



**Reliance
Infocomm**

Do's and Don't's of Building a Large Metro Ethernet Network

Feb 2004

Service Offering – Triple Play Services

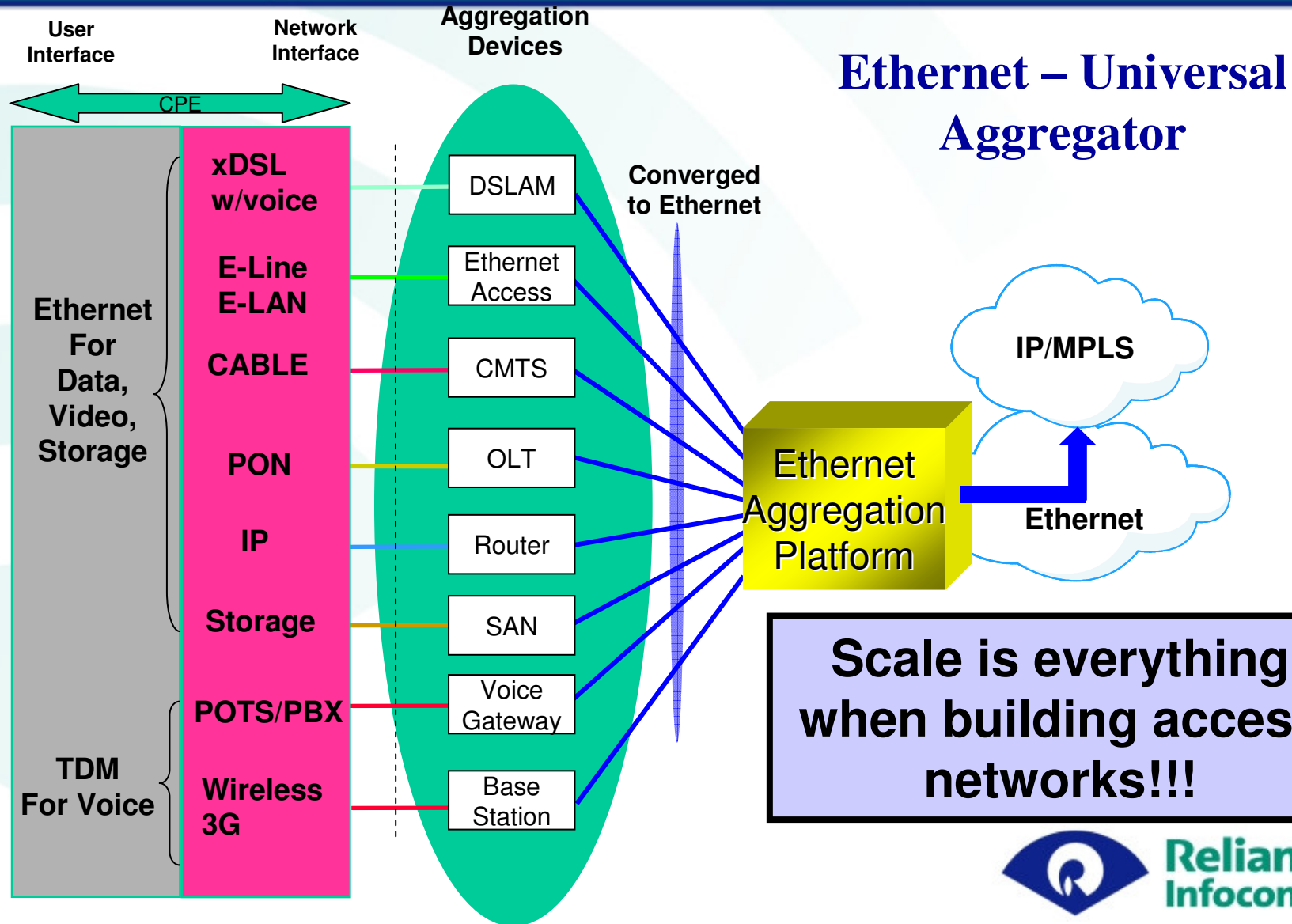
Addressing Requirements for both the Residential and Corporate Markets

- **Data**
 - **Layer 2 VPNs**
 - Ethernet Leased Lines (P2P)
 - Hub and Spoke Connectivity (P2MP)
 - Mesh or TLS (MP2MP)
 - **Layer 3 VPNs**
 - 2547 VPNs
 - **Internet Access**
 - Direct Internet Access
 - Transient Internet Access
- **Voice**
 - VoIP
 - IP Centrex
- **Video**
 - Video Broadcast/Near Video on Demand
 - Video on Demand/Pay Per View
 - Video Conferencing
 - Video Telephony

**Integrated Access ??
What is the First Mile Enabler ??**



Architectural Choices – Why Ethernet ?



