Routing Over Large Clouds Working Group

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13:30 - 15:30, 16:00 - 18:00

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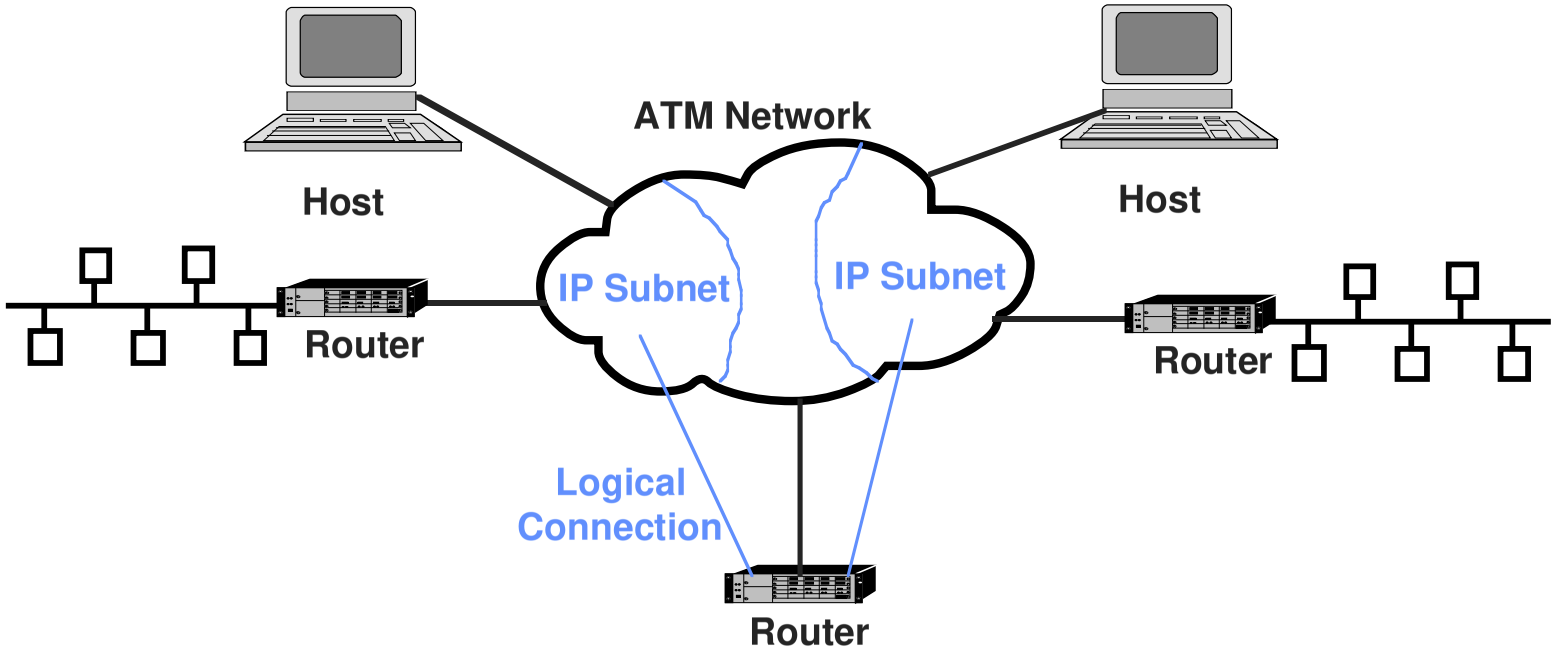
Agenda

- Agenda bashing
- ROLC introduction
- ATM Forum update
- NARP and NHRP implementation experience
- NHRP specification discussion
- Open technical issues (authentication, etc.)
- Discussion of NHRP status and WG recommendation to the IESG (if any)
- Planning for the NHRP Protocol Analysis document
- Updating the workplan

Problem Statement

- Analyze and propose enhancements to IP routing over large “shared media” link layer (with respect to IP) networks
  - ATM
  - Frame Relay
  - X.25
  - SMDS
  - etc.
- Avoid “extra hops” when routing IP
  - Defined as IP datagrams leaving and re-entering the same link-layer cloud as a result of an IP routing decision, such as when routing between different IP subnets overlaid on the same cloud

Finding the "Optimal" Next Hop



ROLC Requirements

- Enable communications between two entities in different IP subnets on the same cloud.
- Support policy restrictions (cannot subvert filtering, etc.).
- Be compatible with existing routing protocols.
- No new infrastructure deployed.
- Must apply to multiple media and routing technologies.
- Must be loop free.
- Support for complex cases should not unduly burden simple cases.
- Support routing hierarchies and aggregation.
- Operate in the presence of multiple layers of routing aggregation, including aggregates which cross the cloud boundary.

ROLC Goals

- Should be effective and cheap in terms of network resources.
- Be extensible to handle QoS (and other new features) in the future.
- Be able to determine the path before having sent any data packets over it.
- Should be diagnosable.
- Should be deterministic.
- Should work on a cloud where not all attached routers are NHRP-capable.
- Reasonable robustness in the face of misconfiguration.
- As much autoconfiguration as possible.
- Non-goal: the working group is not trying to couple this work to link layer routing (this would involve significantly more complexity).

