

RPR Deployment Requirements

Orlando IEEE 802.17 meeting - May 2001

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Introduction

RPR Deployment

Scope and Introduction



- ❖ Analyze some scenarios to figure out how RPR networks can be deployed by different operators
- ❖ Operators can deploy RPR networks in different ways
 - ◆ Established operator – relying on the existing Sonet/SDH networks
 - ◆ Greenfield operator – building completely a new network from scratch

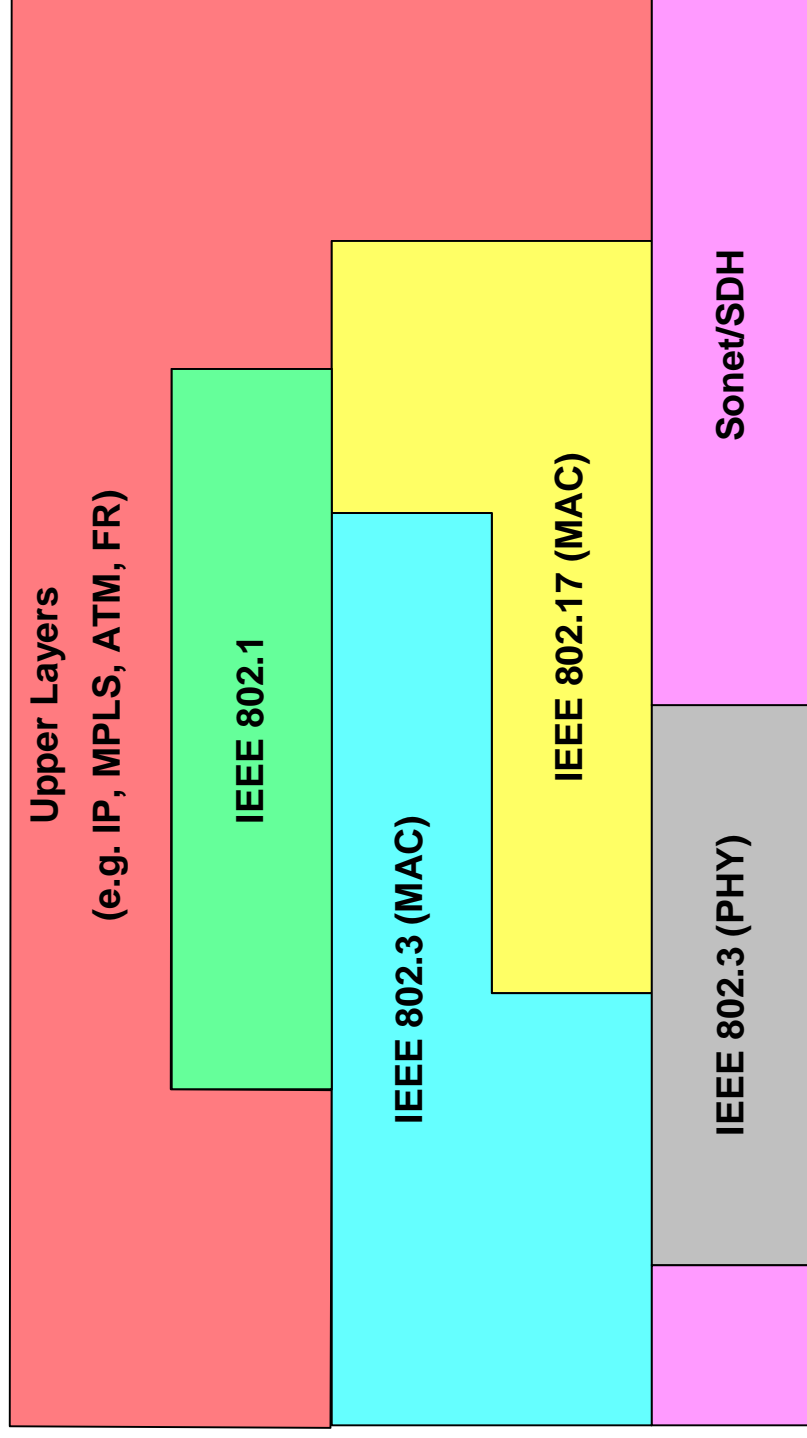
RPR Deployment

Scope and Introduction – 2

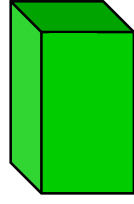
- ❖ Operators can deploy different RPR service scenarios
 - ◆ RPR network – to offer services at RPR layer only
 - ◆ RPR MAC-only – to support services offered at the upper layer (e.g. IP/MPLS, Ethernet, ATM or FR) to routers or switches in a metro ring
