Discussion of PCP Authentication Approaches

IETF 85, Atlanta, November 2012

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Three Drafts Under Discussion

- PCP Authentication Mechanism
  - http://tools.ietf.org/html/draft-ietf-pcp-authentication-01
  - Describes PCP authentication options used in all choices
  - Defines a lower layer to run EAP directly over PCP
- Two alternatives that use PANA for key exchange
  - Provisioning Message Authentication Key for PCP using PANA (Side-by-Side Approach)
    - https://datatracker.ietf.org/doc/draft-ohba-pcp-pana/
  - Provisioning Message Authentication Key for PCP using PANA (Encapsulation Approach)
    - https://datatracker.ietf.org/doc/draft-ohba-pcp-pana-encap/

What is the same?

- All three approaches use EAP (and EAP methods) for key generation
- All three approaches use the same PA Security Association structure
  - As defined in draft-ietf-pcp-authentication-01.txt
- All three approaches use the same PCP Authentication option to pass authentication information in PCP requests, after keys are generated
  - As defined in draft-ietf-pcp-authentication-01.txt

What is Different?

- The only difference between these approaches is whether we use EAP directly over PCP for key management, or whether we use EAP over PANA for key management (either side-by-side with PCP on a single port, or encapsulated in PCP messages)
- In other words, the only difference is how we transport EAP messages
  - directly in PCP messages
  - in PANA messages encapsulated in PCP messages, or
  - in PANA messages sent side-by-side with PCP messages

Direct EAP-over-PCP Approach

- Defines a EAP lower layer
- EAP messages are sent directly in PCP messages
  - Defines PCP Authentication OpCode
- Key management is based on simplified version of PANA and GSS-EAP
- Mechanism allows for both client-initiated and server-initiated security
  - Clients can choose to make secure requests
  - Servers can require authentication when needed

What is PANA?

- RFC 5191: Protocol for Carrying Authentication for Network Access
- Three defined PANA entities:
  - PaC: PANA Client
    - Provides credentials to prove its identify for network access authentication
  - PAA: PANA Authentication Agent
    - Verifies credentials offered by PANA client, and authorizes network access
  - EP: Enforcement Point
    - Blocks all traffic (except PANA, ARP, ND, DHCP) to/from any unauthorized client

PANA Phases

- Authentication and authorization phase
  - A new PANA session is initiated and EAP is executed. Until authentication is complete, network access is blocked by the EP
- Access phase
  - Access device has access to the network
  - “Liveness Tests” may be performed by the client or server sent at any time during this phase
- Re-authentication phase
  - Sub-phase of access phase
  - Either side may initiate re-authentication to update the PANA session lifetime
- Termination phase
  - Either side may terminate, explicit termination message may be sent. After termination, network access is blocked by the EP.

PANA Properties

- Used to control network access
  - Potentially a continuous stream of packets between PANA client and arbitrary other nodes
    - Interruption of the stream could cause application failures
  - Accessing the service (network access) does not involve ongoing traffic between the PANA Client and the PANA Authentication Agent
- Authentication and authorization are tightly coupled
  - PANA client must be continually available for “liveness tests” or re-authentication, in order to retain network access

