Building Smart Broadband Networks™

Fast Reroute for Triple Play Networks

Sachin Natu
Product Management

March 2006

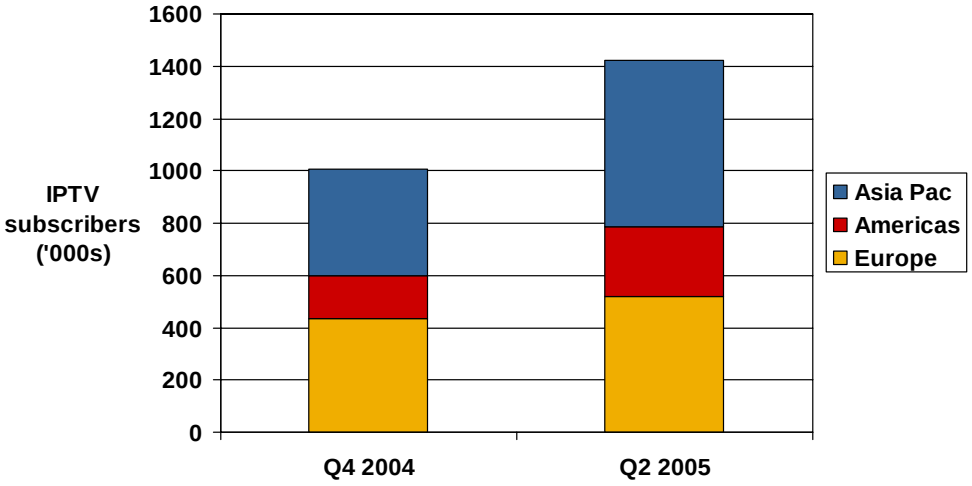
IPTV Service Requirements

IPTV Network Design

Fast Reroute / Convergence Solutions

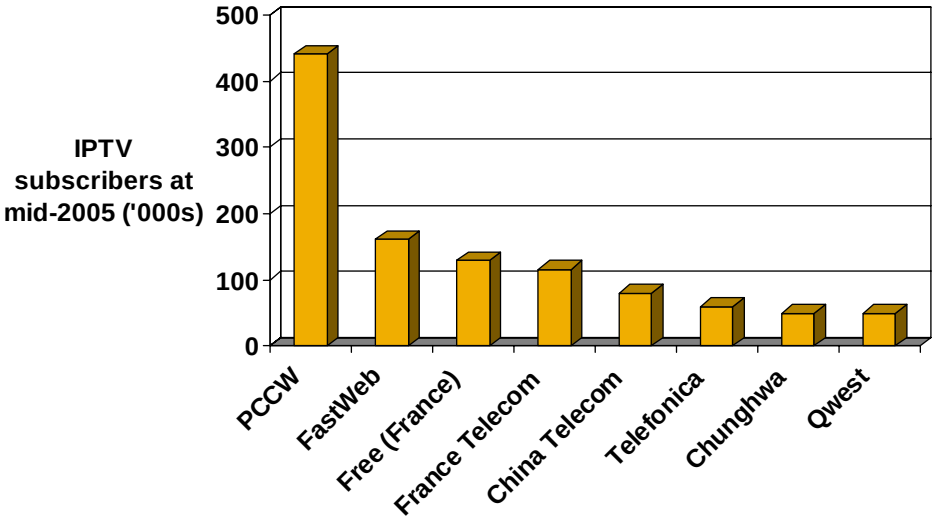
- MPLS FRR
- IGP Fast Convergence
- NextHop FRR

