

Data Center Revolution – Impact on Ethernet and MPLS

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Key Points

- Dramatic bandwidth increase
 - for data center networking on a nationwide scale
 - change of the nature of services
- Large build-outs of data center applications are happening
- Carrier Ethernet Transport platform
 - new economic optimization points with DWDM and Carrier Ethernet technology.
 - enables effective multiple layer optimization for DWDM and CE
- Topological growth flexibility and “ease-of-use” are key

Data Center Revolution - Agenda

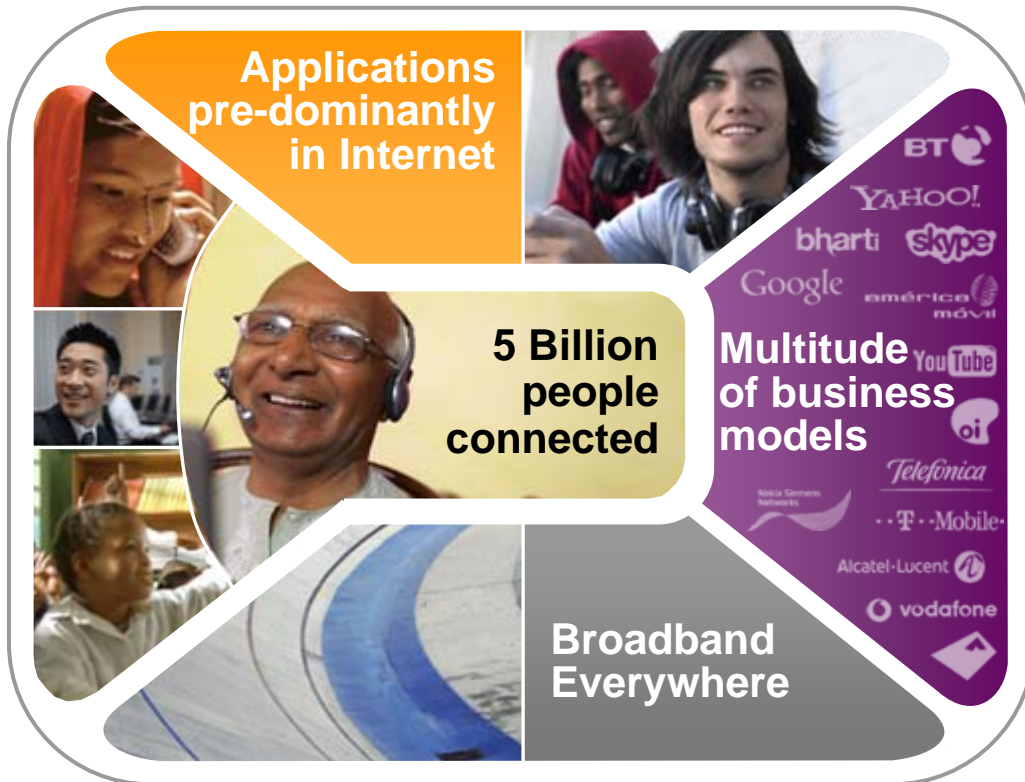
Data Center and Market Trends

Data Center Metro Networks

Data Center National Network Architecture

Conclusions

... 100 x Increase in Traffic by 2015



This implies that:

- Total cost of ownership must decrease
- Technology break as IP reaches economical limits
- High data rate support

