

# RPR Service Analysis

Orlando IEEE 802.17 meeting - May 2001

Italo Busi



- ❖ Introduction
- ❖ Transparent LAN Services
  - ◆ Virtual Ethernet Leased Lines
  - ◆ Virtual Ethernet Distributed Switch
- ❖ Internet Access Services
  - ◆ Virtual Ethernet Leased Lines
  - ◆ Virtual Ethernet Distributed Switch
- ❖ Conclusions

# Introduction

# RPR Service Analysis

## Scope and Introduction



- ❖ Analyze some service scenarios to figure out how services can be offered by different operators – it focuses **only** on Transparent LAN Services and

### Internet Access

- ◆ No difference between physical and virtual rings – out of scope of this presentation
- ◆ Ring interconnection issues out of scope of this presentation – focus only on a single ring for simplicity of explanation

- ❖ Operators can setup RPR services in different ways (different scenarios)
  - ◆ **RPR network** – to offer services at the 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

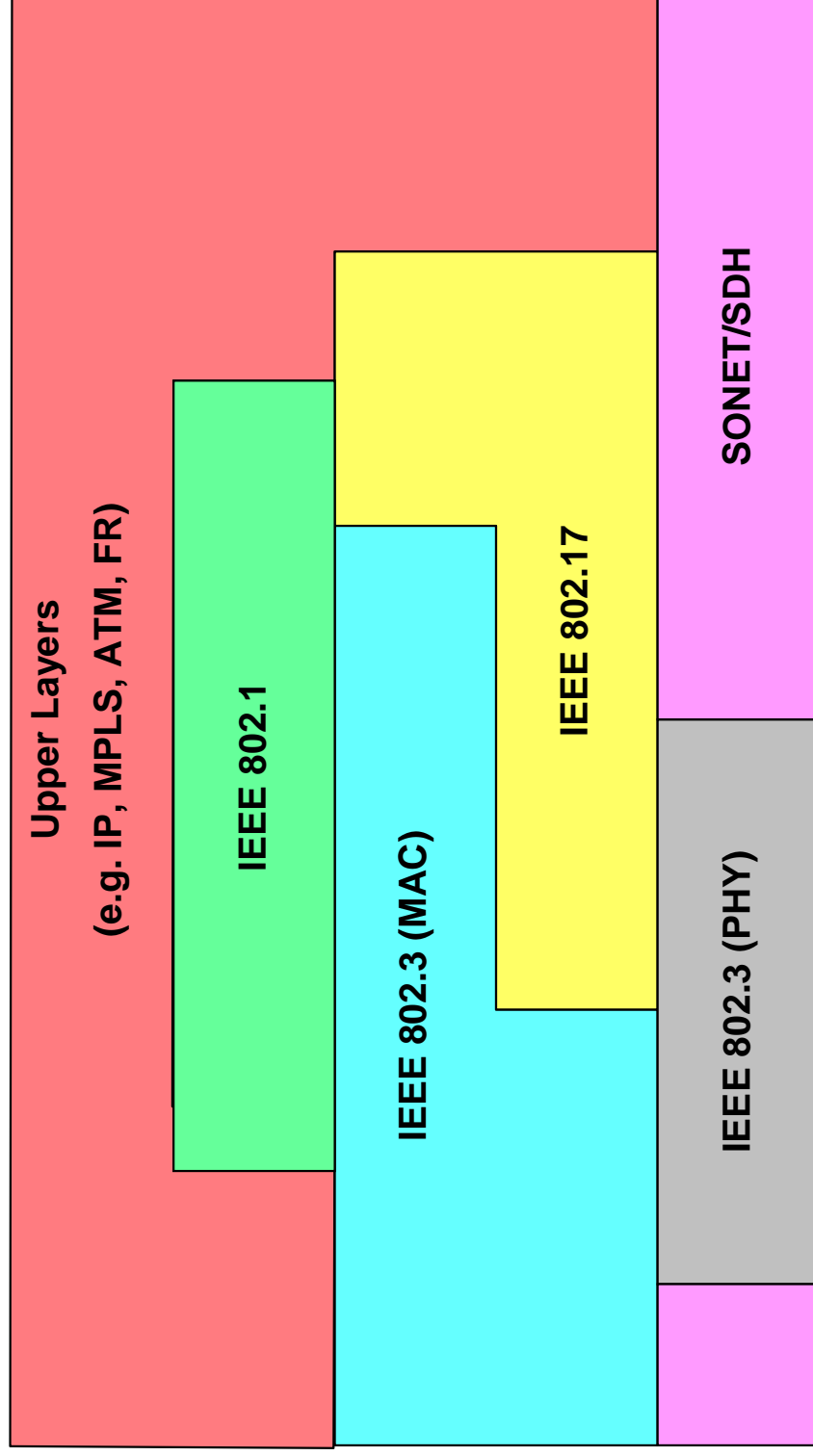
## RPR Service Analysis

### Scope and Introduction – 2



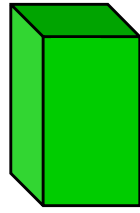
- ❖ Operators can offer different kinds of services
  - ◆ Virtual Ethernet Leased Line – point-to-point interconnections of Ethernet access points
  - ◆ Virtual Ethernet Distributed Switch – multipoint-to-multipoint interconnections of Ethernet access points
- ❖ Different vendors and operators can target different service scenarios
- ❖ **This analysis is not intended to cover all the possible scenarios but only a subset of them**

# RPR Positioning Layered Overview

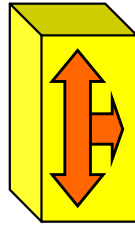




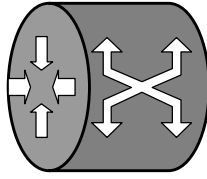
## Symbols Legend



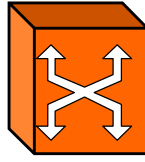
Sonet/SDH Box (e.g. ADM or DXC) – It can also be a WDM/OTN equipment



