

Optical Networks for Next Generation Disaster Recovery Networking Solutions with WDM Systems – Cloud Computing and Security

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Legacy Data Center Today



- Fibre channel used to synchronously mirror disks over 100 km
- Long distance replication async over SONET/SDH, or IP networks using FC to IP gateways

Legacy Data Center Architectures

- Fixed filter WDM networks using 2.4G and 10G wavelengths
- Fibre channel for disk to disk replication
- Network designed for peak bandwidth consumption
- Active and backup data center work loads
- Applications are assigned fixed storage resources
- F500 companies use leased fibre to build WDM networks to connect data centers

Future Data Centers Connectivity

- **New Network built on** → Wavelength switches, Remote Add Drop Mux (ROADM's), electronic variable optical attenuators (eVOA's), Tuneable optics, coherent receivers
 - **Enables:**
 - Routing wavelengths from A to Z on demand
 - Wavelength transmitters adjusts to available spectrum in the network
 - Automated wavelength power balancing via eVOA's
 - 40G – 100G single carrier wavelengths carrying muxed Gige, FCOE (Fibre channel over Ethernet) and Fibre channel
 - Carrier shared fiber networks to service multiple business using the same fiber and networking equipment
 - F5000 access to WDM connectivity for data center links

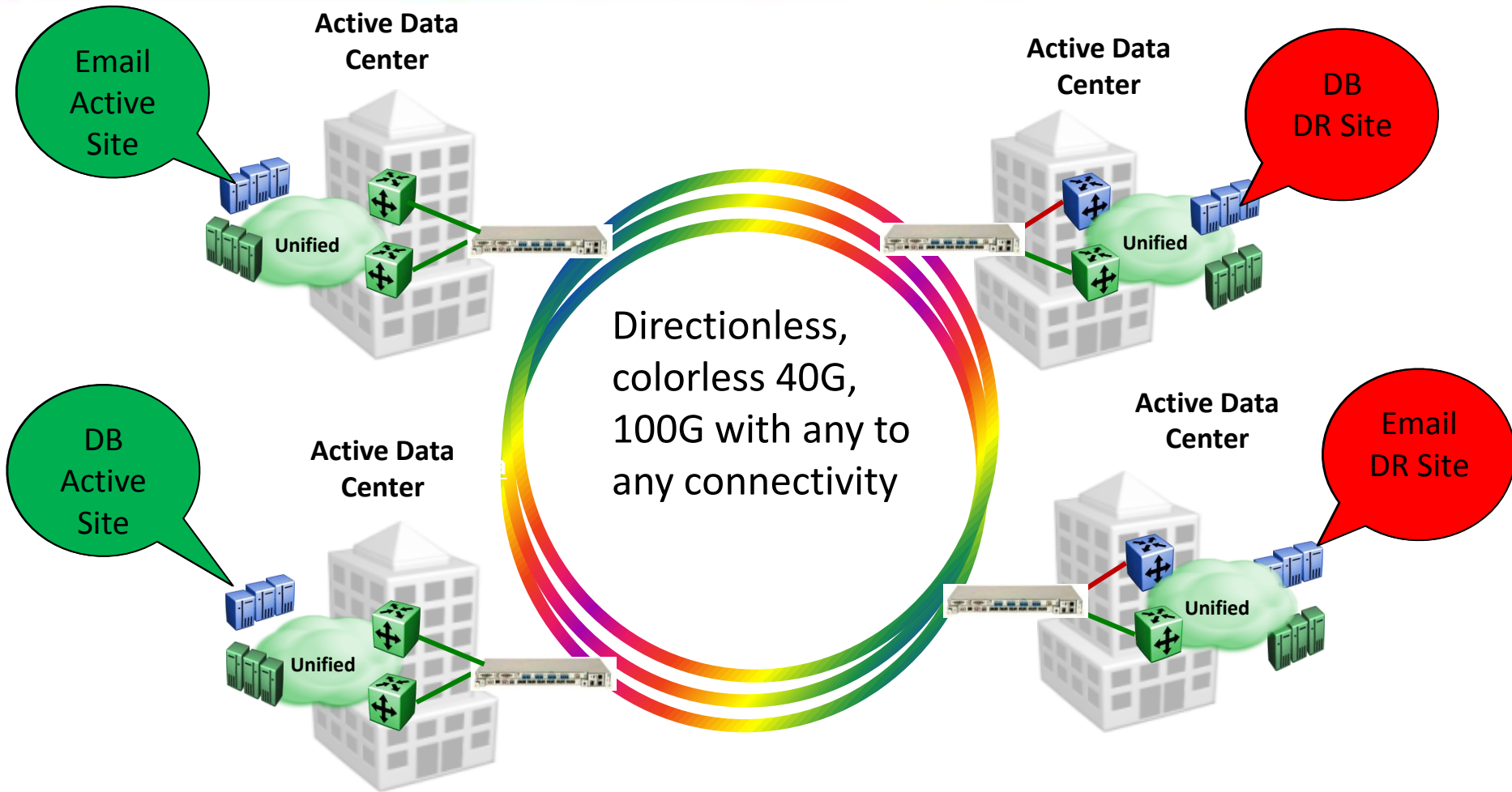
Future Data Centers Trends

- No more primary data center...any data center can be primary at any time (traffic patterns move from hub and spoke to mesh)
- Tuneable lasers on Ethernet routers and switches
- No need to buy bandwidth for peak network usage, with the ability to add wavelengths on demand for peak compute periods
 - Example end of quarter reporting, Holiday season transactions
