



Optical Networks for Healthcare

Solution for Digital Revolution



Healthcare organizations are undergoing a rapid digital revolution where getting a clear live image on the screen of a patient undergoing critical surgery in an operating room, and not just reruns of a cartoon channel, is vital.

In addition, protecting and storing data and replacing outdated processes – such as, scribbling prescriptions and patient records on paper and storing and exchanging X-rays on film – become a must for the healthcare industry since they too are imperative for life-saving surgery .

Today, after years of considerable advancement in technology and development, WDM¹-enabled optical networking and optical wireless are poised for wide-scale implementation throughout the healthcare industry.

Migrating to Multi-site Installations

Healthcare organizations are falling under increased pressure from governments and insurers to implement business improvements, enhance patient care, and reduce costs. Customer-operated WDM networks provide virtually unlimited bandwidth as well as resilient, flexible support for promising new life-saving services and critical process improvements in healthcare. Fixed operational expenditures (opex) get a return-on-investment within a few years, thereby positioning the healthcare organization for dramatic savings in cost over the long term.

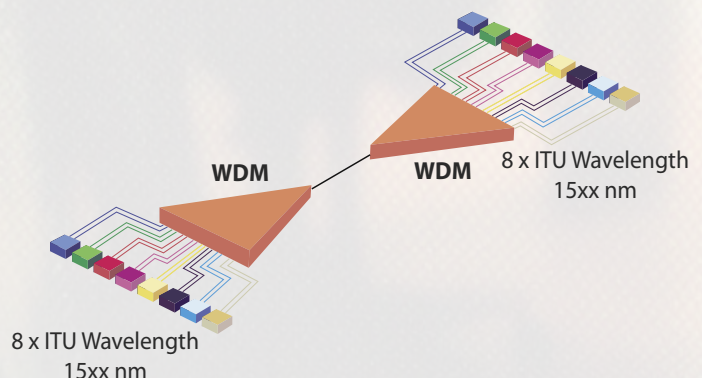
At the same time, the healthcare industry is in a state of rapid and widespread flux. Hospitals are expanding from standalone locations to campus environments while regional healthcare organizations, through mergers and acquisitions, are starting to spread over large geographic areas.

These trends have created new challenges for healthcare Information Technology (IT) departments. Historically, as bandwidth demands increased, healthcare organizations were provisioned additional telecom connection services by network carriers. In many cases though, these traditional services failed to deliver the necessary solution.

Also, due to the accelerating rate of change in healthcare management, the job of predicting IT costs has morphed from a science into an art; making it not uncommon for healthcare organizations to record average increases in telecommunications costs of 10% annually and some even 20% annually. As a result, healthcare IT departments have sought a more efficient, flexible, and cost-effective solution to meet their bandwidth needs.

Technology Evolution

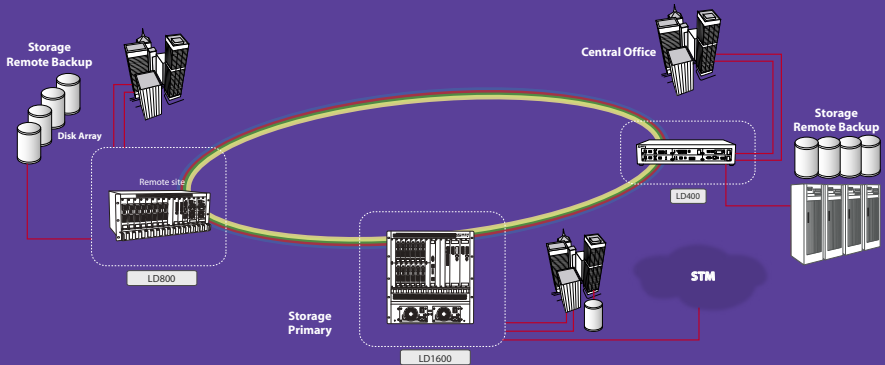
WDM enhanced optical networking – originally developed in the mid-1990s for financial institutions – provides the benefits sought by healthcare IT departments. During the last decade, as deployment has spread to a wide range of enterprise and service provider networks, the technology has undergone critical improvements that have rendered WDM the ideal underlying foundation for data, voice, and video communications in healthcare!





In WDM, wavelengths for different services are multiplexed and driven over the same fiber without jeopardizing the data streams. Triple-play video, voice, and data services using recognized protocols – examples of which are 10/100/1000/10G Ethernet, ESCON/Fibre Channel for storage, ATM for transport, and SONET/SDH – can be run cost-effectively and at native speed using WDM over multiple and single fibers. Additional services can be conveniently and simply provisioned on existing fiberoptic links – without the need to add fibers.

WDM with its unparalleled scalability, security, reliability and protocol independence, offers an especially attractive option for business continuity and disaster recovery across geographically dispersed data centers. Advanced optical storage solutions enable a healthcare organization to ensure that its data and services are constantly available, even in the event of simultaneous failure at multiple sites.



