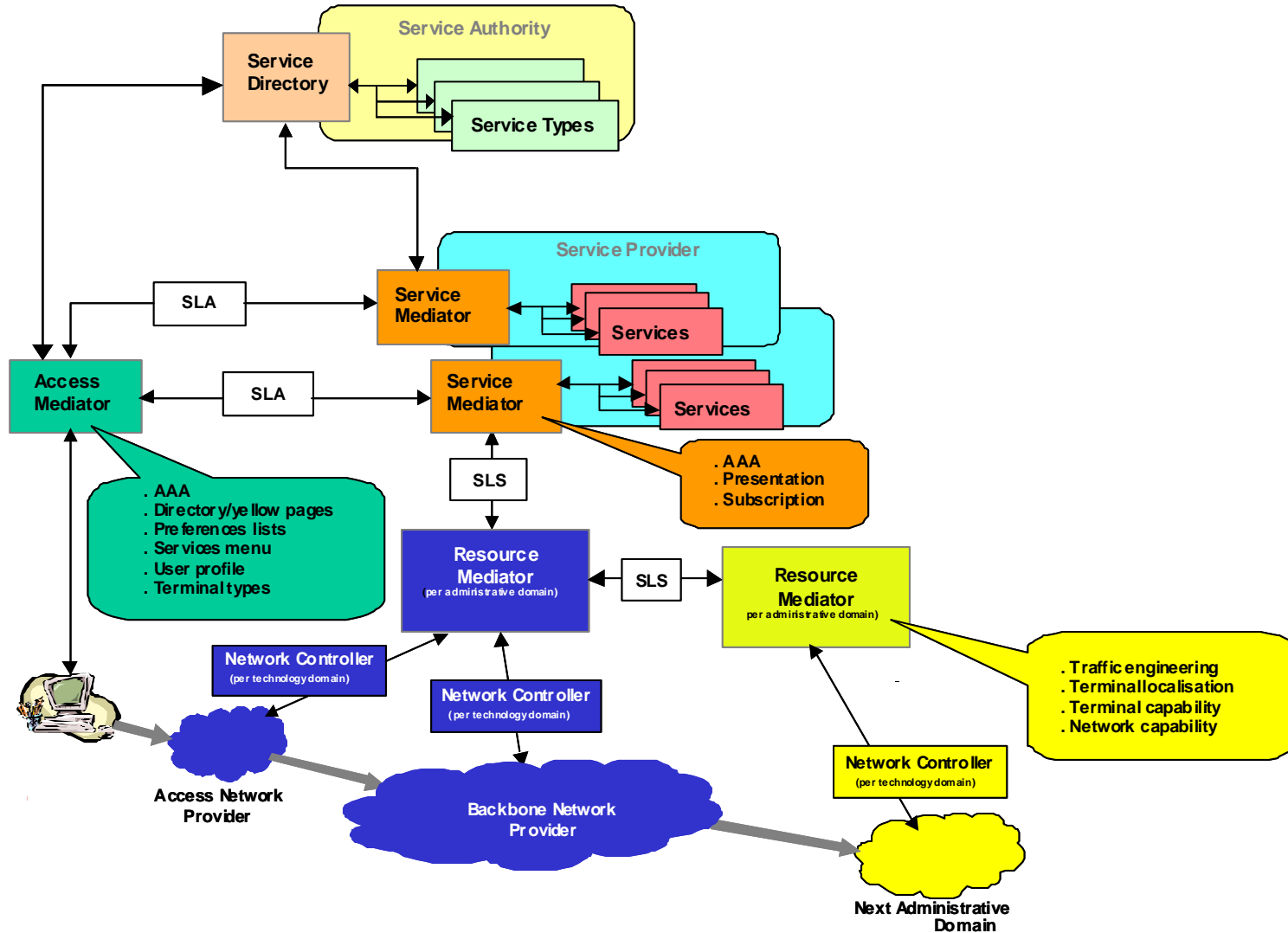


# The CADENUS approach for handling service creation, negotiation, configuration and invocation

# Outline

- ↓ CADENUS architecture and business roles mapping
- ↓ Business Models
  - Hub model vs Cascade model
  - Inter-domain QoS aspects
- ↓ Service Creation, Negotiation, Configuration and Invocation in a WLAN-based Access VPN scenario
- ↓ Scalability issues

# CADENUS Mediation Framework



# Mediators and Business Roles

Vertically integrated offer

Access Mediator



Service Mediator



Resource Mediator

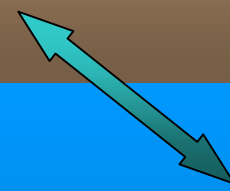
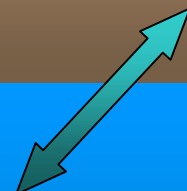
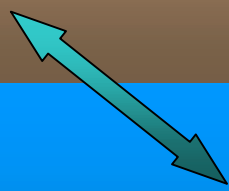
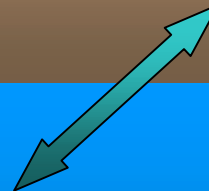
Single Provider

Access Mediator



Service Mediator

Service Mediator



Resource Mediator



Resource Mediator



Resource Mediator



Resource Mediator

Brokers / Retailers

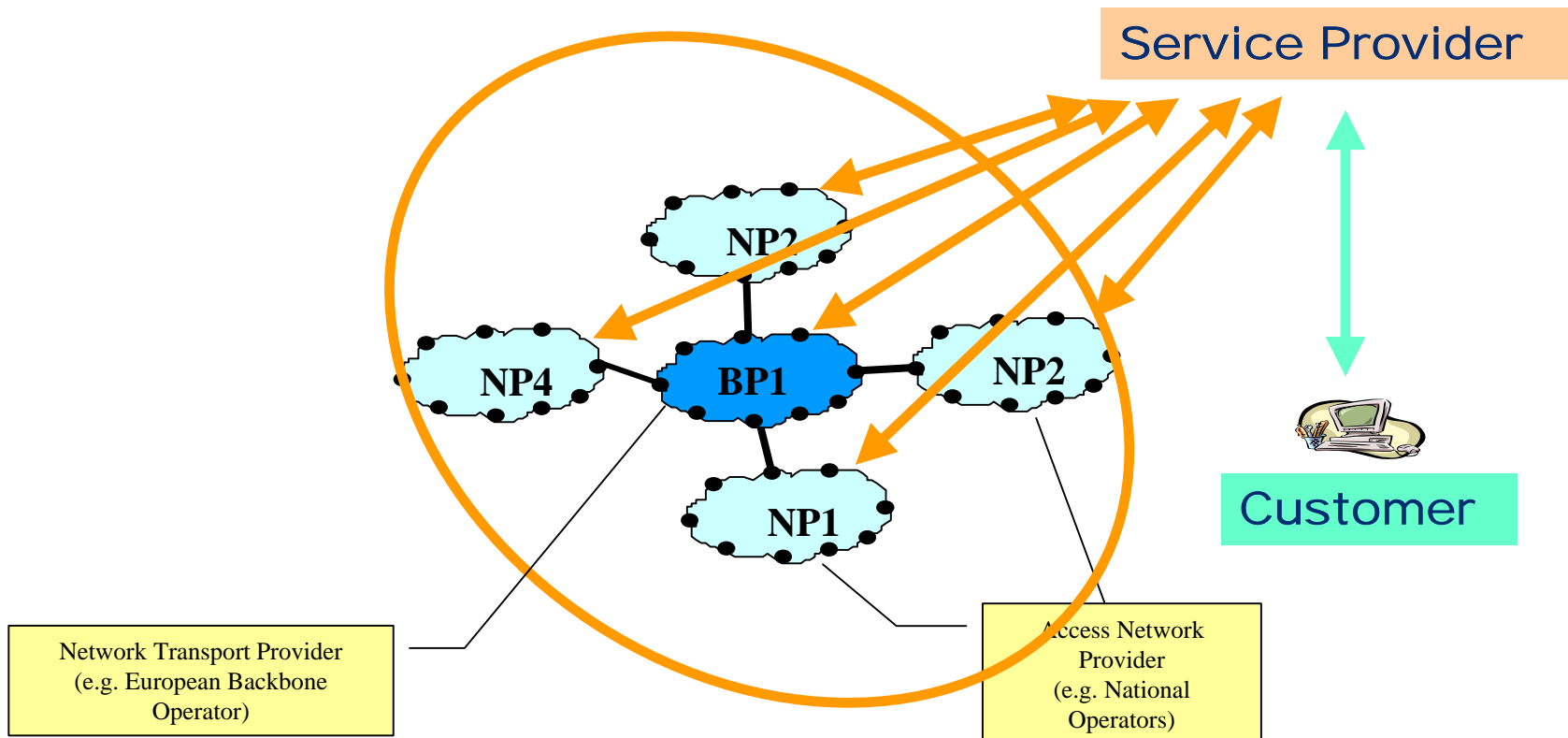
Service Providers

Network Providers

# Reference Models: Hub

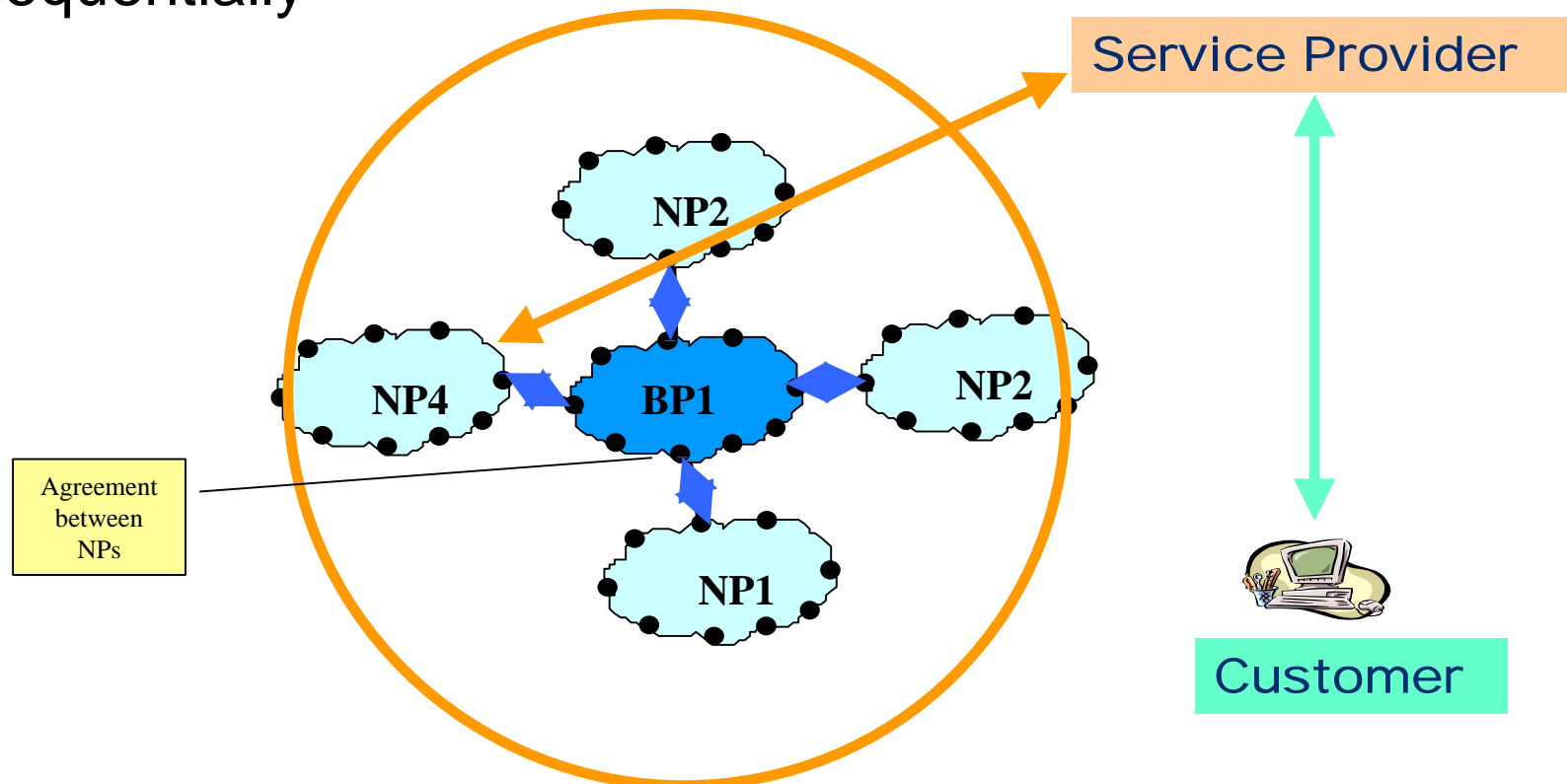
A SP arranges the contract with the Customer, and all the NPs identified to support the service.

- SP is then responsible with respect to the Customer for all aspects of customer care, trouble ticketing etc.
- SM receives the SDs by each RM and builds a Service Offer based on those SDs.
- When receiving a SLA Contract from a Customer, it has to identify all the RMs that are involved to provide the service along the computed end-to-end path and send an SLS to each of them.



# Reference Models: Cascade

- ↓ No single managing organisation has full 'visibility' of the service
- ↓ Peer-to-peer contracts between pairs of NPs along the chain of the end-to-end service have to be arranged sequentially



# Inter-domain management

## Hub vs Cascade models

### ↓ Hub Model:

- the SM computes the end-to-end path, by composing the “elementary” connectivity services provided by RMs
- the SM sends SLSs to each RM involved in the computed path

### ↓ Cascade Model:

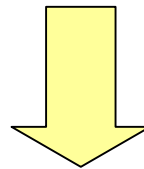
- the SM issues an SLS for the whole end-to-end path to an RM
- the RM identifies the next hop toward the destination
- the RM splits this SLS into one part related to its own domain and another part that is forwarded to the next RM along the end-to-end path

# Inter-domain management (2)

## Hub vs Cascade models

### ↓ End-to-end path Computation:

- The “same” function allocated to different boxes (SM or RM) according to the selected model (Hub or Cascade)
- Compose QoS-enabled connectivity services provided by the NP in their respective domains to form a end-to-end connection (with given QoS) between points in different domains



To solve a Multi-Constrained Shortest Path problem

# Inter-domain management (3)

## Hub vs Cascade models

### ↓ Hub Model

- Centralized
- One entity has global knowledge
- Exchange of Service Descriptions between RMs and SM

### ↓ Cascade Model

- Distributed
- Each entity has only a partial knowledge (its neighbours)
- Exchange of QoS levels information among RM neighbours



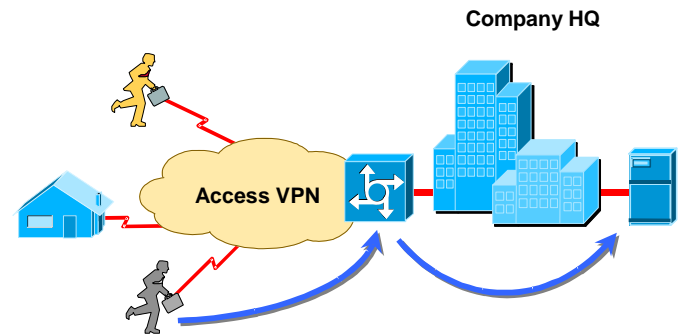
# Hub vs Cascade

## Conclusions

- ↓ Both models reflect possible and realistic business organizations among Service and Network Providers (including mixes of the two)
  
- ↓ The CADENUS architecture accomodates both models
  - SM-RM interface is independent of the selected business model.
    - In the Hub model this interface is used for communication among SP and NP (alias SM -RM).
    - In the Cascade model, this interface is also used as an NP-NP interface (RM to RM)

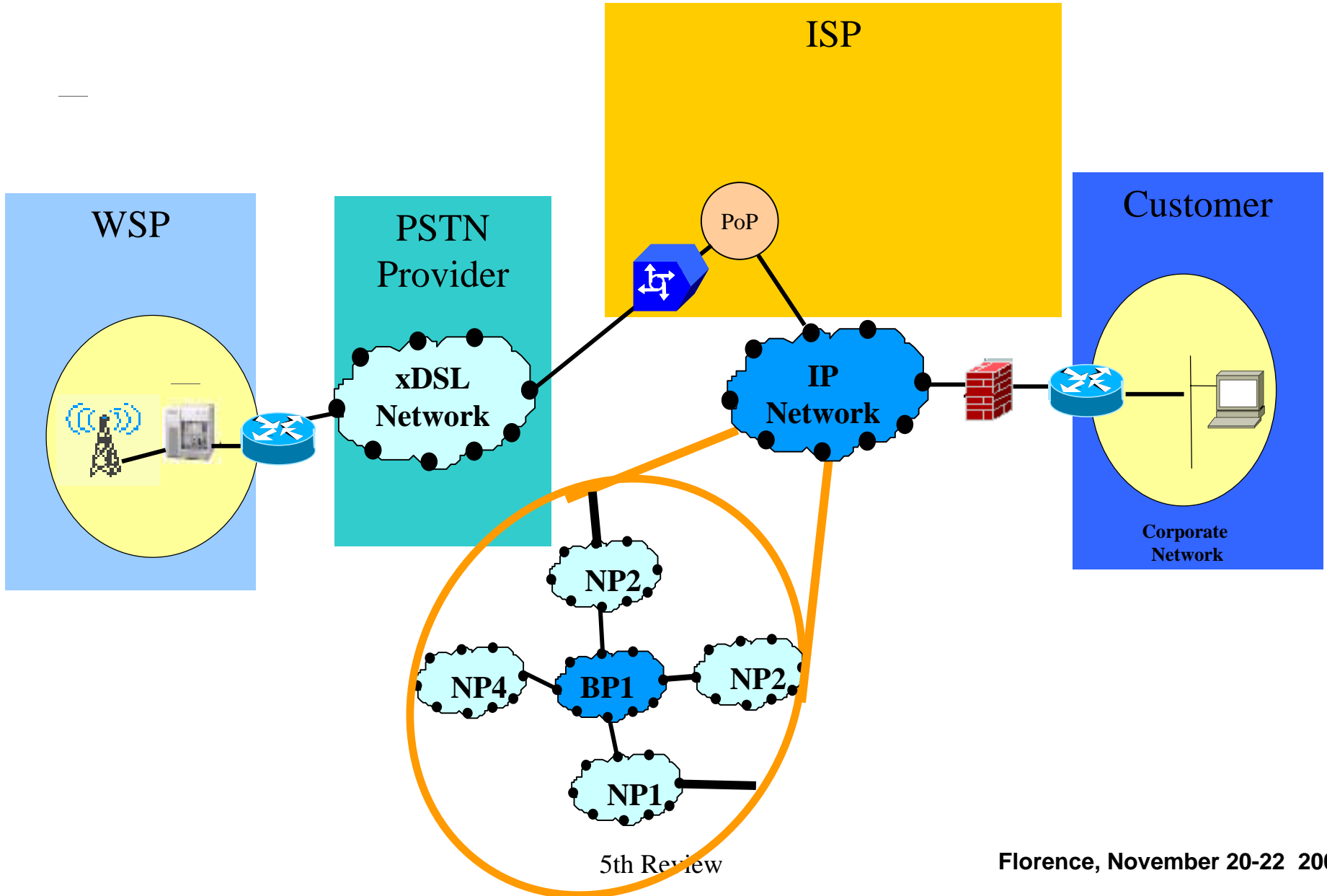
# IP-VPN Scenario

- ↓ **Access VPNs**—Provide remote access to an enterprise customer's intranet or extranet over a shared infrastructure.
- ↓ Access VPNs may use a variety of technologies (e.g. dial-up, ISDN, DSL, WLAN) to securely connect mobile users, telecommuters, and branch offices.

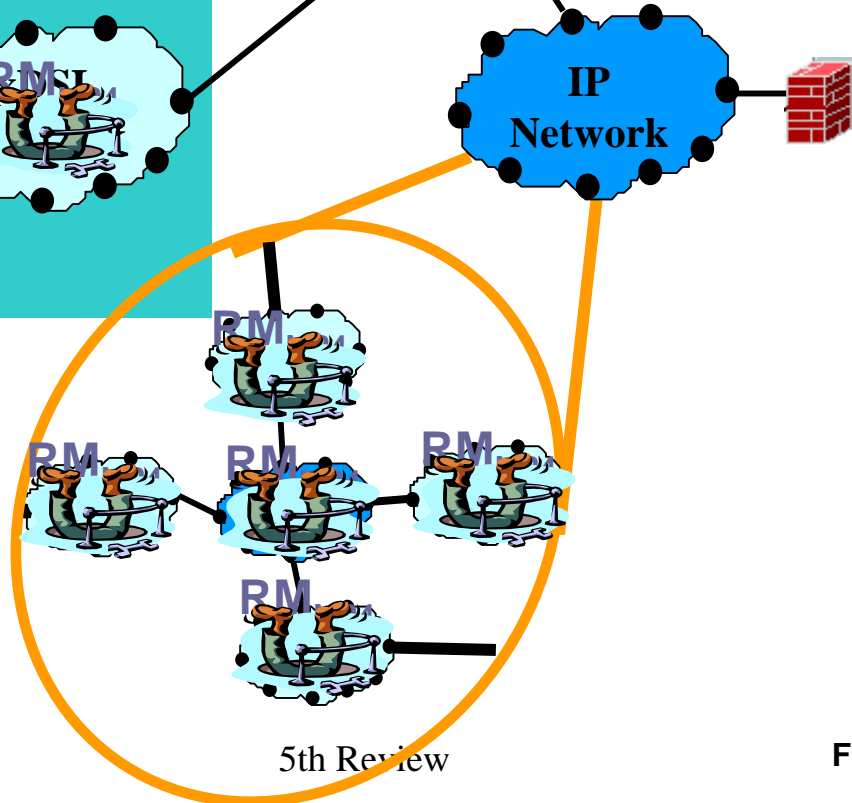
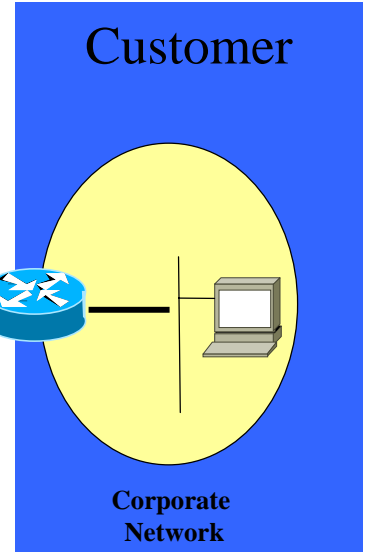
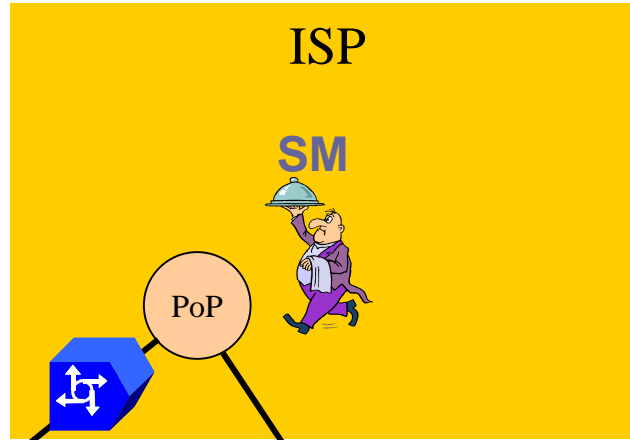
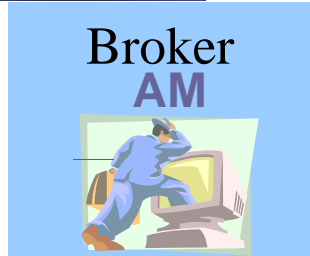