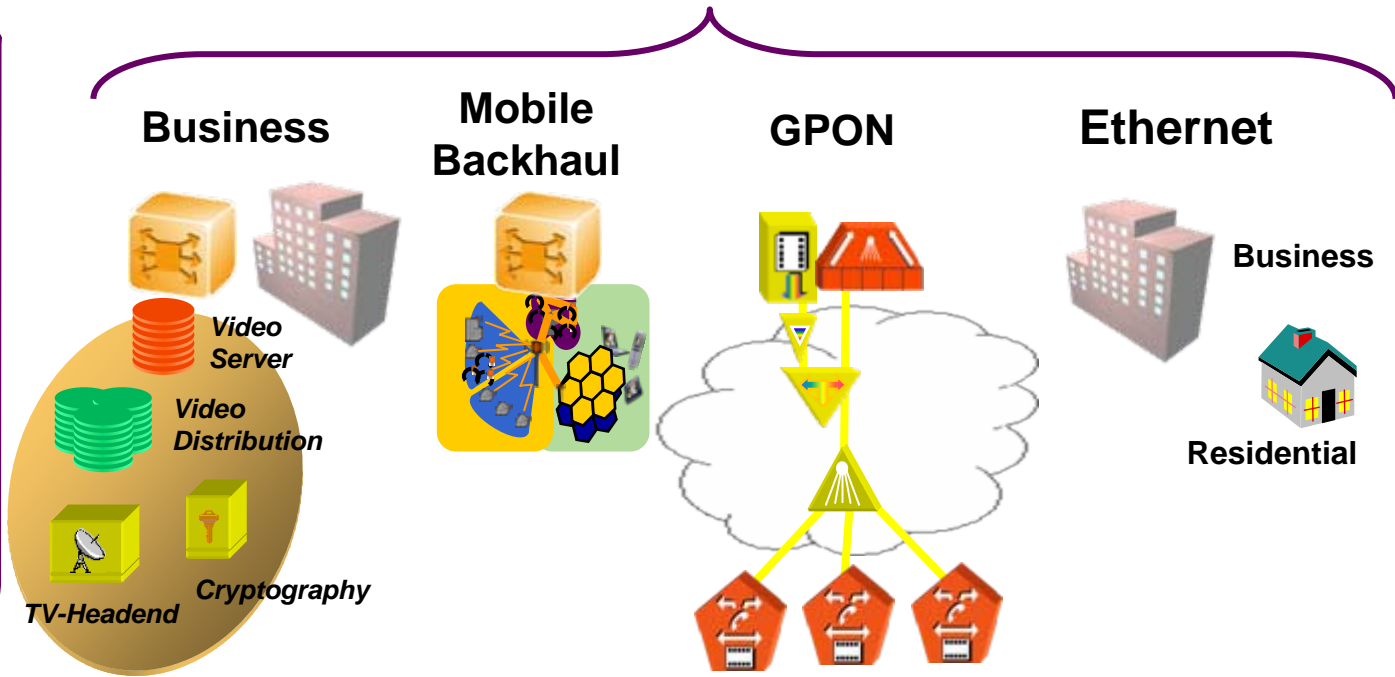
General Applications Trends

Changing business environment



Variety of applications and resulting services:

- Residential:** Triple / Quadruple play
- Business:** Managed services
- Mobile backhaul**



Requirement: Deployment flexibility and service dynamics

The Data Center Challenge

- Bandwidth demand increases continuously
- Technology challenges as IP reaches economical limits
- Total cost of ownership must decrease dramatically

1. Ethernet gains further momentum:

- From enterprise services to consumer data applications
- Carrier Ethernet Transport (CET) is emerging technology
- Entering the classical telco transport domain to overlay or replace SONET/SDH

2. Dynamic optical networks

- are a necessity to support the value proposition
- optical layer (DWDM) is expanding to facilitate the transport of increasing packet traffic volumes driven by data centric applications

3. Converged and simplified end-to-end networks

- Network application flexibility necessary for easy topological growth
- highest deployment flexibility

Data Center Management – Key Requirements

- **Eliminate network layers**
while reducing complexities and equipment costs
- **Improve resource use**
to achieve optimal bandwidth efficiency
- **Simplify end-to-end provisioning**
to improve time-to-market
- **Automate network management**
for scalability and reduced operating expenses
- **Automatically detect problems**
resolve them faster across the entire network

