End-to-end Quality of Service support over heterogeneous networks

The EuQoS signalling approach

University of Coimbra

LAAS-CNRS

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Outline

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  - EuQoS global architecture
  - EuQoS functional architecture
  - SSN architecture
- A-SSN
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  - RA-SSN role
  - RM-RA interaction
- Conclusion

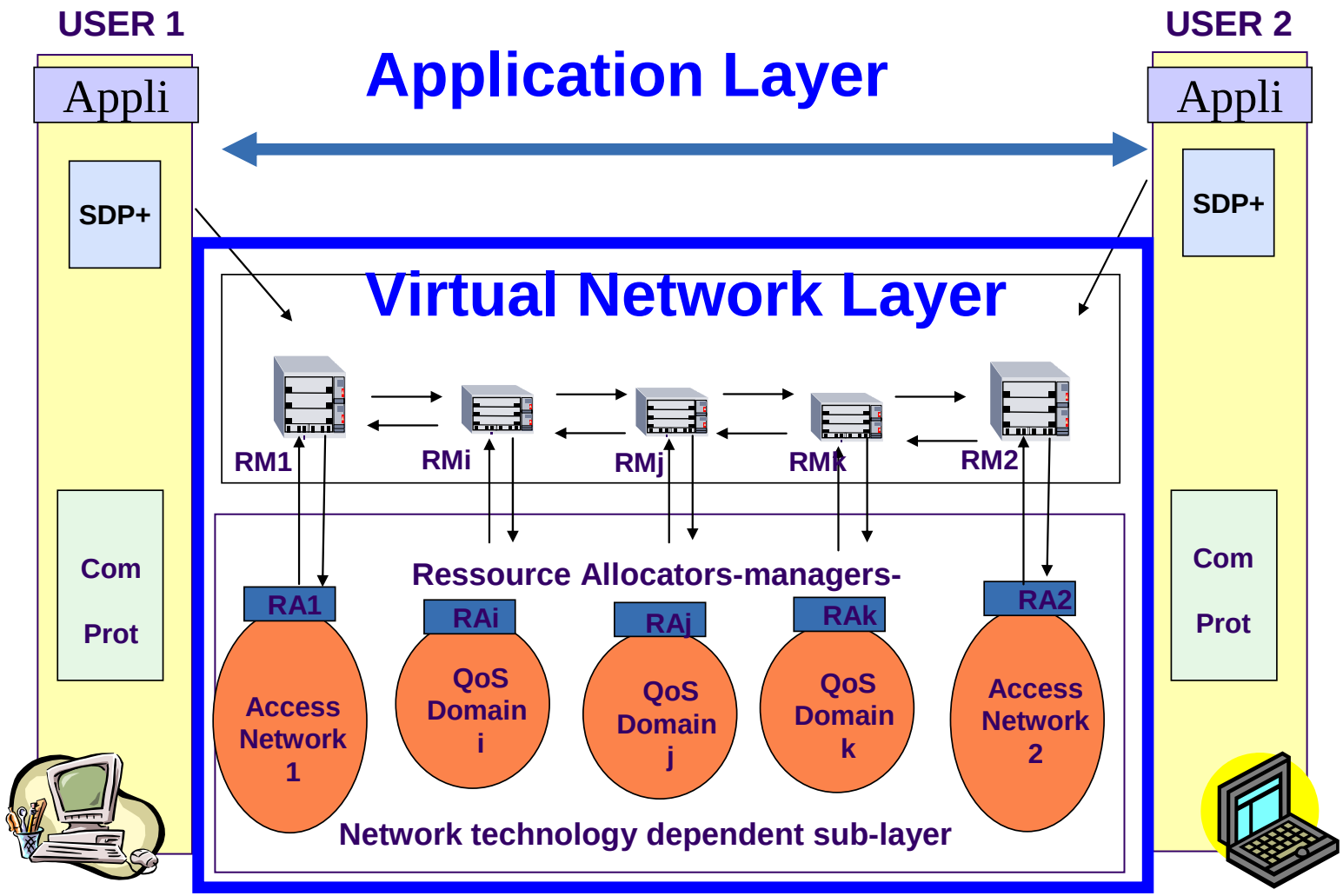
Overview of the SSN function

EuQoS global architecture

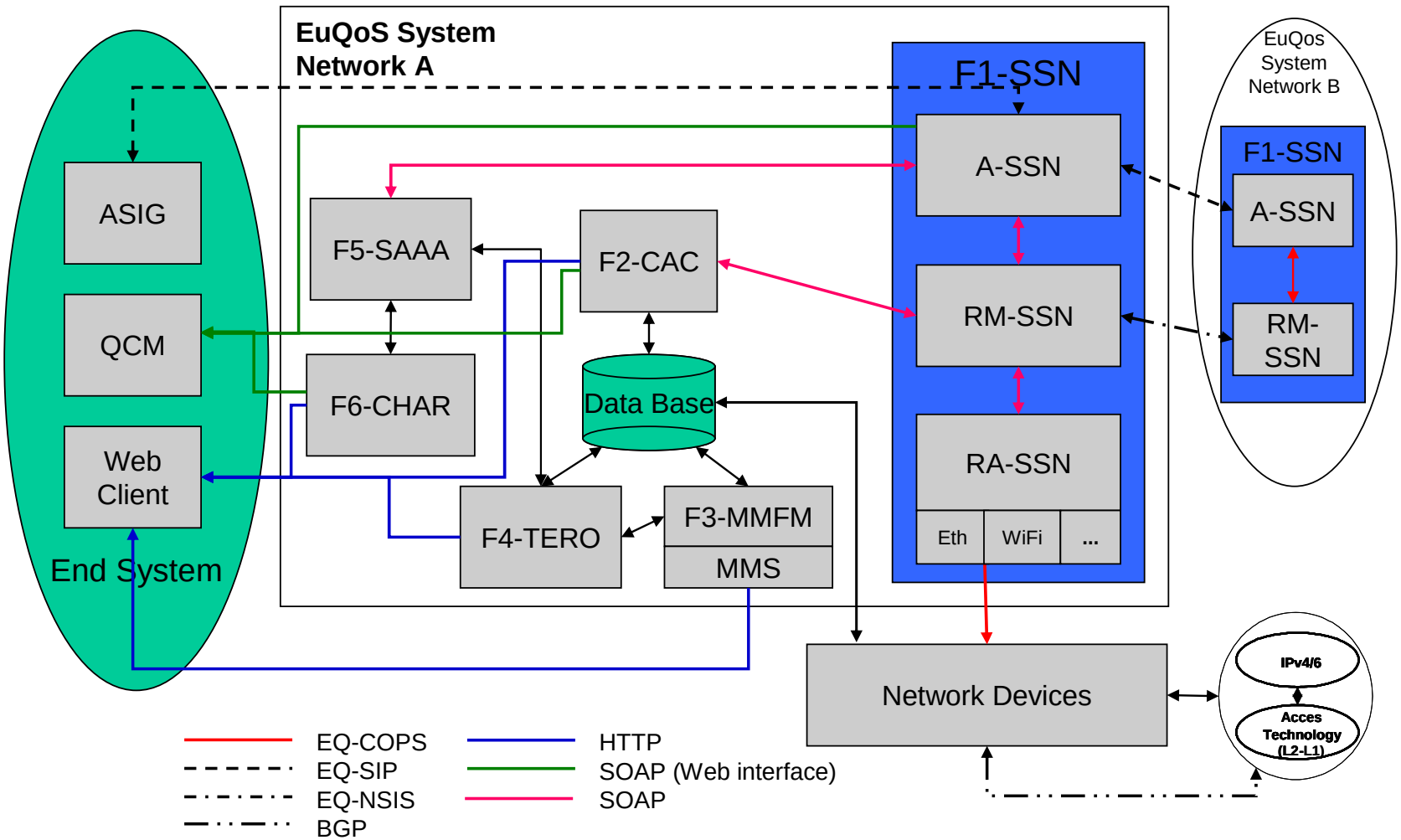
EuQoS functional architecture

SSN architecture

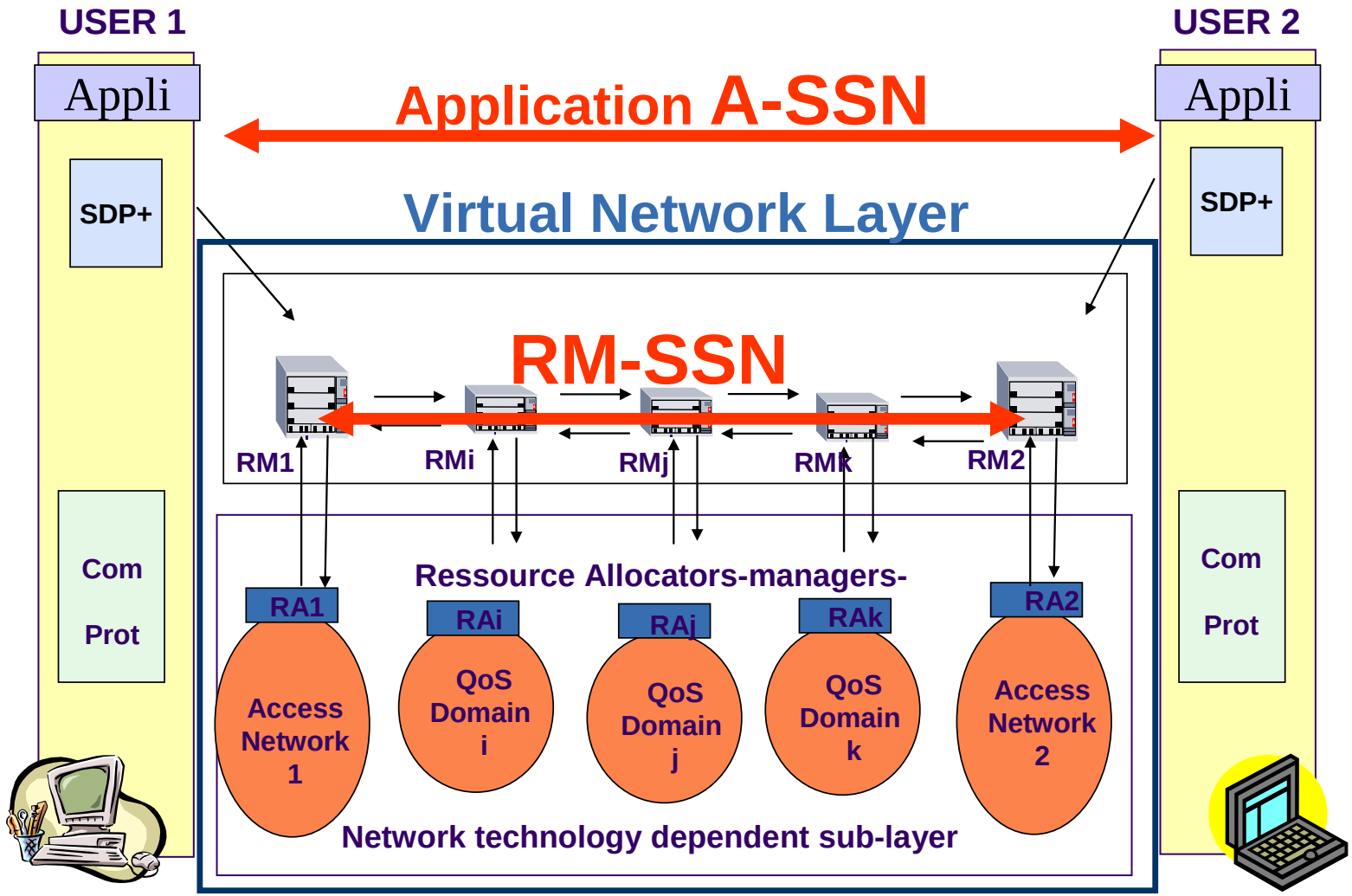
EuQoS global architecture