In the following, we concentrate on  
WLAN access scenario

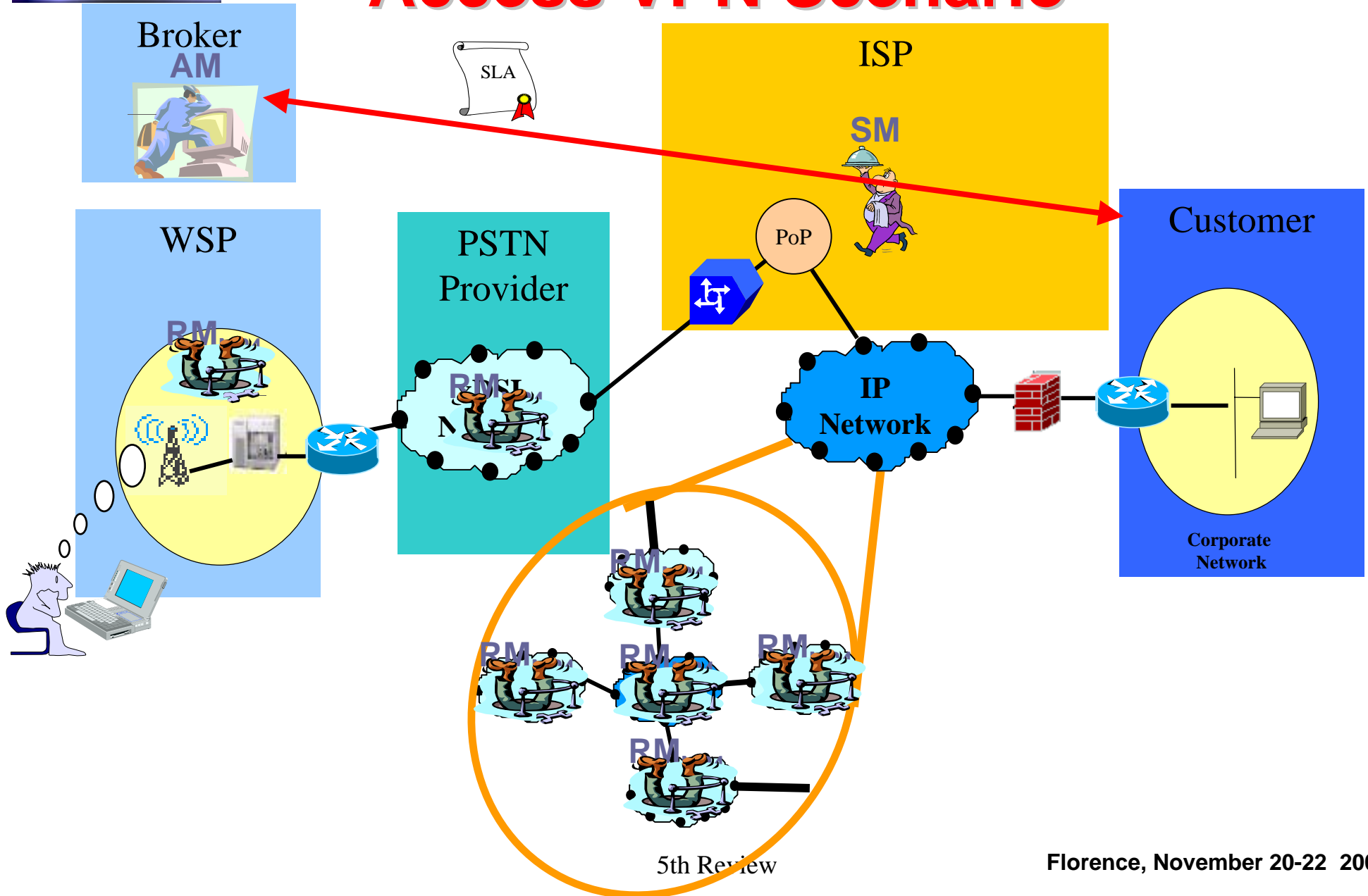
# Access VPN Scenario



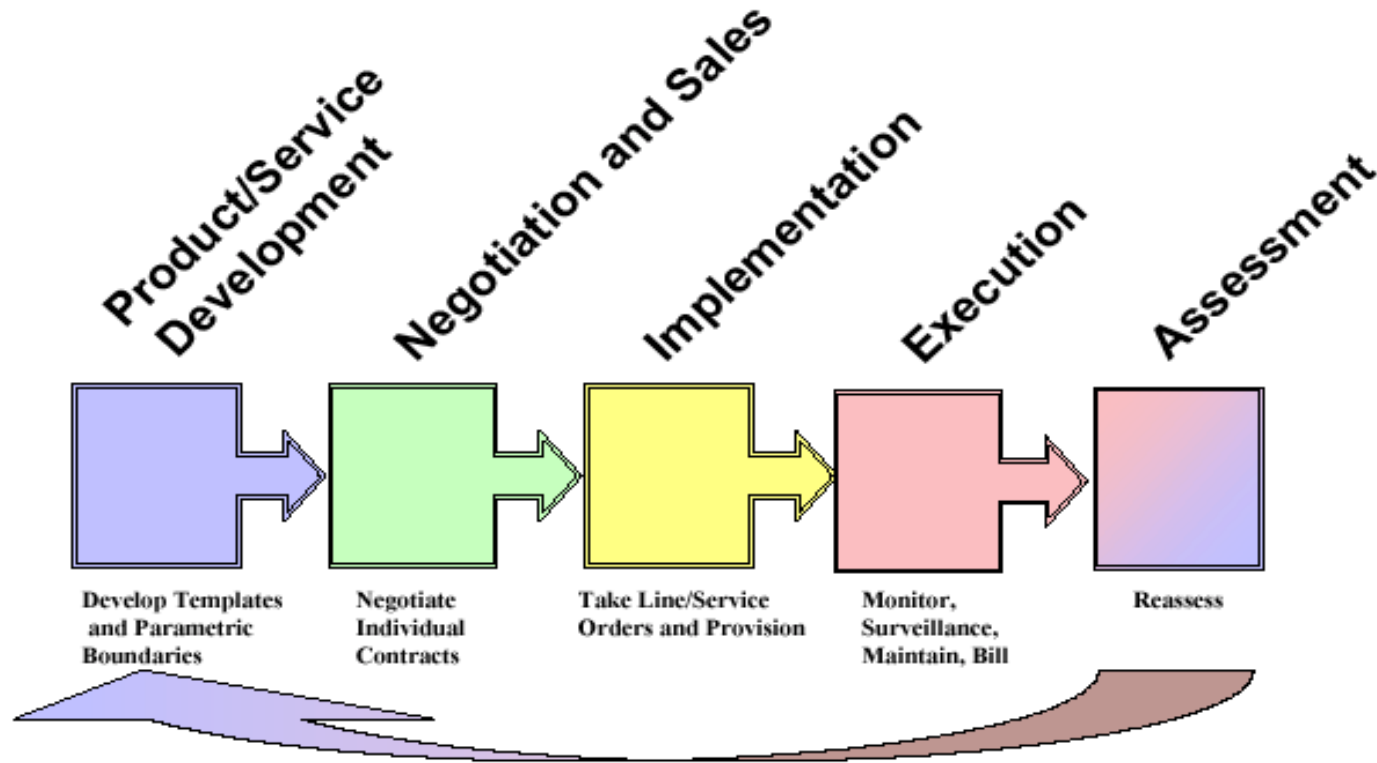
# Access VPN Scenario



# Access VPN Scenario



# SLA Life-Cycle



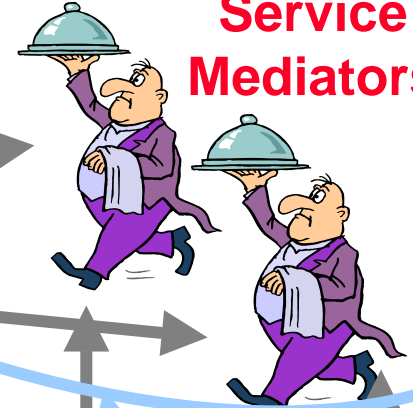
Service Authority



Service Directory



Service Mediators



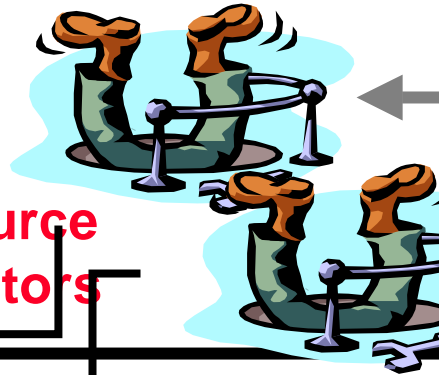
User



Access Mediator



Resource Mediators



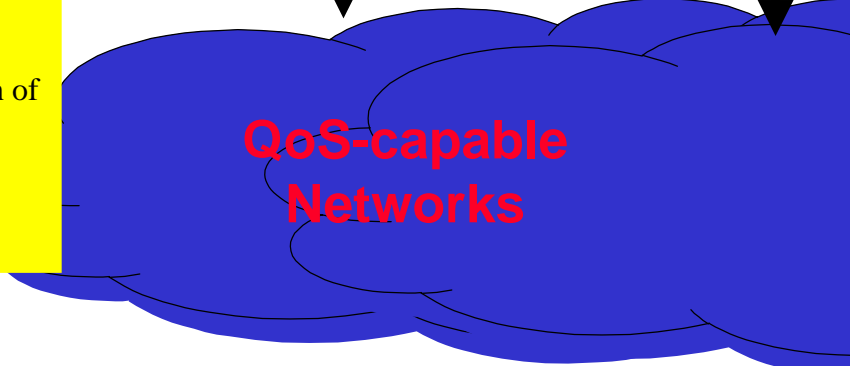
Service Creation

Service Creation

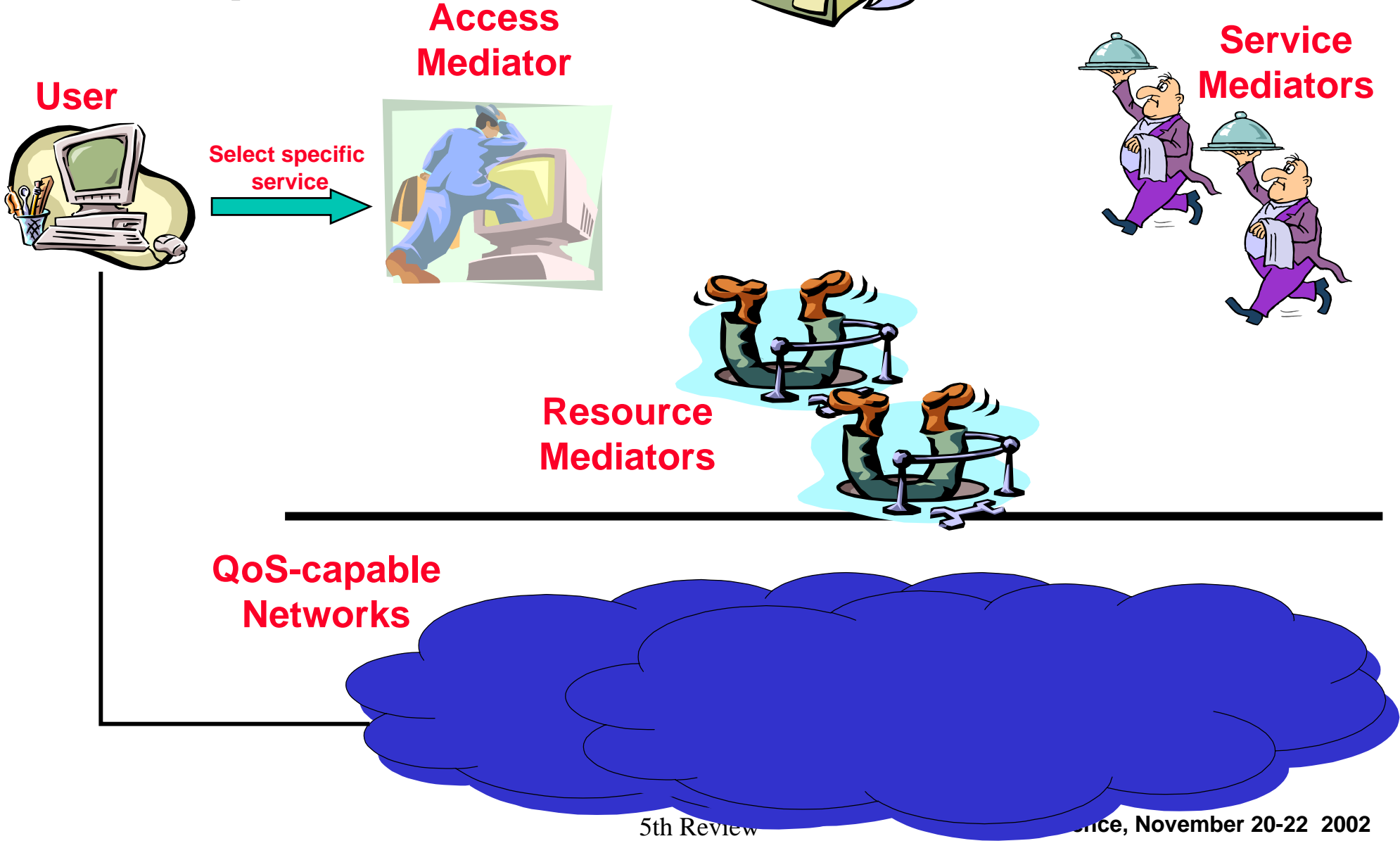
- Define and put in a standard format a description of the business process associated to service trading
- Define a standard Graphical User Interface to allow user's customization of the service parameters
- Define a standard template for the Service Level Agreement

- Define SLA/Contract and Service Template (internal)
- Define Service negotiation and configuration workflows
- Define SLA-SLS translation rules
- Define Configuration policies
- Query the Service Directory and retrieve business process
- Define data format translation and process adaptation rules
- Publish new service in the Service Directory