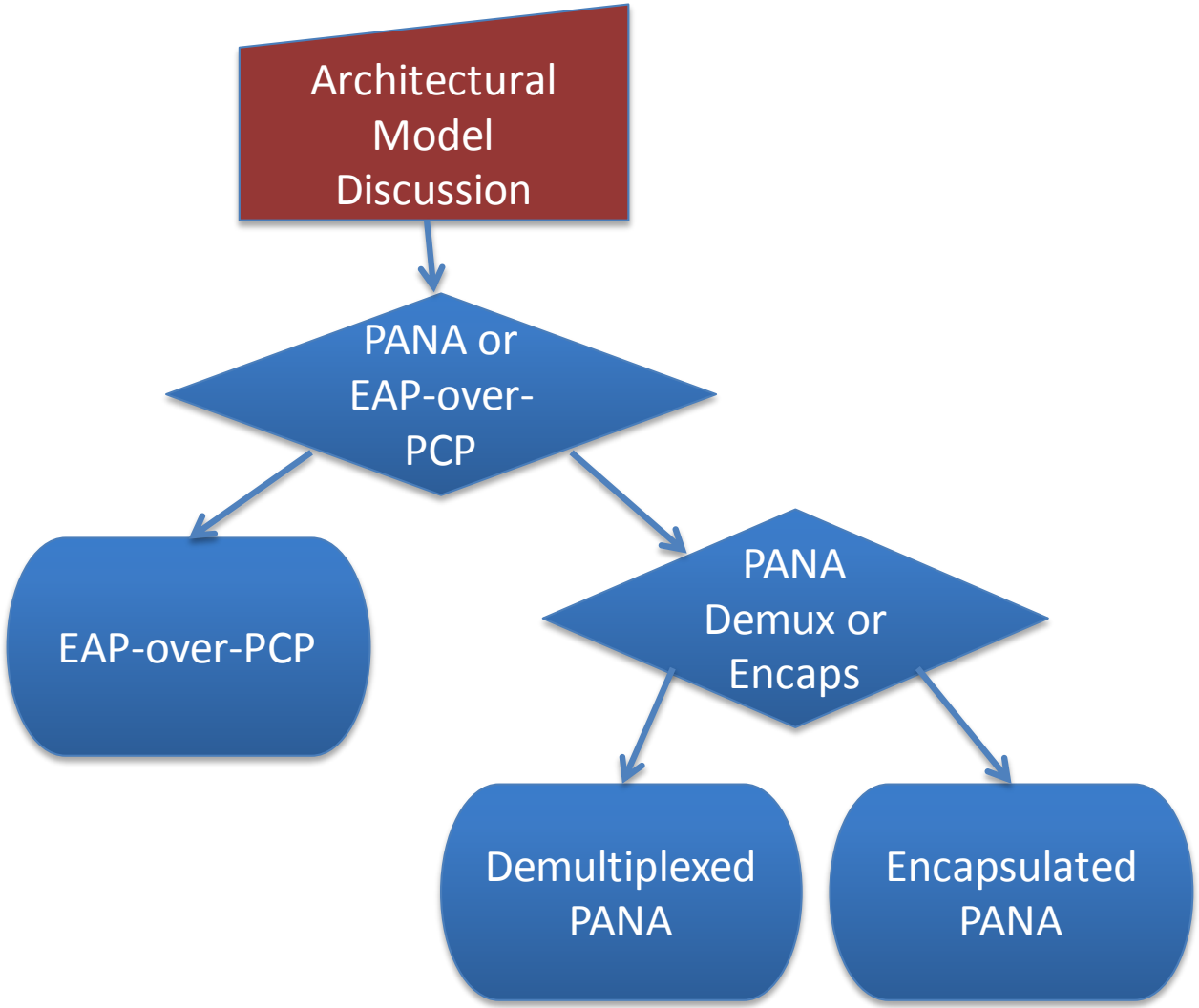
Side-by-Side Approach

- Received packets are demultiplexed based on the first bit of the PCP version field
  - A value of “1” indicate that this is a PANA packet
    - Requires reserving this bit in PANA
  - Any other value is PCP
    - Limits PCP version numbers to < 128
- Whole packet is handed to PANA for processing
- PCP entities that do not implement PCP Authentication will see these packets as having an unsupported version number
  - Errors will go back to PCP client in this case, not to PANA client
  - An unspecified capability discovery mechanism is mandated to avoid this situation

Encapsulated Approach

- Define a PCP OpCode that indicates that the contents are a PANA packet
  - Packets received with this opcode are PANA packets, other PCP header fields can be ignored
- PANA portion is handed to PANA for processing
  - All but the first 24 bytes of the packet
- PCP entities that do not implement PCP Authentication will report an unknown OpCode if they receive these messages