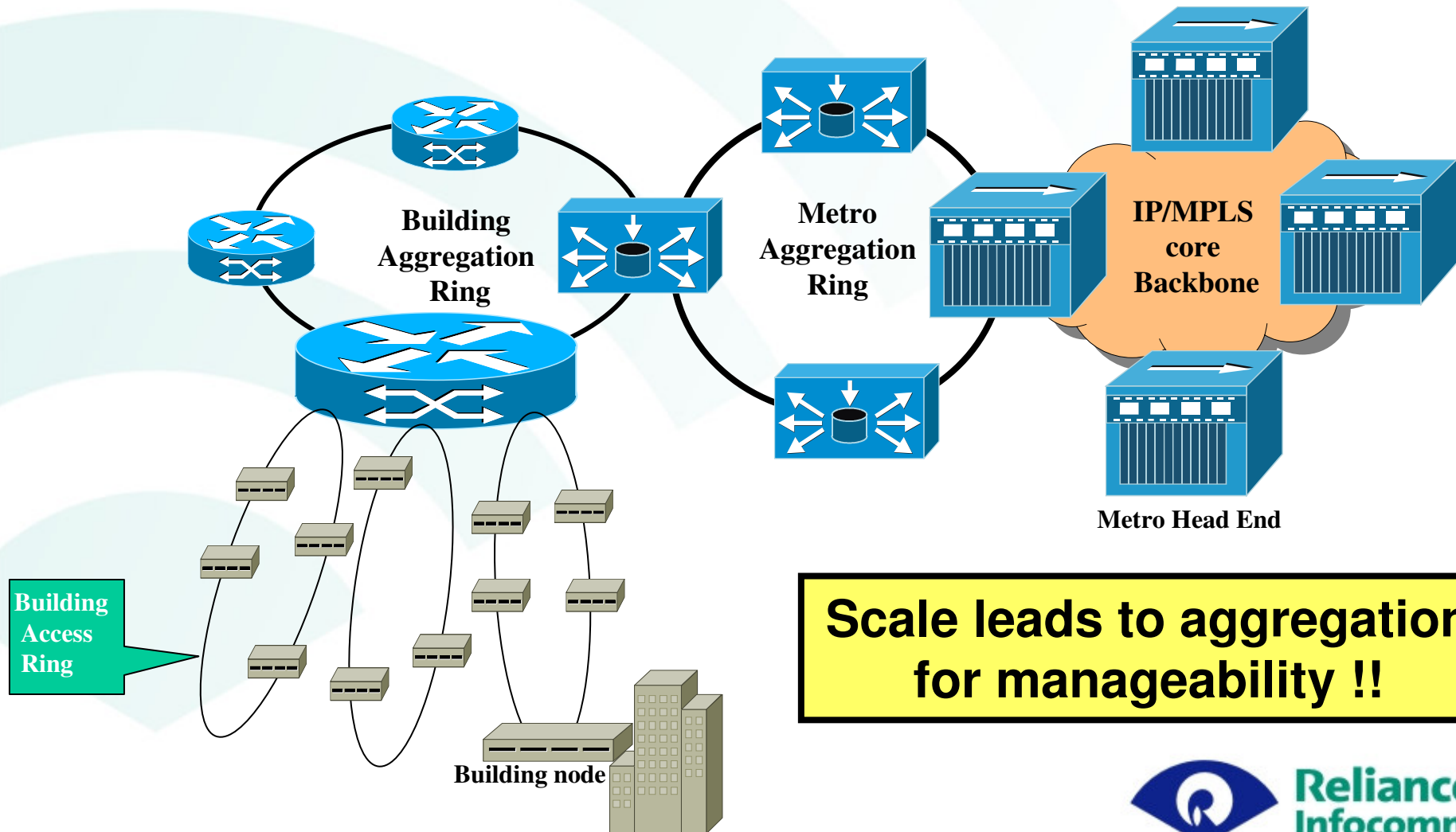
Architectural Choices

Optical Ethernet vs. Routed/Switched Ethernet for the Metro

- **Optical Ethernet World**
 - Ethernet as Service
 - TDM as transport
 - **Maps Ethernet 10/100/1000 ports into some SDH/SONET hierarchy**
 - Utilizes the underlying transport infrastructure
 - Loses the cost advantage provided by Ethernet by exposing it to costly TDM transport
 - Loses the statistical multiplexing gains as the mapping is fixed to SDH granularity
 - **Simpler since there are no complex routing/switching protocols**
- **Routed/Switched Ethernet**
 - Ethernet as Service and Transport
 - **Easier to implement in greenfield operators**
 - Start off with Ethernet based transport
 - More cost efficient and bandwidth efficient
 - **Lot more statistical multiplexing of user bandwidth can be in bandwidth chunks that have nothing to TDM transport**
 - More like ATM networks

Architectural Choices

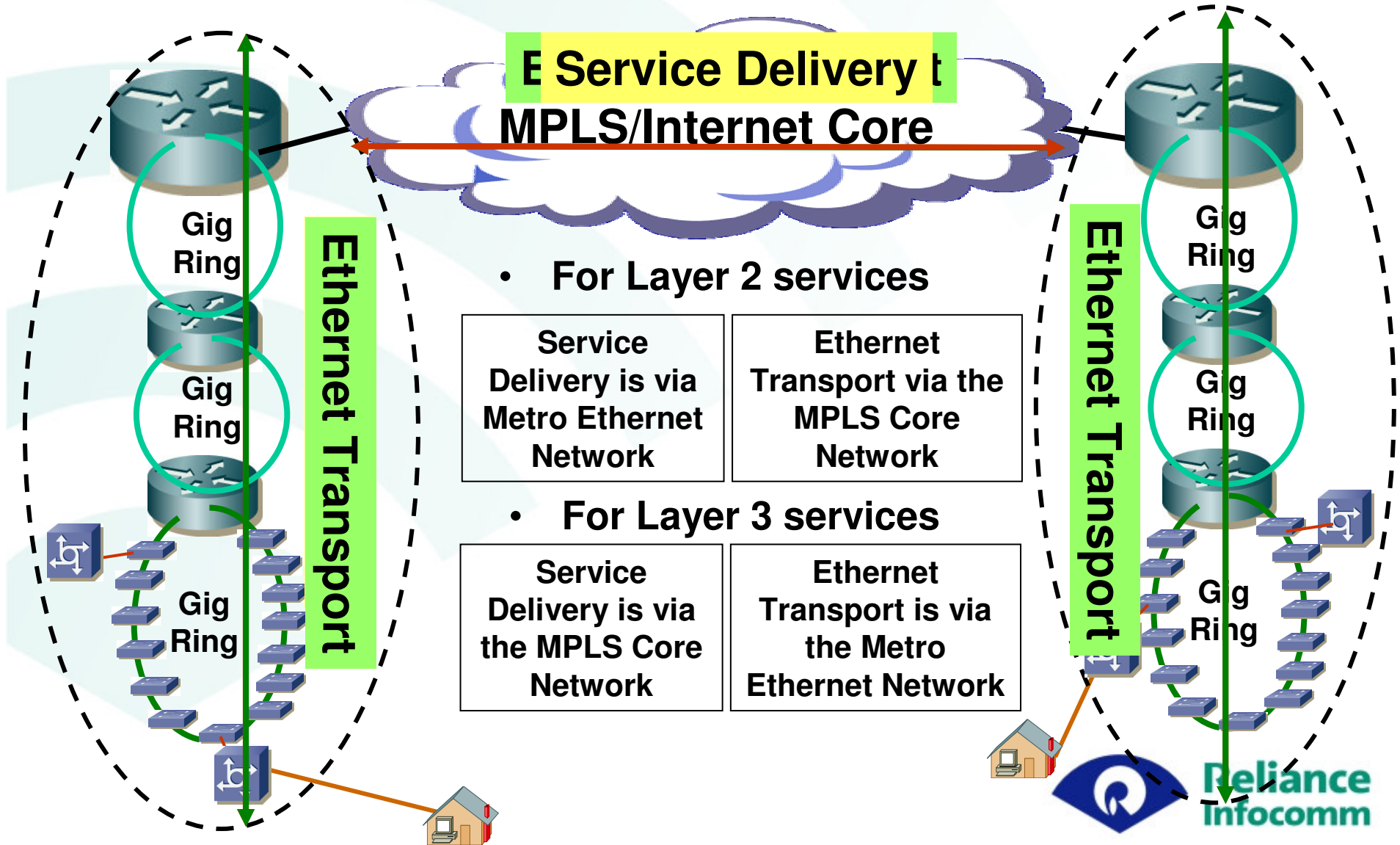
An Architecture Ensuring Service Adaptability & Reliability