QoS-capable Networks



# The negotiation phase



# The negotiation phase



User



Access Mediator

Get involved  
Service Mediators



Service Directory

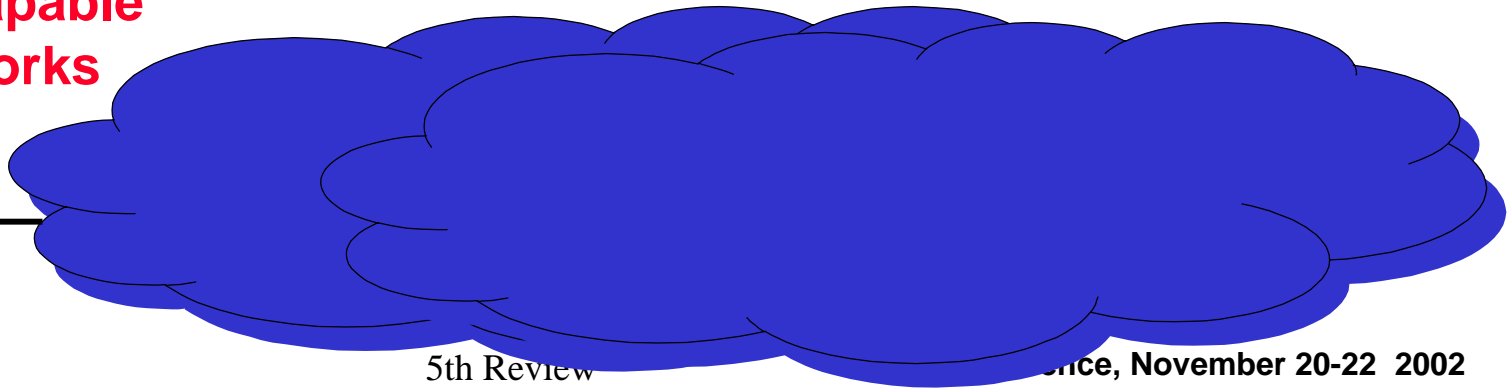


Service Mediators



Resource Mediators

QoS-capable  
Networks



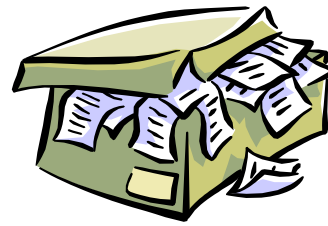
# The negotiation phase



User



Access Mediator



Service Directory

Send list of Service Mediators

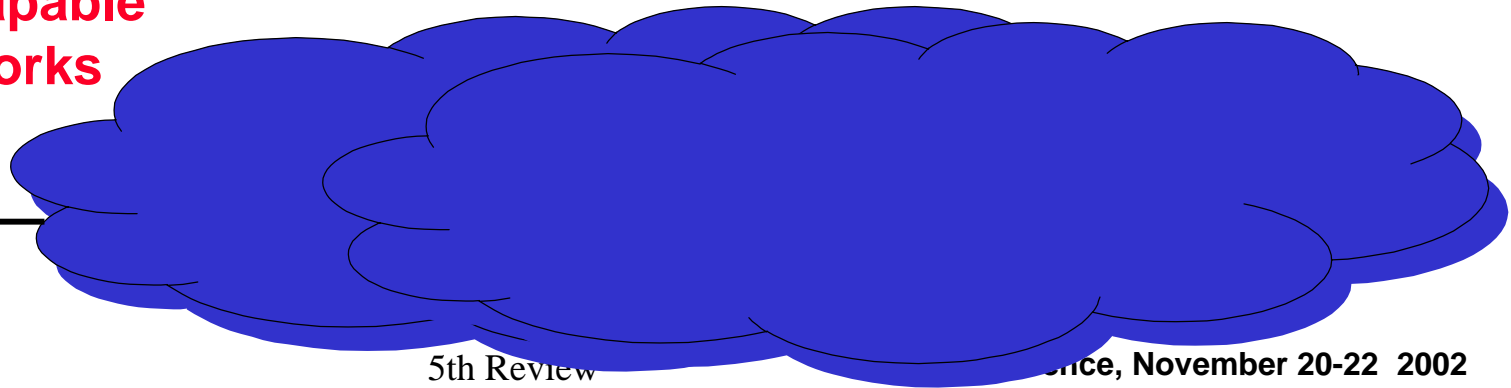


Service Mediators

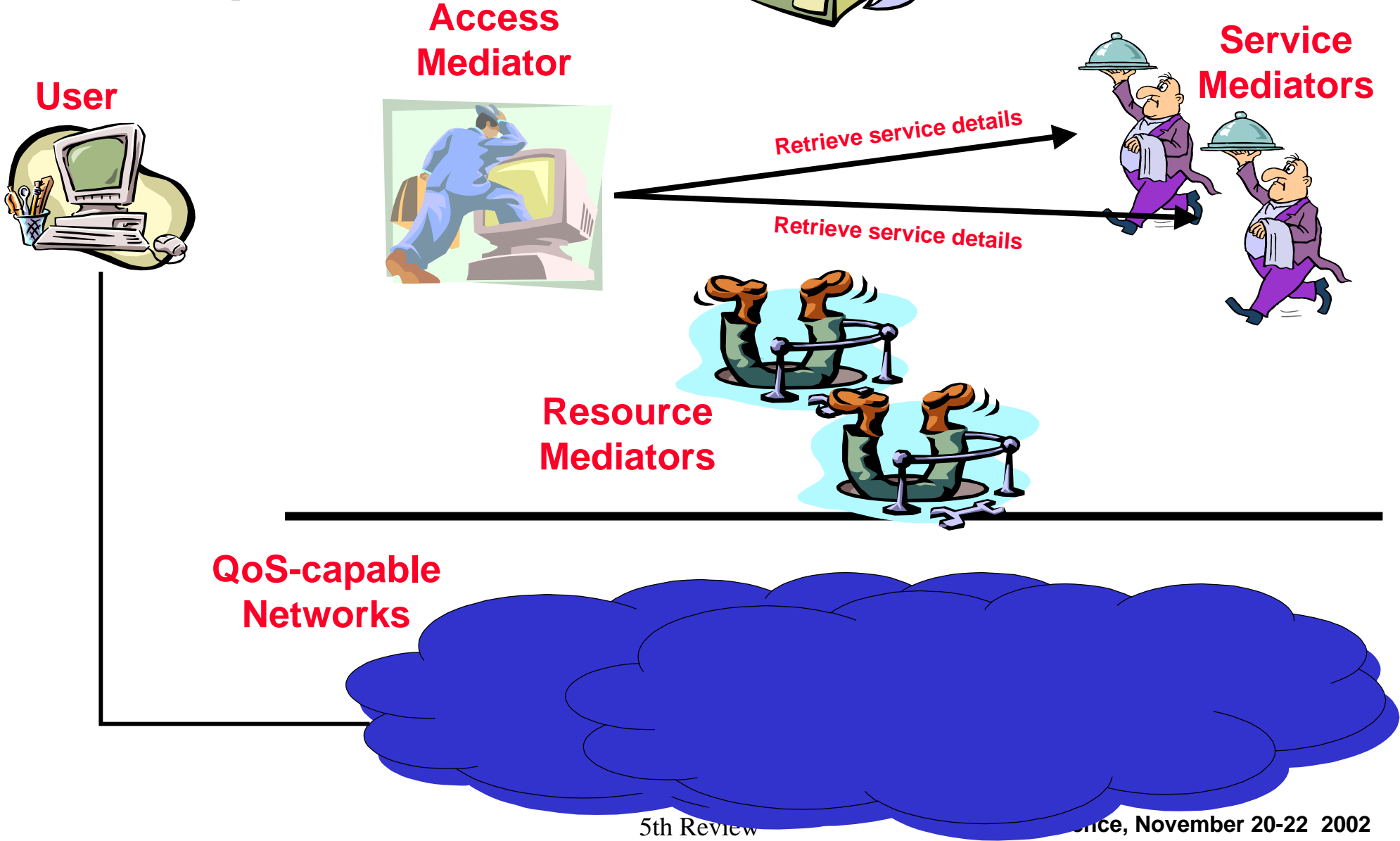


Resource Mediators

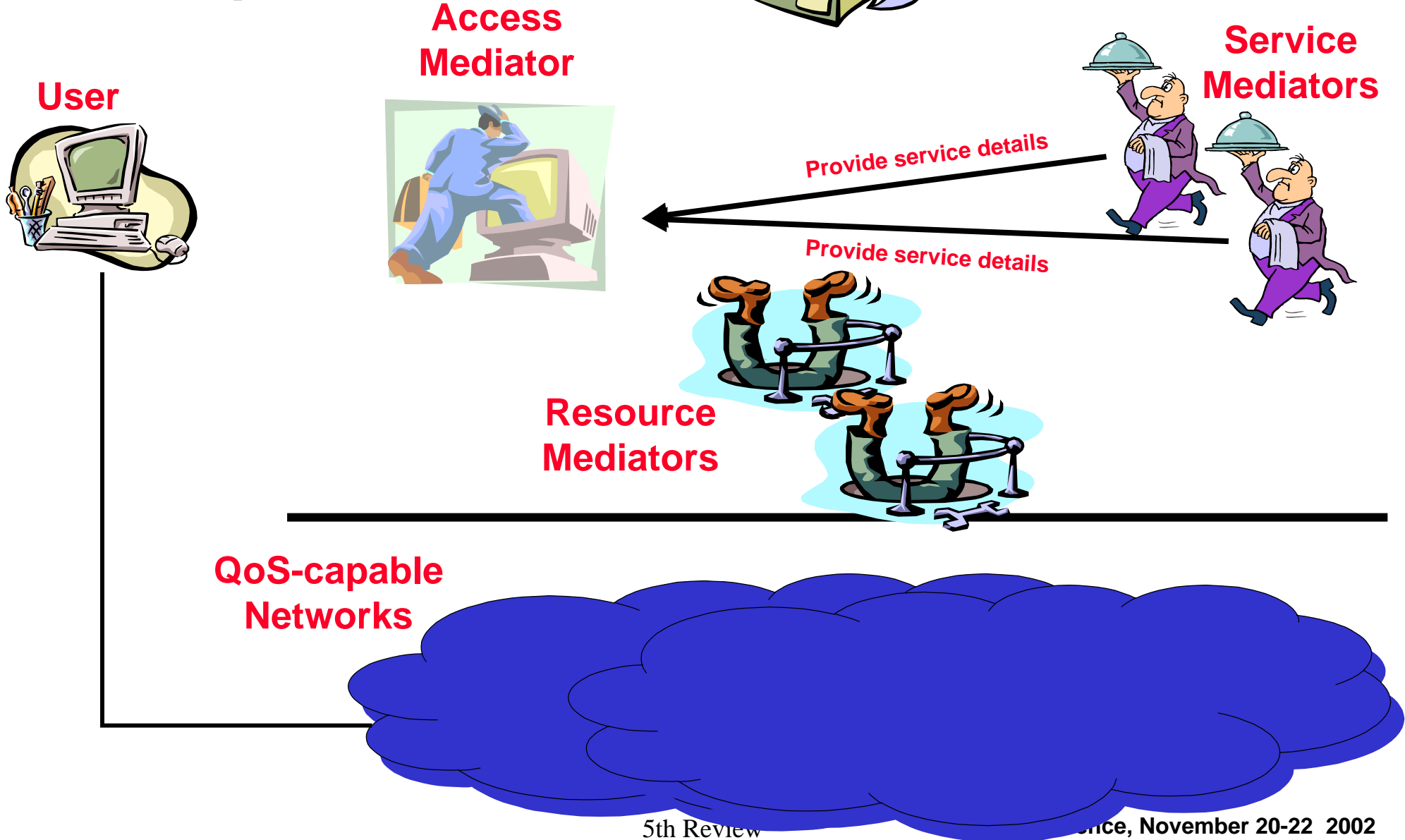
QoS-capable Networks



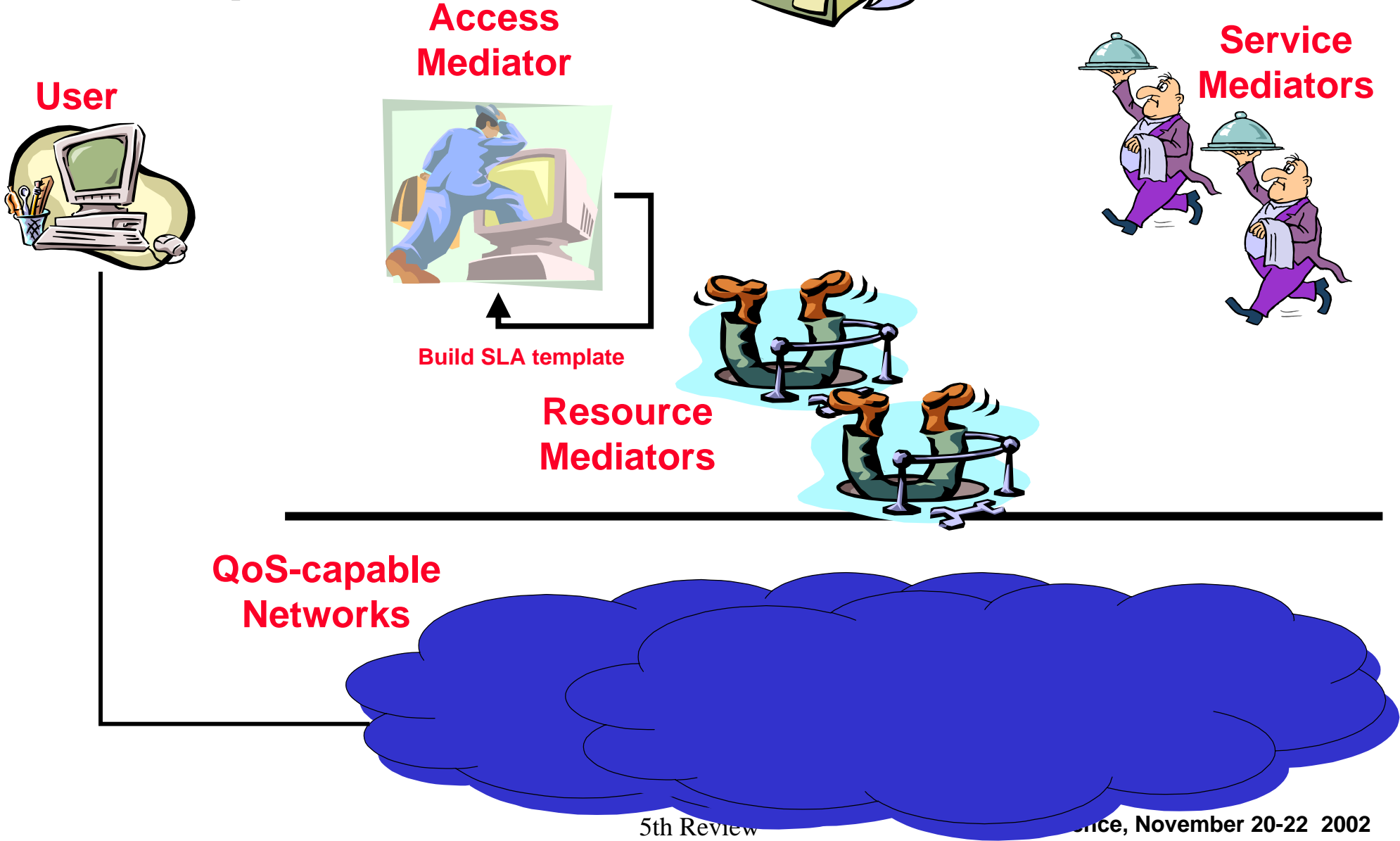
# The negotiation phase



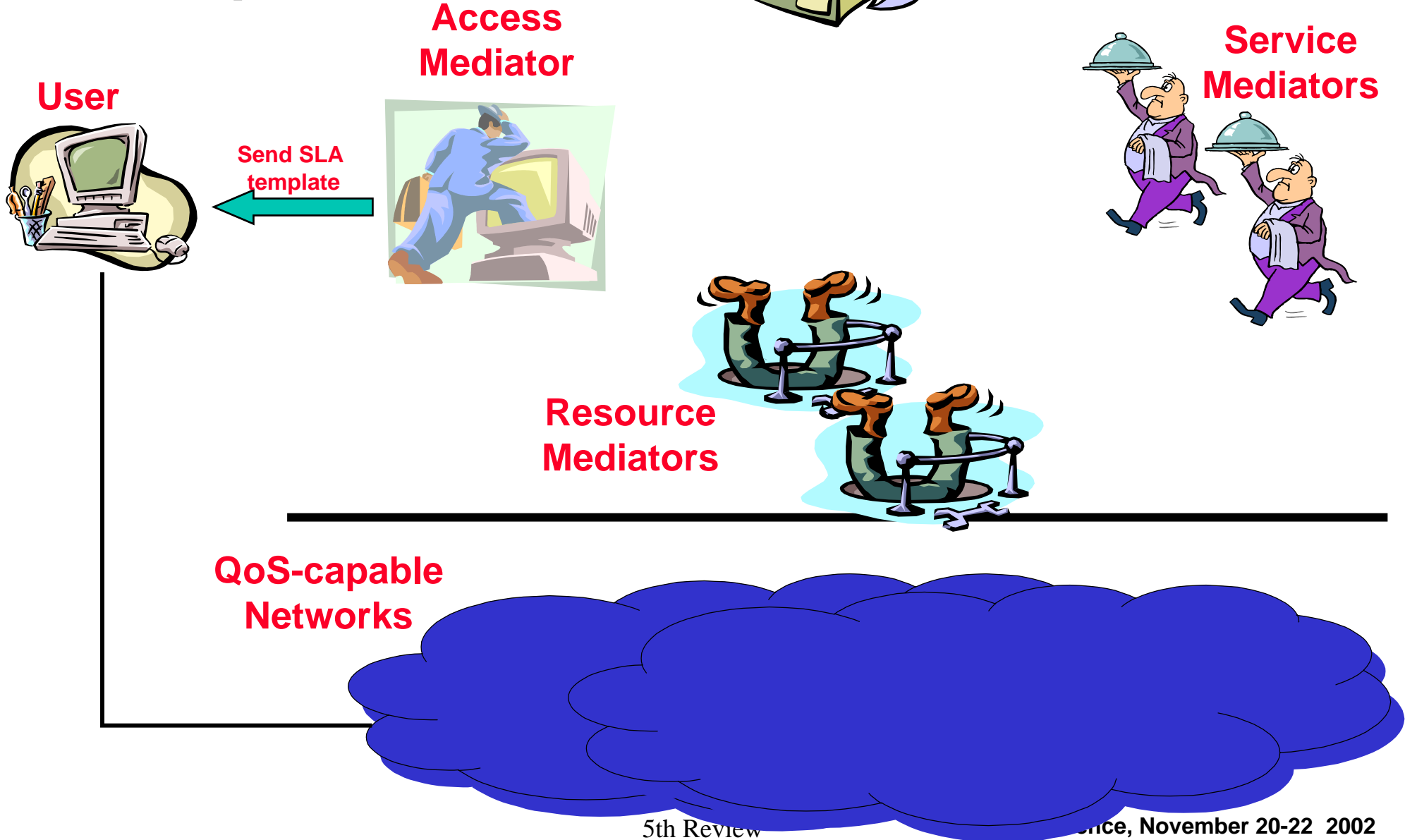
# The negotiation phase



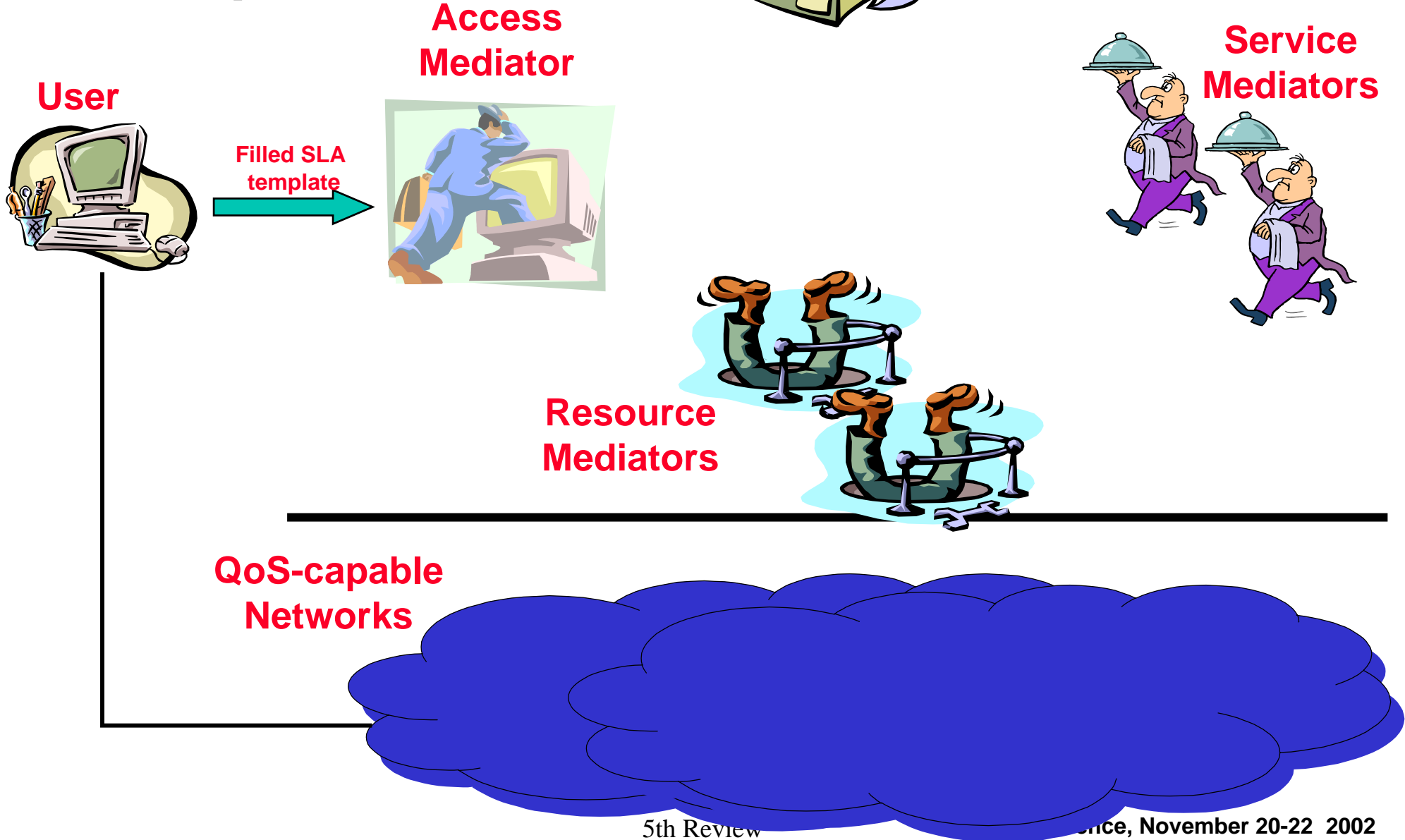
# The negotiation phase



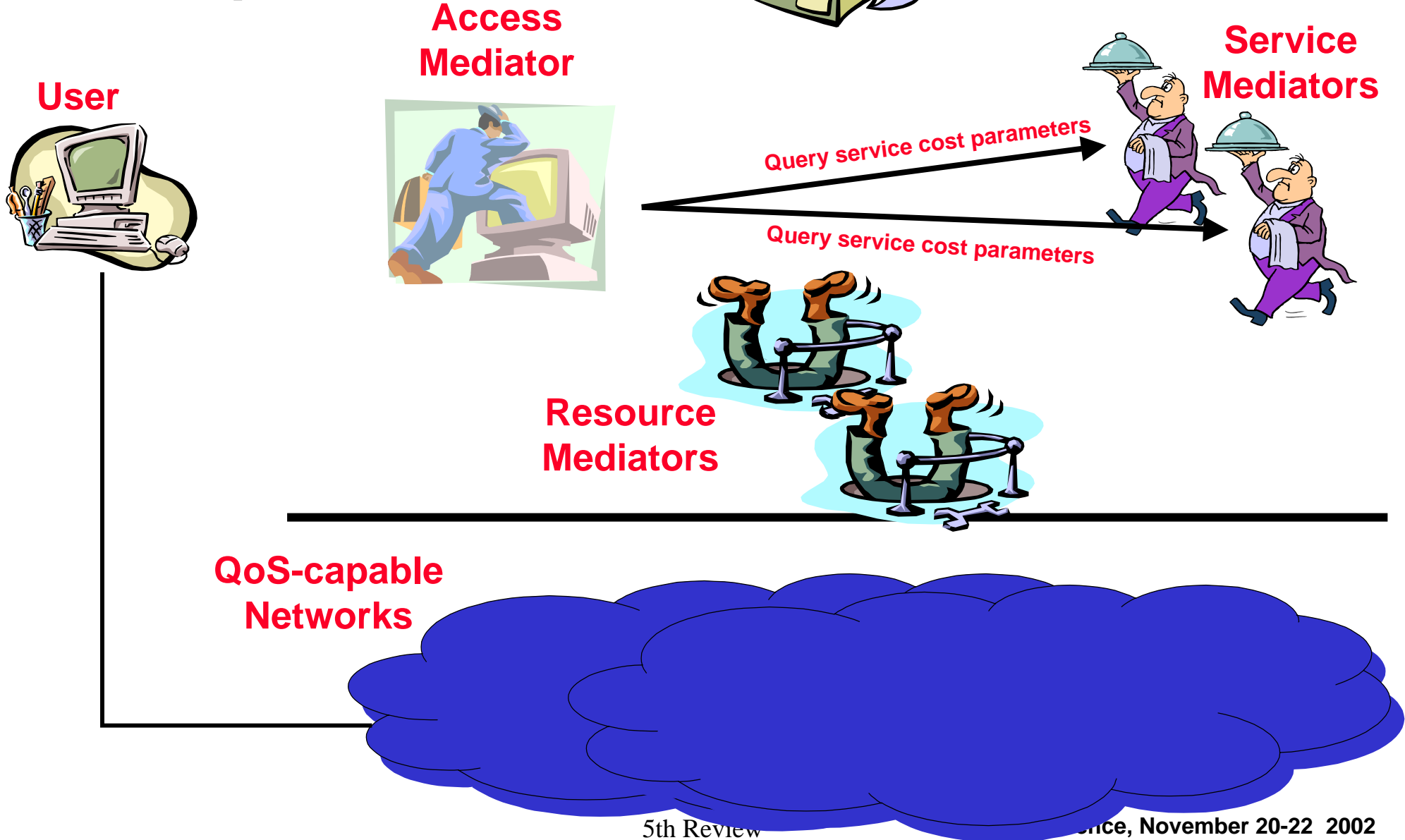
# The negotiation phase



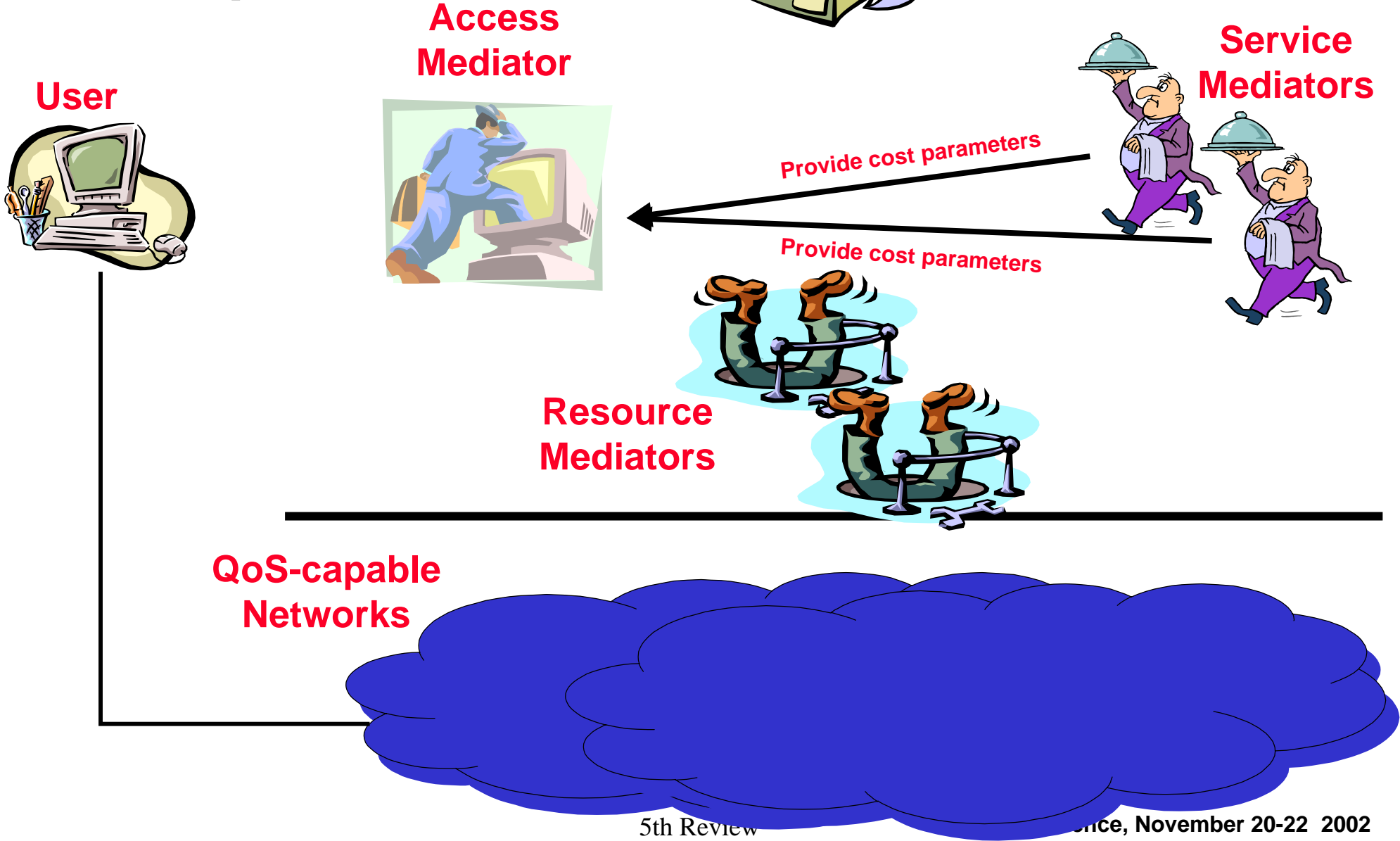
# The negotiation phase



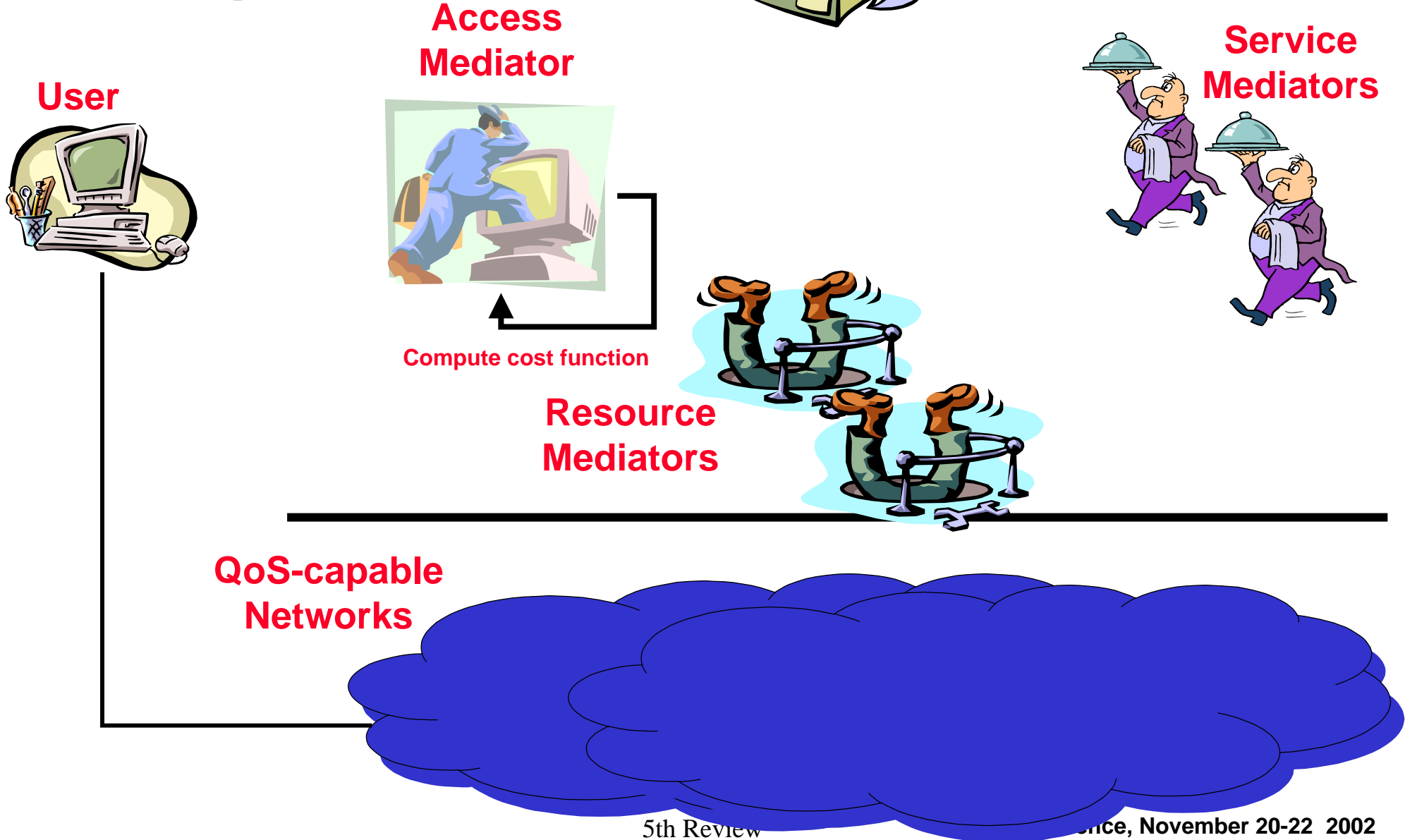
# The negotiation phase



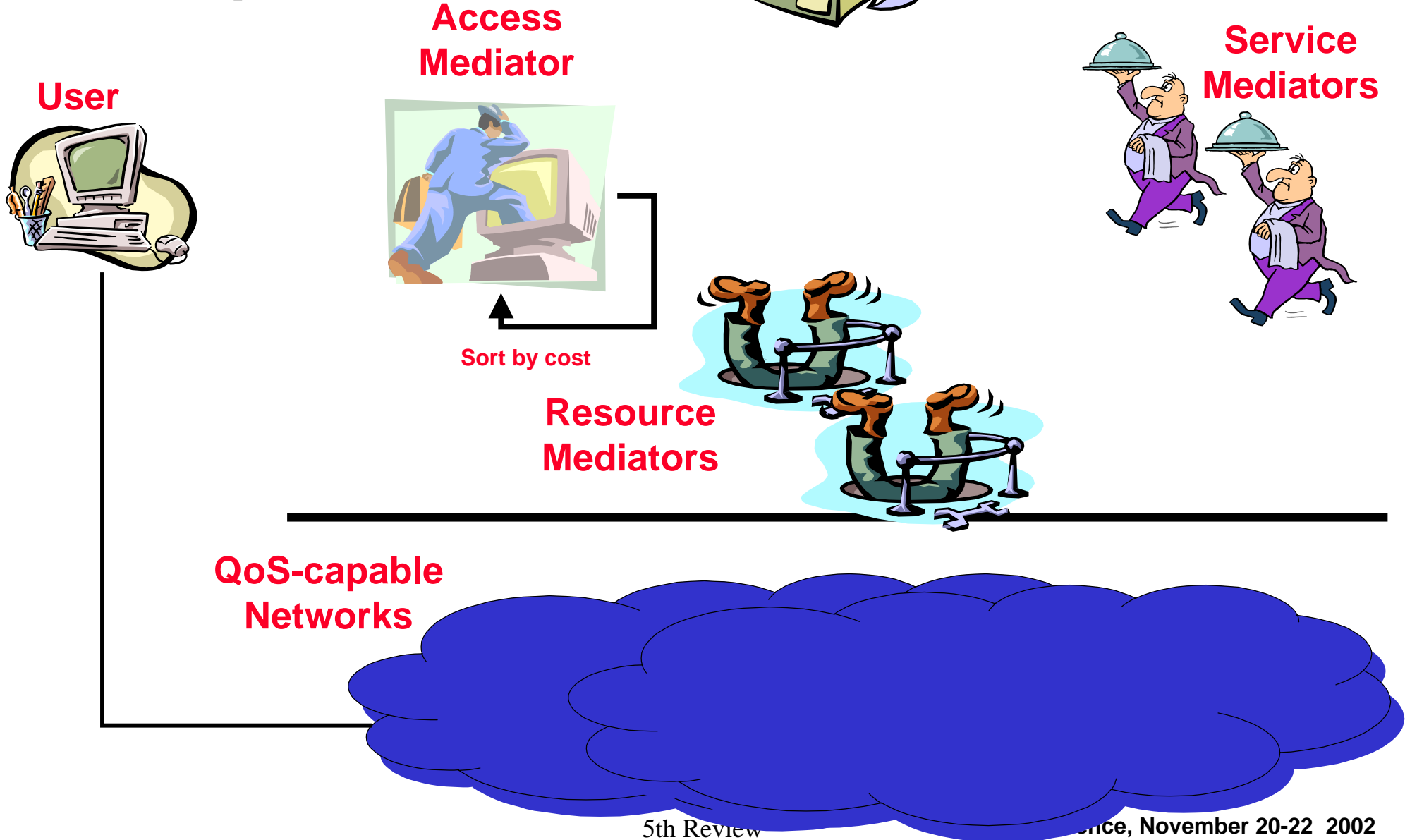