PCP Authentication Decision Tree



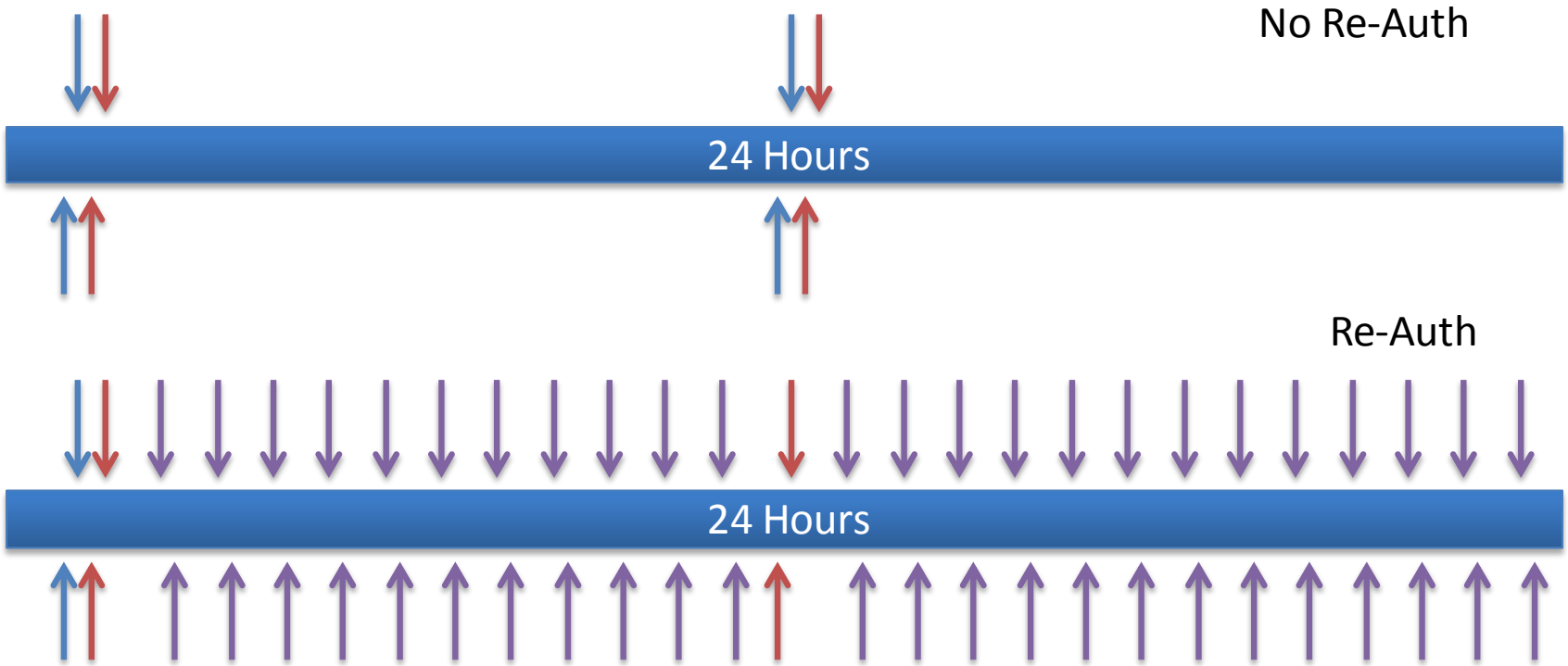
Issue #60: Coupling of Authentication & Authorization

- Loosely coupled:
  - Authentication needed only at the time of a request, to create/modify/query a mapping.
  - Authorization done separately, using the same mechanism as in non-authenticated PCP (implementation-specific)
  - Mapping lifetime is not limited to authentication lifetime
    - NAT/Firewall determines mapping lifetime
    - Mapping lifetime may or may not be dependent on key lifetime, may be shorter or longer than key lifetime
- Tightly coupled:
  - Authentication and authorization are both performed using AAA
  - Mapping lifetime is limited to authentication lifetime
    - PCP/PANA server removes mappings when keys expire
    - Mapping lifetime must be equal to or shorter than key lifetime

Issue #61: Re-Authentication

- Server-Originated Re-Authentication Costs
  - Requires nodes to stay awake or on the network to respond to re-authentication messages
    - In tightly-couple authorization approach, nodes that do not stay reachable will lose their mappings
  - May result in unneeded key exchanges
    - Possibly many unneeded key exchanges for each time the keys are actually required in loosely-coupled authorization approach, as key lifetimes may be much shorter than mapping lifetimes
- Server-Originated Re-Authentication Benefits
  - Keeps keys current, so they don't need to be exchanged when a subsequent PCP Request is initiated
    - Minor benefit, as cost to exchange keys at that time is low, and cost of repeated key exchange may be higher

Re-Authentication Timelines



Assumptions: Loosely coupled authentication/authorization, mapping lifetime is 24 hours, key lifetime is one hour.

- Unauthenticated request/response
- Authenticated request/response
- Re-Authentication messages