**Scale leads to aggregation
for manageability !!**



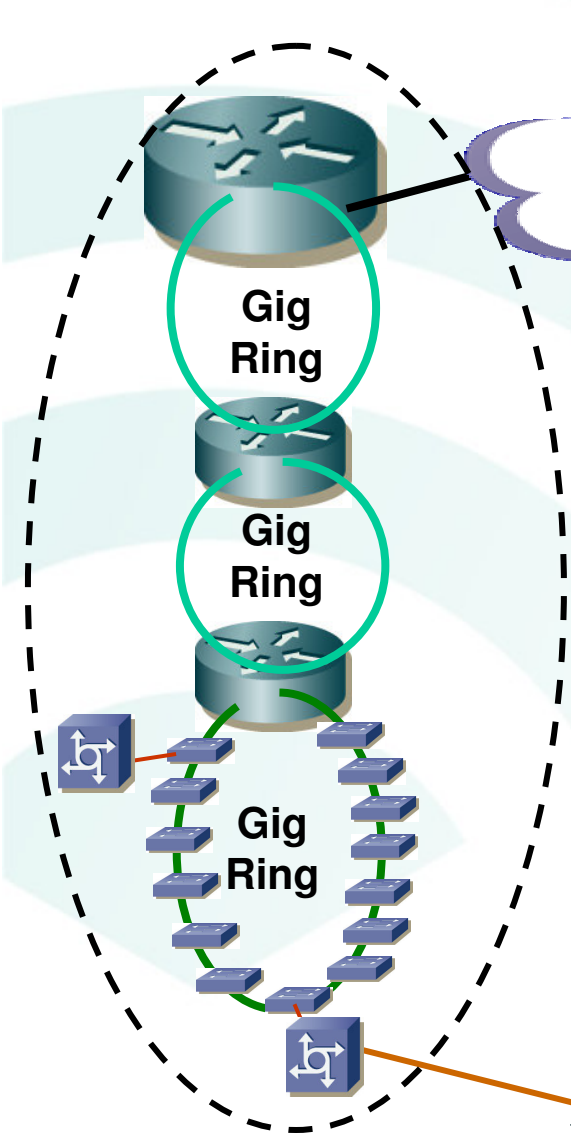
Keep a clear separation between layers



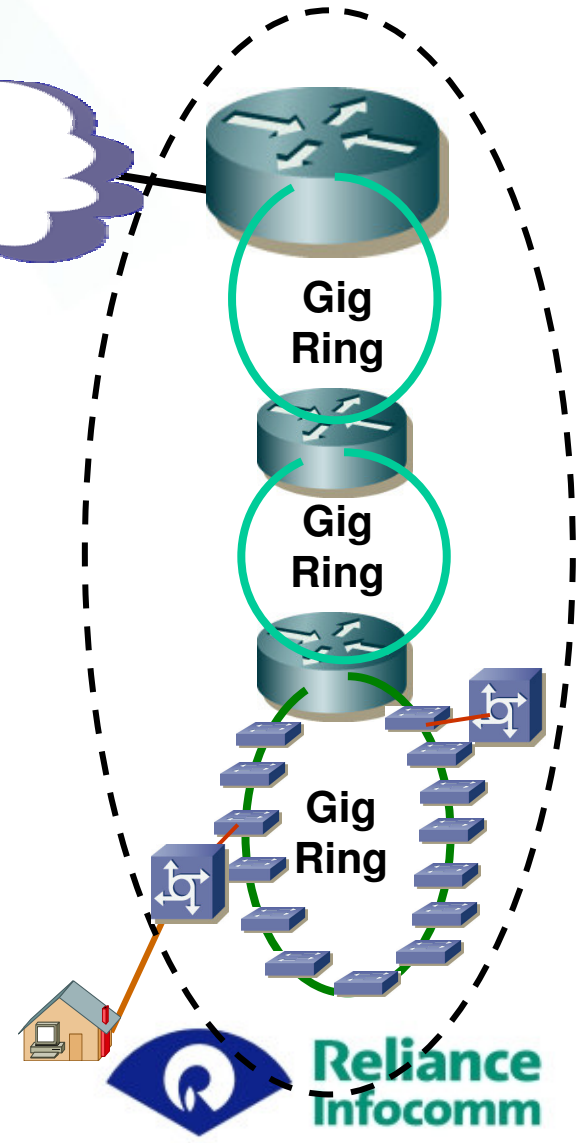


Keep a clear separation between layers

Why ???????

