

Why WAN-PHY

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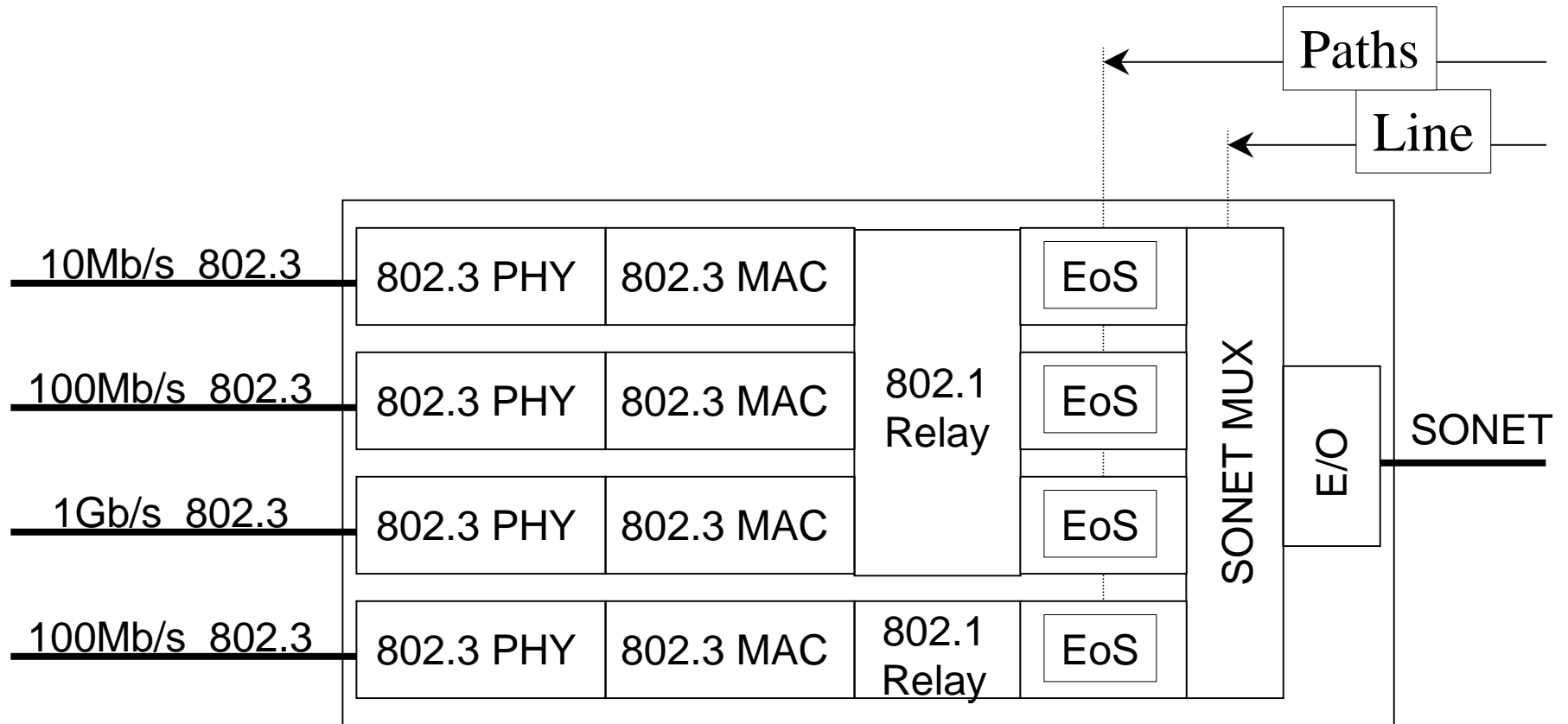
Agenda

- What is wrong with the Bridge solution
- What is wrong with the EoS solution
- How WAN-PHY solves the problems

'Ethernet over SONET (EoS)'

- a) An ANSI/ITU Proposed methodology for mapping 802.3 Ethernet MAC frames intact into SONET payloads.
- b) The *Path* termination is at the interface between the SONET MUX and the EoS mapping function.
- c) This gets mapped over a system fully compliant with all requirements of SONET/SDH standards.

