

**Lucent Technologies**  
Bell Labs Innovations



AT THE



**OIF** OPTICAL  
INTERNETWORKING  
FORUM

WORLDWIDE INTEROPERABILITY DEMONSTRATION  
**SUPERCOMM 2005**

# Lucent Overview

- ◆ Chairman and CEO: Patricia Russo
- ◆ Headquarters: Murray Hill, N.J. USA
- ◆ Approximately 31,000 employees
- ◆ Key operating units: Network Solutions Group (NSG) and Lucent Worldwide Services (LWS)
- ◆ LWS' 14,000 network professionals serve the world's leading service providers, enterprises and government institutions in more than 50 countries on five continents
- ◆ World-renowned Bell Labs R&D institution has thousands of employees in 10 countries around the world, including the United States



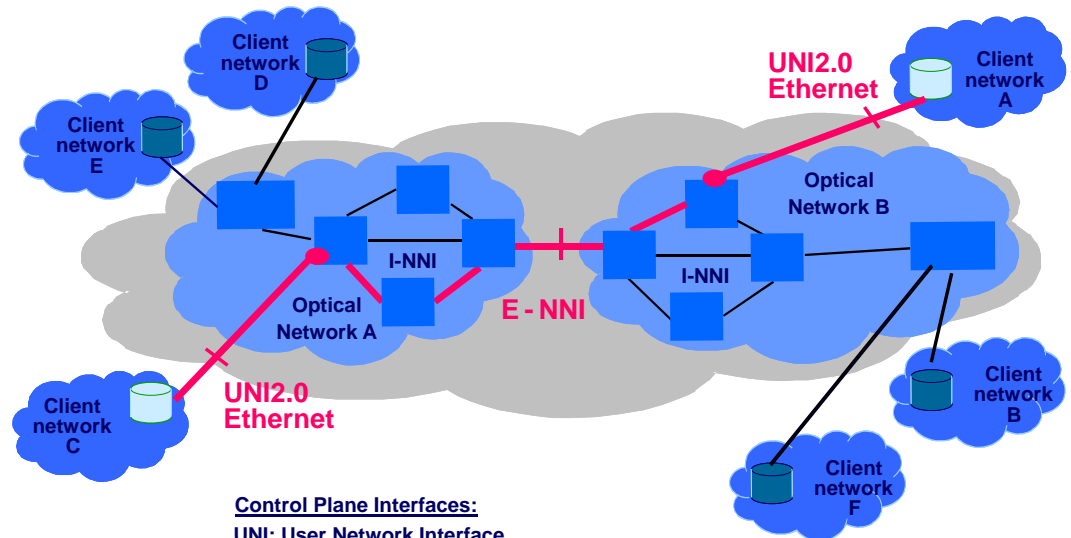
# OIF and Lucent Solutions for Converged Optical Networks

- ◆ **Carrier Challenges**
  - High bandwidth data applications and optical technologies continually evolve
  - Traditional, legacy systems hinder multi-vendor interoperability
  - Higher operations costs and longer service provisioning times
- ◆ **Carrier Needs**
  - Interoperable, cost-effective and robust optical inter-networks
- ◆ **Solutions**
  - Intelligent control plane mechanisms
  - Enhanced data stream mappings



# OIF World Interoperability Demo

- Interoperability of Intelligent Optical Networks
- Ethernet Services over SONET/SDH
  - **Lucent's role**



Control Plane Interfaces:

UNI: User Network Interface

I-NNI: Internal Network to Network Interface

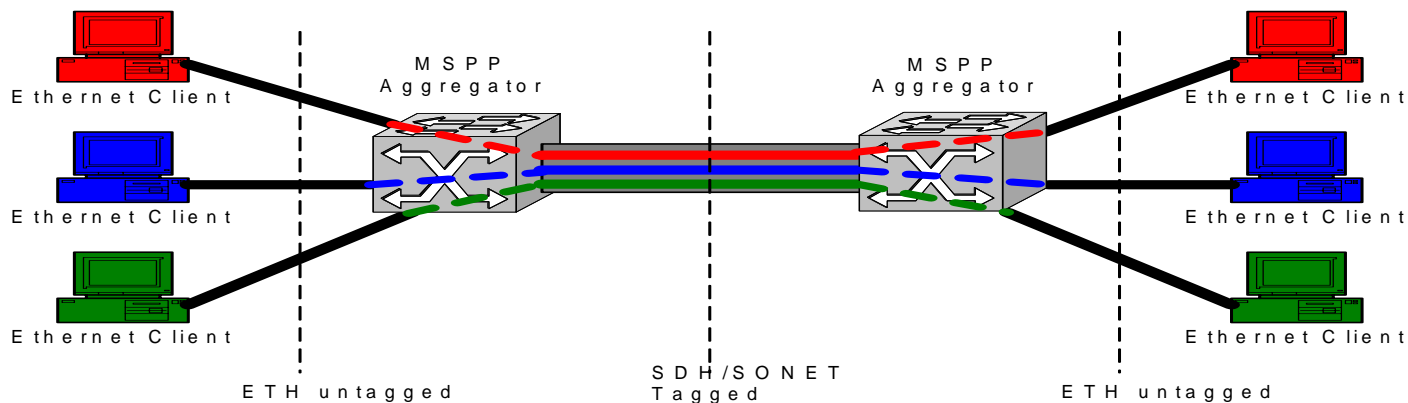
E-NNI: External Network to Network Interface



# Virtual Ethernet Services

## Ethernet Adaptation Interoperability

- **Ethernet virtual services over a multi-carrier, multi-vendor optical transport network**
  - **Virtual Private Line/LAN, and Trunking/Internet Access**
  - **Enabled by bearer plane VLAN tags**
  - **Based on ITU-T standards (GFP-F, VCAT and LCAS) and MEF**
- **Individual client flows are aggregated into a single transport link and separated at the destination based on VLAN tags (802.1Q)**

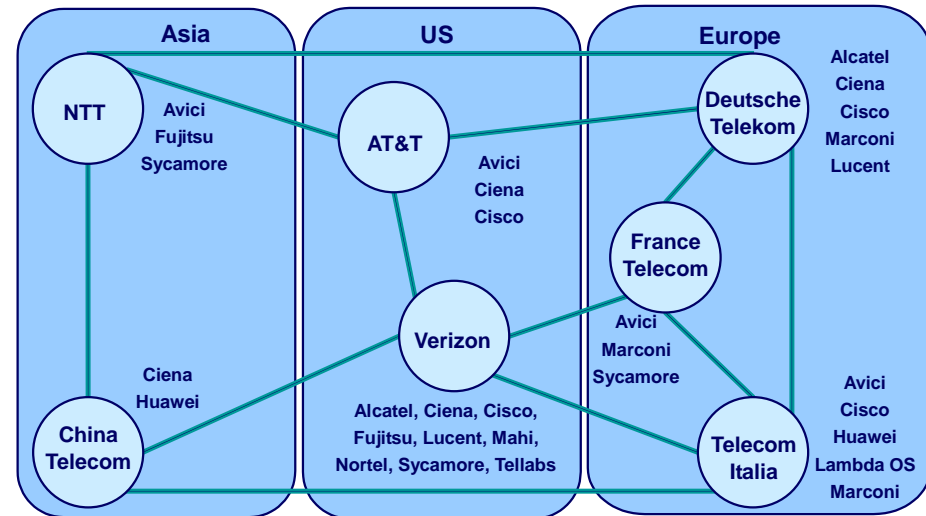
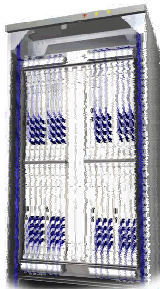


# Virtual Ethernet Services Lucent's Role

- **Metropolis® DMX** interoperates with other leading MSPPs to demonstrate EoS transport via standard-compliant GFP/VCAT/LCAS capabilities



- **LambdaUnite® MultiService Switch** enables end-to-end Ethernet service aggregation and bridging from metro to core