EuQoS functional architecture

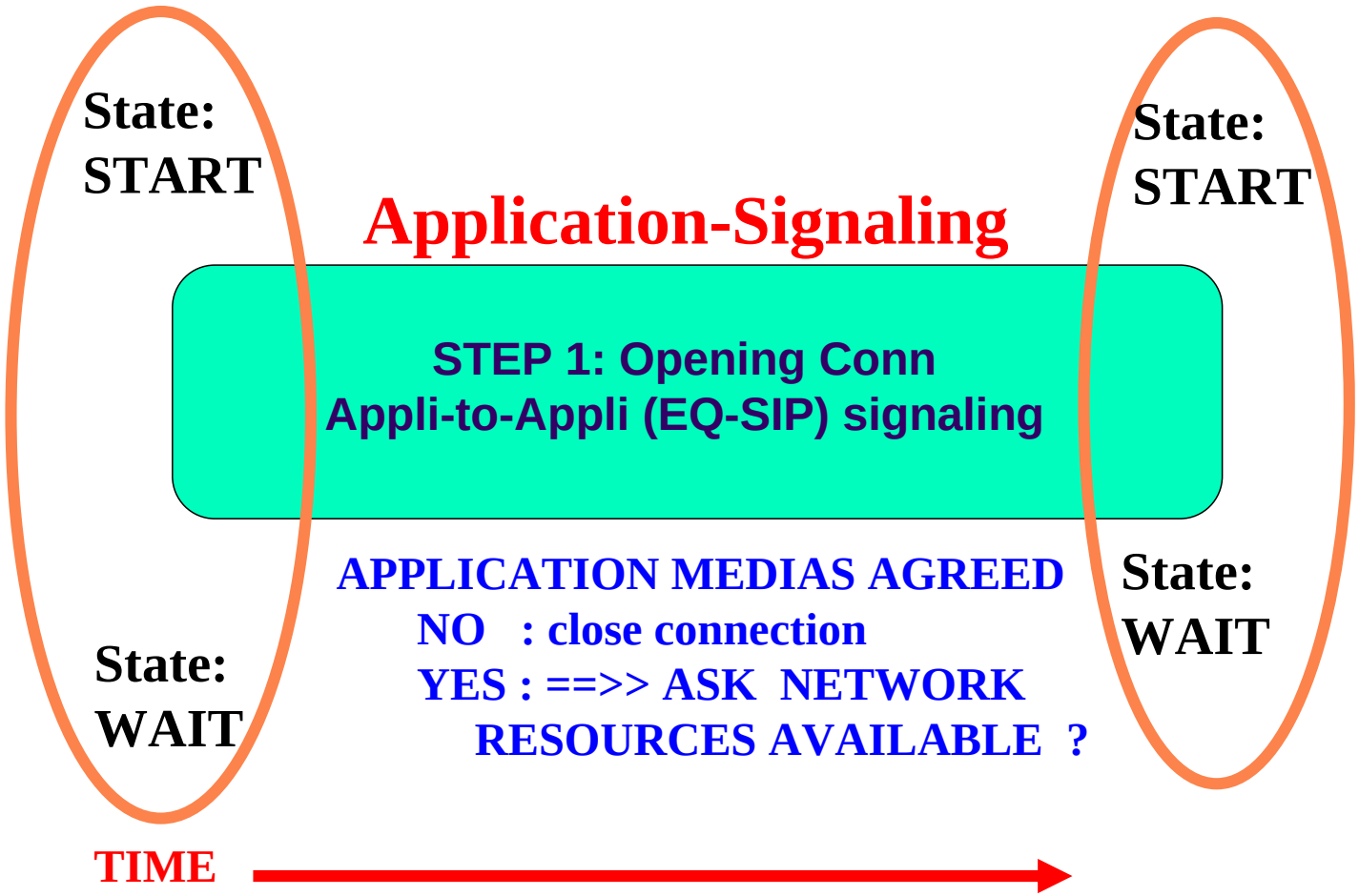


Signalling and Service Negotiation



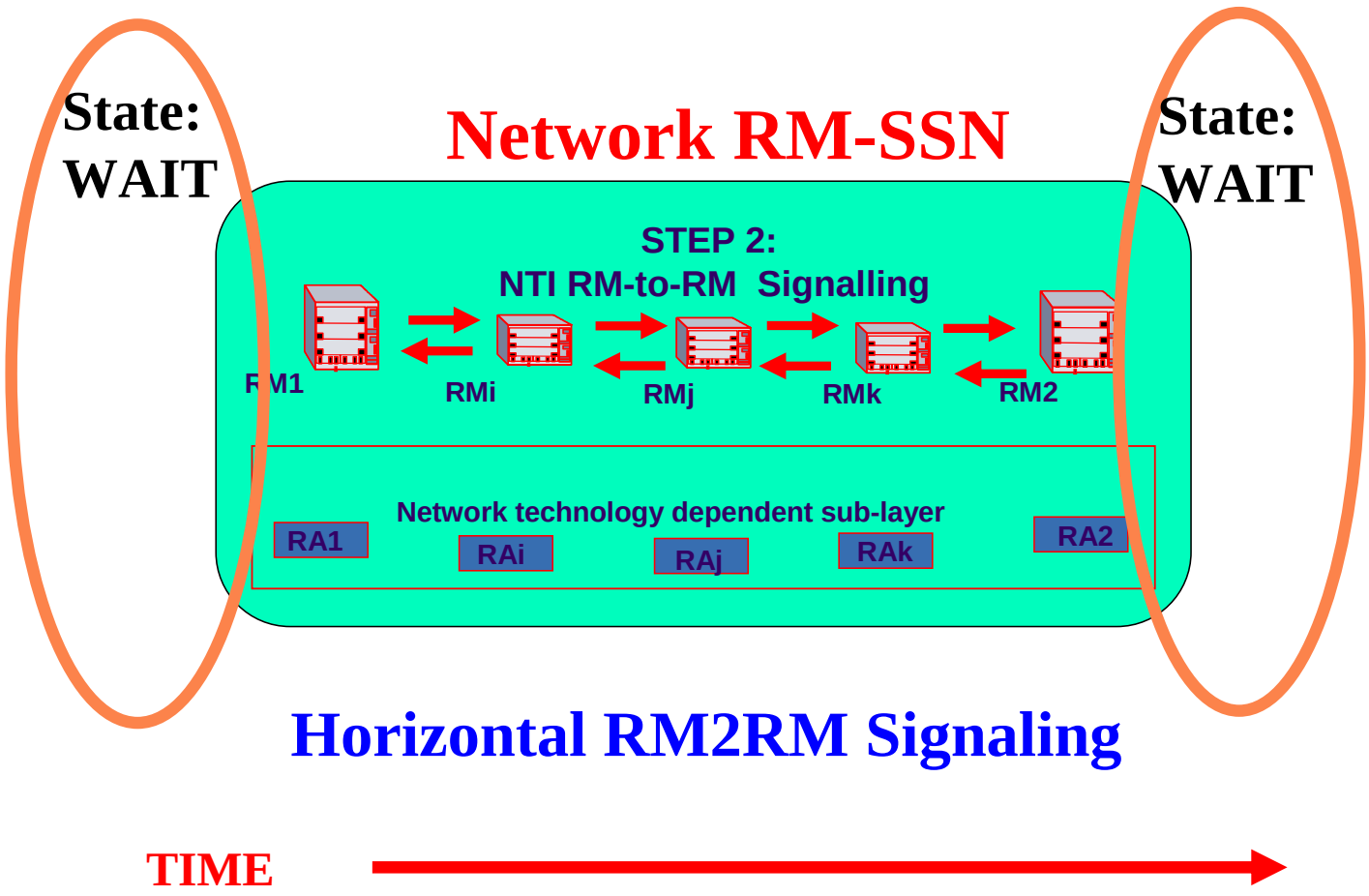
SSN (contd)

- Step 1 – Application connection establishment



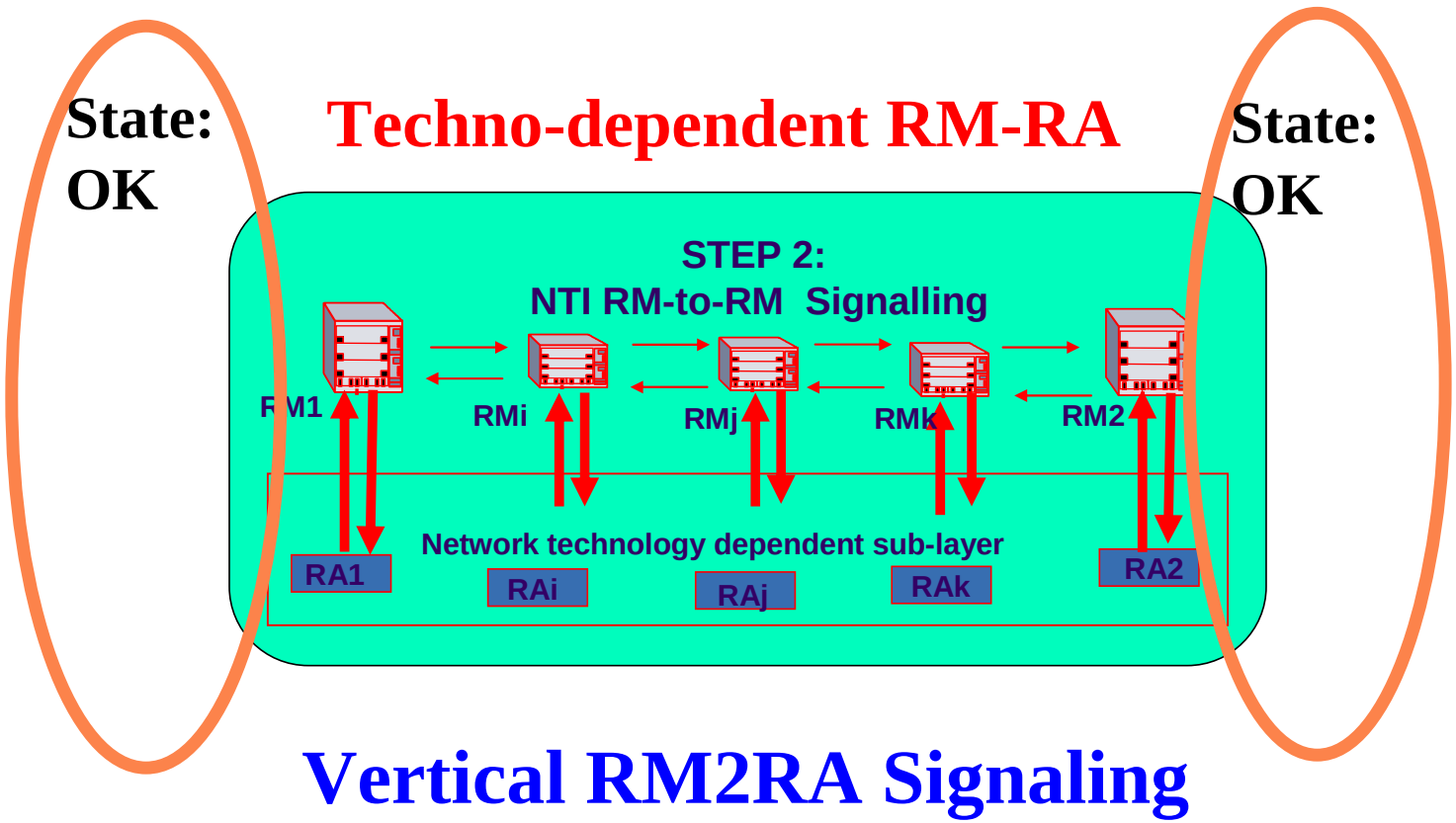
SSN (contd)

- Step 2 – Connection admission

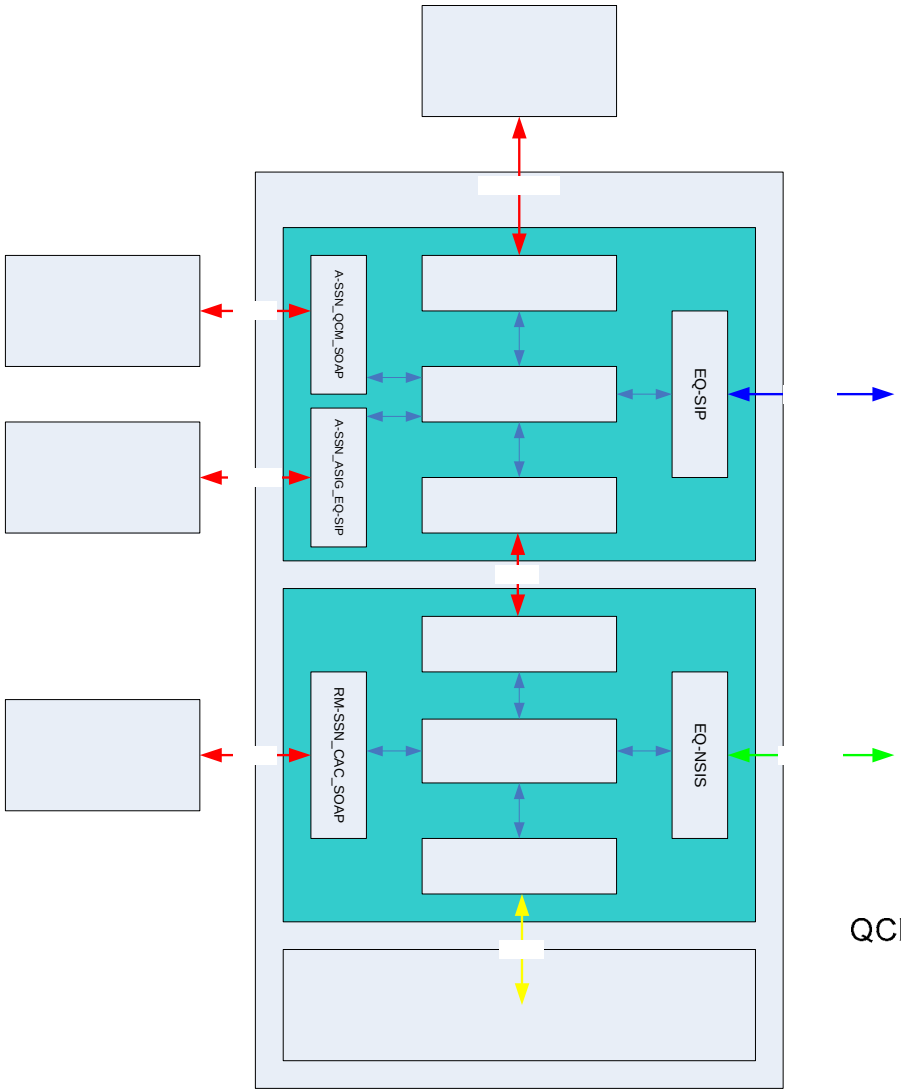


SSN (contd)