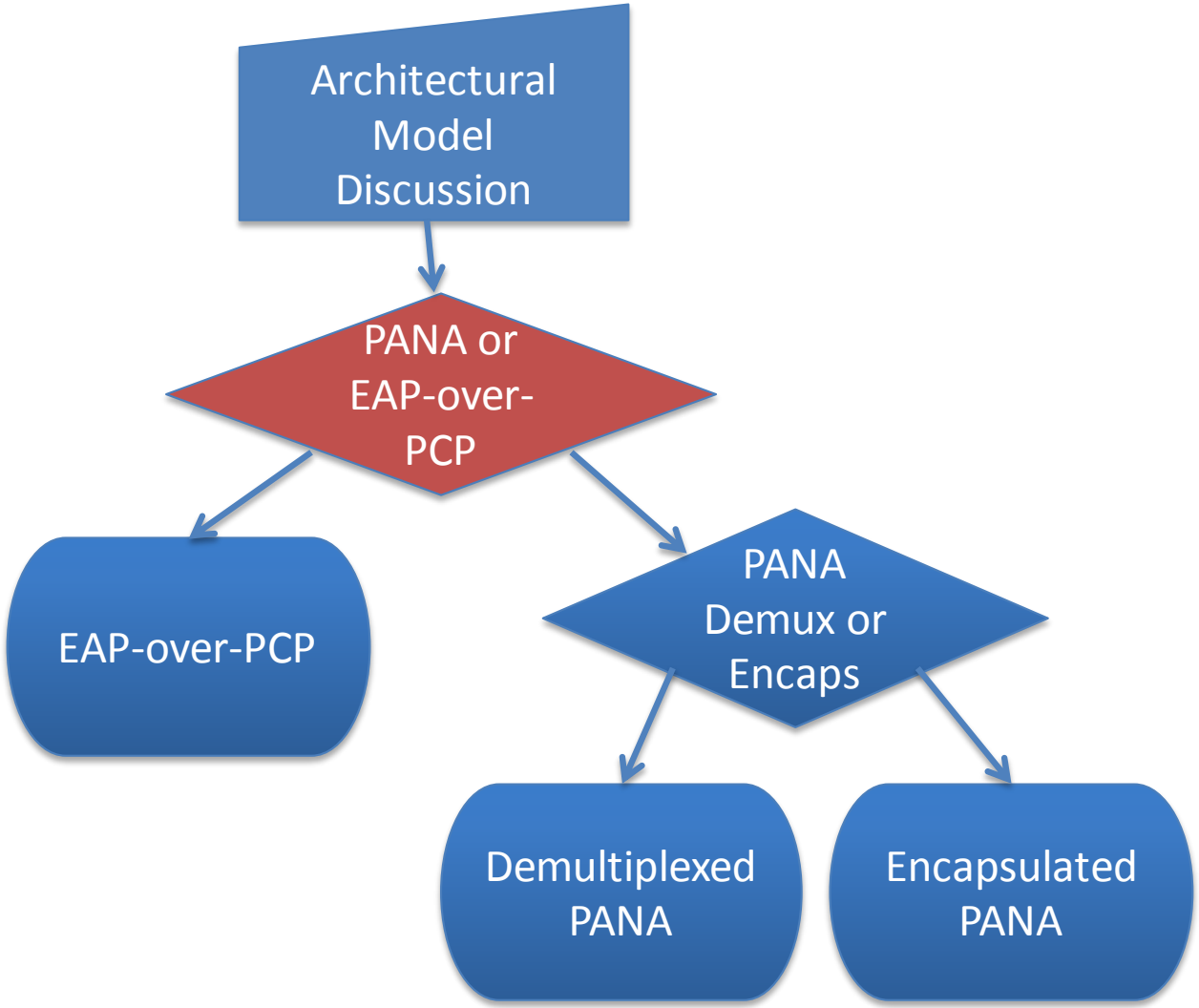
Issue #62: Retransmissions

- Do we need support for server-generated retransmissions?
  - EAP can do retransmission from both sides
  - EAP also allows lower-layers to handle reliability and do their own retransmissions
  - GSS-EAP is an example of an EAP lower-layer that does not do server-generated retransmissions

Operational Model

- All of these issues could potentially affect the PCP operational model
- PCP is a client-initiated request/response protocol with one-way notifications
  - Should authenticated PCP follow the same model?
  - Or is acceptable to use a different model for authenticated PCP?
    - Server-initiated re-authentication, and server-generated retransmissions
- Should a client need to remain reachable in order to defend/retain it's mappings?
  - Tightly-coupled authentication/authorization with server-initiated re-authentication

