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Don't Label Me Yet!

Will Gigabit routers provide a new lease on life for ION protocols....

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Overview of the available options

- ❑ **IETF**
  - – **Started "Classical IP/ATM" (CIP) pre 1994**
  - – **Started Multiprotocol Label Switching (MPLS) mid/end 1996**
- ❑ **ATM Forum**
  - – **LAN Emulation (LANE) first released late 94**
  - – **Multiprotocol over ATM (MPOA) completed late 97**
- ❑ **Label Switching - Flow based**
  - – **Ipsilon's "IP switching"**
  - – **Toshiba's "Cell Switching Router"**
- ❑ **Label Switching - Topology based**
  - – **Cisco's TAG switching**
  - – **IBM's ARIS/Cascade IP Navigator**

Key Attributes of Classical IP/ATM

- ❑ **Flexibility**
  - **Traffic engineered IP routing topologies independent of underlying ATM network**
  - **Underlying ATM network can simultaneously support non-IP services**
  - **Routers act as media translators between ATM and non-ATM transport technologies**
- ❑ **Relatively easy to learn**
  - **IP routing is 'normal'**
  - **ATM routing is 'normal'**
  - **Specifications currently exist**
    - **RFC1577/RFC1483 (unicast), RFC2022 (multicast), RFC2226 (broadcast), RFCxxxx (NHRP)**
  - **RFC1577/RFC1483 product experience exists**

CIP: Complaints file

- ❑ **Main complaints about Classical IP/ATM**
  - **Routers "too slow", they're a "bottleneck"**
  - **Routers loose the "QoS value of ATM"**
- ❑ **IETF partial solution**
  - **Next Hop Resolution Protocol (NHRP) for 'short cuts'**
  - **ISATM working group for QoS mappings**

So, what has changed?

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❑ **Go-fast routers**
- – **Hardware assisted forwarding engines**
- – **Packet oriented - no additional protocol layers needed**
- – **Closing the speed gap with ATM switches**
- – **Emerging, limited, QoS support in hardware**

❑ **If the speed is no longer an issue**
- – **We can revisit Classical IP/ATM for its flexibility**

Label Switching

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❑ **Original Industry Motivators**
- – **"Go fast IP"**
  - • **Ipsilon and Toshiba initially propose re-use of ATM silcon**
  - • **Cisco and IBM jump on board, differing in their choice of label setup mechanism**
- – **Traffic Engineering: Label Switched Paths are an efficient alternative to IP-IP tunnels for odd routes**
  - • **Flow-detection schemes cannot do this**
  - • **Topology based schemes can (e.g. TAG+hacks)**
- – **Conserve the life-span of existing routers**
  - • **For given fixed size of router forwarding table in RAM, a table of labels holds many more entries**
  - • **Turning routers into Label Switching Routers didn't give much speed up, but extended product life span**

❑ **Industry Consequence**
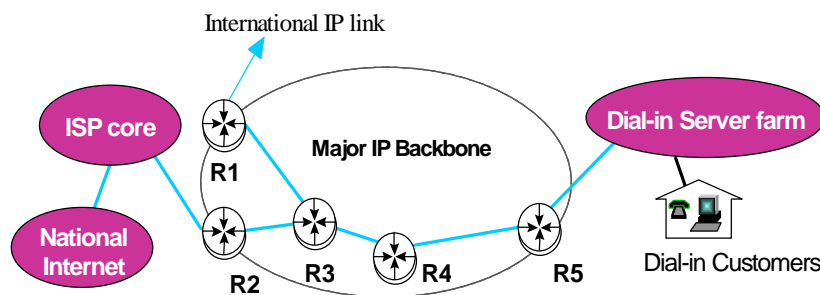- – **MPLS working group in IETF**

Responses to Label Switching

- ❑ **Go fast?**
  - – **Gigabit IP forwarding engines are feasible - Cisco 12000, Cascade/Ascend, etc**
- ❑ **Traffic Engineering?**
  - – **Valid question**
  - – **Classical IP/ATM topology flexibility also potential solutions**
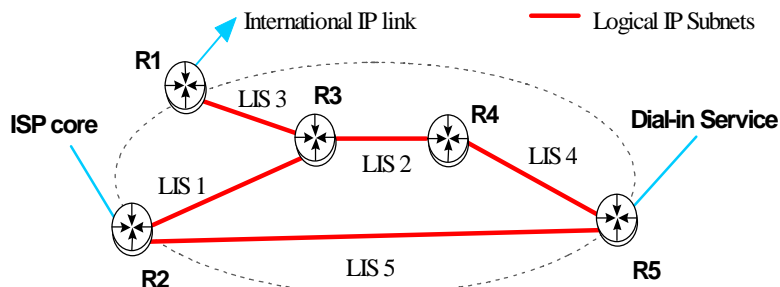
Traffic Engineering example

- ❑ **ISP with topologically remote dial-in service**
  - – **ISP wishes all dial-in packets to flow into ISP Core before final routing out onto IP Backbone**

International IP link

ISP core

National Internet

Major IP Backbone

R1

R2   R3   R4   R5

Dial-in Server farm

Dial-in Customers

4

Traffic Engineering with CIP

❑ **Edge routers are configured with new LIS**

– **Explicit forwarding rules ensure R5 pushes dial-in packets across LIS5 to R2, then into ISP Core**

– **Packets returned through R2 are routed on LIS1 or LIS5 as appropriate**

International IP link   —— Logical IP Subnets

R1

ISP core

LIS 3   R3   R4   Dial-in Service

LIS 1   LIS 2   LIS 4

LIS 5

R2   R5

So what does this mean?

❑ **For speed**

– **Gigabit routers are narrowing the gap with ATM switches, and removing the 'bottleneck'**

❑ **For many traffic engineering problems**

– **Classical IP/ATM allows appropriate LIS topologies.**

❑ **For the most general traffic engineering support**

– ***Might* be appropriate to invest in a label switching technology capable of explicitly routed paths**