- Step 3 – Resource allocation



SSN architecture



SSN

A-SSN

QCM

SOAP

Application QoS signalling

A-SSN features

EQ-SIP protocol

EQ-SIP framework

A-SSN features

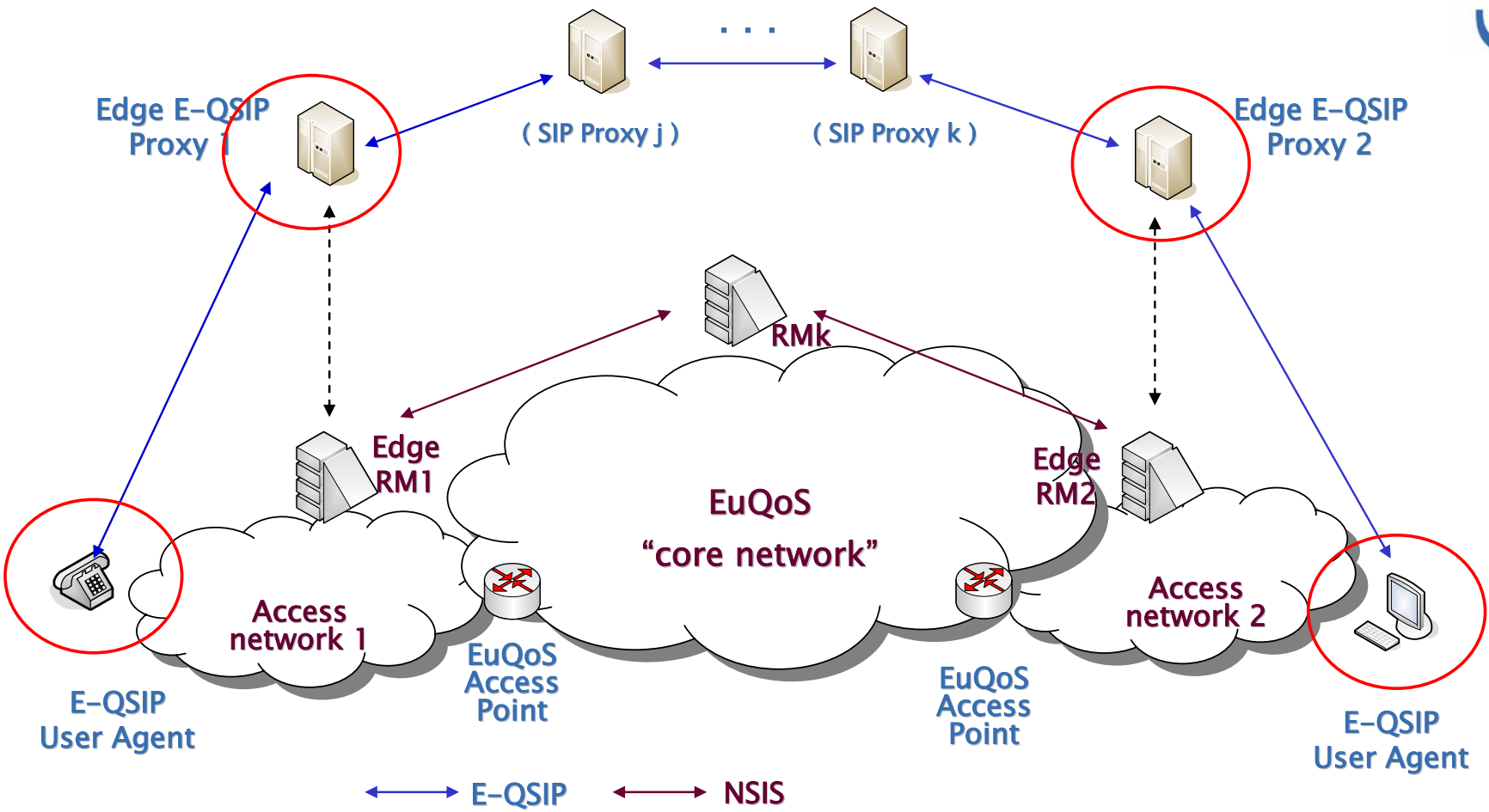
- A-SSN interacts with the applications in order to
  - establish,
  - maintain and
  - release application sessions
- A-SSN is used to negotiate sessions with a specified and assured QoS level
- A-SSN relies on a session signalling protocol
  - based on QSIP (draft-veltri-sip-qsip)
  - extended with EuQoS-oriented QoS support
  - Named EQ-SIP

EQ-SIP protocol

- Basic goal of the EQ-SIP protocol
  - let end-user applications negotiate QoS requirements and characteristics
  - let end-user applications express QoS requirements and characteristics to the EuQoS system
  - let “edge” proxies interact, exchanging information needed by the RM-layer

- The actual allocation of network resources is requested by EQ-SIP Proxies located in access networks

