

# Cisco Transport Manager High-Availability Solution

As optical networks evolve, service providers are increasingly focused on protecting their element management systems (EMSs) and optical networks. Network management system (NMS) applications are becoming more critical for organizations looking for the highest workforce productivity. The Cisco® Transport Manager High-Availability solution addresses these needs, providing customers with a highly robust configuration that protects their mission-critical optical EMSs.

With the new geographic redundancy configuration, based on VERITAS Volume Replicator and Global Cluster Manager, the Cisco Transport Manager High-Availability solution gives customers the flexibility to create an EMS capable of withstanding any type of disaster with minimal downtime.

The Cisco Transport Manager High-Availability solution helps ensure that network downtime is kept to a minimum. It provides carrier-class reliability when customers need it most. Since Cisco Transport Manager is built from relatively low-cost, off-the-shelf hardware and software components, the cost of ownership is low, and the administrative expertise is readily available in today's Internet-driven industry.

## A High-Availability Infrastructure

The Cisco Transport Manager High-Availability solution provides IP connectivity with high performance and availability. It uses the intelligent, add-on Cisco Transport Manager High-Availability Agent, which automatically detects failures and implements failover on a customer's optical EMS. Dual Sun servers and tight integration with Cisco Transport Manager software (Oracle RDBMS and VERITAS products) provide a powerful combination to protect customers' networked environments. With the risk of data corruption reduced and network visibility enhanced, customers now have the added security of knowing their Cisco Transport Manager platform is optimized to provide continuous service when a failure has occurred.

## Cisco Transport Manager High-Availability Solution Advantages

The Cisco Transport Manager High-Availability solution provides an automatic failover solution to specific software and single hardware failures without the need to reconfigure IP addresses on the customer's switched/router network. It offers:

- A highly robust configuration
- Minimal downtime, resulting in carrier-class reliability
- Multiple redundant components to protect against hardware failures
- Low cost of ownership
- Protection of mission-critical optical EMS platforms

- Automatic restoration via the intelligent Cisco Transport Manager High-Availability Agent
- Continuous operation, which translates into operations cost savings by averting disruptions to business
- The ability to perform modifications in real time, while the primary system is active
- Automatic reconnection of Cisco Transport Manager clients after failover
- A Redundant Array of Independent Disks (RAID) 5+0 disk configuration for reduced risk of corrupted database information
- Transparent recovery from any fault within an external disk array
- A blend of best-of-breed products-VERITAS, Oracle, and Sun

### Cisco Transport Manager High-Availability Solution Configuration

Figure 1 provides an overview of Cisco Transport Manager in a locally redundant high-availability configuration where the cluster configuration is connected to a switch/router network.

Figure 1  
Cisco Transport Manager in a Locally Redundant High-Availability Environment