- ❖ Different vendors can target different operator/service scenarios
- ❖ **This analysis is not intended to cover all the possible scenarios but only a subset of them**

RPR Positioning

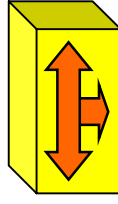
Layered Overview



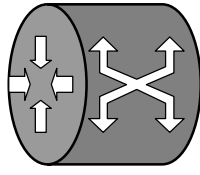
Symbols Legend



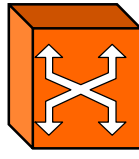
Sonet/SDH Box (e.g. ADM or DXC) – It can also be a WDM/OTN equipment



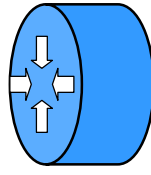
RPR Switch Box, belonging to the Operator



Upper layer Box (e.g. MPLS/IP router or Ethernet/ATM/FR switch) with RPR interfaces, and belonging to the Operator



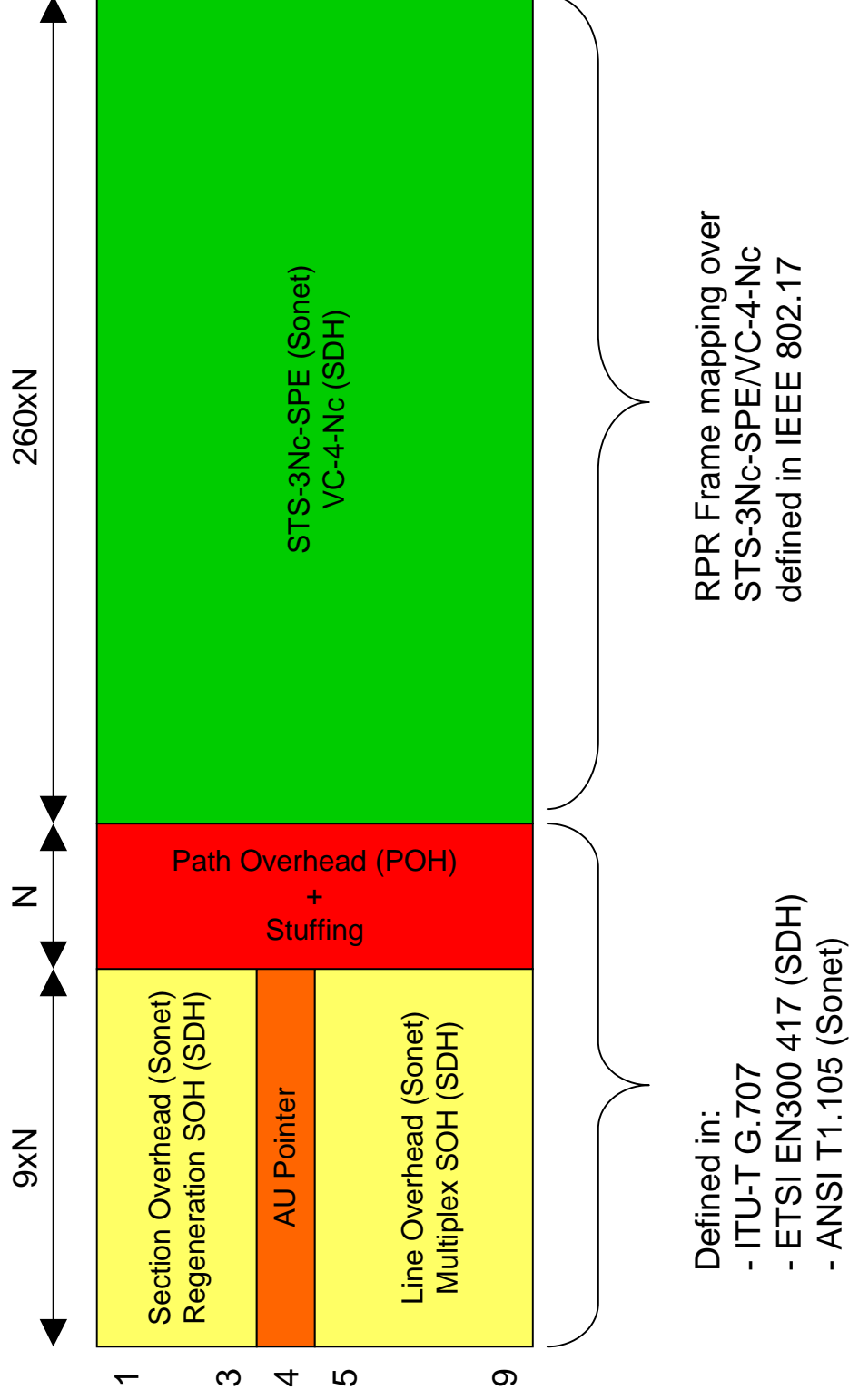
Ethernet Box (e.g. Ethernet Switch) belonging to the customer