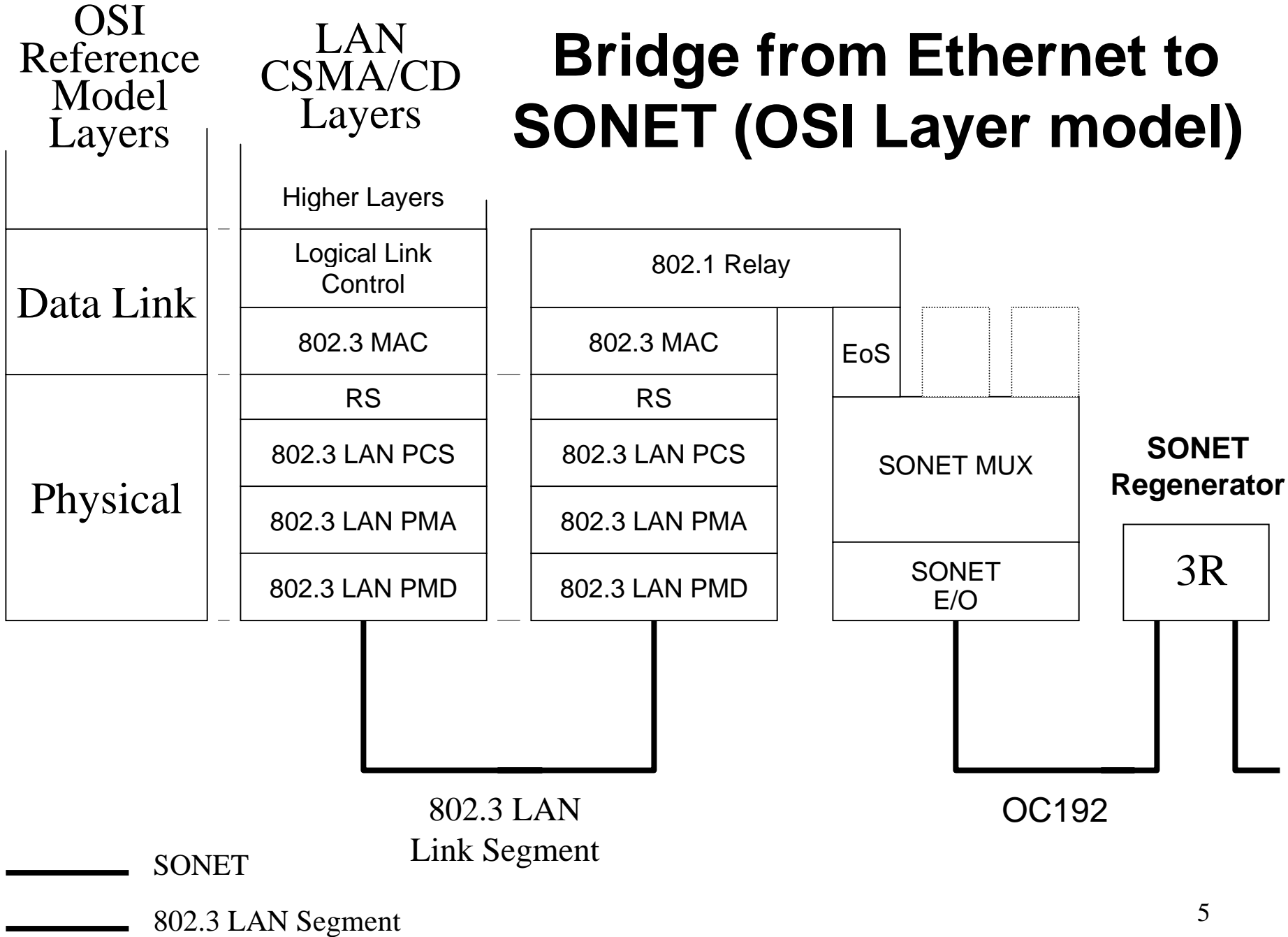
Bridges from Ethernet to SONET



———— SONET

———— 802.3 LAN Segment

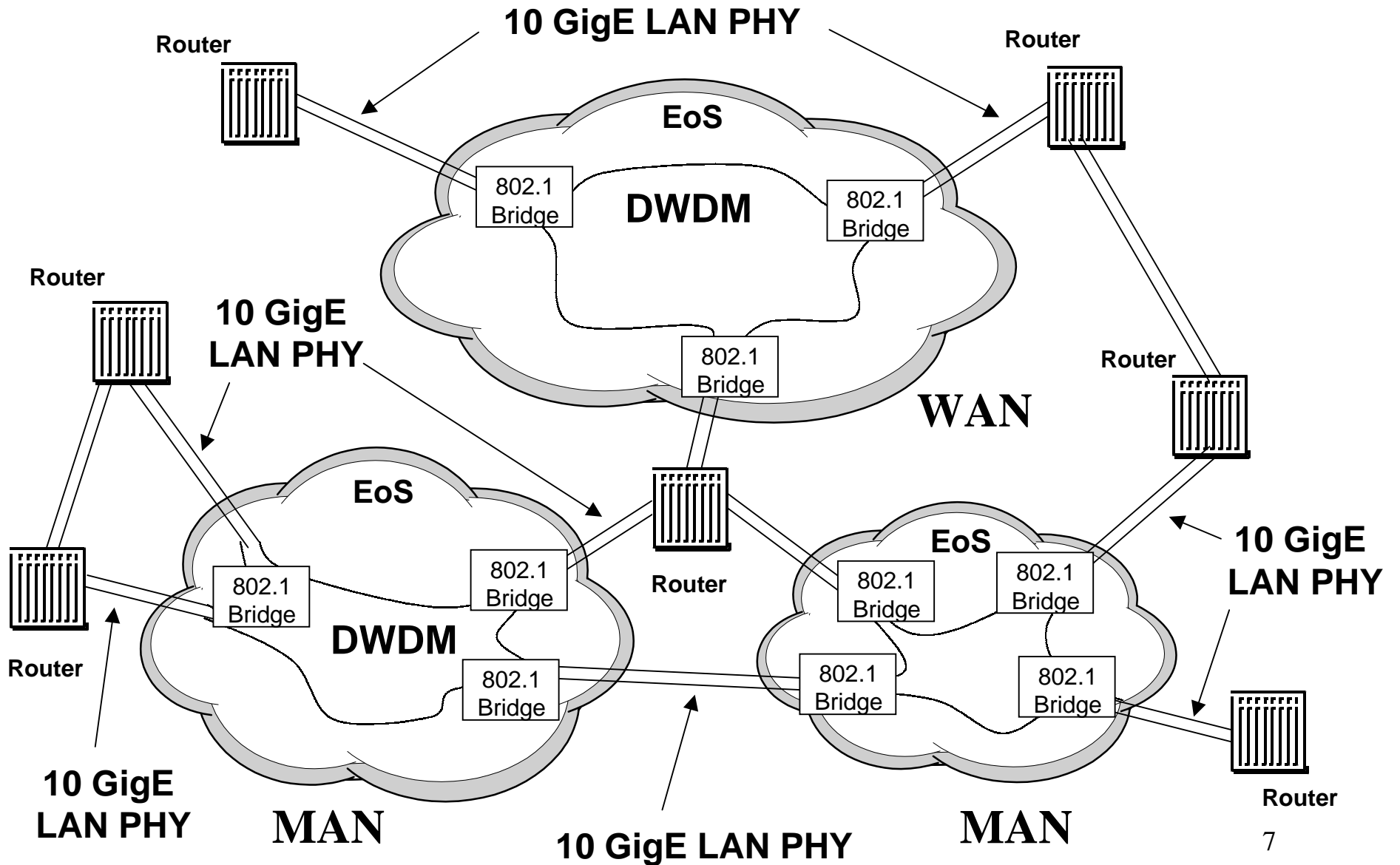
Bridge from Ethernet to SONET (OSI Layer model)



So Why Bother With WAN-PHY

- ANSI/ITU is working on a standard for carrying Ethernet over SONET
- Just bridge from LAN-PHY into EoS
- The cost of a Bridge is low compared to OC-192 SONET optics
- Bridges are already being incorporated into LTEs to provide Ethernet services

