IP Multicast over UNI 3.0/3.1 ATM Networks.

Goals:

- Work within RFC 1577 model.
  (Evolution not revolution)
- Utilize UNI 3.0/3.1 multicast services.
  (higher performance than IP level mc servers)
- Follow 'spirit' of RFC 1112 IP multicast model.

Non-goals:

- Dependency on future UNI 4.0 services.
- Anything to do with IP multicast routing.

Summary: Support IP multicast using ATM UNI 3.0/3.1 services within the scope of single RFC 1577 Logical IP Subnets.

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Constraints and Requirements:

- UNI 3.0/3.1 provides Root managed, Point to Multipoint VCs.
  - ◊ Need service to track and map Class D IP addresses to groups of ATM 'leaf node' addresses.
- IP hosts may join/leave groups at any time.
  - ◊ Need asynchronous distribution of 'leaf node' address information.
- IP hosts may send to group without joining.
  - ◊ Decouple 'send' side VC management from local 'join/leave' operations in each host.
- Robustness of group membership management.
  - ◊ Sequence numbers synchronized to changes.

Key decisions:

- Primary packet distribution is through mesh of ATM multicast VCs.
- The ARP Server...
  - ◊ becomes a central registry of `{IP class D, ATM.1, ATM.2, ..... ATM.n}` mappings.
  - ◊ Returns mappings in `ARP_MULTI`(s) when resolving `ARP_REQUESTs`.
  - ◊ Receives `ARP_MCJOIN` and `ARP_MCLEAVE` messages from hosts explicitly joining or leaving a Class D group.
  - ◊ Maintains a Pt to Mpt VC to every 'registered' multicast host in the LIS. Propagates `ARP_MCJOIN` and `ARP_MCLEAVE` messages over this VC.

Key decisions (continued):

- The IP host...
  - ◊ Sends ARP_MCJOIN and ARP_MCLEAVE messages when joining or leaving a Class D group.
  - ◊ Sends ARP_REQUESTs for Class D addresses just as it would for unicast IP addresses.
  - ◊ If response is ARP_REPLY, host establishes unicast VC as per RFC 1577.
  - ◊ If response is ARP_MULTI, host establishes itself as root of pt to mpt VC, with supplied ATM addresses as initial leaf nodes.
  - ◊ Updates pt to mpt VCs based on subsequent ARP_MCJOIN and ARP_MCLEAVE messages received from ARP Server.

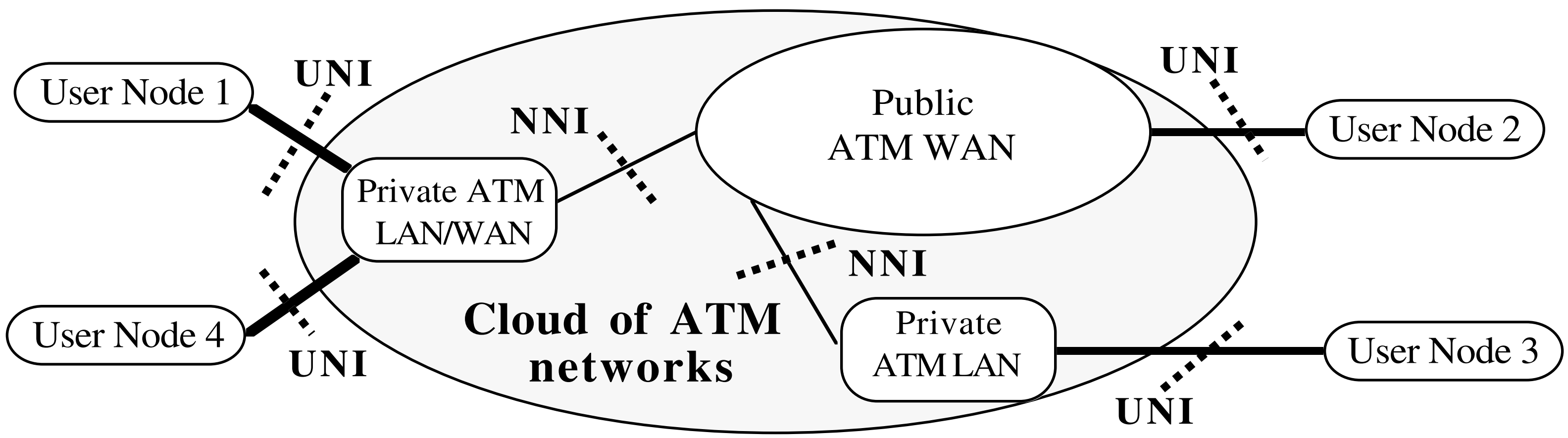
'Registration':

- RFC 1112 requires all multicast hosts be members of the 'all hosts' group - 224.0.0.1
    - ◊ ARP Server 'registers' a host when the host `ARP_MCJOIN`s group 224.0.0.1.

