IETF90-MBONED

IP Multicast Receiver Access Control

draft-atwood-mboned-mrac-req
draft-atwood-mboned-mrac-arch

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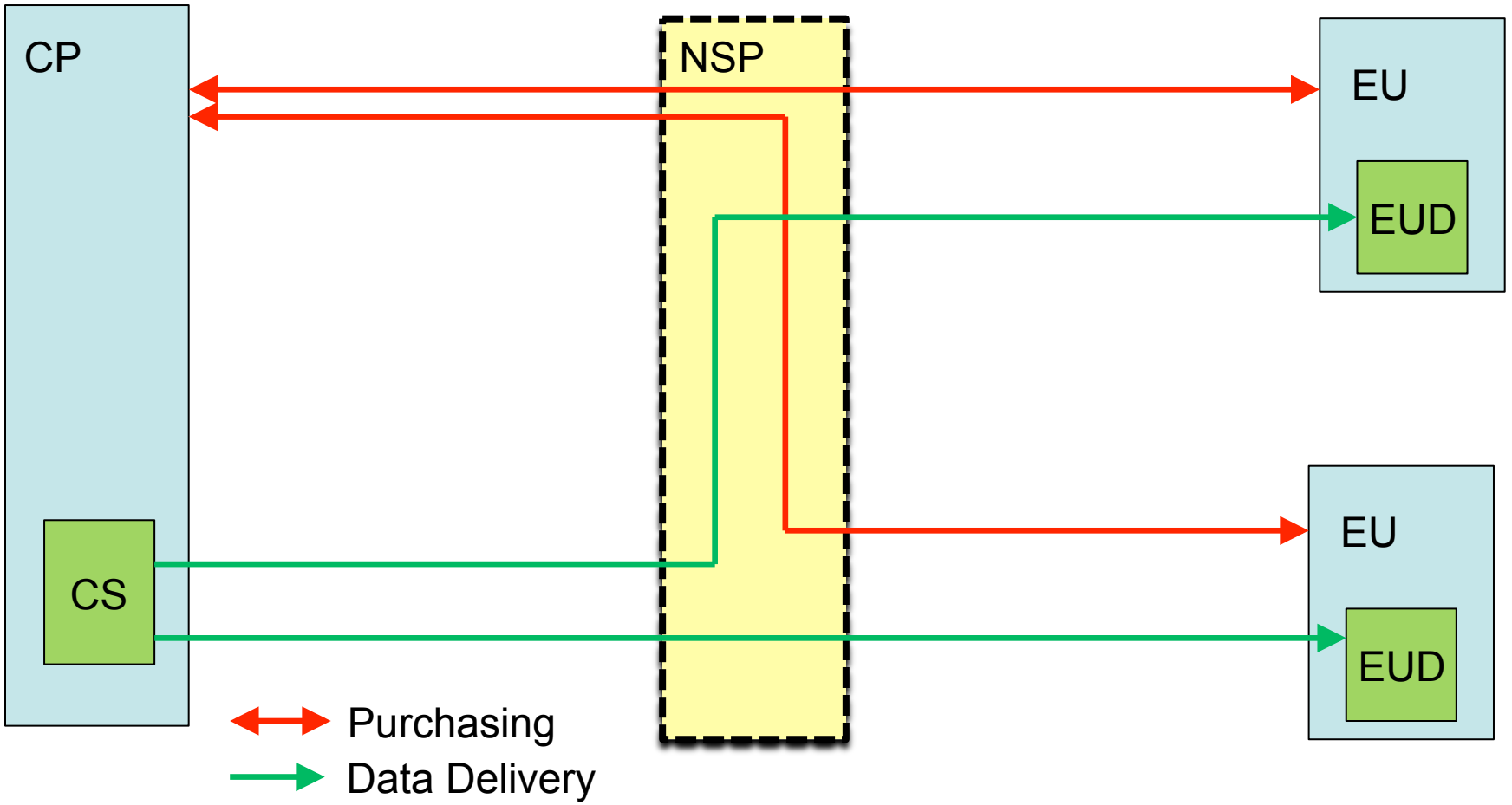
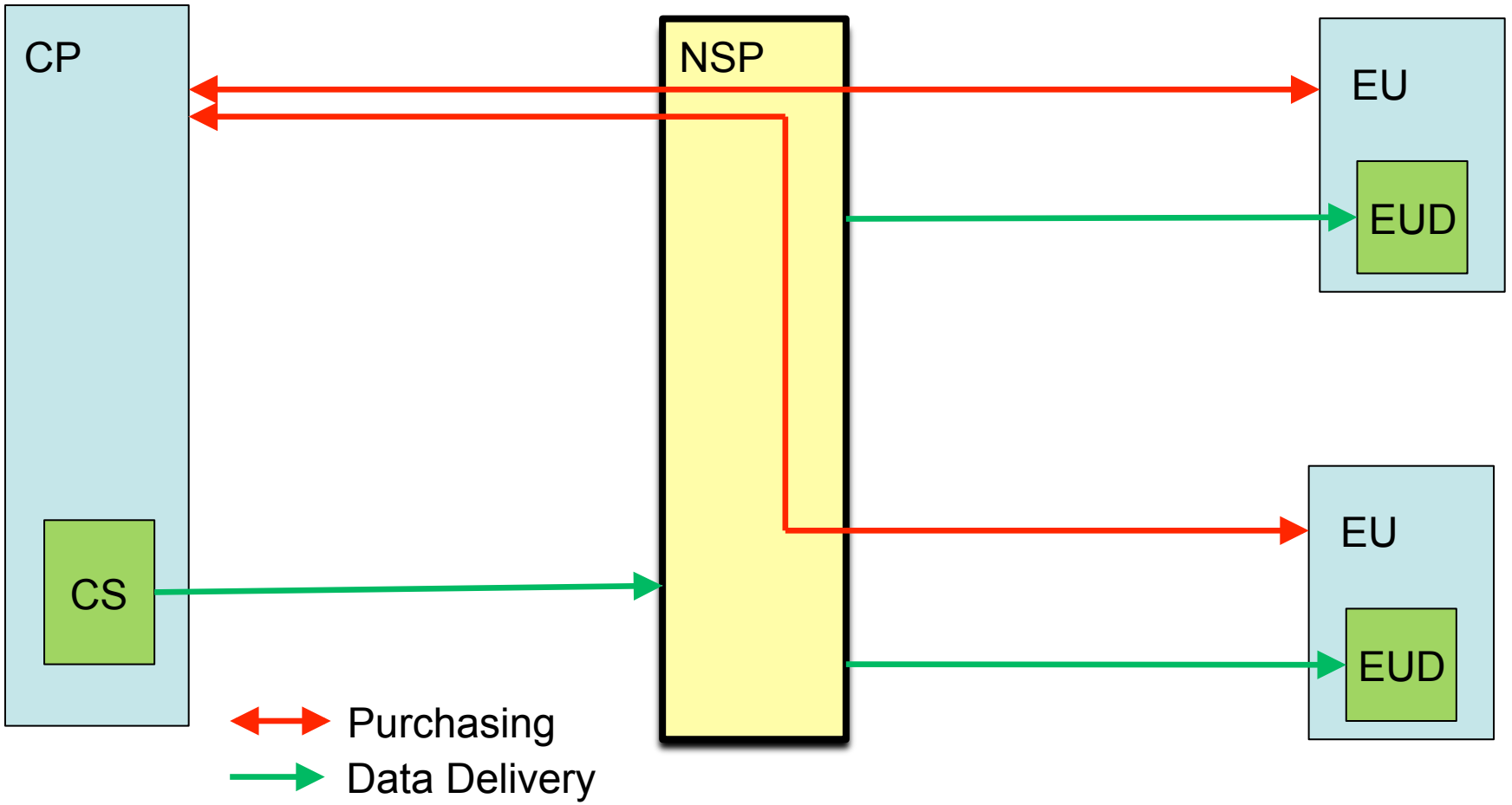
Overview

- Exploring the area of Receiver Access Control for IP Multicast
  - Subtitle: Making money using IP Multicast
  - Covers **some** of the same concerns as those of the "well-managed multicast" work that was presented in MBONED four years ago
  - **much** smaller scope of interest
  - MBONED: "application" level drafts
  - PIM: "network" level drafts