IP Box (e.g. IP Router) belonging to the customer

Sonet/SDH Frame Structure

OC-3N (Sonet) or STM-N (SDH)



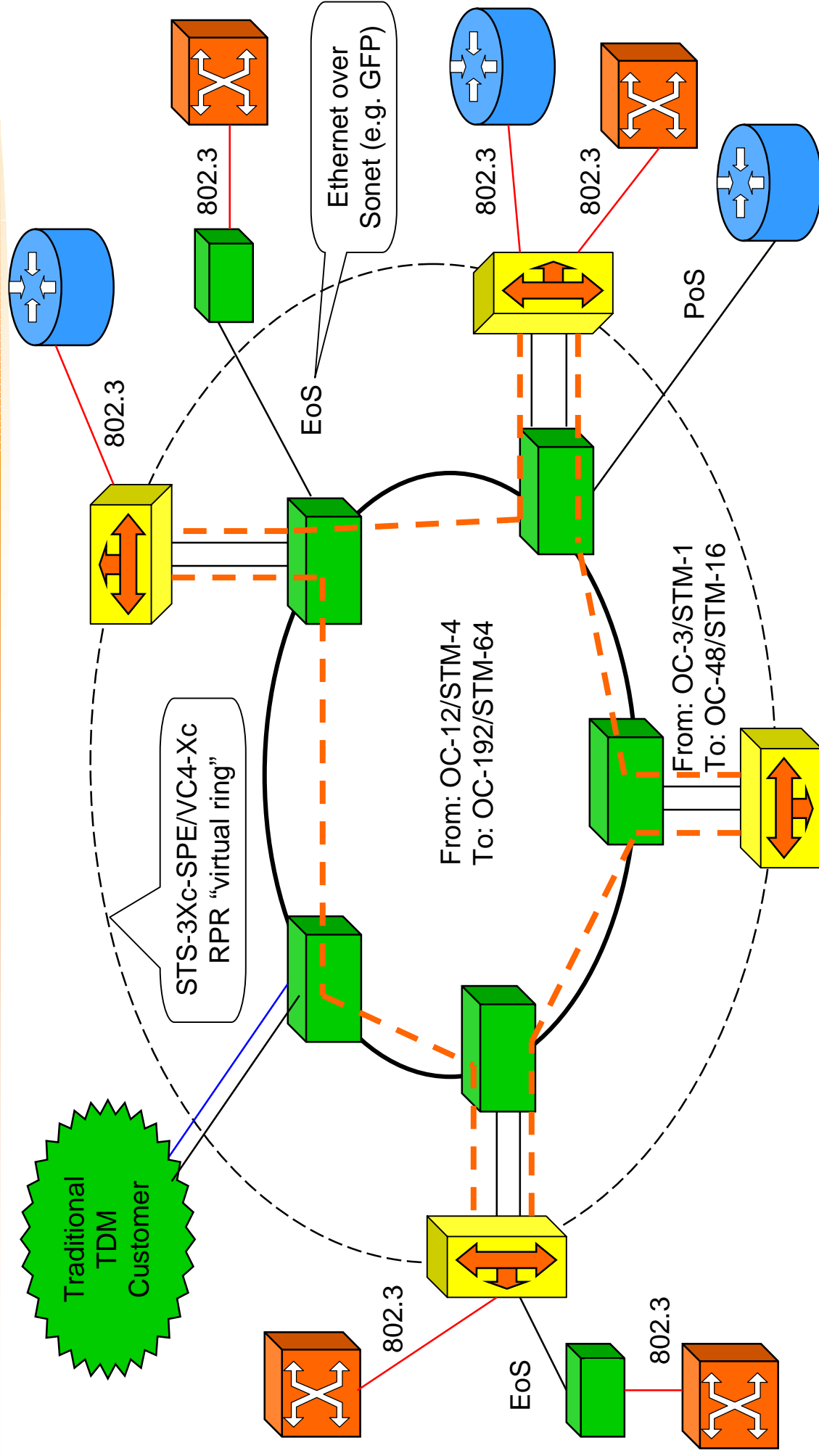


RPR Network Deployment

- ❖ Established operator
- ❖ Greenfield operator

RPR Network Deployment Scenarios

Established operator – an example



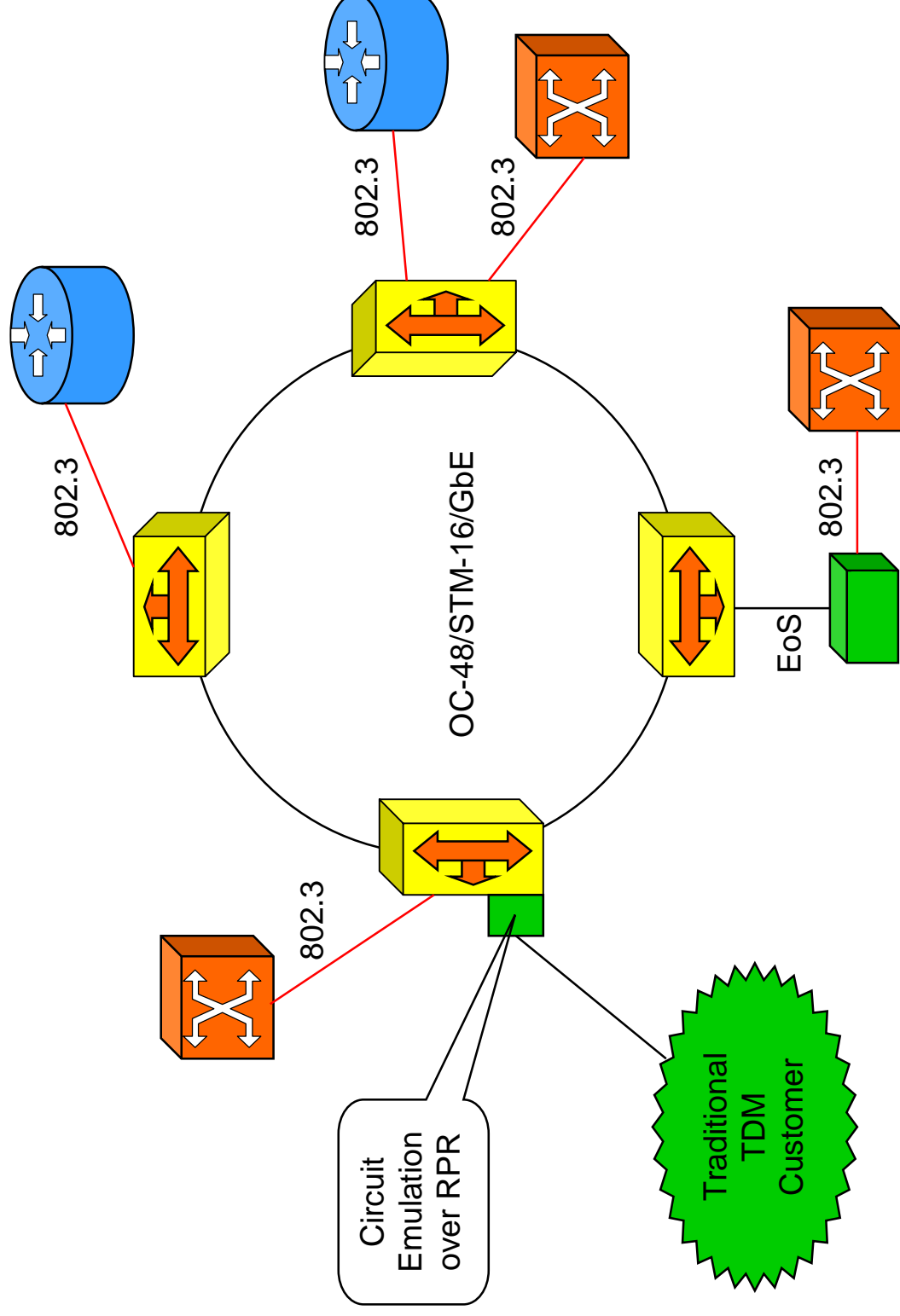
RPR Network Deployment Scenarios

Established operator – 2

- ❖ Starting point: the operator has already deployed a Sonet/SDH network (green boxes) to offer traditional TDM services, e.g. leased lines
- ❖ It can also support IP-oriented services requiring expensive PoS (Packet over Sonet) interfaces on the customer's router (blue box connected via PoS)
- ❖ It can also support Ethernet services requiring “proprietary” boxes to map Ethernet frames into Sonet/SDH frames (orange box connected via EoS)
