Packet Format

• UDP, request/response

• Same packet layout for requests and responses

• Extensible using Informational Elements (IE)
Request

Ver=1 | reserve | 0 | OpCode | Reserved | reserve | 0 | OpCode |

Reserved

Reserved

Internal IP address (32 or 128)

Requested external IP address (32 or 128)

Requested lifetime

internal port | requested external port

(optional) Informational Elements
Opcodes

- PIN44, IPv4 address to IPv4 address
  - NAT44 or IPv4 firewall
- PIN46, IPv4 address to IPv6 address
  - NAT46
- PIN64, IPv6 address to IPv4 address
  - NAT64
- PIN66, IPv6 address to IPv6 address
  - NAT66 or IPv6 firewall
Response

Ver=1 | reserve|1| Opcode | Reserved | Result Code |
Epoch
Internal IP address (32 or 128)
Assigned external IP address (32 or 128)
Assigned lifetime
internal port | assigned external port
(optional) Informational Elements

Most fields echoed from request
Accommodate NATs which (never) lose state
Open Issues (chairs)

- Epoch
- Transaction ID
- Mandatory semantic
Open Issues

• ICMP
• Firewall
• PCP lifetime
• Multi-homing
• Requesting multiple ports
• RTP
• PCP server discovery
  – DHCP option, IANA-registered IP address, default router
  – Only allow CPE to do it?
• DS-Lite encapsulation for PCP messages
ICMP

• ICMP for flow associated with TCP or UDP pinhole

• Implicit or Explicit?
  – Implicit: opens as side-effect of TCP/UDP pinhole
  – Explicit: have to separately open ICMP pinhole
Firewall

• How many remote peers? 1?
• Follow draft-ietf-v6ops-cpe-simple-security?
  – This means simple pinhole, no validation of TCP flow
• Implicit ICMP, or explicit ICMP?
PCP Lifetime

• What happens when PCP lifetime expires?
  1. Expires at end of lifetime
  2. inside->outside traffic keeps mapping alive
  3. Bi-directional traffic keeps mapping alive
Multi-homing

• Common answer is “home users don’t multihome”. But that is changing:
  – E.g., cable/DSL/FTTH with 3G backup link
  – E.g., VPN into enterprise and an Internet connection

• In scope? Out of scope? Defer to later?
Requesting Multiple Ports

• It’s an optimization
• The only cited protocol is RTP
  – (See next slide)
  – If there are other protocols, speak up now!
• Thus, not interested in complicating the protocol
RTP

• RTP likes even+odd port
  – Can’t tell if remote peer is legacy RFC1889 device

• New proposal: IE called “EVEN_PLUS_ONE”
PCP Server Discovery

• DHCP option
  – Requires support by CPE router
• IANA-registered IP address
  – Follows normal route towards the Internet
    • Just like a TCP SYN
  – 192.0.2.1 (DS-Lite’s AFTR address)
• Default router
  – Requires support by CPE router
PCP encapsulation for DS-Lite

- PCP-over-UDP packets from B4 to AFTR
- Two methods:
  - PCP-over-UDP-over-IPv4-over-IPv6, “Encapsulation Mode”
    - IPv4 addresses = subscriber (192.0.0.*) and AFTR (192.0.0.1)
    - IPv6 address=B4 and AFTR
    - Allows B4 to proxy PCP messages, or pass through
  - PCP-over-UDP-over-IPv6, “Plain IPv6 Mode”
    - IPv6 address=B4 and AFTR
    - Requires B4 to proxy PCP messages from internal hosts