MRV's state-of-the-art WDM solutions are proven answers to the challenge of interconnecting widely separated campus buildings carrying mission-critical traffic since they ensure business continuity and high-capacity data storage and availability.

As healthcare seeks robust business continuity solutions for better disaster protection and data availability, an important factor is the extendibility of the operating distance between separate campus buildings while maintaining network efficiency and availability. However, increasing operating distances between data centers spawns the following business and technical factors that have to be addressed:

Network Availability: This means time intervals at which services can be run and data can be accessed. Often, continuous accessibility to data must be guaranteed. One method of doing this is by data replication. It consists of redundant storage arrays and utilizes mainly Fibre Channel storage protocols. This is mainly implemented for multi-sites to protect networks against power outages or natural disasters, which may render an entire site unavailable.

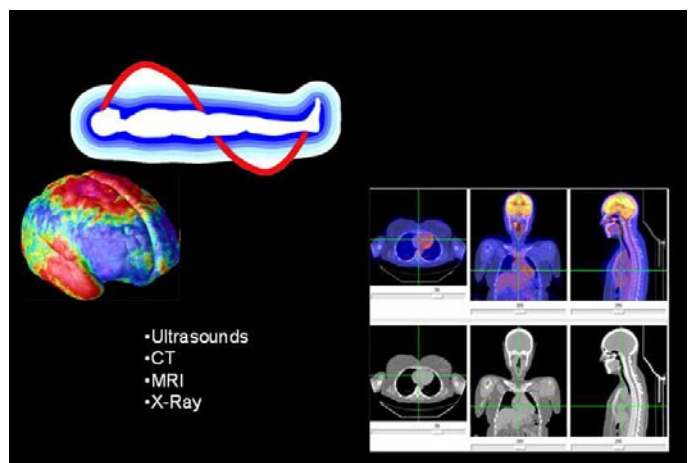
Cost: Often, Storage Area Networks (SANs) are deployed to meet local storage needs. Moving to multi-sites increases costs. A technological solution enabling networking of a multi-site SAN increases asset utilization and lowers total cost of ownership.

Bandwidth: The demand for storage and data protocols may precipitate the need for 4Gbps and even 10Gbps rates. In such cases, multi-site connectivity will require multiple 4Gbps/10Gbps channels to meet the required high-bandwidth demand.

Distance Extension: Fibre Channel was designed for connectivity among local data centers. The multi-site architecture requires a technology enabling interconnectivity of SANs separated by distances of many kilometers. The problems, which these factors raise, are very effectively resolved with the help of MRV's WDM transport technology solutions.

MRV's WDM Solution for Healthcare Connectivity and Storage Networking

To satisfy the needs for extended-distance storage services, networking solutions must meet basic performance requirements. In particular, they must include physical connections of separated sites, address high-speed transfer of native storage traffic, ensure nominal data loss, guarantee secure transport, and deal with the changing requirements of dynamic and growing organizations.



MRV's LambdaDriver® CWDM/DWDM solutions, which use multiple wavelengths to transport up to 128 concurrent streams of digital information over fiber optic cables, are ideal for storage. With proven interoperability with storage vendors, support for a broad range of traffic types and the ability to meet the rigorous performance requirements of storage networking, MRV's WDM solutions are ideal for connecting high-capacity SANs and advanced Ethernet/IP Services.



The flexibility and cost-effectiveness of MRV's WDM solutions have revolutionized availability of services enabling healthcare organizations to enhance patient care in the following respects:

Picture Archiving and Communication System (PACS) -- This advanced clinical service allows caregivers to digitally store, manipulate, and share cardiology and radiology images.

Grid Computing -- The processing load is split among multiple desktop and laptop computers across geographically dispersed facilities, enabling academic researchers to more affordably and seamlessly collaborate.

Computerized Physician Order Entry (CPOE) -- Old, manual processes delay diagnosis and treatment and increase the potential for human error, thereby hampering patient care and increasing costs. In CPOE, a caregiver accesses a patient's medical history and orders procedures from a handheld device.

Electronic Record-keeping Systems -- Nurses input patients' vital signs, symptoms, and medication descriptions directly into a healthcare organization's network database via wireless laptop computers. Doctors can sign in, monitor their patients' progress, and order procedures more efficiently.