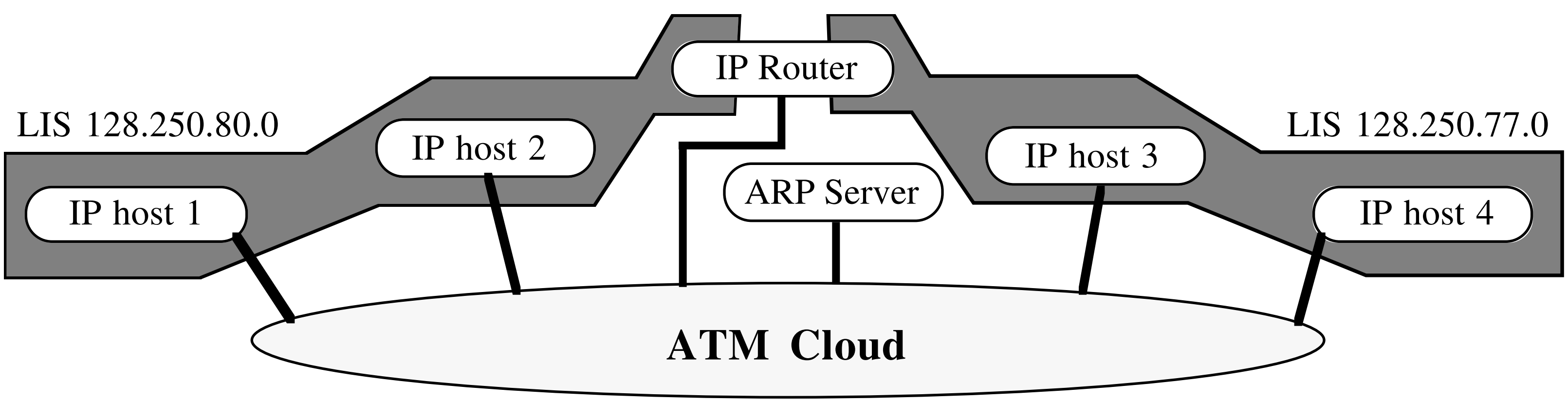
Robustness:

- ARP message loss between host and ARP Server:
    - ◊ Host repeats `ARP_MCJOIN/MCLEAVE`s until it sees its own message back from ARP Server.
- ARP message loss between ARP Server and registered hosts.
    - ◊ Host tracks sequence numbers in all received `ARP_MULTI`s and `ARP_MCJOIN/MCLEAVE`s. Revalidates groups if sequence jumps by 2 or more.

Review - ATM clouds that LIS may span:



Review - LIS wrt ARP Server:



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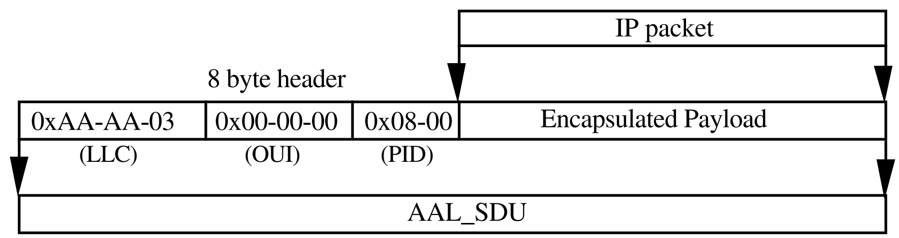
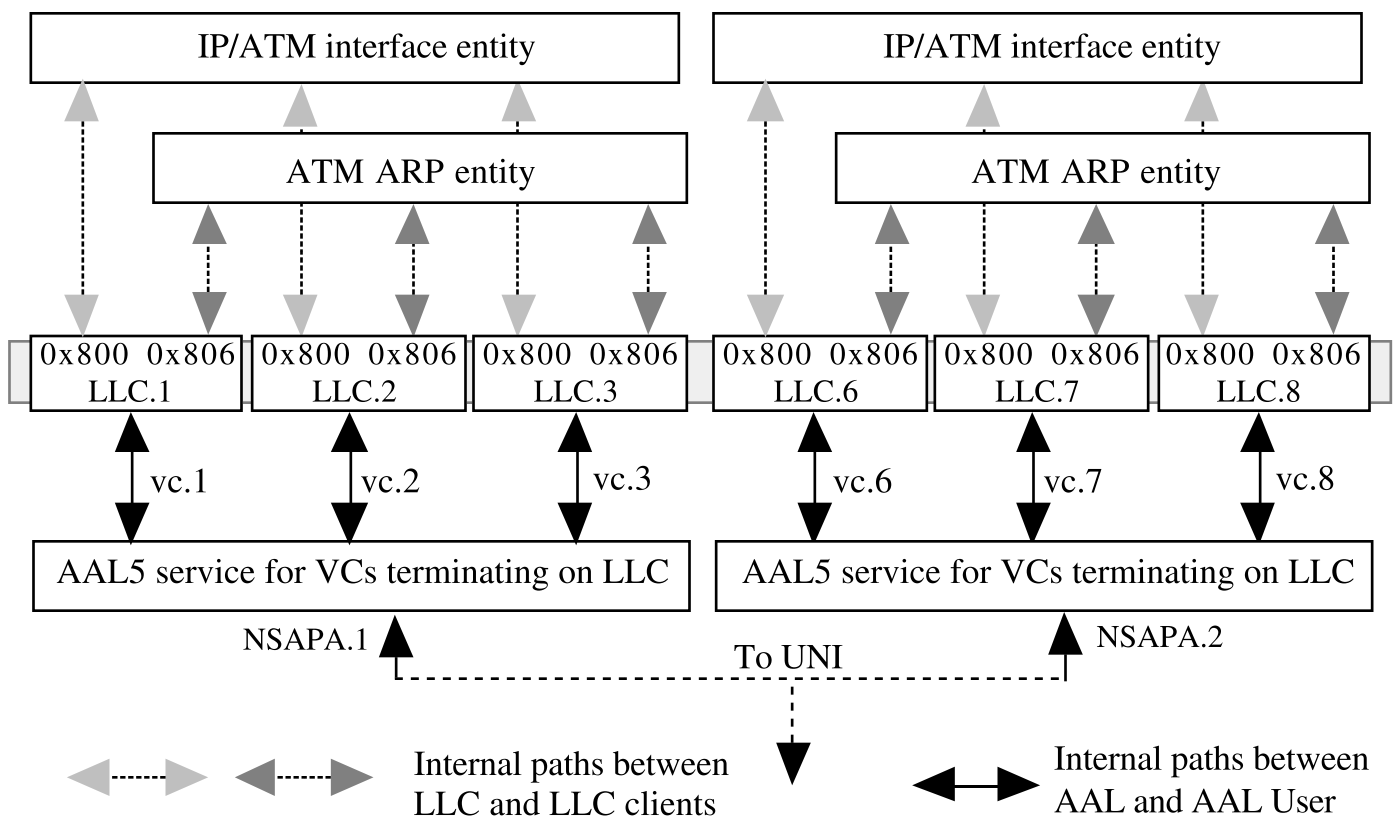
Review - Encapsulation implies LLC layer:





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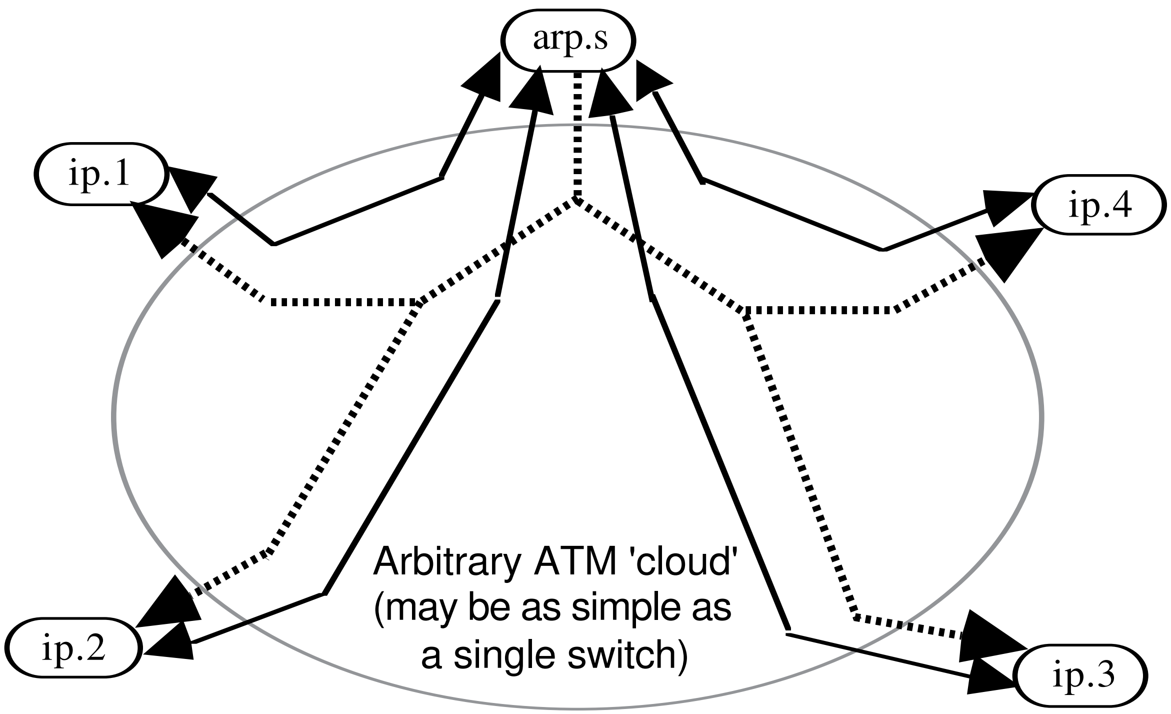
ARP related VCs within a single LIS:

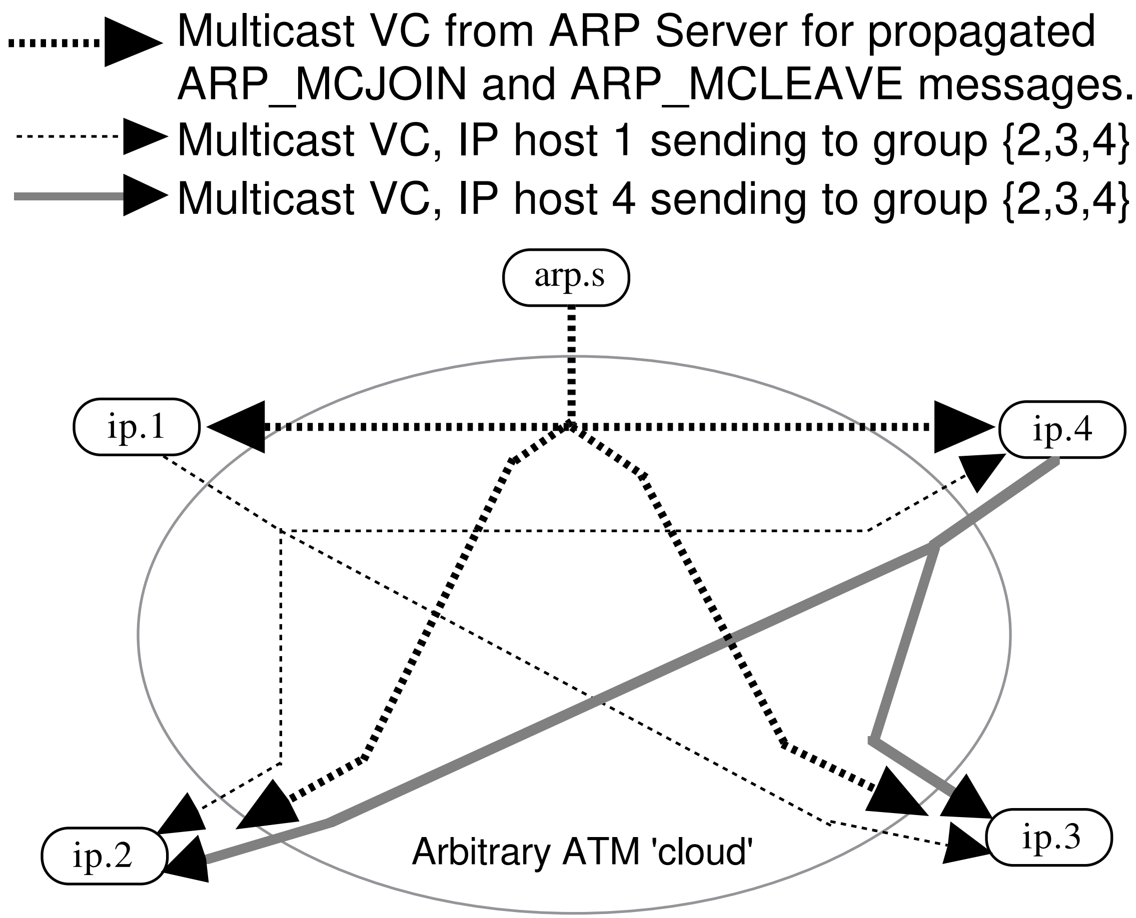
arp.s The ARP Server. ip.n Arbitrary IP host on LIS.

Unicast VC initiated by host for ARP Request, ARP Reply, ARP MULTI traffic.

Multicast VC from ARP Server to host(s) for retransmission of ARP_MCJOIN and ARP_MCLEAVE messages.



Multicast VCs for Class D traffic within LIS:



Unicast VCs for ARP Request, ARP MULTI reply omitted for clarity.

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IP multicast router support:

Present models require multicast routers on subnet edges to have 'promiscuous' reception capability across all Class D groups.

- ARP Server returns routers in every Class D group.
  - ◊ `ARP_MCJOIN/MCLEAVE`s may specify 'blocks' of Class D addresses to be joined or left in a single operation.
- Terminating many VCs may exhaust 'reassembly contexts' in router's ATM interface.
  - ◊ Load may be 'shared' across interfaces by joining each interface to a subset of the Class D space.
- Partially promiscuous router interfaces can ignore high performance multicast groups within LIS.