Ethernet Passive Optical Networks
EPON

Should it be an IEEE Standard?

Contact Information:
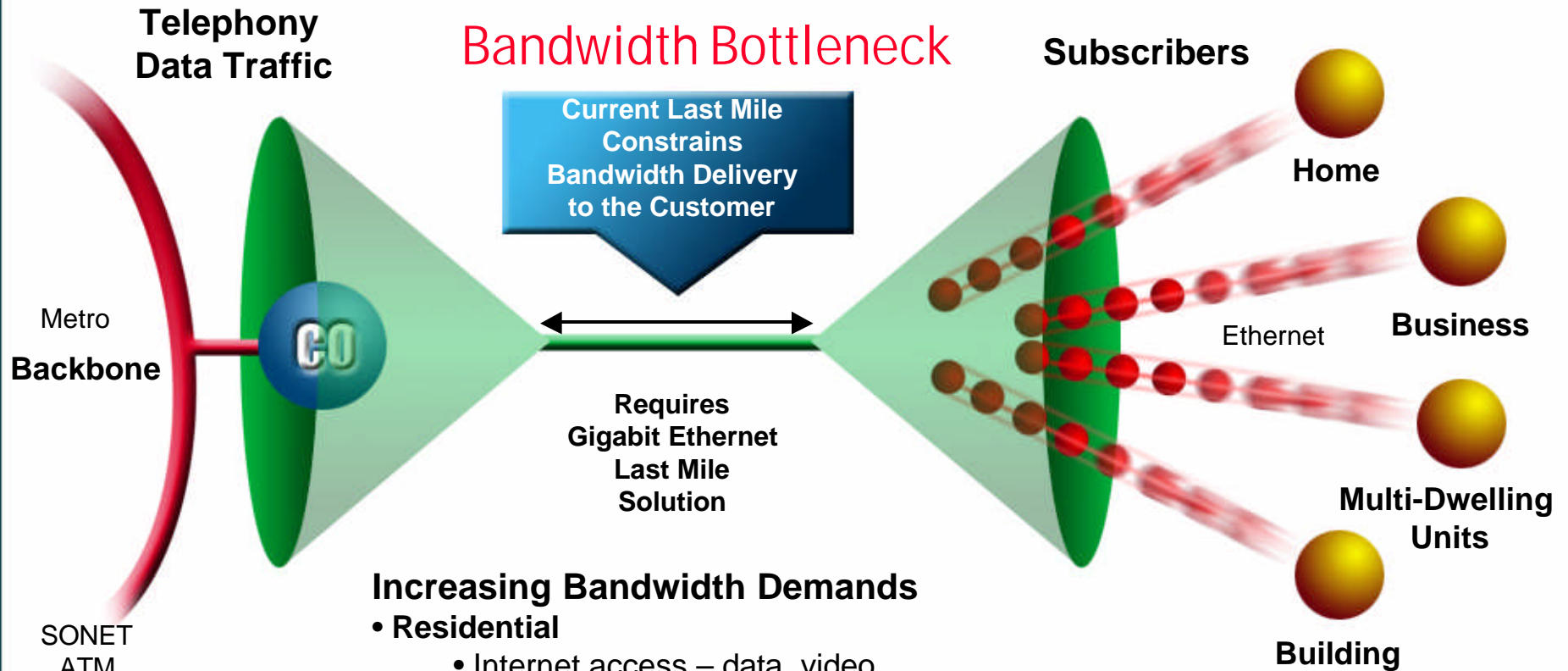
Gerry Pesavento

gerry.pesavento@alloptic.com

Tel 530-219-1954

ALLOPTIC

FIBEROPTIC ACCESS SOLUTIONS

Ethernet in the Last Mile

Telephony Data Traffic

Bandwidth Bottleneck

Subscribers

Current Last Mile Constrains Bandwidth Delivery to the Customer

Metro

Backbone

CO

Home

Ethernet

Business

Requires Gigabit Ethernet Last Mile Solution

Multi-Dwelling Units

SONET
ATM
RPR
IP
VIDEO

Building

Increasing Bandwidth Demands
- **Residential**
  - Internet access – data, video
  - Multimedia downloads
  - Emergence of alternate voice offerings
  - Local Loop growth
- **Business**
  - Virtual LANs
  - Increased dependence on Internet
  - Multimedia applications (video conference)
  - CLECs