EQ-SIP framework



Resource Managers SSN

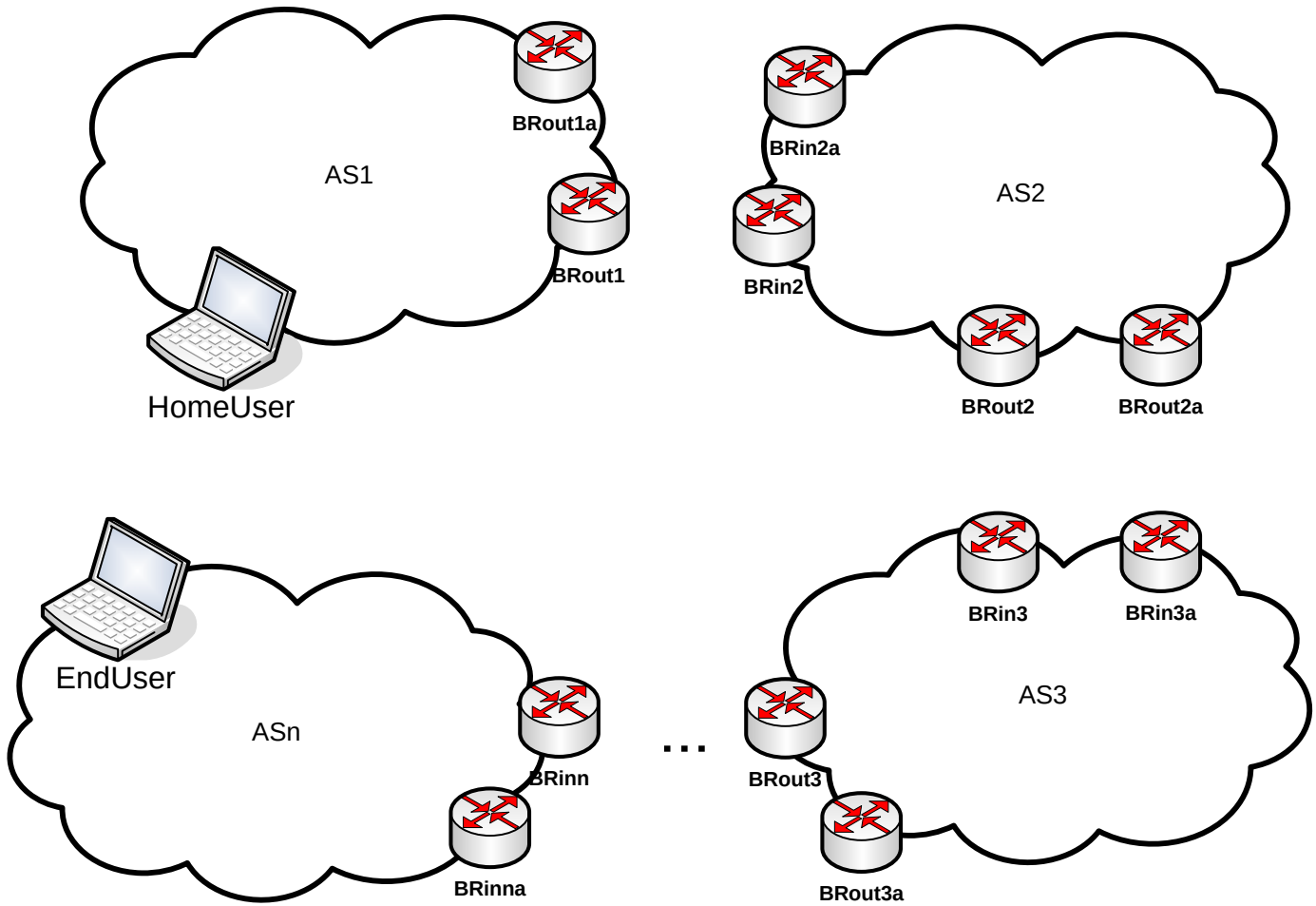
Requirements

Constraints

EQ-NSIS

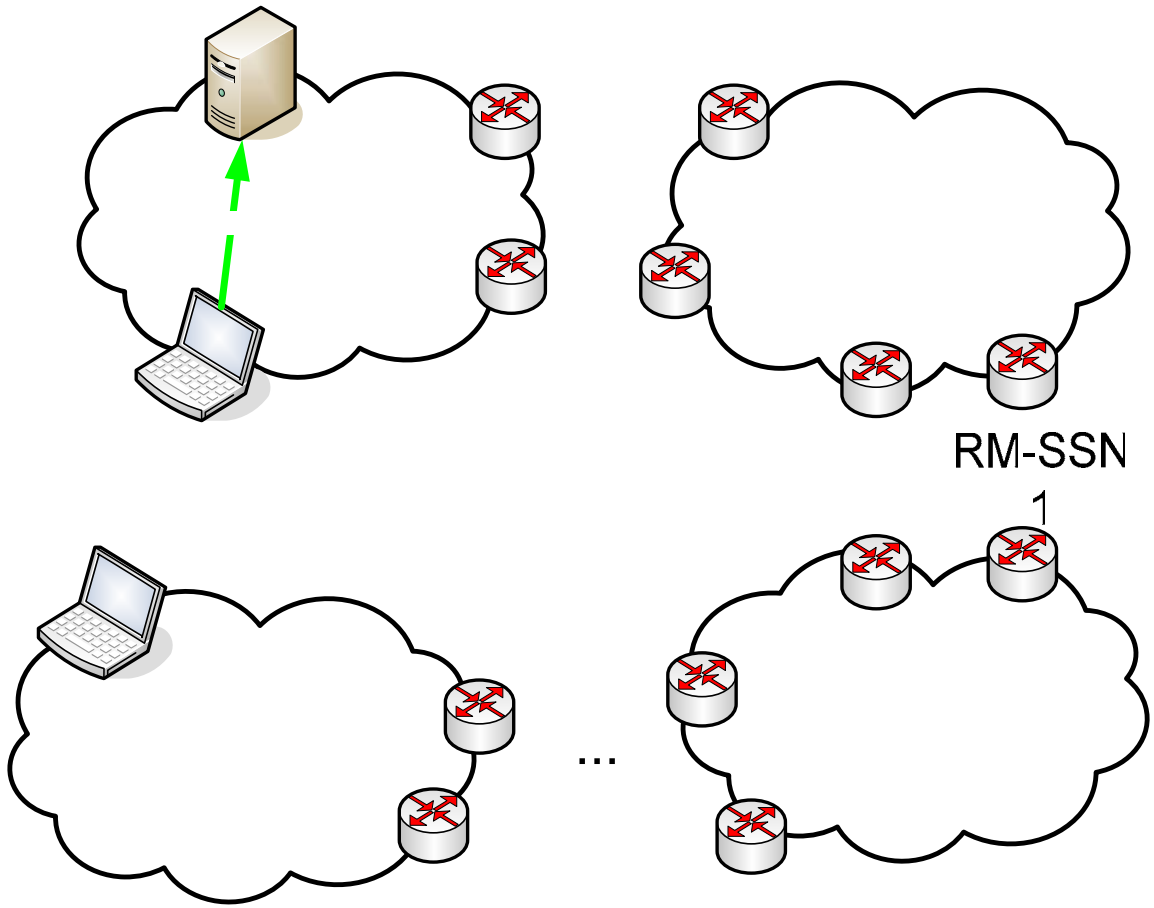
Requirements

- Home-User in AS1 wants to send data to End-User in ASn



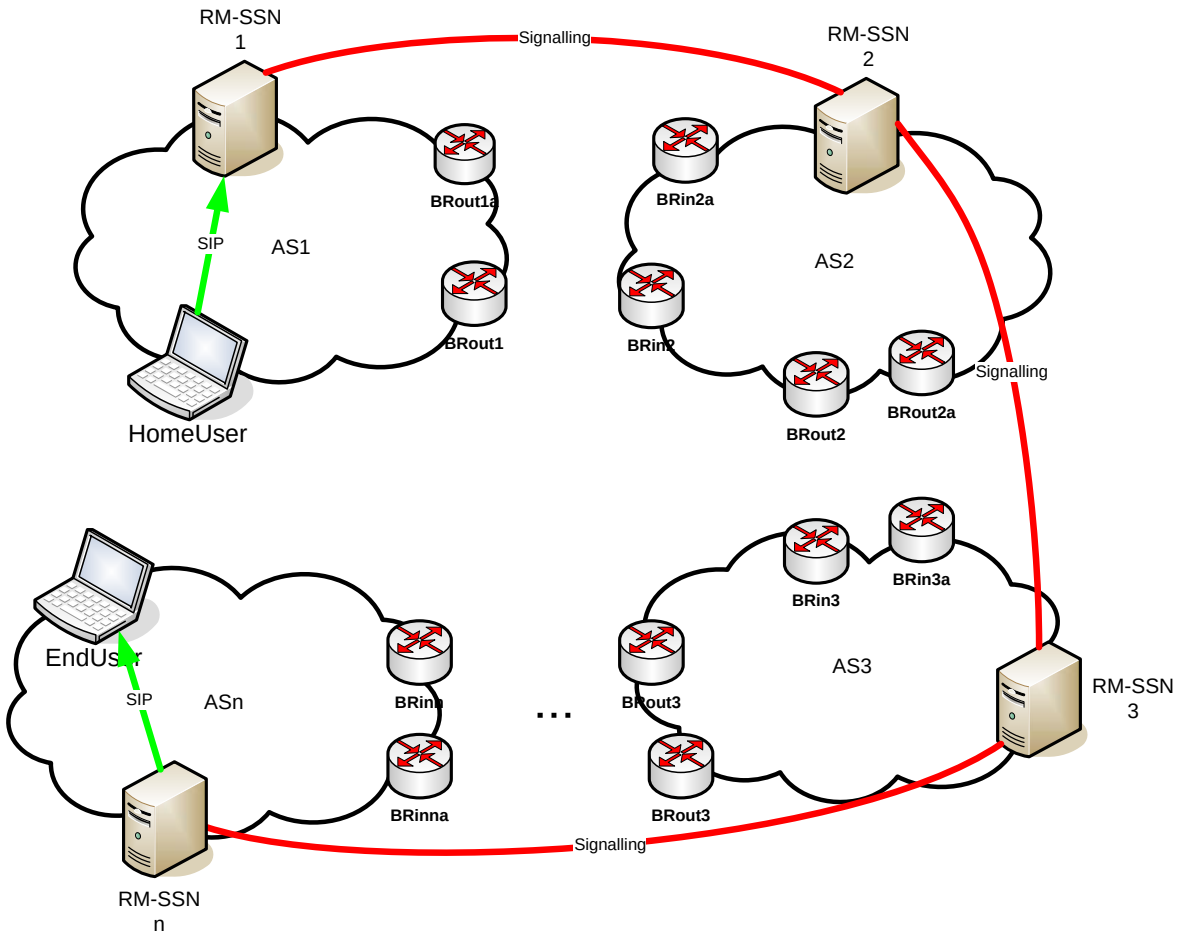
Requirements (2)

- Before starting the data flow the Home-User informs the local RM using A-SSN (EQ-SIP)