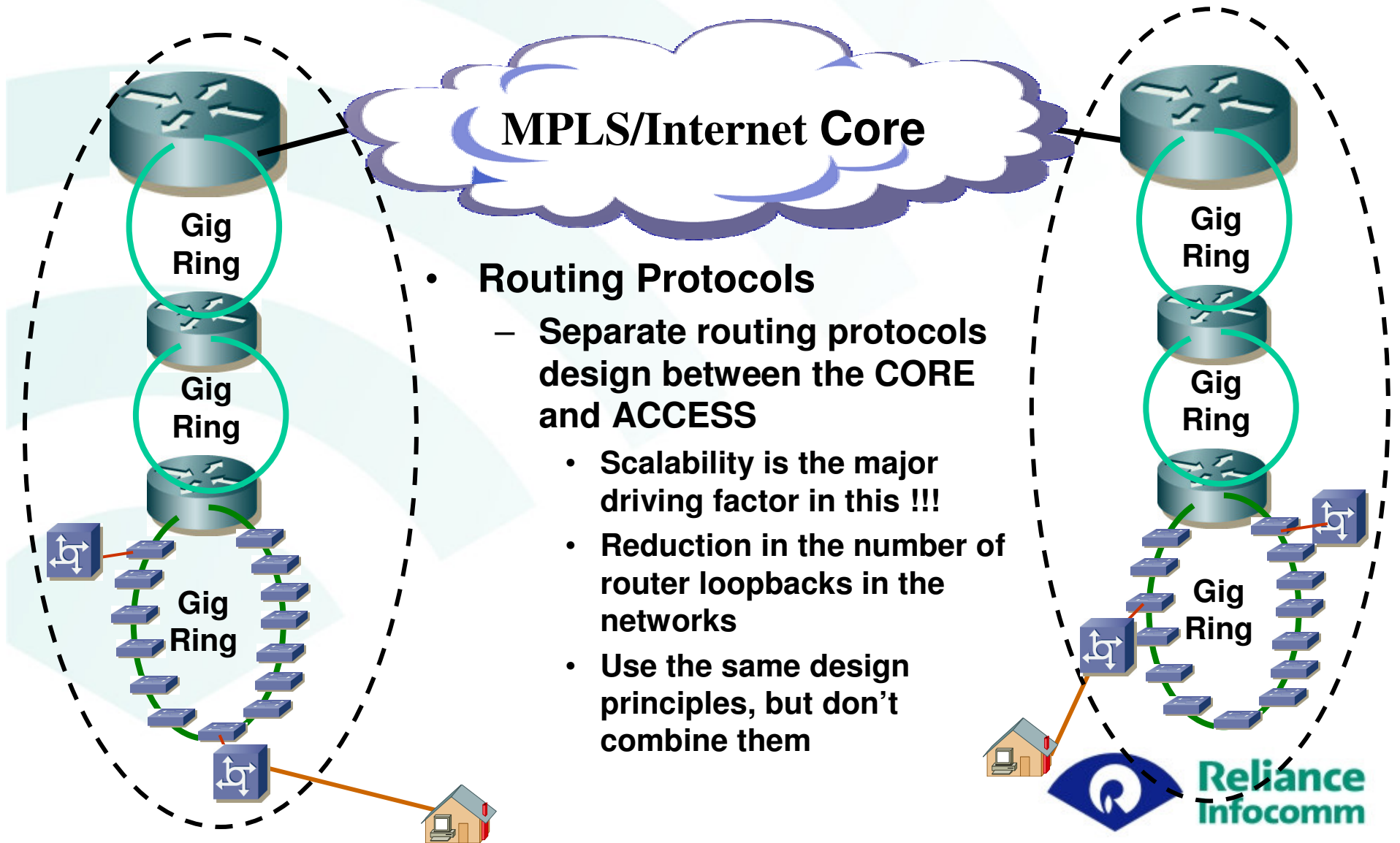


- **Clearer service and network interconnects**
- **Clearer planning and engineering**
 - Easier Addressing and protocols design
- **Clearer operations and administrative domains**
 - Easier Provisioning
 - Easier Operation and Maintenance



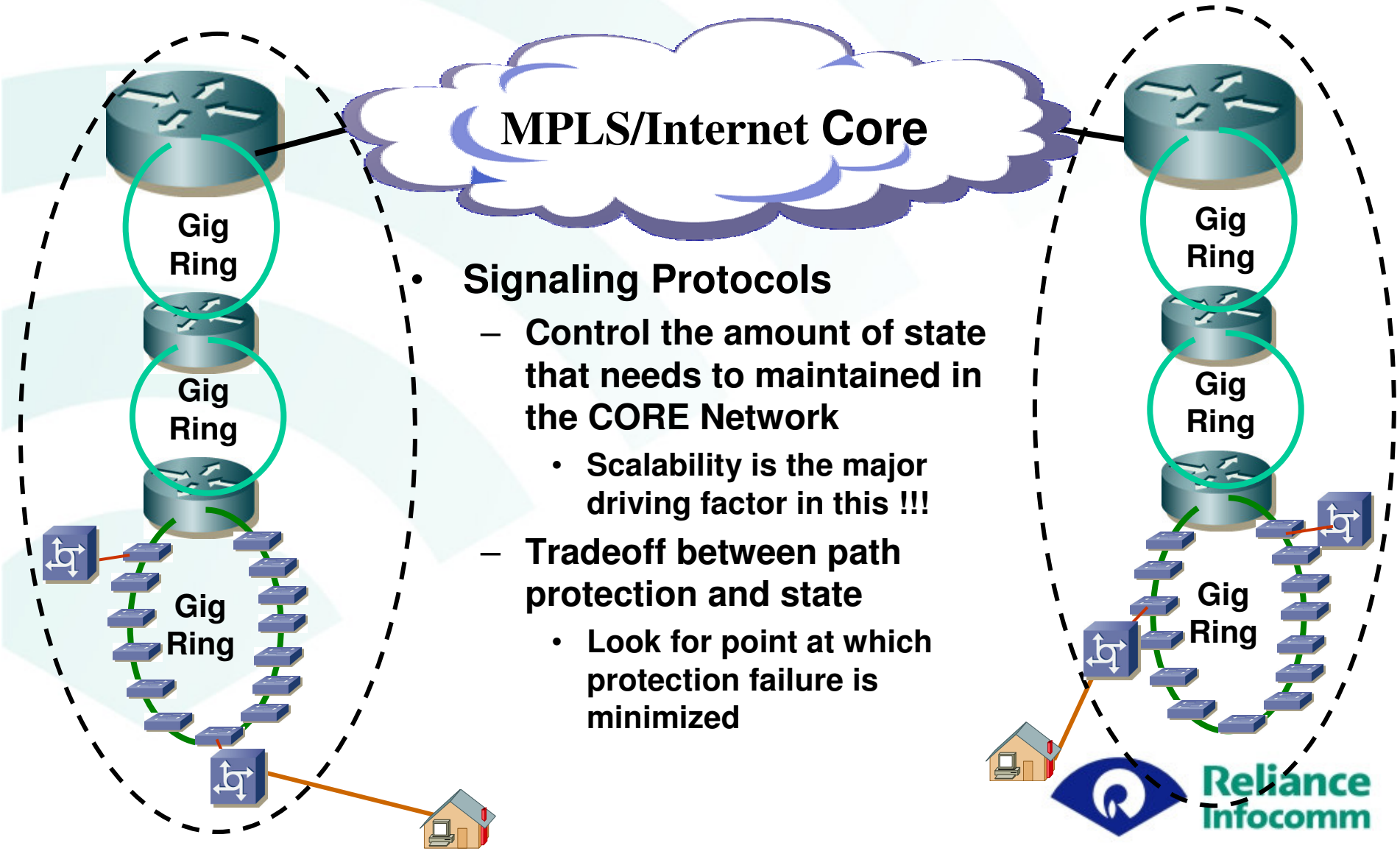


Have a design with protocol scaling Metro Ethernet is a Numbers Game !!!!!