IPTV catching on



IPTV subscribers grew 40% in first-half 2005 to 1.47 million

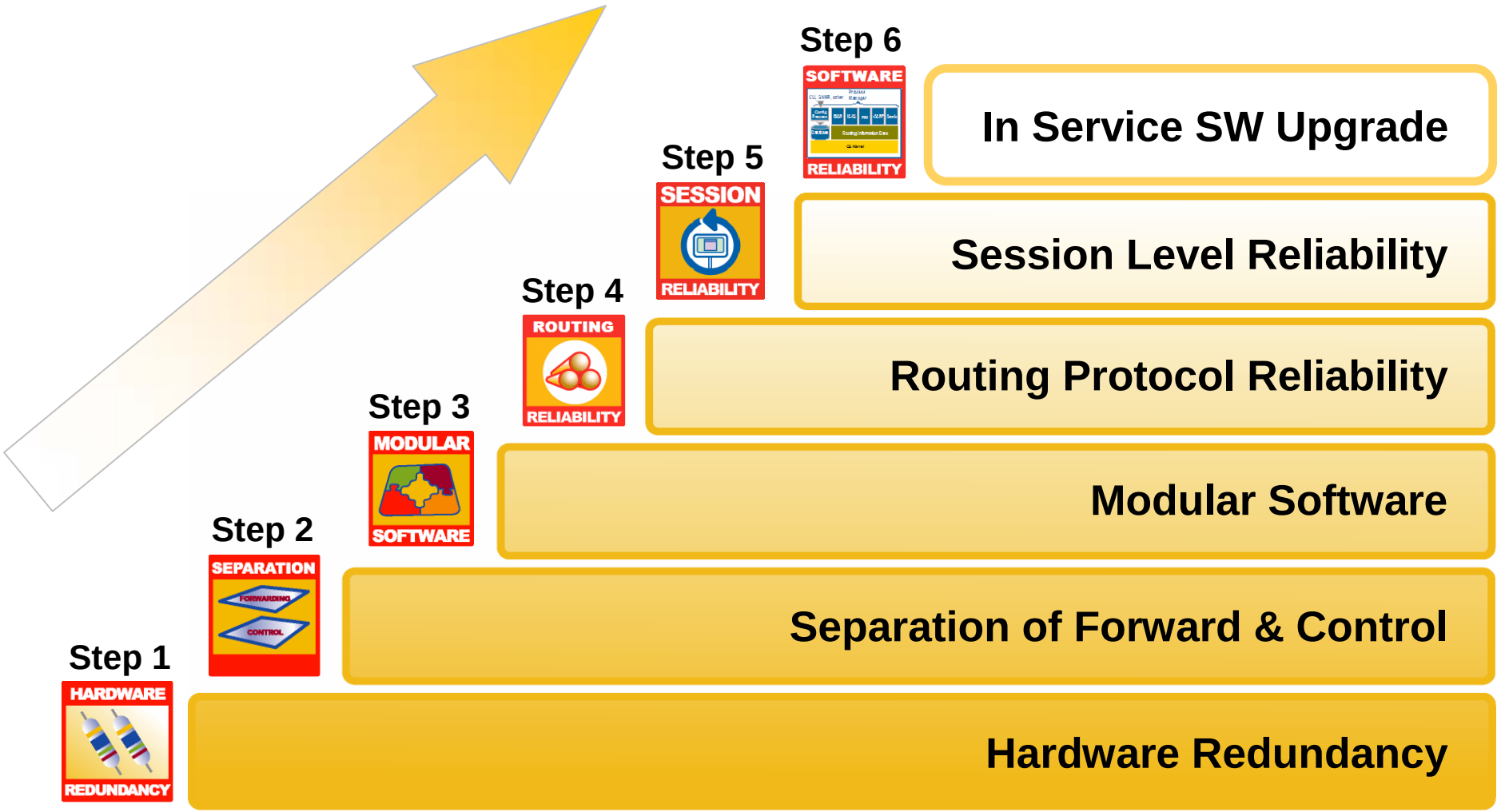
Worldwide, eight IPTV providers have 50,000 or more subscribers



Source: Point Topic BroadBand User Service

Redback NETWORKS

IPTV High Availability Requirements



Redback NETWORKS

Protection Needs

- **Mission critical applications**
- **Delay sensitive services such as VoIP, high quality video, Pseudo Wire services**
- **L3VPN, L2VPN, VPLS networks mainly use IP and LDP**
- ***Goal is to minimize packet loss when network elements fail***

