Agent (CRA). If a switchover occurs, registered applications on the surviving server are notified that a switchover has occurred and that new drive letters have been assigned to the switched disk drives.
Compaq Recovery Agent (CRA)	An OS agent in each server in an on-line server pair. It performs four functions: Sends heartbeats to the paired server via the Recovery Server Interconnect. Monitors and answers heartbeat messages received from the paired server via the Recovery Server Interconnect. Sends commands to the switchable SMART Array Controllers to initiate an automatic switchover. Notifies application programs registered with the CRA on the surviving server that a switchover has occurred.
Local Disk Drive	A non-switchable disk drive attached to only one server in an on-line server pair. In the On-Line Recovery Server configuratin, each of the paired ProLiant servers must have at least one local disk drive that serves as the Windows NT boot disk. A local disk drive can be either internal or external to the server.
On-Line Recovery Server	A two-server configuration using the Recovery Server Option in which both Proliant servers are active and operate independently of each other. If one of the servers fails, customer-selected ProLiant Storage Systems attached to that server are automatically switched over to the surviving server. The surviving server takes on the workload of both servers.
On-Line Server Pair	A pair of ProLiant servers in an On-Line Recovery Server configuration.
Primary Controller	In an on-line server pair, a SMART Array Controller physically attached by SCSI bus to port 1 of a ProLiant Storage System containing a Recovery Server Switch. During normal server operation, switchable disk drives are electrically attached to the primary controller.

Recovery Controller	In an on-line server pair, a SMART Array Controller physically attached by SCSI bus to port 3 of a ProLiant Storage System containing a Recovery Server Switch. During normal server operation, switchable disk drives are not electrically attached to the Recovery Controller. A switchover electrically detaches the switchable disk drives from their Primary Controller in the failed server and electrically attaches them to their Recovery Controller in the surviving server.
Recovery Server Interconnect	The serial cable that connects paired ProLiant servers when the Recovery Server Option is used in either the Standby Recovery Server mode or the On-Line Recovery Server mode.
Recovery Server Option	The Compaq option kit used to configure either the Standby Recovery Server or the On-Line Recovery Server. It includes the Recovery Server Switch (an optional board), the Recovery Server Interconnect cable to connect the paired servers, software for the Standby Recovery Server, software for the On-Line Recovery Server, internal cables and user documentation.
Recovery Server Switch	The intelligent SCSI switch installed in a ProLiant Storage System that switches the electrical connection of the storage system from one server to another in the event of a server failure.
SCSI Cable	An I/O bus used to connect ProLiant servers to ProLiant Storage Systems. In the On-Line Recovery Server configuration, SCSI cables from the two servers attach to Recovery Server Switches installed in switchable ProLiant Storage Systems.
Standby Recovery Server	A configuration in which two identical ProLiant servers (an active primary server and an inactive standby server) are attached to a common set of ProLiant Storage Systems that contains a single copy of the operating system, applications and stored data. If the primary server fails, the ProLiant Storage Systems automatically switch over from the primary to the recovery server. The recovery server then boots and the system is back on-line in minutes without administrator intervention.
Switchable Disk Drives	In an On-Line Recovery Server configuration, disk drives in a ProLiant Storage System that have been modified by the installation of the Recovery Server Switch Option. These disk drives contain data and applications that will switch over if their primary server should fail.