 - ◆ GFP is a new standard method
 - ◆ X.86 (based on HDLC) is not widely known
- ❖ The RPR network can be deployed as an “overlay network” over the established Sonet/SDH infrastructure (yellow boxes)
 - ◆ RPR boxes are installed only where needed and not in all the existing sites
 - ◆ RPR boxes are connected to the Sonet/SDH network via OC-48/STM-16 links
 - ◆ RPR boxes are interconnected each other by STS-48c-SPE/VC4-16c paths ([Virtual ring](#))
- ❖ RPR Services (Transparent LAN Services or Internet Access) can be offered allowing the customer to use cheap Ethernet interfaces both on Ethernet Switches and on IP Routers (blue and orange boxes)
 - ◆ Ethernet over Sonet can be still used for remote customers

RPR Network Deployment Scenario

Greenfield operator – an example



RPR Network Deployment Scenario

Greenfield operator – 2

- ❖ Starting point: the operator has nothing installed
- ❖ The RPR network can be deployed using both Sonet/SDH and Ethernet (GbE or 10GbE) rings (yellow boxes)
 - ◆ RPR boxes are installed all over the metro area
 - ◆ RPR boxes are physically interconnected each other by OC-48/STM-64 links or by Gigabit Ethernet links
- ❖ RPR Services (Transparent LAN Services or Internet Access) can be offered allowing the customer to use cheap Ethernet interfaces both on Ethernet Switches and on IP Routers (blue and orange boxes)
 - ◆ Ethernet over Sonet can be still used for remote customers
- ❖ Traditional TDM services can also be offered, requiring circuit emulation over RPR (green island)
 - ◆ This functionality can be implemented either in a separated box or integrated into the RPR box (Vendor/operator option)