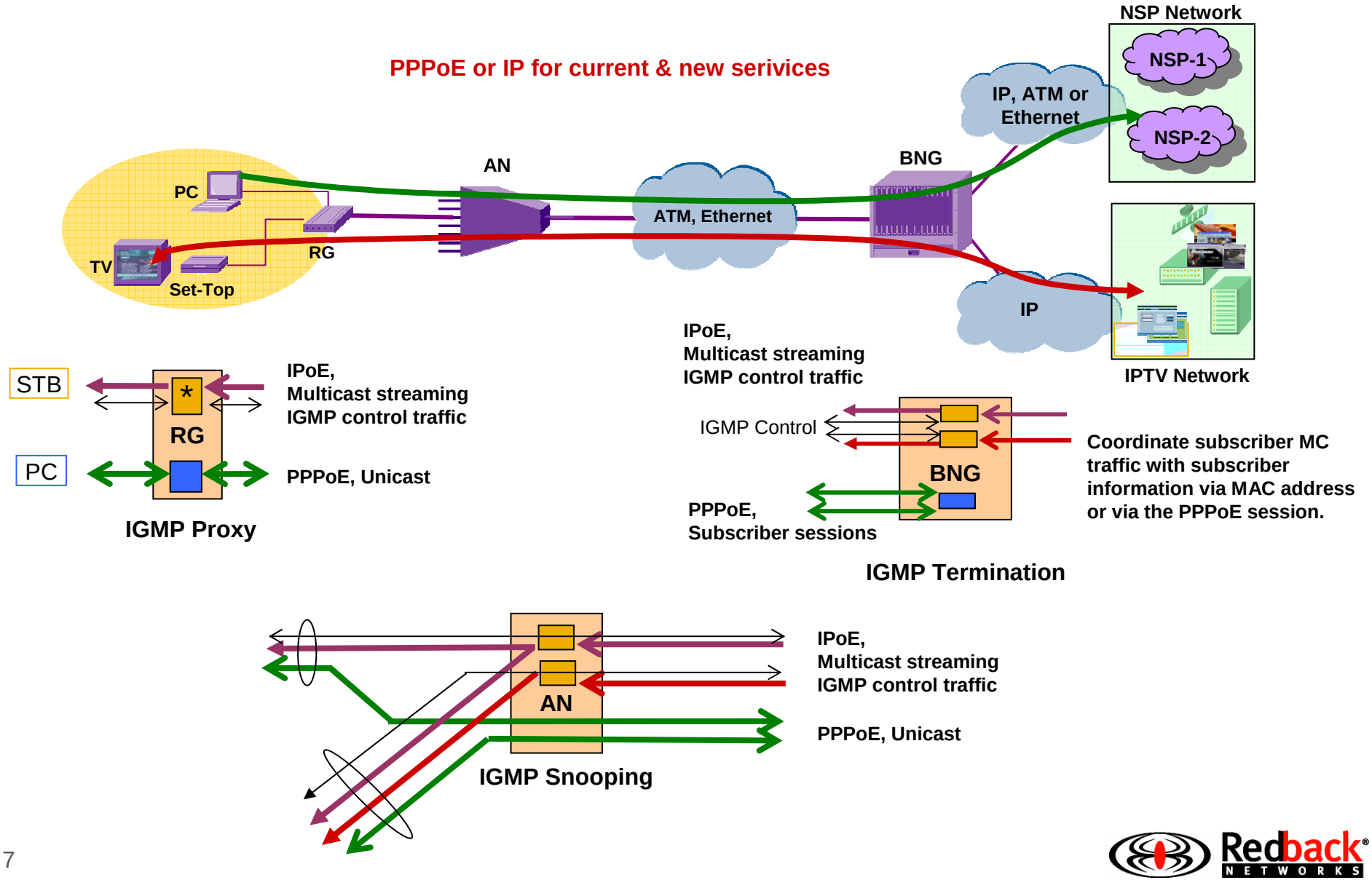
IPTV Service Requirements

IPTV Network Design

Fast Reroute / Convergence Solutions

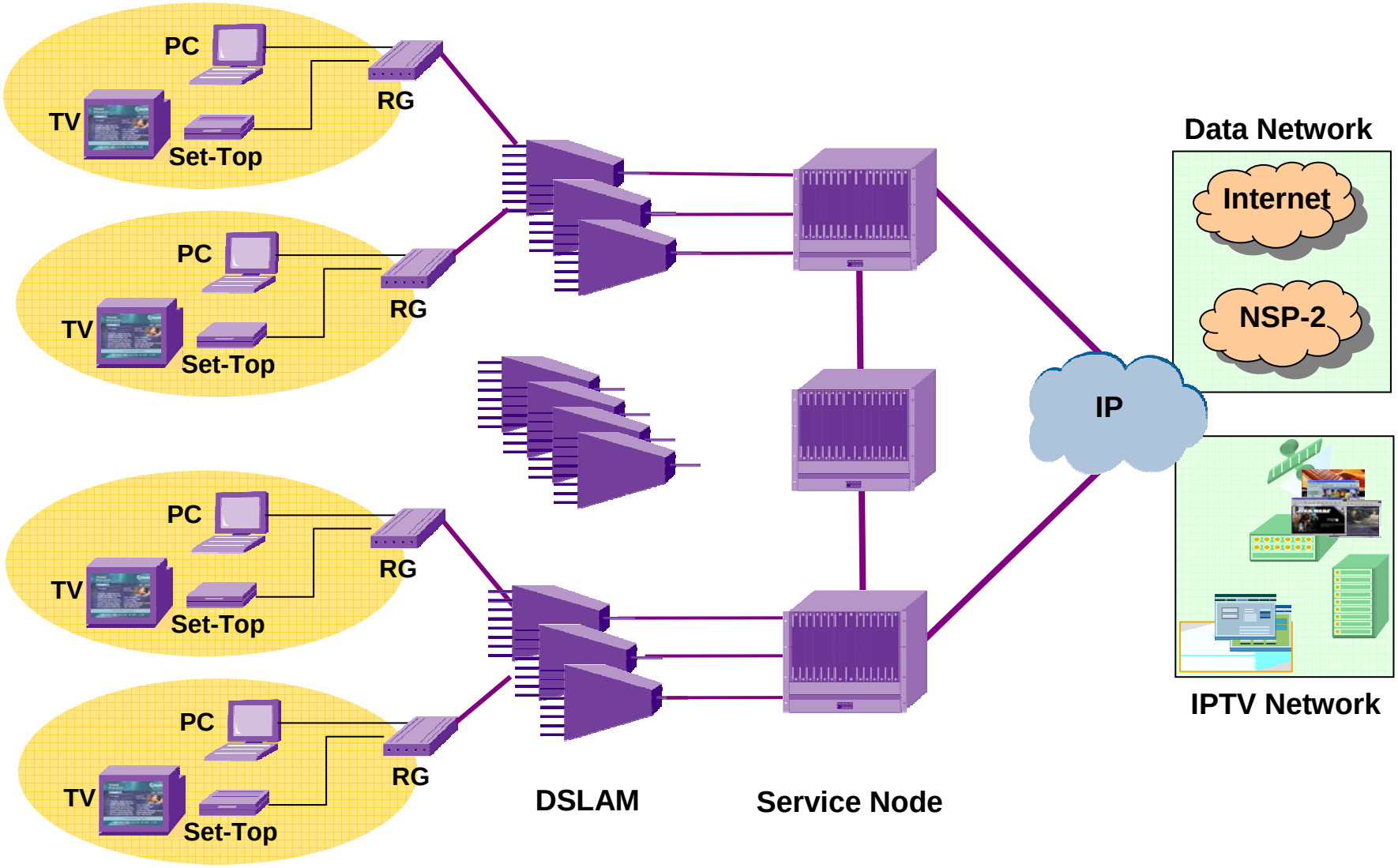
- MPLS FRR
- IGP Fast Convergence
- NextHop FRR