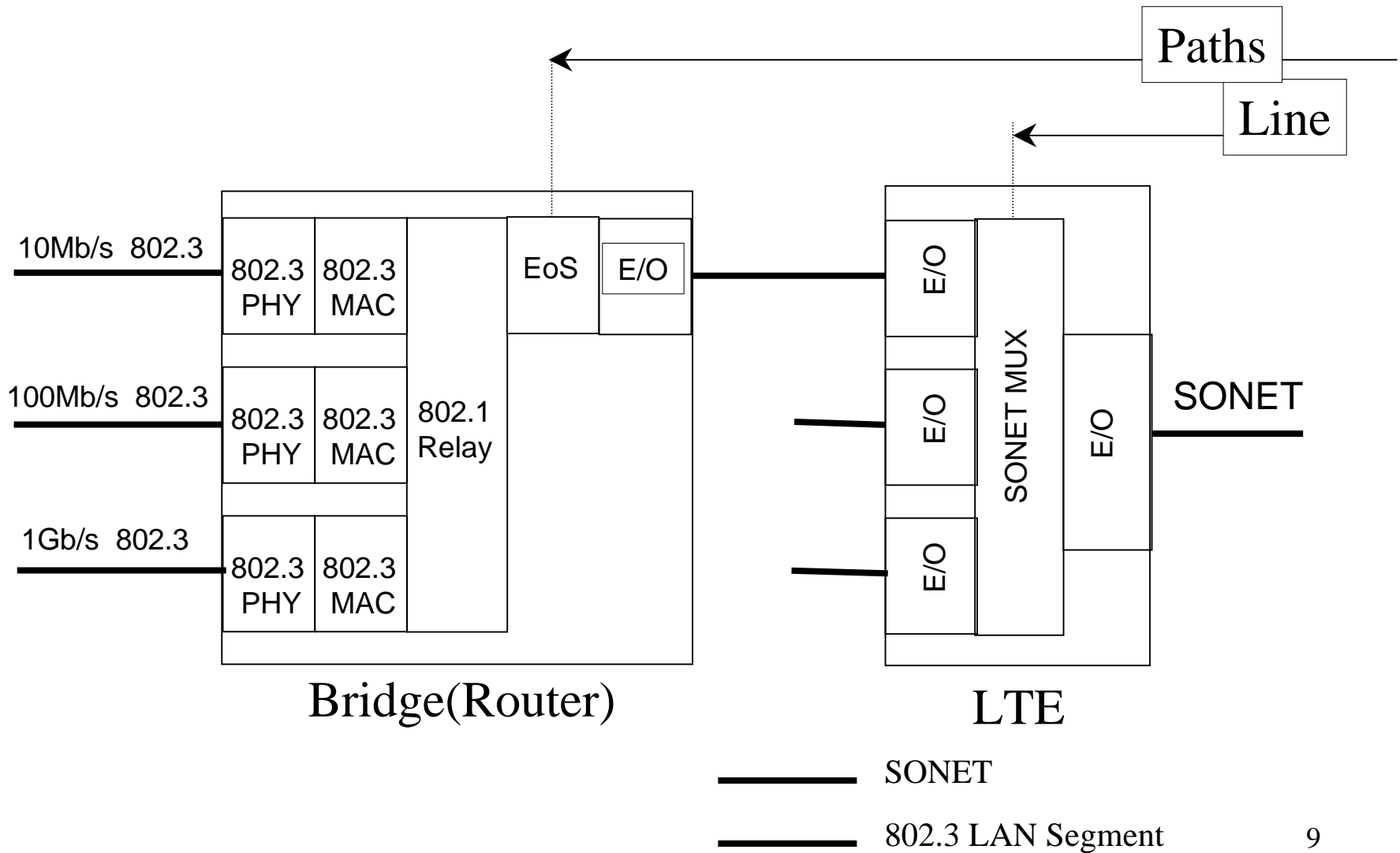
What is wrong with this picture?



Bridges Negate Router Protocols

- IP traffic management does not work!! The bridges do not support a traffic model compatible with current and future IP traffic.
- IP routing is defeated!! The Bridges add traffic merge points outside the IP topology.
- The total buffer in the network is more than doubled giving the network both longer latency and higher delay variation.
- The bridges add unnecessary cost to the network.
- The Bridges limit the useful services a provider can offer

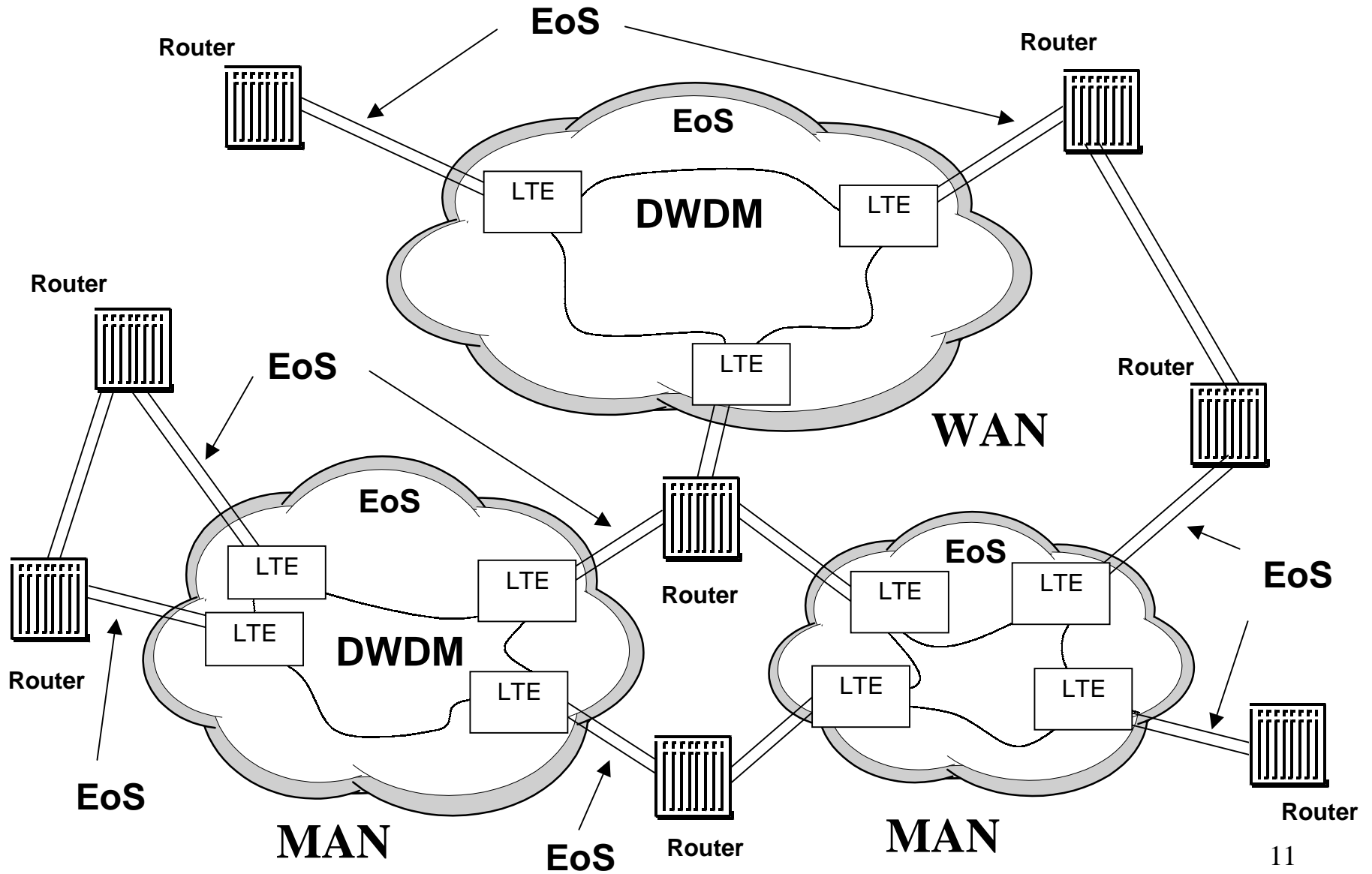
To Fix It Take the Bridge Out Of the LTE



The “Bridge” Can Now Be a Router

- IP traffic management works!! The bridge is no longer an integral part of a carrier equipment.
- IP routing works!! The network no longer has internal merge points.
- The storage in the network is reduced by more than 50% reducing the latency by more than 1/2.