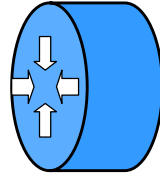
RPR Switch Box, belonging to the Operator



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

# Transparent LAN Services

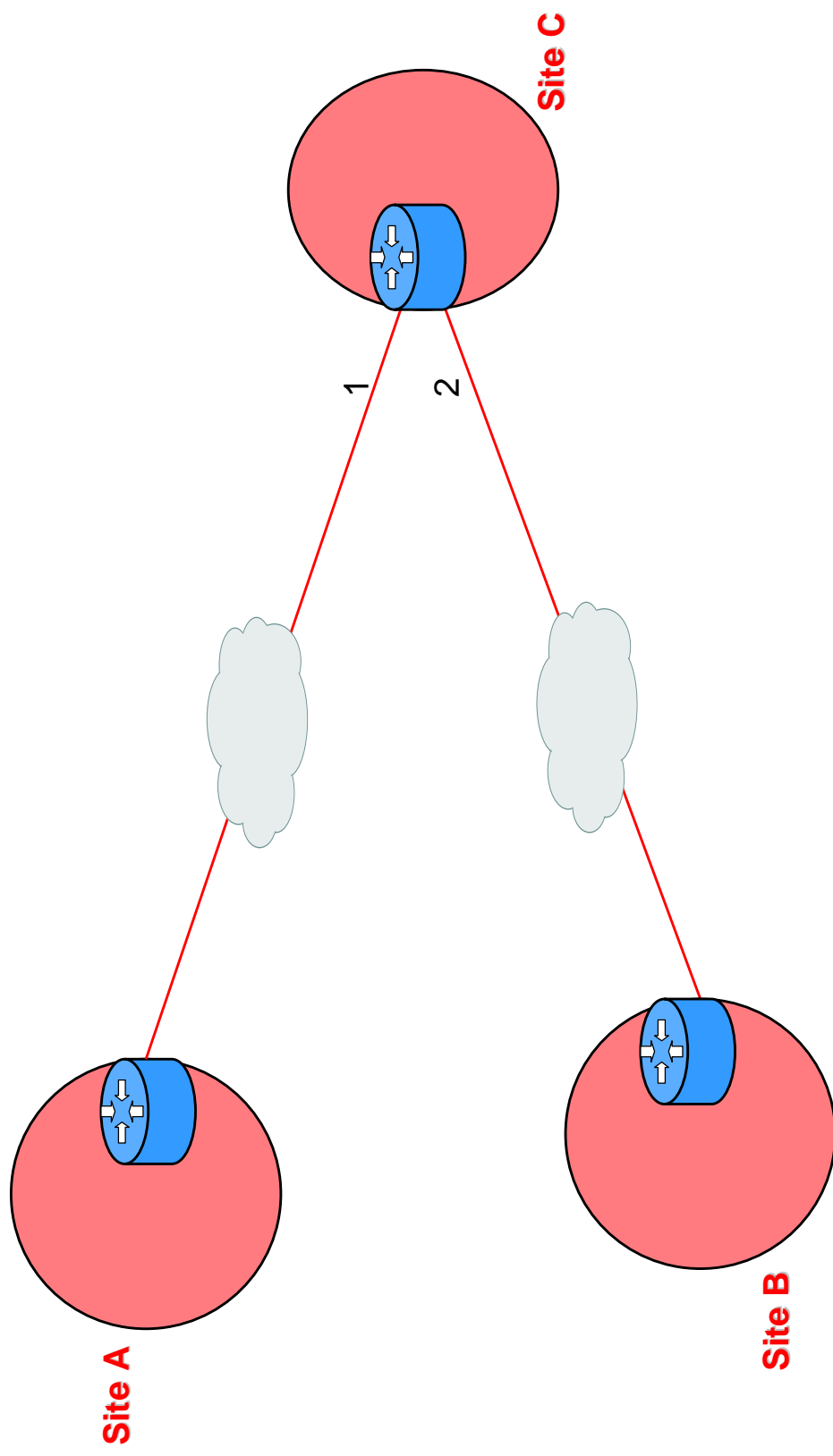
- ❖ Virtual Ethernet Leased Lines
- ❖ Virtual Ethernet Distributed Switch





