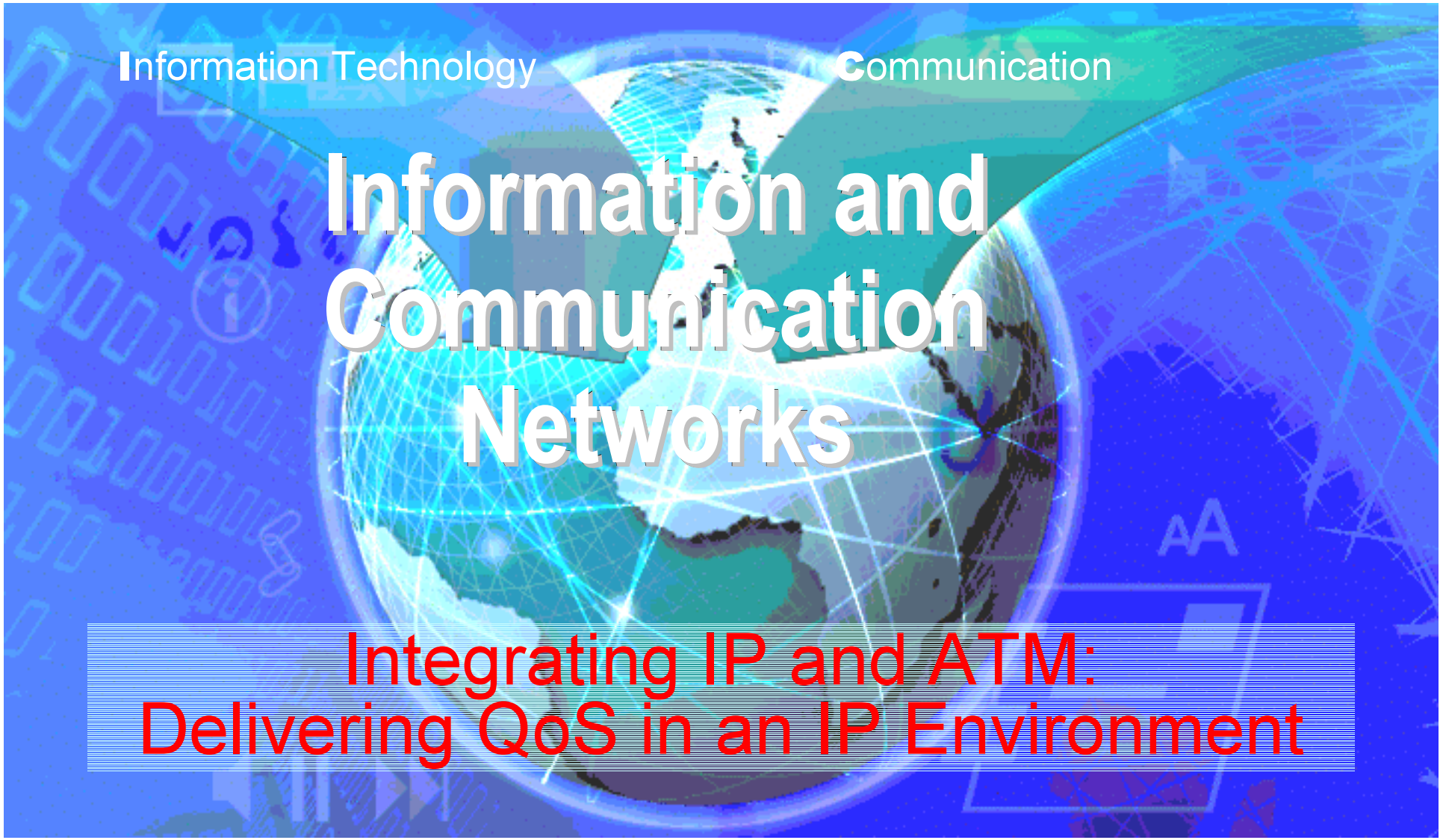
SIEMENS

Unisphere SOLUTIONS



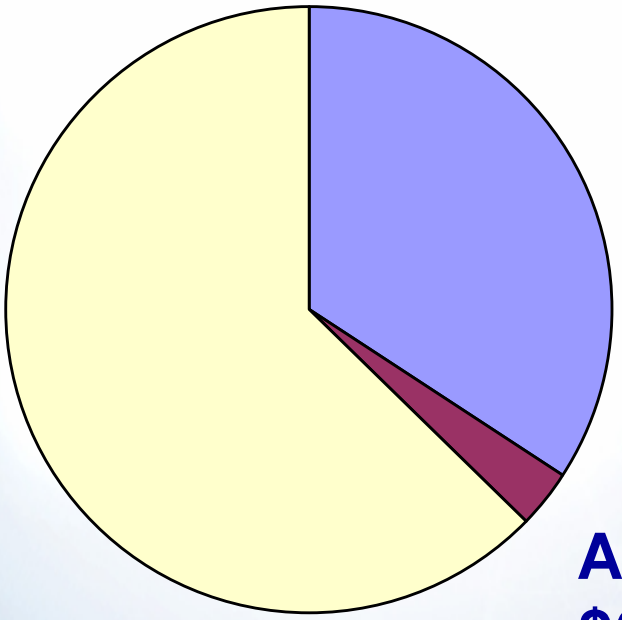
Multiservice Platforms

- One infrastructure supporting voice, video and data
- A bridge between customer legacy systems and emerging technologies

Multiservice Platforms – Benefits

- Reduce capital costs by consolidating service delivery over a single multiservice platform
- Reduce operational costs
- Significantly reduce time-to-market for new, innovative and flexible services and business solutions
- Reduce access costs. One single circuit for all traffic types

Worldwide Market 1998 – Overview



Frame Relay
$6 billion

Leased Lines
$11 billion

ATM
$0.5 billion

ATM Advantages

- Utilize existing circuits with high efficiency
- QoS (even under load)
- Ability to handle all forms of traffic (voice, data, multimedia)
- Statistical multiplexing
  - more traffic than your capacity
  - BW is at premium

Advantages and Disadvantages of SDH and ATM

SDH

- Reliable&proven
- high speeds
- standardized
- transparent for (IP, ATM, voice)
- Fixed channel speeds
- No statistical multiplexing
- No SVC

ATM

- All traffic types
- Statistical multiplexing
- Flexible speeds
- SVCs, PVCs
- FR interworking
- End-to-end OA&M
- QoS
- Complexity
- Connection oriented (not very good for IP)
- Overhead
- Price

IP Characteristics

- Best-effort
- Not real-time
- Connectionless
- Robustness
- Network service interface

IP – Latest Trends

- IP routers are getting smarter and faster
- DWDM delivers plenty of bandwidth (removes congestion)
- Packet over SONET/SDH, VoIP, SS7 Interworking, ...

All the carriers are looking at IP

ATM vs IP

- IP lacks proven mechanisms for prioritizing data flows and controlling delay when network is busy
- How to ensure compliance with SLA if you can so far neither monitor nor manage individual flows

Classes of Service vs Quality of Service

- QoS–predict and guarantee the service that will be provided to a subscriber (availability, throughput, end-to-end delay, jitter, reliability, data loss)
- CoS–traffic prioritization, no absolute guarantees about service quality, which will vary over time

QoS is perceived by the end user of the service.

Classes of Service vs Quality of Service cont.

- Independent of packet technology link utilization and queue length are bound together
  - the better utilization the longer queue
  - the longer queue the larger buffers the longer delays and higher losses
- If packet length is variable then it is impossible to predict delay

It is not a speed of routing that matters.
What matters is queuing.

Capacity

- Non of this CoS vs QoS matters if you utilize only 30% of total network capacity
- Would you run your network at 30% of capacity and ignore the network efficiency costs?

As soon as people get free bandwidth in front of them, they'll find a way to use it.

Classes of Service vs Quality of Service cont.

