

# Advances Toward “Terabit LAN”

- New paradigm for network interface evolution -

Osamu Ishida

Sept. 28, 2005

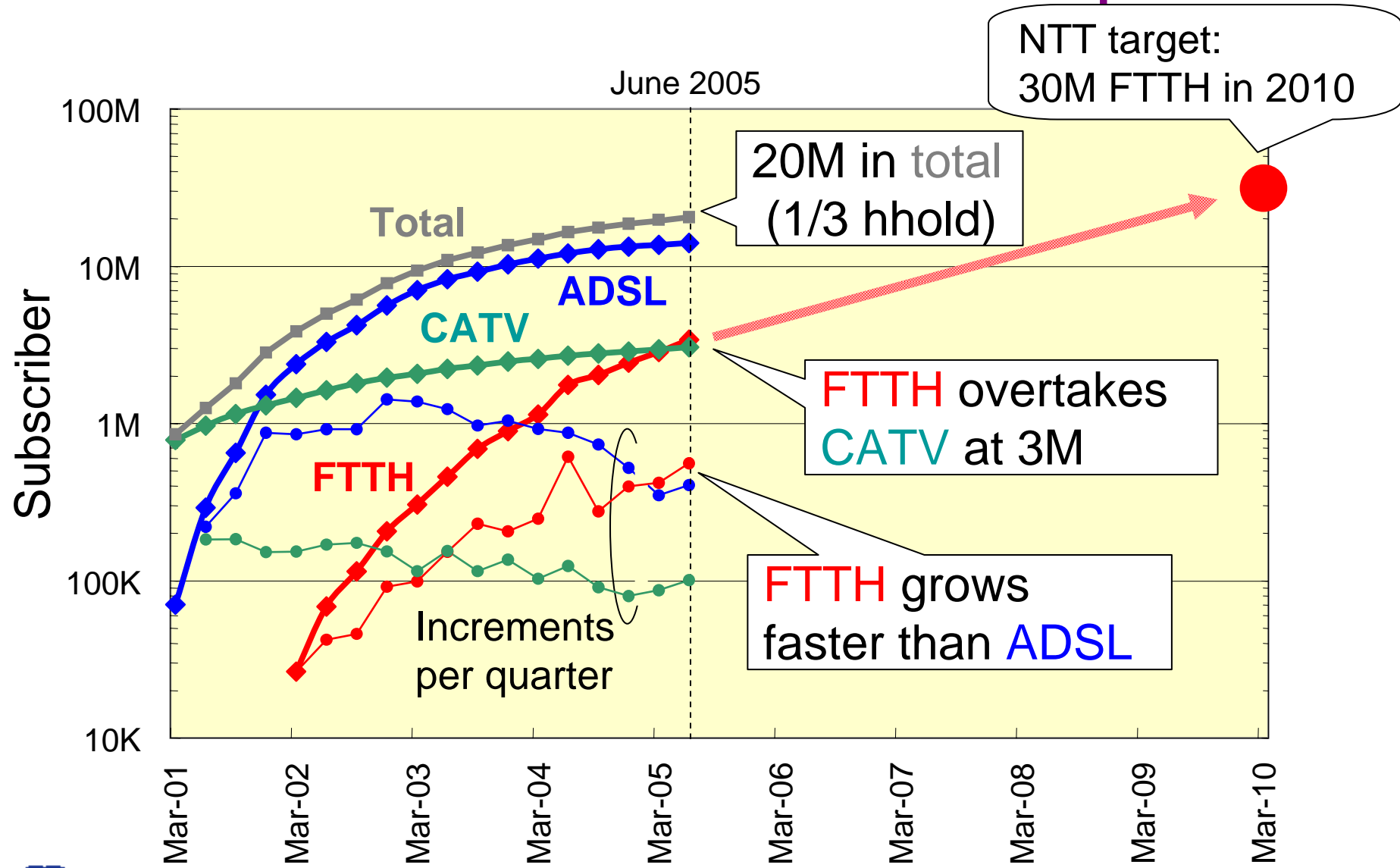
NTT Network Innovation Laboratories

Yokosuka, Japan

# Outline

- Why “Terabit LAN”?
  - Collaborate with high end users
  - Explore multiple lane optical Interfaces
- What is “Terabit LAN”?
  - Target, concept, and technical challenges
- Recent Advances toward “Terabit LAN”
  - OVC (Optical Virtual Concatenation) [JA103]
  - GMPLS inter-working with Grid Middleware [JA101]