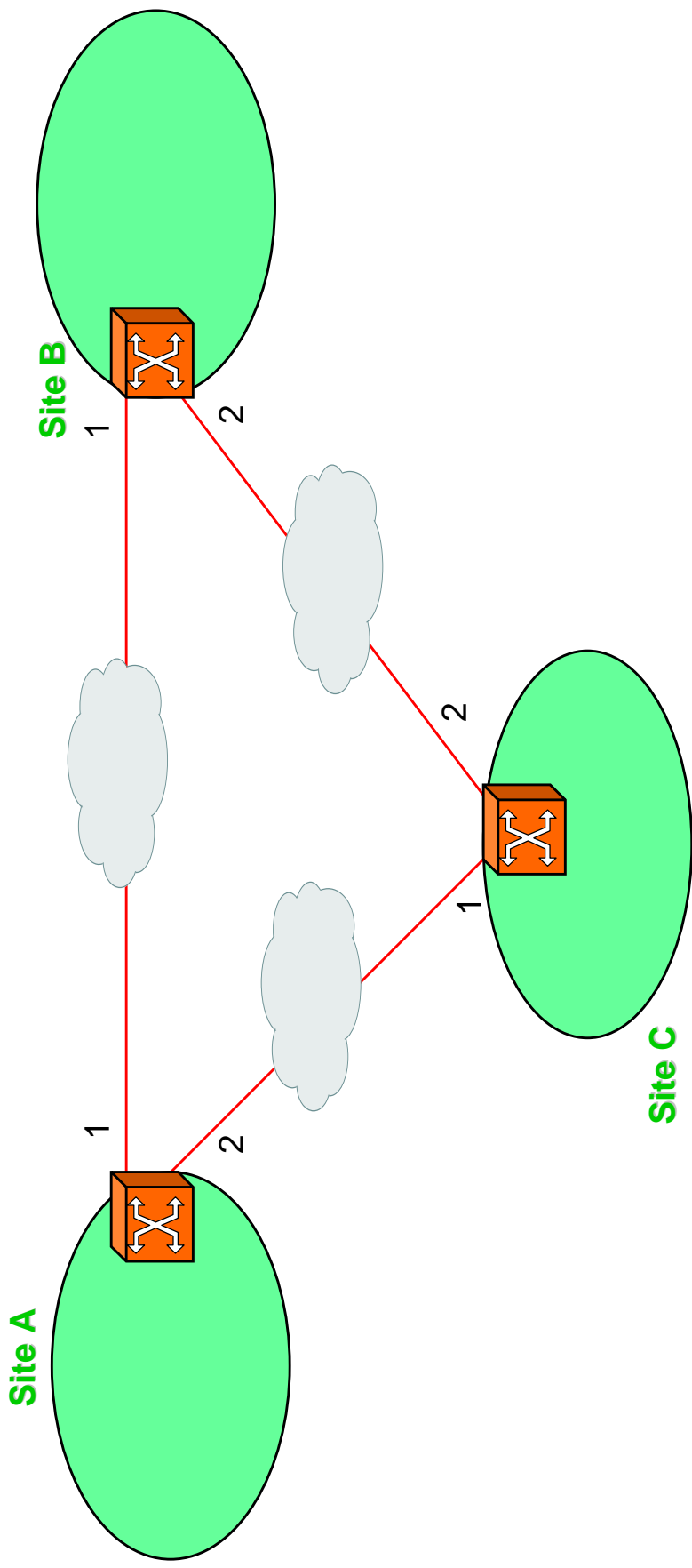
- ❖ The same MAN network is used to offer services to different customers
- ❖ Customers can be attached to the MAN using a L3 router or a L2 switch as CPE
  - ◆ The CPEs are connected via point-to-point lines (802.3 segments)
- ❖ The customer network can have an hub or a meshed topology
- ❖ Two cases are shown as examples
  - ◆ One customer using L3 routers are CPEs connected in a hub topology
  - ◆ Another customer using L2 switches as CPEs connected in a mesh topology