- Integrated services and RSVP
  - at the maximum fixed delay guarantees
  - amount of state information increases with number of flows–huge storage and overhead for routers
  - not scaleable for large IP networks
- Differentiated service
  - packet priorities based on DS field in IP header
  - packets from different sources to different dest. with the same priority receive the same treatment
  - amount of states proportional to the number of classes–scaleable solution

Multiservice Future

- ATM in the core (performance and QoS)
- IP at the access (services)
- Adaptation done at the edge

Adaptation Functions

- flow detection–source, interface, domain name, IP header, MPLS label
- classification (what is it?; where is it going?; what it needs?)–routing policy, QoS policy, transport selection, other services
- mapping–ATM VCs, MPLS tunnels, L2TP tunnels, IP Sec tunnels

MPLS Characteristics

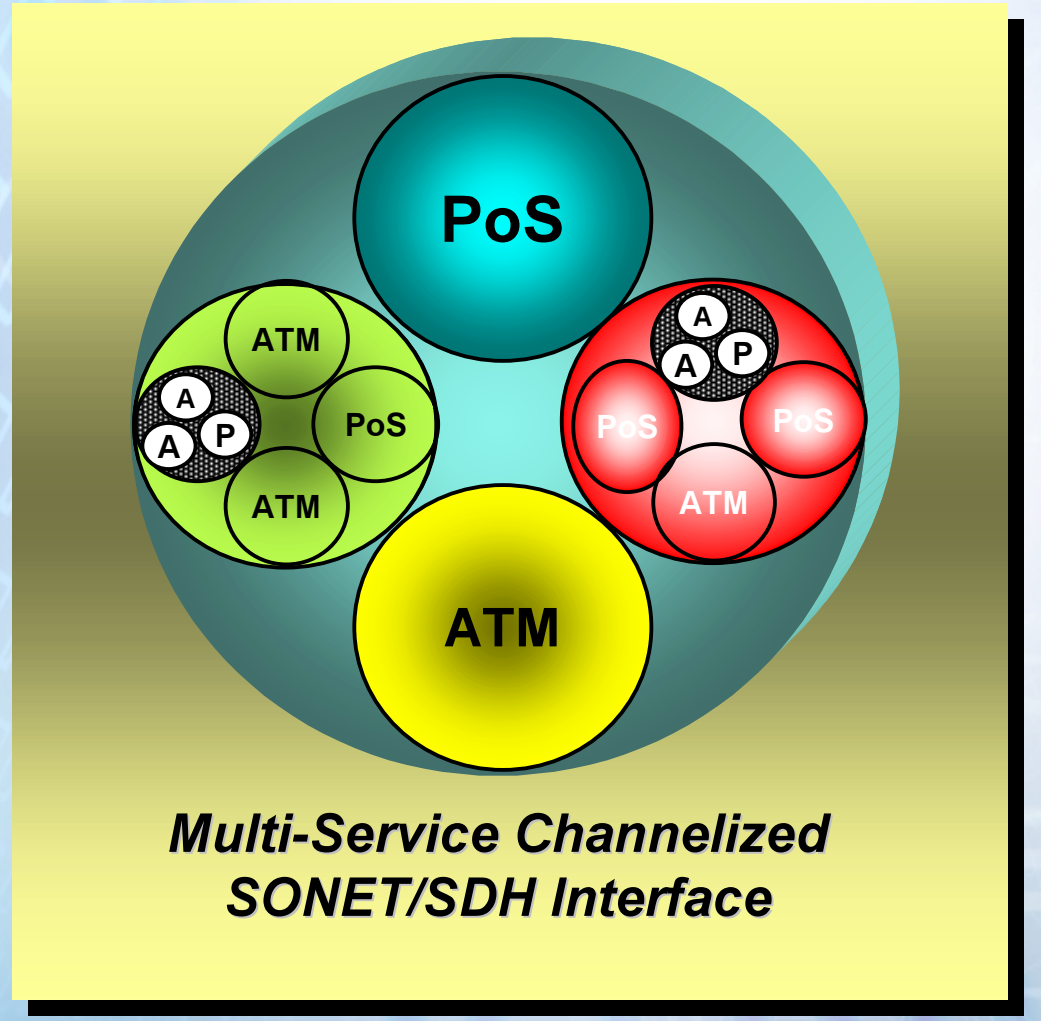
- Classification of packets into Forwarding Equivalence Classes (map each FEC to the next hop)
- Label assignment is done only once, label swapping in the core
- LDP for negotiation label bindings and MPLS capabilities between MPLS routers
- LSP setup control driven or data driven
- Explicit Routes for traffic engineering

Dynamically adjust the network to changing traffic patterns
Rules are defined by the network operator

