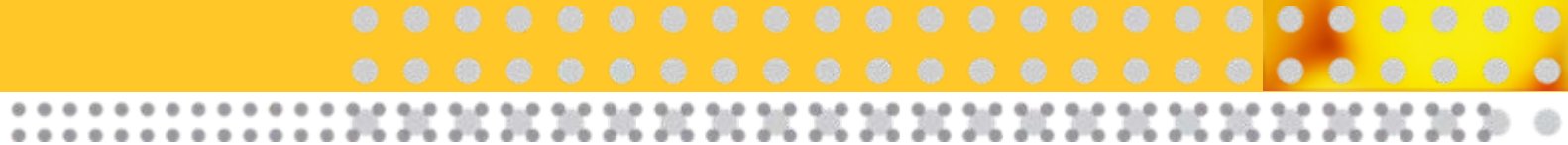


# 40GbE SMF for Carrier Applications



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March, 2008

## Supporters

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Petar Pepeljugoski (IBM)

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## 802.3ba Task force objectives

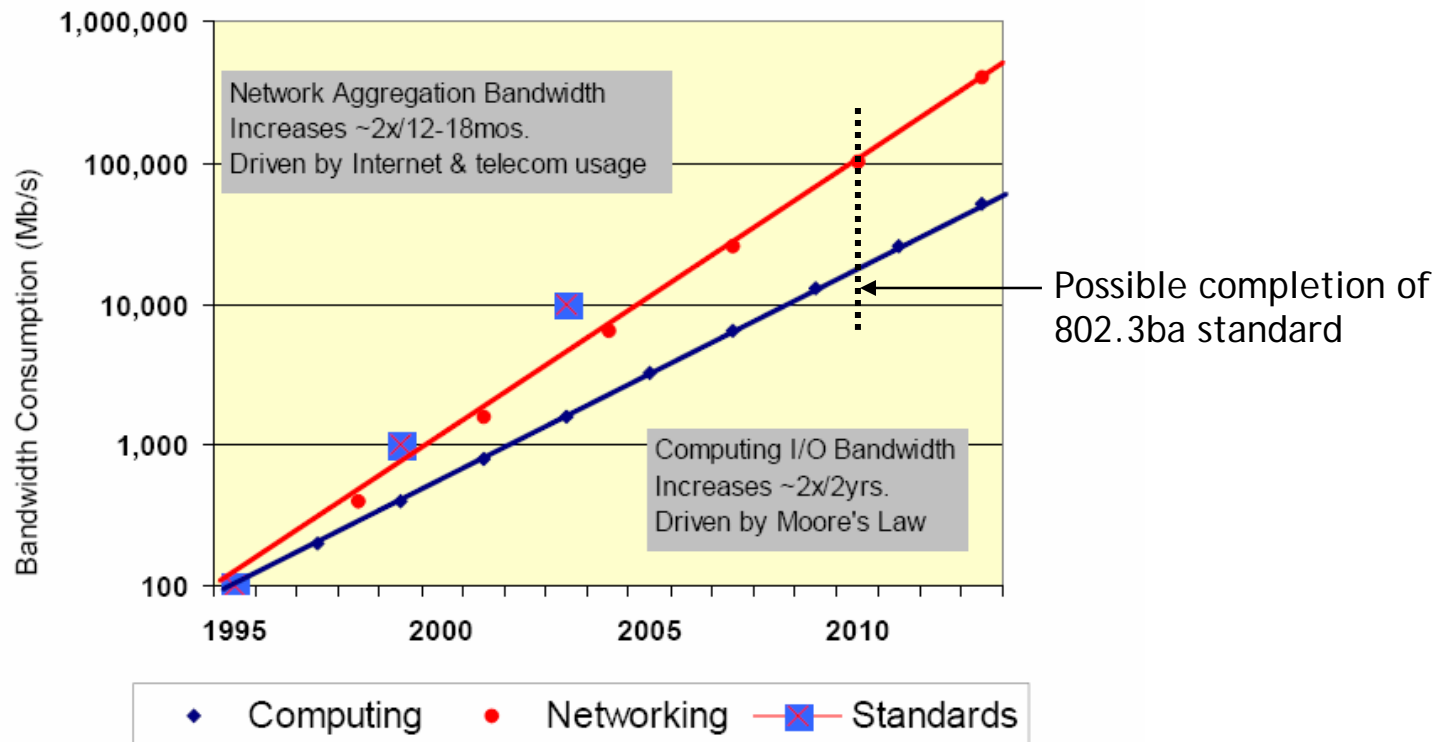
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802.3ba Task Force Objectives

