AGILE OPTICAL NETWORKING
EVOLVING TRANSPORT NETWORKS TOWARDS DE CLOUD ERA.

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WHERE ARE WE TODAY WITH THE TRANSPORT NETWORK?

2015

Backbones have been transformed.

• 100G+ is massively adopted in LH
• High performance ROADMs became the foundation of LH transport networks - Flexible CD ROAMDs
• High capacity OTN Switches - better capacity utilization and Resilience

Future
WHAT’S DRIVING NETWORK TRANSFORMATION?

IP VIDEO

720% INCREASE IN VIDEO TRAFFIC By 2017

MOBILE BROADBAND

Residential

Mobile

Business

Data Center

Core

L2/3 Aggregation

Wi-Fi

Metrocell

Small cell

On-net CDN

BUSINESS AND WHOLESALE SERVICES

Lambdas Services

L2/3 VPN Services

CLOUD-BASED SERVICES AND APPLICATIONS

INCREASE IN CLOUD AND DC TRAFFIC By 2017

720%

440%
CAPACITY EVOLUTION
STRONG IN THE CORE, STRONGER IN THE METRO

560% INCREASE IN METRO TRAFFIC through to 2017

320% INCREASE IN CORE TRAFFIC through to 2017

75% of traffic remains in the Metro by 2017

- More access nodes and endpoints
- Evolving services
- Better user experience
- More bandwidth

Metro Ethernet Exchange
Regional DC
National DC
Metro Data Centres
INFONETICS MARKET EVOLUTION FORECAST*

New Metro Installs—Speeds: 2015 vs 2018 n=34, 34

[Graph showing percentages of different speeds for 2015 and 2018]

DCI capex, N=28,28

[Bar chart showing DCI capex for 2015 and 2018]

*Infonetics-100G-ROADM-Provider-Survey-11-13-15
CAPACITY EVOLUTION IMPACT
METRO 100G PENETRATION, MORE MESHING

- Move to 100G rings
- Move to 100G+ mesh
- ACCESS AGGREGATION
- METRO CORE
- REGIONAL/NATIONAL CORE NETWORK
- METRO NETWORK
- Metro Data Centres
- Metro Ethernet Exchange
- Regional DC
- National DC
- Regional IP Exchange
OPPORTUNITIES FOR SP
THE STRATEGIC JOURNEY
RE-EVALUATE THE FOCUS OF TRANSPORT NETWORKS

OPPORTUNITIES
- LAN & SAN Extensions
- Mission Critical Networking
- Continuous Bandwidth Growth
- Security & Data protection & data integrity
- Private Cloud, Big Data Transport
- Business continuity & disaster recovery
- Low Latency, Secure Networking
- Data Center Consolidation & Interconnections

MARKETS & CUSTOMERS
- OIL&GAS
- TRANSPORTATION
- WEB SCALE
- CLOUD PROVIDERS
- EXTRA LARGE ENTERPRISE
- UTILITY
- SERVICE PROVIDERS (T3)

Transport as a Service “TaaS”
Current Services Offering

Residential/ Enterprise
- HSI, VoD, BTV and VoIP

Transport to IP Core
- Backhaul Movil
- Ethernet LAN to LAN
- TDM Services (E1/E3)
- 1G/10G Connections to carriers

Future “TaaS” Services Offering

Dedicated or Shared High & Low Capacity Bandwidth (<1G up to 100G)
- Flexible granularity
- E2E commissioning, monitoring, supervision

Ethernet/OTN Services
- Pay-per-use Bandwidth
- Ethernet and Optical VPNs

Latency-sensitive & Encrypted Services
- Data-Centres Connection (Oi & others)
- Bank transactions

Managed Capacity Services
- Transparent support for Customer’s applications
- Customers can use the bandwidth however they want

HD Video Conferencing & Health Services
- across multiple sites and multiple enterprises