# The negotiation phase



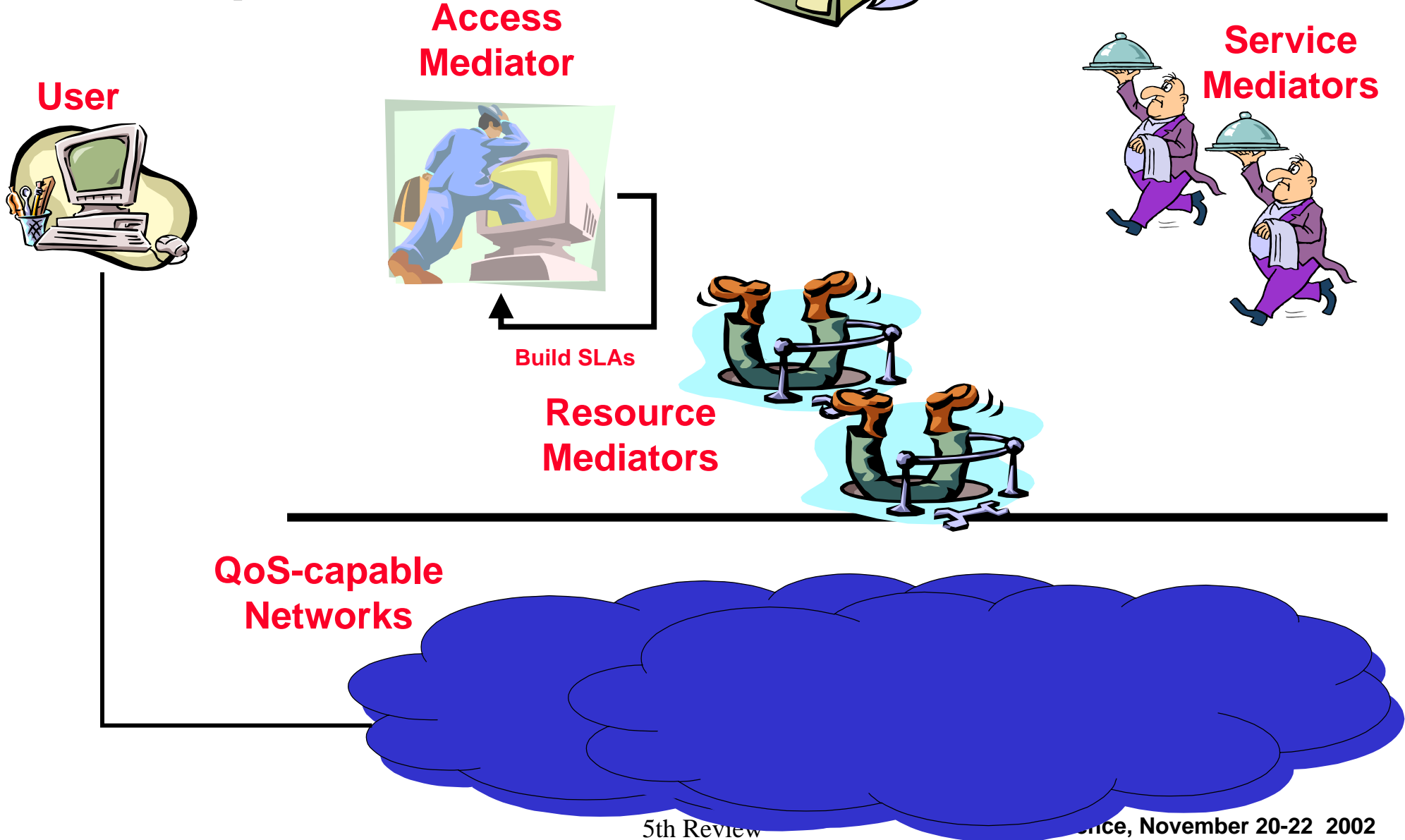
# The negotiation phase



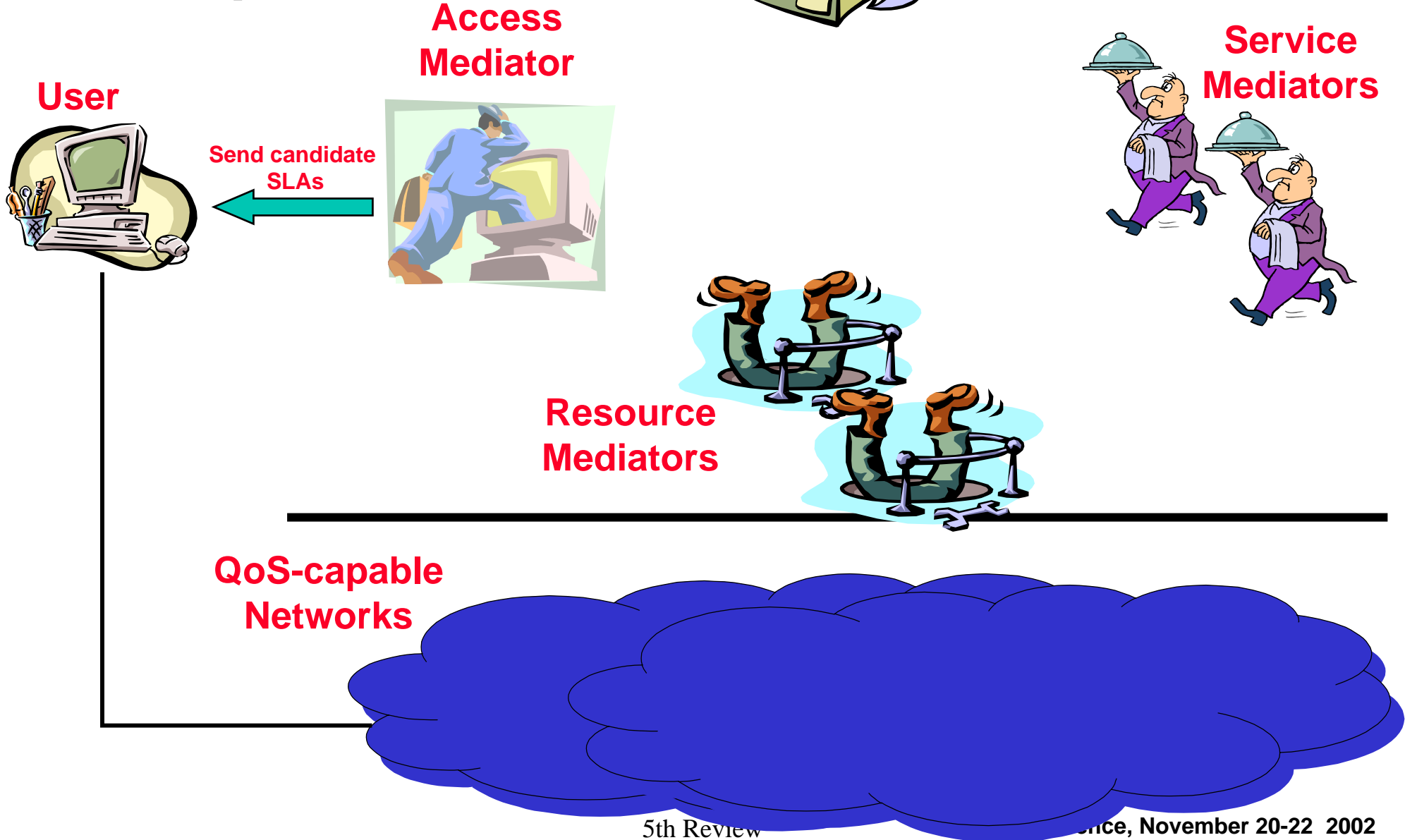
# The negotiation phase



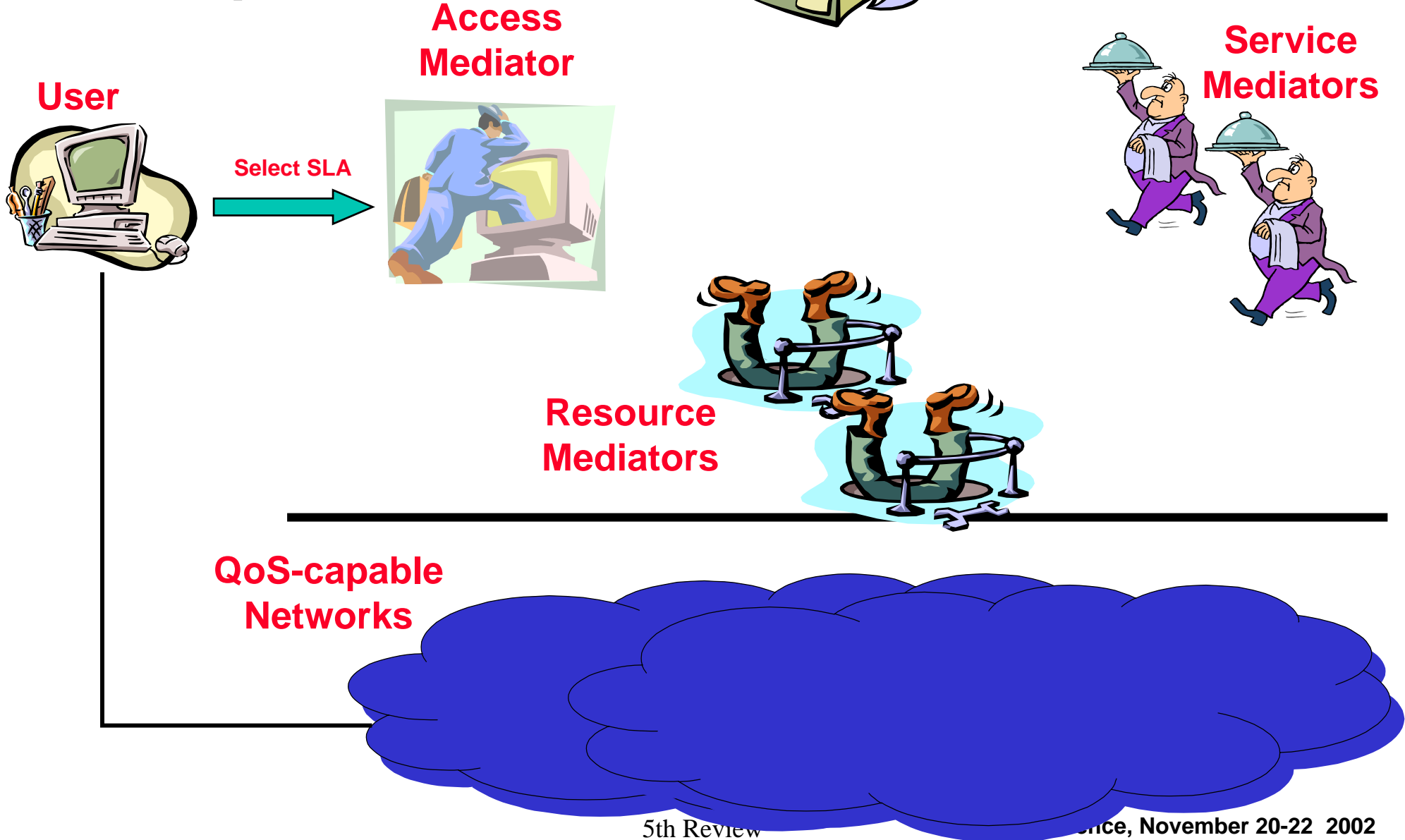
# The negotiation phase



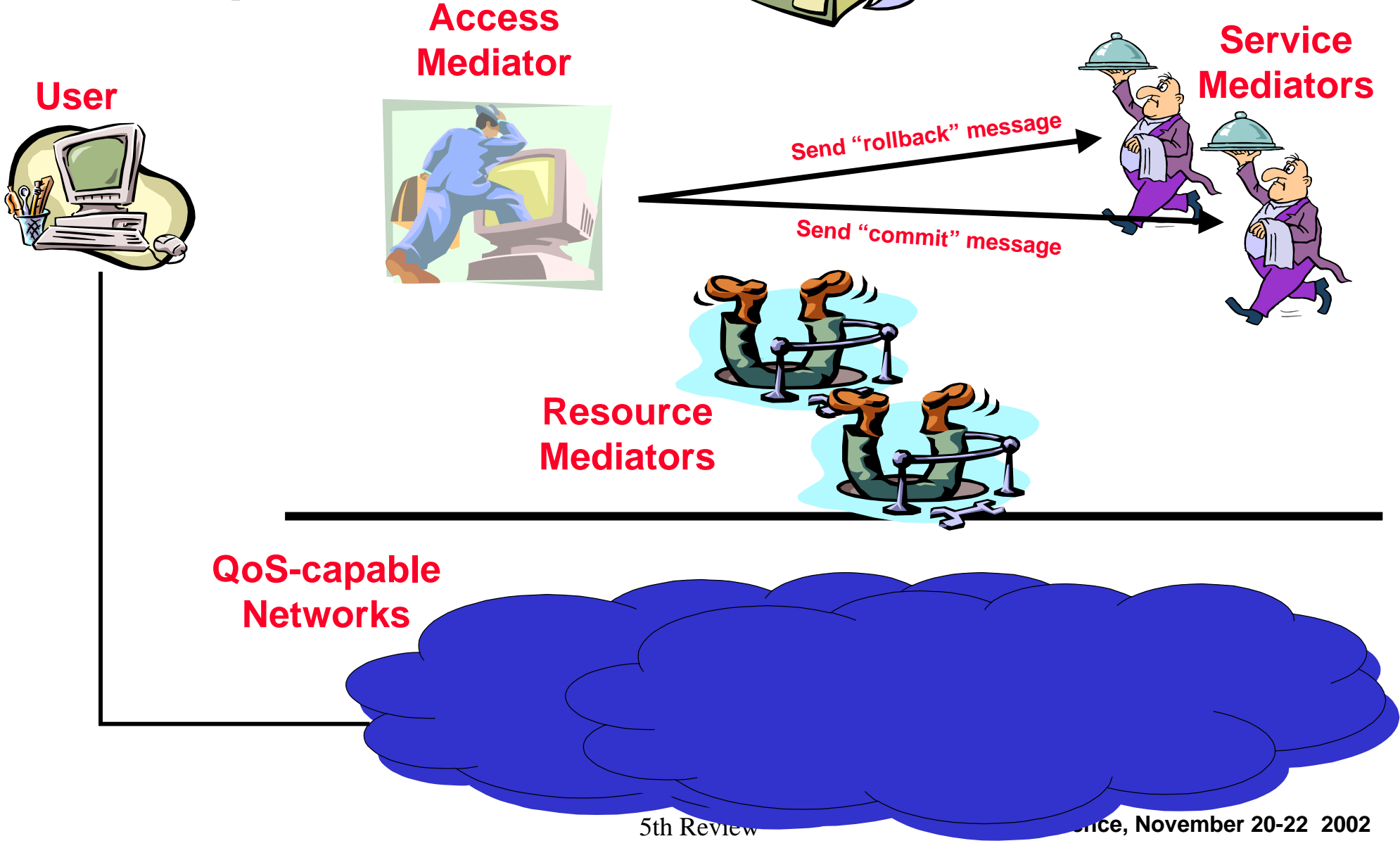
# The negotiation phase



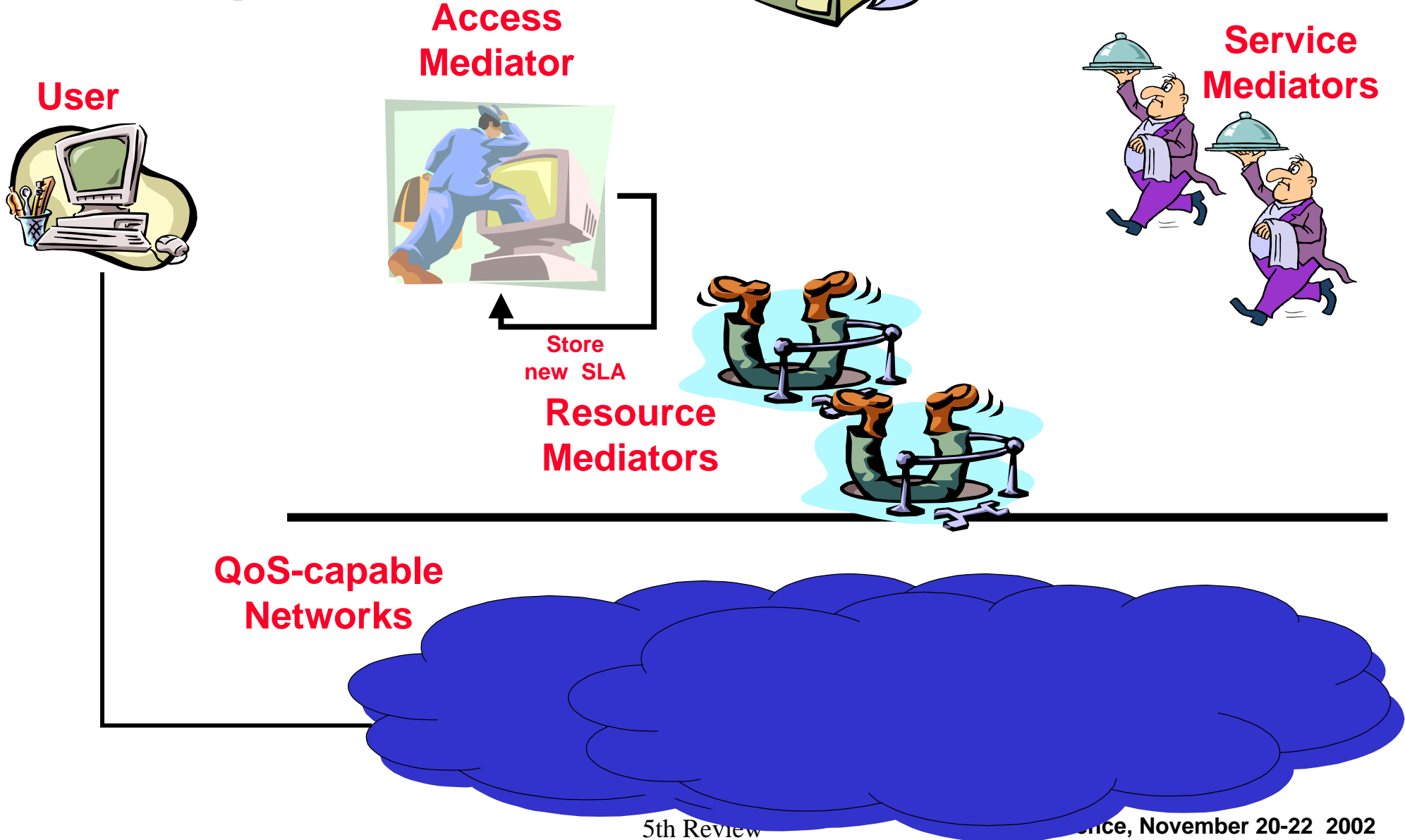
# The negotiation phase



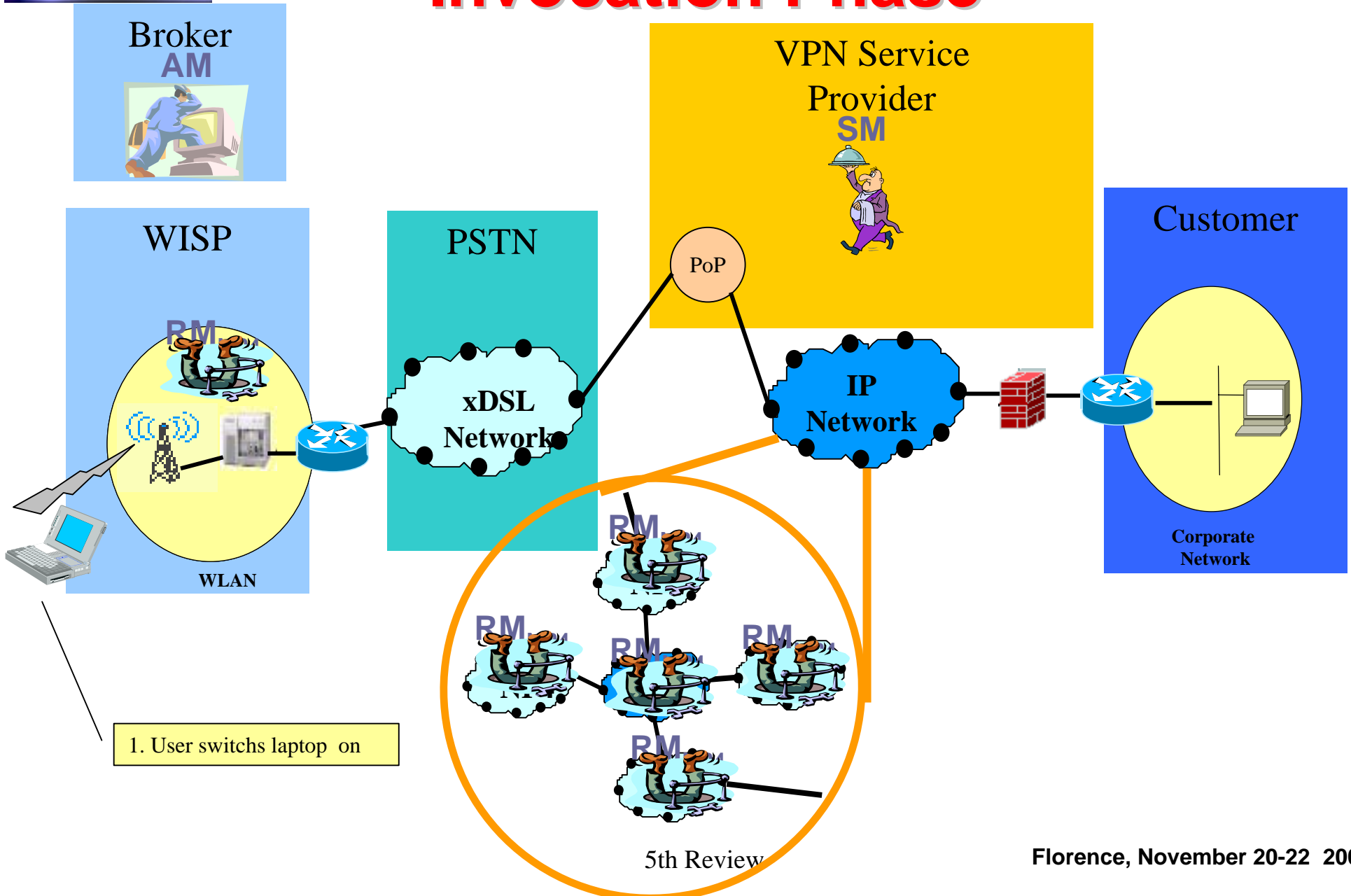
# The negotiation phase



# The negotiation phase




# Invocation Phase




# Invocation Phase

Broker  
AM



VPN Service  
Provider  
SM




WISP

RM



WLAN

PSTN



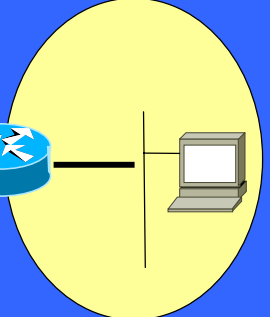
xDSL  
Network

PoP



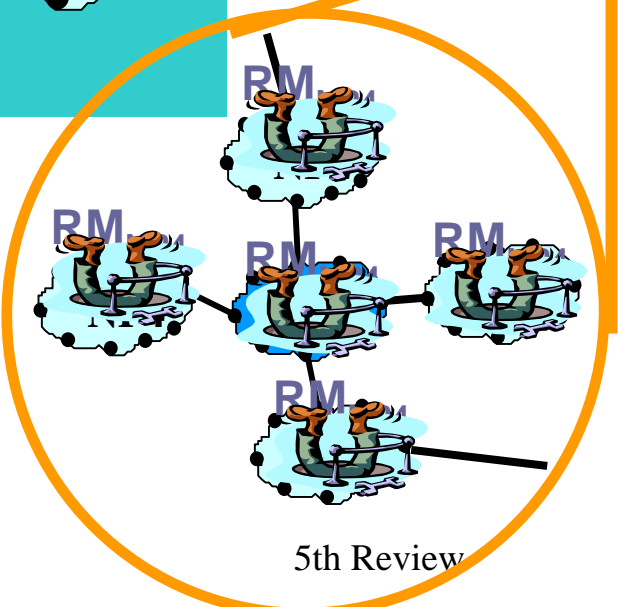
IP  
Network

Customer

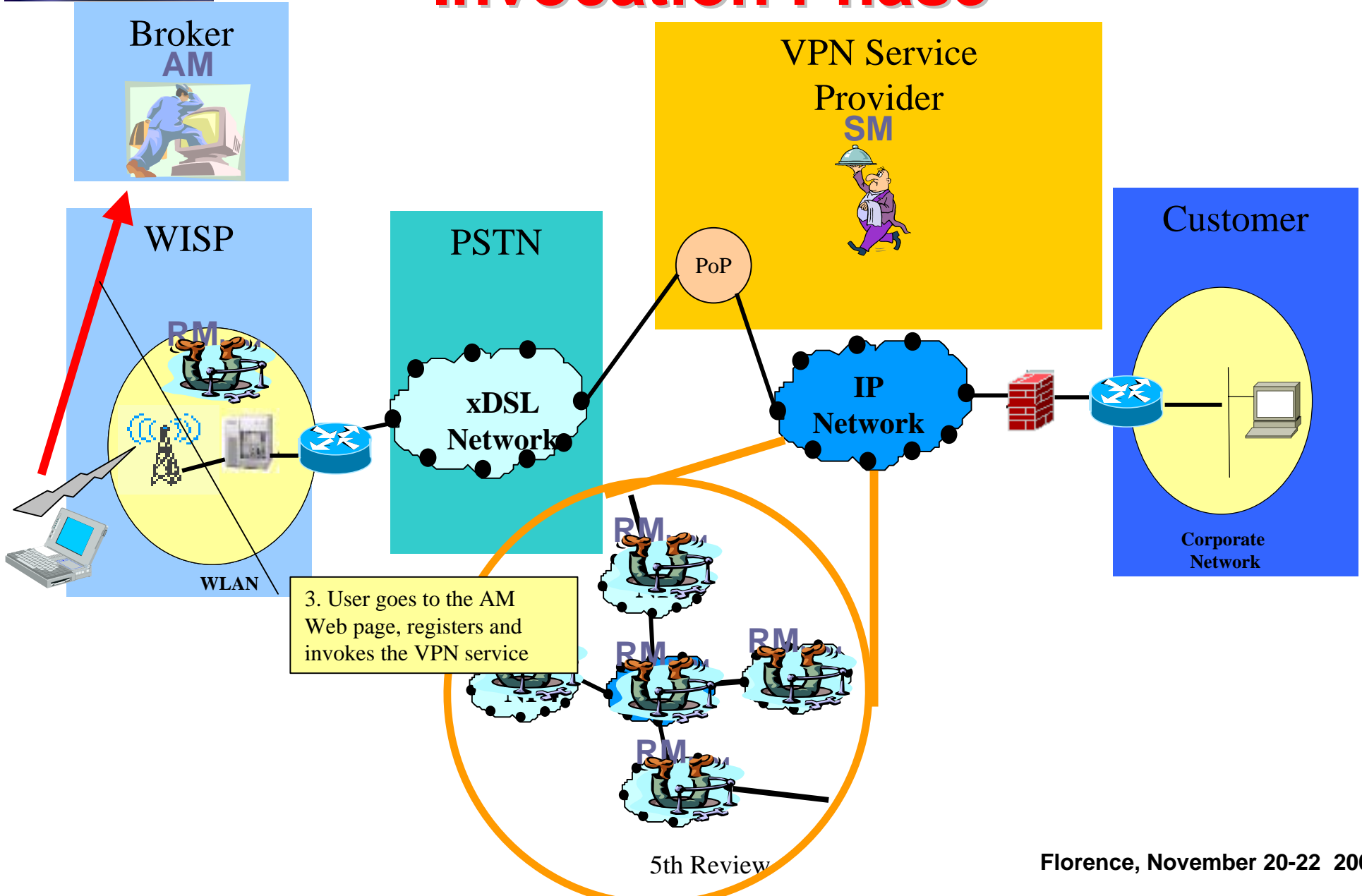


Corporate  
Network

2. User is redirected to a registration page for authentication for using WLAN-based Internet Access Service

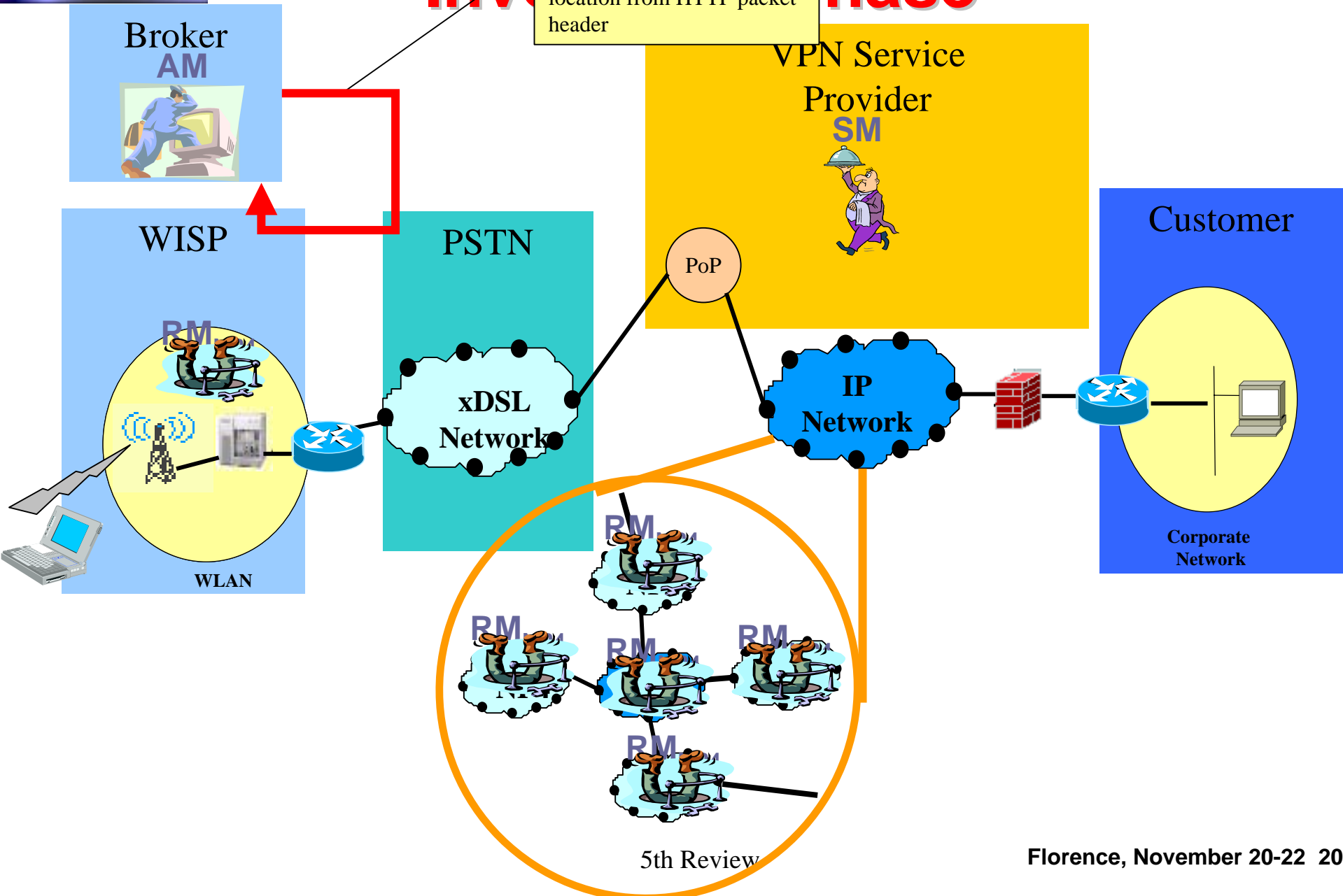


# Invocation Phase

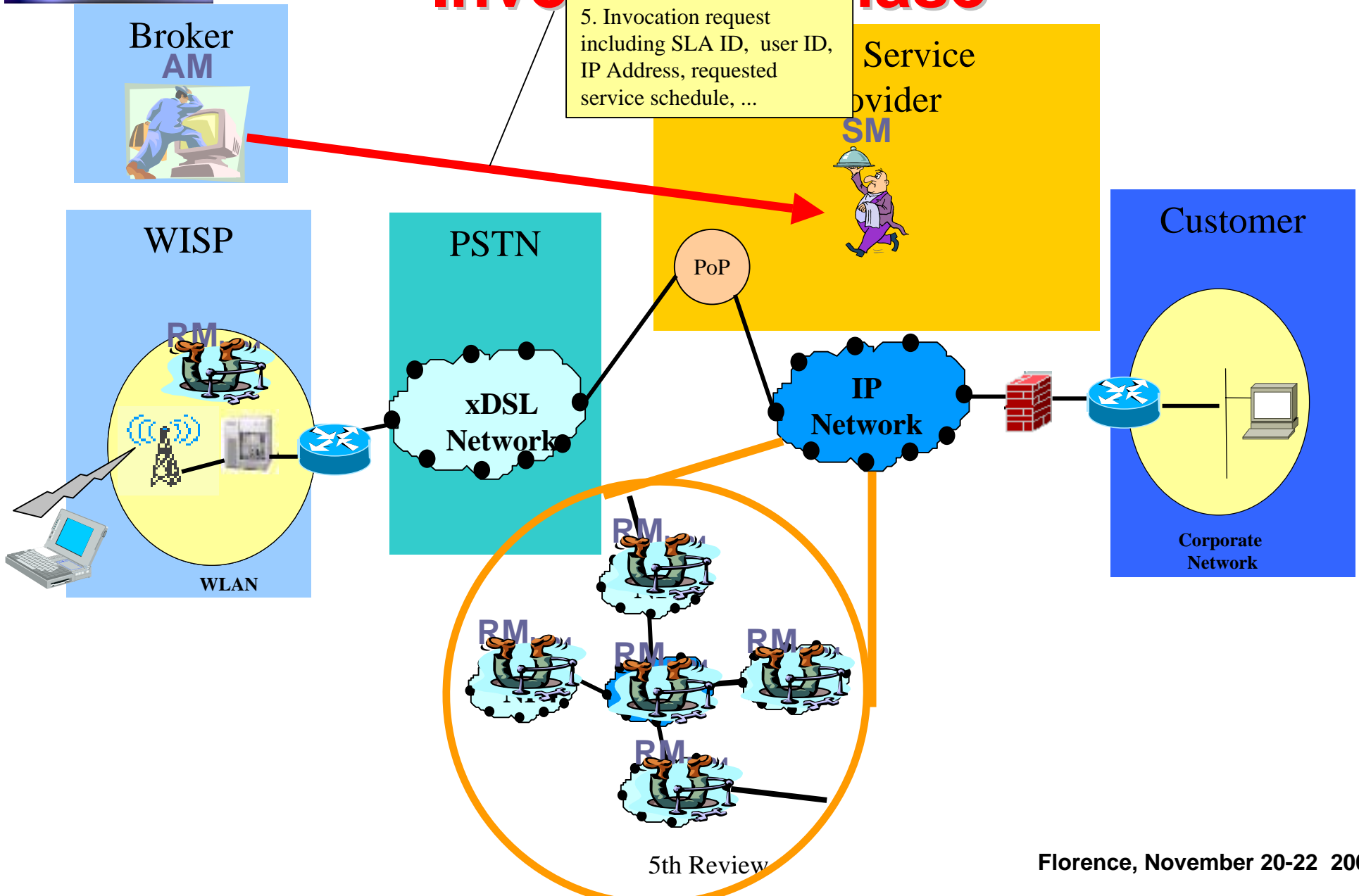


# Invoice Phase

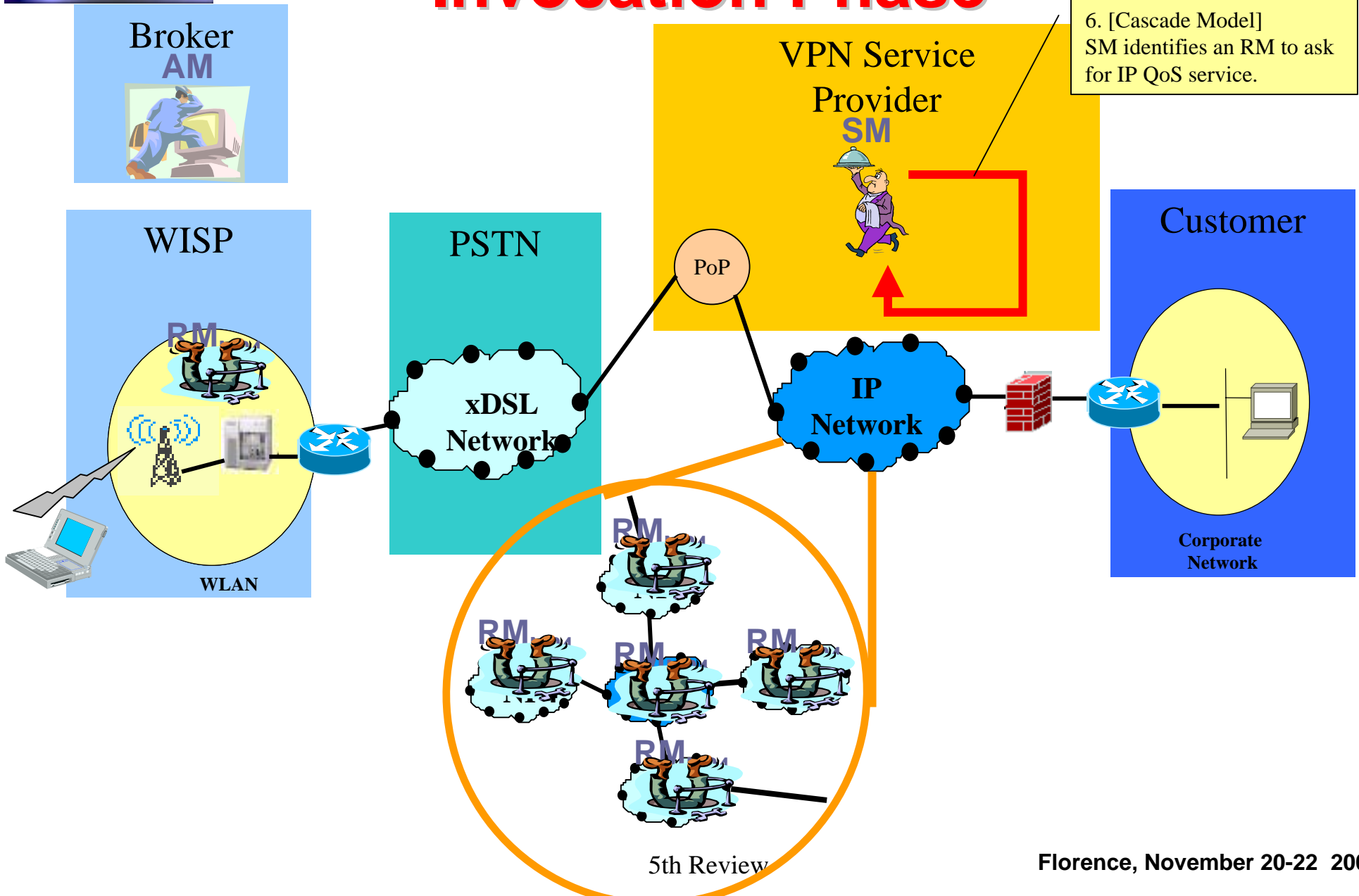
4. AM retrieves user location from HTTP packet header