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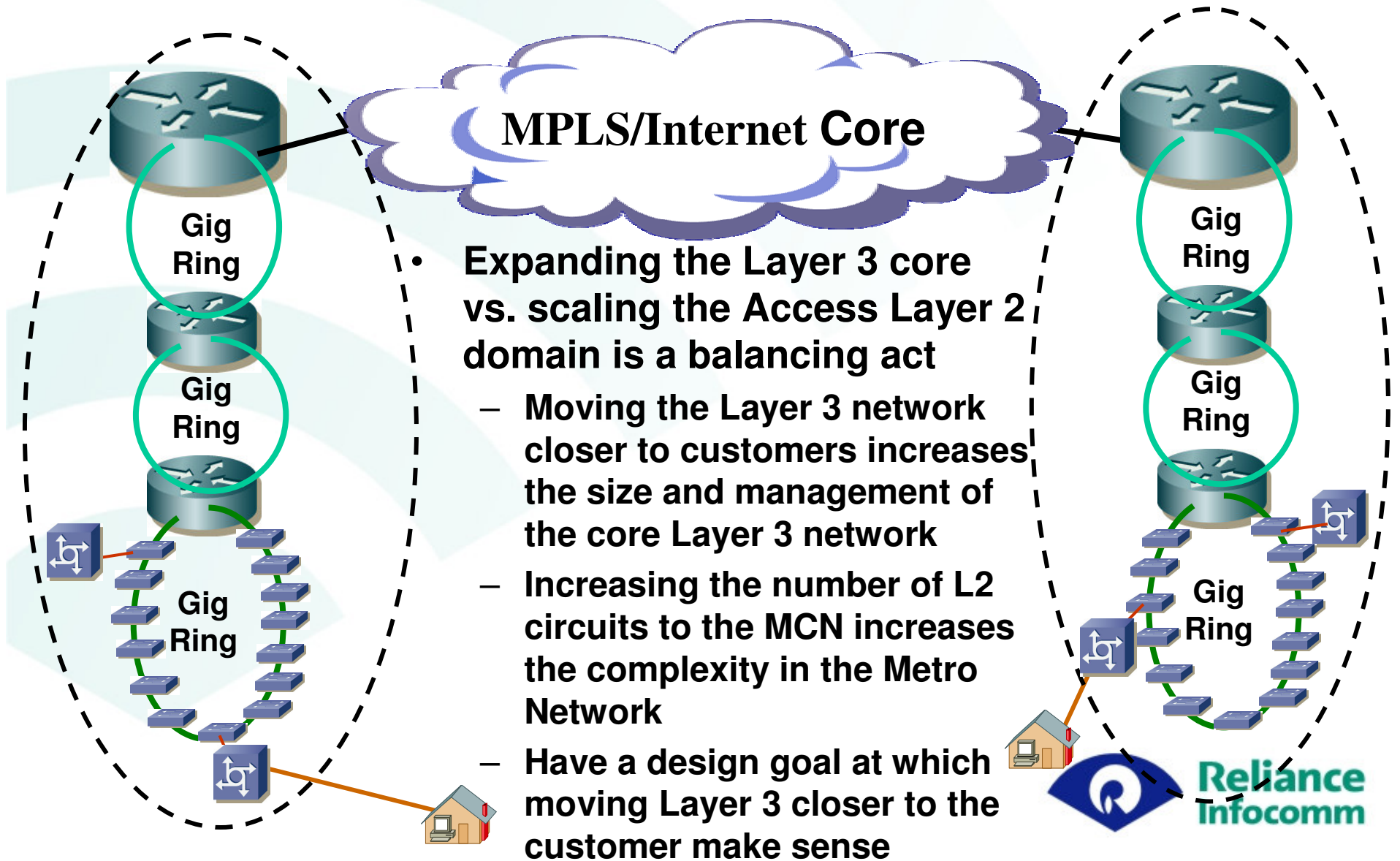


MPLS/Internet Core

- **Signaling Protocols**
 - Control the amount of state that needs to be maintained in the CORE Network
 - Scalability is the major driving factor in this !!!
 - Tradeoff between path protection and state
 - Look for point at which protection failure is minimized



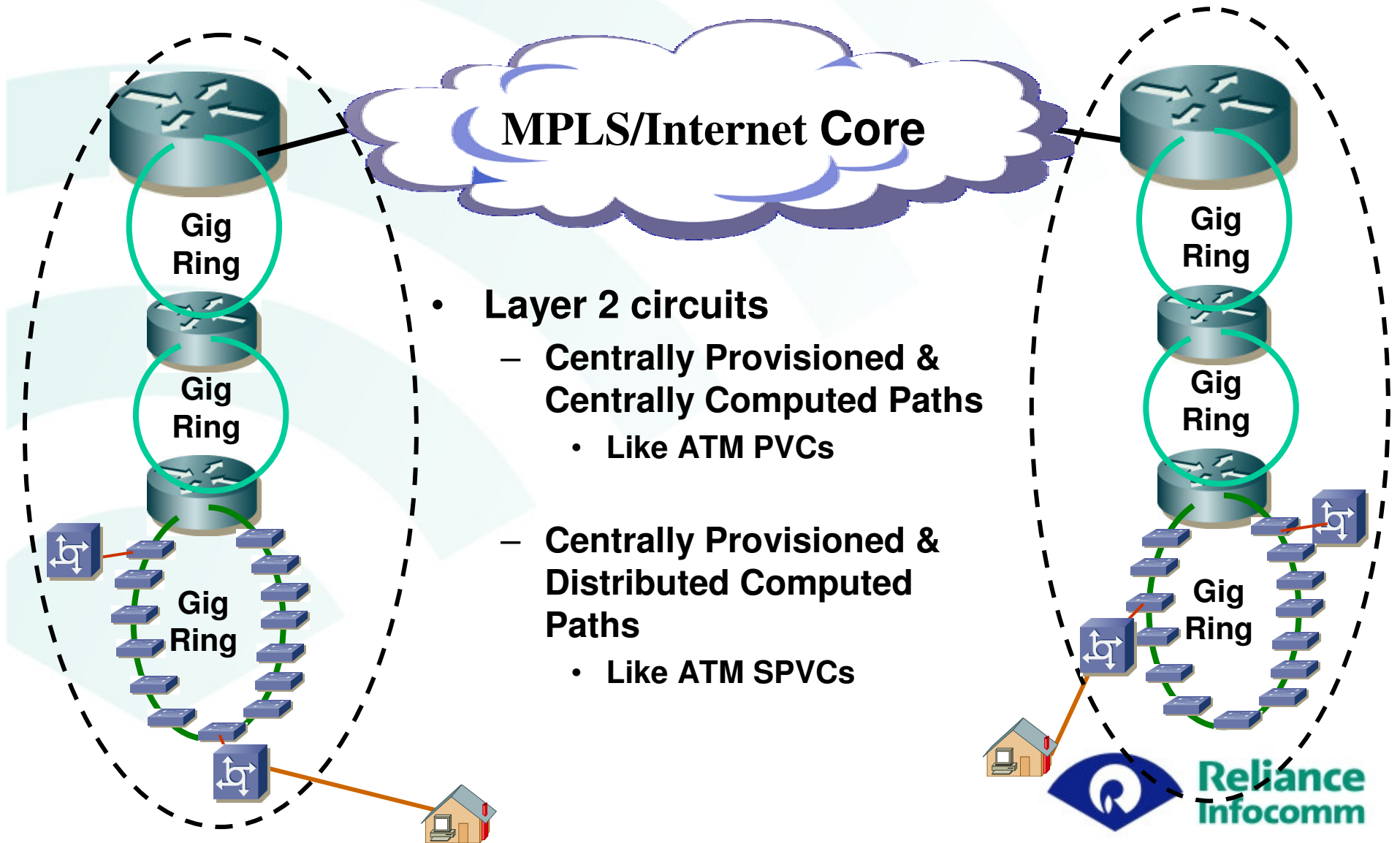
Have a design with user scaling Metro Ethernet is a Numbers Game !!!!!





Centralize the Service Creation

Metro Ethernet is Number Game !!!!