	40 GbE	100 GbE
Backplane, 1m	✓	✗
Cu, 10m	✓	✓
MMF, 100m	✓	✓
SMF, 10km	✗	✓
SMF, 40km	✗	✓

- 100m multi-mode fiber (MMF) is supported for both 40 GbE and 100 GbE
- The longer-reach single-mode fiber (SMF) interfaces are not supported for 40 GbE
  - Attempt to confine 40GbE to the data center
- 40GbE SMF is needed for inter-switch connections
  - Switch-to-switch connections within the data center
  - Link from the data center LAN to WAN

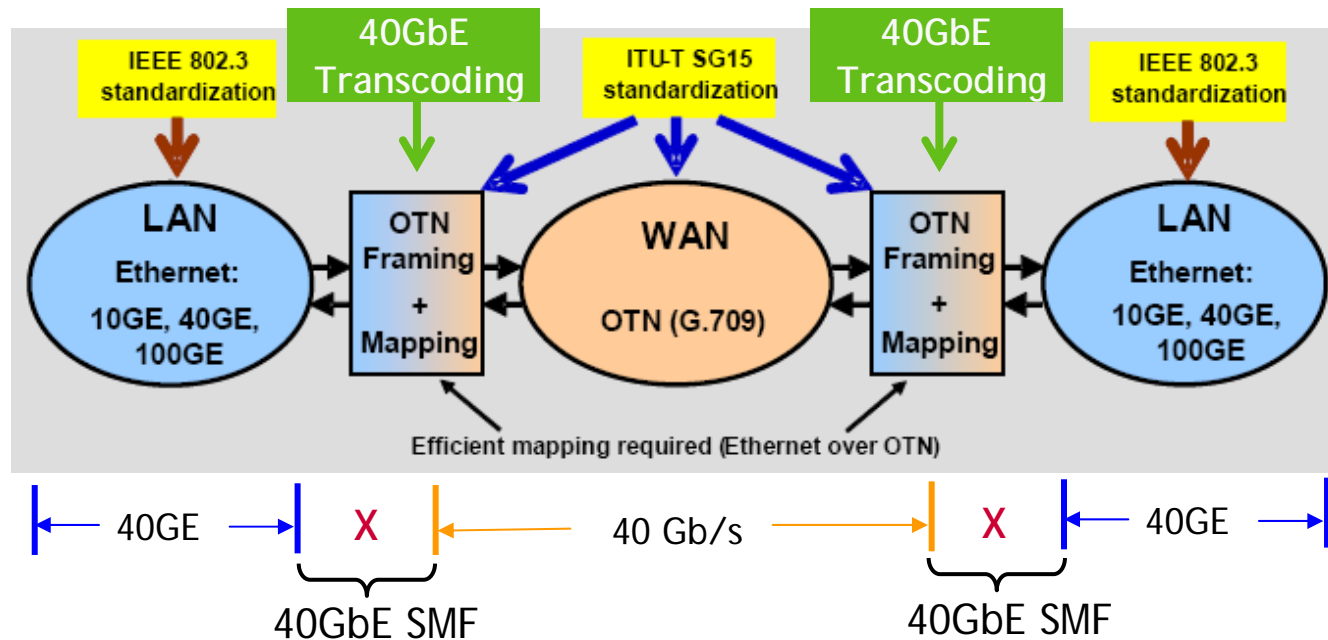
## How did we end up with 40 GbE and 100 GbE?