PCP Authentication Decision Tree



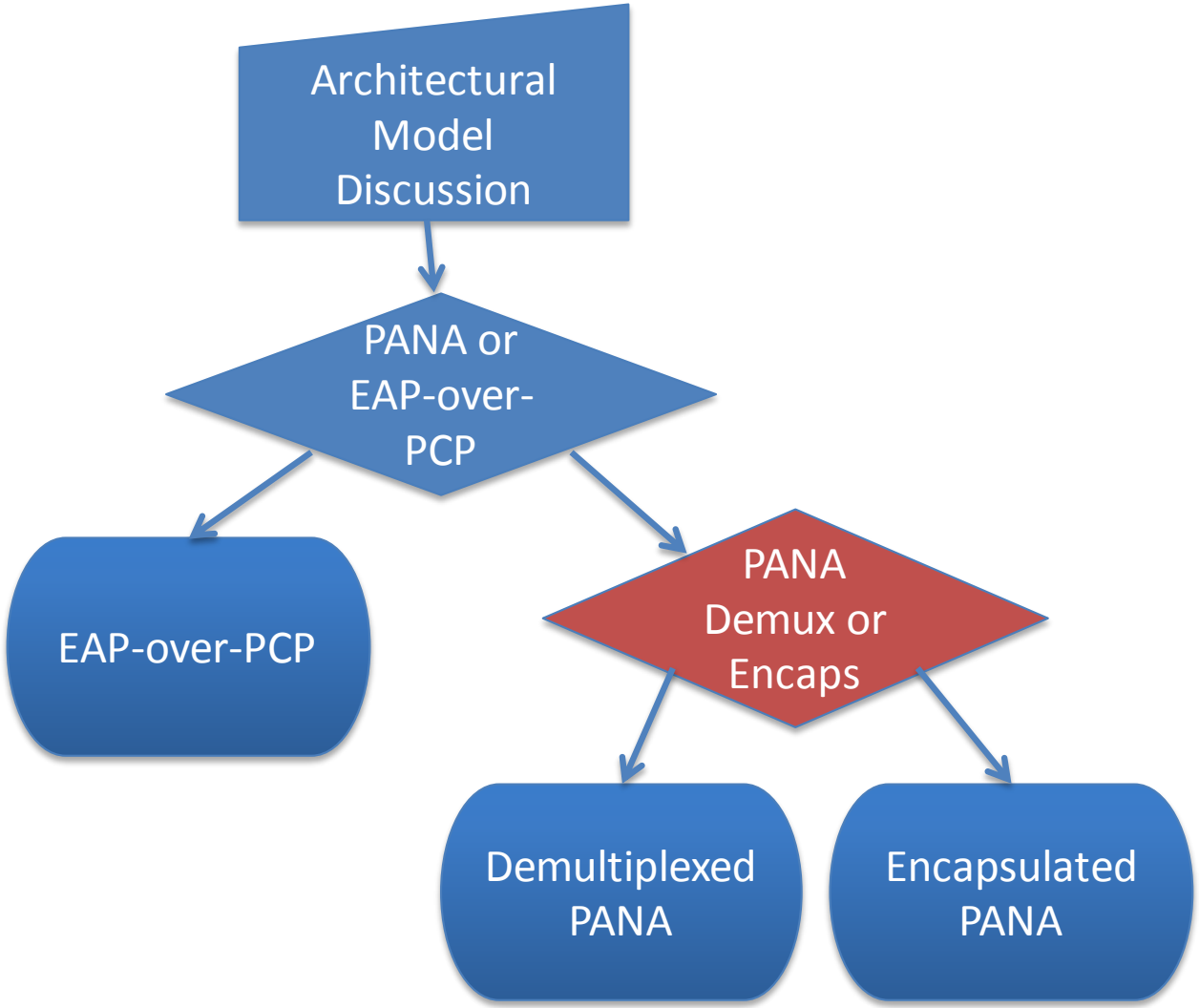
Direct EAP-over-PCP Model

- PCP remains a client-initiated request/response protocol with notifications
  - No “liveness tests”
  - No unsolicited re-authentication or retransmission
  - In fact, no server-generated messages that require a response
- Authentication and authorization are loosely coupled
  - Mappings survive key expiration, but are removed if authorization is revoked
  - Authorization mechanism same as unauthenticated PCP
- Clients do not need to remain reachable for mappings to remain active

PANA Model

- Requires support for server-generated requests
  - To support server-initiated re-authentication and retransmissions
  - To support “liveness” detection
  - Alternative is to update PANA to remove these things
- Authentication and authorization tightly coupled
  - Supports ability to drop mappings immediately when authentication expires
- Clients need to remain active on the network to retain their mappings
  - Mappings are removed if the client goes away or fails to respond to re-authentication requests

PCP Authentication Decision Tree



Key Differences

- In demux case, we overload the first bit of the version field, and hand the entire packet to PANA

- In encaps case, we have no overloading, and we have to add 24 bytes to the packet pointer before sending it to PANA

Conclusions?

- What decision should we reflect in the next version of the PCP Authentication document?