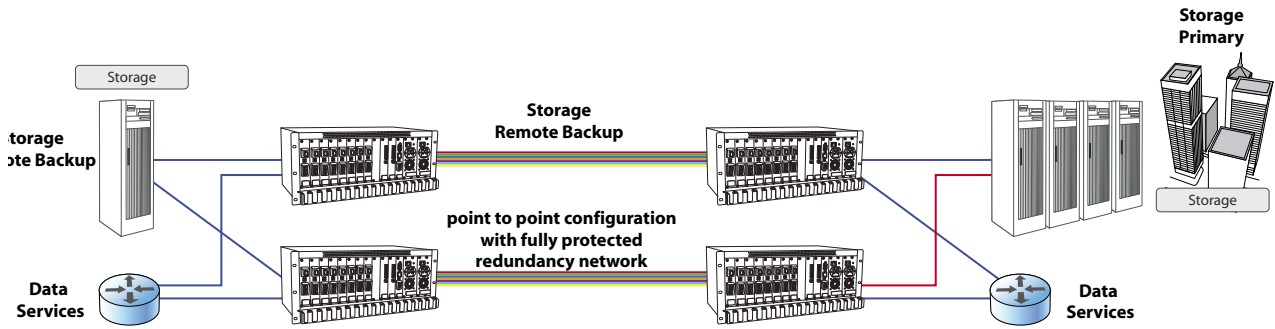
Physiological Monitoring -- Telemetry data is relayed in real time from intensive-care units to enable constant monitoring and analysis of a patient's condition.

Robotic-arm Surgery -- A doctor views a magnified image of the patient and remotely guides a robotic arm. The capabilities of a precious resource, namely, specialized skilled surgeons, are extended remotely to areas where they were previously unavailable. Bleeding and post-operation recovery time are reduced because the robotic arm, not susceptible to the tremors of a human hand, makes smaller, more precise incisions. This type of surgery is becoming more prevalent for an expanding range of operations, including removal of cancerous prostate glands, heart repairs, and gastric bypass.

Disk Mirroring -- With the Fibre Channel protocol, data is synchronously written to multiple data centers, ensuring continuity of care in the event of failure at any one of the sites.

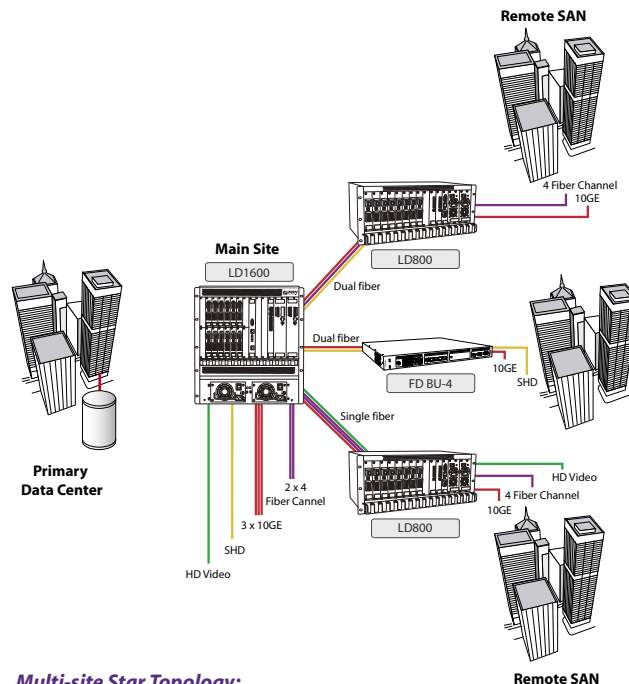
In addition, many healthcare organizations seek to join collaborative research efforts. The common requirement for all these services is the availability of reliable and secure bandwidth, which MRV's WDM solution cost-effectively delivers. The solution spans:

- **Optical Data & Storage applications**
- **Data replication (synchronous and asynchronous)**
- **Distance extension for data backup and virtual storage**



Primary-Backup Point-to-point Topology:

MRV Optical Connectivity solution extends Healthcare SAN/Data business continuity and storage services over long and short distances in addition to carrying multiple data-rate (10G, 1G, etc.) services over the same fiber infrastructure. The network is built from MRV's LambdaDriver WDM systems.



Multi-site Star Topology:

MRV Optical Connectivity solution extends Healthcare continuity by replication using MRV's LambdaDriver WDM systems

Why MRV for Healthcare Optical Networking

MRV's LambdaDriver Optical Connectivity systems deployed at hospitals around the world connect the hospital campus, including data centers and patient-care facilities, in physical point-to-point or ring topology networks. The networks provide carrier wavelengths for data, voice, and video services of up to 10 Gbps. Using MRV's LambdaDriver systems, hospitals now have the bandwidth necessary for PACS and other life-saving services. The LambdaDriver network offers inherent support for Fibre Channel SAN applications so that up-to-date copies of all data are always readily available. The MRV solution enables flexible network architecture with no single-points-of-failure. Even if the hospital loses power at a given LambdaDriver system, traffic passes through it unaffected to other LambdaDriver systems. The network is flexible, allowing the IT managers to expand services without increasing bandwidth costs.

The LambdaDriver systems have:

- Proven carrier-class reliability and high availability
- Better scalability and support for protocols operating at different speeds (from 5Mbps to 40Gbps per channel, including Ethernet, Fibre Channel & other storage protocols, SONET/SDH, and HD-SDI video and other flexible interfaces) on the same LambdaDriver system
- Fiber operating distance extension to more than 1000 kilometers
- Proven interoperability with other vendor products since 1988