PART IV: Internetworking of ATM, LANs, and the Internet

Classical IP and ARP over ATM
RFCs 1577, 2225

Objective

- Use ATM to "replace the wires" connecting stations, as in a "classical" LAN.
- The ATM cloud is equivalent to one Logical IP Subnetwork (LIS).
- Multiple LISs still need to be interconnected by routers.
- Originally defined in RFC 1577; revised by RFC 1626 and RFC 2225.

Issues with supporting IP over ATM

- ATM is connection-oriented; a node cannot communicate with any other node until a connection (VC) is established.
- To send packets, a node must first open the connection.
- To open the connection, a node must know the ATM address of the destination.
- The node only knows the destination IP address.
- Problem: how to translate a destination IP address into an ATM address in a network where there is no broadcast?
  - Need to come up with something similar to ARP!

Classical IP Characteristics

- The same MTU (Maximum Transfer Unit) is the default for the whole LIS, but may be changed in a VC basis.
  - Recommended default is 9180 bytes
- Uses the LLC/SNAP encapsulation from RFC1483.
- Same end-to-end IP routing architecture as other networks.
- IP addresses are resolved into ATM addresses by using an ATMARP service (server) within the LIS.
  - From the client point of view, it follows the same model as classical ARP
- Each VC connects two members in the LIS.

Configuration Requirements

- All members of the LIS must have the same IP subnet number and mask.
- All members of the LIS are directly connected to the ATM network.
- All members of the LIS must have access to the ATMARP services:
  - Converting IP addresses into ATM addresses and vice versa.
  - Figuring out the IP address of the node on the other side of a PVC or SVC.
- Any member of the LIS must be able to communicate via ATM with any other member of the LIS.

Inverse ARP (InARP)

- Originally defined in RFC 1293 in the context of Frame Relay.
- Used in ATM unmodified.
- Given a VC (PVC or SVC), InARP is a mechanism to discover the IP address of the device on the other side of the VC:
  - Target "hardware address" (ATM address of the other side) is known.
  - Node sends a standard unicast ARP request, indicating its own hardware and IP Address as the source, the target's known hardware address.
  - The target adds the source hardware and IP address to its cache, and responds with its IP address.
  - The source adds the target's IP and hardware addresses to its cache.

PVC Operation

- Uses the InARP protocol.
- Stations are manually configured with the PVC numbers they should use.
- Stations issue InARP requests over each of the PVCs, and learn the IP addresses of the nodes on the other side of each PVC.
- Unknown fields in the ARP packet (e.g., target hardware address) are set to a null length.