# Virtual Ethernet Leased Lines Customer's network views – Red customer

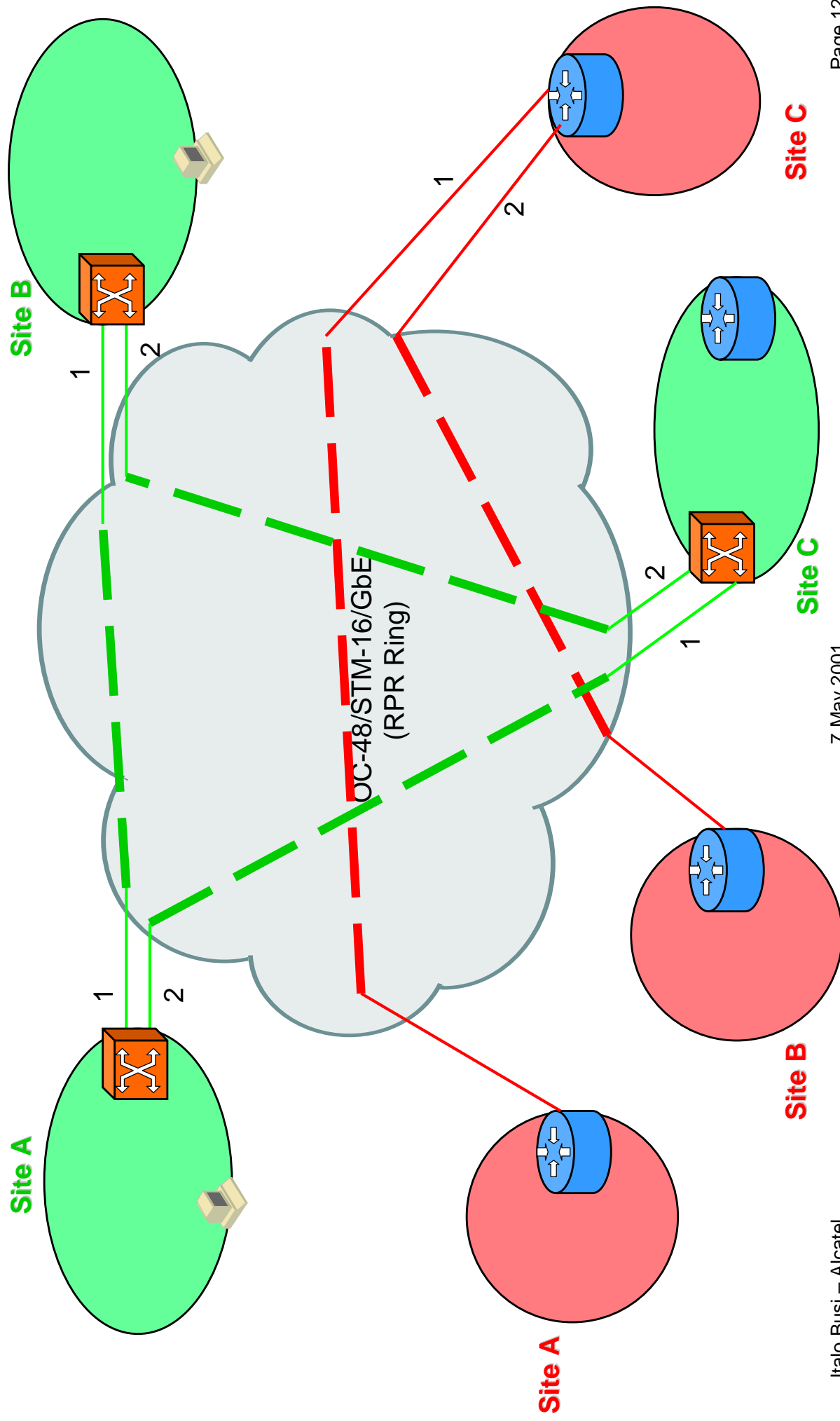


# Virtual Ethernet Leased Lines

## Customer's network views – Green customer



# Transparent LAN Services Virtual Ethernet Leased Lines – an example



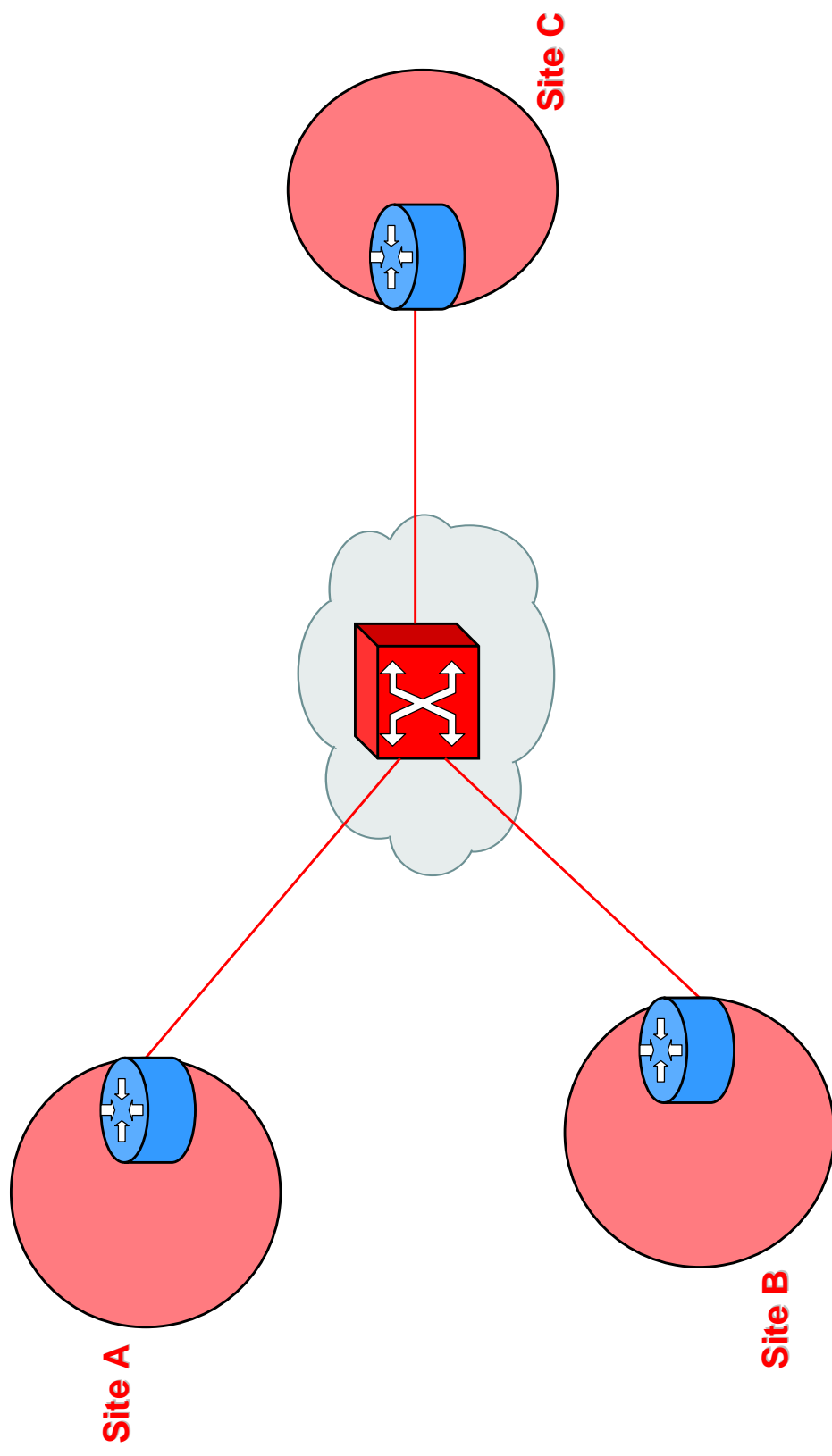
## Transparent LAN Services Virtual Ethernet Leased Lines – 2

- ❖ Starting point: the operator has deployed a MAN network using an RPR ring
- ❖ One customer (called “**red customer**”) has three remote sites with three L3 (e.g. IP) routers, that he wants to interconnect using an IEEE 802.3 interfaces in an hub way
- ❖ Every router has one (the spokes) or two (the hub) 802.3 interfaces
  - ◆ All the interfaces are connected to the operator’s network
  - ◆ The operator’s network establishes two virtual leased line between the involved interfaces
- ❖ Another customer (called “**green customer**”) has three sites with three L2 switches, that he wants to interconnect using IEEE 802.3 interfaces
- ❖ Every switch has two 802.3 interfaces: one for each remote switch.
  - ◆ All these interfaces are connected to the RPR network
  - ◆ The RPR network establishes three virtual leased lines between these interfaces
- ❖ The RPR ring can interconnect
  - ◆ RPR switches (RPR network scenario)
  - ◆ IP routers or Ethernet switches (RPR MAC-only scenario)