FTTx represents an aggregate $8B opportunity in the next 5 years

2   31-Aug-00

Why Start an Ethernet Last Mile Standard Now
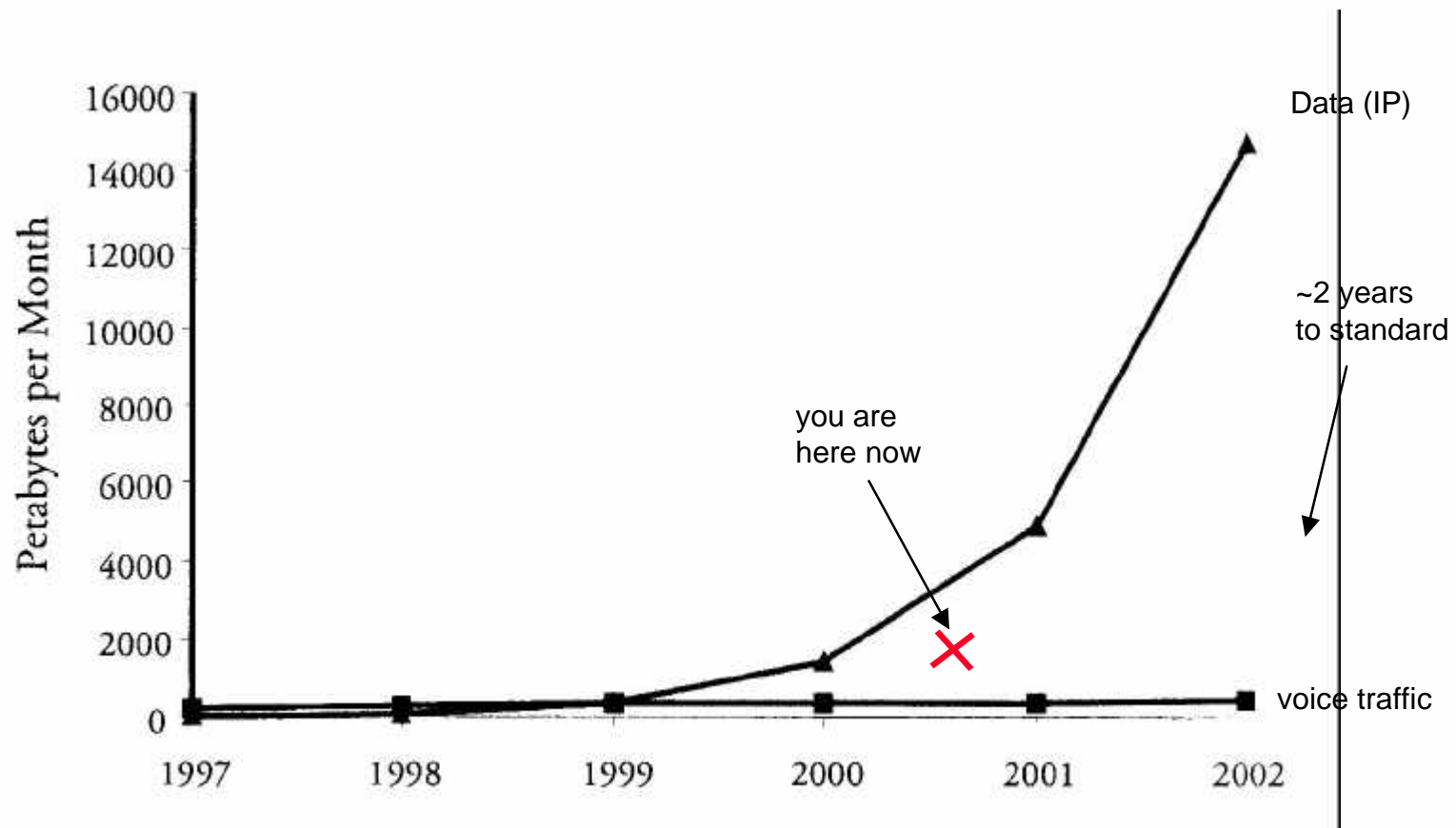
Answer: Because a data-IP-centric ubiquitous standard is needed,
and no current standard covers the unique requirements of the last mile
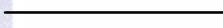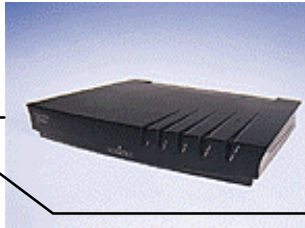
Last Mile Evolution: To Ethernet