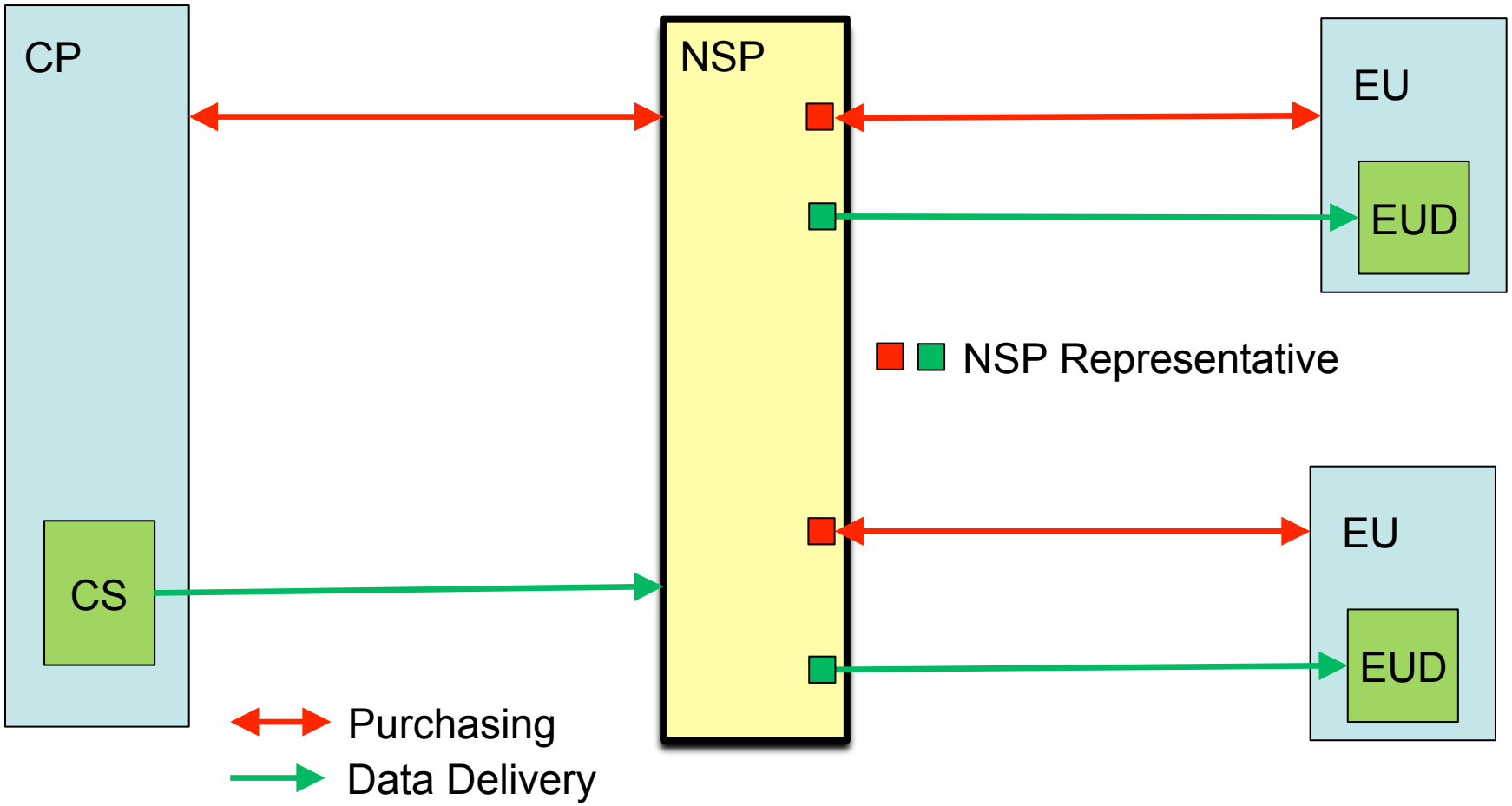
Trust Relationships: Unicast



Trust Relationships: Multicast



Trust Relationships: Multicast, Re-established

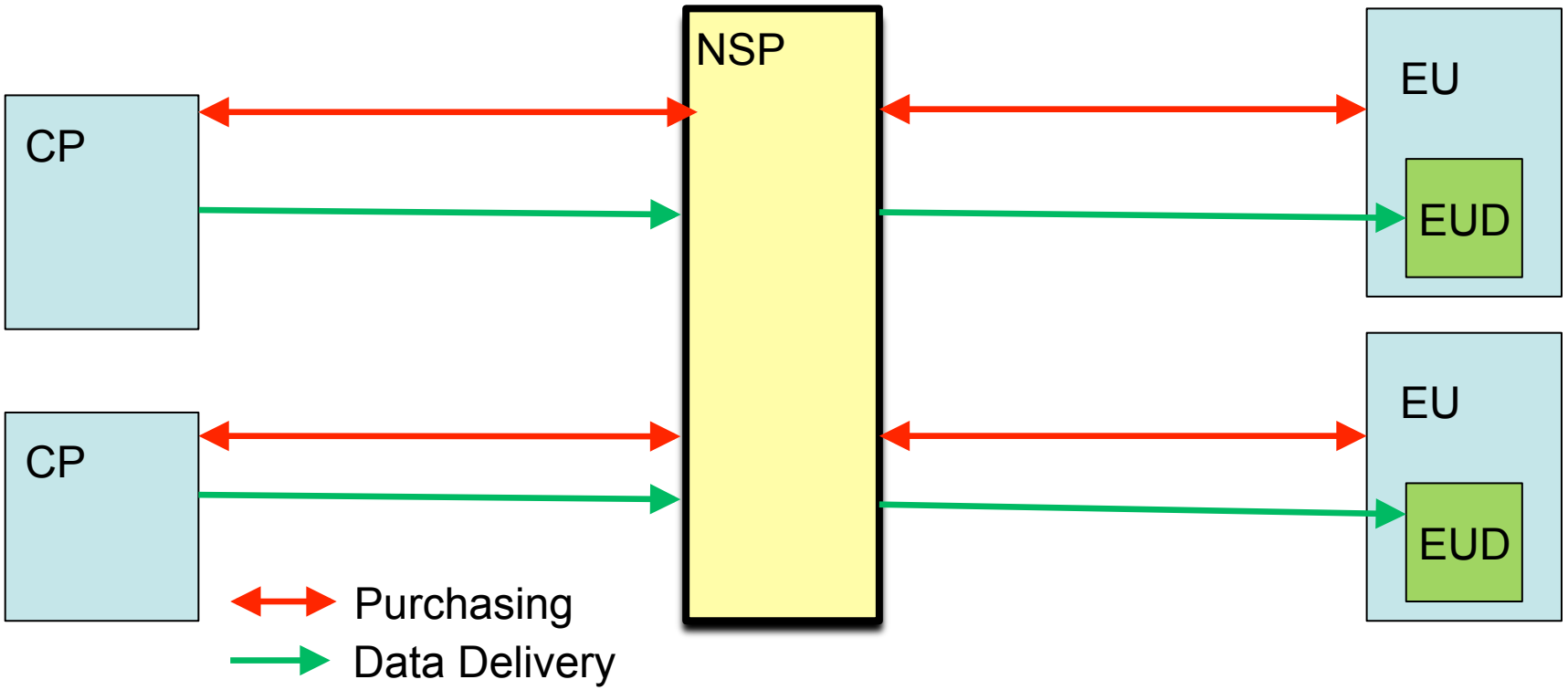


Problem Size: mboned-maccnt-req

AAA
QoS

Covers various business models

Constraint: only one user on a physical link



Problem Size: Other work in my lab

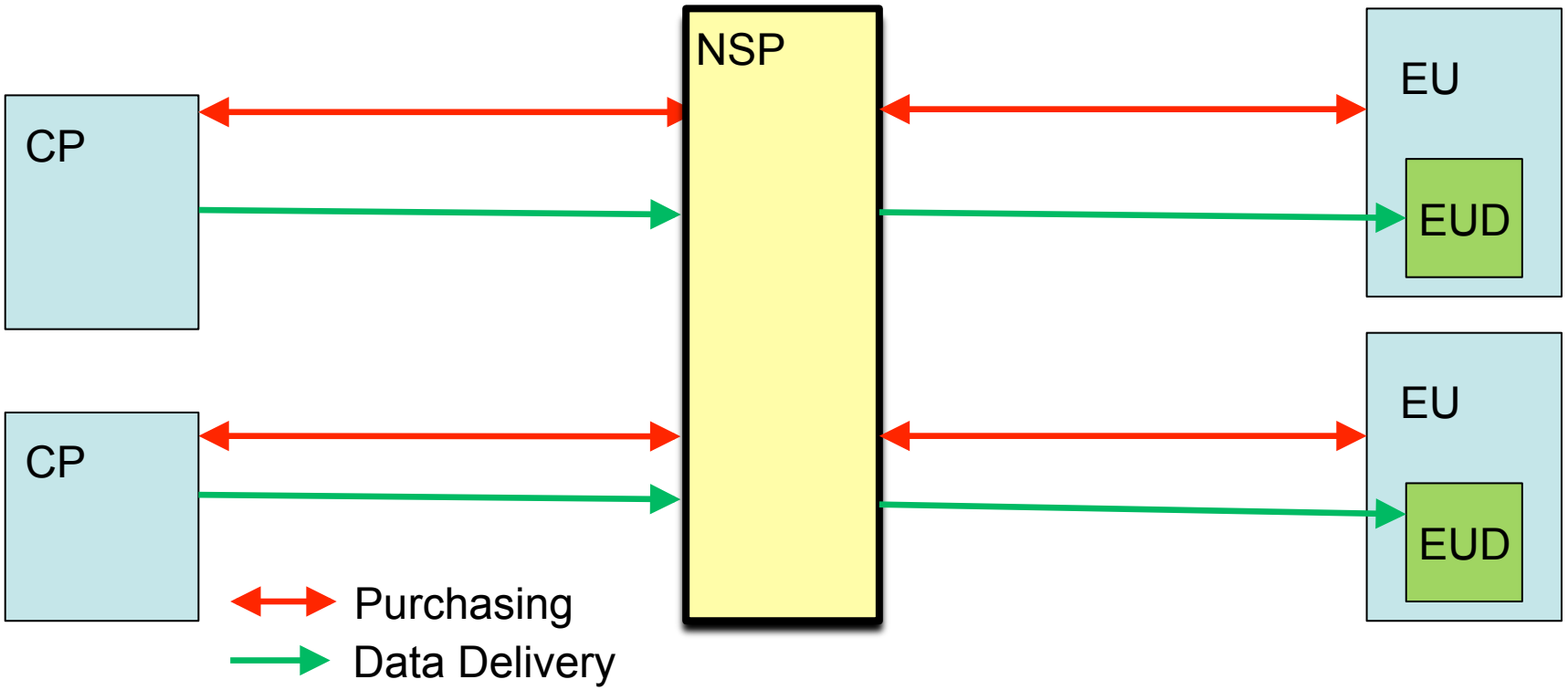
AAA

No QoS

MR

FI

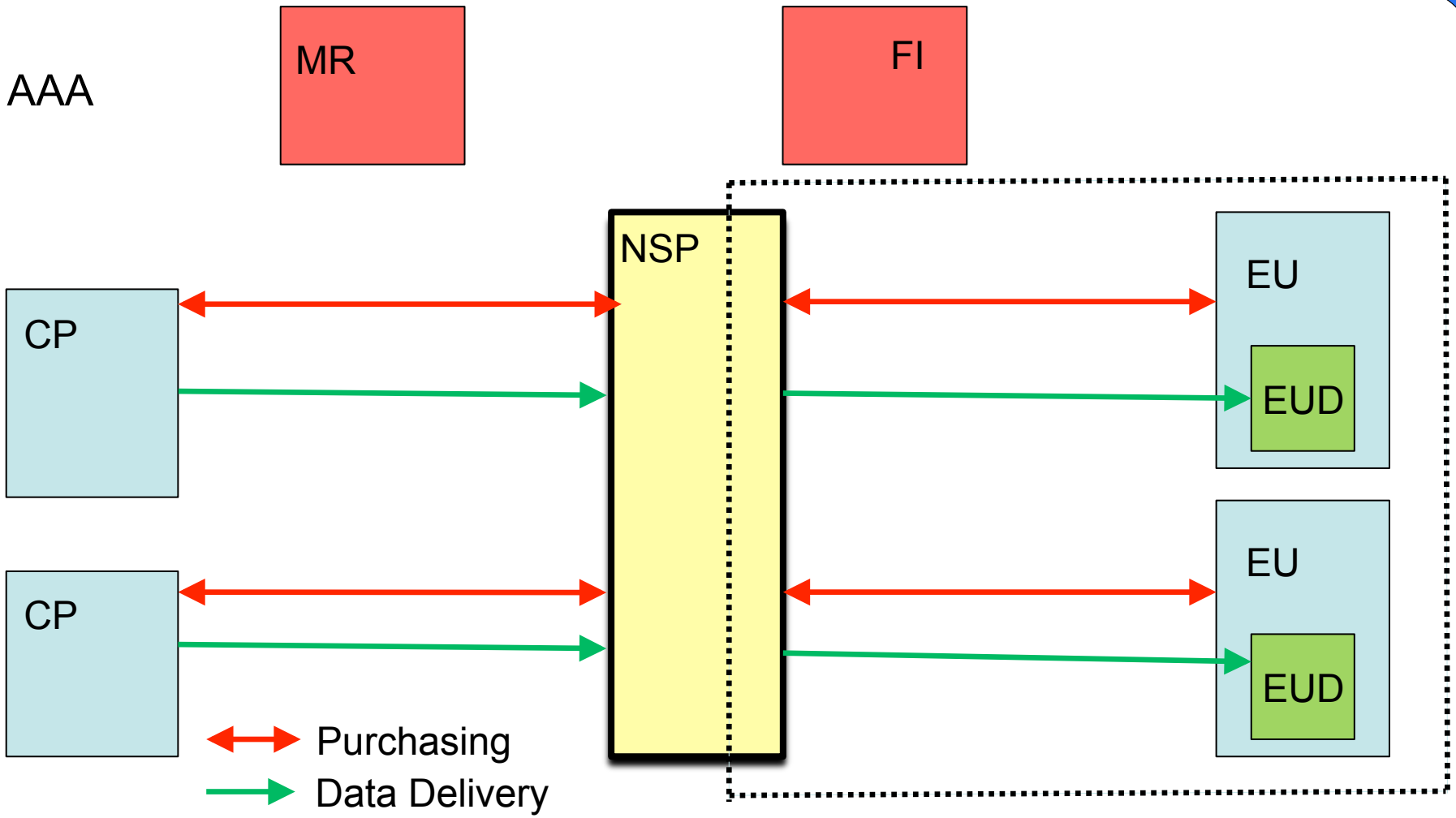
General business model
N users on link



Two Assumptions

- The End User (EU) acquires a “ticket” from the Merchant (or anyone else) containing:
  - Session Descriptor
  - Secure End User authentication
  - Possibly, an encryption key for the data stream
- The “Network Representative” has information on how to validate a “ticket” or assess the authorization of the EU or EU Device
- This makes the discussion today independent of the business model in use by the NSP and/or CP
- It restricts the scope of the work

Problem Size: Today's Discussion



Two levels of interaction

- Application Level
  - EU presents the “ticket”
  - Goal: Join the group
- Network Level
  - End User Device issues IGMP/MLD

- To ensure that only legitimate subscribers get access
  - MUST be secure at Application Level
  - MUST be secure at Network Level

Two Approaches

- Solution 1
  - Carry the “ticket” in an extended network-level join exchange
    - The security of the two levels is implied by the fact that they are carried in a single level of message exchanges, which are secured
- Solution 2
  - Provide separate secure application level join and secure network level join functions, along with a method for explicitly coordinating them

Extending IGMP

- Long history of attempts to extend IGMP
  - All of them abandoned
  - All were “restricted” solutions
    - Based on a particular version of IGMP, -OR-
    - Proposed a limited set of authorization methods
  - A list of citations is in the draft
- None of these attempts considered “accounting” specifically

Securing IGMP/MLD

- One IRTF Internet Draft on securing IGMP
  - Once a device established a secure relationship with its router, it was allowed to send a join for ***any*** group.
- RFC 3376 suggests using AH to secure IGMP packets
- RFC 3810 is silent on the issue of securing MLD packets
- None of these attempts considered “accounting” specifically
  - No need to deploy the solution if accounting is unnecessary!