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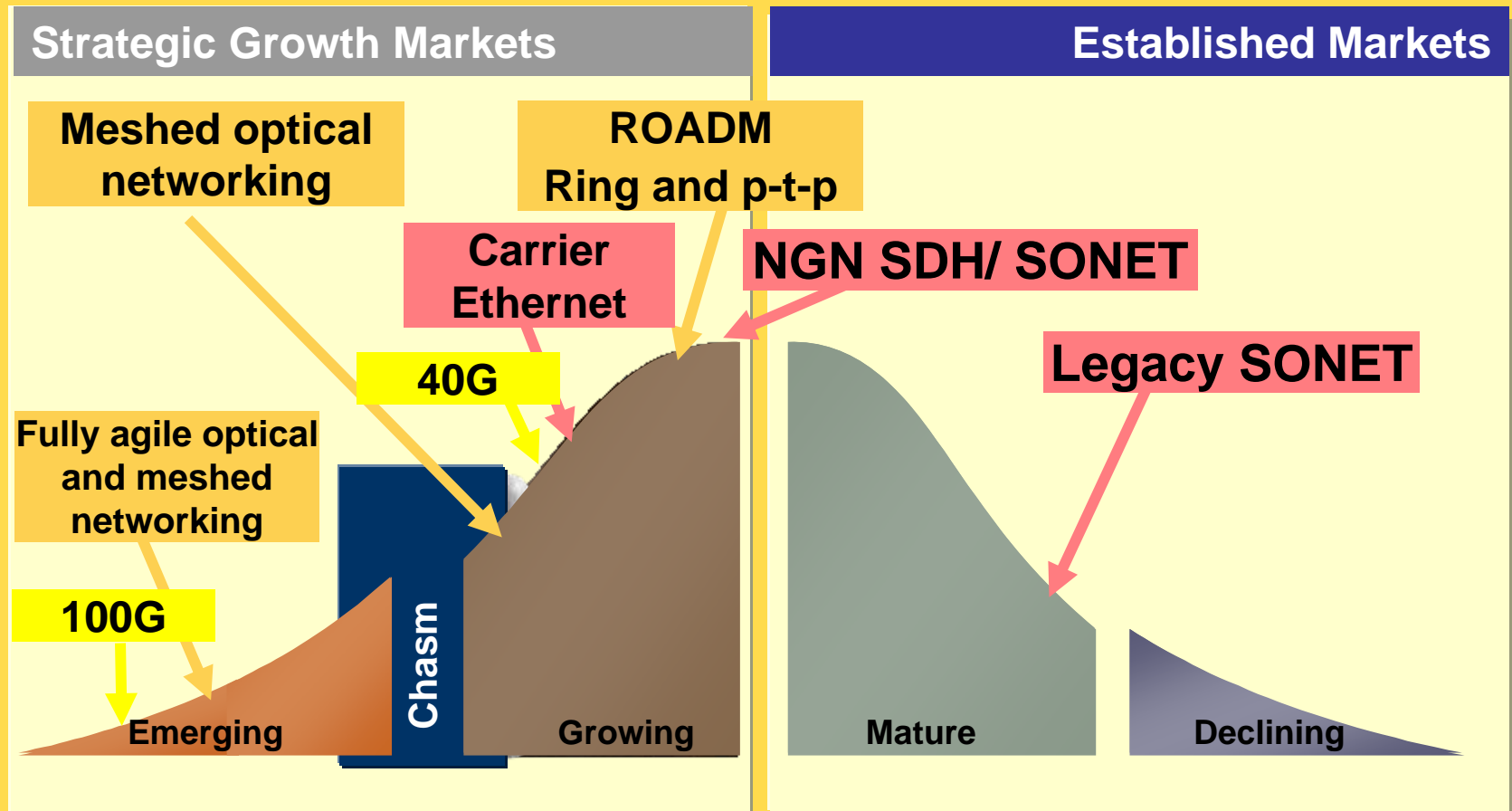
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Data Center Transport Technology Options



New technologies enable many new powerful and cost-effective architectures / solutions



Telco & Data Center Networks - Comparison

Telco Networks

- Intra metro connectivity increasing at dramatic speeds.
- Ethernet connectivity services ranging from 10M to 1G
- Typically 4 to 5 POPs with 10G metro connectivity
- Business SLAs are mission critical with financial penalties

Long haul Network

- nX10 G long haul network
- Multiple carriers involved in building a nationwide network.