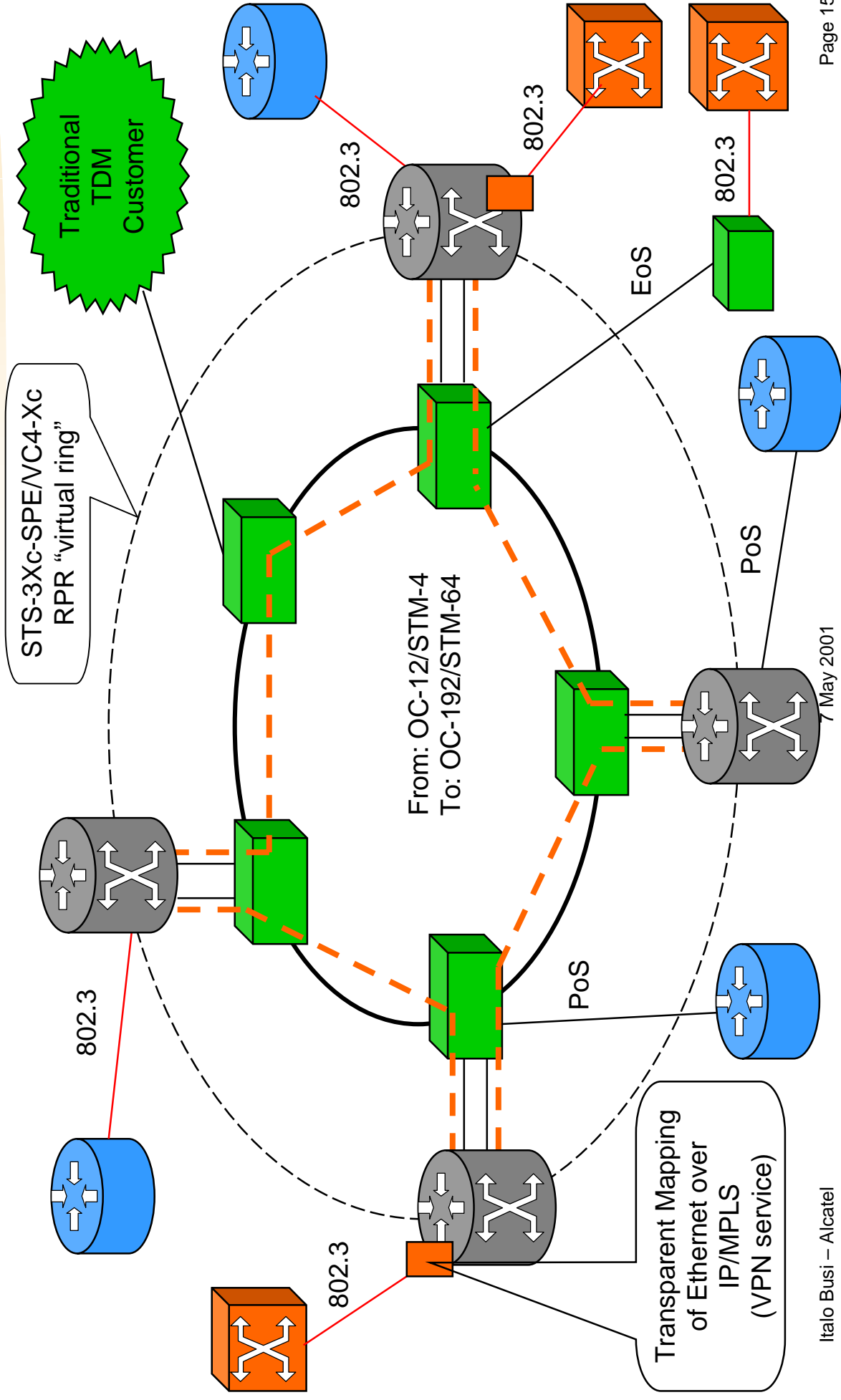


RPR MAC-only Deployment

- ❖ Established operator
- ❖ Greenfield operator

RPR MAC-only Deployment scenario

Established operator – an example



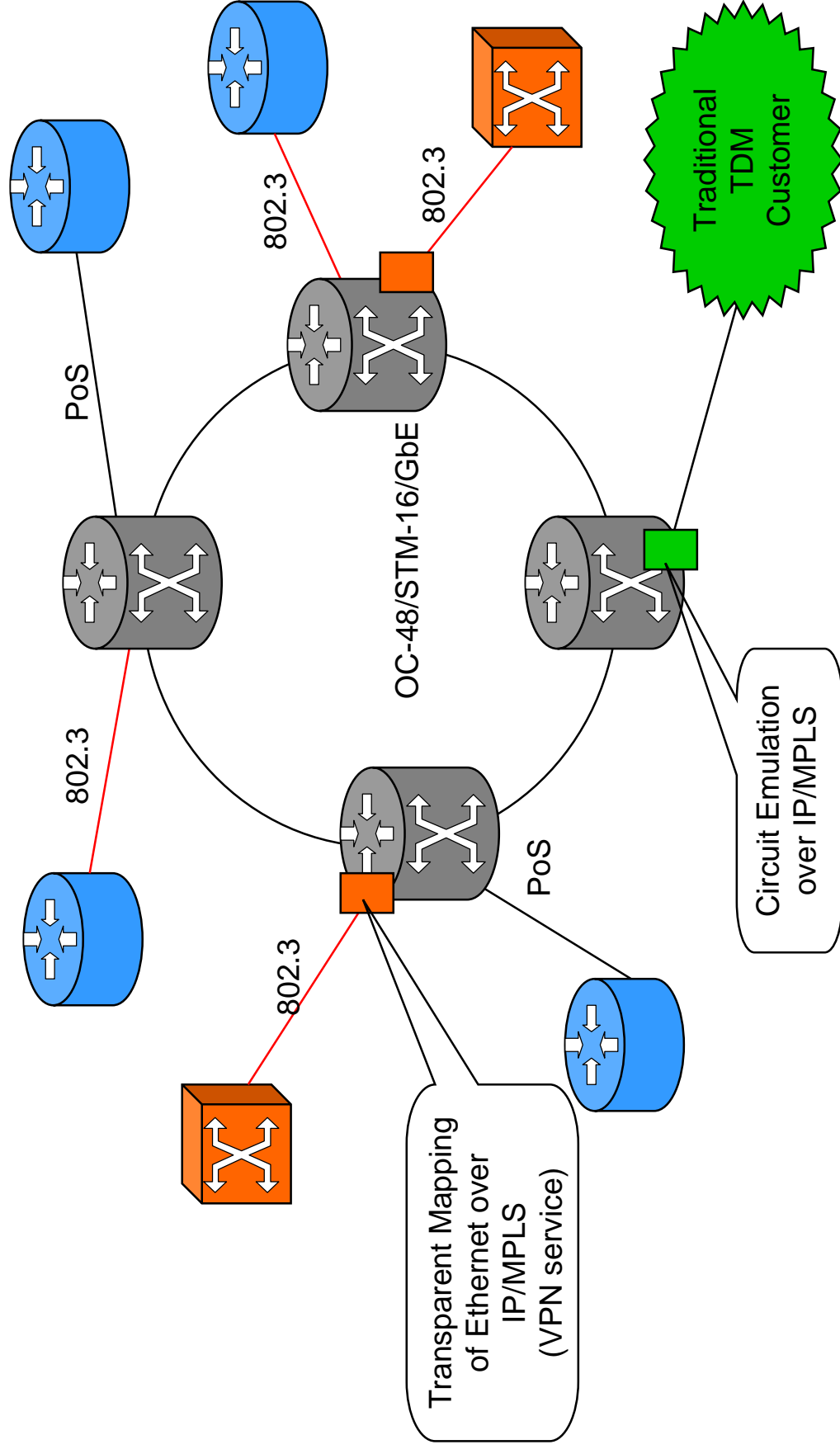
RPR MAC-only Deployment scenario

Established operator – 2

- ❖ Starting point: the operator has already deployed a Sonet/SDH network (green boxes) to offer traditional TDM services, e.g. leased lines
- ❖ It can also support IP-oriented services requiring expensive PoS (Packet over Sonet) interfaces on the customer's router (blue box connected via PoS)
- ❖ It can also support Ethernet services requiring “proprietary” boxes to map Ethernet frames into Sonet/SDH frames (orange box connected via EoS)
- ❖ The IP/MPLS routers with RPR MAC interfaces can be deployed to support an “overlay IP/MPLS network” over the established Sonet/SDH infrastructure (gray boxes)
 - ◆ They are installed where needed and not in all the existing sites
 - ◆ They are connected to the Sonet/SDH network via OC-48/STM-16 links
 - ◆ They are interconnected each other by STS-48c-SPE/VC4-4c paths (**Virtual ring**)
- ❖ Traditional IP/MPLS services (e.g. IP or MPLS VPNs) or Internet Access can be offered allowing the customer using cheap Ethernet interfaces to access the IP network
 - ◆ Expensive PoS accesses are still supported
- ❖ TLS can be offered as upper layer services by mapping Ethernet frames over IP/MPLS