# Invocation Phase

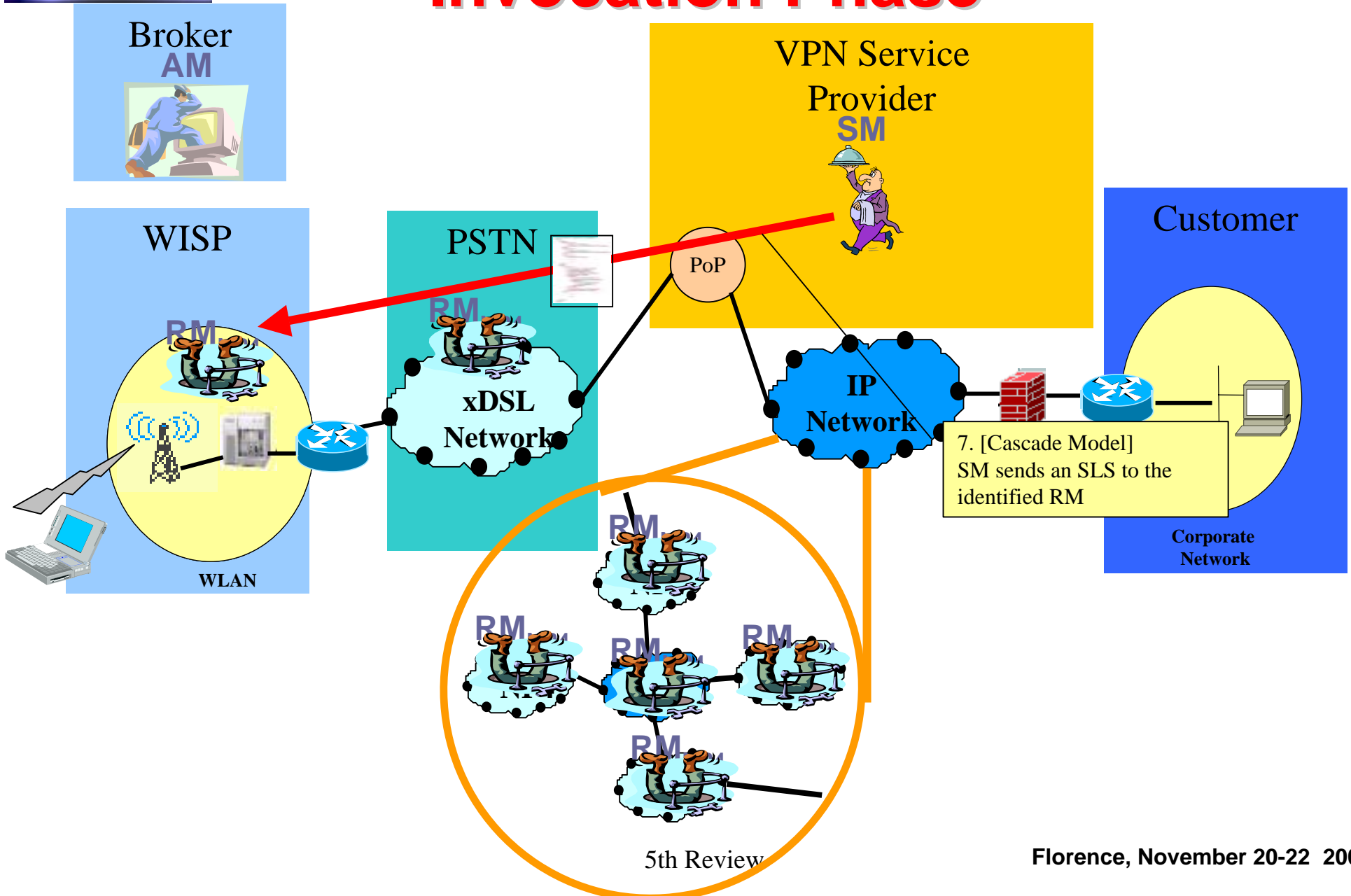


# Invocation Phase

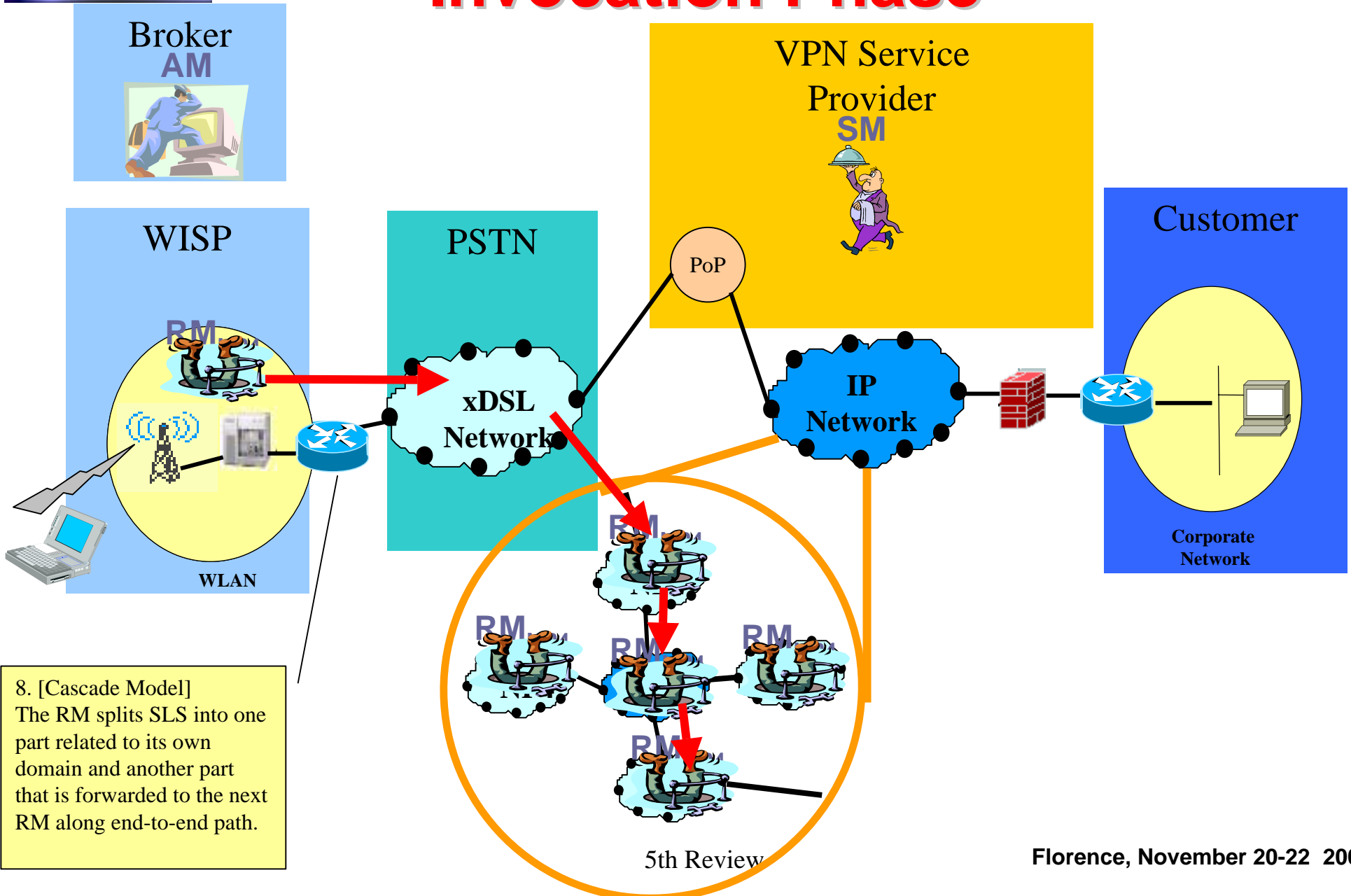


6. [Cascade Model]  
SM identifies an RM to ask for IP QoS service.

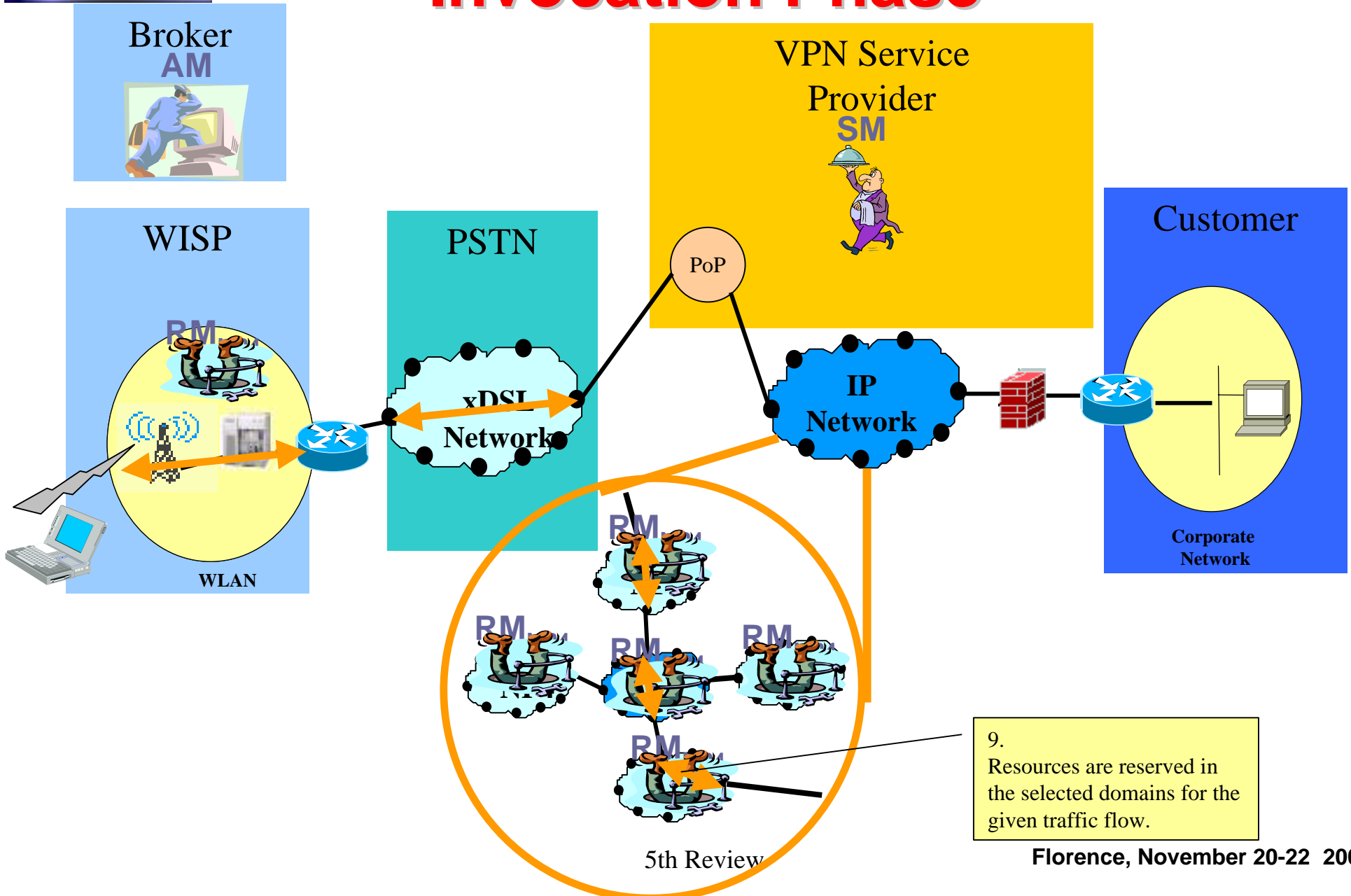
# Invocation Phase



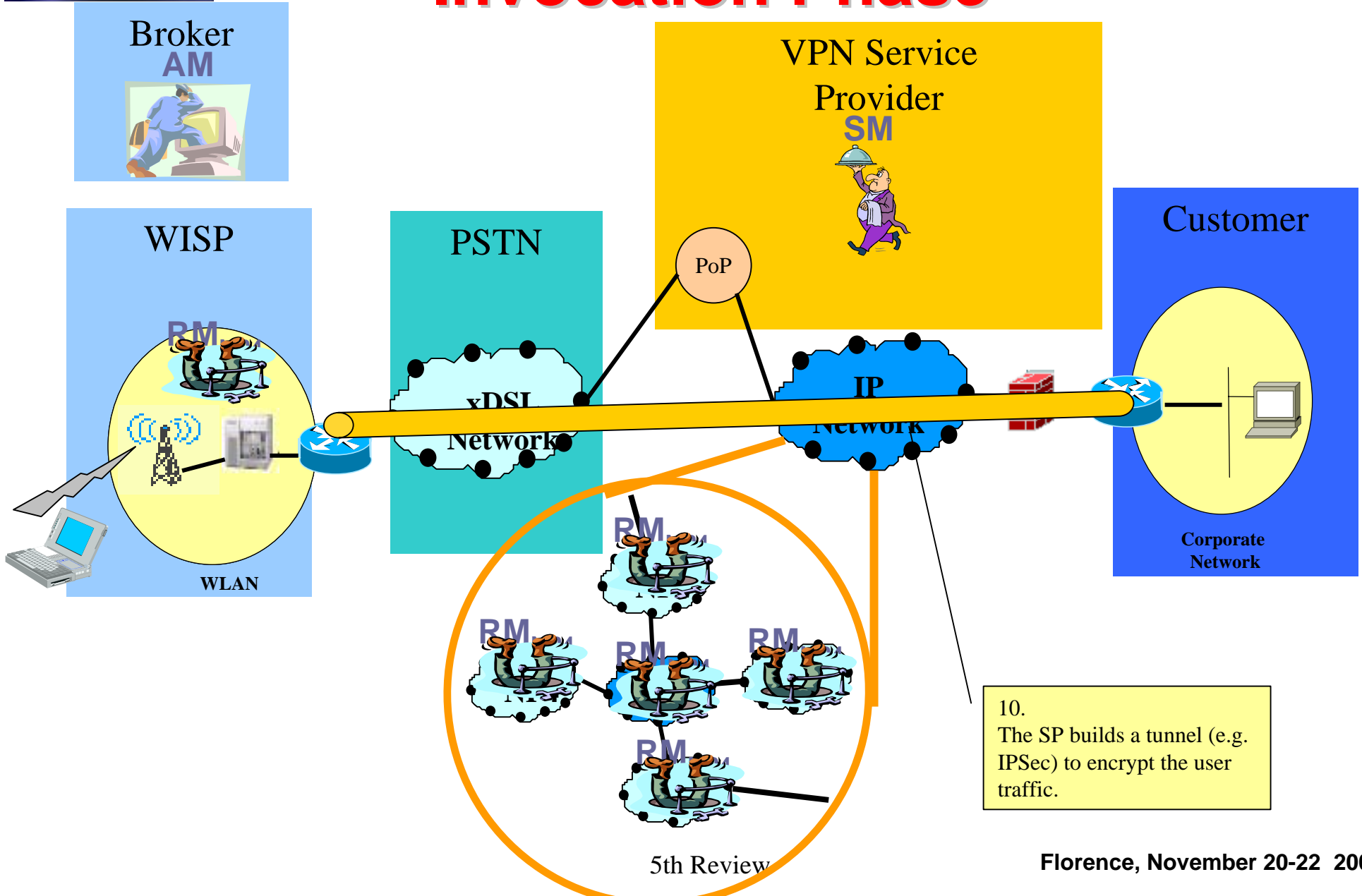
# Invocation Phase



# Invocation Phase



# Invocation Phase



# Scalability Issues in CADENUS

## ↓ Mediation Framework:

- Distributed architecture

## ↓ Service Directory:

- UDDI business registry is implemented as a logically centralised, but physically distributed service

## ↓ AM, SM, RM:

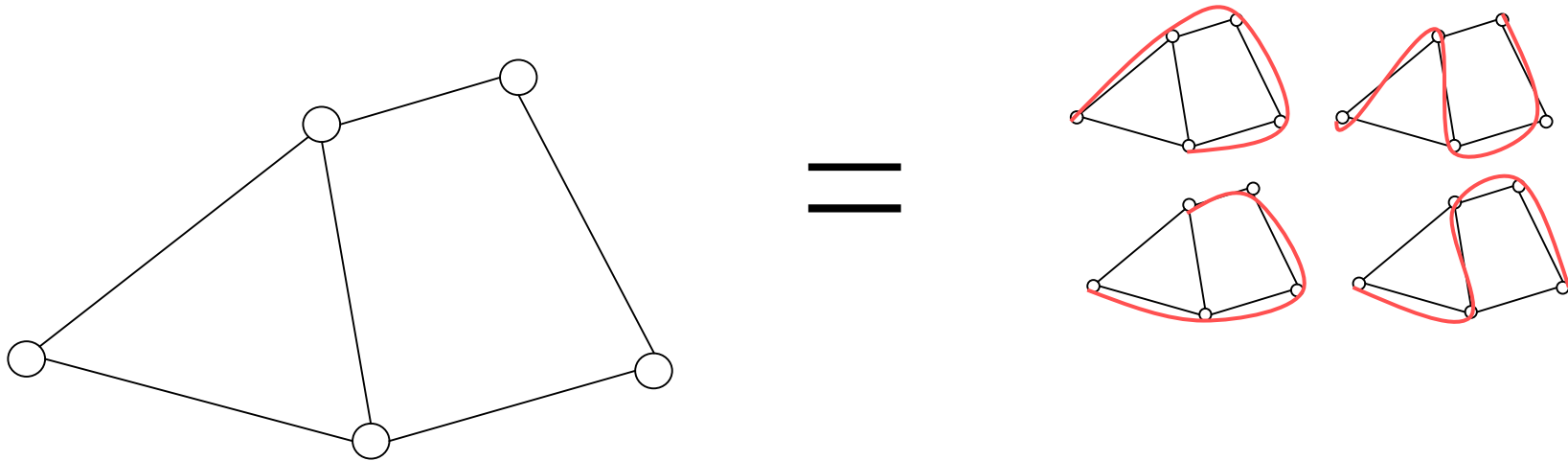
- Hierarchical structures and algorithms
- Distribution / Replication

# AM Scalability

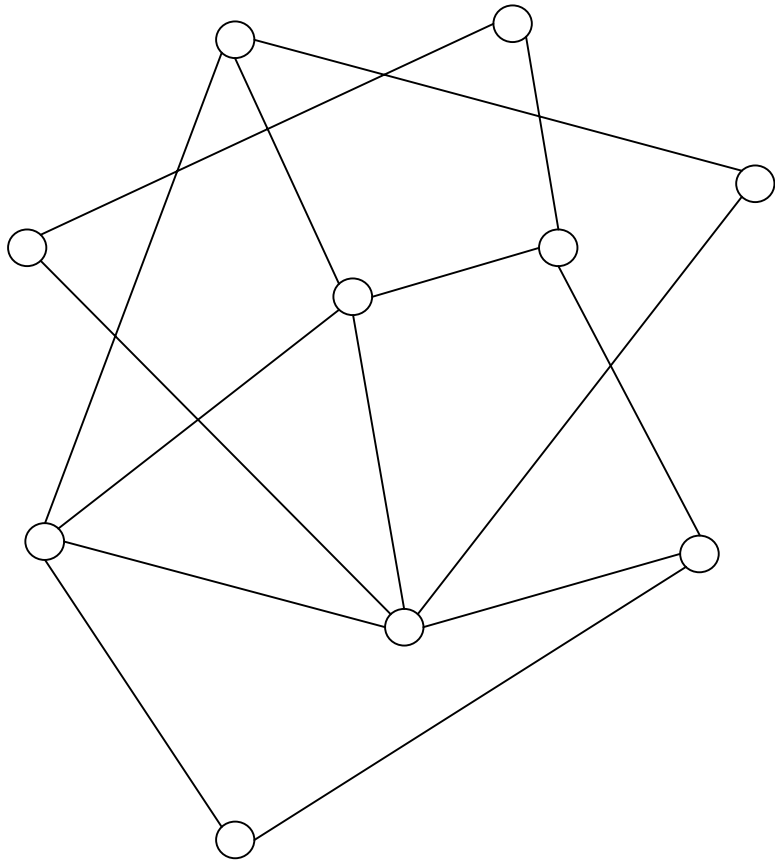
↓ The AM is a Web service ...

- Issues about scalability of Web services:
  - the number of web users is definitely much higher in the web scenario
  - the randomness associated with the way that users visit sites makes the problem of workload forecasting and capacity planning difficult
  - a Web service consists of a variety of components: different browsers and servers running on a diversity of platforms with different capabilities
  - end-to-end response time is both *time-* and *space-dependent*
- Performance objectives and related approaches:
  - high availability --> infrastructure reliability / redundancy and software robustness
  - high scalability, low response time --> replication, distribution

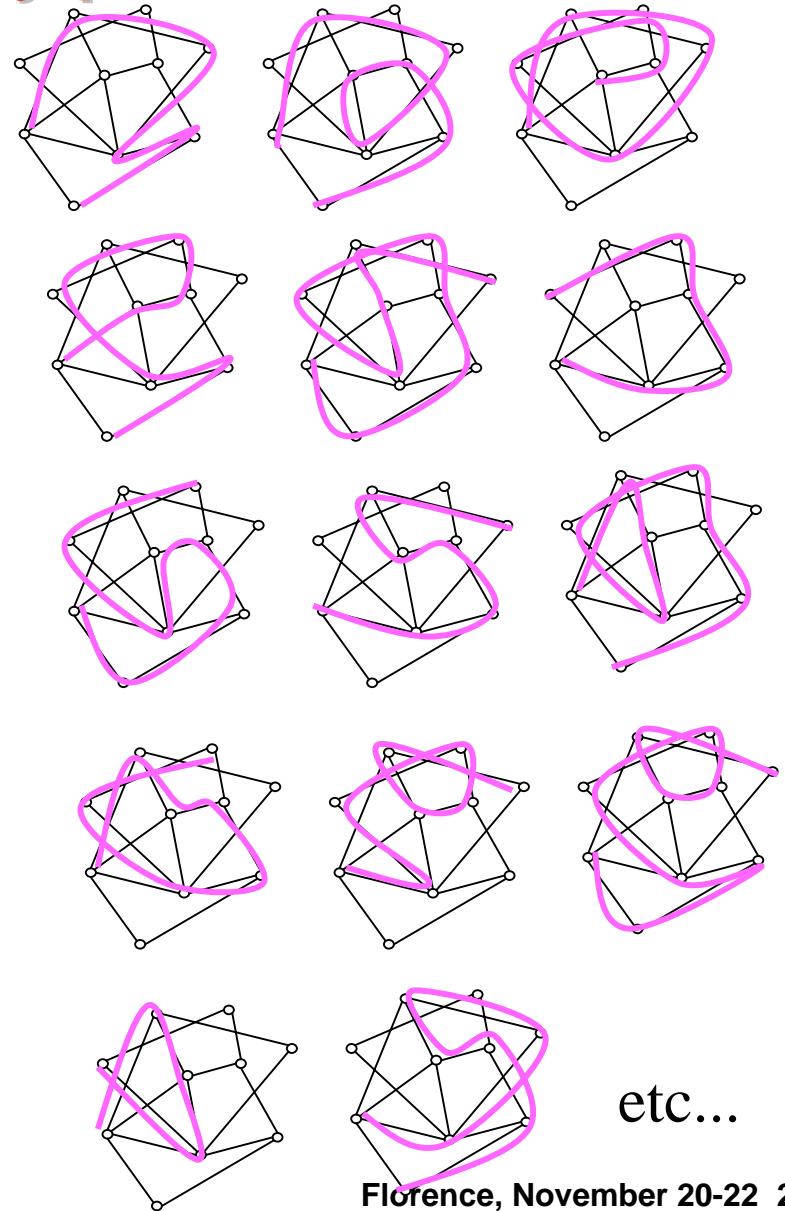
# End-to-end Path Computation the scalability problem



# End-to-end Path Computation the scalability problem

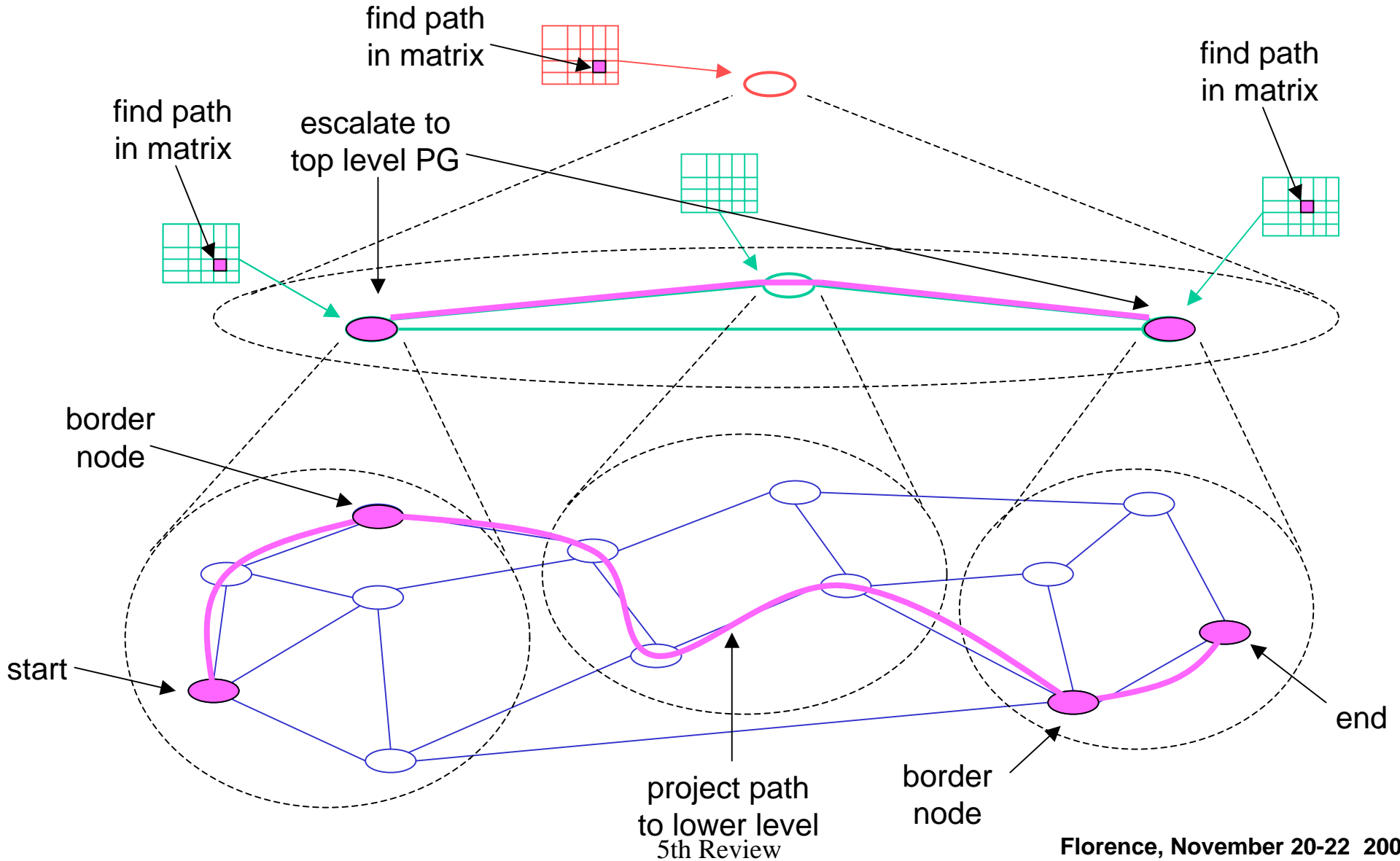


==



etc...