IPTV Broadband Architecture



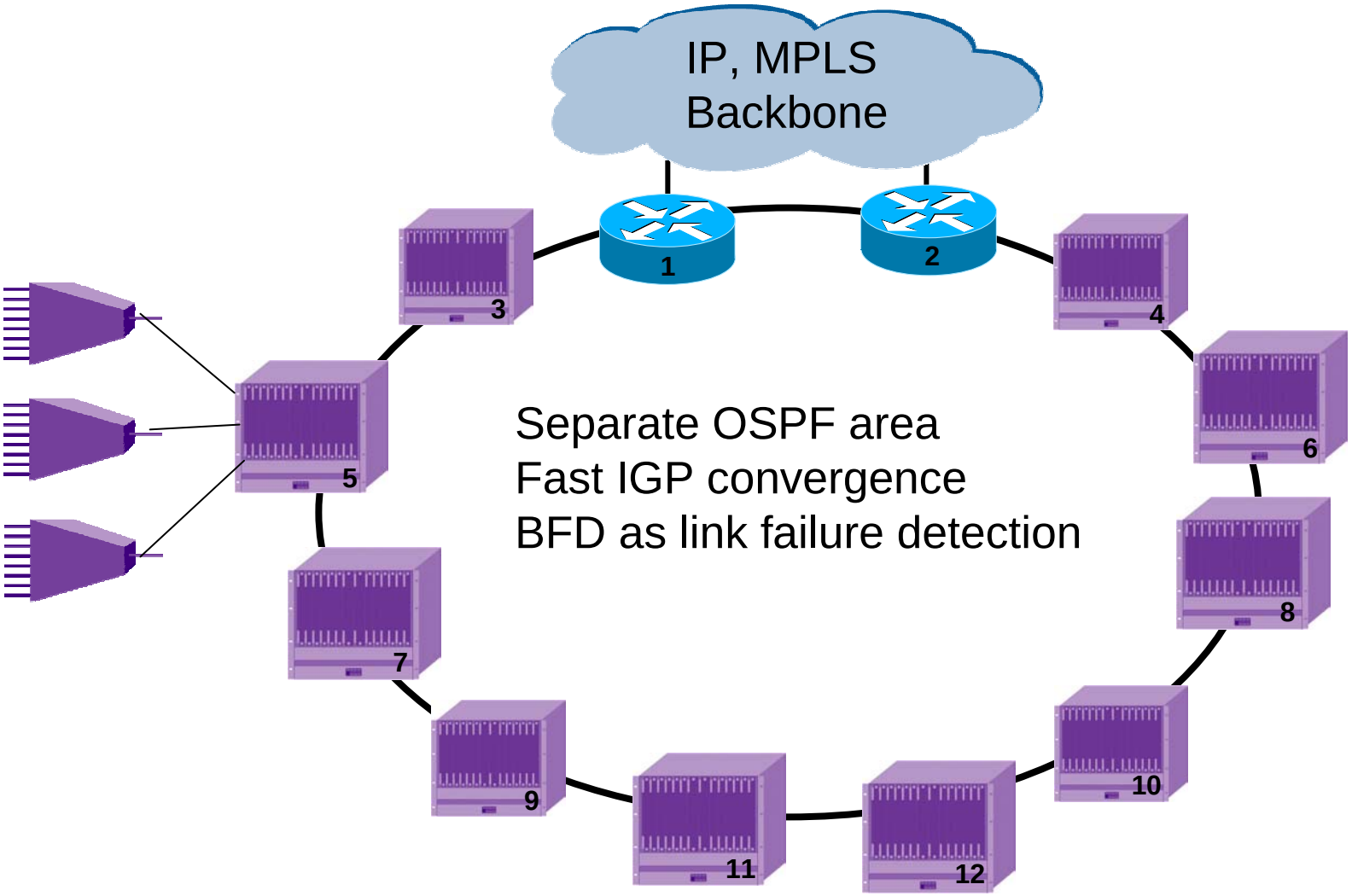
Redback NETWORKS

IPTV Network Architecture



Redback NETWORKS

IPTV Network Ring Design



Redback NETWORKS

IPTV Service Requirements

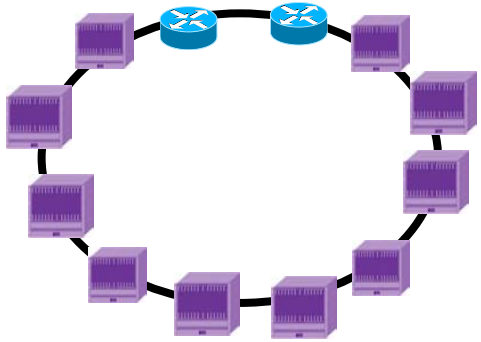
IPTV Network Design

Fast Reroute / Convergence Solutions

- MPLS FRR
- IGP Fast Convergence
- NextHop FRR

Redback NETWORKS

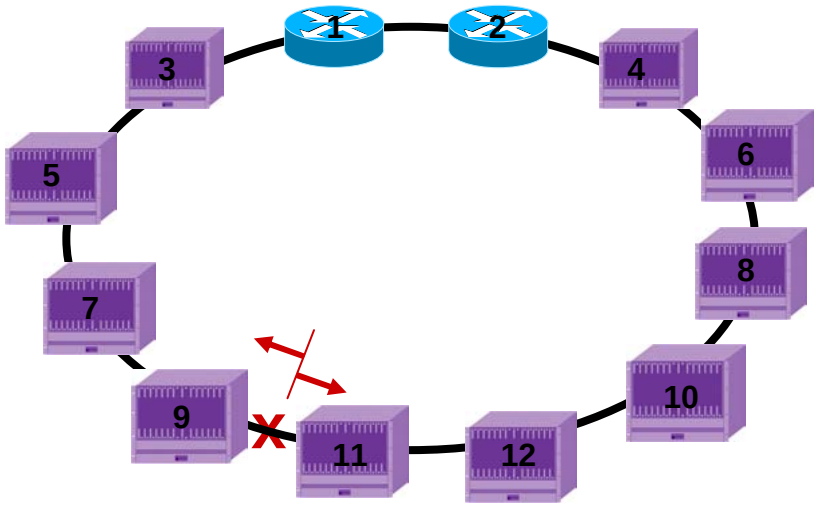
Ring Design Fast Restoration Solution



- Fast Restoration…
  - How fast is fast ? 50 msec. ?
  - How fast is needed ?
- Handle non MPLS TE traffic when traffic engineering is non-goal