 - ◆ This functionality can be implemented either in a separated box or integrated into the IP/MPLS router (Vendor/operator option)

RPR MAC-only Deployment scenario

Greenfield operator – an example



RPR MAC-only Deployment scenario

Greenfield operator – 2

- ❖ Starting point: the operator has nothing installed
- ❖ The RPR network can be deployed using both Sonet/SDH and Ethernet (GbE or 10GbE) rings to interconnect IP/MPLS routers (gray boxes)
 - ◆ IP/MPLS routers are installed all over the metro area
 - ◆ IP/MPLS routers are physically interconnected each other by OC-48/STM-64 links or by Gigabit Ethernet links
- ❖ Traditional IP/MPLS services (e.g. IP or MPLS VPNs) or Internet Access can be offered allowing the customer to use cheap Ethernet interfaces to access the IP network
 - ◆ All the possible interfaces normally supported by IP routers (e.g. Pos) are still supported
- ❖ TLS can be offered as upper layer services by mapping Ethernet frames over IP/MPLS
- ❖ Traditional TDM services can also be offered, requiring circuit emulation over IP/MPLS (green island)
 - ◆ These functionality can be implemented either in a separated box or integrated into the IP/MPLS router (Vendor/operator option)



Conclusions

RPR Deployment Requirements

Conclusions



- ❖ There are different environments in which RPR functionalities can be useful
 - ◆ Not all the possible scenarios have been analyzed, but only a subset of them
- ❖ Focusing on one or more scenarios is a vendor and operator decision