Goals

- List the requirements on a set of mechanisms that
  - allow the Network Service Provider to act on behalf of the Content Provider
  - meet the access control and revenue generation goals
  - remain as independent as possible from the specific business model in use
- Specify an architecture that meets these goals

Approach

- We explore Solution 2
  - Separate joins and explicit coordination
- Thus, the constraints fall naturally into three categories:
  - Application-level constraints
  - Network-level constraints
  - Interaction constraints

Requirements

- Application level constraints
  - Authenticating and Authorizing Multicast End Users
  - Group Membership and Access Control
  - Independence of Authentication and Authorization Procedures
  - Re-authentication and Re-authorization
  - Accounting
  - Multiple Sessions on One Device
  - Multiple Independent Sessions on a LAN
  - Application Level Interaction must be Secured

Requirements ..2

- Network level constraints
  - Maximum Compatibility with MLD and IGMP
  - Group Membership and Access Control
  - Minimal Modification to MLD/IGMP
  - Multiple Network Level Joins for End User Device
  - NSP Representative Differentiates Multiple Joins
  - Network Level Interaction must be Secured

Requirements ..3

- Interaction constraints
  - Coupling of Network and Application Level Controls
  - Separation of Network Access Controls from Group Access Controls

Building Blocks

- AAA: A general framework for managing access to networks, based on RADIUS and Diameter
- EAP: A general framework for negotiating a method for authenticating users
  - Some methods allow mutual authentication
  - Typically used for access to the “entire network”
  - Can be adapted to manage access to multicast groups

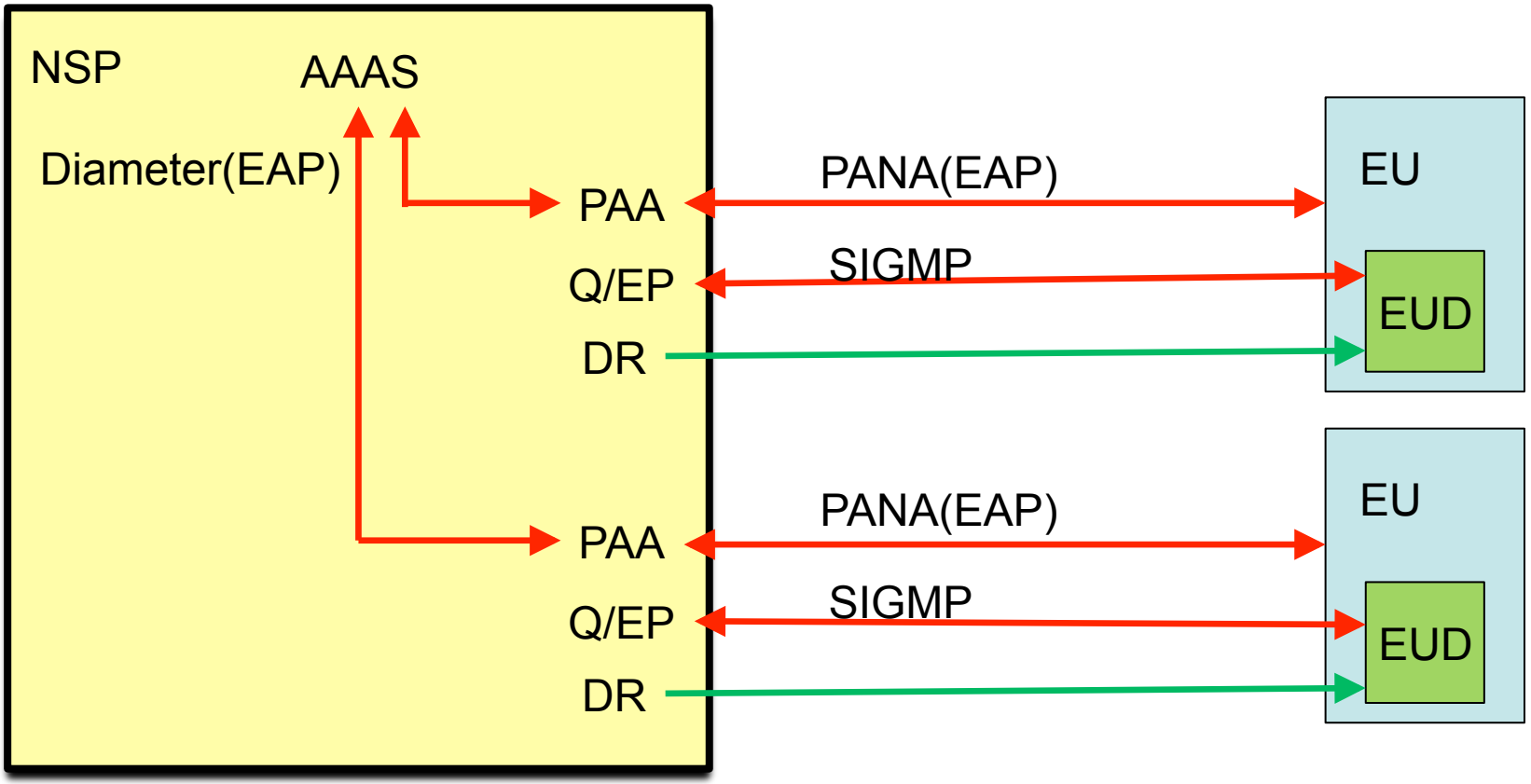
Building Blocks..2

- PANA: A “lower layer” for EAP, between the EUD and the NSP
  - Can be used to create a key, known to the PANA Client (PaC) and the PANA Authentication Server (PAA) (= NSP Representative)
  - Enforcement is done by an Enforcement Point (EP)
- IGMP/MLD: Network-level access control for IP Multicast
  - Unsecured (in standard multicast)

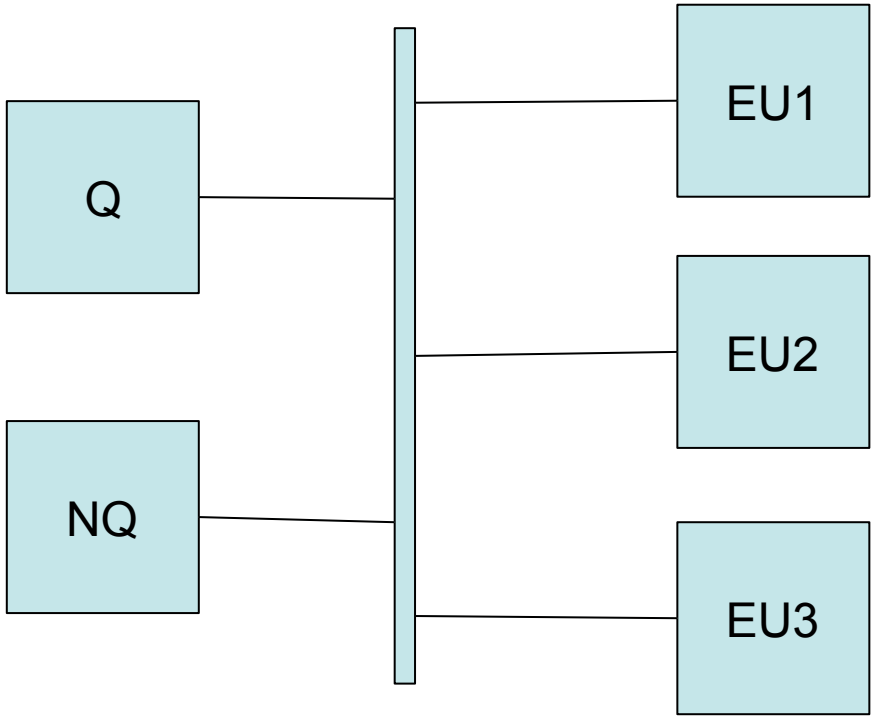
Building Blocks..3

- IP Security (IPsec): Protocols and methods for establishing the authenticity, integrity, and other cryptographic properties of IP datagrams
  - Can be used to secure IGMP/MLD
  - We call this secure form of IGMP/MLD Secure IGMP (SIGMP) or Secure MLD (SMLD)