# Broadband Services in Japan

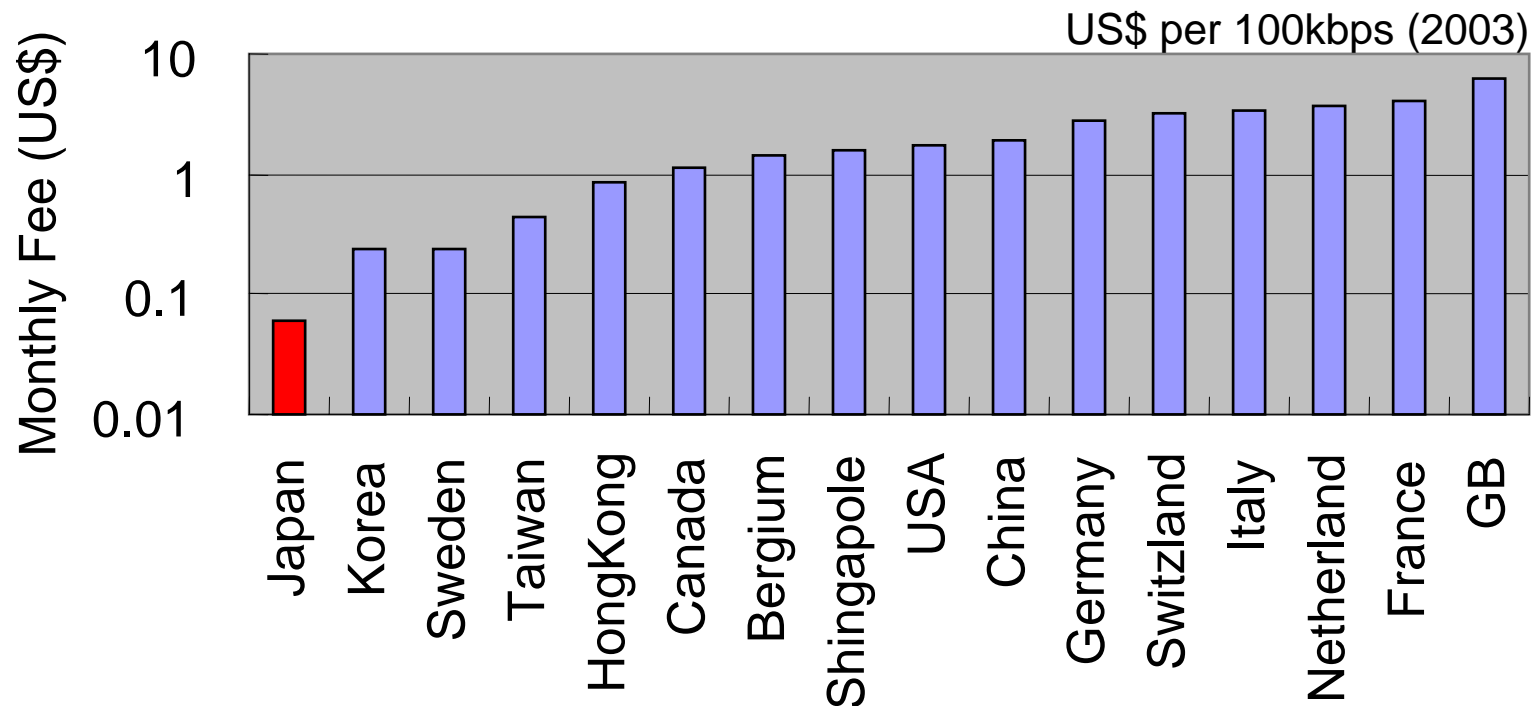


Source: MPT press release

3

# BB Service Rates in Japan

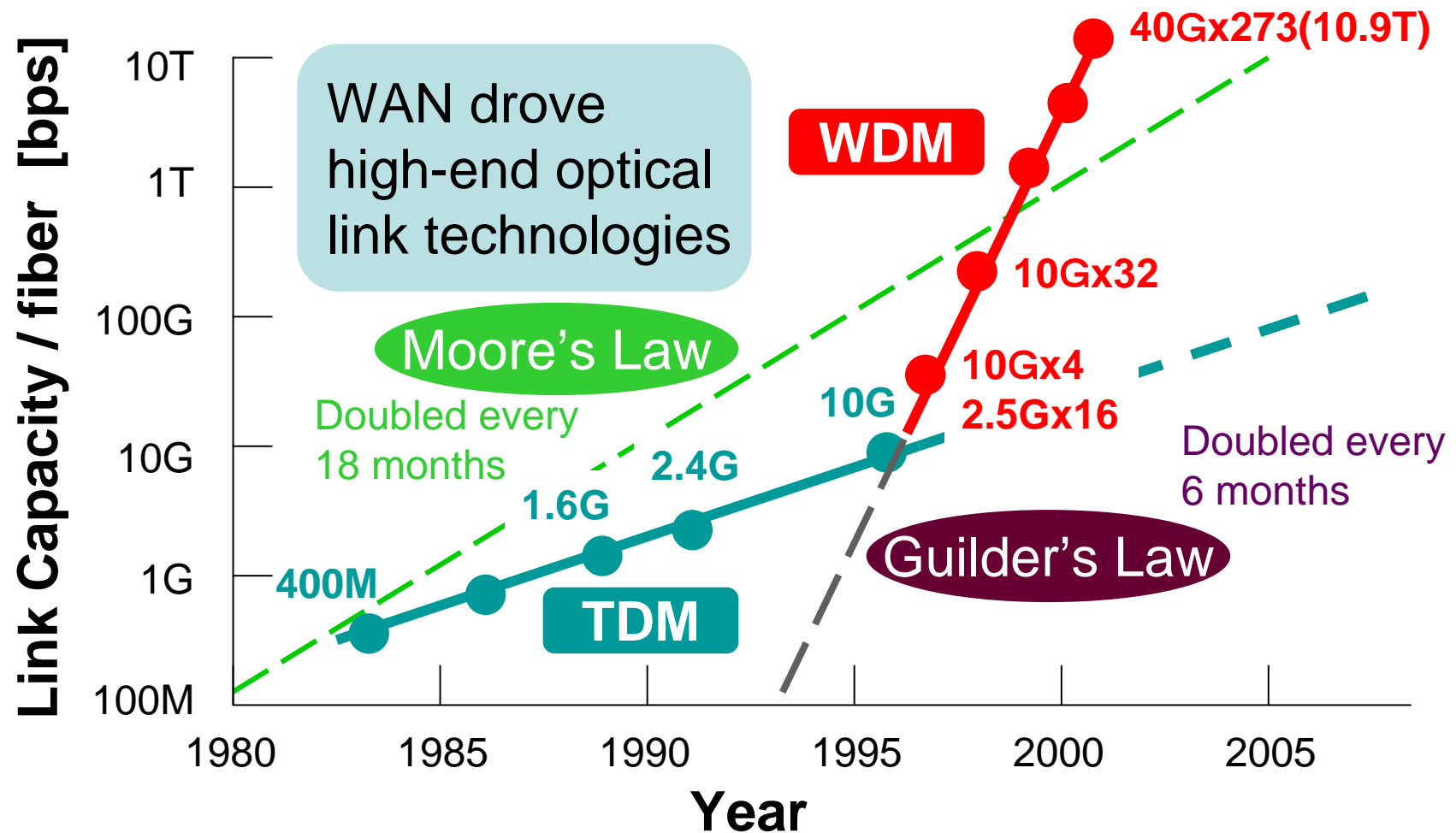
- 100Mb/s Optical Access
  - \$55 (JPY 6,000)
  - \$30 (JPY 3,500) for condo
- DSL Access
  - \$25 (JPY 2,800) for 50Mb/s
  - \$14 (JPY 1,500) for 1-3Mb/s