- Wire-speed transparent link encrypted from 1G to 10G
- Long distance VMware VMotion between data centers driving Layer 2 Ethernet WAN architectures
- Storage virtualization allows pooling of block based storage over distance ex. EMC Vplex

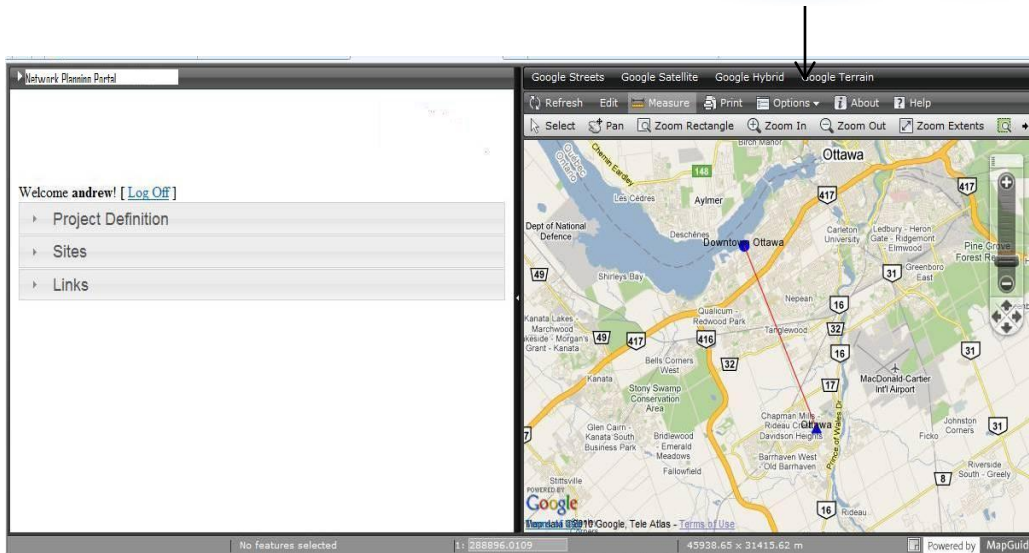
Future Data Centers Technologies

- FCoE (Fibre channel over Ethernet) converges FC fabric into the Ethernet switching layer. Standardized today
 - Layer 2 protocol requires L2 path between data centers
- GMPLS – enables wavelength activation end to end in minutes to add more capacity. Standardized today, example research networks, Internet 2
- IPoWDM – Adding Optics intelligence to routers and Ethernet switches to integrate the management between the optical layer (layer 0) and data layer (switching and routing). Reduce cost and management simplicity
- 100G Ethernet and 100G wavelengths available today

Future Data Center Deployments



Carrier Managed Encrypted Key Management



Customer Portal Offers

- Generates keys on demand
- Accepts keys from customers keying systems (e.g., RSA RKM)
- Provides graphical network view with security alarms
- Chief Security Officer Dashboard

Hyped Technologies

- **Infinband**
 - Host to host clustering
 - Host to storage
 - Operates with buffer credit flow control requires extension solution for WAN use
 - Not deployed widely, except for financial and research vertical for computational clusters
- **FCoE**
 - Expected to surpass Fibre channel as the storage interconnect protocol in port shipments in 2012
 - Lowers costs with single switching fabric for LAN and SAN
 - Simplifies extension between data centers over WDM, SONET, IP, MPLS by requiring Layer 2 Ethernet
 - Requires re-engineering current Data center to Data center networks that were Layer 3 interconnect