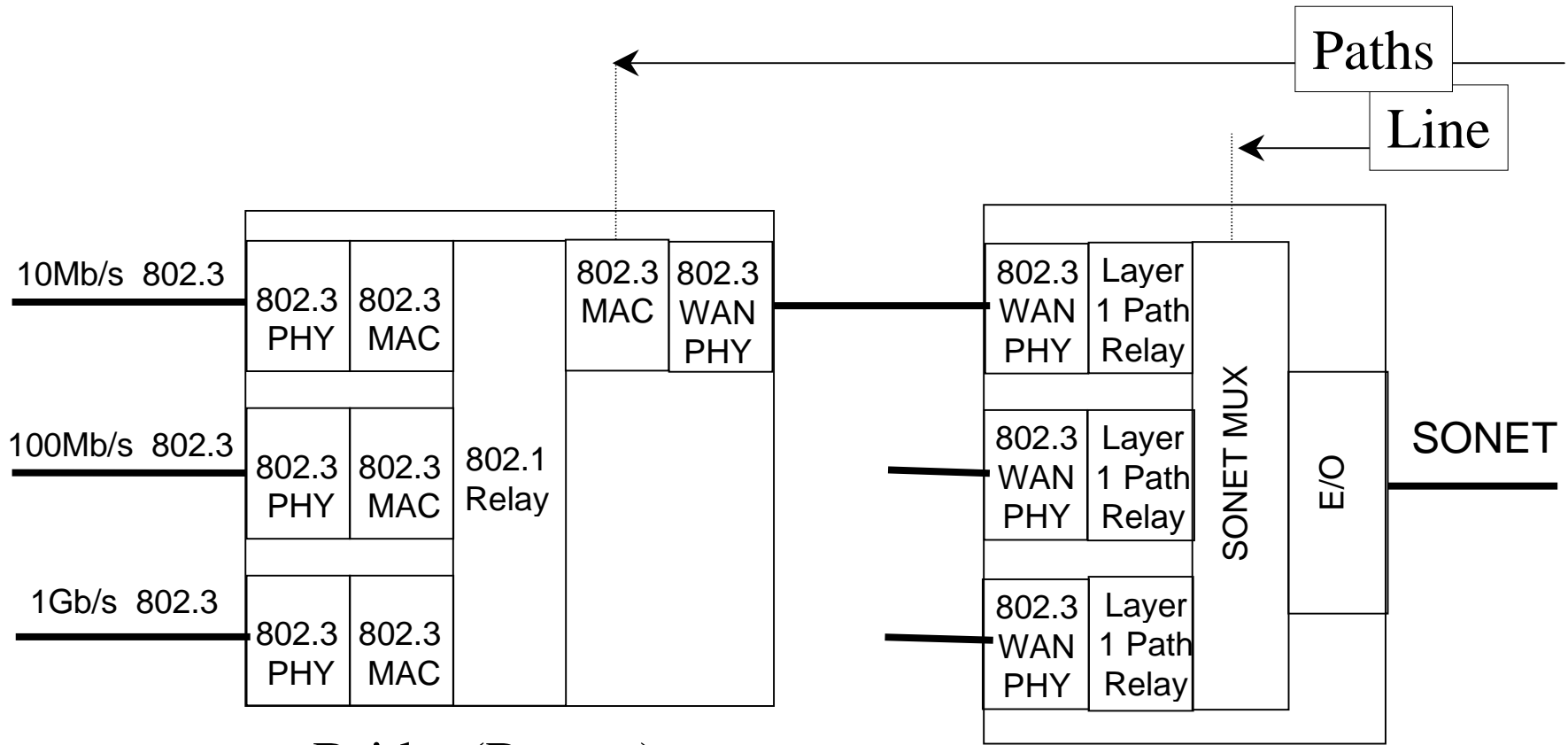
Better - But?



We still have some problems




- We have tripled the SONET optical components increasing the the cost of both the LTE and the Router/Bridges
- The EoS interface is not specified in detail limiting the vendors who can successfully build Router/Bridge interfaces
- Bridge/Routers will need to implement full SONET management, SONET clock, and SONET systems for standard compliance