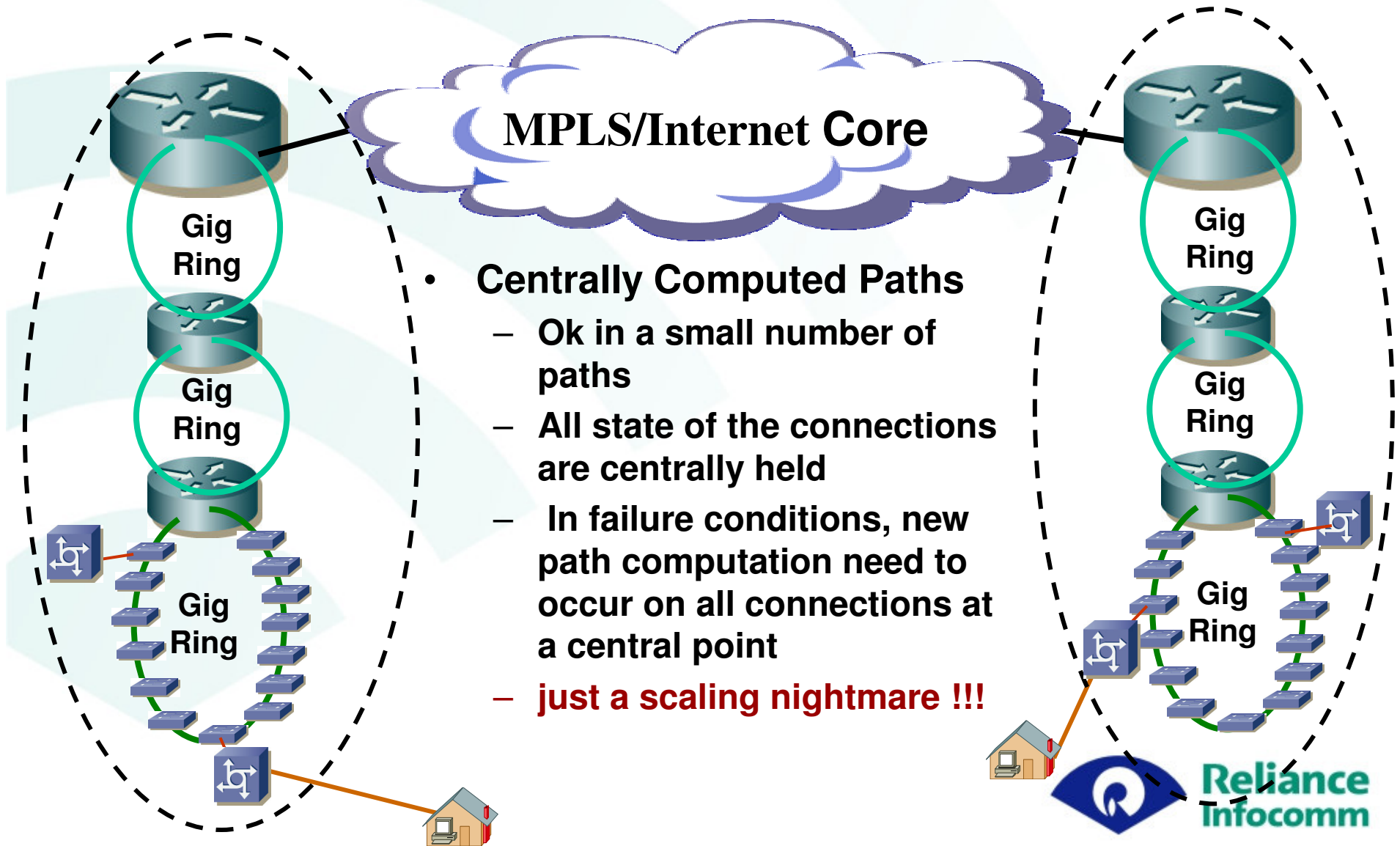


Centralize the Service Creation

Why is this bad !!

MPLS/Internet Core

- **Centrally Computed Paths**
 - Ok in a small number of paths
 - All state of the connections are centrally held
 - In failure conditions, new path computation need to occur on all connections at a central point
 - **just a scaling nightmare !!!**



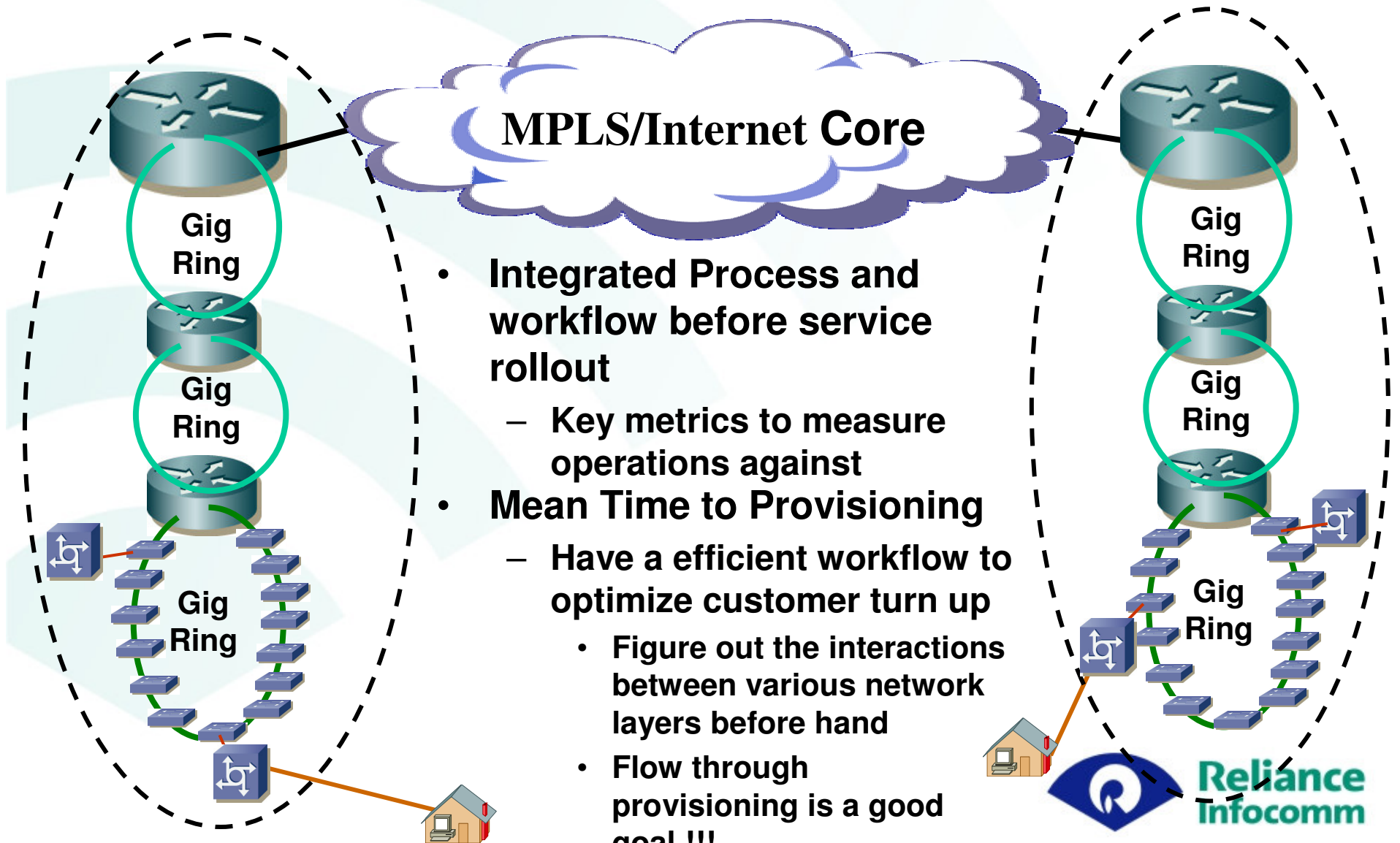


Forget about NMS/OSS/BSS Integration

Service Fulfillment Time

MPLS/Internet Core

- **Integrated Process and workflow before service rollout**
 - Key metrics to measure operations against
- **Mean Time to Provisioning**
 - Have a efficient workflow to optimize customer turn up
 - Figure out the interactions between various network layers before hand
 - Flow through provisioning is a good goal !!!