- Be simple, in terms of mechanism, development, configuration, computation, deployment and maintenance

Fast Restoration Steps

1. **Detection Delay**
2. **Propagation Delay**
3. **Calculation Delay**

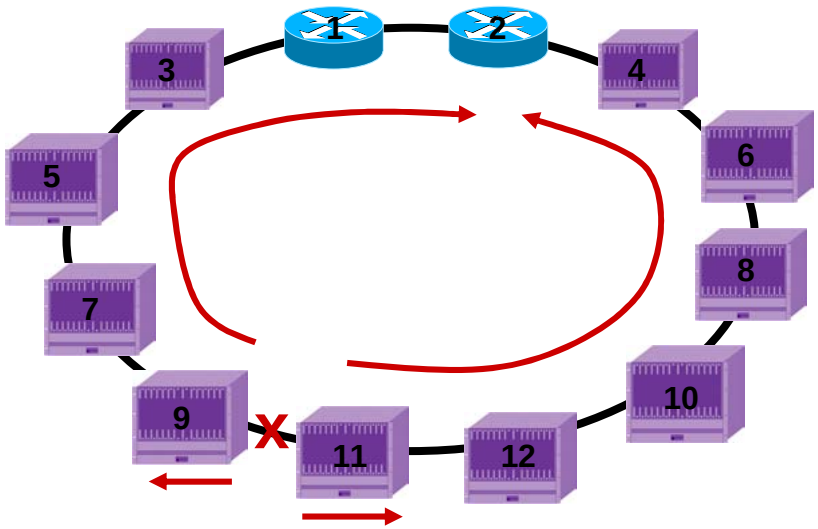


Detection Delay is time independant of the Fast Restoration solution used.

1. **Media dependant**
   a. SDH, SONET:
   b. Ethernet: 802.1ag Ethernet OAM
2. **Light Out**
3. **Media in-dependant**
   a. Bidirectional Forward Detection (BFD)

Fast Restoration Steps

1. Detection Delay
2. Propagation Delay
3. Calculation Delay

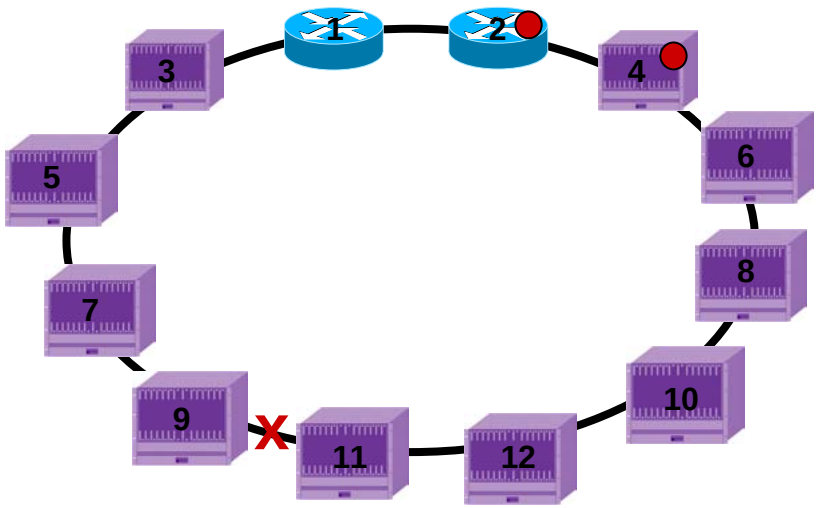


Propagation Delay very dependant on the Fast Restoration solution used.