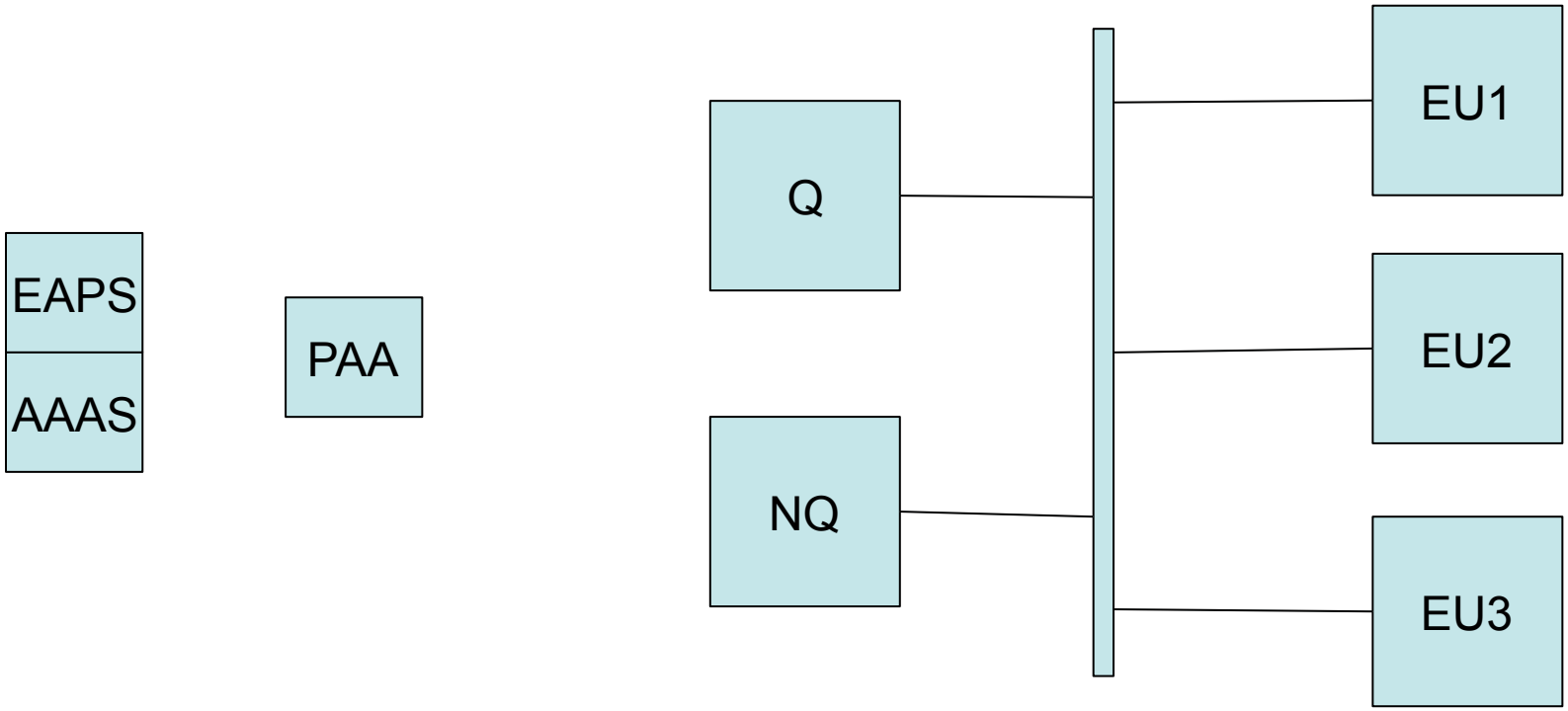
Architecture



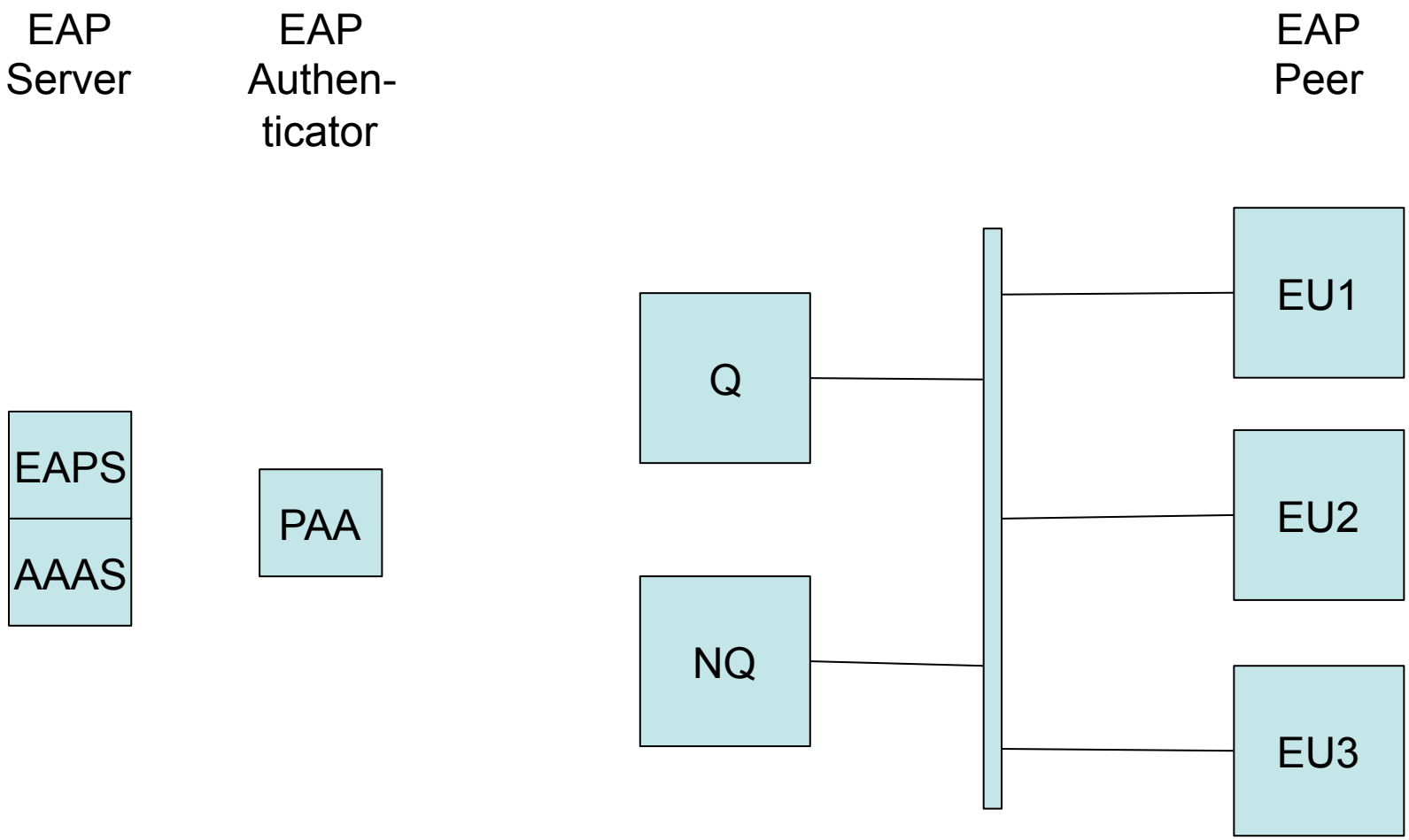
Environment: Network Segment for Multicast