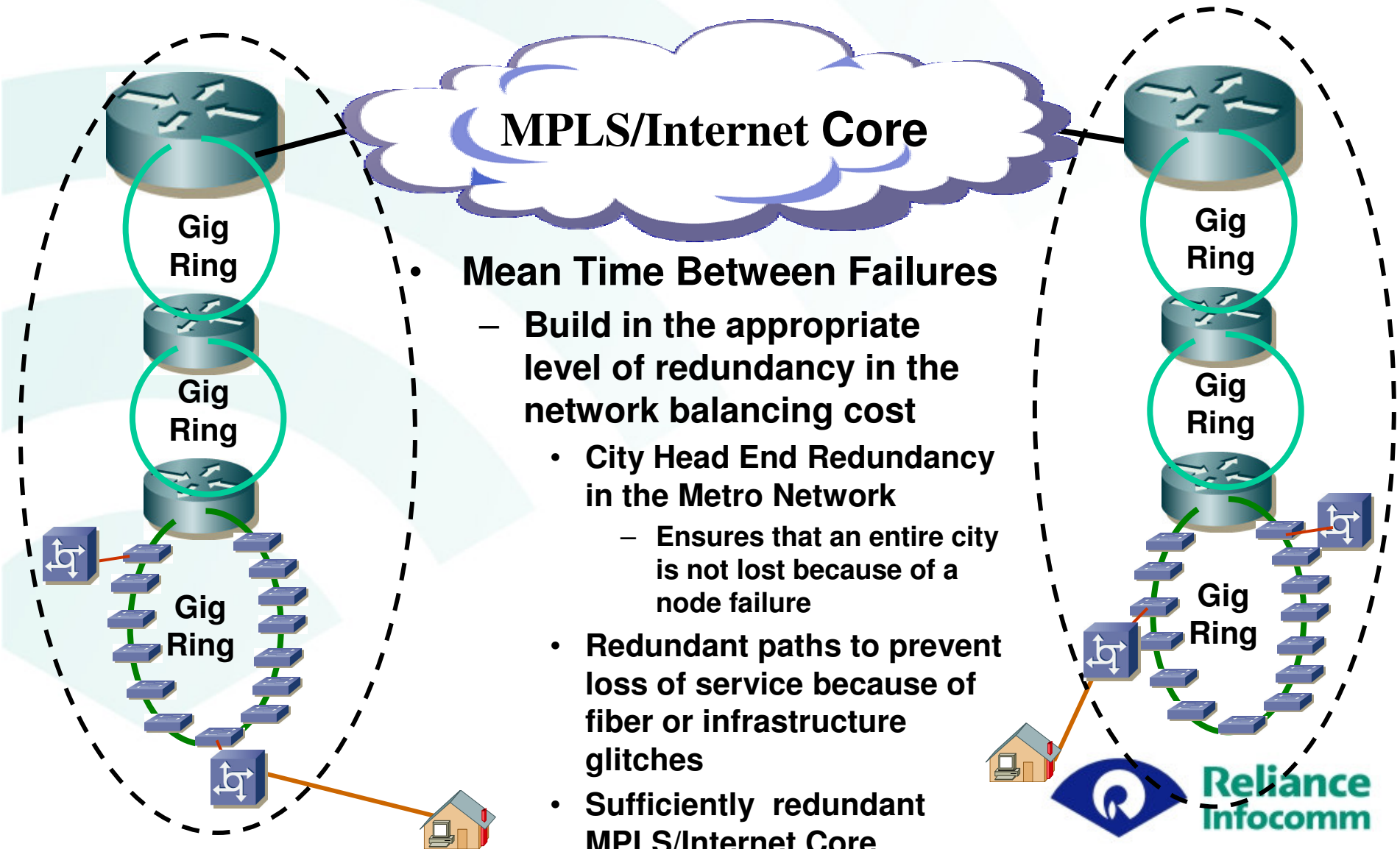
Forget about NMS/OSS/BSS Integration

Service Assurance Time

MPLS/Internet Core

• Mean Time Between Failures

- Build in the appropriate level of redundancy in the network balancing cost
 - City Head End Redundancy in the Metro Network
 - Ensures that an entire city is not lost because of a node failure
 - Redundant paths to prevent loss of service because of fiber or infrastructure glitches
 - Sufficiently redundant MPLS/Internet Core





