Document Clarifications

• All NAT mappings are bidirectional
  – MAP mappings apply for both inbound and outbound packets
• MAP mappings are by definition EIM
  – Purpose of MAP mappings is to receive traffic from any peer
• PEER mappings may be EIM or EDM
Document Clarification

THIRD_PARTY Option and Liveness

• Clients using THIRD_PARTY option (e.g. IGD IWF) MUST verify ongoing liveness of the third party
  – e.g. periodic test connections to the service, etc.
• Purpose of lifetime & renewals is to clean stale state
• If device goes away, its mappings should clean up too
• Clients using THIRD_PARTY option MUST NOT defeat this mechanism by renewing unwanted mappings forever
Document Enhancement

Sample Code Improvements

• Improve sample code to illustrate event-driven operation
• PCP mappings are *by necessity* dynamic
  – May move your laptop to a new network and get a new external address and port
  – NAT gateway may be rebooted and give you a new external address and port
• Current sample code suggests:
  – Client asks for mapping
  – Client gets it
  – Client never has to think about it again.
• This is not what we intend to suggest
Protocol Question

PCP Port Number 5351 or 44323?

• PCP Packet format is based on NAT-PMP
• Initial fields of header are the same
  – Version 0 ⇒ NAT-PMP
  – Version 1 ⇒ PCP
• Using 5351 for both NAT-PMP and PCP eases transition
  – Dual-mode server listens on only one port
    and handles both kinds of requests
  – Dual-mode client sends PCP-format request to 5351;
    from NAT-PMP-only server gets immediate “bad version”
    error so client can re-issue request as NAT-PMP-format
Protocol Clarification

PCP Lifetime Extension with Active Traffic

- Uniform treatment of all mapping types:
  - Outbound packet & PCP request
    - Creates mapping if necessary
    - Extends expiration timer if necessary
  - Inbound packet
    - Does neither
    - (Remote peer is not necessarily trusted)
Protocol Enhancement

Notification of State Changes

• Needed for capability parity with NAT-PMP
• State Loss:
  – On reboot, NAT MAY multicast announcement
  – Clients MAY listen for multicast announcements
• Reconfiguration:
  – NAT MUST send new unicast replies to clients
  – Clients MUST handle unsolicited responses
Design Philosophy Comment

• Purpose of PCP server is to **serve** PCP clients
• Reasonable for server to reject:
  – Malformed client requests (client software mistake)
  – Excessive client requests (user mistake)
    – Resource limits should be scoped so this rarely happens
• **Unreasonable** for server to reject:
  – Well-formed requests
  – This is why we’d like to eliminate a couple of bogus error codes
Protocol Simplification (1)

Eliminate NONEXIST_PEER error

• Allow PEER opcode to *create* a mapping?
  – Consistent handling of TCP SYN & PCP PEER opcode
  – Avoids race condition between which is received first

• Allow PEER opcode to *recreate* a mapping?
  – With addition of *suggested port* field
  – Allows connection recovery after reboot
  – No NAT is obliged to respect *suggested port* field
Protocol Simplification (2)

Eliminate IMPLICIT_MAPPING_EXISTS error

A:B → P:Q

C:D → R:S

E:F → R:S

E:F → P:Q

(EDM NAT)
Protocol Simplification (2)

Eliminate IMPLICIT_MAPPNG_EXISTS error

A

C

P:Q → A:B

R:S → E:F

R:S → C:D

(EDM NAT)

P:Q → E:F

R

P
Protocol Simplification (2)
Eliminate IMPLICIT_MAPPNG_EXISTS error

PCP MAP
A:B ← ALL

R:S → A:B ?
R:S → C:D ?

(EDM NAT)

R:S → E:F
ALL → E:F
X:Y → A:B

A
C
R
P
Protocol Simplification (2)

Eliminate IMPLICIT_MAPPING_EXISTS error

- What to do on reception of PCP MAP A:B request?
  - Give (A:B ← ALL) mapping external addr:port E:F and kill (R:S → E:F) ⇒ (R:S → C:D) mapping? No!
  - Give (A:B ← ALL) mapping different ext addr:port G:H?
    - (P:Q → E:F) ⇒ (P:Q → A:B)
    - (R:S → E:F) ⇒ (R:S → C:D)
    - (X:Y → G:H) ⇒ (X:Y → A:B)
    - (P:Q → G:H) ⇒ (P:Q → A:B)
  - Give (A:B ← ALL) mapping different ext addr:port G:H and kill (P:Q → E:F) ⇒ (P:Q → A:B) mapping?

These are the same!
What source to use for (A:B → P:Q) replies?
Protocol Simplification (2)

Eliminate IMPLICIT_MAPPING_EXISTS: Solution (1)

- Keep EDM (P:Q → E:F) ⇒ (P:Q → A:B) mapping
- Keep EDM (R:S → E:F) ⇒ (R:S → C:D) mapping
- Give EIM (A:B ← ALL) mapping same ext addr:port E:F but “subordinate” to any existing EDMs
- If a packet matches both an EDM mapping and an EIM mapping, then the EDM mapping is used
- If an EIM mapping exists, no new EDM mappings are made using the same external addr:port
- If an outbound packet matches only an EIM mapping, but a reply to the translated packet would match an existing EDM mapping and go to wrong internal host then a new EDM mapping needs to be made
Protocol Simplification (2)

Eliminate IMPLICIT_MAPPING_EXISTS: Solution (2)

- If an outbound packet matches only an EIM mapping, but a *reply* to the translated packet would match an existing EDM mapping and go to wrong internal host then a new EDM mapping needs to be made

- If we translate $A:B \rightarrow R:S \Rightarrow E:F \rightarrow R:S$ then reply will translate $R:S \rightarrow E:F \Rightarrow R:S \rightarrow C:D$

- In this case, only solution is that outgoing $A:B \rightarrow R:S$ packet has to make its own new EDM using different external addr:port not in use by any EIM

- Can be mitigated if NAT partitions its port space into ports for EDM use and ports for EIM use
Protocol Simplification (2)

Eliminate IMPLICIT_MAPPING_EXISTS

Remember:
This only applies to EDM NAT!