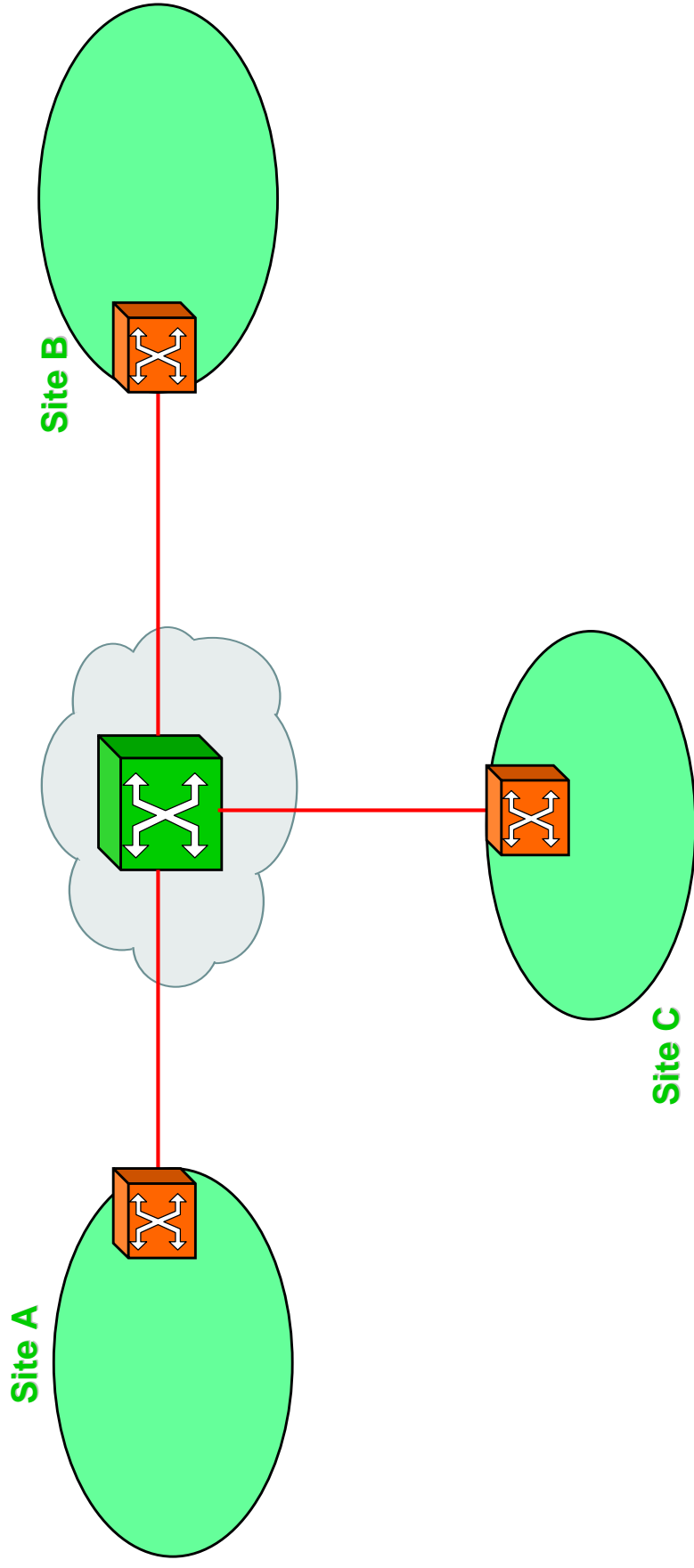


- ❖ The same MAN network is used to offer services to different customers
- ❖ Customers can be attached to the MAN using a L3 router or a L2 switch as CPE
  - ◆ The CPEs are connected via a virtual Ethernet Switch
- ❖ Two cases are shown as examples
  - ◆ One customer using L3 routers are CPEs
  - ◆ Another customer using L2 switches as CPEs