Data Center Networks

- Intra-datacenter connectivity exploding
- Intra-cage connectivity ranging from 100M to nX10G
- 2 to 4 Datacenters in Metro for resiliency; 10G to 40G bandwidth
- SLA's between Cages and servers are mission critical

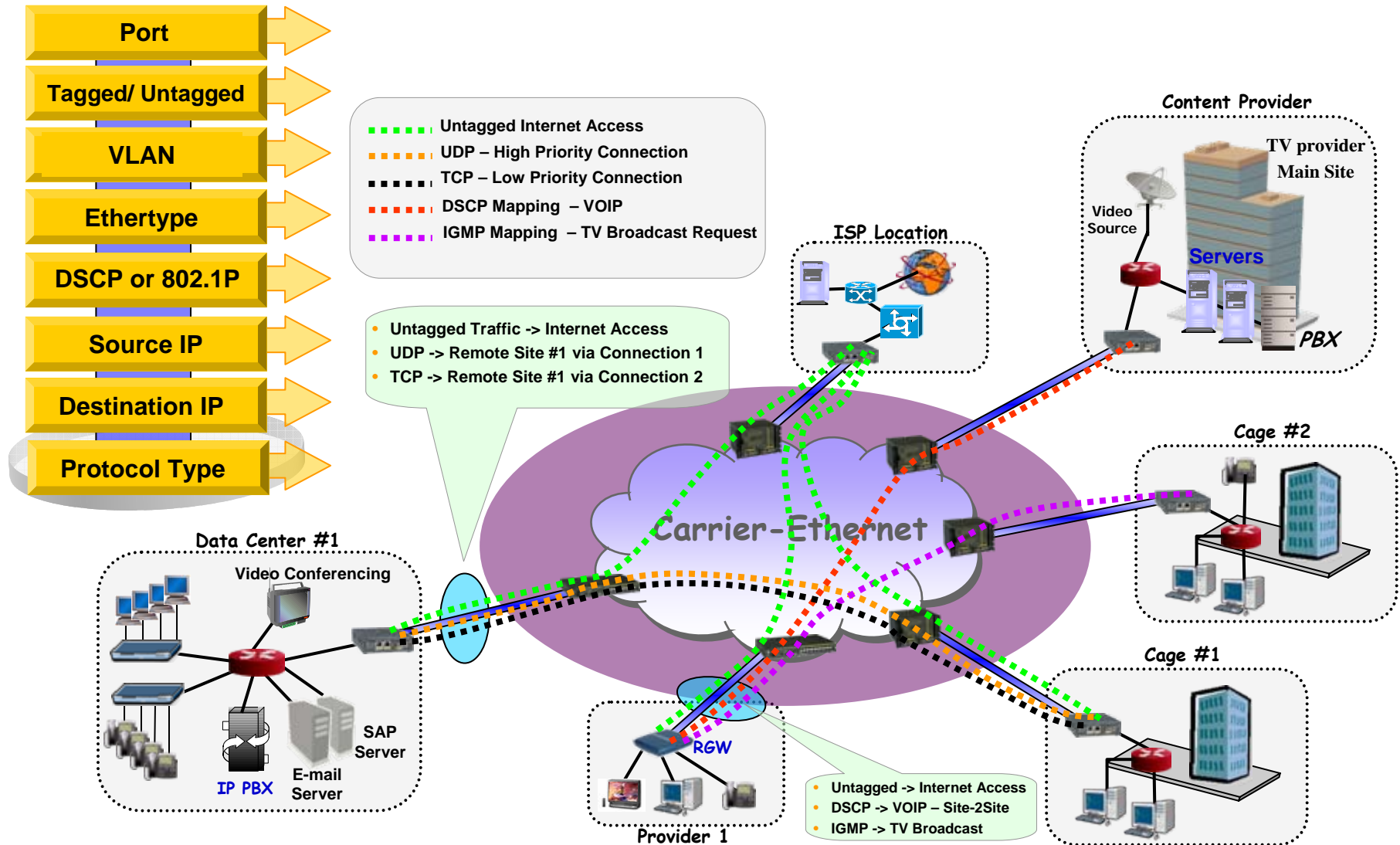
Long haul Network

- Need to deploy 40G and 100G national network
- Simplicity of management is key to an ultra scalable network.