- “Bandwidth requirements for computing and networking applications are growing at different rates... which necessitates two distinct data rates, 40 Gb/s and 100 Gb/s.”, 802.3ba Distinct Identity
- This is still true, however, the networking bandwidth consumption shown above is applicable to high-end applications such as video on demand
- Computer traffic aggregation applications will require 40GbE SMF
  - Higher-speed switch port deployments lag the networking bandwidth curve (see [barbieri\\_01\\_0108.pdf](#))

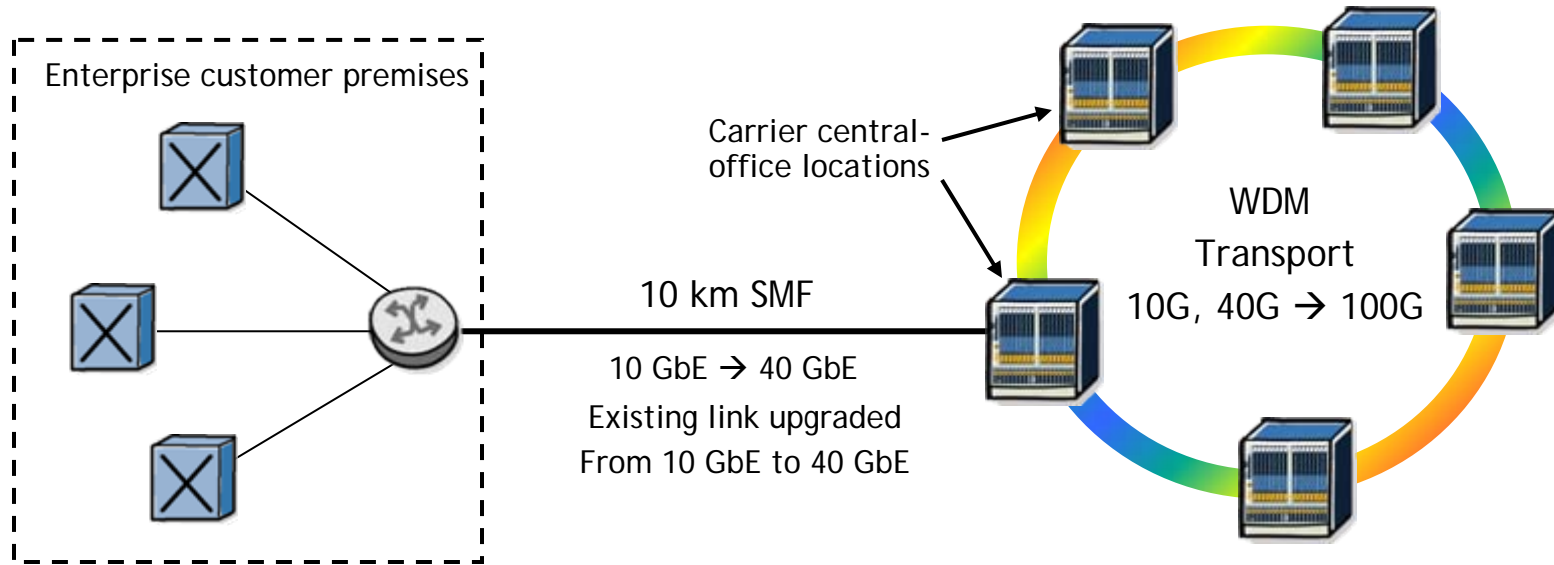
# OIF Carrier Working Group requirement for 40 GbE SMF