# Virtual Ethernet Distributed Switch Customer's network views – Red customer

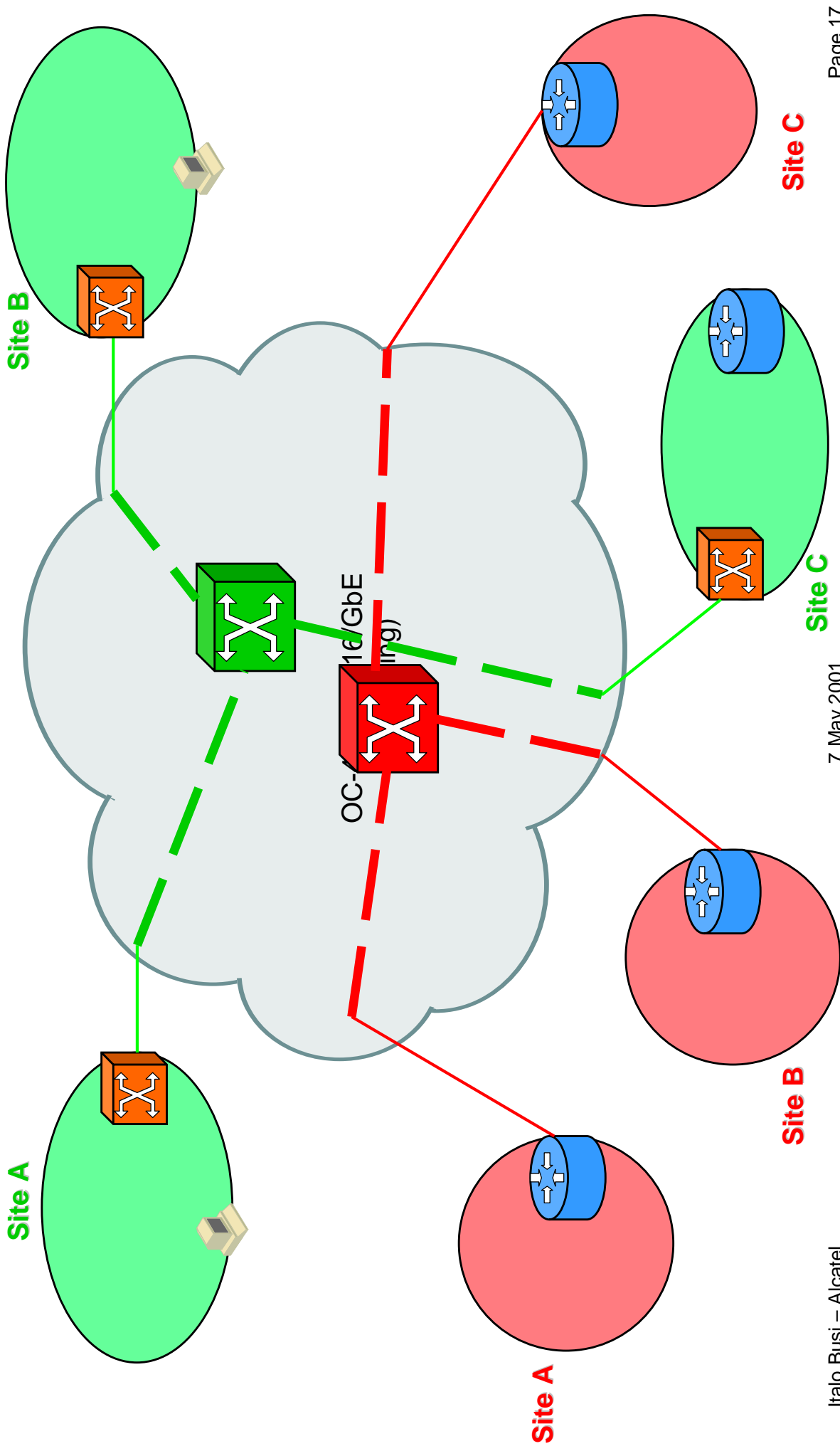


# Virtual Ethernet Distributed Switch Customer's network views – Green customer





# Transparent LAN Services Virtual Ethernet Distributed Switch – an example



## Transparent LAN Services Virtual Ethernet Distributed Switch – 2

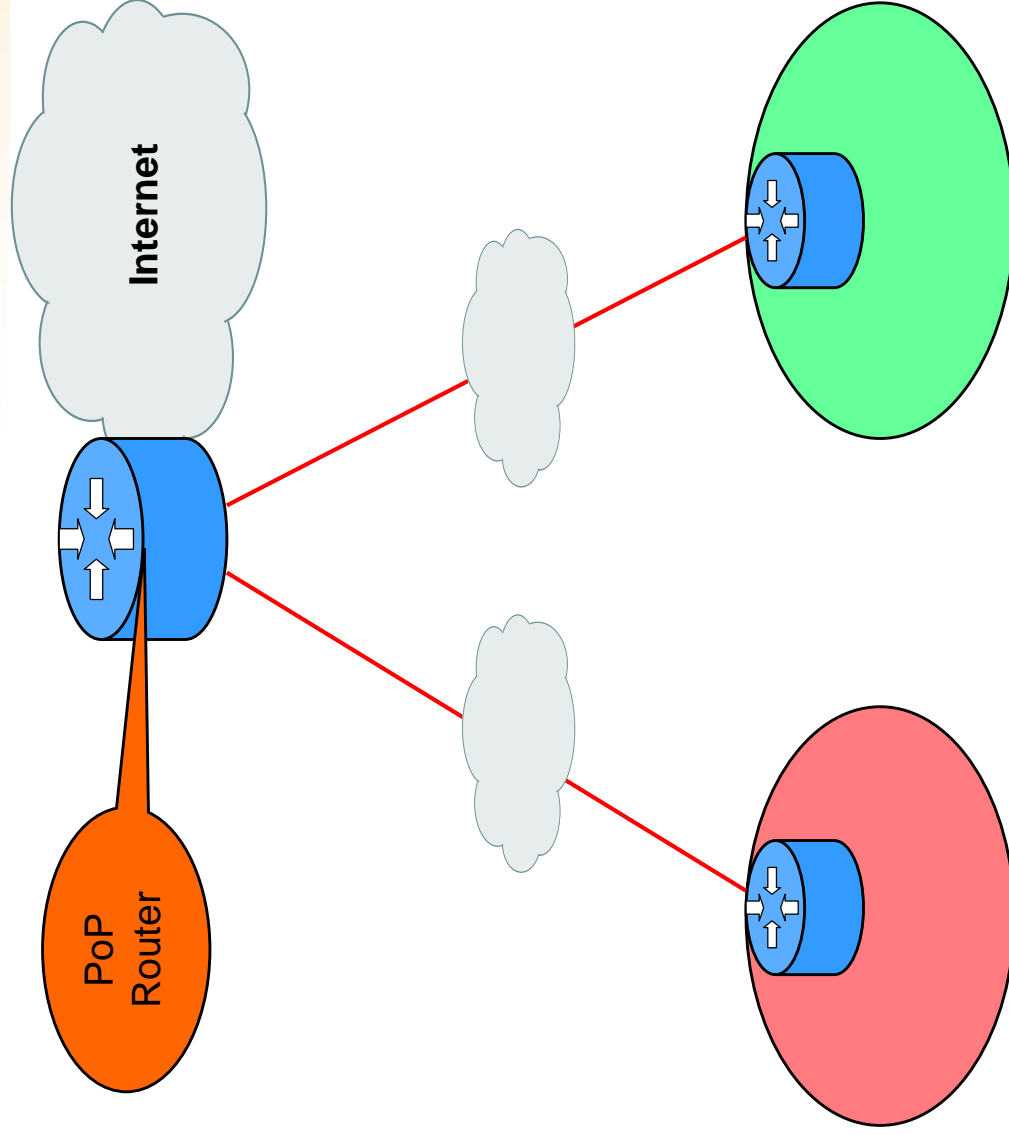


- ❖ Starting point: the operator has deployed a MAN network using an RPR ring
- ❖ One customer (called “**red customer**”) has three remote sites with three L3 (e.g. IP) routers, that he wants to interconnect using an IEEE 802.3 network
- ❖ Every router has one 802.3 interface
  - ◆ All the interfaces are connected to the operator’s network
  - ◆ The operator’s network allows the three router to speak each other as if they are connected to an Ethernet switch inside the customer network
- ❖ Another customer (called “**green customer**”) has three sites with three L2 switches
- ❖ Every switch has one 802.3 interface
  - ◆ All the interfaces are connected to the operator’s network
  - ◆ The operator’s network works like an Ethernet switch inside the customer network
- ❖ The RPR ring can interconnect
  - ◆ RPR switches (RPR network scenario)
  - ◆ IP routers or Ethernet switches (RPR MAC-only scenario)