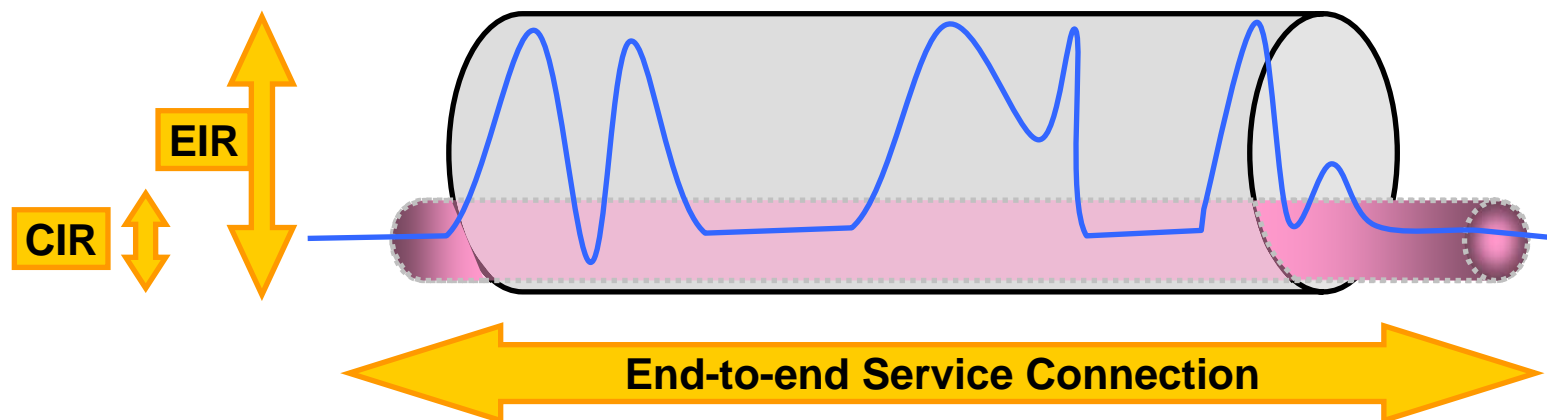
Flexibility and Simplicity for Data Centers

- **Flexibility of Bandwidth**
 - CIR for applications requiring SONET like bandwidth guarantees
 - EIR bandwidth for best effort applications such as occasional bursts.
- **Flexibility of Service Creation**
 - Enables flexible service packages to meet specific market demands and dynamics.
 - Example – 10M bundle (3M CIR and 7M EIR) for small and medium customers
- **Flexibility in delivering customized solutions for each tenant**
 - Create customized services for large business customers.
- **Simplicity of Service Upgrades**
 - Enables commitment to fast service upgrades
 - CNM delivers “Customer Controlled” service upgrades for premium customers
- **Simplicity of Up Selling Customer Bandwidth**
 - Sales teams are empowered to upgrade customers bandwidth up to 100M or 1G.

Hard SLAs Without Changing IT Processes



Connection Oriented Carrier Ethernet: Hard QoS for All Services



- Committed Information Rate (CIR): 64Kb/s to 1Gb/s
 - Connection Admission Control
- Excess Information Rate (EIR): 64Kb/s to 1Gb/s
- Configurable burst window
- Network delay priority & jitter options:
 - CES
 - Delay Sensitive
 - Business Critical
 - Normal
- Protection

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Data Center and Market Trends