 - ◆ This can help both operators and vendors to differentiate themselves
- ❖ IEEE 802.17 standard should be open to all of them in order to be widely accepted and implemented
 - ◆ Any proposal should work in all the scenarios and not only in some of them
 - ◆ The MAC should be payload agnostic – mapping any upper layers over RPR
 - ◆ The mapping of upper layers is outside the scope of IEEE 802.17
 - ◆ The RPR switching capabilities, for the RPR network scenarios, should be defined in IEEE 802.17

RPR Deployment Requirements


Conclusions – 2

- ❖ Support of standard-compliant (ITU-T G.707 and others) Sonet/SDH ring interfaces
 - ◆ Proposed rates ranging from OC-3/STM-1 up to OC-192/STM-64
- ❖ Support of standard-compliant (IEEE 802.3) Gigabit and 10-Gigabit Ethernet PHY ring interfaces
- ❖ RPR frames should be mapped in the SPE/VC
 - ◆ It will be possible, if needed, to connect the RPR boxes through a standard TDM network
- ❖ Services can be provided both at the RPR layer (RPR network) or at any upper layer
 - ◆ Both Ethernet and EoS (Ethernet over Sonet) add/drop tributaries should be supported when an RPR service is offered (“**RPR network**” scenario)
 - ◆ Every kind of possible interfaces should be supported when an upper layer service is offered (“**RPR MAC-only**” scenario), according to the upper layer in use
- ❖ Circuit emulation over RPR (or upper layers) should be supported for the Greenfield scenario



RPR Deployment Requirements

Questions and Answers



Thank you!