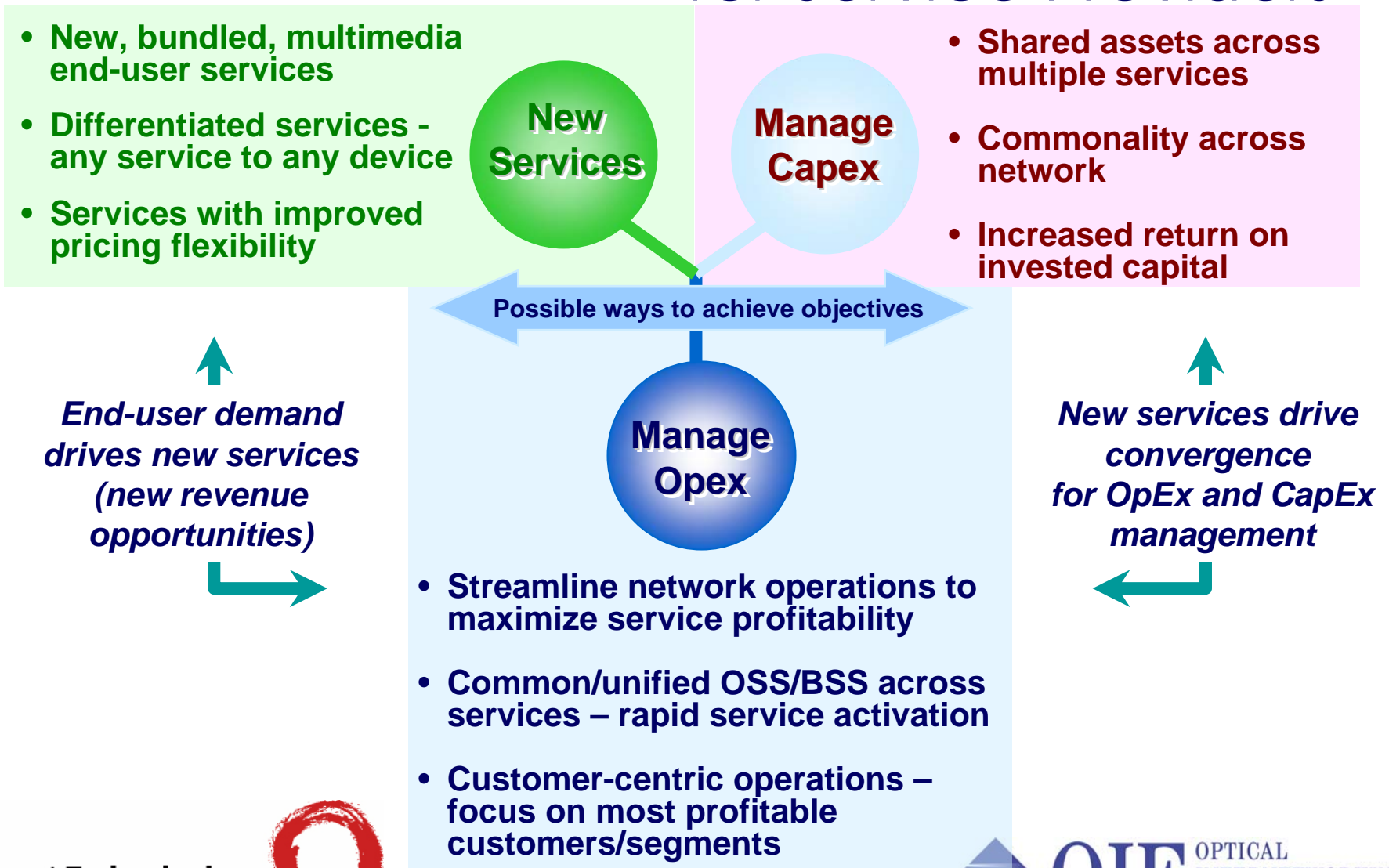


# Ethernet over SONET/SDH Carrier Benefits of EoS Service Adaptation

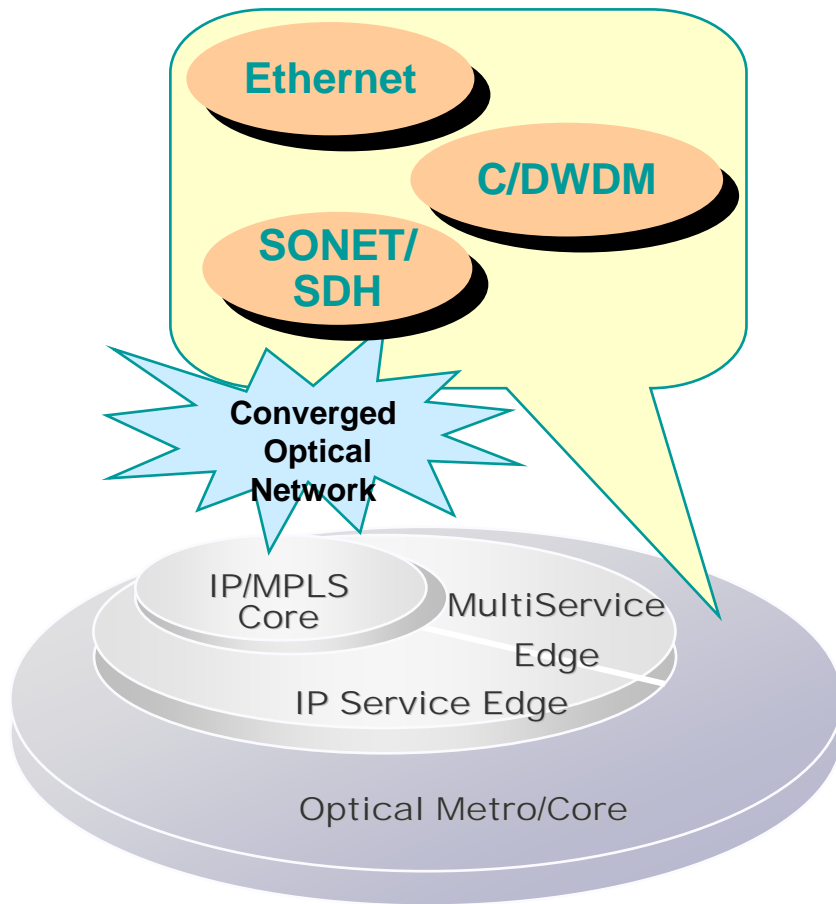
- ◆ Allows carriers to leverage and reuse their extensive SONET/SDH infrastructure
- ◆ Supports a range of services including:
  - Ethernet Private Line Services
  - Ethernet Switched Services
- ◆ Enables carriers to efficiently integrate and deploy data and optical technologies
- ◆ Accelerates the deployment of interoperable, cost-effective and robust next generation converged optical transport networks