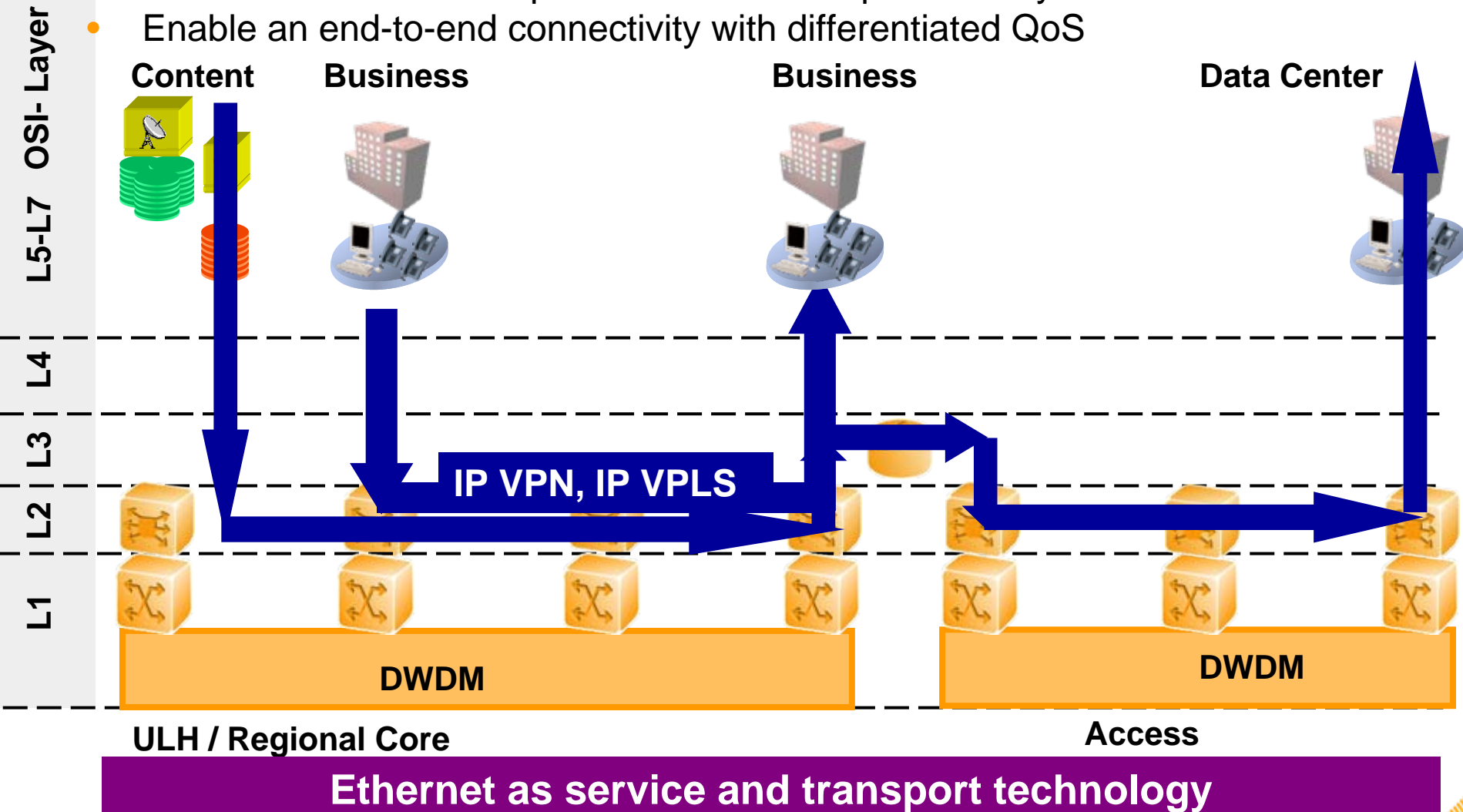
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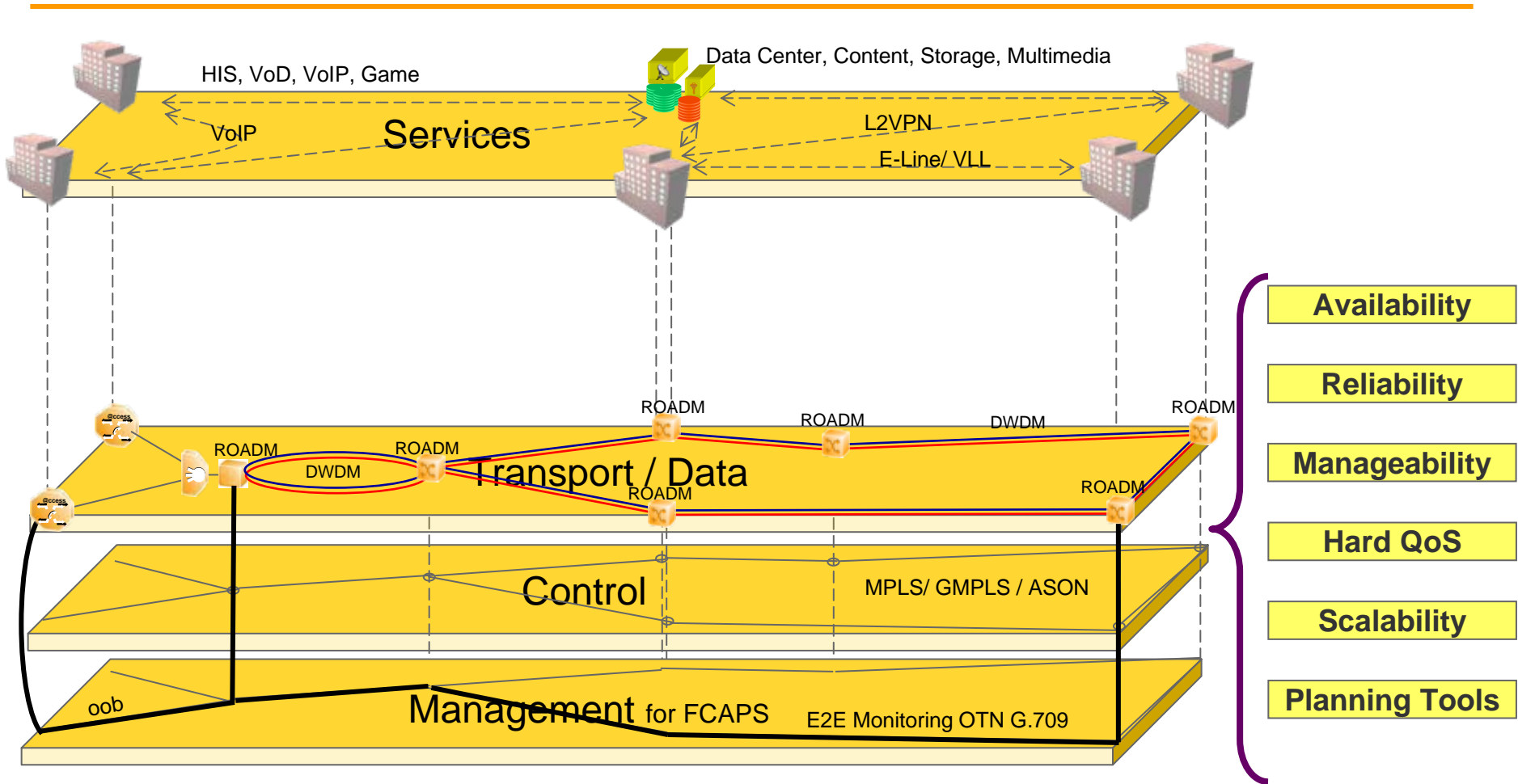
Conclusions