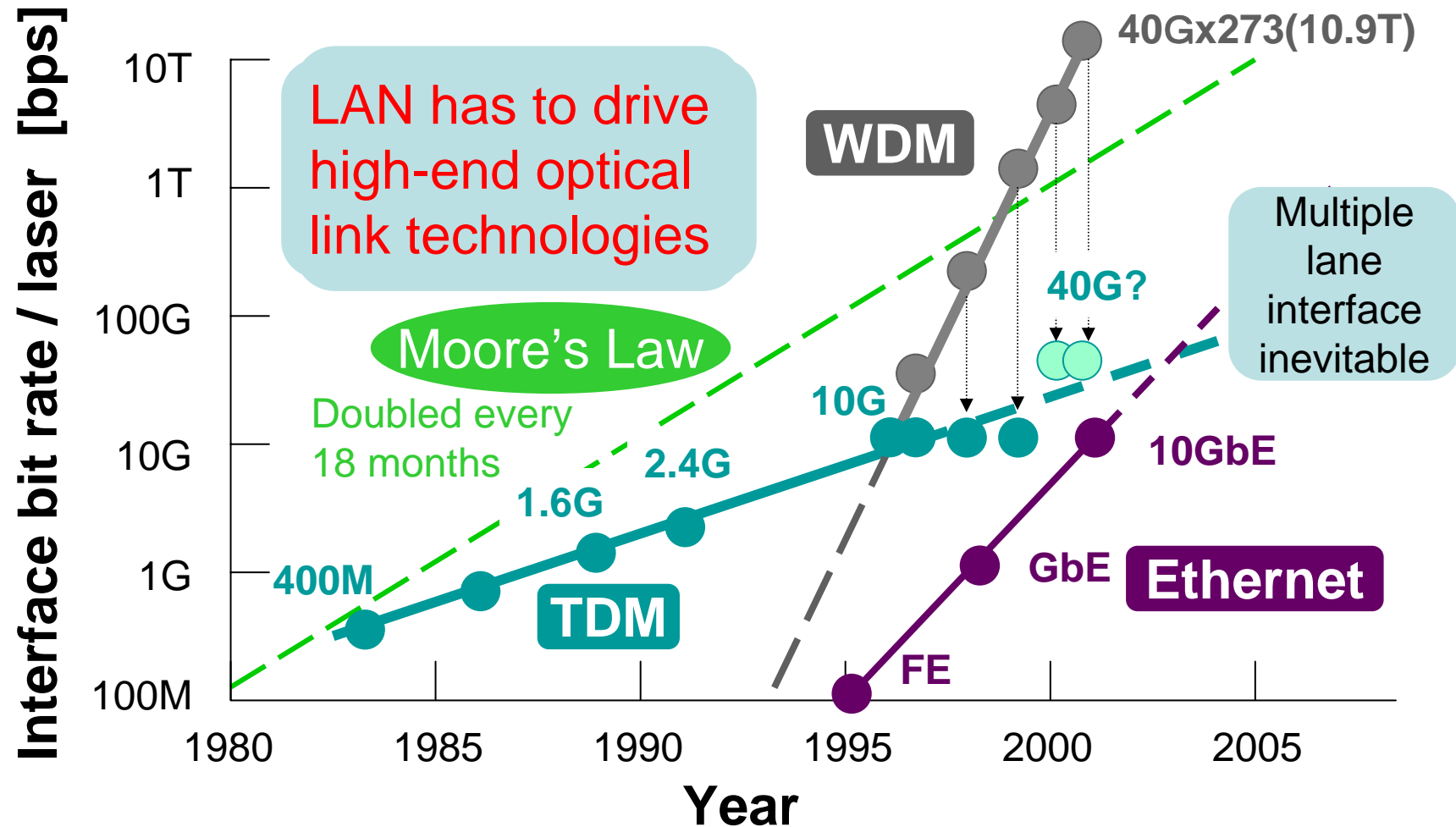
# Why “High End Users”?

- Mass user will be satisfied with FTTH
- All IP networks must be built out to support such an extremely low-priced packet-based best effort services. But this may not be enough to share....
- Carriers should find out yet another value added service to share their fiber network infrastructure
- Who needs? – **High end user** will do
  - Performance in first priority

# Optical Link Performance, per fiber



# Optical Link Performance, per Laser



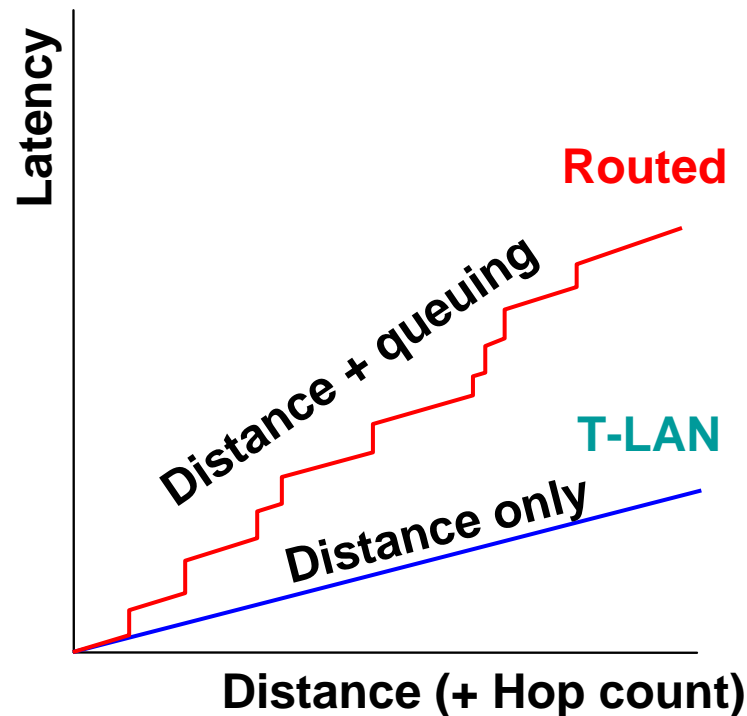
# Terabit LAN Targets

- Anticipate new (or revival) paradigm
  - Multiple Lane Optical Interfaces
  - Network facility shared by Lane ( = Lambda)
  - Dynamic lane setup and release
- Provide extreme performance
  - Multiple 10 Gb/s capacity on demand
  - Absolute low latency, just distance delay
  - Error free transport by FEC