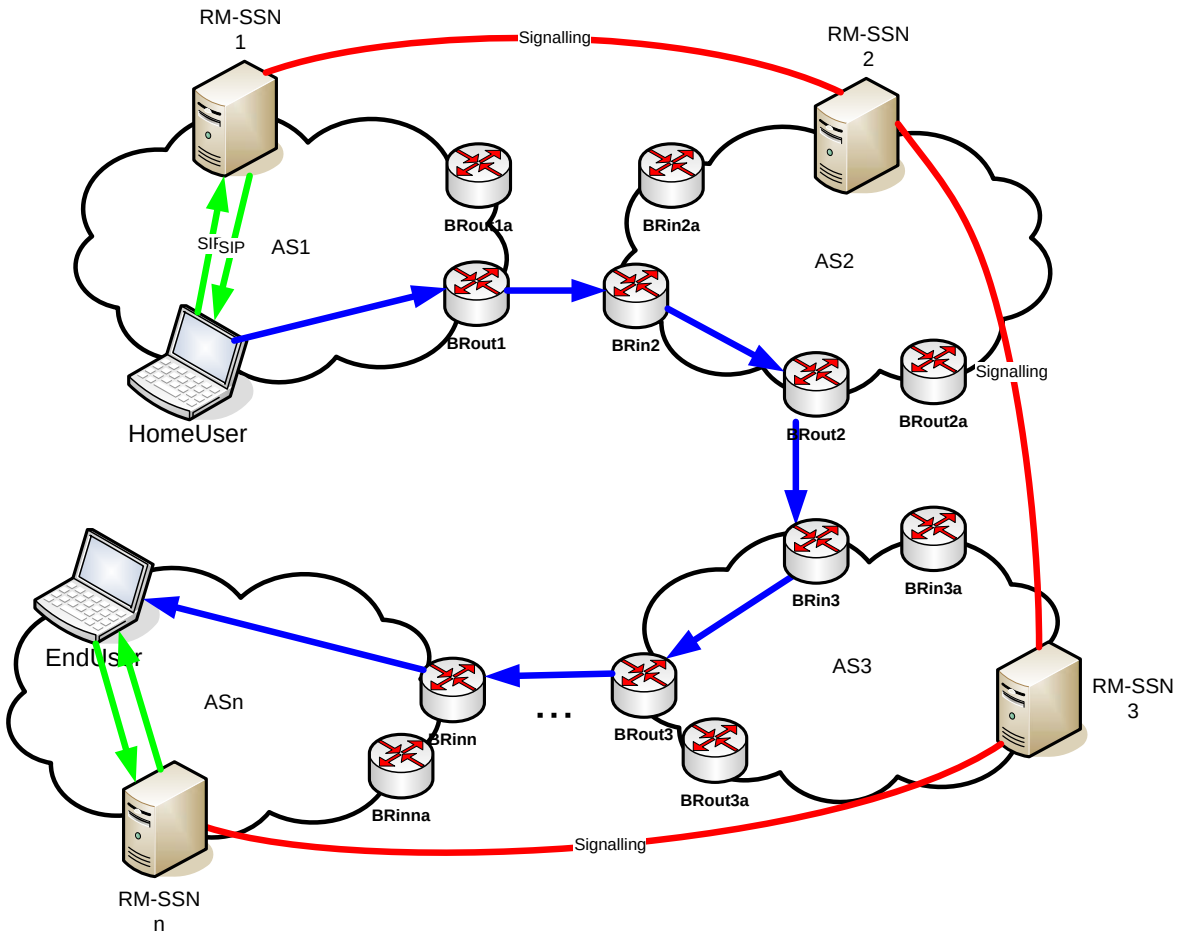
Requirements (3)

- An RM-SSN association needs to be created hop-by-hop until the last RM
- CAC decision will take place in each AS



Requirements (4)

- After the successful RM-SSN completion and CAC decisions the data path will start from the Home-User to the End-User

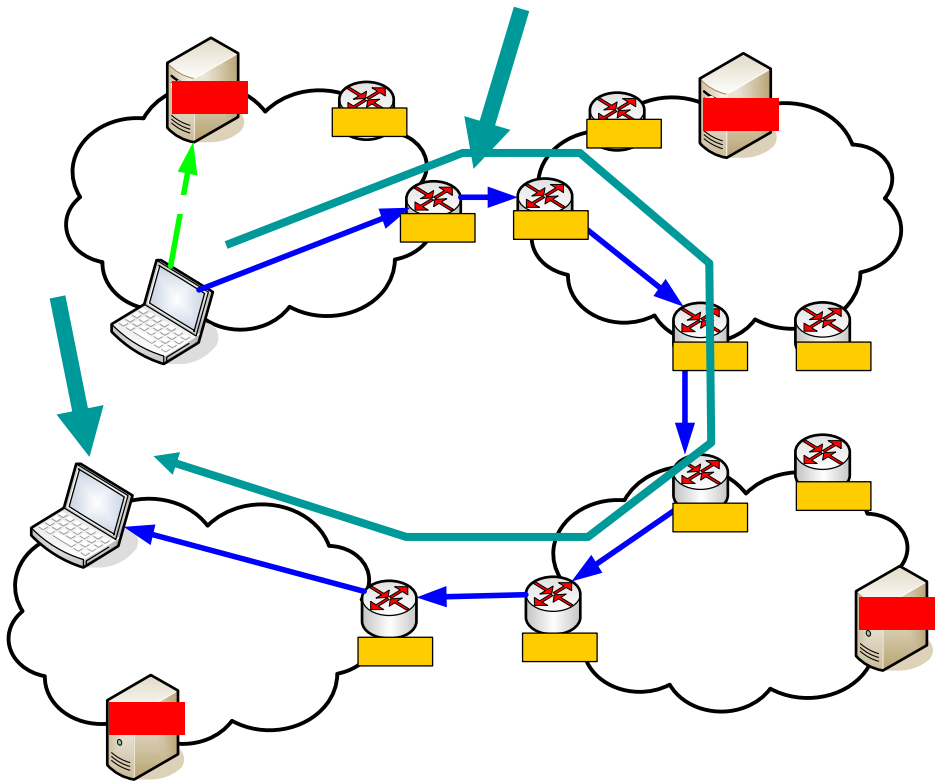


Constraints

- The RM-SSN signalling path and the data path must cross the same domains
- The data path may change frequently due to routing dynamics (both intra and inter domain changes)
  - Use of soft-state reservations and refresh signalling
- The RM-SSN signalling path and the data path may cross the different routers
  - If so, on-path resource reservation not possible inside domains

EQ-NSIS

- We need to know the Exit Border Router of the HomeUser, BRout1
- We want to make a path-coupled signalling
- We need NSIS in RMs
- We need an EQ-Agent on the border routers
- Signalling needs to be addressed to the End-User



Border Router discovery

- Using an extended BGP table we can easily discover the Exit Border Router for the path
- This happens even in networks with asymmetric routing

Example of BGP table

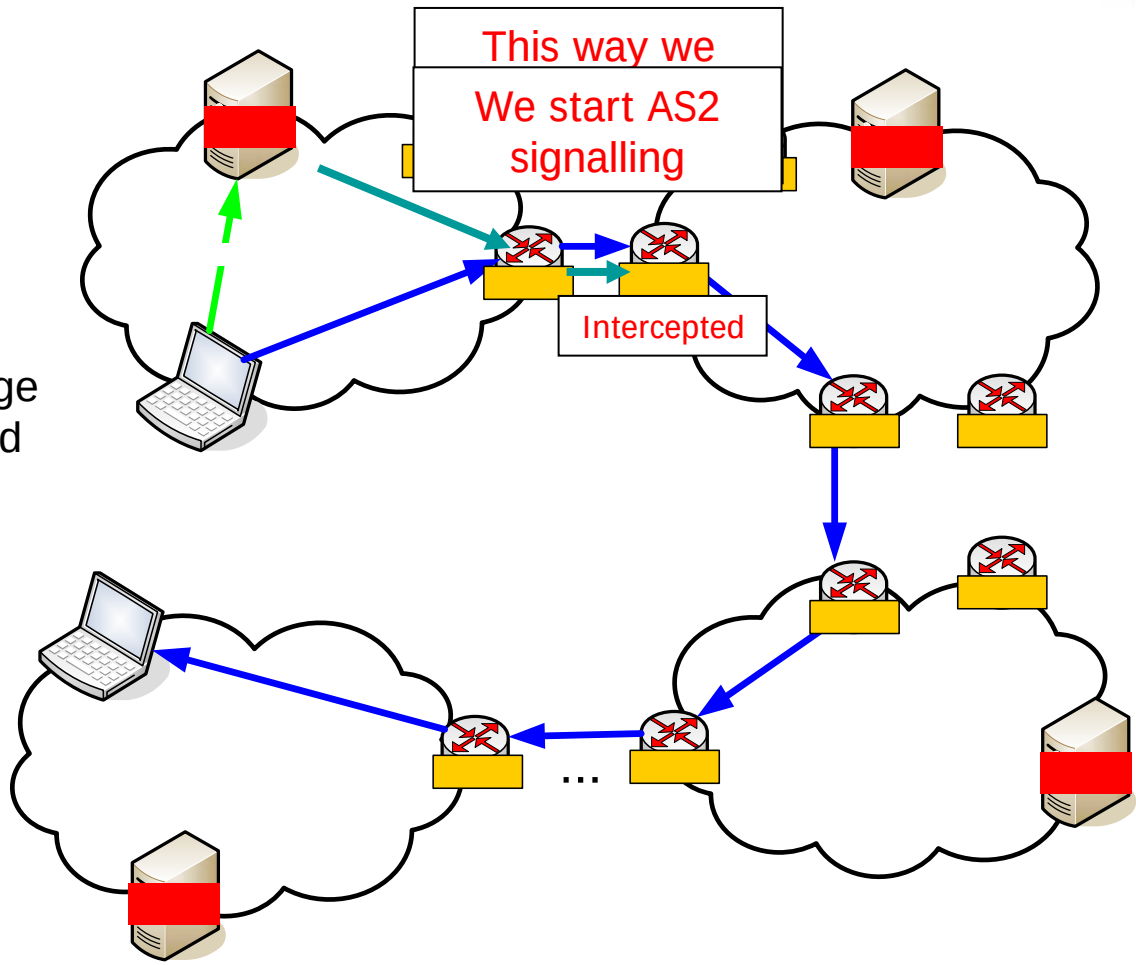
Destination network	Exit border router	ASs in the path	Origin	Etc.
AS2	BRout1	2	Network 1	…
AS2	BRout1a	2	Network 2	…
AS3	BRout1	2,3		…
ASj	BRout2	i,…,j		…
ASn	BRout1	2,3,…,n		…