The Solution Is WAN-PHY

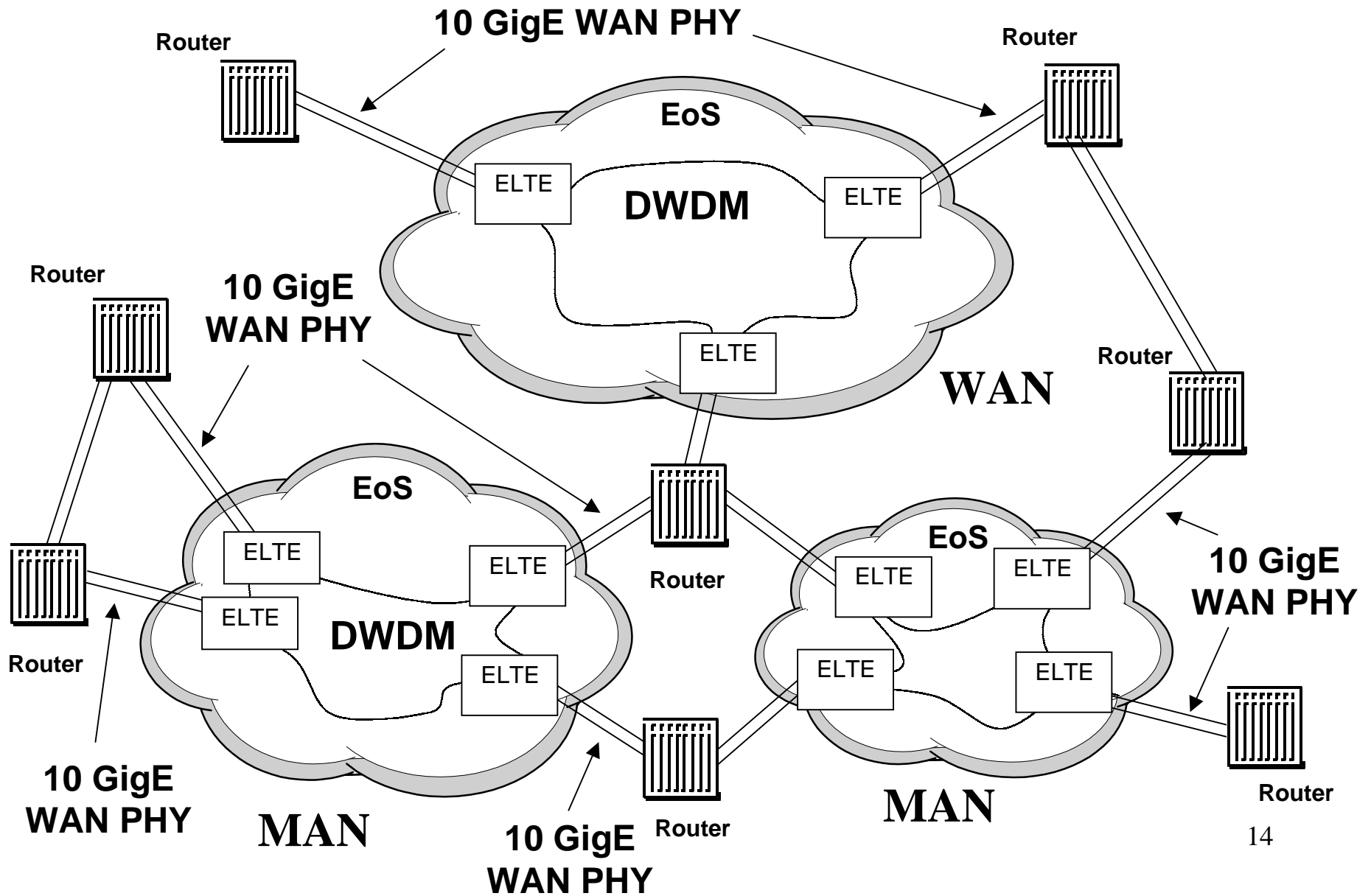


Bridge(Router)