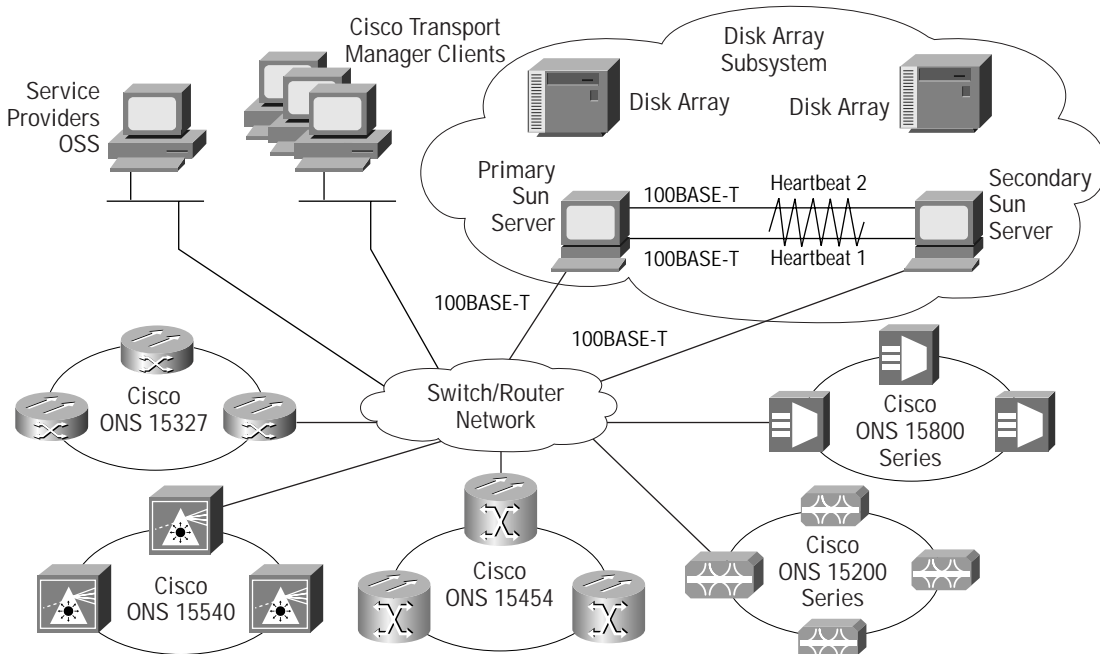
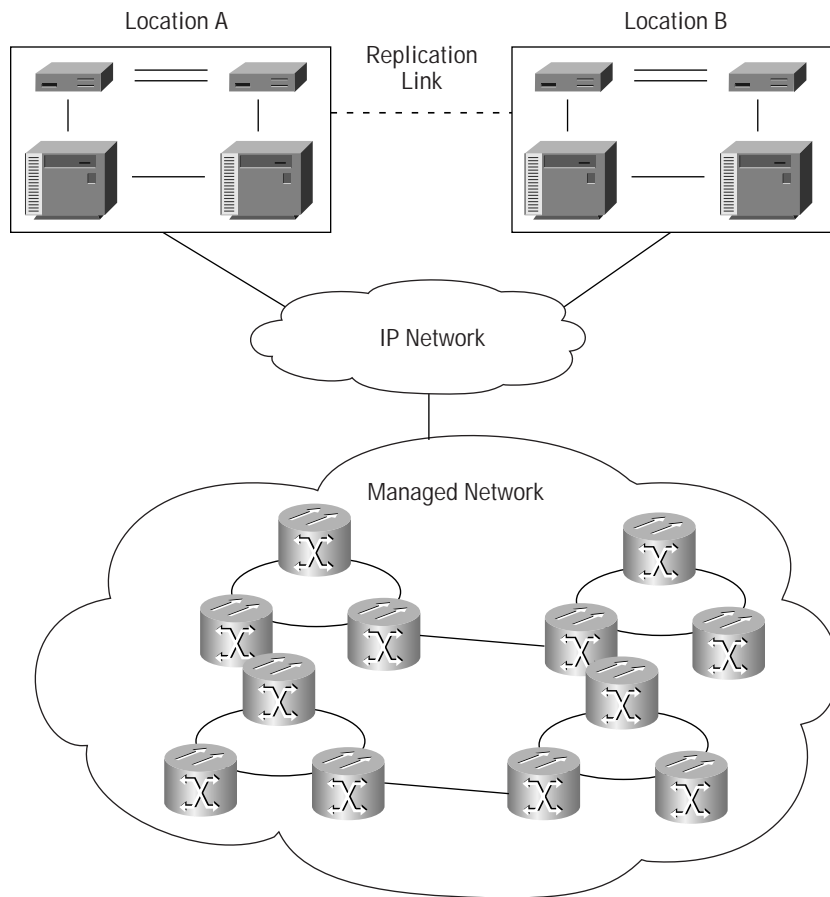


Figure 2 provides an overview of Cisco Transport Manager in a geographically redundant high-availability configuration with the cluster configuration connected to a switch/router network. Each location consists of a one- or two-node Cisco Transport Manager local redundancy configuration (a two-node configuration is shown).

Figure 2  
Cisco Transport Manager in a Geographically Redundant High-Availability Environment



### Cisco Transport Manager High-Availability Agent Features

The Cisco Transport Manager High-Availability Agent offers several features, including:

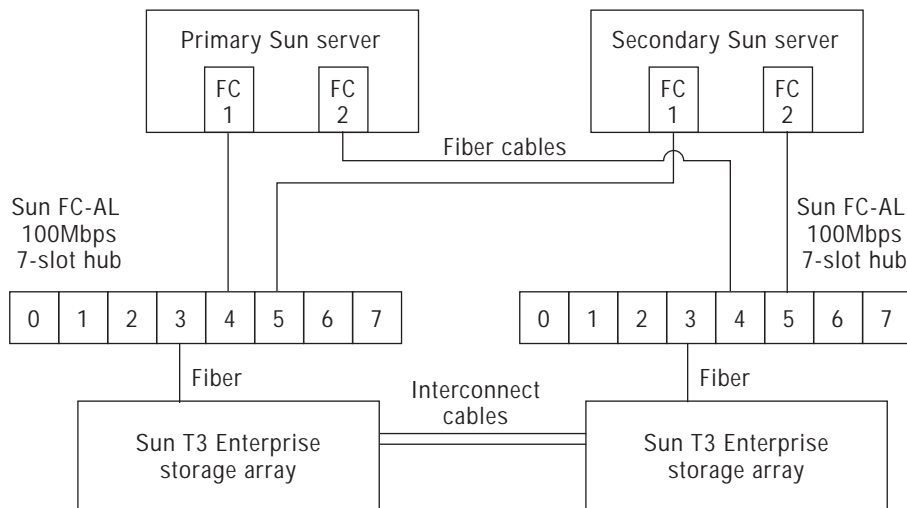
- Restoration of the system when a failure has been detected
- Server and disk array redundancy
- Automatic reconnection to Cisco ONS 15000 Family network elements
- Mirrored internal boot/root disks
- Status monitoring of multiple “heartbeat” interfaces
- The ability to make modifications in real time while the primary system is active
- Fiber connectivity between both servers and disk arrays
- RAID 5+0 disk configuration optimization
- Transparent recovery of any fault in an external disk
- Redundant IP interfaces
- Automatic reconnection of Cisco Transport Manager clients

## Cisco Transport Manager High-Availability Infrastructure Components

The Cisco Transport Manager High-Availability solution operates on two identical Sun servers installed in a cluster configuration. A heartbeat interconnection between the two servers is set up in a redundant configuration with dedicated 100BASE-T connections, to proactively monitor the status of the primary Sun server. Redundant power supplies with multiple IP interfaces eliminate any potential single point of failure within the hardware design. Additional redundancy has been added in both primary and secondary servers with mirrored internal boot/root disks.

The disk array connectivity to the Sun StorEdge T3 disk arrays is accomplished via diverse fiber cabling and Sun FC-AL hubs (Figure 3). Dedicated direct-connect interconnect cables are used to pass data between the redundant T3 disk arrays with the disks optimized in a RAID 5+0 configuration.

Figure 3  
Hardware Connectivity to the Disk Array



The Sun StorEdge T3 disk arrays are connected to two separate Sun FC-AL 100Mbps seven-slot hubs. With diverse fiber paths to each disk array and to the fiber channel hubs, connectivity is completely redundant and the data transfer occurs at the PCI adapter's optical speed.

## Cisco Transport Manager High-Availability Hardware Configuration

- Redundant servers and disk array design
- Optimized with RAID 5+0 disk configuration
- Mirrored internal boot/root disks
- Redundant 100BASE-T IP interfaces
- Diverse fiber connectivity between both servers and disk arrays

## Cisco Transport Manager High-Availability Cluster Software Configuration

The Cisco Transport Manager High-Availability solution is comprised of several software elements. The database and Cisco Transport Manager application processes run on Solaris 8 with Oracle Enterprise Database Edition. The VERITAS Database Edition/HA 3.0 for Oracle 3.0 is used as the high-availability foundation for the intelligent Cisco Transport Manager High-Availability Agent to provide a fully integrated solution.

## Functional Description

The Cisco Transport Manager High-Availability local redundancy solution works with one or two identical Sun servers configured in a 1:0 or 1:1 protection schema to protect against a single failure in the cluster. The benefit of a single node cluster is that the Cisco Transport Manager High-Availability Agent and VERITAS HA software can monitor the server hardware and software and can communicate problems to a geographically redundant Cisco Transport Manager server, a Simple Network Management Protocol (SNMP) management system, or failover redundant components within the server.

A “virtual” IP address is used for Cisco Transport Manager. If the intelligent Cisco Transport Manager High-Availability Agent has determined that the primary Sun server is no longer operational, the secondary Sun server is activated to assume the master role. All Cisco Transport Manager connectivity remains the same via the virtual IP address.

In the event of a primary server failure, reconnection of the Cisco Transport Manager clients is automatic. Once the secondary server has restarted all its “daemon” processes in the correct sequence via the intelligent Cisco Transport Manager High-Availability Agent, reconnections from the Cisco Transport Manager clients will be transparent to users.

Prior to toggling the master secondary server back to the primary server, platform managers should investigate the failure condition and manually revert back to the primary server after the condition has been cleared. The system will not automatically revert to prevent toggling of servers. Since all clients and operations support systems (OSSs) will interface to the virtual IP address, the GateWay/TL1, GateWay/SNMP, and GateWay/CORBA functions will not be affected by the loss of the primary server.

A failure with an external disk in the array will be transparent and the system will continue to operate with the RAID 5+0 configuration. Even with the failure of one of the cluster servers’ heartbeat interfaces, the primary server would continue to operate without a failover.

## Virtual IP Address Connectivity

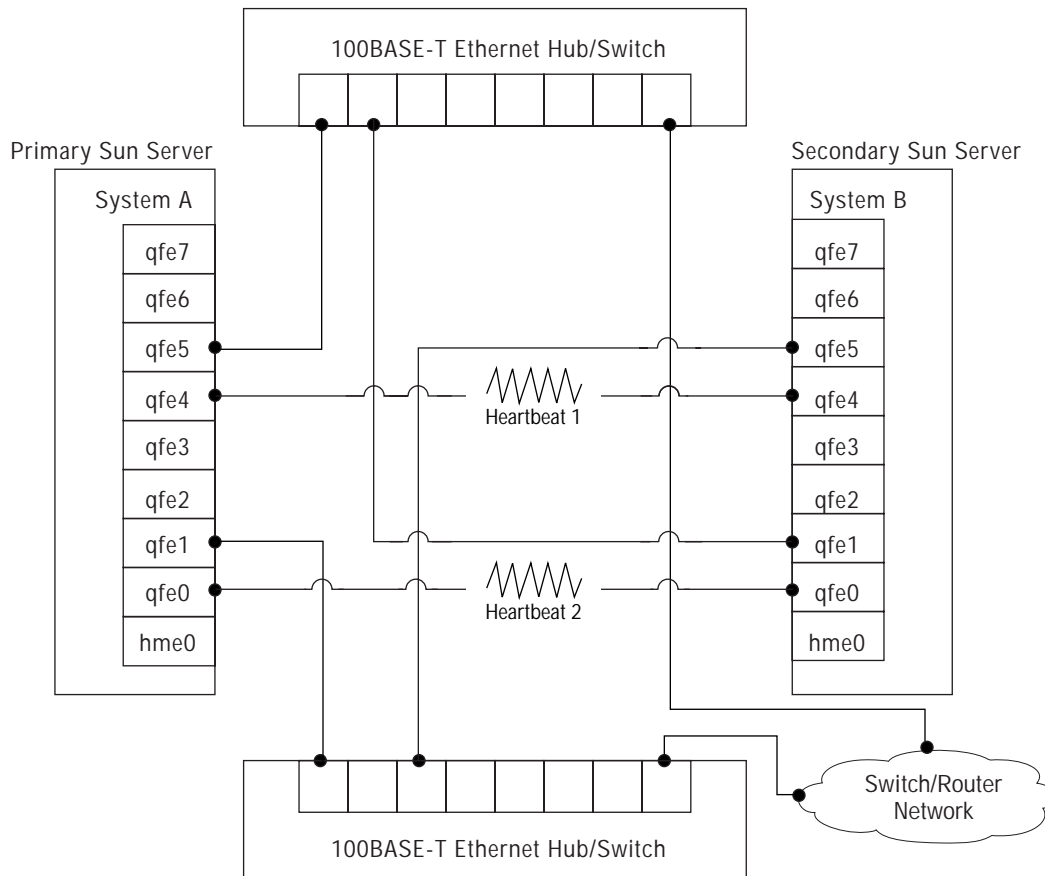
Cisco has deployed its Cisco Transport Manager High-Availability solution with multiple redundant IP interfaces. The virtual IP address configuration integrated into the solution enables all Cisco Transport Manager clients, the Cisco ONS 15000 product family, and the OSS platforms to interface via a single (but redundant) IP interface. If a failure occurs due to cabling, a faulty PCI adapter module, or the redundant hub, the intelligent Cisco Transport Manager High-Availability Agent will automatically fail over to another interface and continue to operate with the same virtual IP address via the customer’s switched/router network. Customers do not have to reconfigure any network elements or Cisco Transport Manager clients.

## The Intelligent Cisco Transport Manager High-Availability Agent

The intelligent Cisco Transport Manager High-Availability Agent interacts with best-of-breed products from Oracle, VERITAS, and Sun, providing the application link between VERITAS and Cisco Transport Manager processes. It can automatically detect failures by proactively monitoring the redundant heartbeat interfaces, checking the status of specific daemons, and assessing the health of Oracle and Cisco Transport Manager. It is also responsible for starting and stopping all processes in an orderly fashion.

When a critical failure has been detected, the Cisco Transport Manager High-Availability Agent will attempt to shut down the primary server and restart all processes on the secondary server in a matter of minutes. The Cisco Transport Manager automatically recovers, network visibility is restored, and all data is resynchronized, thus ensuring reliability, recoverability, and continuous operation of the network. If a failure has been detected on the active primary virtual IP interface, the system will automatically toggle to a new physical interface via the switched/router network (Figure 4).