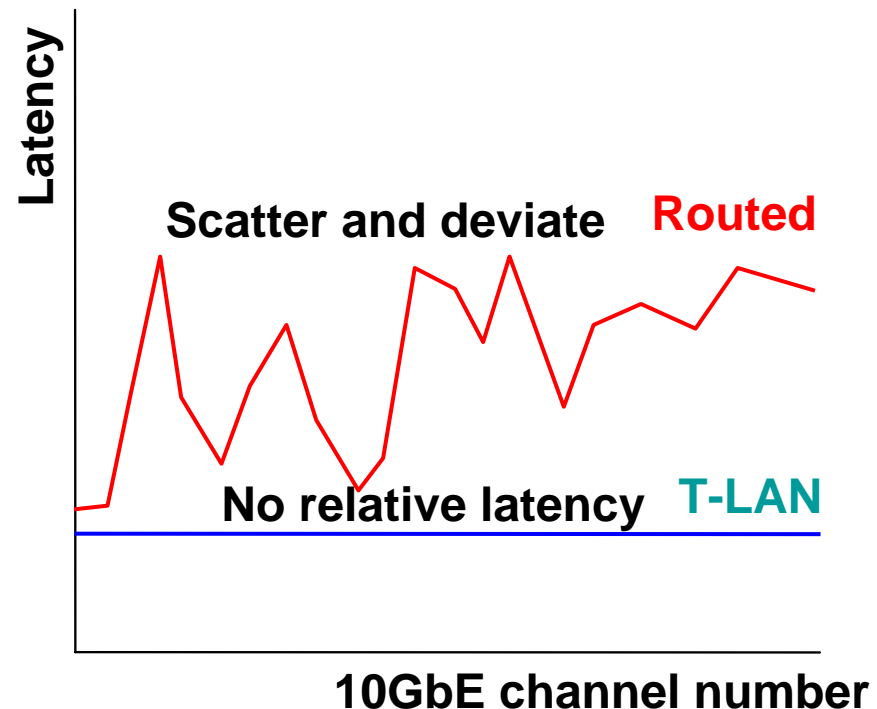


# Target Latency Performance

## Latency vs. distance



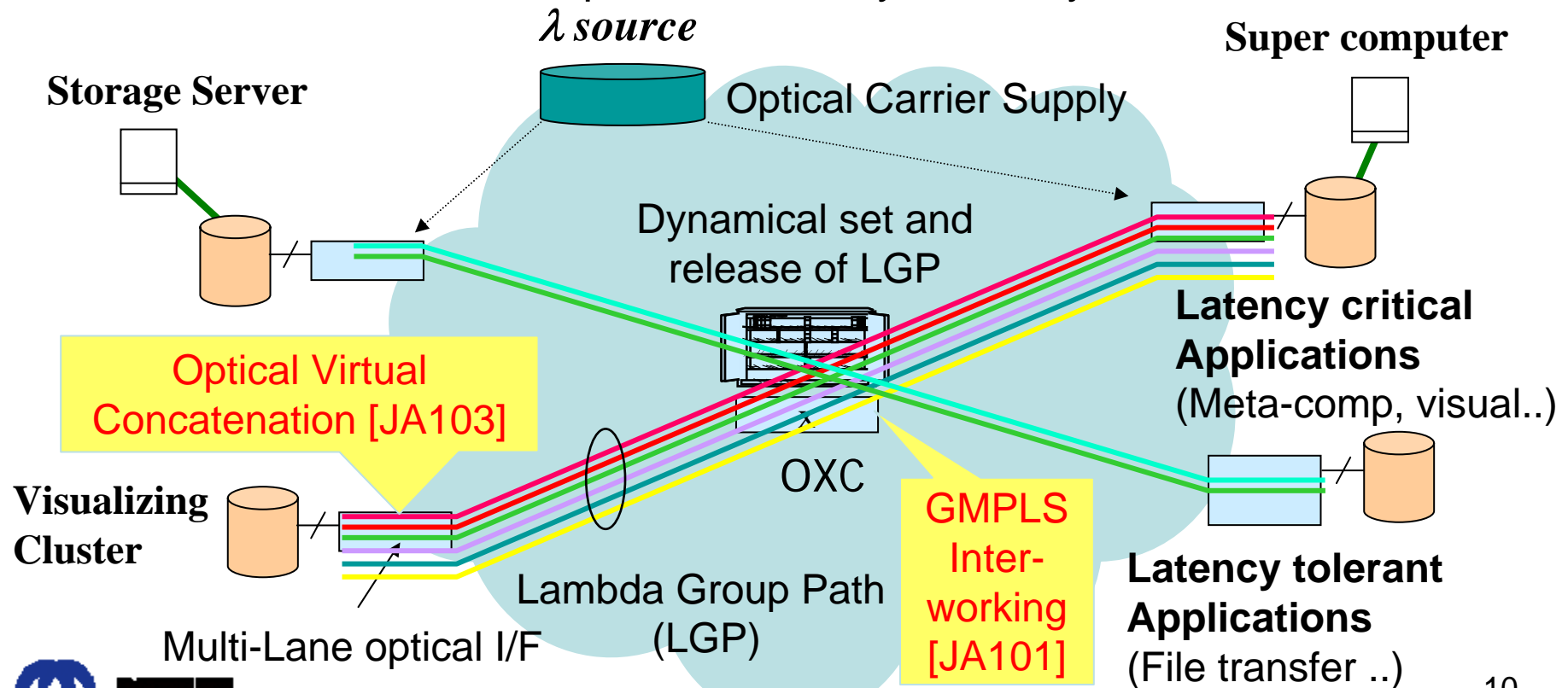
## Latency fluctuation



**Deterministic and no relative latency**

# Terabit-LAN Concept

- Number of lanes is determined by latency requirement
  - Lane-by-lane latency deviation must be compensated
  - Lane must be setup & released dynamically



