IP over ATM

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These slides are available at http://www.cis.ohio-state.edu/~jain/talks/atm_ip.htm

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Overview

- Key Features of ATM
- LAN Emulation
- Classical IP over ATM
- Multicast Address Resolution (MARS)
- Next Hop Resolution Protocol (NHRP)
- Multiprotocol over ATM (MPOA)
- IP Switching
What is ATM?

- Asynchronous Transfer Mode
- ATM Net = Data Net + Phone Net
- Combination of Internet method of communication (packet switching) and phone companies’ method (circuit switching)
ATM: Key Features

- Fixed Size Cells: 48B payload + 5B header
- Connection Oriented: Dial-up virtual circuits (VCs)
- Switching: VC Id is used as index. No address lookup.
- Signaling: Declare the traffic and performance
- Quality of Service: Path depends upon delay/throughput
All IP nodes have a 32-bit IP address
IP routers forward the packets towards the destination subnet
On the same subnet, routers are not required.
On the destination subnet, IP address is translated to LAN address.
IP Over ATM
Make ATM layer look exactly like Ethernet layer
IP layer runs on ATM as if it is running on Ethernet
⇒ LAN emulation

IP Addresses: 164.56.23.34
Ethernet Addresses: AA-23-56-34-C4-56
ATM : 47.0000 1 614 999 2345.00.00.AA....
- LAN Emulation driver replaces Ethernet driver and passes the networking layer packets to ATM driver.
- Each ATM host is assigned an Ethernet address.
- LAN Emulation Server translates Ethernet addresses to ATM addresses.
- Hosts set up a VC and exchange packets.
- All software that runs of Ethernet can run on LANE.
LAN Emulation

1. Client gets recipient's address from LES and sets-up a VC.
2. Client sends messages on the VC.
3. Messages for ATM clients are delivered directly.
4. Messages for non-ATM clients are forwarded through bridges.

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IP Over ATM: Issues

1. How to find ATM addresses from IP addresses
   Address resolution [RFC1577]
2. How to handle multicast? [MARS, RFC 2022]
3. How do we go through $n$ subnets on a large ATM network? [NHRP]
Address Resolution

- IP address: 123.145.134.65
  ATM address: 47.0000 1614 999 2345.00.00.AA....

- Issue: IP Address ⇔ ATM Address translation
  - Address Resolution Protocol (ARP)
  - Inverse ATM ARP: VC ⇒ IP Address

- Solution: ATMARP servers
ATM stations are divided into Logical IP Subnets (LIS).

ATMARP server translates IP addresses to ATM addresses.

Each LIS has an ATMARP server for resolution.

IP stations set up a direct VC with the destination or the router and exchange packets.
IP Multicast over ATM

- Multicast Address Resolution Servers (MARS)
- Internet Group Multicast Protocol (IGMP)
- Multicast group members send IGMP join/leave messages to MARS
- Hosts wishing to send a multicast send a resolution request to MARS
- MARS returns the list of addresses
- MARS distributes membership update information to all cluster members
Next Hop Resolution Protocol

- Routers assemble packets ⇒ Slow
- NHRP servers can provide ATM address for the edge device to any IP host
- Can avoid routers if both source and destination are on the same ATM network.
Multiprotocol Over ATM

- MPOA = LANE + “NHRP+
- Extension of LANE
- Uses NHRP to find the shortcut to the next hop
- No routing (reassembly) in the ATM network

Routing

Bridging

Next Hop Resolution Protocol
Multicast Address Resolution Server
LAN Emulation
IP Switching

- Developed by Ipsilon
- Routing software in every ATM switch in the network
- Initially, packets are reassembled by the routing software and forwarded to the next hop
- Long term flows are transferred to separate VCs. Mapping of VCI in the switch ⇒ No reassembly
IP Switching (Cont)

- Flow-oriented traffic: FTP, Telnet, HTTP, Multimedia
- Short-lived Traffic: DNS query, SMTP, NTP, SNMP, request-response
  Ipsilon claimed that 80% of packets and 90% of bytes are flow-oriented.

- Ipsilon claimed their Generic Switch Management Protocol (GSMP) to be 2000 lines, and Ipsilon Flow Management Protocol (IFMP) to be only 10,000 lines of code

- Runs as added software on an ATM switch
- Implemented by several vendors
After
LANE allows current applications to run on ATM
- Classical IP allows ARP using ATMARP servers
- MARS allows IP multicasts on ATM
- NHRP removes the need for routing in an ATM net
- MPOA combines LANE and NHRP
- IP Switching automatically set up VCs for long-lived flows.
References

- LAN Emulation and IP over ATM References, http://www.cis.ohio-state.edu/~jain/refs/ipoa_ref.htm
Thank You!