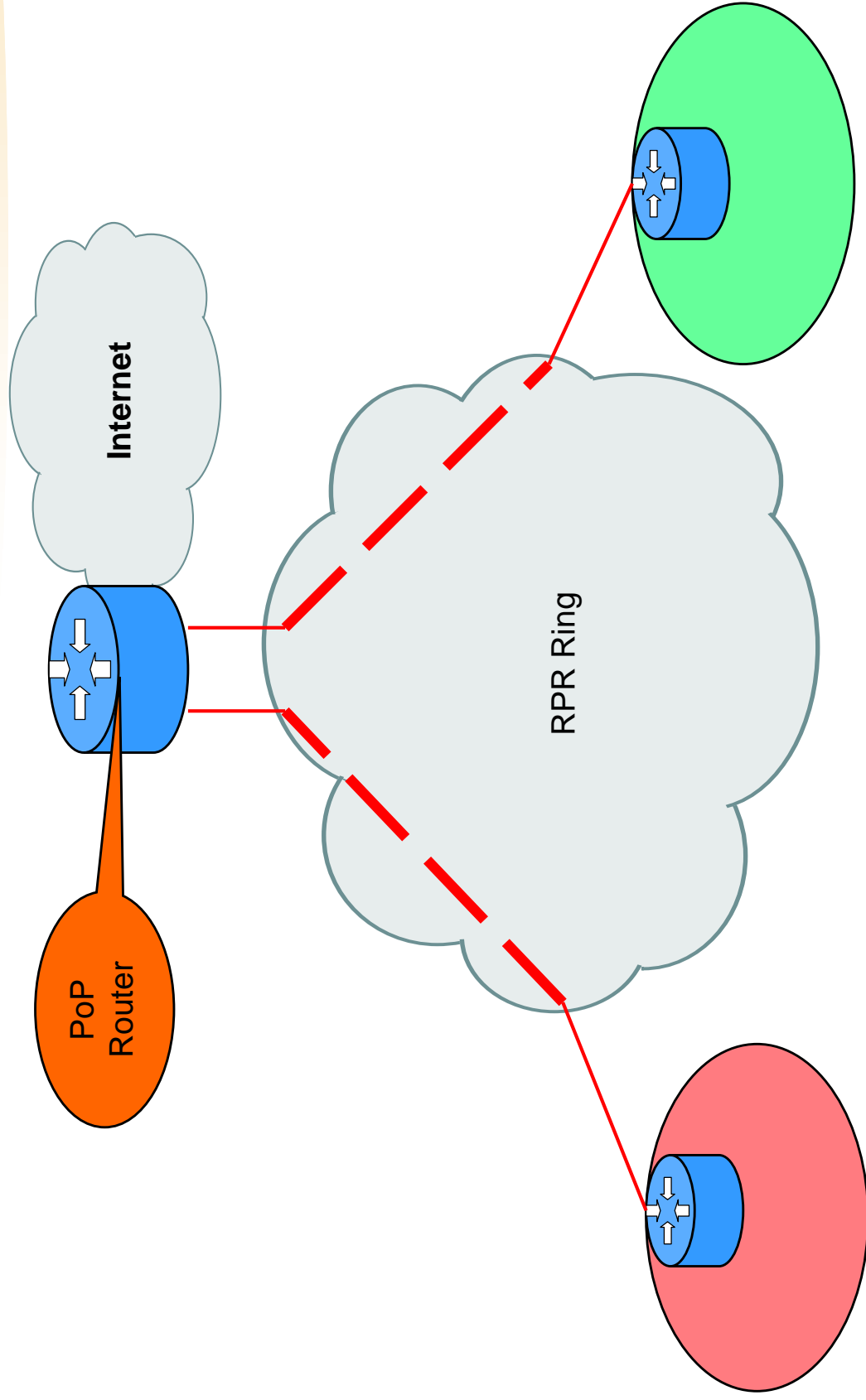
# Internet Access Services

- ❖ Virtual Ethernet Leased Lines
- ❖ Virtual Ethernet Distributed Switch

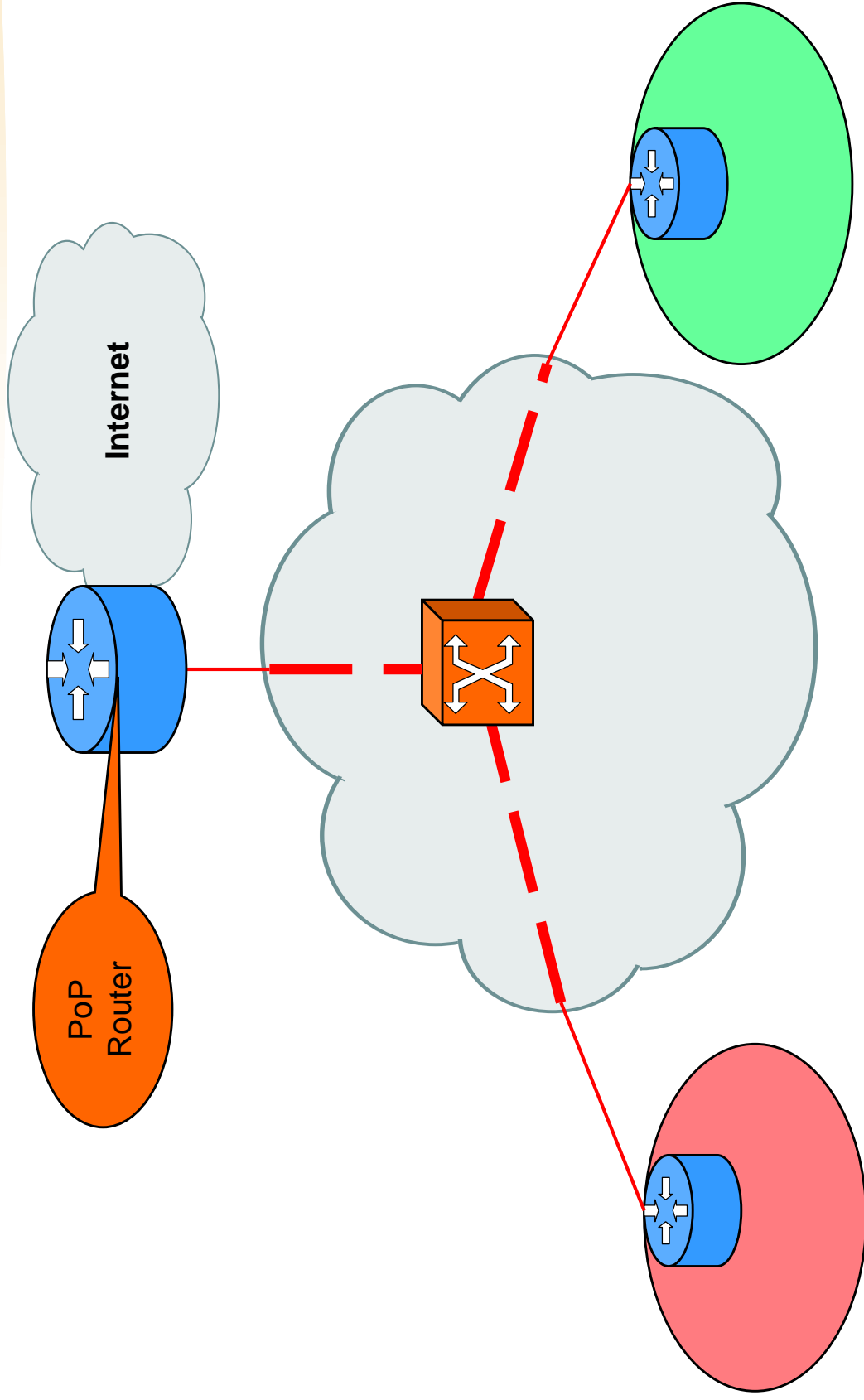
# Internet Access Service Logical View



# Internet Access Service Virtual Ethernet Leased Lines



# Internet Access Service Virtual Ethernet Distributed Switch





ALCATEL



# Requirements and Conclusions

## RPR Service Analysis

### Transparent LAN Services – Requirements



- ❖ Per leased-line traffic separation is required
  - ◆ Traffic sent to one virtual leased line should not be delivered to a different leased line (even if it belongs to the same customer)
- ❖ Per distributed switch traffic separation is required
  - ◆ Traffic sent to one virtual distributed switch should not be delivered to a different distributed switch (even if it belongs to the same customer)
- ❖ The distributed switch “should” optionally inter-work with the customer’s switches (e.g. for the Ethernet Spanning Tree Protocol)
  - ◆ This is mandatory only if the customer’s CPEs are Ethernet switches



## RPR Service Analysis

### Internet Access Services – Requirements



- ❖ Per customer traffic separation is required
  - ◆ The traffic generated by one customer cannot be delivered to a different one
- ❖ Leased-line approach
  - ◆ One leased line and one interface on the PoP router for each customer