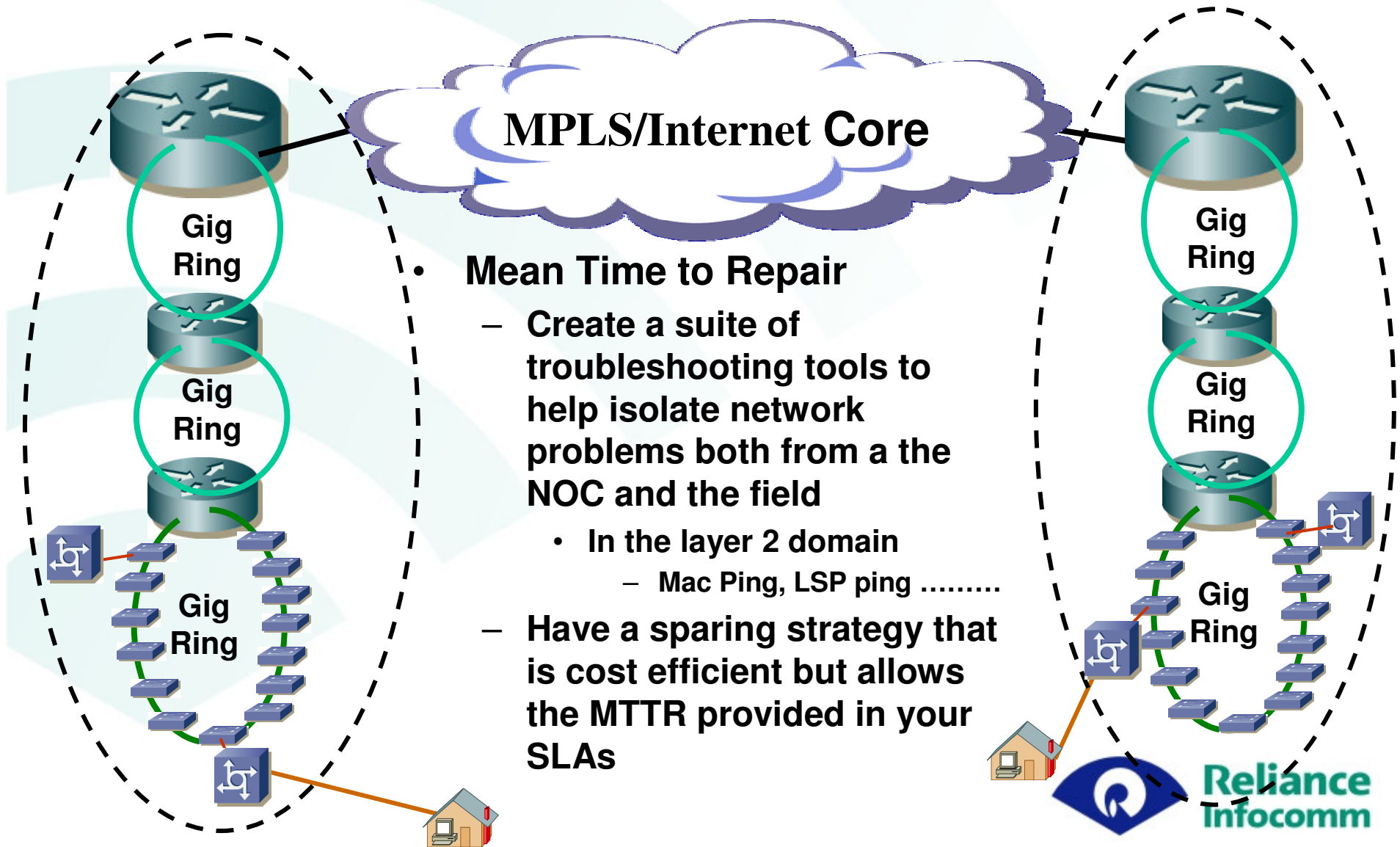
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Service Restoration Time

MPLS/Internet Core

• Mean Time to Repair

- Create a suite of troubleshooting tools to help isolate network problems both from a the NOC and the field
 - In the layer 2 domain
 - Mac Ping, LSP ping
- Have a sparing strategy that is cost efficient but allows the MTTR provided in your SLAs

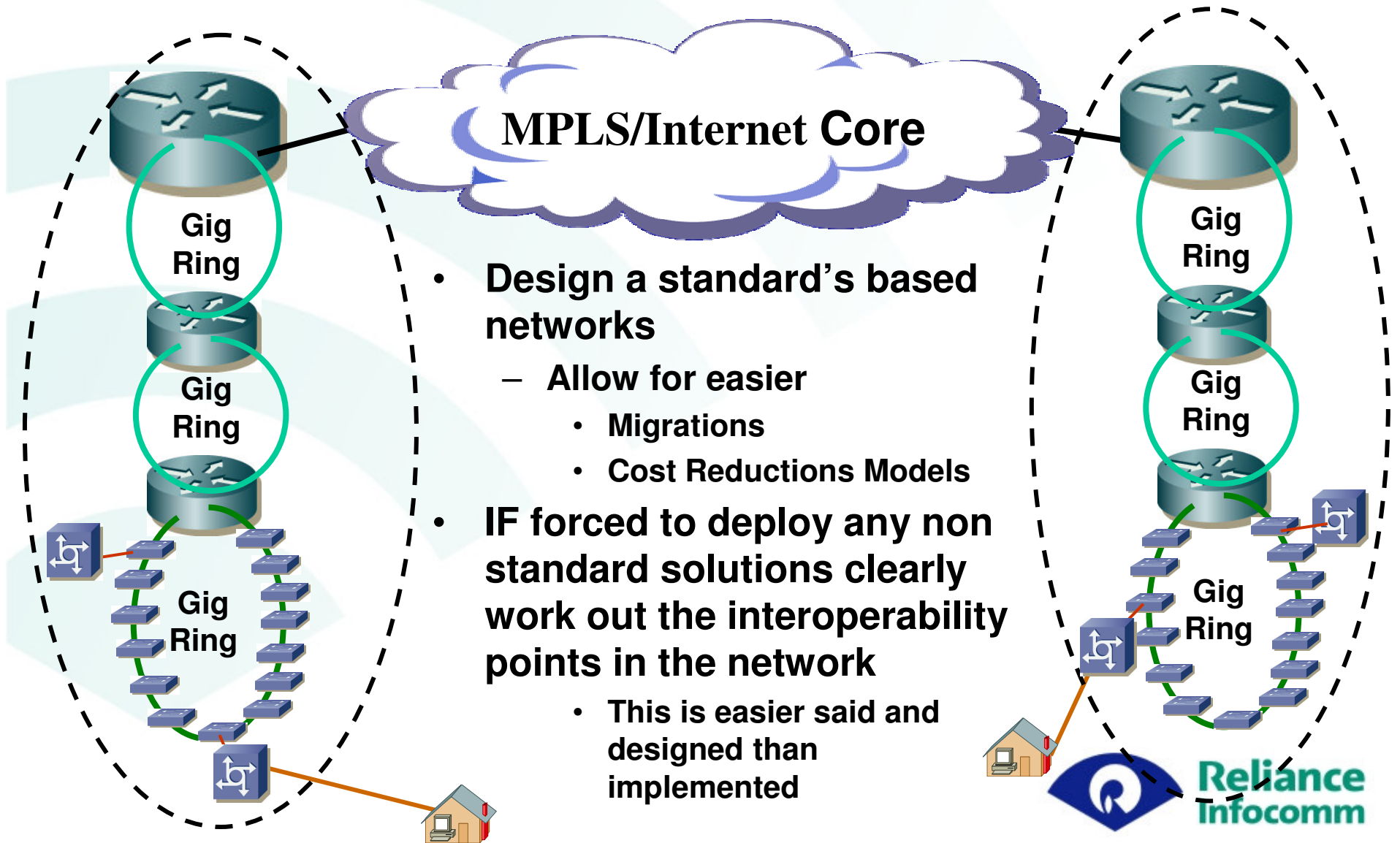


Don't!

Use Proprietary solutions

MPLS/Internet Core

- Design a standard's based networks
 - Allow for easier
 - Migrations
 - Cost Reductions Models
- IF forced to deploy any non standard solutions clearly work out the interoperability points in the network
 - This is easier said and designed than implemented



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Summary

- **Do's**

- **Separate the layers in the network**
 - **Layer 2 and Layer 3 Services and Transport Networks**

- **Play the Numbers Game of Scaling**

- **Protocol Scaling**
 - **Routing**
 - **Signaling**
- **User Scaling**

- **Don't's**

- **Centralize Service Creation**
- **Forget about the OSS and BSS integration**
 - **Service Provisioning Time**
 - **Service Assurance Time**
 - **Service Restoration**
- **Use proprietary solutions**

**Nothing earth shattering here !
Just applying things that we have learnt before !!**