TDM ────────────────────────────► T1 (1.5 Mbps) - legacy

Cable Modem

Analog
Coax ────────────────────────────► Ethernet (1-10 Mbps)
(Video)

DSL Modem

ATM
Copper ───────────────────────────► Ethernet (1-10 Mbps)
(POTS)

Optical Modem
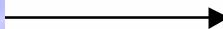
IP/Ethernet
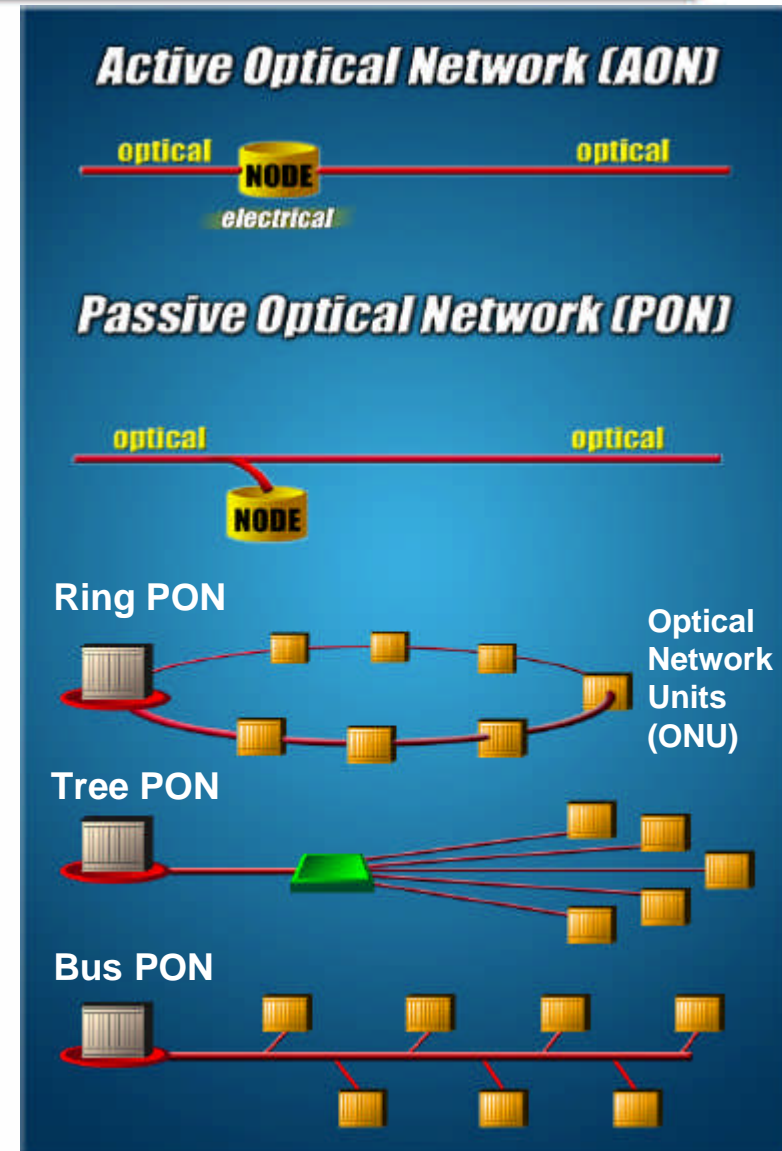Fiber ────────────────────────────► IP/Ethernet (1000 Mbps)
(POTS, Video)

Bandwidth

Built in features:
Firewall, Routing, Switching, etc.