# [JA103] Optical Virtual Concatenation

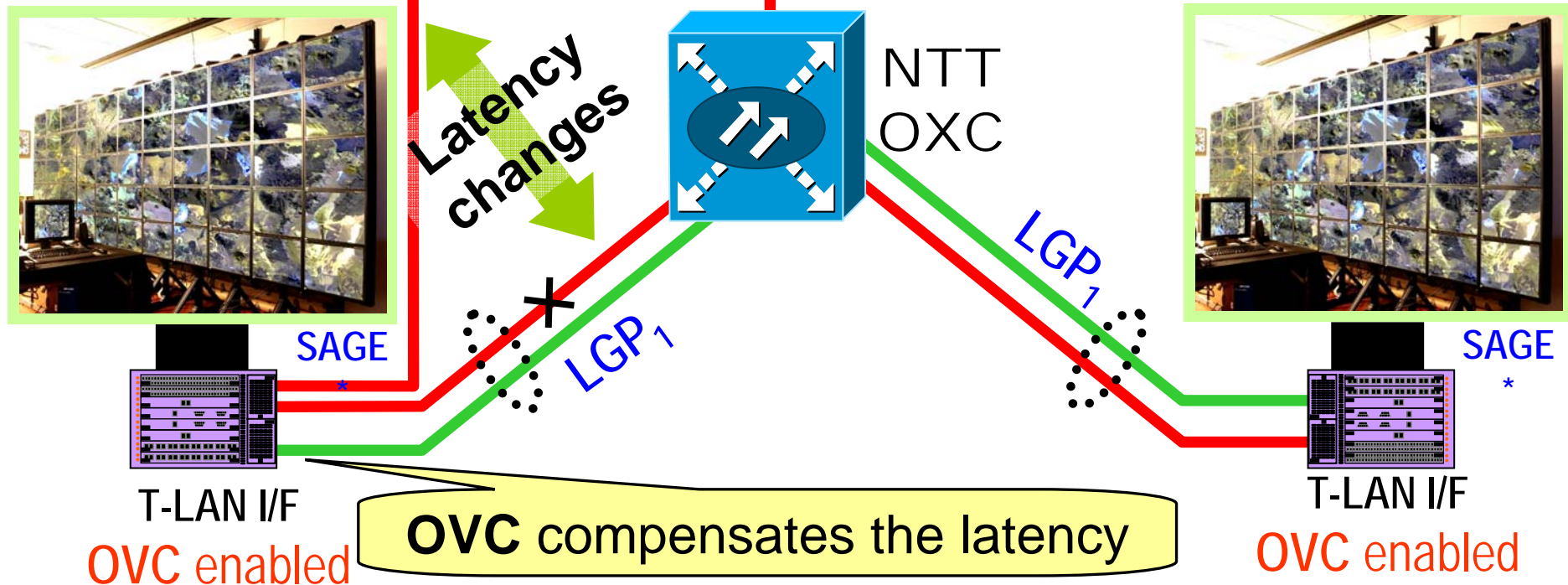
## ~ 2λ LGP connection btw EVL and Calit2 ~

Protection path  
(via Amsterdam)

OVC (de-skewing) DEMO in  
a LGP (2λ⇒2GbE vlans)  
btw EVL and Calit2

Calit2 (HERE)

EVL (Chicago)



This slide is from M. Hirano et al., JA103, iGrid2005. 11  
\*Images are displayed using UIC/EVL SAGE software.