Data Center Transport Vision: Network Simplification

- Dramatic simplification of network architecture
- Most cost efficient transport: use the lowest possible layer
- Enable an end-to-end connectivity with differentiated QoS



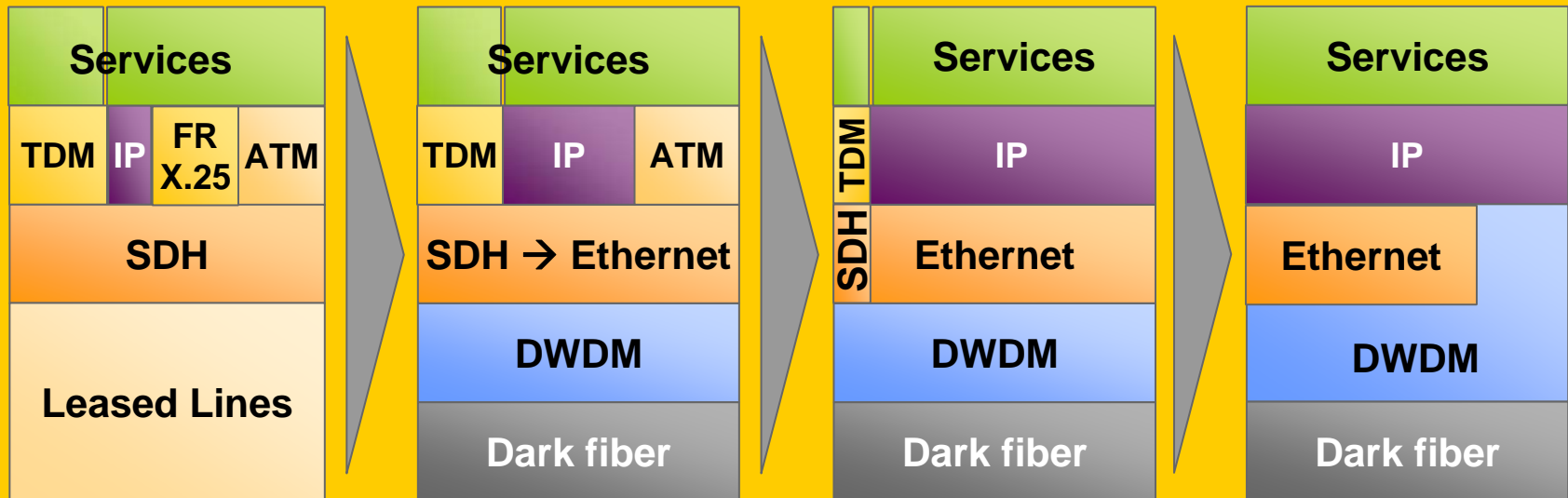
Example of an Data Center Transport Architecture