  - ◆ Per customer traffic separation can be guaranteed by the per leased-line traffic separation
- ❖ Distributed switch approach
  - ◆ One distributed switch and one interface on the PoP router for all the customers
  - ◆ Per customer traffic separation can be guaranteed by supporting the VLAN tagging in the virtual Ethernet distributed switch

## RPR Service Analysis Conclusions



- ❖ Services can be offered in the RPR Layer or in a Upper Layer that uses the RPR MAC to optimize the packet transport over the MAN ring
  - ◆ Targeting either the RPR network scenario or the RPR MAC-only scenario is a vendor/operator decision
- ❖ The IEEE 802.17 group should define an RPR MAC Layer open to all the possible scenarios
- ❖ The IEEE 802.17 group should define an RPR Service layer to be used in the RPR network scenario
  - ◆ In the RPR MAC-only scenario the services are offered in the Upper Layer and then their standardization is outside the scope of IEEE 802.17

## RPR Service Analysis

### Conclusions – 2



- ❖ The RPR Service Layer should support two kind of services
  - ◆ Virtual Ethernet leased lines
  - ◆ Virtual Ethernet distributed switch
- ❖ The previous requirements affects
  - ◆ RPR Service Layer (in the **RPR network** scenario) – in the scope of IEEE 802.17
  - ◆ Upper Layers (in the **RPR MAC-only** scenario) – out of scope for IEEE 802.17

# RPR Service Analysis

## Questions and Answers

# Thank You!