BRout1 → local exit border router of the data-path

HomeUser → End-User

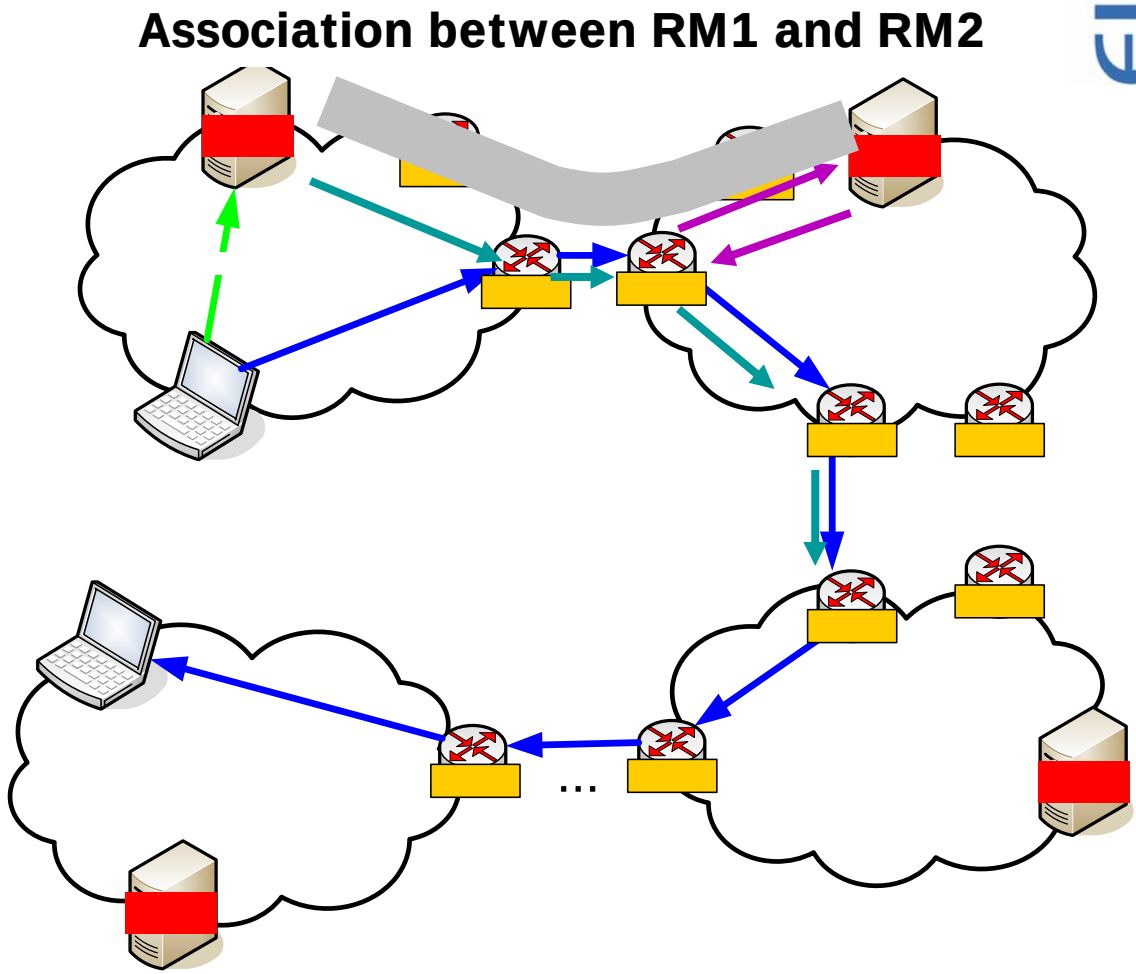
EQ-NSIS working (1)

- Send signalling message from the local RM to the local Exit BRout1 (with the EQ-SLS payload)
- In BRout1 a new NSIS message is created with the EQ-SLS and sent to the End-User
- In BRin2 the NSIS message is intercepted



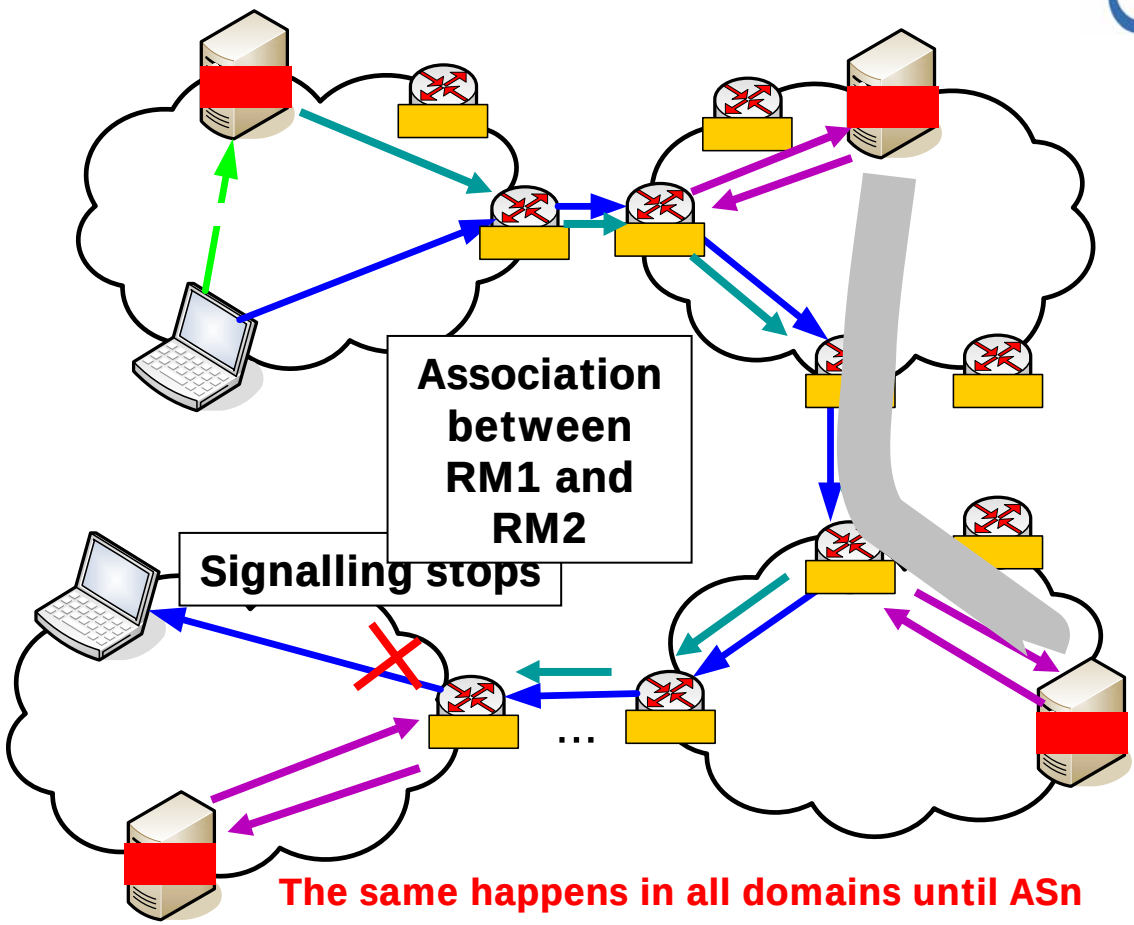
EQ-NSIS working (2)