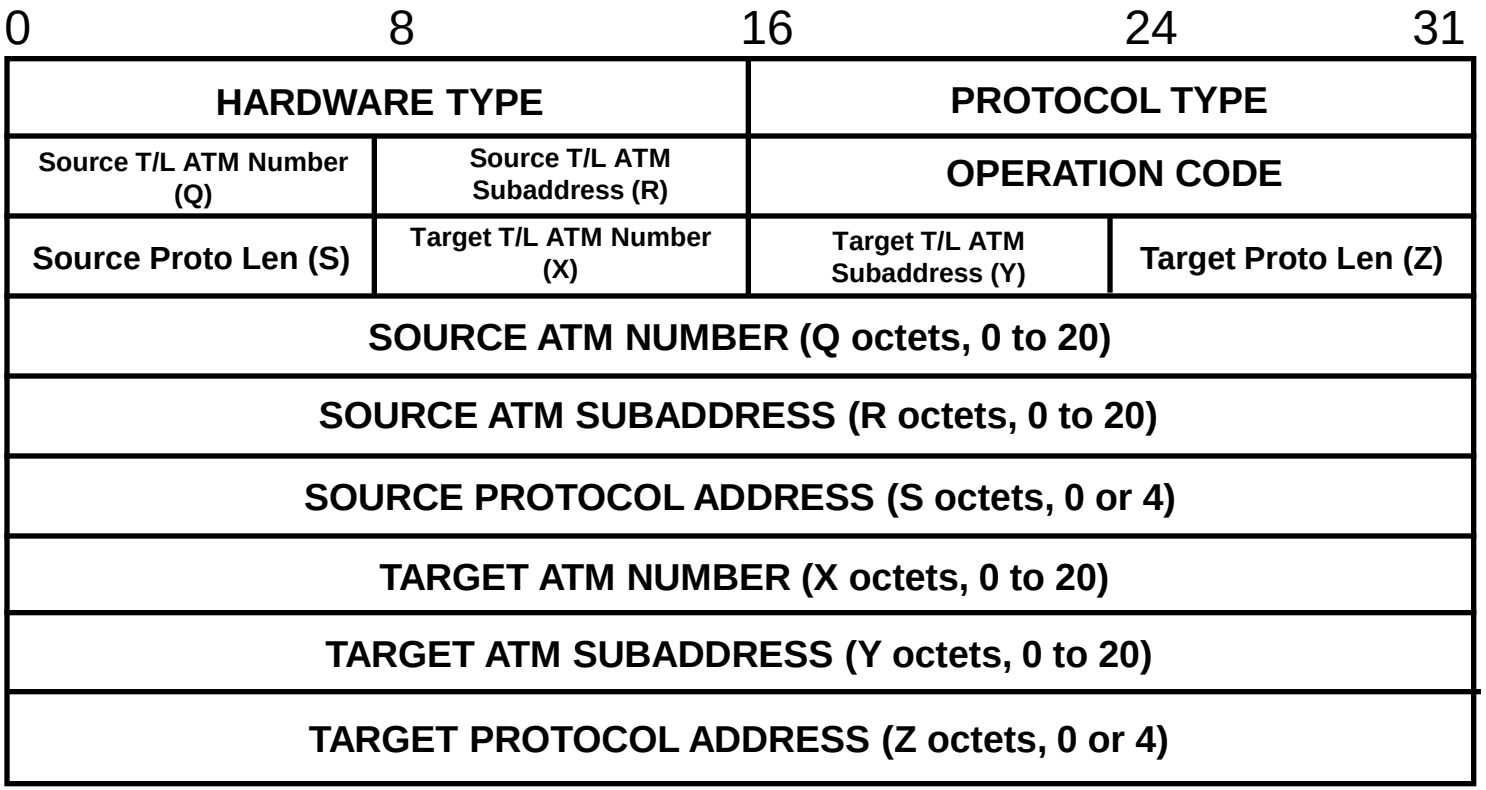
SVC Operation

- An ATM ARP server is required to "replace" the broadcast function.
- All members of the LIS are manually configured with the ATMARP server ATM address.
- ATMARP servers are passive and never initiate connections.
- Clients initially register with the ATMARP server when they boot:
  - Open an SVC to the server.
  - Send an ARP request for the client's own address (to verify duplication and register with the server)
- Clients are also required to:
  - Refresh their registrations at least once every 15 minutes.
  - Respond to InATMARP requests.
  - Generate InATMARP requests as needed.
  - Refresh their ARP cache entries.

ATM Address/Subaddress

- Normally a node has only one ATM address.
- This address can either be an ATM Forum NSAPA (ICD), if it is on a private ATM network, or an E.164 address, if it is connected to the public network.
- However, a node may be (logically) connected to BOTH types of networks, and have BOTH an ATM Forum NSAPA and an E.164 address.
- In this case, the ATM Forum NSAPA is considered a Subaddress.

ATMARP Packet Format

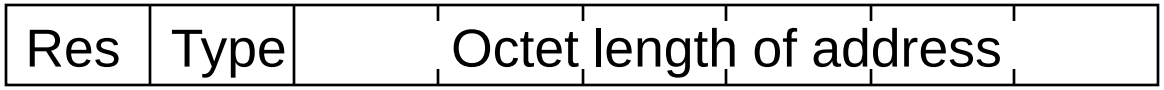


ATMARP Packet Fields

- **Hardware Type:** 0x0013 (ATM Forum address family)
- **Protocol Type:** Standard protocol type (0x0800 for IP)
- **Operation Code:**
  - ARP Request: 1
  - ARP Reply: 2
  - InARP Request: 8
  - InARP Reply: 9
  - ARP NAK: 10

  (ARP NAK is used by the ATMARP server to indicate that it does not know the requested mapping)

Type/Length Fields



- Res: reserved, set to 0.
- Type:
  - 0: ATM Forum NSAPA Format
  - 1: E.164 Format
- Length of address, from 0 to 20.

Limitations of Classical IP

- No support for broadcast traffic.
  - Nodes still need to recognize and deliver broadcast packets if they see them.
- No support for IP multicast (where to send it?).
  - A "multicast address resolution server" has been proposed (RFC 2022, November 1996) but has never been implemented commercially.