ELTE

-  SONET
-  802.3 LAN Segment
-  802.3 WAN PHY Segment

Best - Simple, Efficient, Low Cost

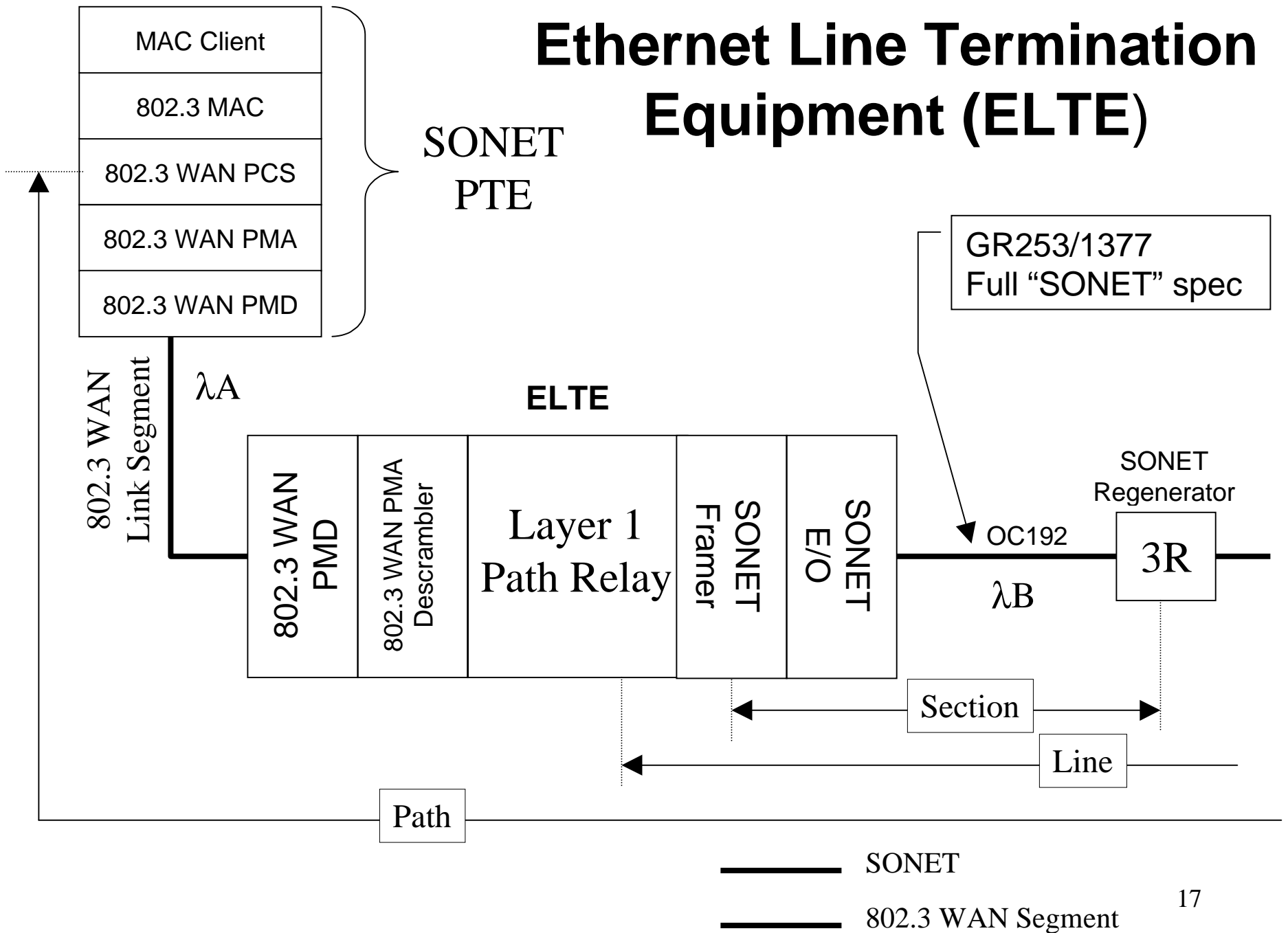


WAN-PHY Benefits

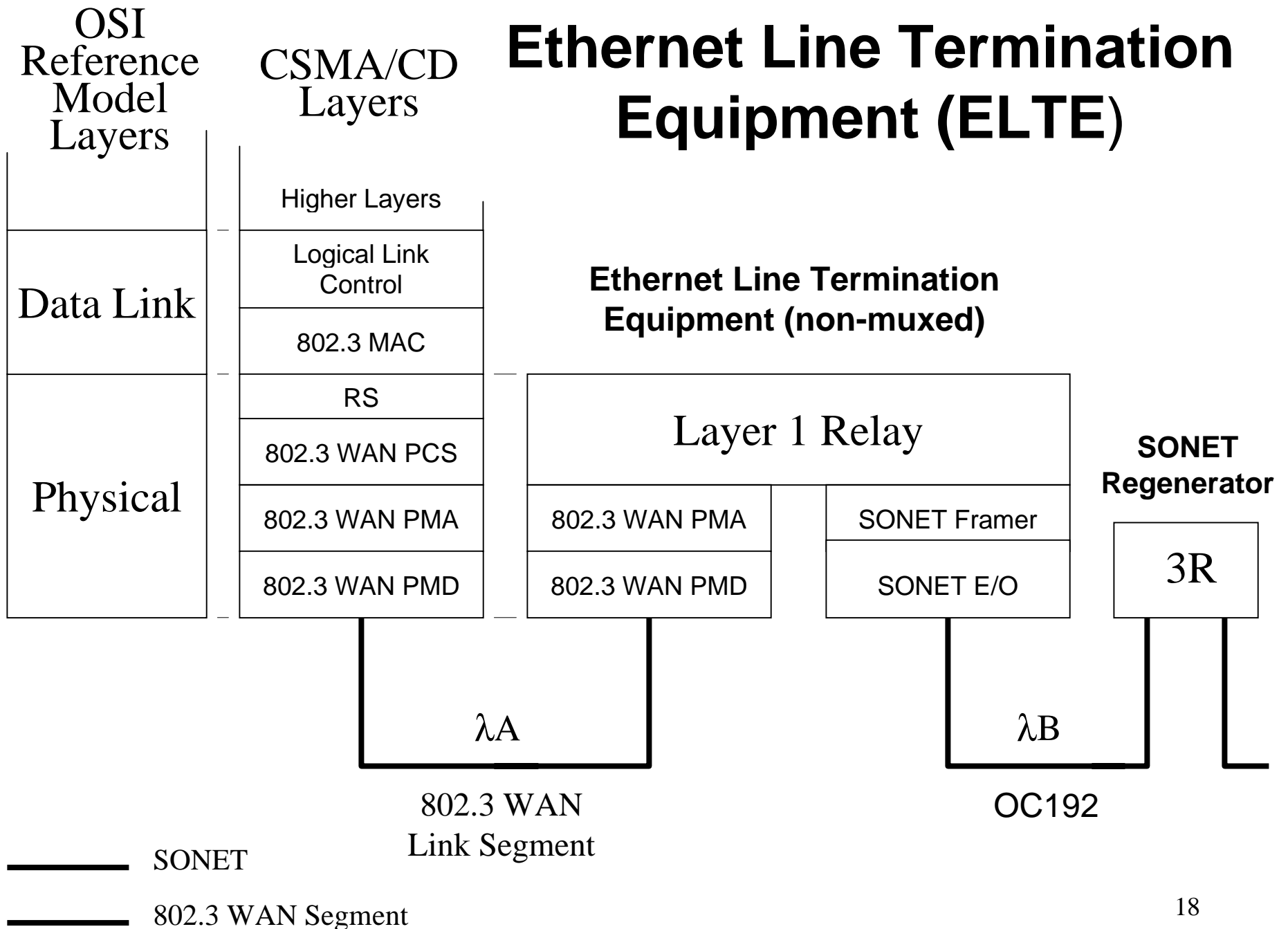
- IP traffic management works
- IP routing works
- The network storage and latency is reduced by 50%
- IEEE standard gives a complete equipment specification enabling a universal WAN interface
- Ethernet's low cost optics reduce the cost of routers and LTEs

A WAN Architecture Proposal

Ethernet Line Termination Equipment (ELTE)

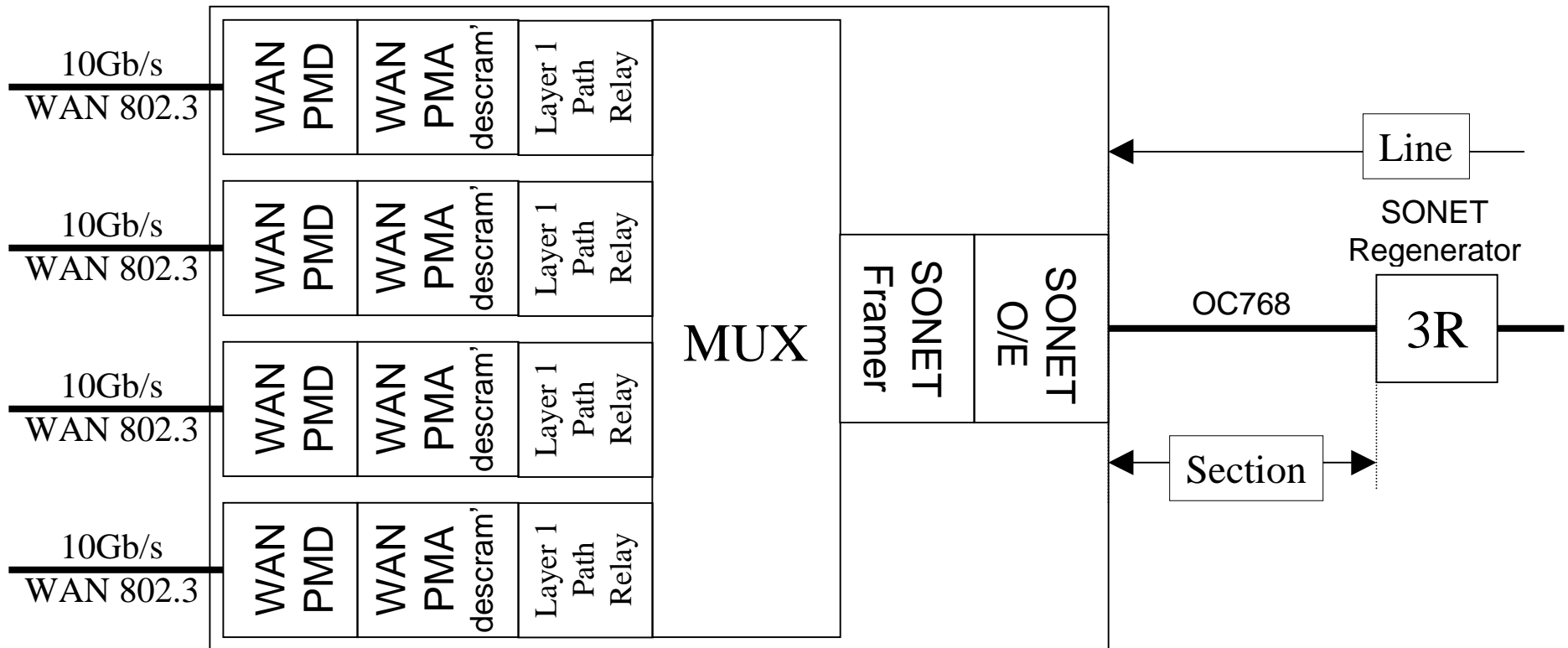




Ethernet Line Termination Equipment (ELTE)