# Convergence Opportunities for Service Providers



# Convergence in Optical Transport

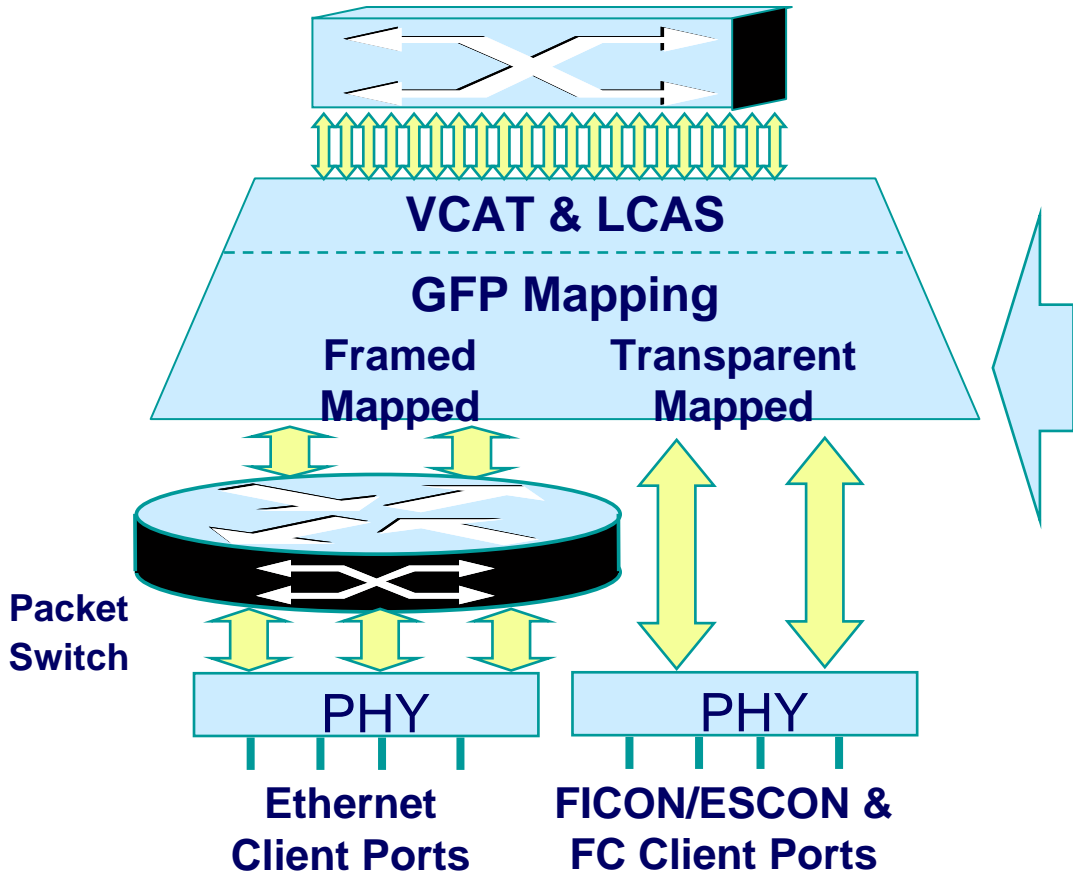


- Leverage embedded base in Optical Networks for “any service”
  - Eliminate complex operations and additional assets needed for pure Ethernet Networks
  - Better leverage SONET/SDH for transport economies of scale
- Continue carrier-class network characteristics:
  - Leverage highly reliable and robust SONET/SDH restoration/ reliability characteristics
- New edge elements for converged transport services across all optical technologies (SONET, SDH, DWDM)
- Reduce OpEx through automated operations and maximum network utilization



# Support of Multiple Services Using GFP

## SONET Cross-Connect Matrix



The Generic Framing Procedure (GFP) provides an efficient, scalable and unified mode of transport for corporate LAN, SAN, Internet access, and other data transfer applications.

GFP minimizes system bandwidth requirements. It allows multiple protocols from different ports or links to share the same transport path, resulting in more efficient use of available bandwidth.



# Generic Framing Procedure (GFP)

- ◆ **International standard**
  - Adopted by both ANSI and ITU-T.
  - Framing protocol to replace framing of native Ethernet protocol.
- ◆ **Efficient framing protocol with a small, fixed overhead**
  - Rate adaptation function
  - Essential for rate-guaranteed services
  - Efficient OA&P capabilities included
  - Scales well to higher transport rates
  - X.86 (LAPS/X.25/HDLC-based) alternatives limited in these areas
- ◆ **Two modes**
  - **GFP-F: Frame-based** – packet-aware, optimized for packet-based services. Used for Ethernet services.
  - **GFP-T: Transparent** - for 8B/10B encoded protocols with high delay sensitivity. Used for SAN services.



# Virtual Concatenation (VCAT)

◆ Eliminates SONET granularity limitations, enabling efficient data transport!

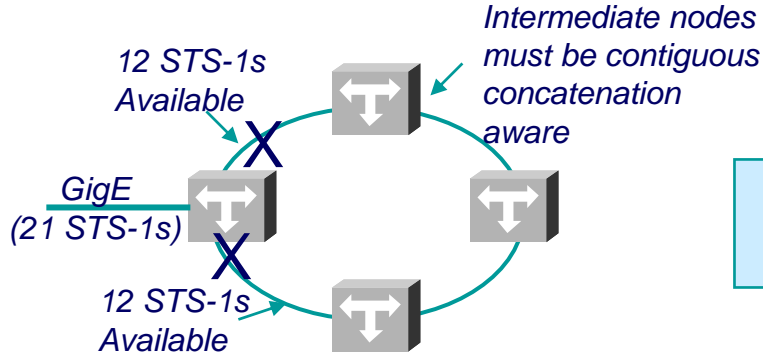
*No capacity mismatch, no "stranded capacity"*