1. **Internal in Box**
   a. is part of all solutions
   b. internal architecture dependant
2. **Across the Network**
   a. MPLS FRR: Not relevant
   b. IGP Fast Convergence: Protocol optimization dependant
   c. Nexthop FRR: Not relevant

Fast Restoration Steps

1. Detection Delay
2. Propagation Delay
3. Calculation Delay



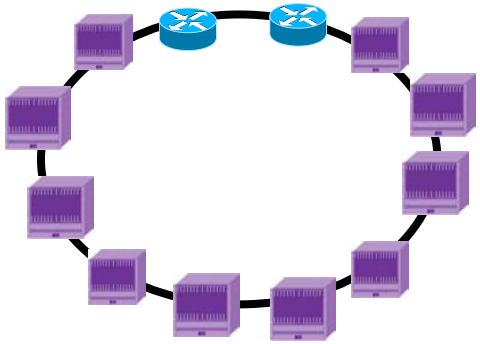
Calculation Delay very dependant on the Fast Restoration solution used.

1. Box dependant

a. MPLS FRR: Not relevant
b. IGP Fast Convergence: Protocol optimization dependant
c. Nexthop FRR: Not relevant

MPLS FRR in the Ring

RFC 4090



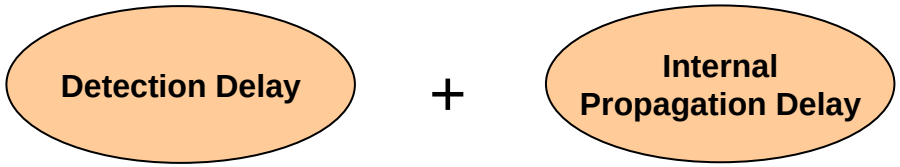
Pros:

- Switch-over time less than 50 milliseconds

Cons:

- Complication of setup MPLS TE LSPs
- Issues of supporting IP unicast, multicast and LDP traffic
- MPLS TE network needs constant tuning

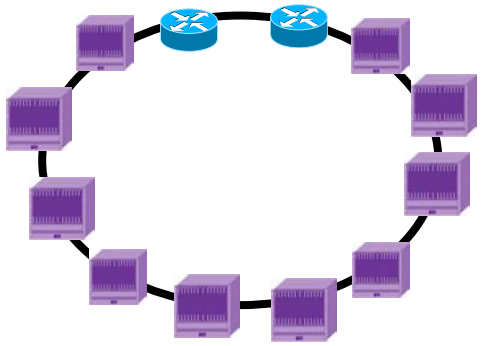
Repair Time: ”Detection Delay” + ”Internal Propagation Delay”



IGP Fast Convergence

Pros:

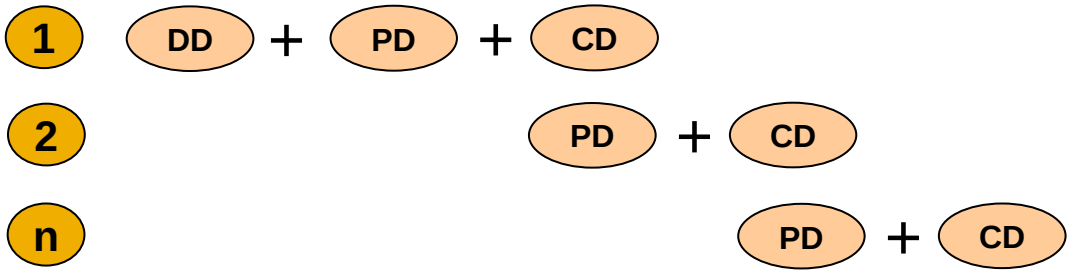
- Simple solution, based on “normal” IP routing
- Protect all types of traffic