# [JA101] iGrid Demonstration (AIST, NICT, KDDI, NTT)

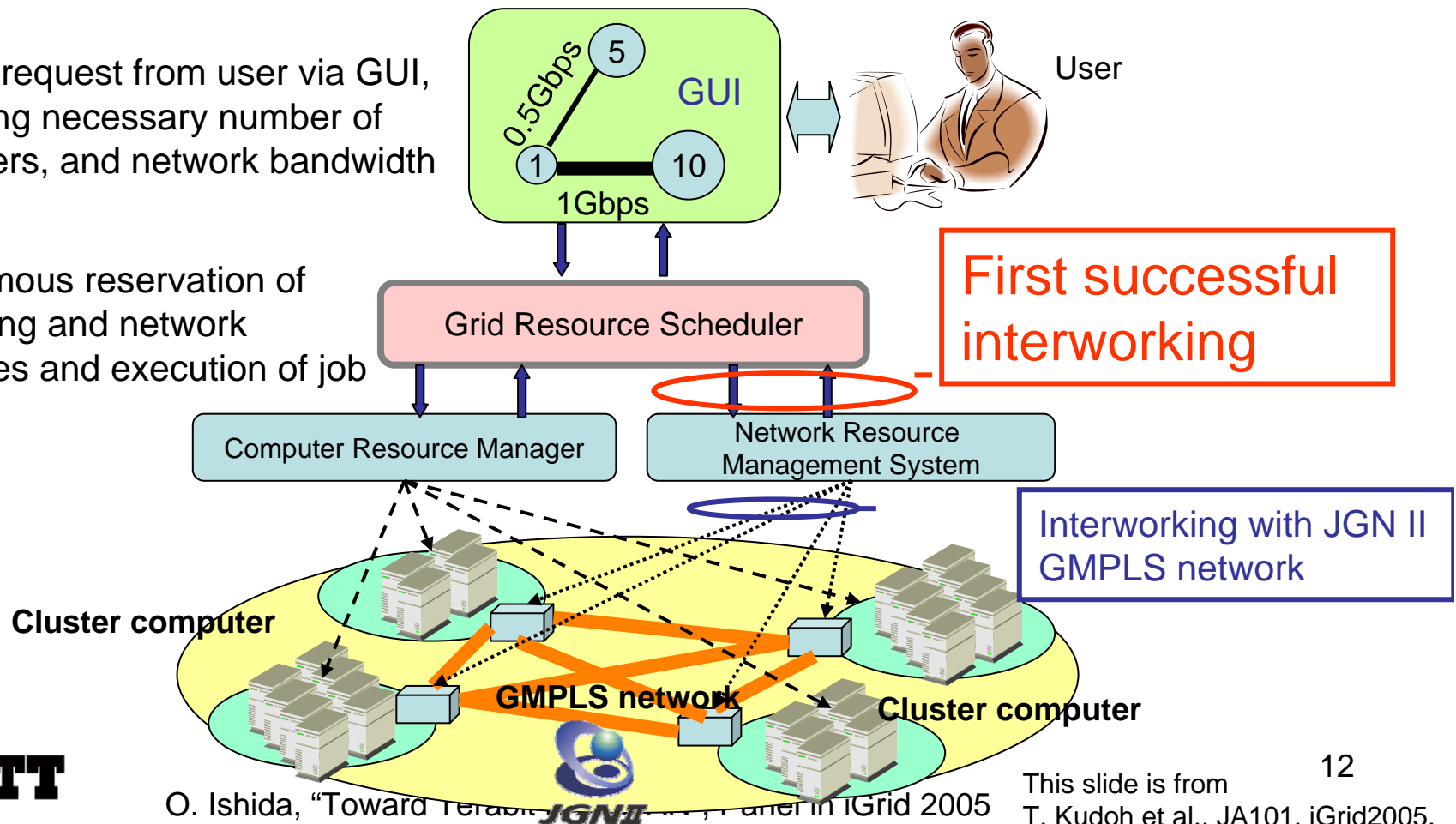
- Interworking between Grid and GMPLS network
- Autonomous reservation of both computing and network resources
  - user/application-driven network use is possible