- Service aware network is only possible with a tight integration of service, transport/data, control and management plane.
- Multi-Layer Optimization (L1-L3) is a necessity.

Ethernet (IP) over optics (WDM) technology enables the cost efficient Terabit Connection

Today



- Cross-layer optimization will disruptively improve overall cost
- Direct IP over WDM technologies, along with packetized optical networks will serve a new Internet connectivity infrastructure.
- Simplification of stacks will drive Convergence of telco and data networks

Deployment in Data Centers is Underway

- Deployments of meshed transparent optical networks have been announced
- **Deployment flexibility**
 - In a real world scenario deployment flexibility is key
- **Mesh networks**
 - Any variation in one part of the network shall never have an influence on any other part of the network. Meshed networks are by nature strongly inter-connected with all their entities. The hardware and software need to be capable to counter-act those potential challenges
- **Planning and Deployment**
 - Processes and procedures of large-scale or continent-wide meshed networks are different than those used for the planning and deployment of smaller segmented networks.



Network Planning Tools

- **Computer based tools**

- Network planning tools with increased computer calculation power became a key element for optical meshed networks deployments.

- **Site optimization**

- Network planning tools calculate the consolidation of sites as well as the concentration of switches/ routing sites.

- **Integrated network planning**

- Service providers are requesting not only a network planning tool, but an ordering, provisioning and maintenance work flow package that is supported by one tool.

- **Management system interface**

- Interfacing of the network planning tool to the management system appears to be a necessary step to handle the complexity of meshed network planning.

Network Planning Tool

... much more than adding up OSNR



Network simulations consider physical effects

- such as dispersion, non-linear effects, OSNR and component aging from 1 channel up to full channel count
- **Benefit:** Guaranteed end-of-life performance without unnecessary margins (CapEx optimizer)



Advanced routing algorithms

- map meshed traffic demands to links and wavelengths
- **Benefit:** Optimizes the number of wavelengths in a mesh scenario



Input for ordering, installation and commissioning

- LOM, cabling plan, card placement, commissioning parameters, network configuration files ...
- **Benefit:** automation of planning, ordering, commissioning; speeding up processes, and eliminating faults

An easy-to-use planning tool providing expert results to non-experts

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Conclusions – Carrier Ethernet + DWDM

- MPLS can be used to create **connection oriented Ethernet services**
- Trends towards **next generation services** eg video has accelerated the trend towards Ethernet / Optical based infrastructure.
- The **meshed capable Ethernet** structure is ideally supported by a **meshed optical infrastructure**.
- These advances offer increased **flexibility**, reduced operational **complexity** and lower equipment **costs** as compared with today's widespread SONET/SDH infrastructure.
- DWDM's key advantages are its ability to easily transport these newer data protocols and effectively **collapse current network overlays**
- **Carrier Ethernet and DWDM** layer are a perfect match for Data Center topologies as well as supporting the service capabilities.



**Nokia Siemens
Networks**

Thank You !!

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