# Hierarchical Algorithm Path resolution



# Conclusions

- ↓ CADENUS Architecture supports different business models (Hub, Cascade)
- ↓ Application of CADENUS Framework to a “mobile / nomadic” service
- ↓ Hierarchy, replication and distribution to face scalability problems



# Q & A

CADENUS Resource Management  
Architecture:  
main concepts and answers to some  
FAQs

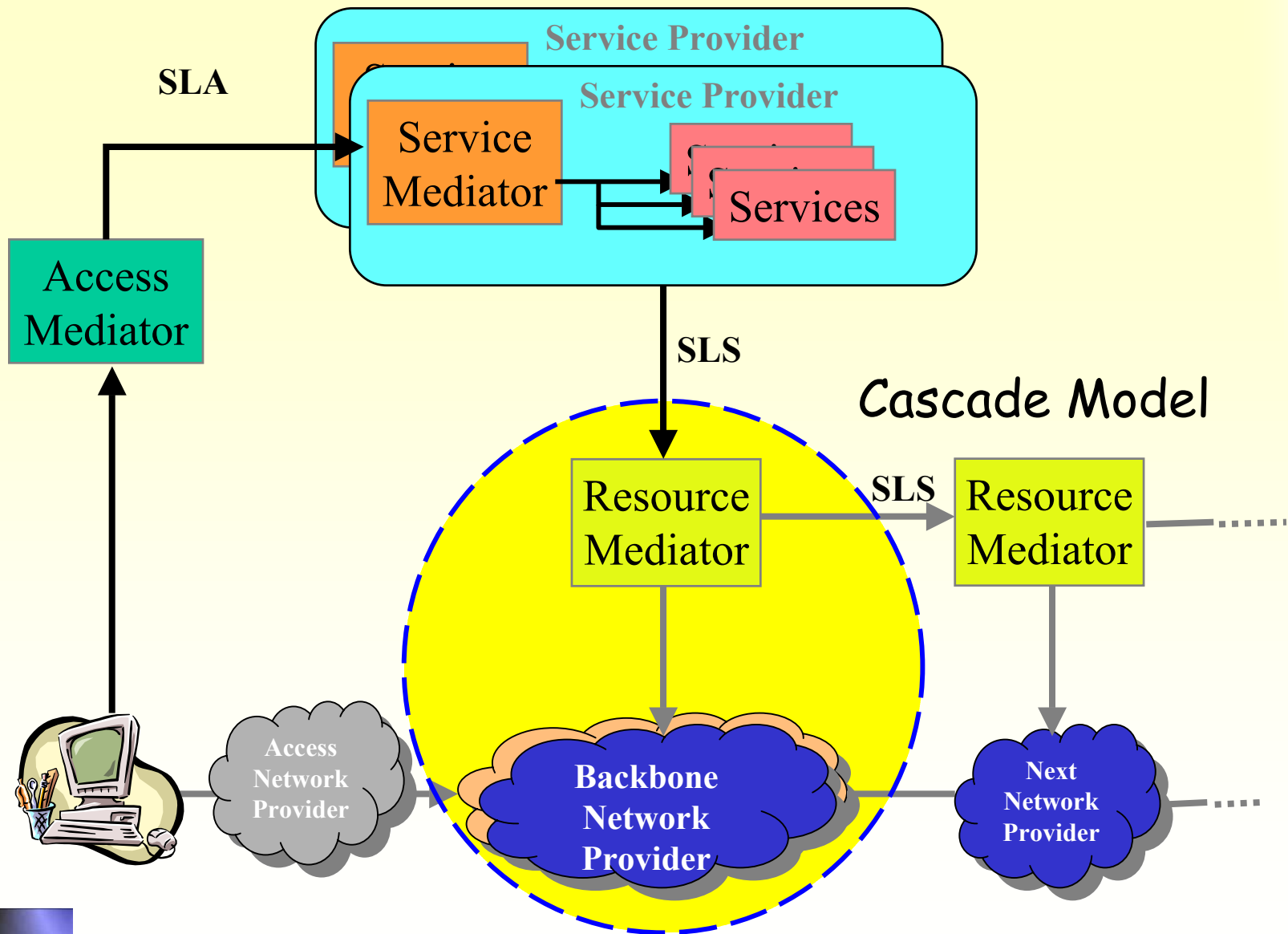
Florence Review - 20-22 Nov 2002



# Roadmap

- **Preliminary considerations:**
  - The Cadenus Resource Management Architecture
  - The Resource Mediator's 'algorithm'
- **4 Questions:**
  - How to enforce a multi-domain SLS?
  - Do Cadenus components trust each other?
  - Where is the Cadenus bottleneck localized?
  - Is SLS management a top-down or a bottom-up process?

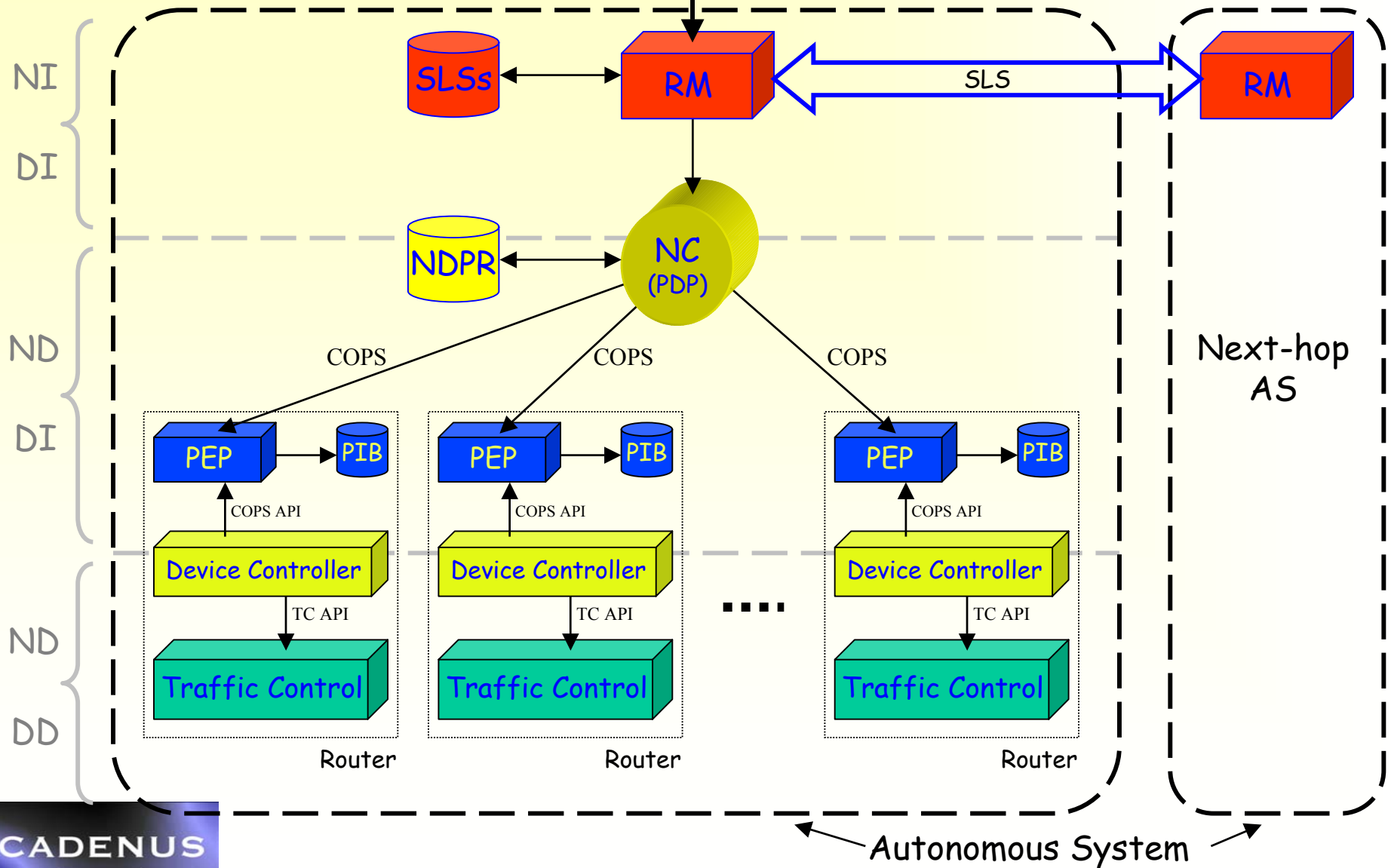
# The CADENUS overall architecture



# The CADENUS resource management architecture

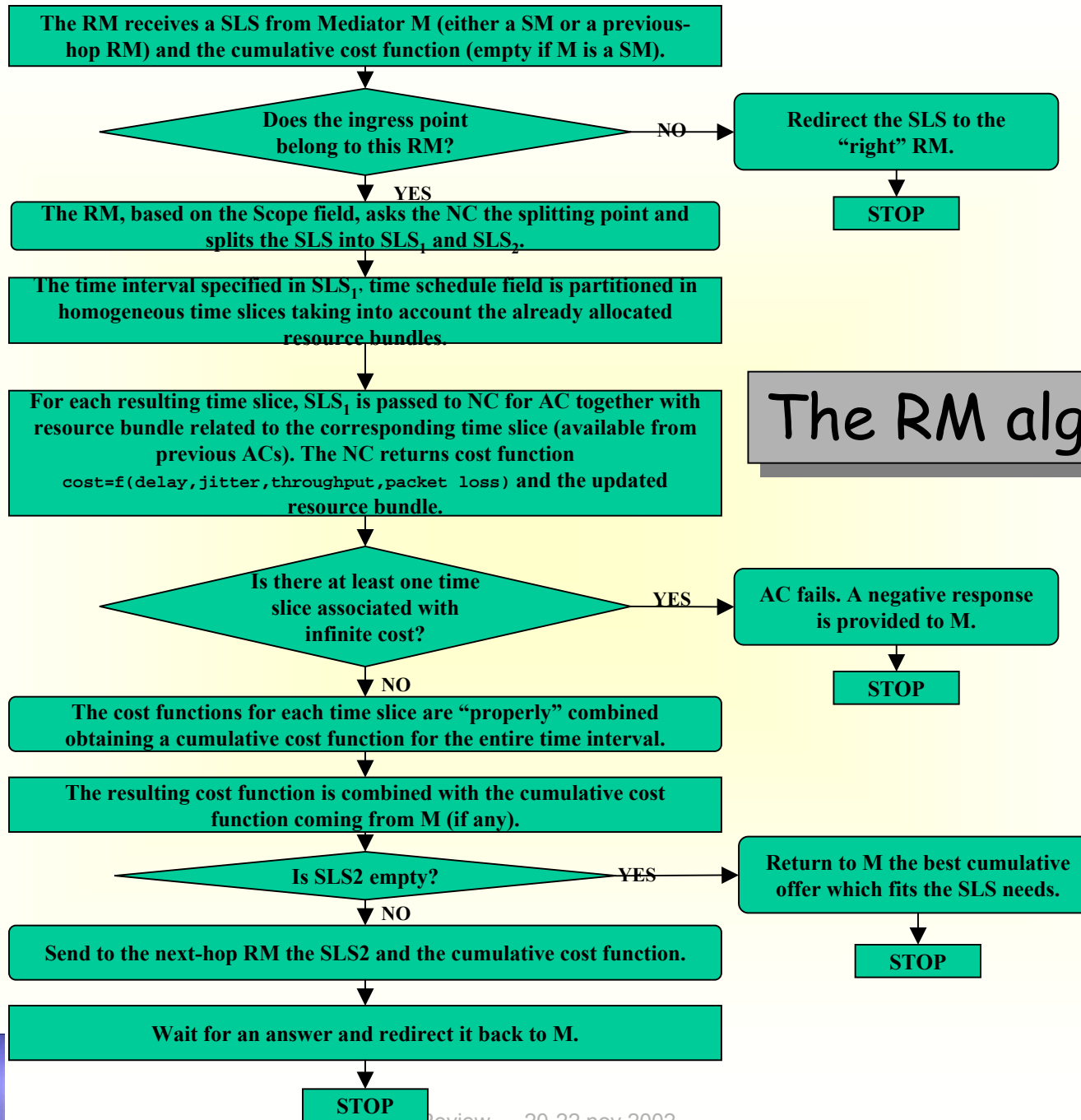
SLS = Service Level Specification  
 RM = Resource Mediator  
 NIPR = Network Indep. Policy Repository  
 NC = Network Controller

PDP = Policy Decision Point  
 PEP = Policy Enforcement Point  
 PIB = Policy Information Base  
 NDPR = Network Dep. Policy Repositor



# Roadmap

- Preliminary considerations:
  - The Cadenus Resource Management Architecture
  - The Resource Mediator's 'algorithm'
- 4 Questions:
  - How to enforce a multi-domain SLS?
  - Do Cadenus components trust each other?
  - Where is the Cadenus bottleneck localized?
  - Is SLS management a top-down or a bottom-up process?

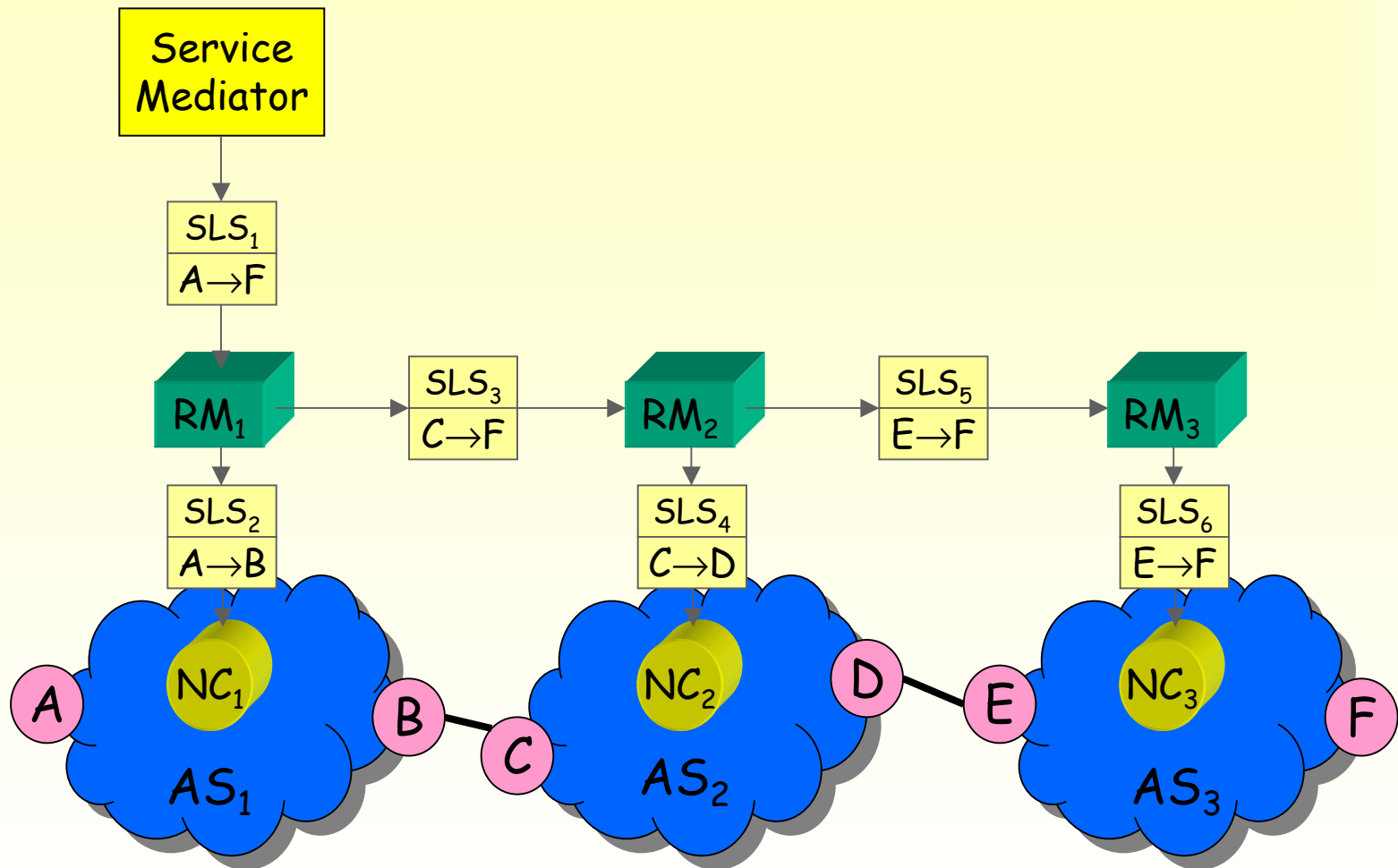


# The RM algorithm

# Roadmap

- Preliminary considerations:
  - The Cadenus Resource Management Architecture
  - The Resource Mediator's 'algorithm'
- **4 Questions:**
  - How to enforce a multi-domain SLS?
  - Do Cadenus components trust each other?
  - Where is the Cadenus bottleneck localized?
  - Is SLS management a top-down or a bottom-up process?

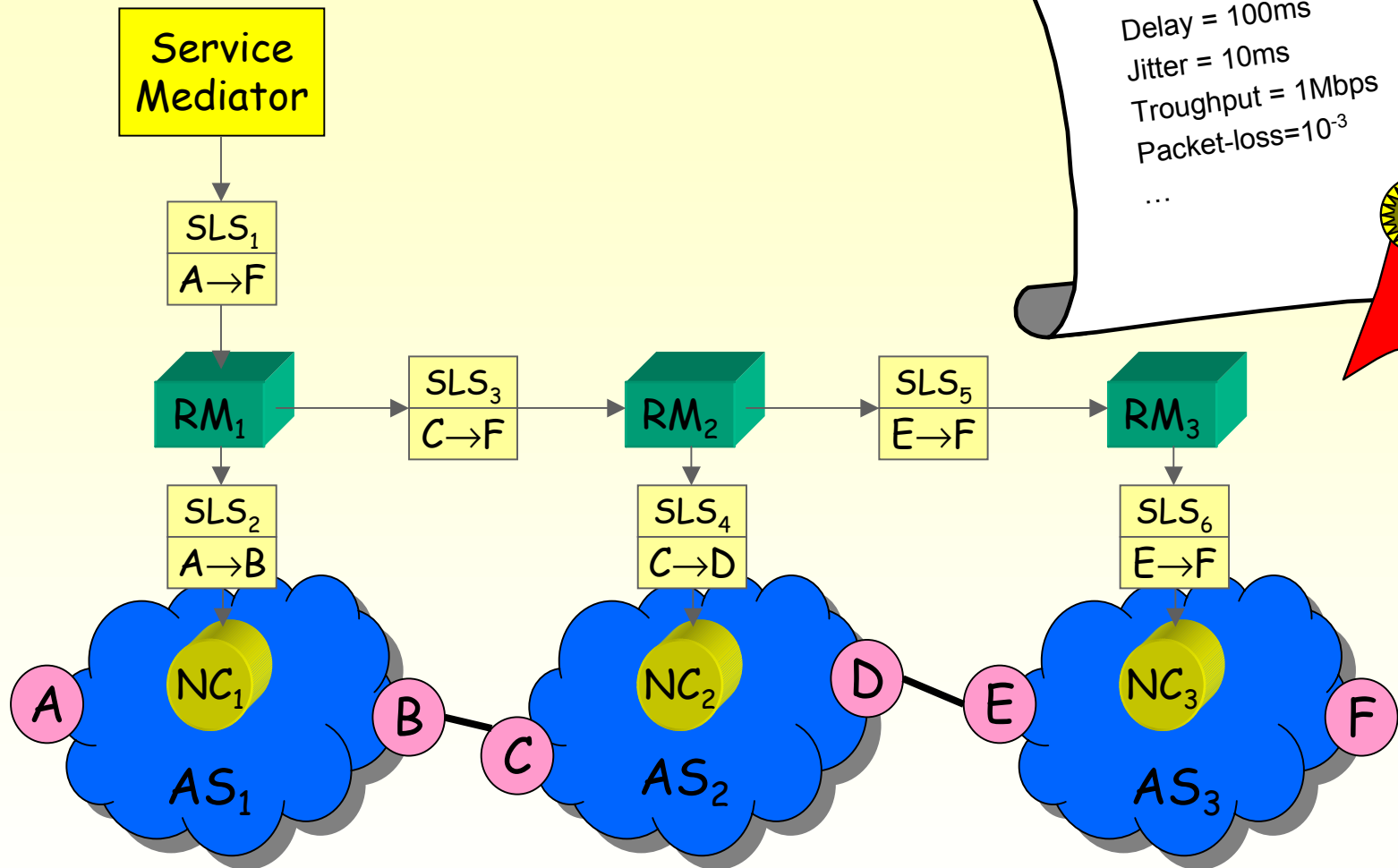
# The SLS splitting (1)



# The SLS splitting (2)

```
class NCInterface: ... {  
    .  
    .  
    public:  
        virtual bool IsIPAddrMine(const TIPAddress& IP) = 0;  
        virtual void GetBoundaryRouterForDest(const TIPAddress& DestIP,  
            TIPAddress& BoundaryIP, TIPAddress& NextHopIP) = 0;  
    .  
    .  
};
```

# The SLS splitting (3)

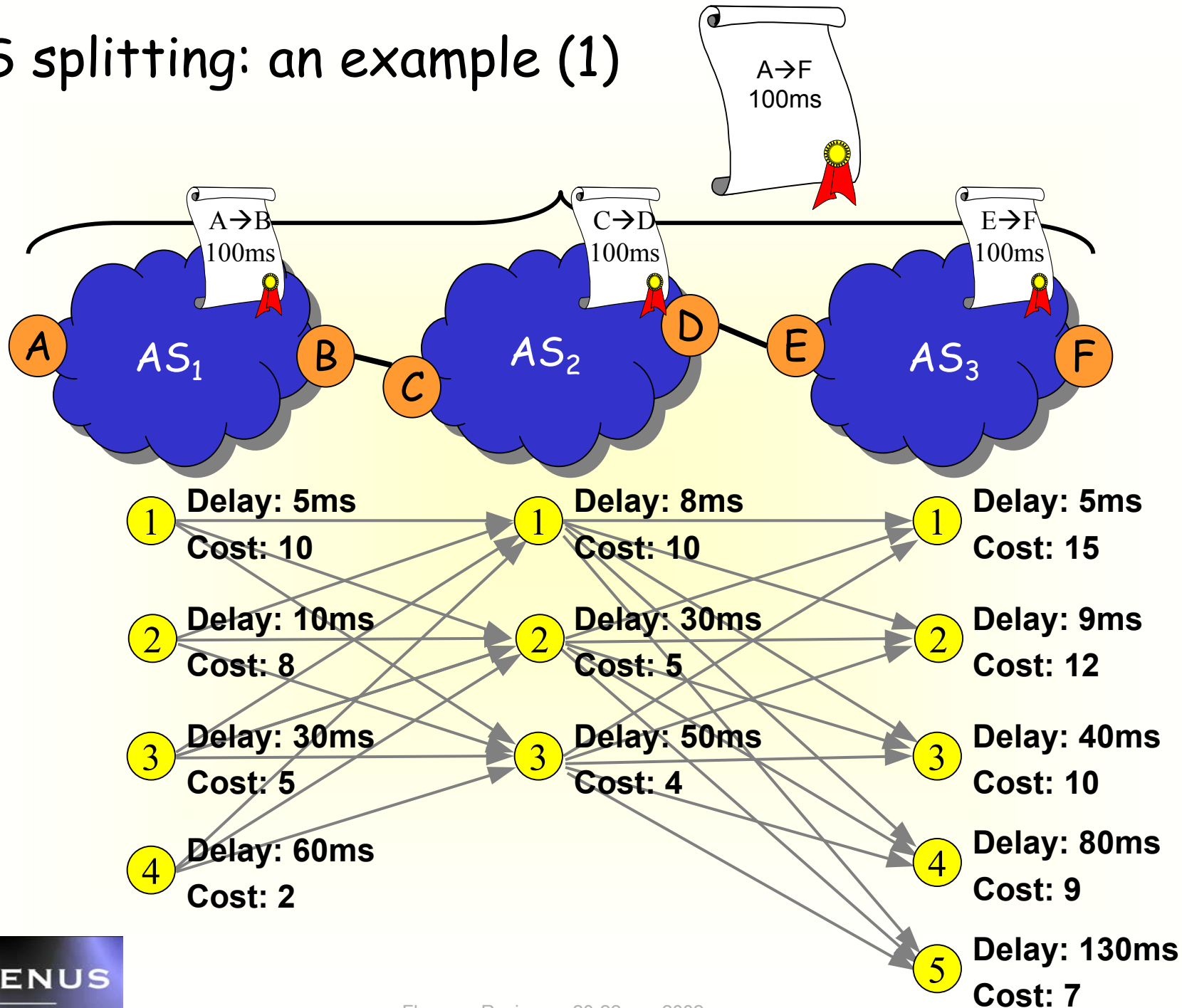


# The problem formalization

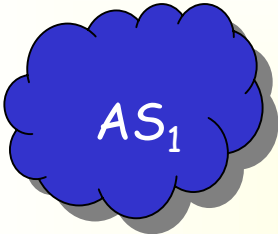
- $\sum_{i=1}^N d_i \leq D_{SLS}$  (SLS delay)
- $\sum_{i=1}^N j_i \leq J_{SLS}$  (SLS jitter)
  - $d_i > 0$
  - $j_i > 0$
  - $0 \leq p_i \leq 1$
- $\prod_{i=1}^N (1 - p_i) \geq (1 - P_{SLS})$  (SLS packet-loss)
- $t_i \geq T_{SLS} \quad \forall i \in 1 \dots N$  (SLS throughput)

$$f(x_1, \dots, x_N) = \sum_{i=1}^N c_i(x_i) \quad \text{MIN !}$$

# SLS splitting: an example (1)



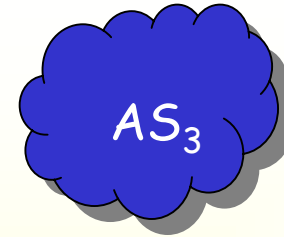
# SLS splitting: an example (2)



S <sub>1</sub>		
(x <sub>1</sub> )	Delay	Cost
1	5	10
2	10	8
3	30	5
4	60	2



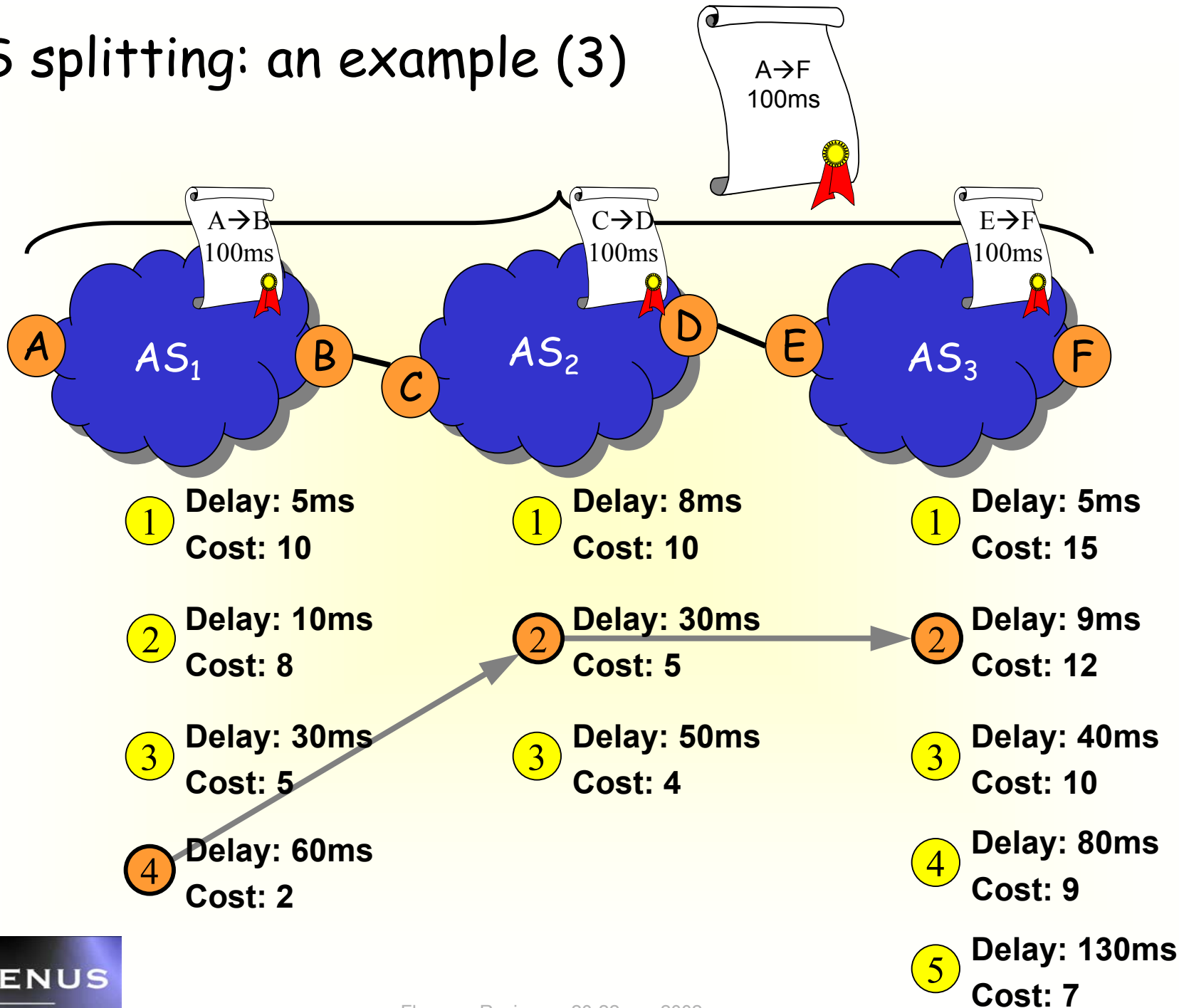
S <sub>2</sub>		
(x <sub>1</sub> , x <sub>2</sub> )	Delay	Cost
(1,1)	13	20
(1,2)	35	15
<del>(1,3)</del>	<del>55</del>	<del>14</del>
(2,1)	18	18
(2,2)	40	13
<del>(2,3)</del>	<del>60</del>	<del>12</del>
<del>(3,1)</del>	<del>38</del>	<del>15</del>
(3,2)	60	10
(3,3)	80	9
<del>(4,1)</del>	<del>68</del>	<del>12</del>
(4,2)	90	7
<del>(4,3)</del>	<del>110</del>	<del>6</del>