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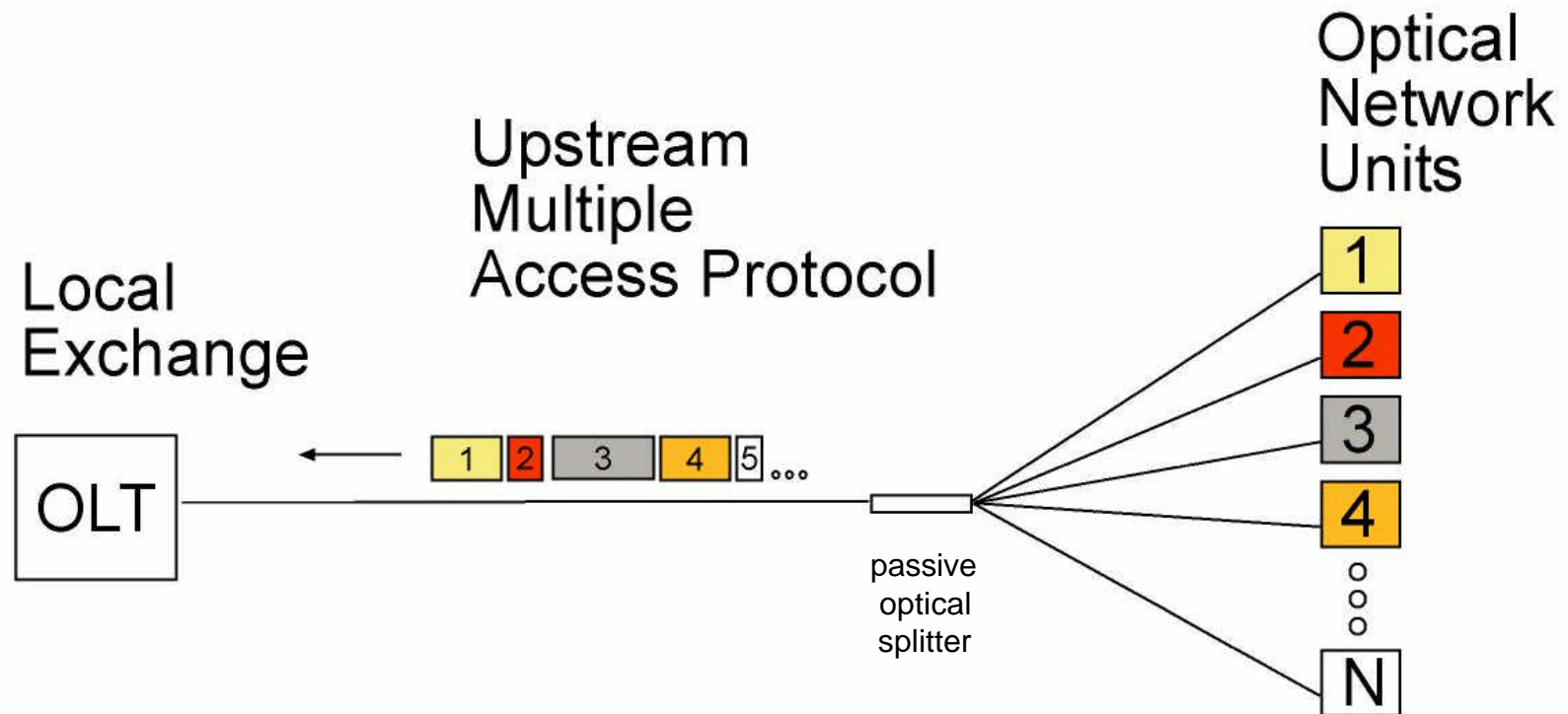## EPON Optical Local Loop