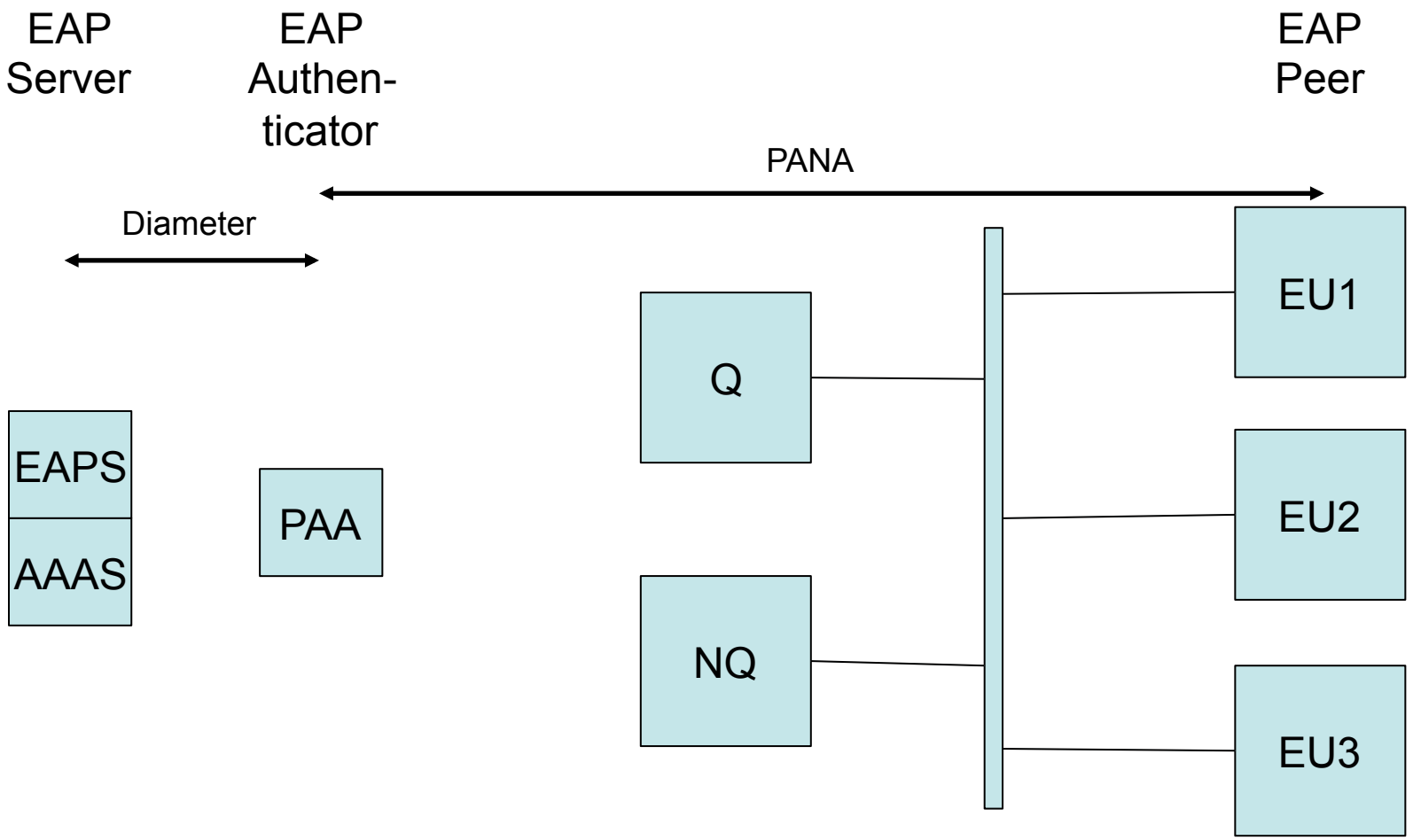
Environment: Add EAPS and PAA



Environment: Locate EAP participants



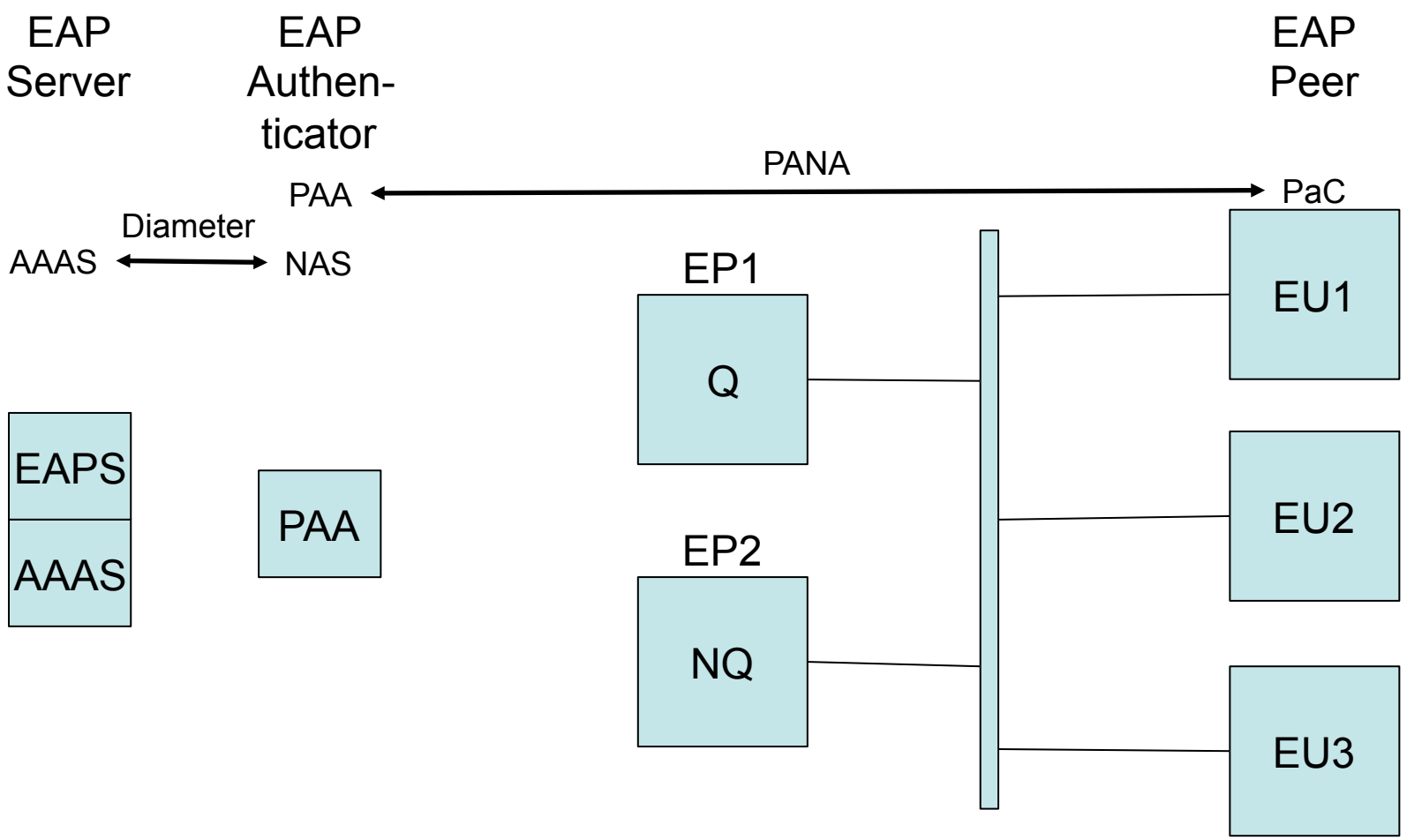
Environment: Show EAP Transport



Enforcement Points

- The PAA is the negotiator for the network end of the PANA session
- The PaC is the negotiator for the user end of the PANA session
- In general, the PAA will have one or more Enforcement Points (EP) under its control
  - For general network access control, the EP may well be a switch
  - For our application, the EP must be the Querier (Q) for that network segment. If a snooping IGMP switch is present, we may need to adjust this.

