Slide 1

ATM: Dangerous at any speed?

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Slide 2

The ATM Conspiracy?

- lack of critical technical
- politically incorrect (RACE/ACTS $\equiv$ ATM)
- evolving: "this is in capability set $N + 1$"
- large field (Didn't you read the paper in *Sixth Macombe County Workshop on ATM* sponsored by the Kiwanis?)
- Internet NAP crisis (ATM fallback to FDDI): nobody wants to talk

$\rightarrow$ point out operational *and* technical challenges
$\rightarrow$ basis for discussion

Slide 3

ATM Today

European ATM pilot:

- 34 Mb/s, permanent point-to-point VPs only (by fax), UBR
- some AAL 3/4, some AAL 5
- very small switch buffers
- VP by fax (48 hour turnaround)
- UNI 3.1 signaling not compatible with UNI 3.0 signaling
- German tariff for 34 Mb/s: $18,000/month; $2500/hour (regional)

→ not fair, won't discuss

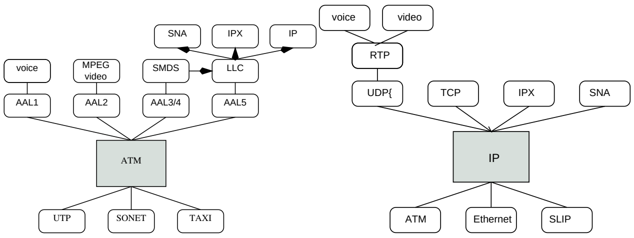
Slide 4

ATM Has Grown Up

- AAL per service class → AAL5, AAL1 for carriers, AAL3/4
- GFC not defined, used
- DQDB (as opposed to SMDS) used?
- service classes $\xrightarrow{\text{ATM Forum}}$ QOS parameters

Slide

Two Views of the World



→ the disappearance of the network layer?

Slide

ATM inheritance of X.25 and ISDN

- connection-oriented
- VCI/VPI concept (but more of them)
- interfaces (UNI/NNI) instead of protocols
- ISDN signaling (Q.2931)

Slide 7

Fixed, Small Cells

Old topic, but…

- $>$ 30% overhead for data; packetized voice: 60% utilization
- higher overhead → worse overload performance
- queueing behind long packets only matters for slow links
- want to discard frames, not cells → PPD and EPD → AAL visible to switch → ≈ 1 AAL (5)

Slide 8

Host Adapters

- gate comparison 100 Mb/s Ethernet vs. 25 Mb/s ATM?
- reassembly buffers larger for partial packets
- need garbage collection for partially assembled cells (denial of service attack?)
- want single demux point in protocol stack → ~~AAL3/4~~

Slide 9

VCs

- scarce (X.25, ISDN) $\rightarrow$ signaling $\leftrightarrow$ cheap $\rightarrow$ hold forever?
- garbage collection on node or software failure?
- typical switch: 4096 VCs
- over 64 seconds, a router sees 2000 flows
- software connection behavior may depend on carrier tariff structure
- telephone (reconnect on failure) or TCP (keep probing?)
- distinction VPI/VCI $\rightarrow$ disappear as for X.25? management?
- if no VP, VCs are scarce (2^{16}); need 37,500 phone calls per OC-48, want to support electric meter readers
- latency: 157 ms locally ($\equiv$ 3 MB of data at 155 Mb/s; RPC, WWW?)
- charges for connection setup?

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Slide 10

Multicast

- IP multicast: per-group state per mesh
- ATM multicast: per-VC state $\rightarrow M \cdot N$ per mesh
- currently, root has to add participants (ST-II experience: a pain)
- rendezvous problem (no group addresses):
  1. find one participant (how?)
  2. ask it for all other participants (long list)
  3. set up own root
- receiver-joins in UNI 4.0?

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Slide 1

Network View

Internet:

- interconnection of technically equal networks
- routing determines status: transit or subscriber
- hosts can become (backup) routers
- wire/fiber with two ends

ATM, X.25, FR:

- few networks, lots of customers
- trusted carrier talks to untrusted customers
- carrier vs. customer premises equipment
- interfaces, demarc

→ still a culture gap

Slide 1

UNI vs. NNI

- separation really useful? (ATM LAN to other networks?)
- currently, no NNI
- NNI-0: static configured routes (→ OSPF-like)
- addressing hierarchy (currently, organizational hierarchy)?
- E.164 numbers geographical, does not work well for multiple providers

Slide 13

Security

- current signaling relies on trusted carriers checking originating phone number
- no security on call setup (impersonate anybody)
- during call, “stealing” VCs if switch compromised

Slide 14

Signaling

- SPANS was pretty good (RPC based, XDR encoding, single exchange)
- signaling delay adds to transport handshake
- possibly several three-way UNI handshakes
- ugly: 7-bit bytes, BCD digits, not aligned, strange packet formats
- call/connection, advanced functionality: not better done at higher layers?
- most of IN functionality can be trivially implemented by end systems, using data protocols

Slide 15

TCP over ATM

- most experiments carefully tune parameters (policer, shaper, window size, MSS, ...)
  - not practical in operational networks
  - very sensitive to slight parameter variations
- Naive TCP over UBR performs very badly
- TCP uses moderate loss to probe network capacity
  but: moderate cell loss turns into massive packet loss for long packets

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Slide 16

TCP over ABR

- zero rate, but still send RM cells (1/32nd of data rate)
- TCP needs non-zero MCR; otherwise, no ACKs

Four modes:

1. TCP over CBR, with GCRA at edge – anybody?
2. TCP over UBR, no shaping: $\rightarrow$ 0 throughput
3. TCP end-end ABR: slow start just gets in the way
4. mixed bag: all losses at edge of ABR cloud

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Slide 17

Operational Issues

- need `ping`: OAM specified for UNI, VC/VP, but not implemented
- need `traceroute`: maybe signaling?
- directory service to map names/IP addresses/…to ATM NSAPs?
- several ATM address formats → hard to have an ATM internet

Slide 18

Coexistence Architecture

- IP over fiber/SONET?
- dump SMDS (use FR format instead if you must)
- dump GFC, use uniform VCI/VPI
- LAN emulation only for transition (offers no QOS advantages)
- AAL1 only for DCS, not for workstations
- AAL5 dominates computer applications → special treatment by switches
- VPs between IP routers for datagram traffic, using ABR?
- end-end ATM VCs for traffic with minimum bandwidth requirements
- challenge: build fast (IPng) routers
- IPng addresses within ATMF NSAPs?