Emerging Requirements for the Data Center

- **New Network Requirements:**

- The advent of VM mobility between hosts/data centers and Cloud computing providers like Amazon means fault isolation and determining root cause is increasingly difficult without automation
- Layer 2 Ethernet Connectivity for VM mobility
- End to End Security
- Bandwidth on demand
- Geographically dispersed Virtual Block Storage
- Location Aware Application Monitoring
 - Geospatial monitoring of data center infrastructure and applications
 - Requires real-time mapping of current active application location to physical infrastructure
 - Root cause network faults to show application impacts
 - Example VM is moved or migrated to Cloud provider

Location Aware Application Monitoring

Superna Application Framework

Legend

Tasks

Welcome tok! [Log Off] [A]

- Network Health
- Alarm Summary
- Site/Depot Locations
- Physical Fiber Plant

Maps External Providers View

Refresh Select Radius Select Polygon Clear Selection Buffer Measure Feature Info Query Theme Redline

Select Pan Zoom Rectangle Zoom In Zoom Out Zoom Extents Zoom Selection Previous Next

Superna 2 Alarms

- RAISED - PSS1MD4H-1: Lss1 (Major) - Test Alarm, EquipmentController-1-1 9/27/2010
- RAISED - PSS1MD4H-1: GIGE (Critical) - Gige alarm test, FAC-14-1 9/30/2010
- CLEARED - PSS1MD4H-1: OCH (Critical) - OCH error test, FAC-14-3 9/29/2010
- CLEARED - PSS1MD4H-1: GIGE (Critical) - Gige alarm test, FAC-14-1 9/29/2010
- RAISED - PSS1MD4H-1: EOPT (Major) - equipment alarm test, FAC-14-2 9/30/2010

Superna 3 Alarms

- PSS1MD4H-6: Lss1 (Major) - Test Alarm, SFC2A-1-4 9/27/2010
- PSS1MD4H-6: Lss (Major) - Loss of Synchronization, SFC2A-1-4 9/28/2010
- PSS1MD4H-6: GIGE (Critical) - Gige alarm test, FAC-14-1 9/30/2010
- PSS1MD4H-6: OCH (Critical) - OCH error test, FAC-14-3 9/29/2010
- PSS1MD4H-6: EOPT (Major) - equipment alarm test, FAC-14-2 9/30/2010

Superna 4 Alarms

- RAISED - PSS1MD4H-9: Lss1 (Critical) - Test Alarm, 4dpa4-1 9/28/2010
- RAISED - PSS1MD4H-9: EOPT (Major) - equipment alarm test, FAC-14-1 9/30/2010
- RAISED - PSS1MD4H-9: GIGE (Critical) - Gige alarm test, FAC-14-1 9/30/2010
- CLEARED - PSS1MD4H-9: GIGE (Critical) - Gige alarm test, FAC-14-1 9/29/2010
- CLEARED - PSS1MD4H-9: OCH (Critical) - OCH error test, FAC-14-3 9/29/2010

Superna 1 Alarms

- RAISED - PSS1MD4H-2: Lss1 (Critical) - Test Alarm, FanUnit-1-6 9/28/2010
- RAISED - PSS1MD4H-2: feLss (Critical) - Far End Loss of Synchronization, FanUnit-1-6 9/28/2010
- RAISED - PSS1MD4H-2: EOPT (Major) - equipment alarm test, FAC-14-2 9/30/2010
- RAISED - PSS1MD4H-2: GIGE (Critical) - Gige alarm test, FAC-14-1 9/30/2010
- CLEARED - PSS1MD4H-2: EOPT (Critical) - equipment alarm test, FAC-14-2 9/29/2010
- RAISED - PSS1MD4H-2: GIGE (Critical) - Gige alarm test, FAC-14-1 9/29/2010
- RAISED - PSS1MD4H-2: OCH (Critical) - OCH error test, FAC-14-3 9/30/2010
- CLEARED - PSS1MD4H-2: OCH (Critical) - OCH error test, FAC-14-3 9/29/2010

Map showing Ottawa, Ontario, Canada. Locations marked include Baskin's Beach, Malwood, Queens Park, Aylmer, Ottawa, Nepean, Kanata, Huntley, Stittsville, Fallowfield, and Greely. Distances shown: 7.7km, 3.8km.

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Thank You