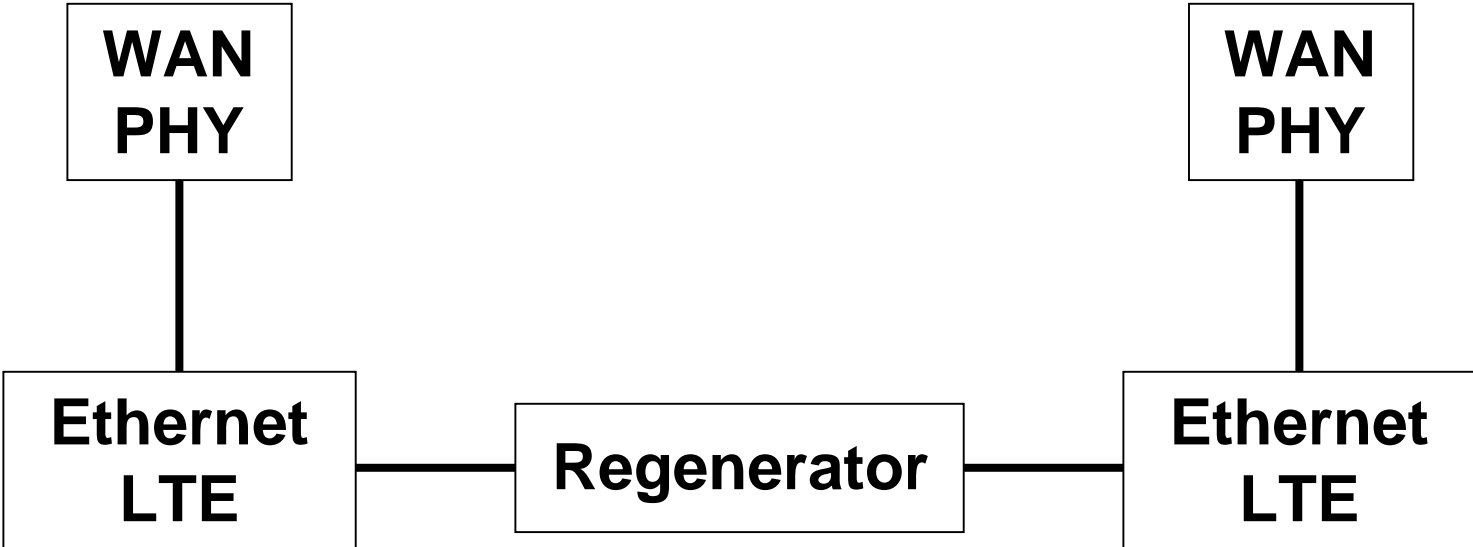
Ethernet Line Termination Equipment (ELTE)

Ethernet Line Termination Equipment (muxed)



 SONET
 802.3 WAN Segment

Point to Point SONET Interconnect



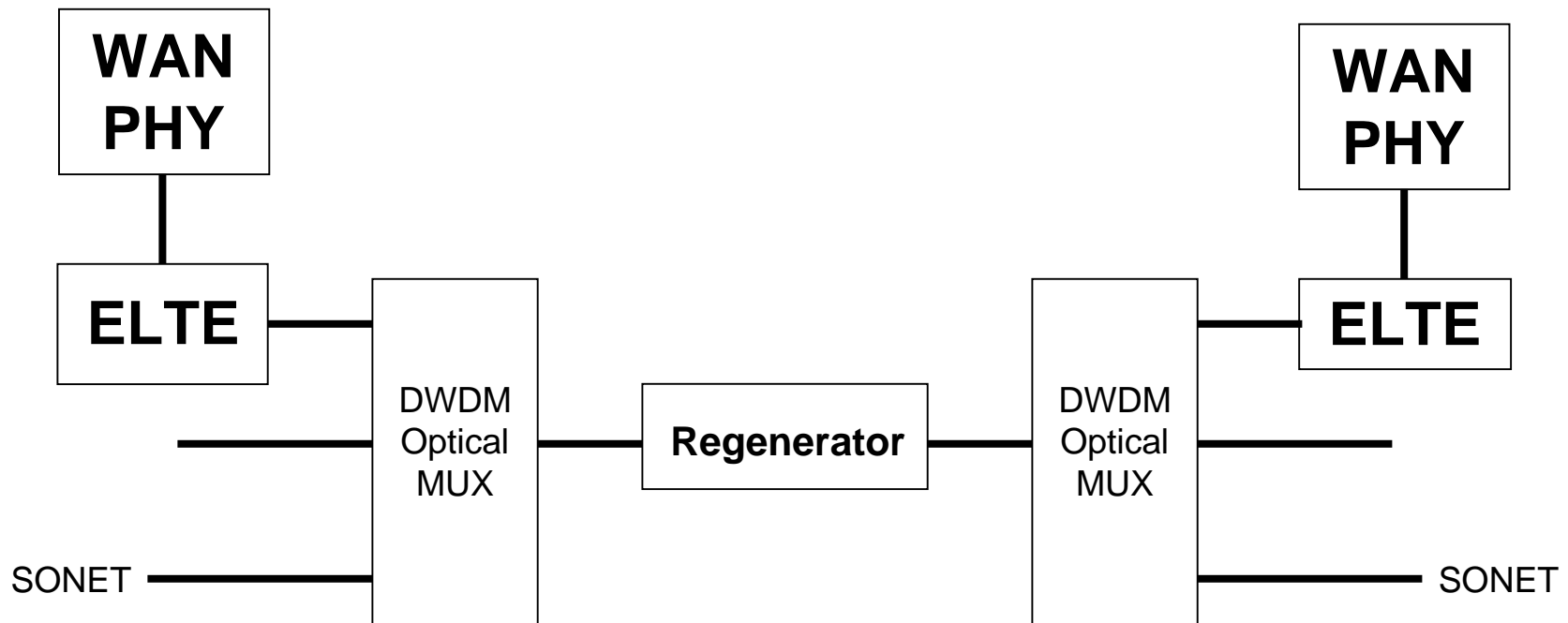
— SONET
— 802.3 WAN Segment

Dark Fiber



—— 802.3 WAN Segment

DWDM Case



———— SONET
———— 802.3 WAN Segment

Backup

WAN PHY DEFINITIONS

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Nader Vije

Some definitions for us from 802.3 and SONET

'802.3 MAC'

- a) 802.3 standard.
- b) MAC client above.
- c) Reconciliation sublayer below.
- d) Single channel, no multiplexor.
- e) Full duplex (for 10GbE), no CSMA/CD.
- f) No buffering.

