IVD at Citicorp

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Questions Asked

◆ What major corporations are using IVD?

◆ International trends in IVD

◆ Voice over IP

◆ Private corporate ATM networks

◆ Public ATM networks

◆ IVD business models

Questions Answered

◆ Voice over IP

◆ QoS in IP networks

◆ The state of ATM

    Private corporate ATM networks

    Public ATM networks

Voice over IP

◆ 1st application - "free" calls to Paris

    worth almost that much

◆ to do it right requires QoS controls in network

    not yet state of the art

◆ how to do it

    simple - throw bandwidth at problem

    hard - reserve bandwidth & delay needed

Quality of Service (QoS) in IP

◆ the ability to define or predict aspects of the performance of systems on a network
◆ one of the original goals for the Internet Protocols
    "type of service" - differ in speed, latency & reliability
    datagram protocol (for robustness)
◆ little or no QoS features in LAN protocols

Integrated Services (Int-Serv)

◆ architecture for supporting real-time applications over the Internet Protocols and the Internet
◆ guaranteed delay bounds
    absolute upper bound of delay
◆ link sharing
    set maximum shares of a link
◆ predictive real-time service
    stable delay
◆ overview - Informational RFC 1633

Int-Serv, contd.

- ◆ basic parts
  - admission control - determines if new flow can be added
  - classifier - determines flow for incoming packet
  - packet scheduler - queues packets for transmission
    - also requires an estimator for outgoing packet stream
    - uses Weighted Fair Queuing (WFQ)
- ◆ not just traffic prioritization on a link

Int-Serv, cont.

- ◆ priority be itself is not enough
  - if too much high-priority traffic
    - prioritization does not help
  - separate request process
    - not accepted if it would overload
- ◆ requires flow-specific state in routers
  - change in basic Internet model
  - use soft state - can change on path change
    - vs. hard state - set at start, teardown at end
- ◆ may require request & flow authentication

Delay Affected Application Types

◆ real-time applications
- application "plays" packets a fixed delay after transmission
- queues up packets that arrive before
- intolerant applications drop packets that arrive after
- adaptive applications can change delay to deal with network

◆ elastic applications
- use data when it shows up

◆ Int-Serv delay features control time-of-delivery of packets
- absolute and variance

Int-Serv, Resource-Sharing

◆ multi-enity link-sharing
- split one link between organizations

◆ multi-protocol link-sharing
- split link between protocols (IP, SNA, IPX etc)
- can help deal with different congestion responses

◆ multi-service sharing
- application-based
- limit amount of file transfer

RSVP

- ◆ Resource ReServation Protocol (RSVP)
- ◆ implementation of INTSRV reservation process
- ◆ can be used to set aside resources for a specific application along a communications path
- ◆ can transfer the requests to a new path if rerouted
- ◆ simplex (one direction per reservation)
- ◆ receiver-oriented
- ◆ may make use of QoS-active links

RSVP - Process

- ◆ using admission control, router
  - will accept reservation request if enough capacity
    - record reservation and forward `resv` to next-hop
  - if not - send `resverr` to previous hop
- ◆ state refreshed periodically with new messages
  - entry removed on timeout
- ◆ periodic refresh deals with reroute

RSVP & Int Serv Status

- protocols nearly ready
- performance issues
- scaling issues
- authorization issues
- accounting issues
- end system vs. border router
- advanced reservations *very* hard

Current Status, Problems and Future Directions of ATM Technology

The end of a dream?

ATM under attack

- ◆ by competing technology
- ◆ by need
- ◆ by zealots
- ◆ by complexity
- ◆ by standards process
- ◆ by ATM

Competing Technology

- ◆ switched Ethernet
- ◆ 100 Mb Ethernet
- ◆ Gb Ethernet
- ◆ RSVP

Need for ATM

- ◆ QoS is a major driver
- ◆ where is it needed?
- ◆ LAN vs. WAN
- ◆ end to end?

Zealots

"and there is just no ATM there!
we are talking about _real_ 155MB, no fake"

Complexity

◆ much session-dependent state in the net
◆ routing
◆ QoS scheduling (time-share again?)
◆ in comparison to alternatives

Standards Process

◆ rather big
◆ rather political
◆ rather commercial
◆ rather confusing
◆ why was it necessary to say that ATM Forum would not commit patricide (anymore)?
◆ slow?

ATM

◆ the ATM dream

◆ was it the original mission?

◆ could it have been real?

◆ did it do more harm than good?

Cells In Frames (CIF)

◆ hype in open feedback loop?

◆ way to preserve host interface and LAN
   connection investment?

ATM's future

◆ one of the gang

Future

◆ no monoliths
   assuming type of desktop connectivity is chancy
◆ no predictable end to end technology
   other than transport protocol
◆ the transport protocol of the future
   will be called IP