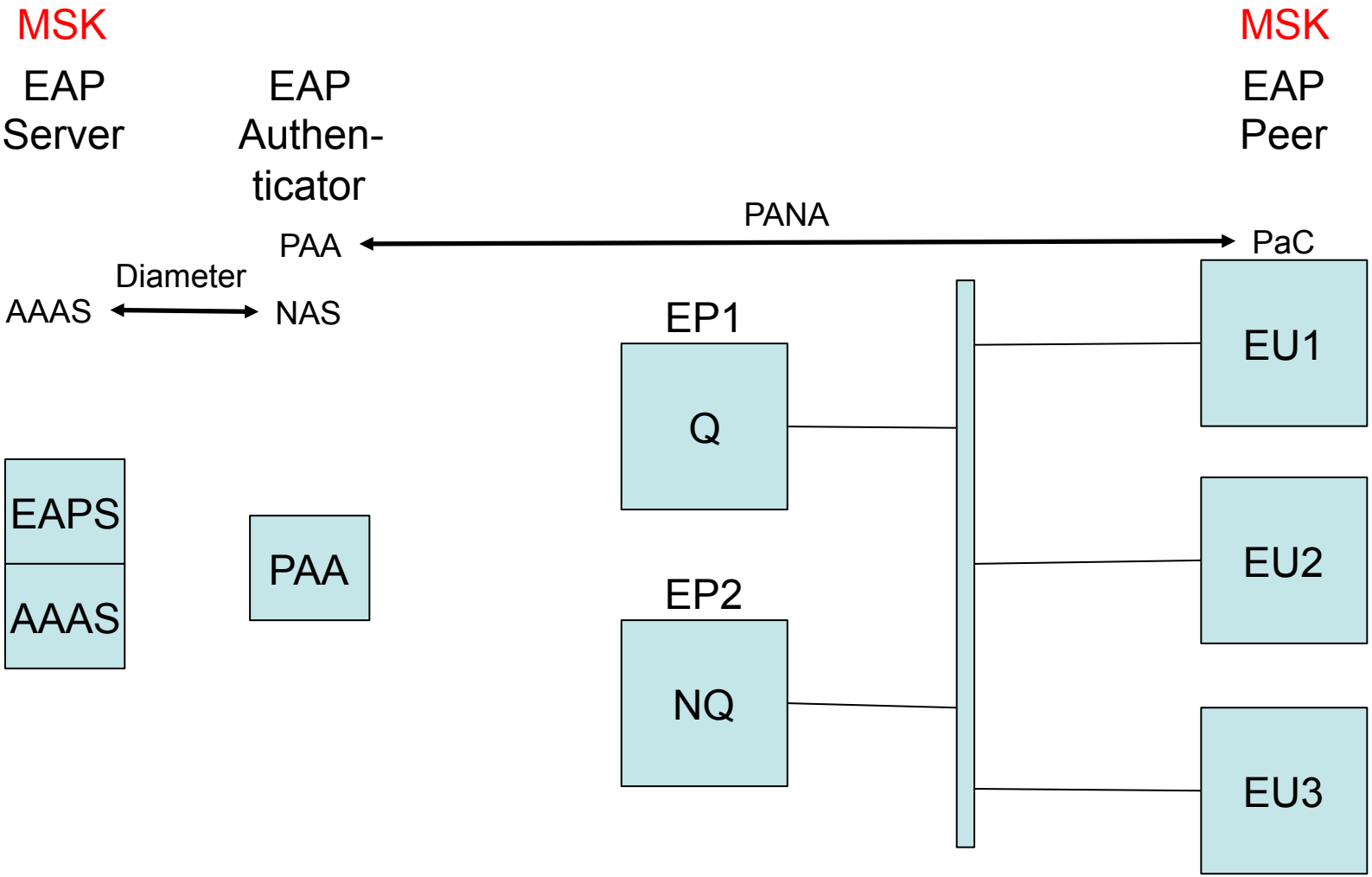
Environment: Show EPs



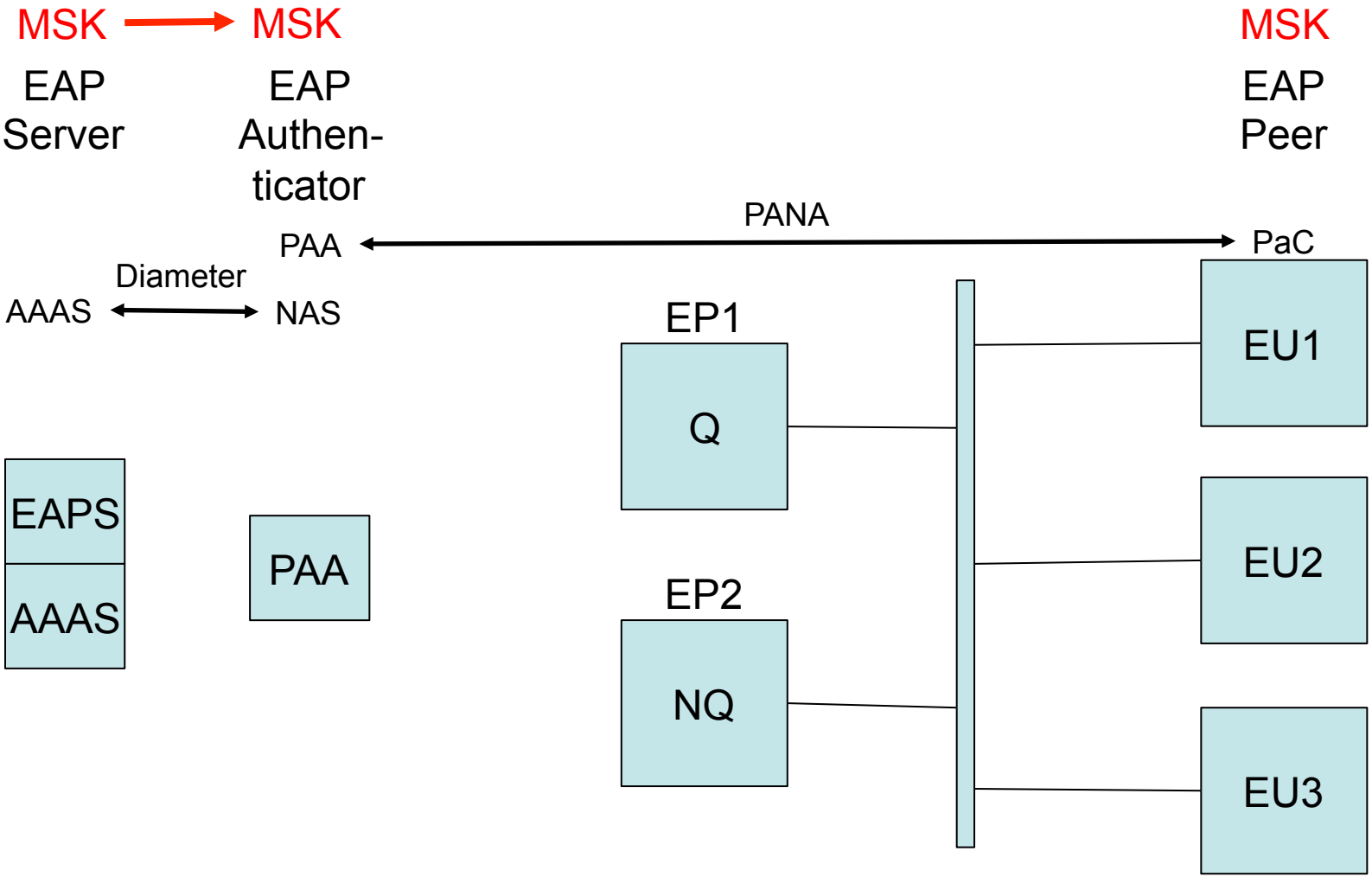
Master Session Key

- From EAP negotiation, a Master Session Key (MSK) becomes known to the EAPS and the EU.
- The EAPS forwards a copy to the PAA using Diameter.

EAP: MSK


MSK
EAP Server
EAP Authen-ticator
MSK
EAP Peer
PANA
PAA
PaC
Diameter
AAAS
NAS
EP1
Q
EU1
EAPS
AAAS
PAA
EP2
NQ
EU2
EU3