- ❑ Inverse multiplexing over SONET
  - ❑ Logical grouping of non-contiguous SONET channels to create a Virtual Trunk for transporting data traffic (VCG=virtual concatenation group)
  - ❑ 21 STS-1 for full-rate GbE transport
- ❑ Compatible with standard SONET network infrastructures
  - ❑ Only endpoints need to be virtual concatenation aware
- ❑ Individual SONET channels in a VCG can be groomed onto available bandwidth and transported independently through the SONET network
- ❑ Differential delay compensation for diverse paths through the SONET network



# Flexible Bandwidth Provisioning

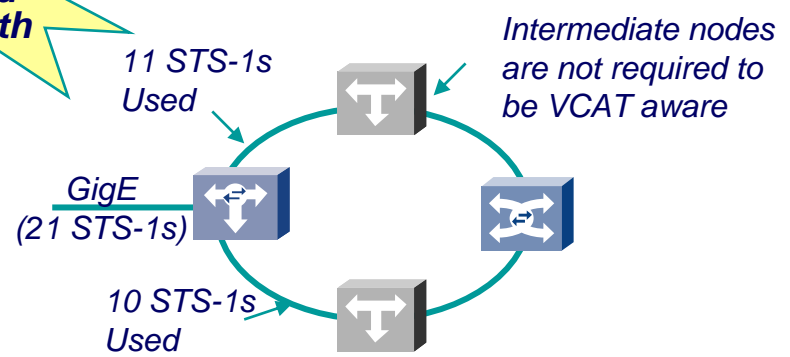
## Traditional SONET Contiguous Concatenation



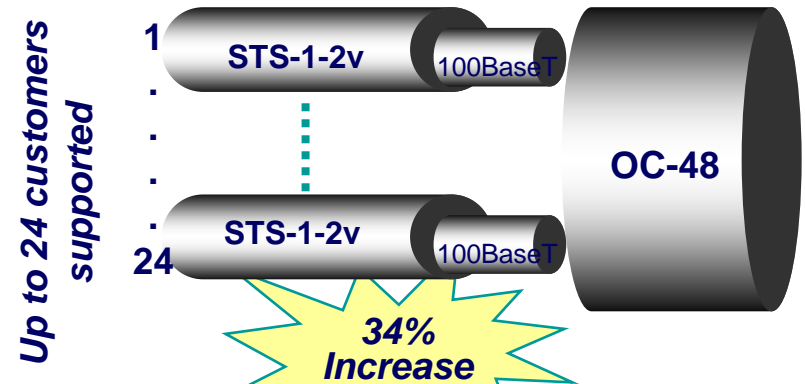
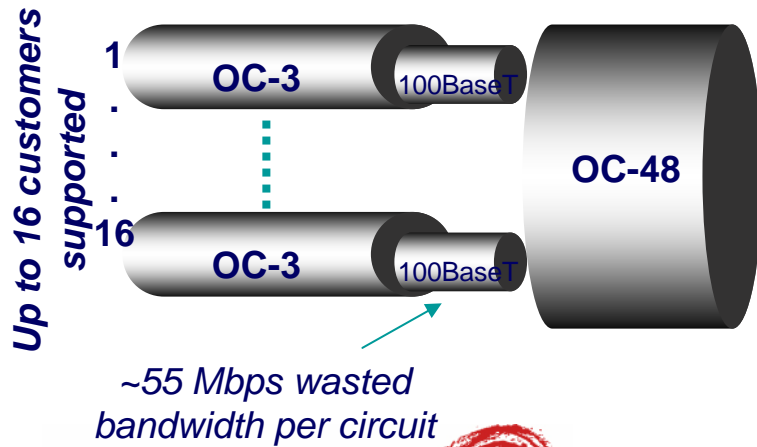
*Bottleneck arises with contiguous concatenation*

**No more Stranded Bandwidth**

## Next Generation SONET Virtual Concatenation



*Virtual Concatenation Group (VCG) can follow dissimilar paths avoiding bottlenecks*



# For More About Lucent

- **SUPERCOMM 2005 – Booth 64056**
- **[www.Lucent.com](http://www.Lucent.com)**