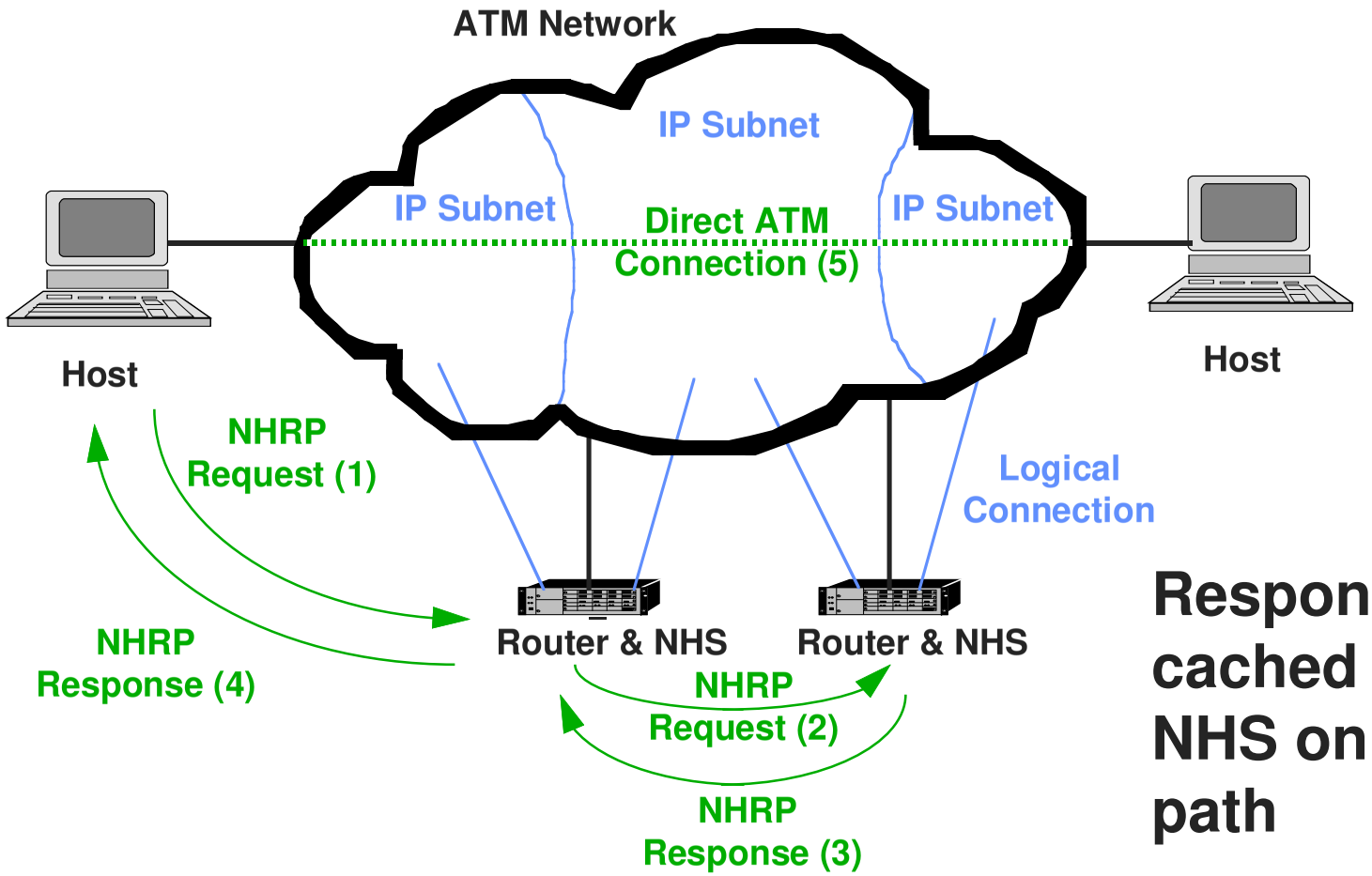
Introduction to Next Hop Resolution Protocol

- Used by IP source station to determine “best” link layer address to use to reach a destination station
- Result may be link layer address of:
  - The destination itself
  - Closest exit router to the destination
  - An intermediate router, if required by policy restrictions
- NHRP may be incrementally deployed
  - First in some routers - Server Mode
  - In all routers - Fabric Mode
  - Hosts are identical no matter which mode is in use
    - Host support may be incrementally deployed as well (existing hosts can benefit via NHRP-capable router)

Protocol Overview

- Participating hosts register with their Next Hop Server (NHS), exit routers may register entire IP subnets behind them
- Source host sends NHRP request to NHS, host may also send data along routed path
- NHSes forward the request to the destination's NHS
- Destination's NHS returns proper link layer address, result cached on way back
- Source opens direct connection to destination for subsequent datagrams

NHRP Example



Response is cached in each NHS on return path

Server Mode and Fabric Mode

- In Server Mode, only a small number of routers also NHSes
  - Static configuration used for NHS-to-LIS associations and NHS adjacencies
  - This produces NHRP request/reply route
- In Fabric Mode, all ingress/egress routers are also NHSes
  - IP Routing used to produce NHRP request/reply route
  - No static configuration required
- Host configuration is identical for both modes

NHRP Supports ...

- Network-layer policy restrictions
  - If a router on the path has filtering enabled, it can provide its own address in the response
- Quality of Service
  - Desired QoS of the final path can be included in NHRP Requests
- Supportability
  - Includes forward and reverse route recording and full error indications
- Other network layer protocols
  - Protocol ID field allows use of IPng and other network layer address formats in NHRP requests and replies

Current Workplan

Dec 94 Meet at San Jose, put finishing touches on NHRP, plan implementations and analysis document.

Dec 94 Submit NHRP document to IESG as a Proposed Standard.

Apr 95 Submit companion analysis document to IESG.