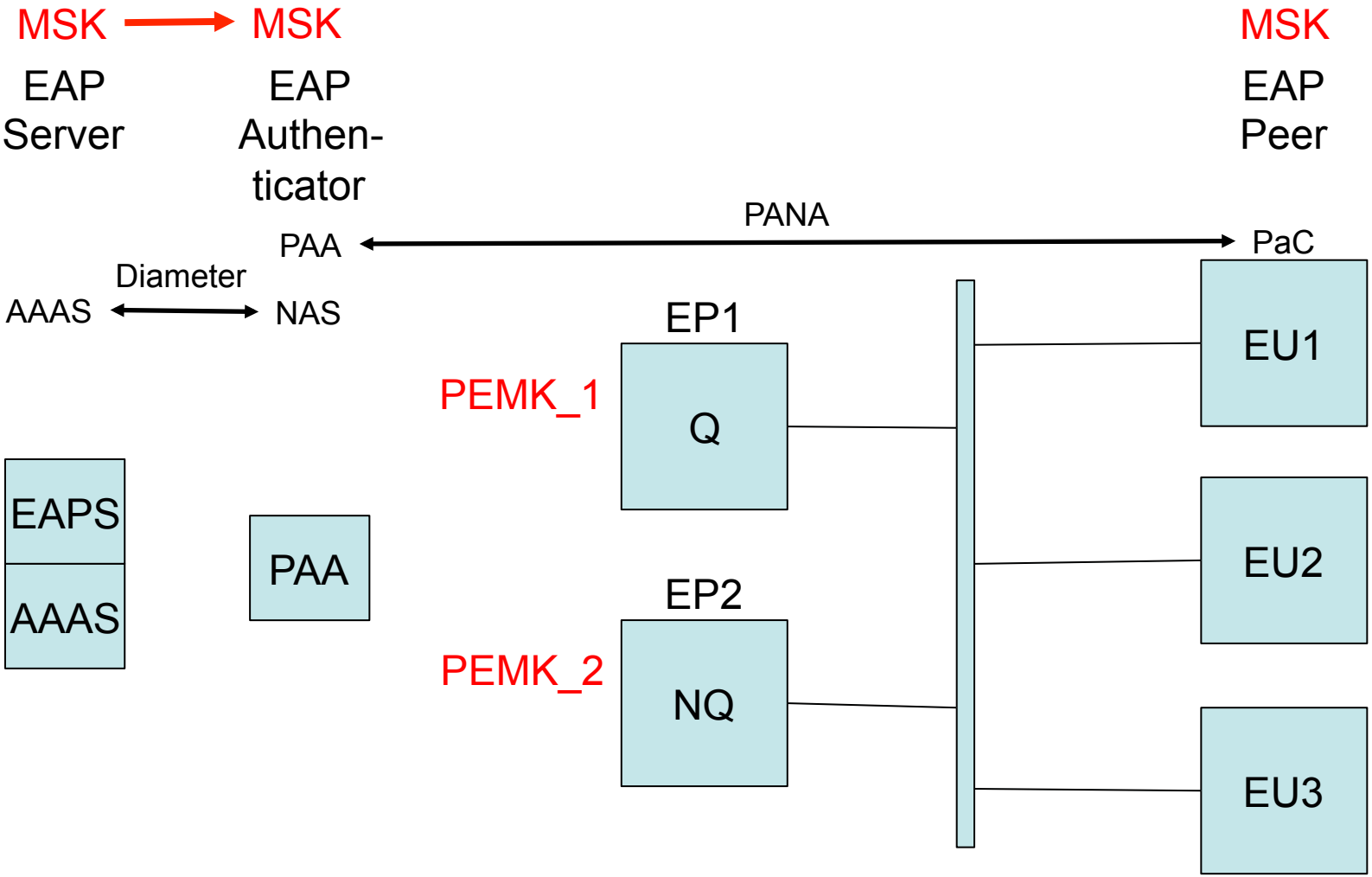
EAP: MSK copied to PAA



PaC-EP Master Key

- The PAA uses the MSK and EP-specific information to compute a PaC-EP Master Key (PEMK) for each EP.
- It sends the corresponding key to each of the EPs, along with information identifying the multicast group and the EU address.

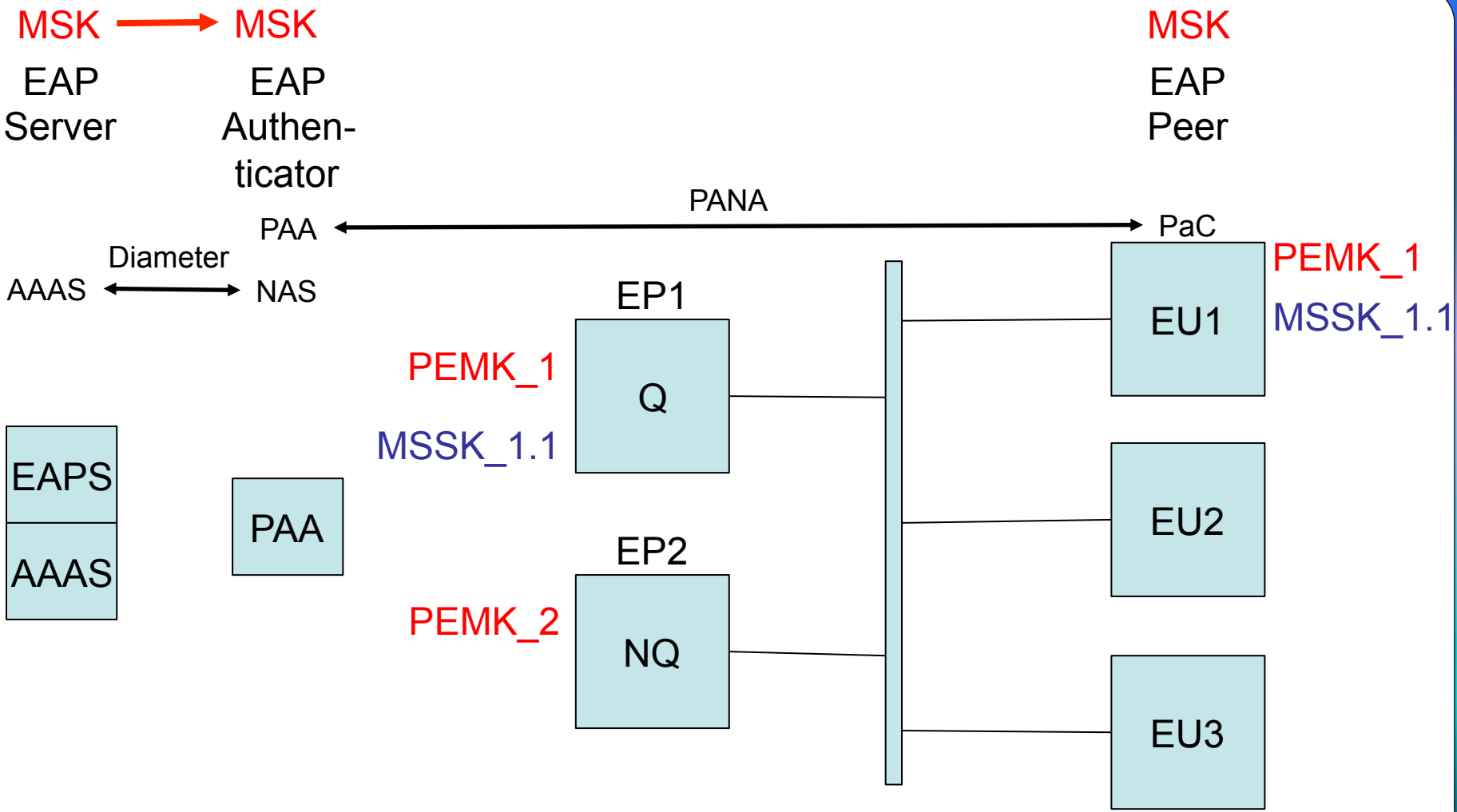
PAA sends PEMK to EPs



Multicast Session Specific Key

- Each EP combines its PEMK with information about the EU address and the specific multicast session, to produce a Multicast Session Specific Key (MSSK).
- At the EU, given that the EP is known to be Q, and given the MSK and the specific multicast group, the EU can calculate the same MSSK.
- The EP and the EU now have a shared key that they can use to establish the EU's right to join the multicast group.

EPs compute MSSK; EUs compute PEMK and MSSK



Open vs Secure Groups

- Open Group
  - No access controls
  - Operations will follow standard IP multicast rules (3376 or 3810)
- Secure Group
  - Access controls to prevent an unauthorized EU from accessing the group
  - Additional operations are needed
  - IGMP/MLD exchanges are protected with IPsec, using the derived keys

Multicast Security Associations for Secure IGMP

- Many distinct Multicast Security Associations are required on each network segment:
  - One with Q as the sender, and NQ plus the admitted members as receivers
  - One for each legitimate participant EU, with the EU as the sender, and NQ plus Q as the receivers
  - All are uni-directional, as defined in RFC5374
- These are negotiated using GSAM, and used by Secure IGMP (SIGMP) (or Secure MLD, for v6)

Results

- Secure Authentication of the End User
- Authorization is then possible using standard AAA interactions within the NSP
- A shared key is generated, which can be used to derive the necessary keys for protecting the IGMP/MLD exchanges

Documents: Issued

- MRAC Requirements
  - draft-atwood-mboned-mrac-req
- MRAC Architecture
  - draft-atwood-mboned-mrac-arch
- Secure IGMP
  - draft-atwood-pim-sigmp
- GSAM (coordination of Secure IGMP end points)
  - draft-atwood-pim-gsam

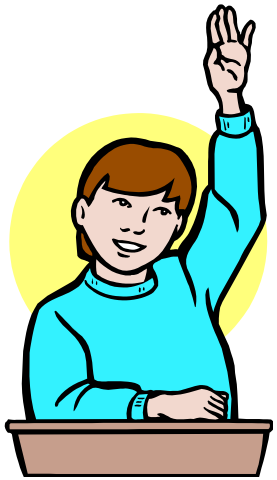
Documents: To Come

- Using PANA+EAP to achieve the MRAC
- Secure MLD

Next Steps

- Request for feedback (on the list or elsewhere)
- If this work is found useful, we request a liaison statement to PIM WG asking for the SIGMP/ SMLD work to be done.

Thank You!



Questions?