S <sub>3</sub>		
(x <sub>1</sub> , x <sub>2</sub> , x <sub>3</sub> )	Delay	Cost
(1,1,1)	18	35
(1,1,2)	22	32
<del>(1,1,3)</del>	<del>53</del>	<del>30</del>
<del>(1,1,4)</del>	<del>93</del>	<del>29</del>
<del>(1,2,1)</del>	<del>40</del>	<del>30</del>
(1,2,2)	44	27
<del>(1,2,3)</del>	<del>75</del>	<del>25</del>
<del>(1,2,4)</del>	<del>115</del>	<del>24</del>
<del>(2,1,1)</del>	<del>23</del>	<del>33</del>
(2,1,2)	27	30
<del>(2,1,3)</del>	<del>58</del>	<del>28</del>
<del>(2,1,4)</del>	<del>98</del>	<del>27</del>
<del>(2,2,1)</del>	<del>45</del>	<del>28</del>
(2,2,2)	49	25

<del>(2,2,3)</del>	<del>80</del>	<del>23</del>
<del>(2,2,4)</del>	<del>120</del>	<del>22</del>
(3,2,1)	65	25
(3,2,2)	69	22
<del>(3,2,3)</del>	<del>100</del>	<del>20</del>
<del>(3,2,4)</del>	<del>140</del>	<del>19</del>
<del>(3,3,1)</del>	<del>85</del>	<del>24</del>
(3,3,2)	89	21
<del>(3,3,3)</del>	<del>120</del>	<del>19</del>
<del>(3,3,4)</del>	<del>160</del>	<del>18</del>
<del>(4,2,1)</del>	<del>95</del>	<del>22</del>
(4,2,2)	99	19
<del>(4,2,3)</del>	<del>130</del>	<del>17</del>
<del>(4,2,4)</del>	<del>170</del>	<del>16</del>

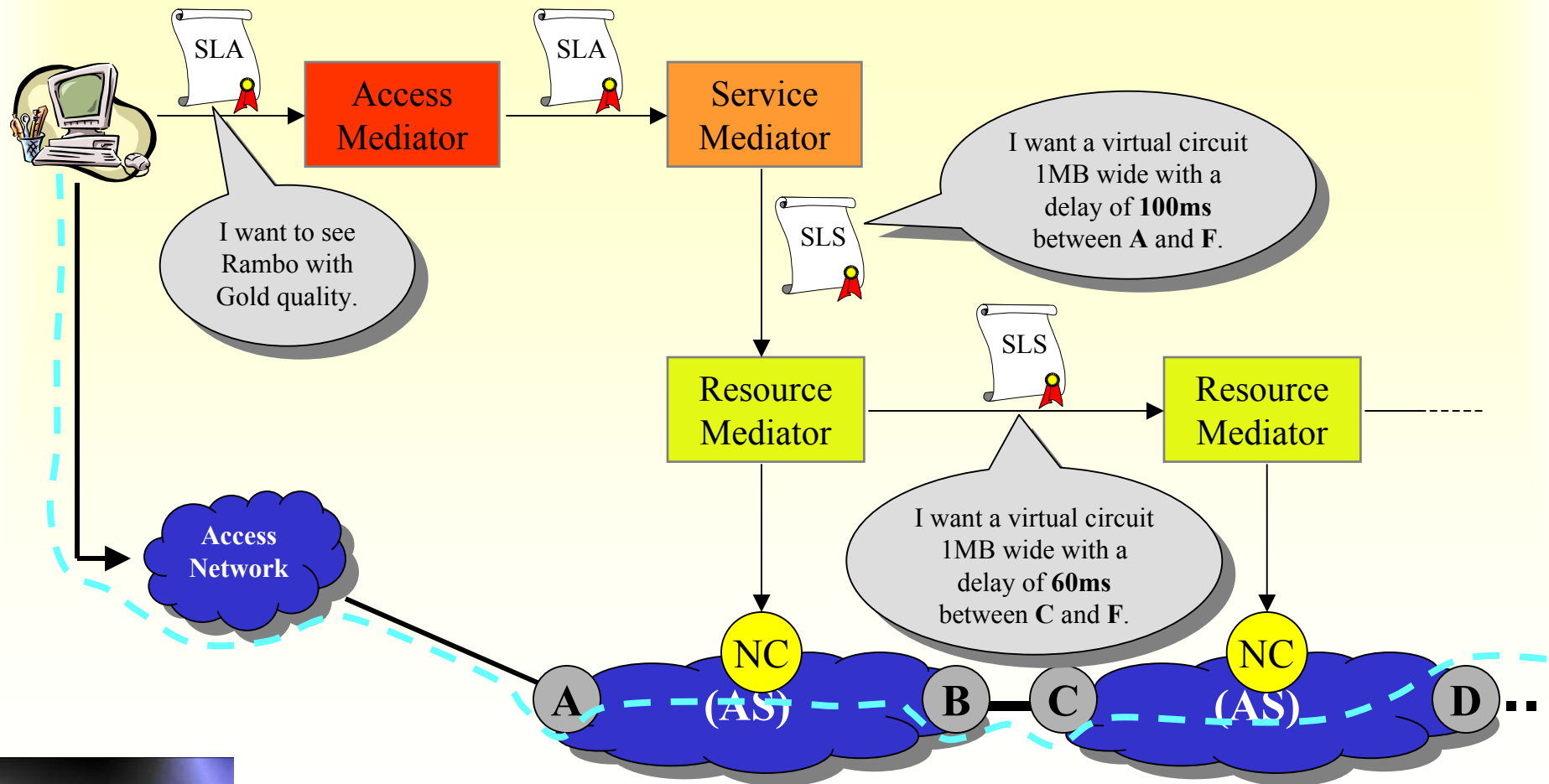
# SLS splitting: an example (3)



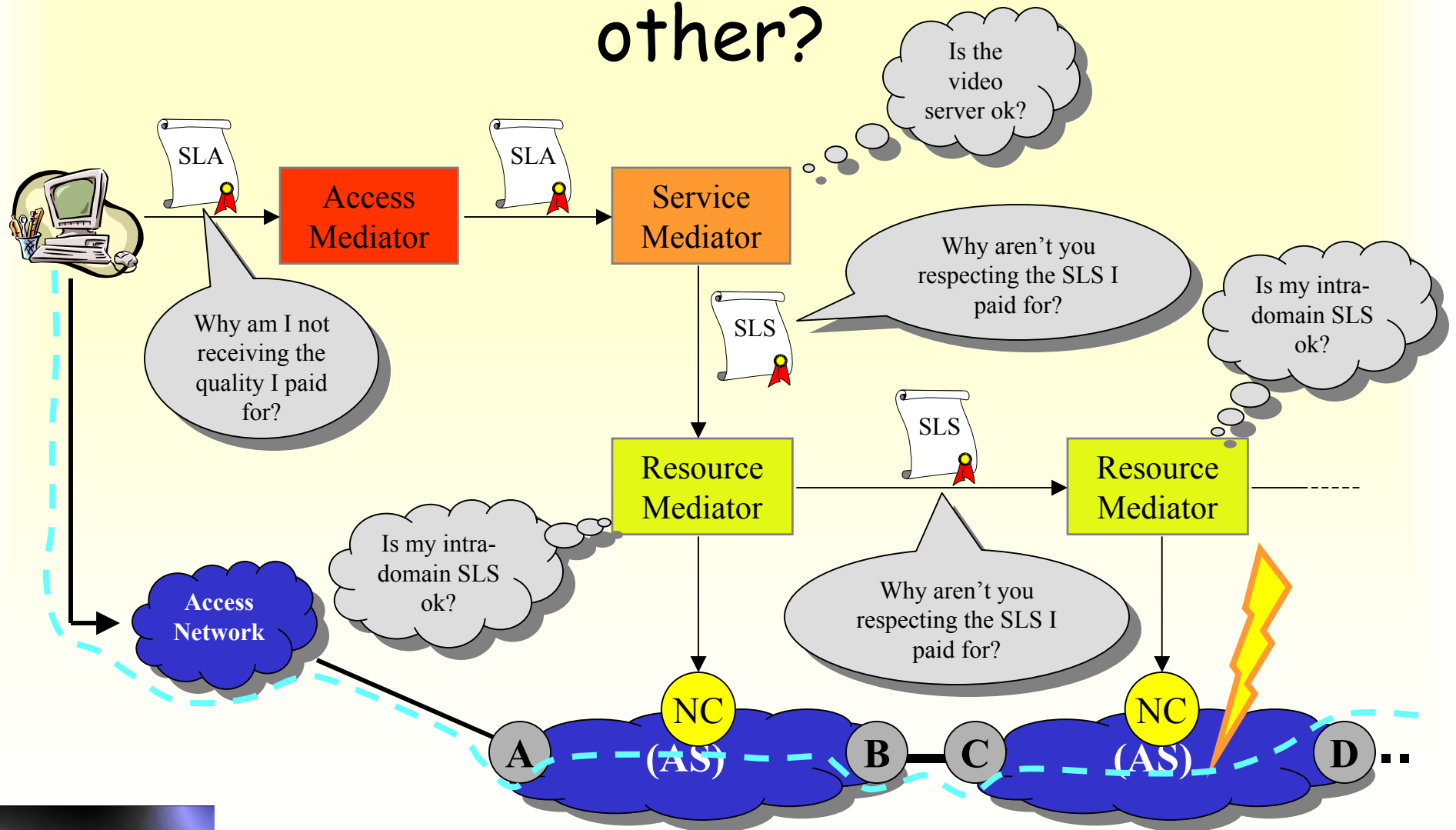
# Roadmap

- Preliminary considerations:
  - The Cadenus Resource Management Architecture
  - The Resource Mediator's 'algorithm'
- **4 Questions:**
  - How to enforce a multi-domain SLS?
  - Do Cadenus components trust each other?
  - Where is the Cadenus bottleneck localized?
  - Is SLS management a top-down or a bottom-up process?

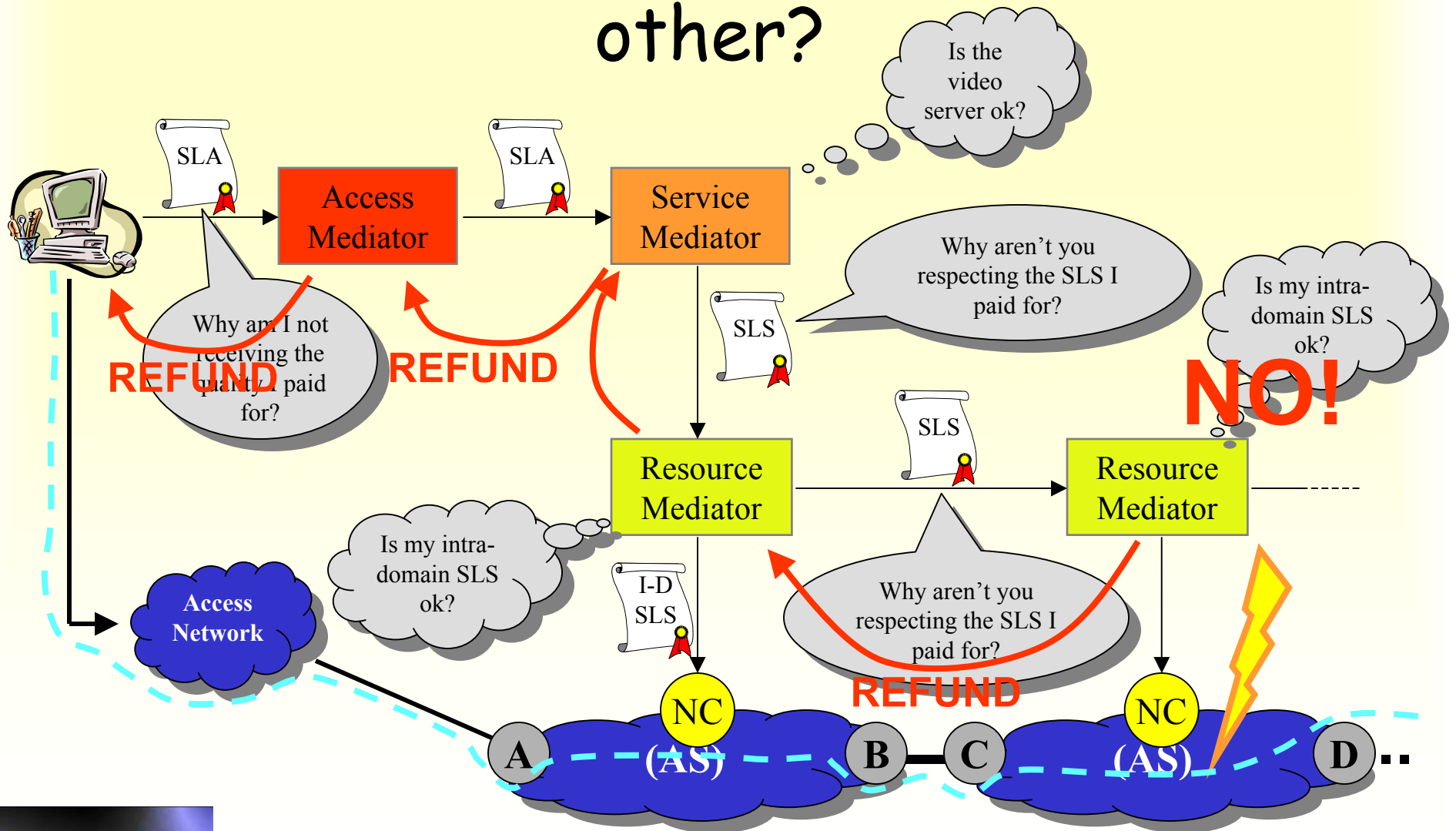
# Do Cadenus components trust each other?



# Do Cadenus components trust each other?



# Do Cadenus components trust each other?



# Roadmap









- Preliminary considerations:
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# Where is the Cadenus bottleneck localized?

- The CADENUS framework is built of 3 main components.
- The overall logic is spread among the components.
- As for every non trivial system, loads with different characteristics stress different parts of the framework.
- Hence, to find the bottleneck, we have to
  - single out framework life-cycle phases;
  - characterize/classify traffic loads.

Where is the Cadenus bottleneck localized?

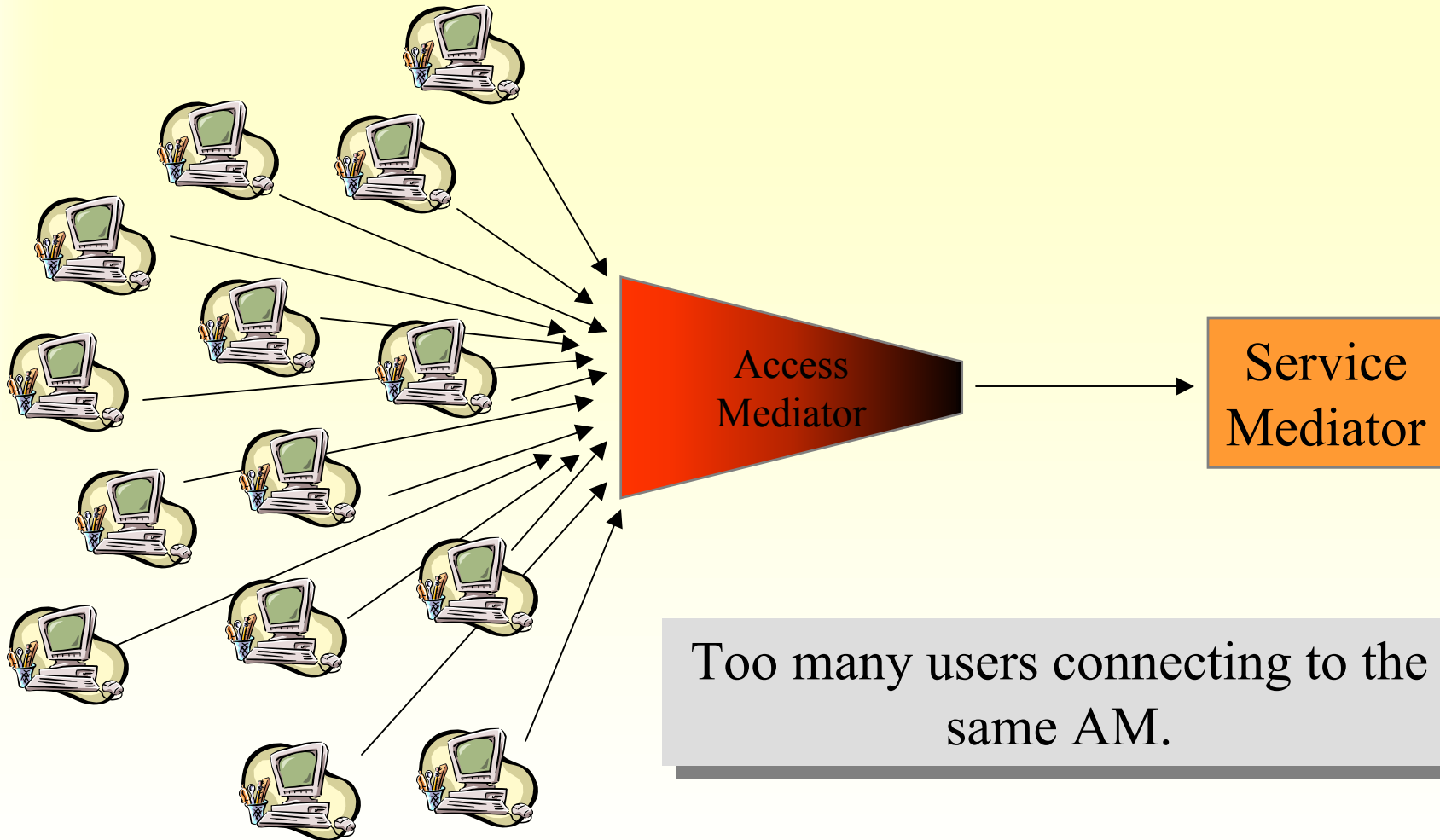
# Life-cycle phases

<i>Phase</i>	<i>Involved components</i>	
Service Subscription	 Access Mediator	 Service Mediator
Service Configuration		 Service Mediator  Resource Mediator
Service Activation		 Service Mediator  Resource Mediator
Service Invocation	 Access Mediator	 Service Mediator

Where is the Cadenus bottleneck localized?

# Service Subscription (1)

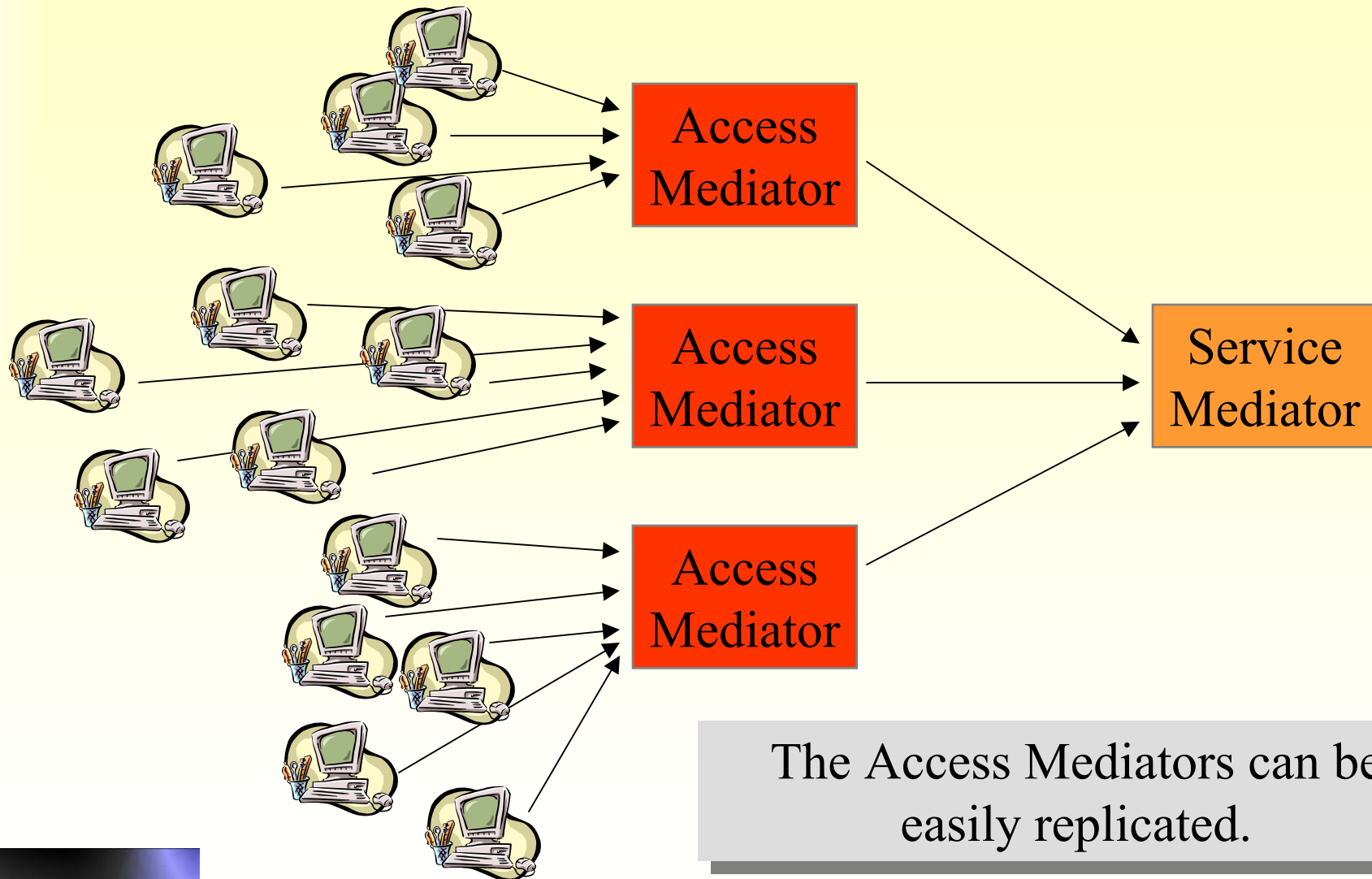
(The problem)



Where is the Cadenus bottleneck localized?

# Service Subscription (1)

(A solution)

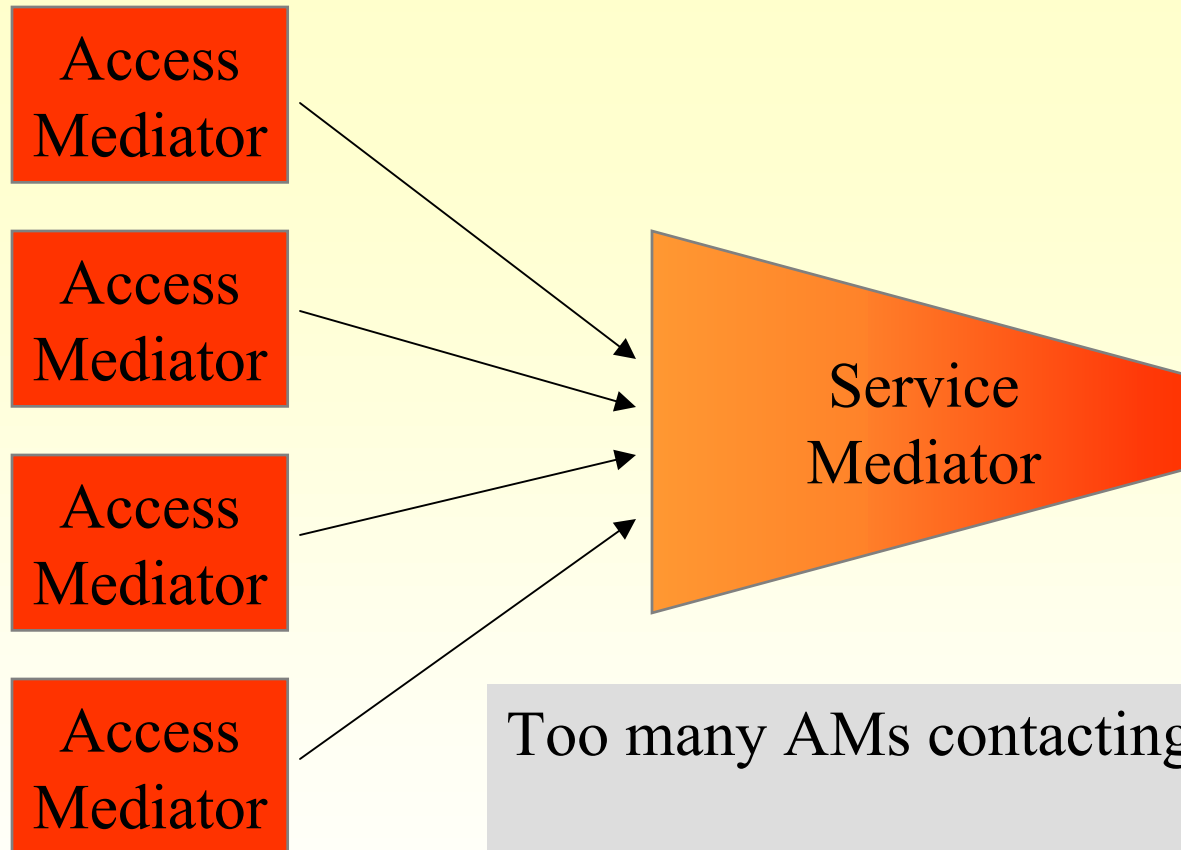


The Access Mediators can be easily replicated.

Where is the Cadenus bottleneck localized?

# Service Subscription (2)

(The problem)



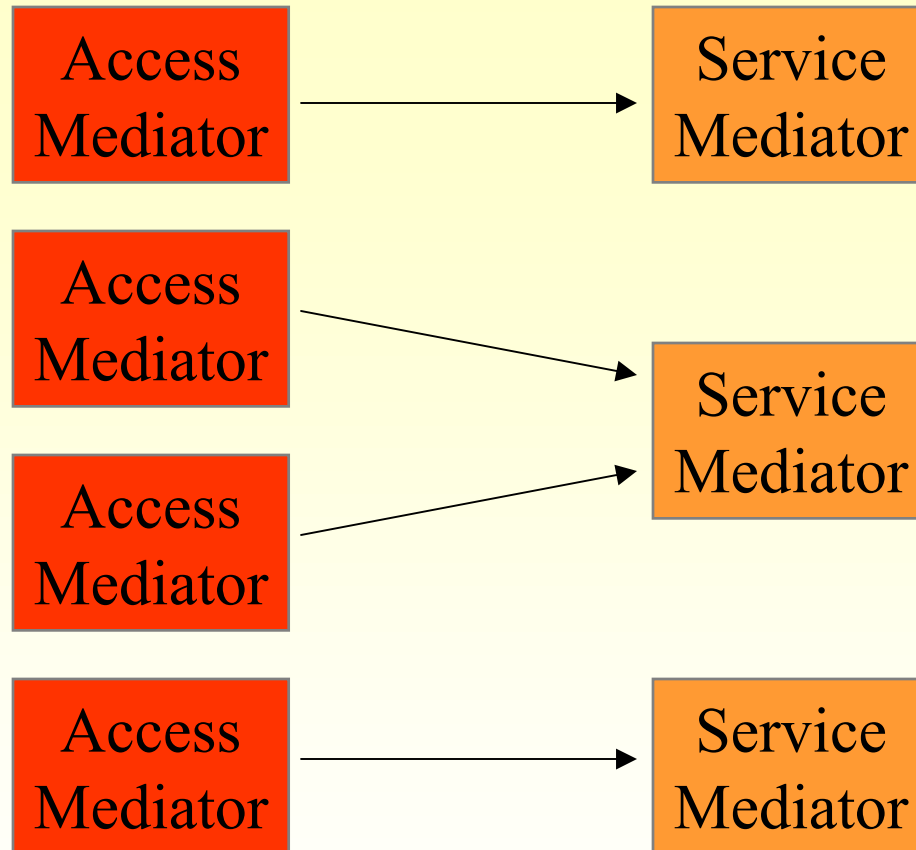
Too many AMs contacting the same SM.

This might happen when just one SM sells a particular service (e.g. it is the only one who owns the rights, or it won a market rush against other SMs).

Where is the Cadenus bottleneck localized?

# Service Subscription (2)

(A solution)



SM replication is not as simple as in the previous case.