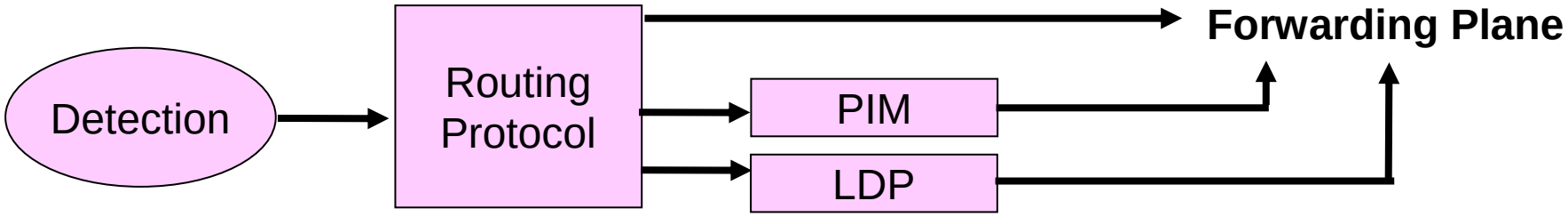
Cons:

- Convergence time dependant of failure place
- Does not meet the 50 msec magic number requirement

Repair Time: **”Detection Delay” + (n * ”Internal Propagation Delay”) + ”Calculation Delay”**

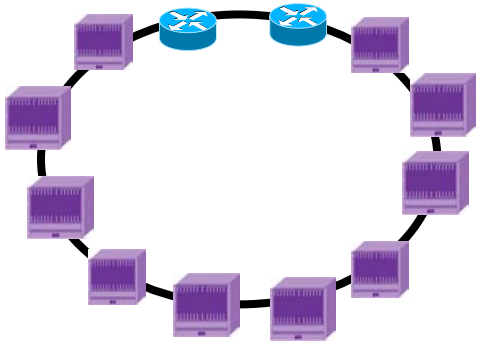


IGP Fast Convergence



- **IGP MUST be implemented in a ”event driven” mode to allow for immidiate SPF calculation**
- **IGP MUST be implemented with a ”fall back” to timer SPF calculation in case of network instability**
- **PIM MUST be implemented in a mode to remember join & leave messages from unexpected interfaces**
- **LDP MUST advertise all labels to everybody, and make it the responsibility of the receiver to discard labels.**

Next-Hop Fast ReRoute Solution



Pros:

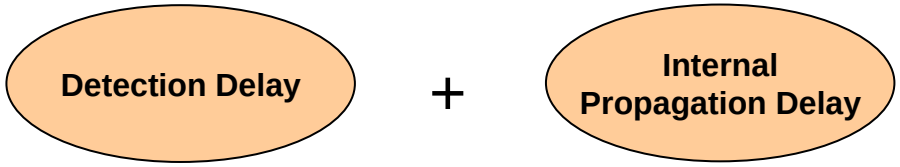
- Switch-over time less than 50 milliseconds
- Protect all types of traffic

Cons:

- Multicast PIM and LDP protocol enhancement for node protection

  (This is required by any next-nexthop solution, so not a real-life cons. but more a fact of life)

Repair Time: ”Detection Delay” + ”Internal Propagation Delay”



Next-Hop Fast ReRoute Solution

- Nexthop Fast ReRoute (NFRR) can perform fast re-route for any type of traffic in the event of a link/node failure or a nexthop unreachable.
- The protected traffic can be IP, MPLS, unicast or multicast.
- The re-routed traffic can either be destined to the nexthop router or to the next-nexthop router. RSVP explicitly routed LSPs are used as a tool to perform the local patch for minimizing the packet loss.

- The LDP protocol only needs to know label mapping for the adjacent peers and there is no way for an LSR to learn the adjacent peer's downstream label mapping. As such an LDP extension that allows an LSR to discover the next-nexthop label mapping from its downstream peers is needed for node-protection using the NFRR solution.

- A PIM node knows the direct downstream neighbors, but currently it has no mechanism to learn the downstream nodes of the adjacent neighbors, or the next-nexthop downstream nodes. As such an PIM-SM extension to allow a PIM node to discover its next-nexthop downstream neighbors is needed for node-protection using the NFRR solution.

Summary

Detection Delay is part of all Fast Restoration solutions, so select a fast, scalable non media dependant solution like BFD.

New technology and processor performance have made IP Fast Convergence a valid ”Fast Reroute” solution for IP and LDP traffic in 100s of msec failover.

A MPLS Fast Reroute implementation like ”NFRR” is needed to create a common Fast Reroute solution for all kind of traffic and 10s of msec failover.

Building Smart Broadband Networks™

www.redback.com