## OIF Carrier Working Group Reference Architecture



- 40 Gb/s exists in OTN WAN
- One objective of 802.3ba: Provide appropriate support for OTN
  - Transcoding at the LAN/WAN interface (see, e.g., trowbridge\_01\_0907)
  - Enterprise (LAN) and Carrier (WAN) equipment is increasingly not co-located
  - Connection from LAN to WAN is missing from current objectives
  - 40GbE SMF 10 km objective fills this gap
- OIF carrier working group draft liaison letter sent to ITU-T and IEEE 802.3ba with the requirement:
  - R 17 Physical layer interface specifications for 40 and 100 GB Ethernet shall include an option for SMF minimum 2 km. The interface architecture should support an evolution to a single wavelength serial interface.
- From a Carrier perspective, 10 km reach ensures adequate coverage to reach a broad population of their Enterprise customers

# 40 GbE and 100 GbE Applications

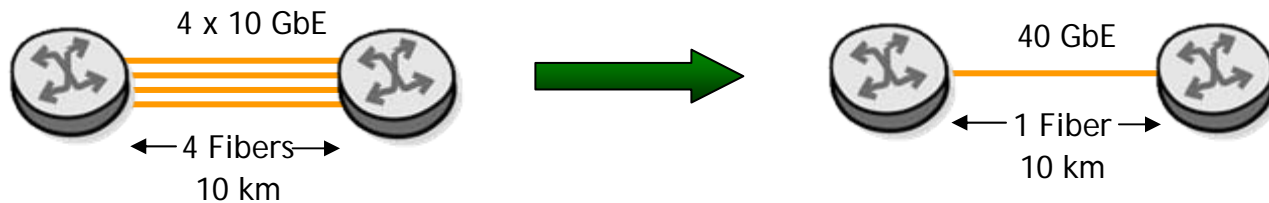


- There will be a market for 100 GbE SMF driven by high-end applications - e.g. IPTV video on demand
- Web surfing: bandwidth per user ~ 100 kb/s vs. HD TV: bandwidth per MPEG4 HD stream ~ 8 Mb/s
- Example metropolitan area network with 1 million households and 10% concurrency:
  - Video on demand generates ~800 Gb/s
  - Web surfing generates ~10 Gb/s
- Data applications can often be cost-effectively supported by 40 GbE switch interfaces
  - Connection from enterprise data center to 40 Gb/s WAN transport
- Need for 100GbE and 40 GbE on single-mode fiber comes from the diversity of applications
  - High-end, bandwidth intensive (e.g. entertainment networking) vs. data centric (e.g. server traffic aggregation)

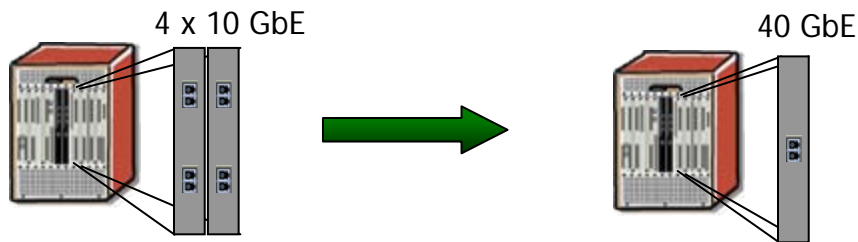
## Problems with 4 x 10 GbE link aggregation

There are several reasons why link aggregation of 4 x 10 GbE is not satisfactory for many customers

- Fiber may not be available:



- Lower port density for multiple low-bitrate ports and increased OPEX from a larger number of managed ports



- Flow-based load balancing can be problematic (see [trowbridge\\_01\\_0906.pdf](#))
  - E.g., encrypted flows with IPSEC

## Conclusions

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- 40 GbE was brought into the objectives to support computing applications
- Adding 40 GbE SMF objective allows switch-to-switch connections for server traffic aggregation
- Volume of 100 GbE driven by high-end networking applications, e.g. video on demand
- Task force objectives include support for OTN
- OIF Carrier Working Group requirements include 40 GbE SMF for connection from LAN to WAN
- 40 GbE SMF reach objective of at least 10 km supports the migration of 10 GbE LR to 40 GbE LR in already existing fiber infrastructures
- The inclusion of a 40 GbE SMF objective is consistent with providing appropriate support for OTN