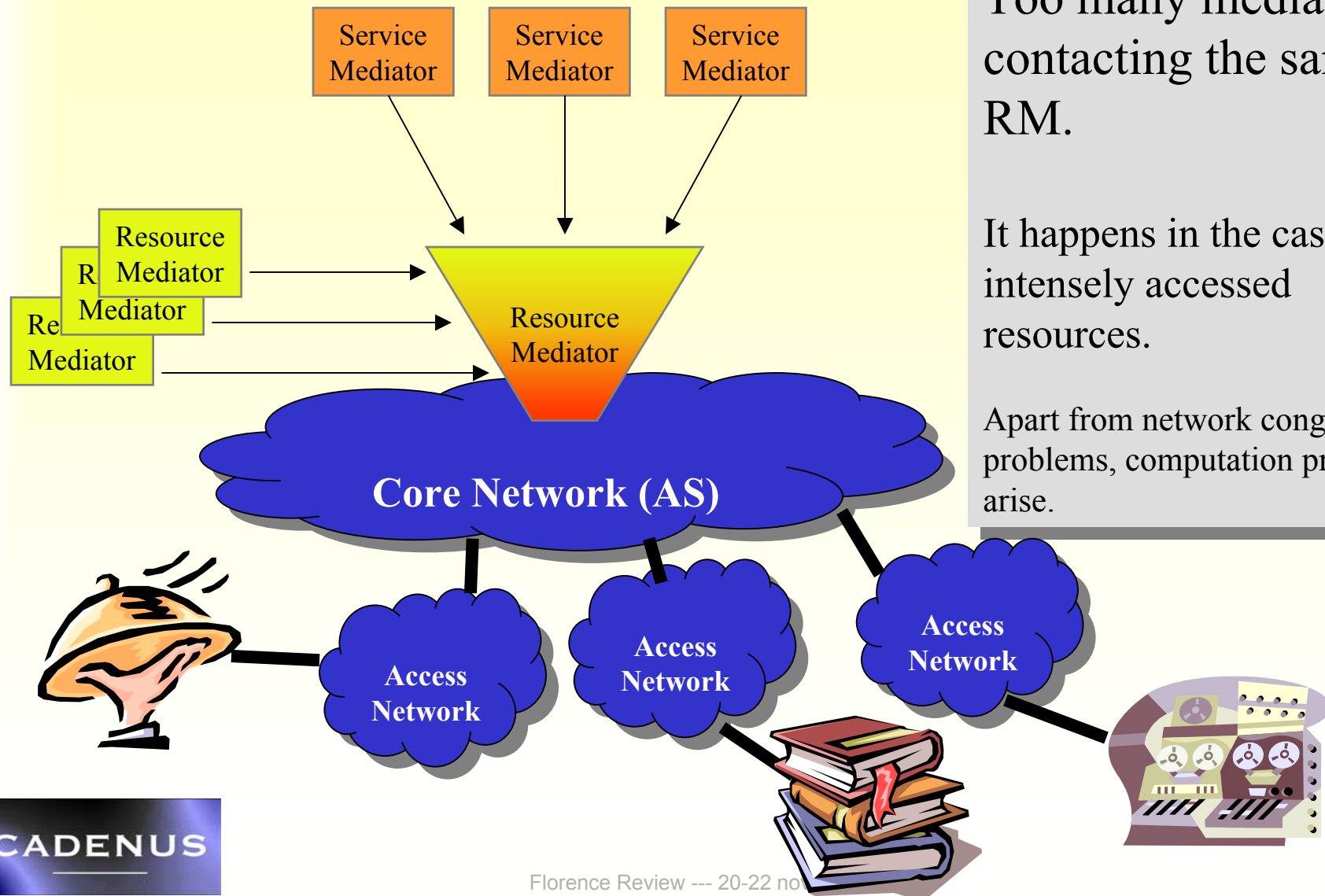
Replication might be either internal to the 'bottleneck' SM, or linked to the arrival on the market of new SMs offering the service in question.

The more appealing the service, the more the SMs wishing to sell it (which helps avoiding scalability problems).

Where is the Cadenus bottleneck localized?

# Service Configuration

(The problem)



Too many mediators contacting the same RM.

It happens in the case of intensely accessed resources.

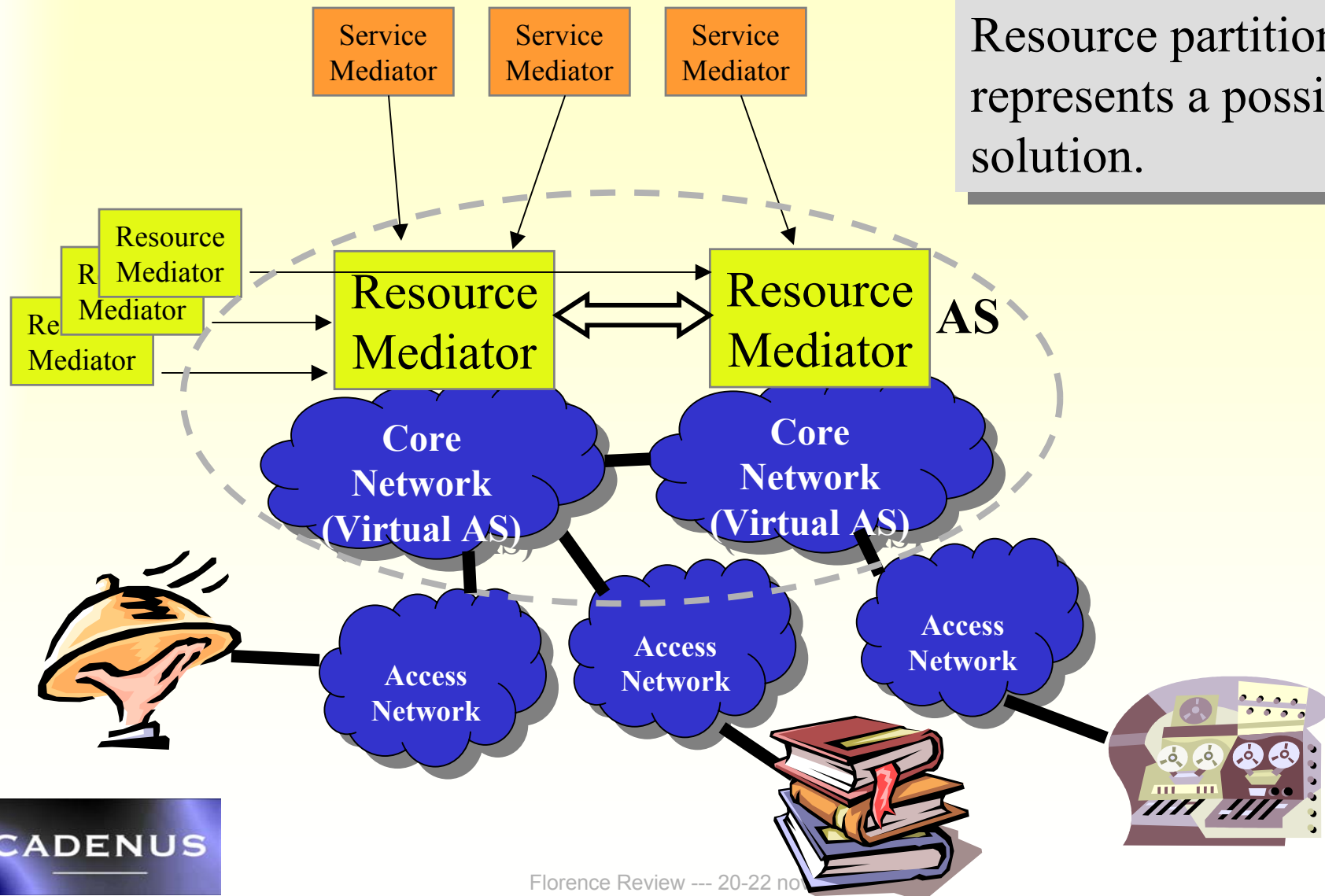
Apart from network congestion problems, computation problems arise.

Where is the Cadenus bottleneck localized?

# Service Configuration

(The problem)

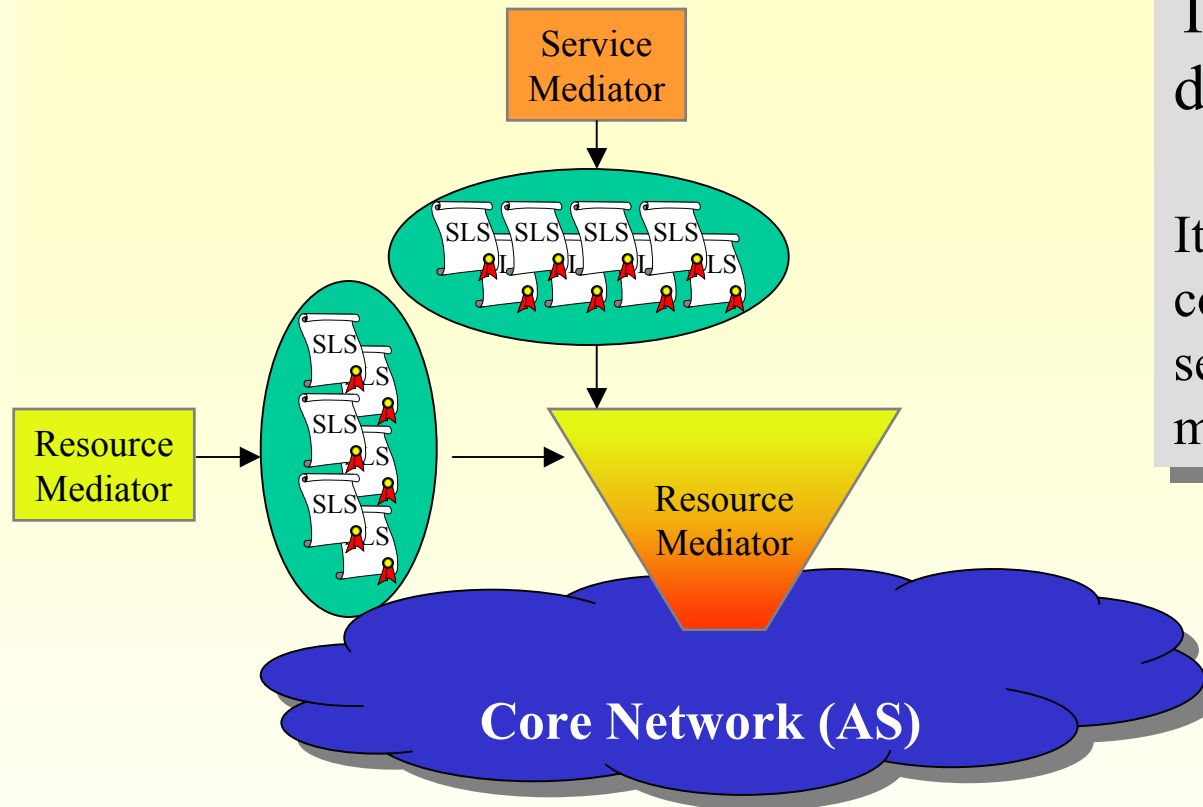
Resource partitioning represents a possible solution.



Where is the Cadenus bottleneck localized?

# Service Configuration/Activation

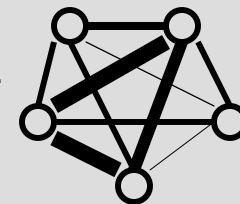
(The problem)



Too many SLSs delivered to an RM.

It happens in the case of complex (time/space) services composed by many simple services.

As an example, a VPN connecting 5 sites with a full-meshed graph would need 20 SLSs (2 for each edge).



Where is the Cadenus bottleneck localized?

# Service Configuration/Activation

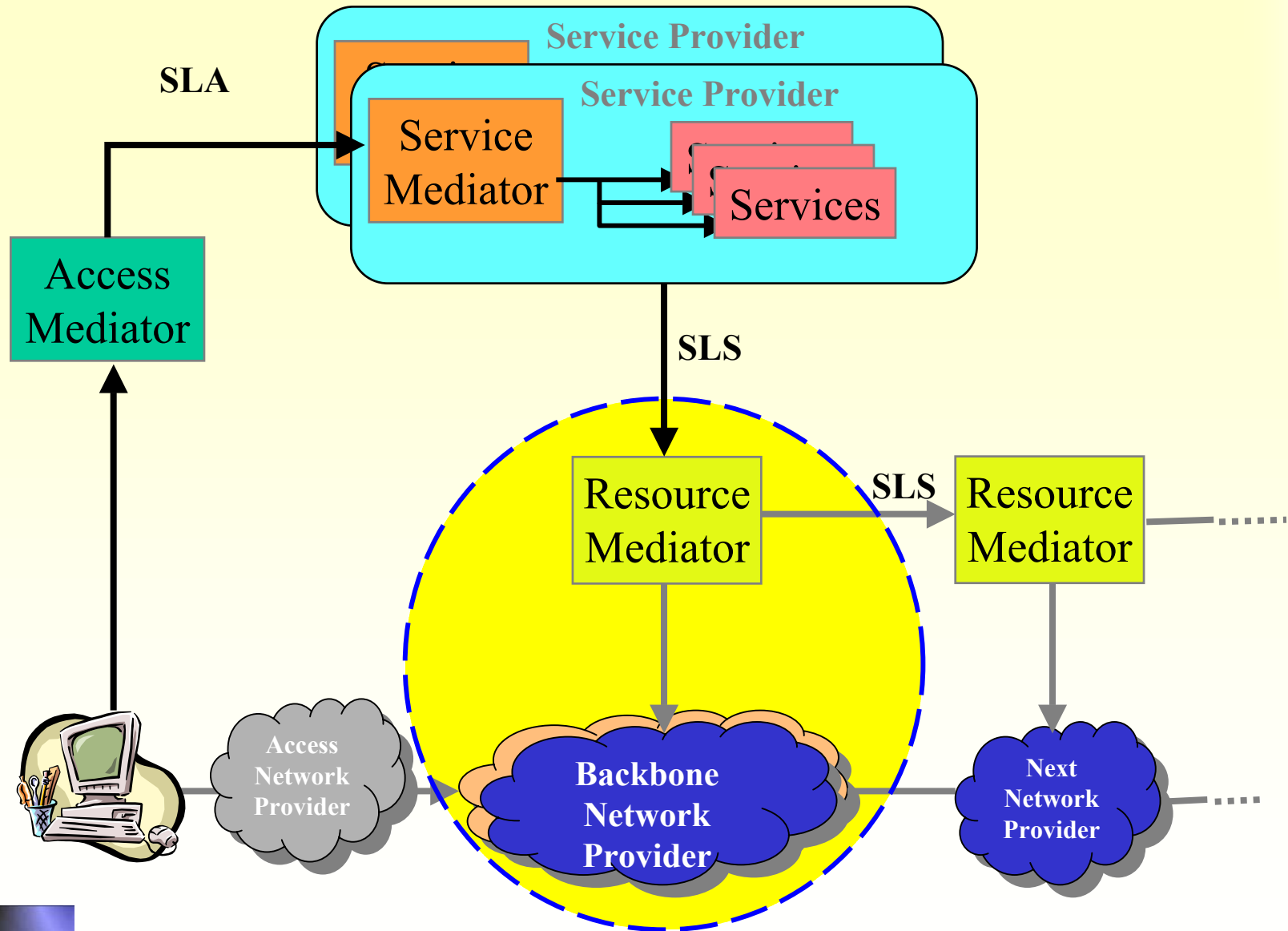
(A solution)

- In this case, there are no solutions to tackle the scalability issues. Possible remedies are:
  - increase the computation capabilities;
  - parallelize the RM's activities (cfr. D2.3→RM scalability analysis);
  - improve the SLS semantics (e.g. heterogeneous hose model);
  - make network configuration reflects such more complex semantics.

# Roadmap

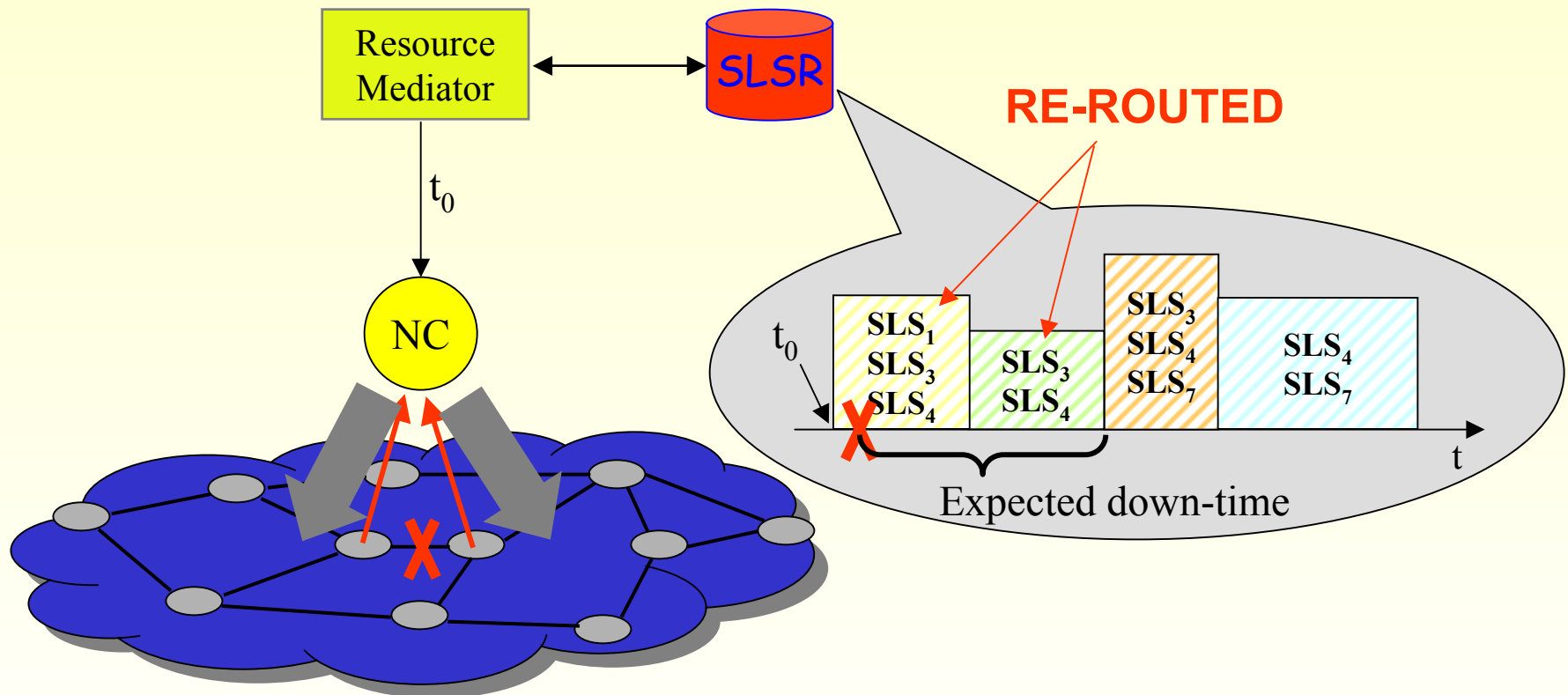
- Preliminary considerations:
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- **4 Questions:**
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  - Is SLS management a top-down or a bottom-up process?

# SLS management is generally top-down



# Special cases

- Fault recovery
- SLA/SLS monitoring



In these cases the SLS management might be triggered bottom-up.

See you all in Napoli at

IDMS - PROMS 2003

Keep cheking

[ip2003.idms-proms.org](http://ip2003.idms-proms.org)

CADENUS



# **WP 4: Test Trial 2**

## **Result from the WTC-2002 demo**

**21/11/02**

Dr. Olivier Dugeon FTR&D/DAC

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# Objectives of CADENUS



- ⇒ Each network & service provider recognises the importance of QoS to the future of their business, but some points are unclear
  - ✓ They don't know how to provide this QoS
  - ✓ They don't know what sort of QoS And for what sort of services
- ⇒ Network providers have another paradigm
  - ✓ QoS is the key point to make money from value-added network services

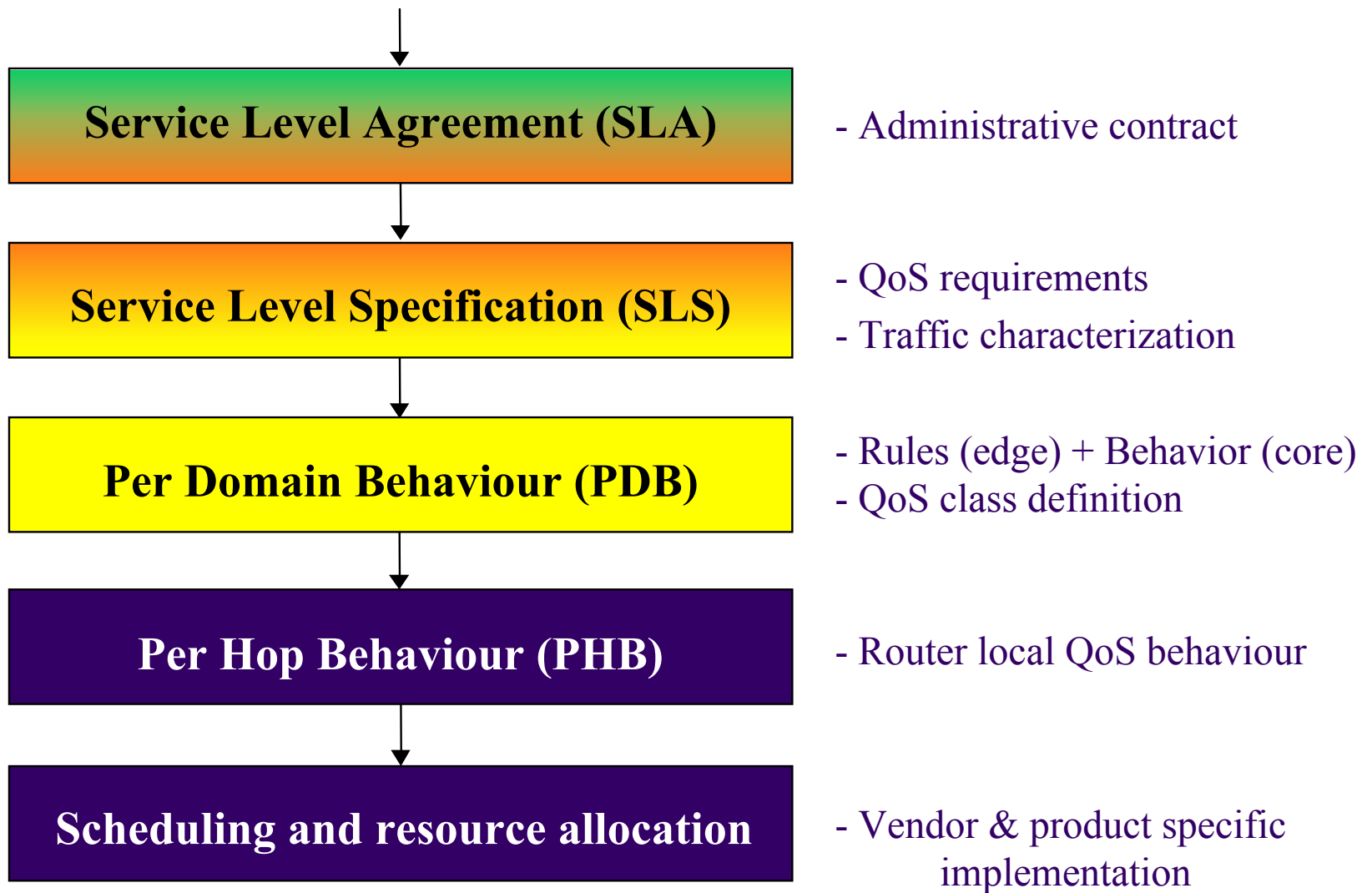
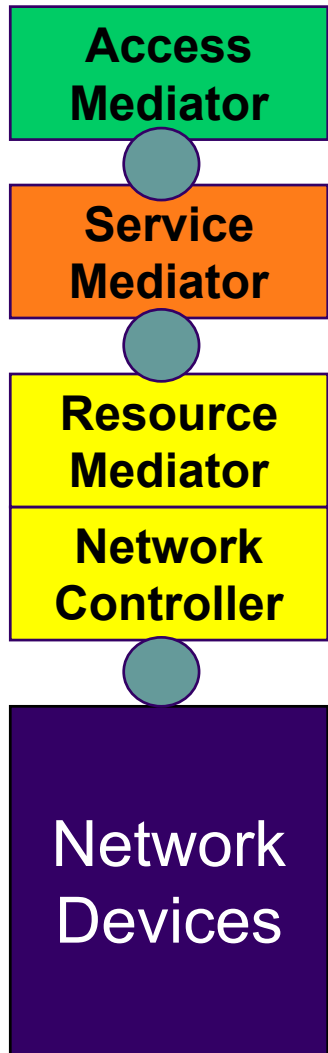
## The Main Goal is

- ⇒ To propose an integrated solution for the creation, configuration and provisioning of end user services with QoS guarantees in Premium IP networks.
- ⇒ **Define a framework** in which all the relationship can be seen as client/furnisher one
- ⇒ Let the end-user select the QoS he/she wants
  - ✓ Both during the subscription and the invocation process

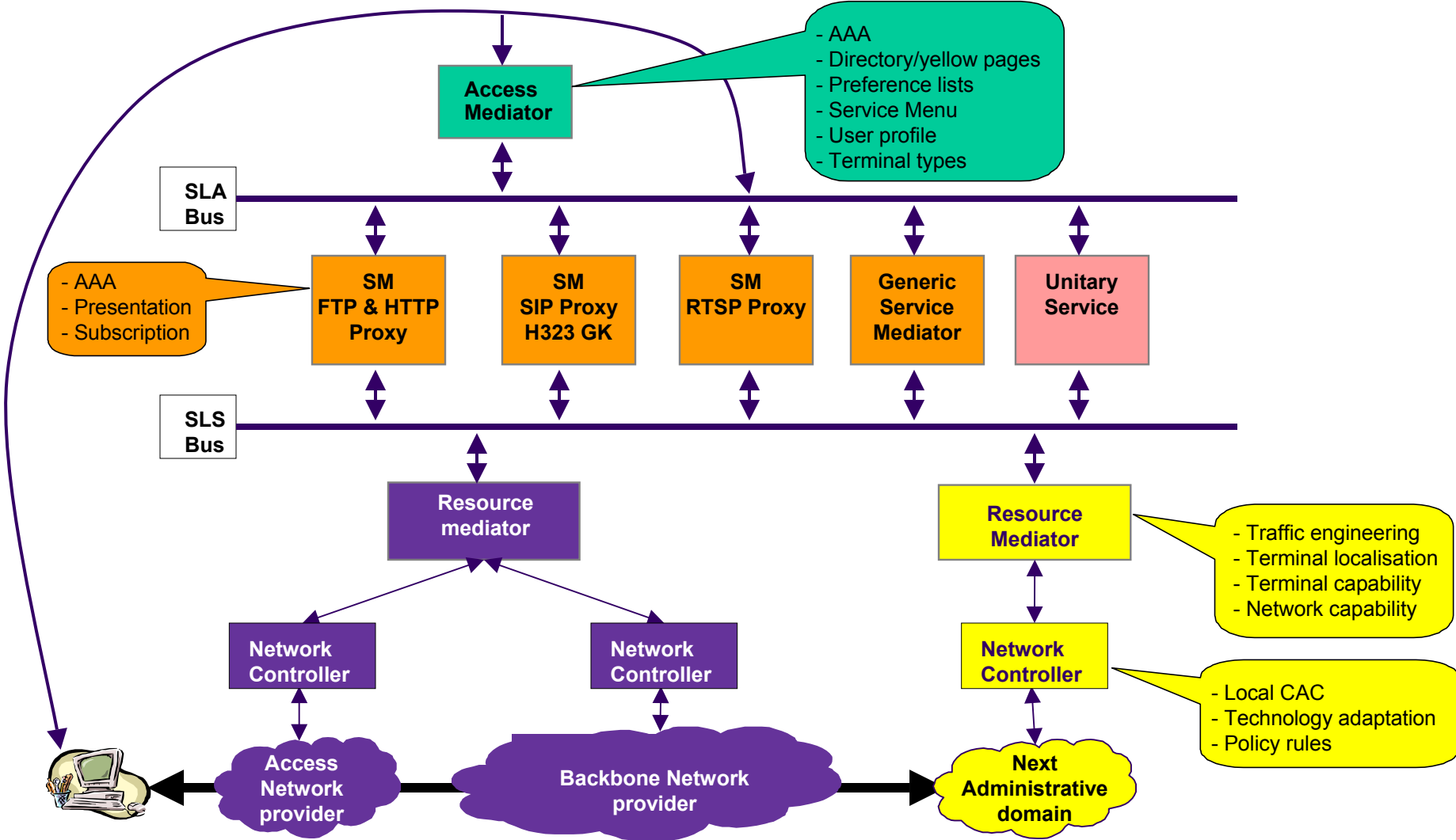


- ⇒ Solutions are based on the answers to these questions :
  - ✓ Who is requesting the content services QoS ?
  - ✓ Who is requesting the network services ?
  - ✓ Who and How to control the QoS ?
  
- ