

Deploying Reliable and Scalable DOCSIS with TimeCreator® 1000

TimeCreator 1000
Front View



Key Benefits

- Enable cable operators to transition to next generation IP-based services over DOCSIS with rock solid synchronization
- Complement CMTS and Edge QAM redundancy solutions with redundant 1+1 DTI servers to maximize M-CMTS system reliability
- Scale port capacity with single Root and multiple subtending Slave Servers

Cable operators worldwide are deploying DOCSIS 3.0 networks very aggressively as they compete with telcos to offer broadband connectivity to residential and enterprise customers. The head end modular CMTS devices, such as the Cisco® uBR10012 Universal Broadband Router and the Edge QAMs, are becoming increasingly dense, as they offer high performance and capacity in a single chassis.

As cable networks evolve to IP based next generation networks with superior reliability, performance, scale, and density, customers will be demanding SLAs from cable operators, especially if they are paying a higher price for an enriched set of business and residential services.

In this context, it is critical to ensure high availability of the modular CMTS and Edge QAM devices, and to maintain reliable, accurate, precise and scalable synchronization in a DOCSIS network. Modular CMTS devices such as the Cisco uBR10012 CMTS and the Cisco RF Gateway 10 Universal Edge QAM provide high availability with redundant system common components, redundant network interfaces, and N+1 line-card redundancy. For DOCSIS synchronization, CableLabs specifications suggest that modular CMTS devices support at least two timing ports on the DTI client and that the DTI client

boards operate in 1+1 redundancy mode. In essence, this implies there are three levels of protection mechanisms that cable operators can use when connecting modular CMTS and EQAMs. These include:

- Connecting every Modular CMTS device with 2 DTI links
- Using 2 DTI servers in 1+1 redundant configuration
- Dual homing the devices to two different DTI servers.

DTI Root and Slave Servers

The cornerstone of DTI is a Root DTI Server. The Root Server controls the synchronization for an entire hub or head end. All M-CMTS devices, including the CMTS, EdgeQAMs and Upstream Receivers, synchronize either directly to the Root Server or through a subtending Slave Server. Since the Root Server is central to the operation of the DOCSIS network, the CableLabs DTI specifications suggest that a Root Server be extremely reliable. Symmetricom's TimeCreator 1000® has been designed to offer high availability. The TimeCreator 1000 has a passive backplane architecture to eliminate single-point-of failure active components. It can be configured with redundant clock cards (IOCs) and redundant power supplies to protect all of the active signals.

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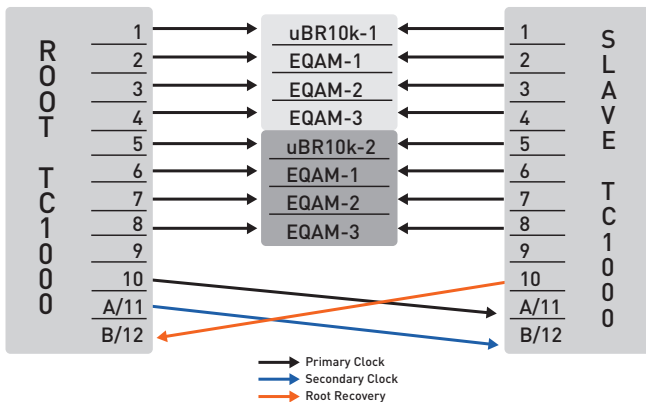


Figure 1. Typical configuration with one Root DTI Server and one Slave DTI Server

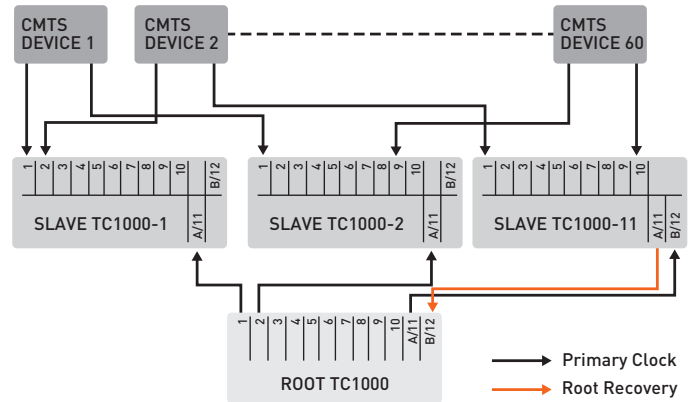
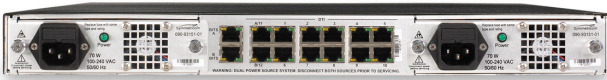


Figure 2. Large Scale Deployment with one Root DTI Server and Multiple Slave DTI Servers

Securing High Availability with Root and Slave Combination

Figure 1 shows a typical deployment with two CMTSs and six EQAMs in a head end. All the devices are dual homed to two DTI servers, Root and Slave. The Root Server is a fully redundant server with hot swappable 1+1 Input/Output cards and power supplies. The Slave Server does not need internal redundancy and is connected to the Root Server using a dual protected DTI connection. This architecture provides each M-CMTS device two redundant paths to the Root Server, one direct and one through the Slave Server. In the event of failure of either the root or slave, the DTI client residing in the M-CMTS device switches to the alternate timing signal. Note that when the Root is not connected to a GPS, there is a feedback loop from the output of one Slave Server to the input port (port 12) of the Root Server.

With one Root and one Slave Server, one can connect up to 9 (with Root Server Recovery feature) or up to 10 (w/o RSR feature) M-CMTS devices. The Root Server Recovery feature essentially enables the Root to recover gracefully after failure without causing any service outage. Without Root Server Recovery feature, in the event of Root failure, the Root will take longer to align its phase with the Slave Server. With the feature on, the Root will get the new phase directly from the Slave Server right away.



TimeCreator 1000
Rear View

Scaling TimeCreator 1000 with MC3G60 and Edge QAMs

A very high capacity head end may house several CMTS and EQAM chassis. This implies that the DTI port capacity needs to scale beyond 12 ports.

Figure 2 is an example of how cable operators can scale DTI port capacity for a large scale deployment. Here the modular CMTS devices are dual homed to Slave Servers only. All the Slave Servers are subtended off a single fully redundant Root

The slaves need not be fully redundant and can be connected to the Root Server with one DTI link versus two. Note that when the Root is not connected to a GPS, there is a feedback loop from the output of one Slave Server to the input port (port 12) of the Root Server. The red arrow indicates the RSR feed.

With this architecture, one can connect up to 60 M-CMTS devices dual homing them to two different Slave Servers and greatly improve the overall reliability of the DOCSIS network.

Conclusion

With head end equipment becoming very dense, it is important to secure high availability and reliability of DOCSIS networks by designing high redundancy in the equipment and in how the equipment is connected for synchronization. The Cisco uBR10012 and RF Gateway 10, and the Symmetricom TimeCreator 1000 all offer excellent redundancy features. In addition, Symmetricom recommends as best practices:

- Ensure every device has two links to the DTI server
- Ensure you use at least two DTI servers in 1+1 redundant mode
- Dual home the devices to at least two DTI servers and
- Use Root Server recovery to gracefully recover from root failure