Figure 4  
MultiNIC Configuration



Aside from the intelligent Cisco Transport Manager High-Availability Agent, no changes have been introduced into Cisco Transport Manager.

The intelligent Cisco Transport Manager High-Availability Agent:

- Checks for heartbeat and status on the primary Sun server
- Monitors the status of daemons, Oracle RDBMS, and Cisco Transport Manager
- Operates with best-of-breed products from Oracle, VERITAS, and Sun
- Is responsible for orderly shutdown and startup of daemon processes
- Constantly checks the status of IP interfaces used with the virtual IP address
- Is an add-on module to Cisco Transport Manager

The combination of the Cisco Transport Manager High-Availability Installation Guide with the new intelligent Cisco Transport Manager High-Availability Agent provides customers with an integrated high-availability solution. The installation guide is based on a reference architecture that details all the hardware, software, and required Solaris patches needed for a successful high-availability implementation. It provides detailed steps (articulated down to UNIX shell-level commands where possible) to install the complete Cisco Transport Manager High-Availability solution from ground zero. Cisco provides a high-availability certification and test plan as part of the Cisco Transport Manager High-Availability Installation Guide.

## Geographic Redundancy

The geographically redundant configuration consists of two locally redundant Cisco Transport Manager installations that are “connected” via VERITAS Volume Replicator, and “controlled” via VERITAS Global Cluster Manager. The Volume Replicator keeps the data at the two sites synchronized via asynchronous block-level replication, while the Global Cluster Manager communicates with the high-availability agent at each site to handle site failover, when required. The two sites use an Internet Control Message Protocol (ICMP) ping-based heartbeat mechanism, allowing for short failure detection time. A Web-based Global Cluster Manager graphical user interface allows flexible management of multiple clusters and sites from a single console. With geographic redundancy, the highest level of redundancy is attained.

## Testing

Cisco provides a high-availability certification and test plan as part of the Cisco Transport Manager High-Availability Installation Guide.

## Availability

The Cisco Transport Manager High-Availability solution provides customers with a robust configuration that ensures their mission-critical optical EMSs are protected. The platform protects against single hardware failures with mirrored internal/root disks, redundant servers, redundant disk arrays, N+1 power supplies, and multiple IP heartbeat interfaces. Incorporating a RAID 5+0 provides the extra layer of disk security with a RAID 5 (distributed-parity striping) and RAID 0 (striping) combination for added protection against any disk failure.

With VERITAS as an integral part of this solution, customers can resize volumes, perform online storage reconfiguration or defragmentation, and even add or remove disks in real time in their environment. VERITAS File System and Volume Manager provide increased flexibility, allowing modifications to be done on the active Sun server in real time while the system continues to operate. These features ensure continuous operation during routine or unplanned outages.

- VERITAS enhanced features include:
- Reduced maintenance downtime by enabling online maintenance operations
- Reduced outages due to hardware failure
- Simple manageability
- Reduced outages due to file system panics
- Faster recovery when outages do occur

## Reference Architecture

The Cisco Transport Manager High-Availability team has created a baseline architecture comprised of Sun hardware that customers can use to set up their Cisco Transport Manager High-Availability environment. For customers with no high-availability hardware components in their network, the reference architecture provides the complete tested and qualified solution. The hardware is designed around a single hardware vendor (Sun) to help ensure support and interoperability between all products. By implementing all Sun hardware (Sun servers, T3 StorEdge disk arrays, and FC-AL fiber channel hubs), customers have a seamless solution across a single vendor-and a single contact to resolve any potential hardware problems.

This reference configuration provides a baseline to validate the complete Cisco Transport Manager High-Availability solution for both hardware and software. Customers may deviate from this configuration and implement their preferred hardware (Sun server and disk array), provided the hardware selected has been validated by VERITAS for use with the VERITAS Database Edition/HA product. Factors such as CPU, memory, cache, and disk capacity should be assessed and any applicable Solaris 8 patches will need to be applied.

Customers who have chosen to implement their preferred disk array can also select their optimal RAID configuration. Since a RAID configuration spans multiple disks, load balancing is optimized, increased throughput and bandwidth is accomplished, and protection against single-disk failures is ensured to prevent any data corruption. As a result, online disk maintenance (such as defragmenting file systems, adding new disks or volumes, or even potentially changing from a RAID-5 to a RAID-1 layout) can be performed while the system is in operation with the VERITAS tools.

All of these features combine to provide customers with a fast recovery (if needed) and continuous service for planned and unplanned outages-critical to organizations requiring a high level of availability.

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