- Minimize fiber deployment
  - in the local loop
  - in the Local Exchange Office
- Minimize number of optical transceivers
- Low cost
- High bandwidth (can add WDM overlay)
- Fault tolerant: power loss
- Asymmetric or symmetric traffic
- Lowest initial deployment cost
- Broadcasts downstream (video)
- Eliminate loop electronics
- Voice, Data and Video
- Becomes point-to-point with one ONU
- Low maintenance

Active Optical Network (AON)

optical — NODE — optical

electrical

Passive Optical Network (PON)

optical — NODE — optical

Ring PON

Optical Network Units (ONU)

Tree PON

Bus PON

Optical
Network
Units

Upstream
Multiple
Access Protocol

Local
Exchange

OLT

passive
optical
splitter

EPON Standard requires
(1)   upstream Multiple Access Protocol, current solutions available for 1.25 GBE, can extend to 10 GBE
(2)   WDM layer specification
(3)   Other: Encryption, management, signaling control, etc
(4)   Possible link to ITU G.983 FSAN

Last Mile PON System Companies
1. Alloptic, Inc.
2. Quantum Bridge
3. Terawave
4. Marconi
5. Nortel
6. Optical Solutions
7. Lucent
8. Alcatel
9. Fujitisi
10. Hitachi
11. Eluminent
12. Paceon
13. OnePath
…and more about to announce
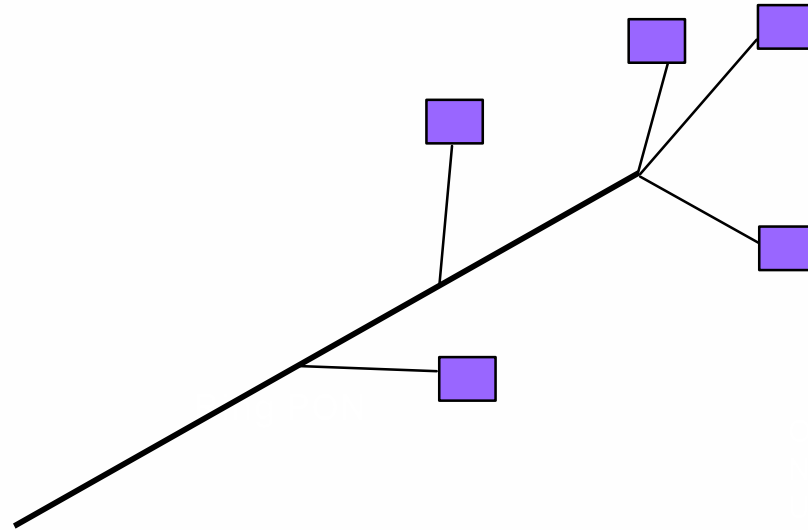
APON vs. EPON Standard

	Ethernet PON (EPON)	ATM PON (APON)
Standard	IEEE?	FSAN, ITU G.983
Authors	-	NTT, BT, etc.
Date	-	1995
Speed	1.25 Gbps	155/622 Mbps
IP efficiency	good	not-so-good
Multiple Access	TDMA, Other	TDMA
Scalable	yes, 10 Gbps	difficult
ONU Features	routing, switching, firewall, etc.	
LANs	Ethernet	--
Home PNA	Ethernet	--
Components	IP/Ethernet	ATM
Cost	Ethernet cost	ATM cost

Conclusion: ATM PON uses non-IP-optimized protocol (ATM) at low speeds (OC-3) and high cost, Ethernet PON uses the IP-optimized protocol (Ethernet) at high speeds (GBE) and low cost

Conclusion

IEEE Ethernet Passive Optical Network (EPON) Standard

….. it's time to bring broadband home.

- EPON is the next generation of FSAN APON: faster, cheaper, and IP-centric

- IEEE should own the EPON standard, but can expedite process with link to ITU APON.

- Allows for Optical IP/Ethernet for FTTH, FTTC and FTTB networks

- 1.25 Gbps TDMA technologies are available today, 10 Gbps in the future

- RBOCs and CLECs have requested standard, will support

- Large Telecom OEM equipment vendors have expressed interest in an IP PON standard

- Allows for low cost residential optical Ethernet delivery; <$300 Gigabit box is a realistic goal.