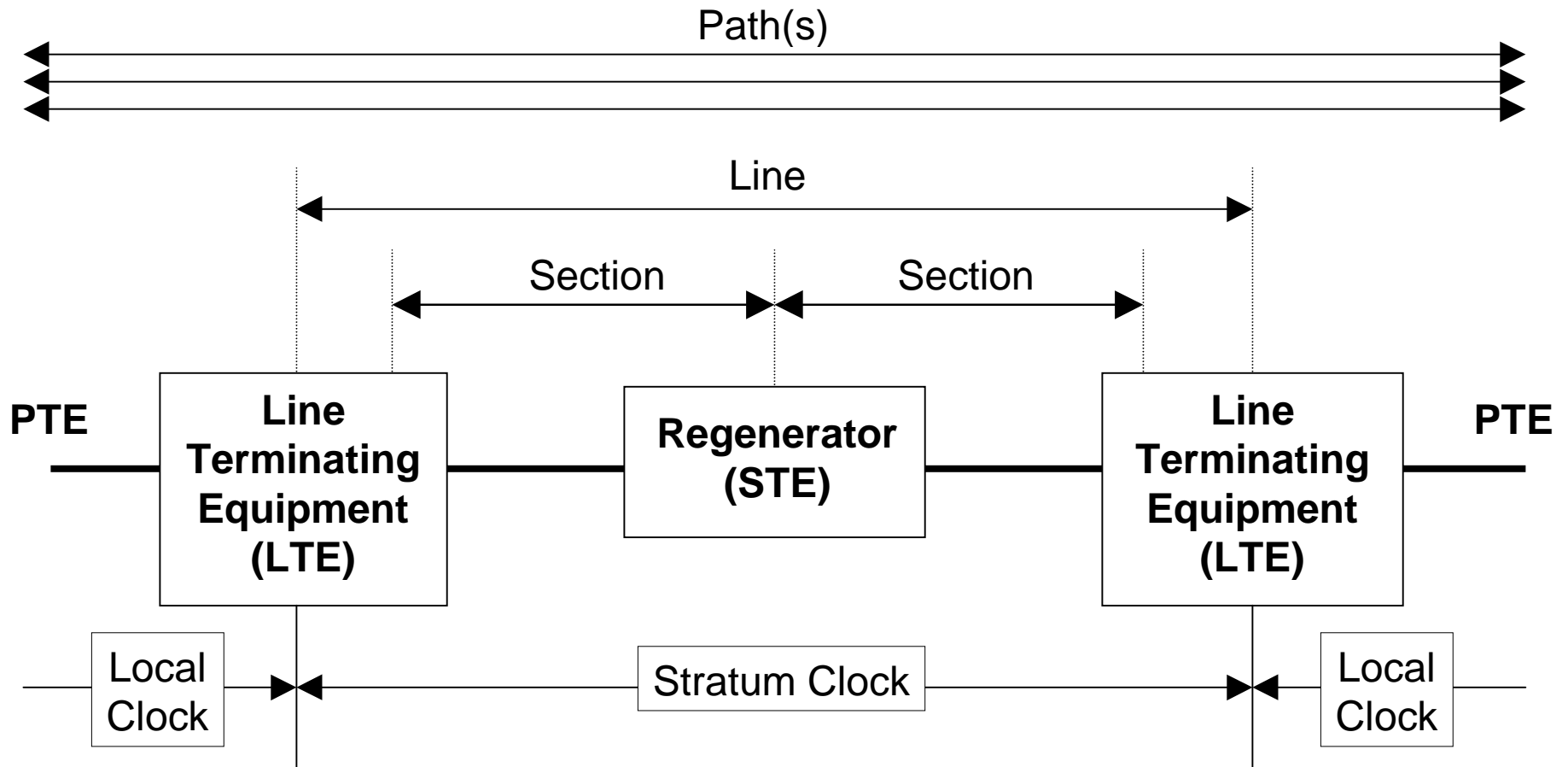
'802.1D Relay'

- a) Connects elements (eg MACs) at MAC-client interface to create a bridge / switch.
- b) A MAC client.
- c) Packet store and forward (no cut through).
- d) Accommodates speed changes port to port.

'802.3 Repeater'

- a) 10, 100, 1000 single speed.
- b) Half-duplex, CSMA/CD only (no full-duplex).
- c) Shared access to a single channel.
- d) Bit store and forward for clock tolerance differences.
- e) Fractional packet latency.

'Path', 'Line', 'Section'



Note: A Line can be longer than two Sections

'SONET Regenerator'

- a) Full-duplex (dual-simplex).
- b) Operates on one and only one wavelength in each direction.
- c) Input wavelength equals the output wavelength in each direction.
- d) Forward wavelength may or may not equal the reverse wavelength.
- e) Couples SONET *Sections* within a *Line*.
- f) Buffer-less. Pipeline fixed delay. Transmit clock is the recovered receive clock.

continued ...

'SONET Regenerator' (cont')

- g) Examines and/or writes SONET section overhead.
- h) Payload, *Line* and *Path* information are passed through unmodified.
- i) Unscrambles and re-scrambles to support g).
- j) Keeps output *Section* active even if input *Section* fails (fault isolation).
- k) This is a '3R' (re-amplify, re-shape, re-time).
- l) This is a 'STE' (Section Terminating Equipment)

SONET 'Line Terminating Equipment (LTE)'

- a) Everything a SONET Regenerator does plus:
- b) Terminates a *Line* and the associated *Section*.
- c) Operates on Stratum clock.
- d) Multiplexes *Paths* onto a *Line* and de-multiplexes a *Line* into *Paths*.
- e) It is a dual simplex *Path* mux.
- f) Maintenance/Protection switching for muxed *Paths* between *LTEs*.

SONET 'Path Terminating Equipment (PTE)'

- a) Terminates a *Path* and the associated *Line* and *Section*.
- b) Operates on Local clock.
- c) This is where the SONET path overhead is processed.
- d) This is the 802.3 WAN PHY.
- e) In 802.3 this is where we attach the Reconciliation sublayer.
- f) This is where the 802.3 MAC Frames are mapped into the SONET payload.

'SONET Transponder'

- a) Couples differing optical PMDs back to back.
- b) E.G. wavelength 1 to wavelength 2, multimode to singlemode, 850nm to 1300nm.
- c) Dual simplex.

'Passive Transponder' (emerging term) :

- d) Transparently passes all bits (Items a, b, c).

'Active Transponder' (emerging term) :

- e) This is a special case of SONET *Regenerator* because of item a).
- f) Terminates *Section* (see *Regenerator*) and *Line* (see *LTE*).