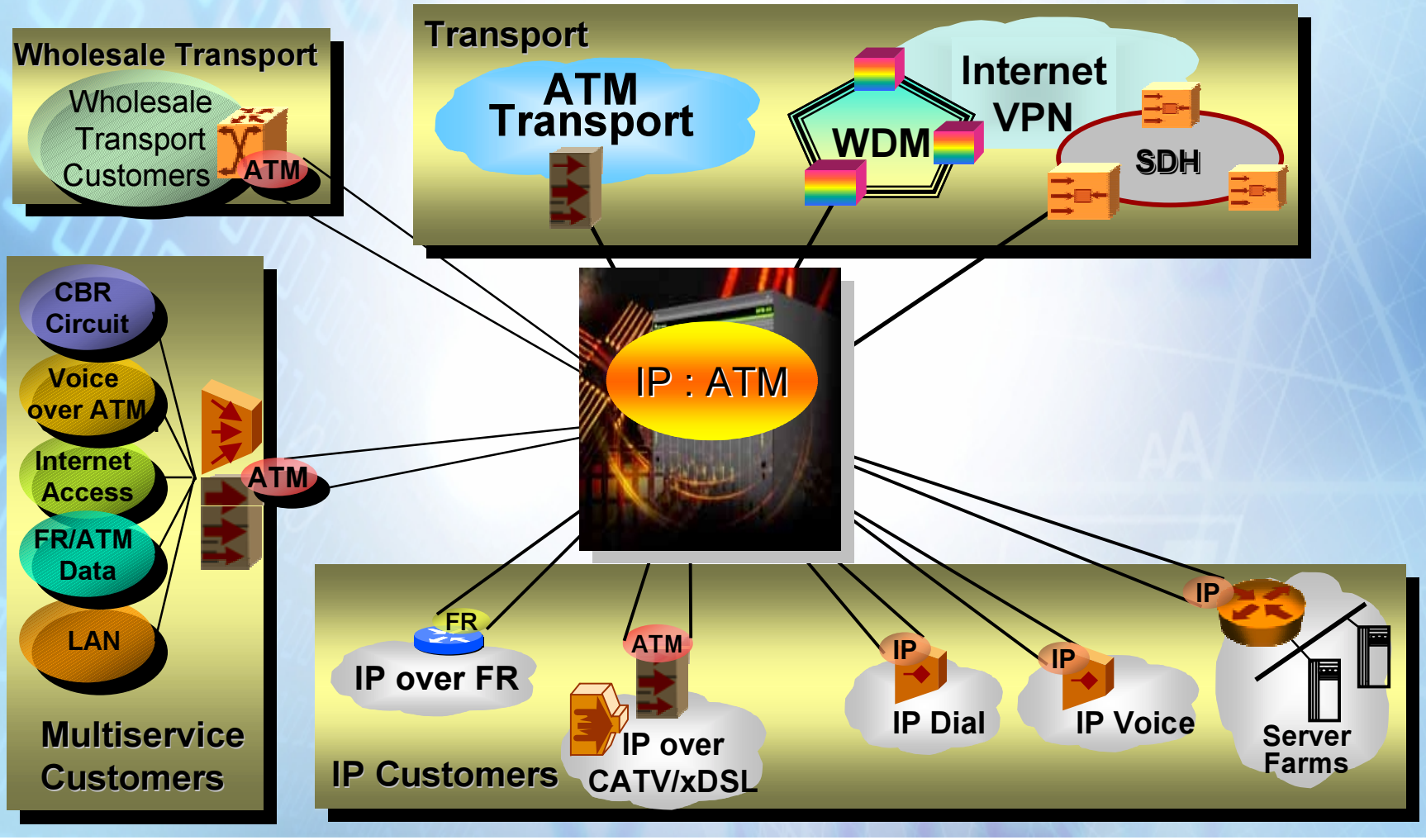
Hybrid ATM/IP Switches

- Unites ATM switching and IP routing and integrates SDH multiplexing
- Any interface (SDH sub-channel) can support ATM or IP
- Eliminate previously independent platforms and management systems
- Cost-effective alternative to multiple overlays and associate grooming/degrooming

Hybrid ATM/IP Switches–Channelized SDH Interfaces



Hybrid ATM/IP Switches–Backbone Solution



Conclusion

- IP and ATM will not disappear
- Each has its own strengths and weaknesses
- Integrated IP/ATM network (ATM in the backbone and IP in the access)