Service’s Offering Evolution

Transport as a Service (“TaaS”)
INTRODUCING THE PHOTONIC CITY
AGILE PHOTONIC NETWORK “FABRIC” WITH MULTI-LAYER SWITCHING

Creating Optical Highways connecting main buildings in the cities to key data centers
COMMON INFRASTRUCTURE SLICED FOR MULTI-TENANT USAGE

simply program Services from single Optical Fabric

L3/L2 VPN
L1 O-VPN
L0 O-VPN
AGILE PHOTONIC NETWORK “FABRIC” WITH MULTI-LAYER SWITCHING

A Metro optical infrastructure more efficient, elastic and adaptable to further growth and change:

• Multi-Services platform, Highly integrated with Ethernet and IP layers

• Fully flexible to unleash the true potential of SDN networks

• Adaptable to changing business models, pay-per-use on-demand capacity

• Deliver Ethernet and Wavelength Services with shelf-manage capabilities
FLEXIBILITY EVOLUTION IN THE PHOTONIC LAYER

CDC-F ROADM
- Colorless directionless Contentionless
- Flexgrid
- Fully configurable

CD ROADM
- Colorless directionless
- Shared colorless ADD/DROP
- Direction remotely configurable

ROADM
- Most simple node configuration
- Pass-through remotely configurable
- Colored ADD/DROP block per degree

Node/Network Evolution

Unleashing the true potential of photonic networks!!
HIGH CAPACITY TRANSMISSION
500G MUXPONDER DELIVERING PROGRAMMABLE LINE RATE CAPACITY

1Tb in a single 3RU equipped with 2x500G Transponder
**FLEXIBLE GRID**
**ENABLING NARROWER AND FLEXIBLE CHANNEL SPACINGS**

- LCoS-based WSS enables flexible and granular allocation of bandwidth
- 12.5 GHz granularity
- Enables advanced modulation formats for joint reach & spectral efficiency optimization
- Enables “Superchannels”

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**FLEXGRID WSS**

- 50 GHz
- 37.5 GHz
- 75 GHz
- 100 GHz
- 50 GHz
CAPACITY, FLEXIBILITY, SPACE & POWER OPTIMIZED OPTIMIZED METRO PLATFORMS

• **FLEXIBLE** multi-function optimized platforms for access to metro core

• **SCALABLE** bandwidth with distributed switching

• **MULTISERVICE** photonic, OTN, packet transport with scalable sub-10G/10G/100G+

• **HIGH CAPACITY** Ethernet (1GE to 100GE) and SAN/storage (1GFC to 16GFC) networking

• SDN-enabled to support application-driven, dynamic service instantiation

DELIVERY OF HIGH CAPACITY multi-protocol services to meet Customer expectations
NETWORK TO ADDRESS PERFORMANCE, SCALE, REACH AND SECURITY

Scale Bandwidth

Reach the Distance

With Encryption

without sacrificing the Optimized Latency

Fast service activation (whatever is the protocol)

IT IS THE USER-EXPERIENCE, MACHINE-TO-MACHINE AND APPLICATIONS THAT SETS THE REQUIREMENTS OF E2E PERFORMANCE
ADDED VALUE SERVICES
MANAGED LOW-LATENCY ENCRYPTED

Cyber security Admin
Key Management Tool (KMT)

E2E Managed Encrypted 10G Wavelength Service

Network management

L1 Encryption
N=28,28

Average Percent of Layer 1 Encryption
HIGLY INTEGRATED IP/OPTICAL NETWORK
FIRST STEP INTEGRATION: MRN & GMPLS UNI

IP/OP Integration with GMPLS UNI CP

ROADM and OTN Under single GMPLS based MRN CP

UNIFIED, CONSISTENT AND EFFICIENT CONTROL

SIMPLIFIED PROVISIONING & MAINTENANCE

IMPROVED PROTECTION & RESTORATION

INCREASED RESOURCE UTILIZATION
BRING IT ALL TOGETHER - NETWORK SERVICE PLATFORM

Enabling Carrier SDN, delivering profitable on-demand services
BUSINESS SERVICES
- Optical Services
- Carrier Ethernet
- IP VPN access

MOBILE
- Backhaul
- Fronthaul
- Packet Core
- Wi-Fi

DATACENTER
- DC Interconnect
- Network Virtualization and Automation

RESIDENTIAL
- BNG
- Video / CDN
- Wi-Fi

CLOUD OPTIMIZED METRO

THANK YOU!
Every success has its network