(1)

Service request from user via GUI, specifying necessary number of computers, and network bandwidth

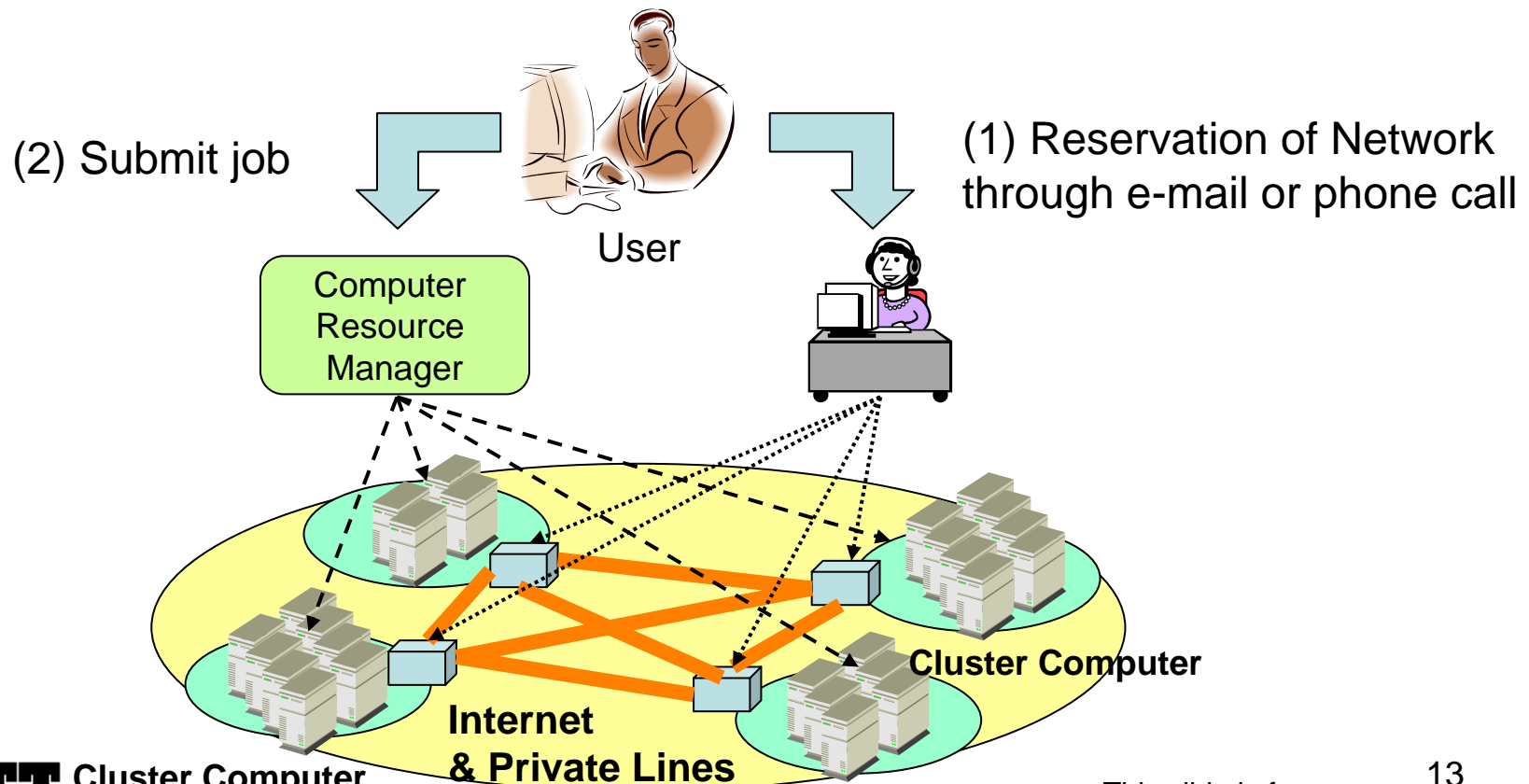
(2)

Autonomous reservation of computing and network resources and execution of job



## Cf. Conventional Grid over Wide-Area Network

- Internet doesn't guarantee the quality
- Private line requires negotiation in advance
- Computing & network resources are managed independently



**NTT**

Cluster Computer

O. Ishida, "Toward Terabit LAN/WAN", Panel in iGrid 2005

This slide is from  
T. Kudoh et al., JA101, iGrid2005.