- BRin2 then sends the EQ-SLS payload to RM2, and waits for the result
- RM2 receives the payload and, if not the last RM, after processing returns the new EQ-SLS payload to BRin2
- In BRin2 the NSIS message with the new EQ-SLS payload continues its way through the data path to the End-User



Hop-by-hop signalling
AS3 signalling

- BRin3 intercepts the NSIS message an sends the EQ-SLS payload to the local RM, RM3, and waits for the result
- RM3 receives the payload and, if not the last RM, after processing returns the new EQ-SLS payload to BRin3
- In BRin3 the NSIS message with the new EQ-SLS payload continues its way through the data path to the End-User



Resource Allocators SSN

RA-SSN role

RM-RA interaction

RA-SSN role

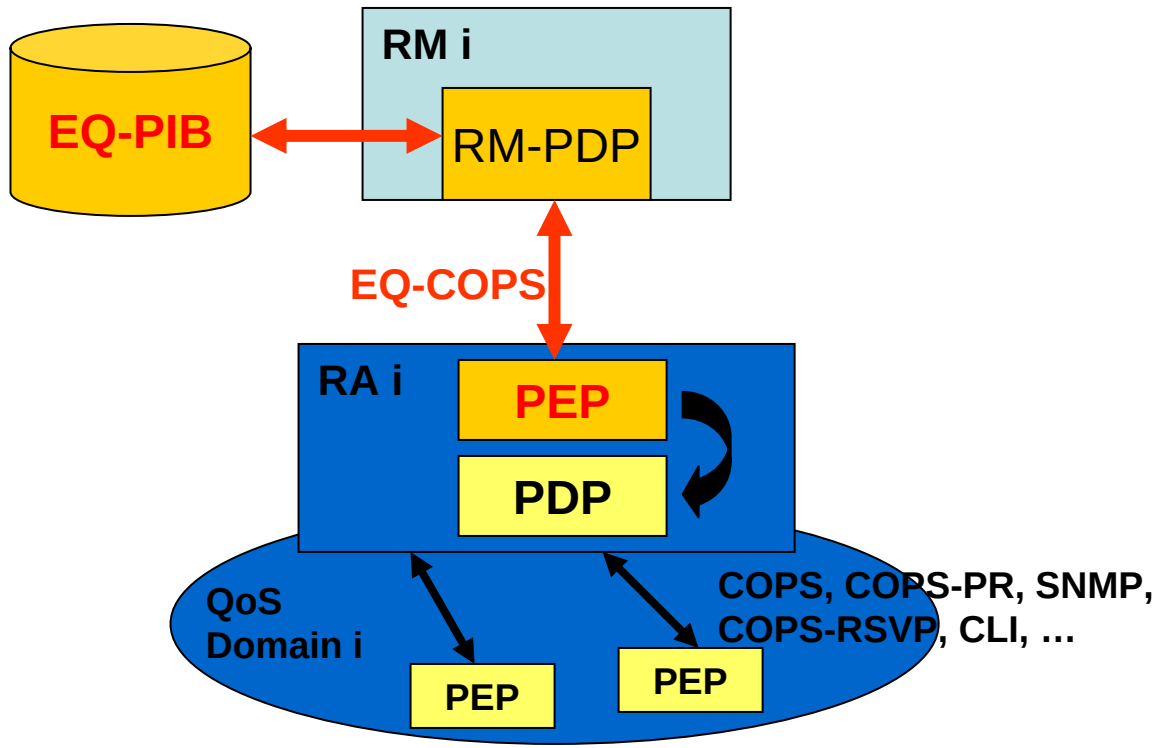
- RA-SSN controls the allocation of resources inside domains
  - Technology dependent
  - Map technology-independent rules (from RM-SSN) into low-level policies (enforced by RA-SSN)
  - Map low-level policies (general RA-SSN) into low-level rules (specific, technology-dependent RAs)

RA-SSN Role

Technology – Independent Policies

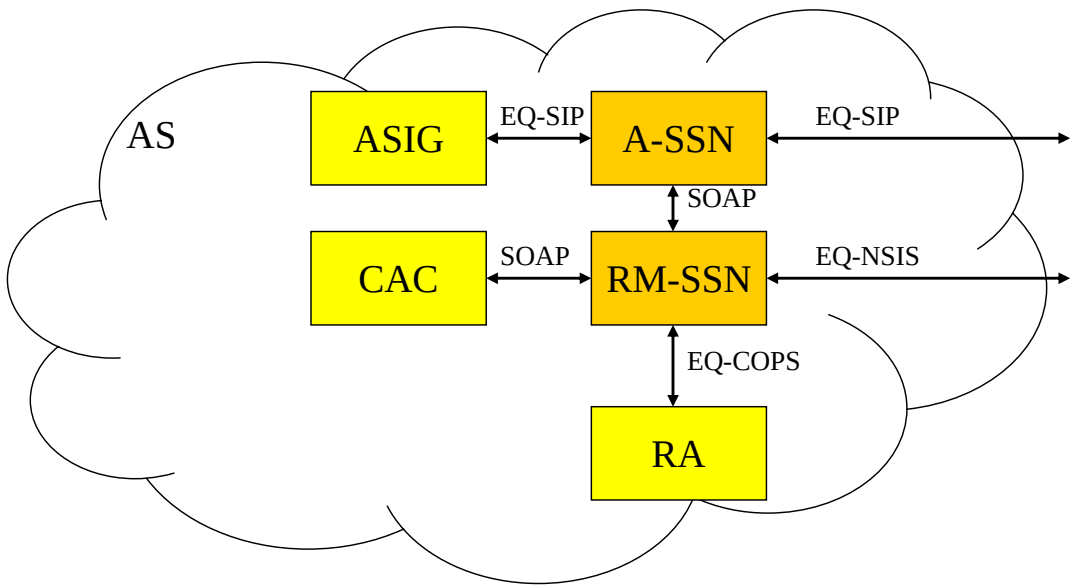
Technology – dependent Policies

Low Level Rules

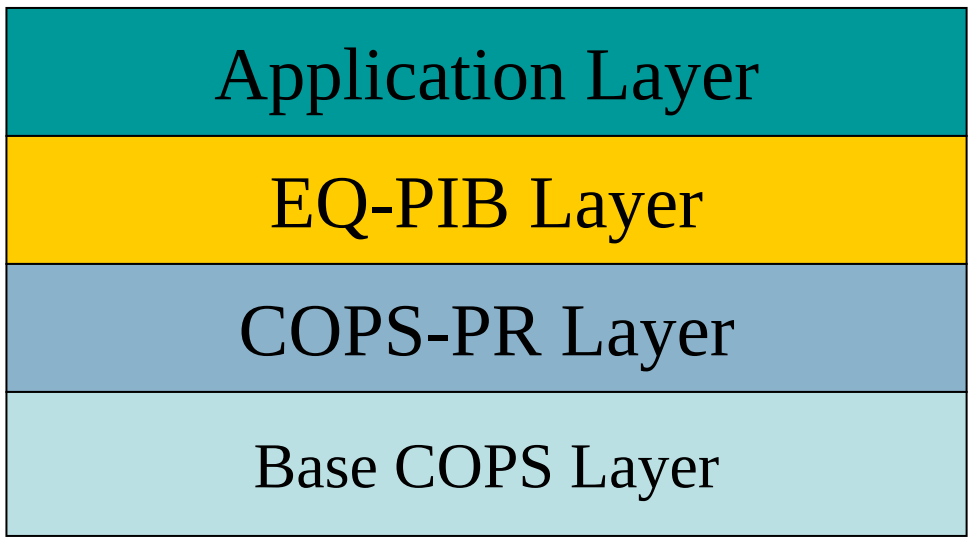


RM-RA interaction

- Use of EQ-COPS protocol
  - Based on the COPS-PR protocol;
  - Definition and implementation of EQ-PIB;
  - Definition of the Application Interface with RM and RA;



Design Points of EQ-COPS (1)



Design Points of EQ-COPS (2)

- Install a new Request State at the RM-PDP for each accepted flow;
- Setup of the “Control Request State” at the RM-PDP;
- Technology-independent resource allocation policies in the EQ-PIB.

Conclusion

Conclusion

- Signalling and service negotiation is a key function of EuQoS
- Session negotiation is performed by A-SSN
  - Suported by a SIP-based protocol
- Resources in each domain along the path are managed by RM-SSN
  - Hop-by-hop reservation
  - NSIS-based
  - Path-coupled operation
  - Dynamic inter- and intra-domain resource allocation
- Interaction between RM and RA is based on COPS-PR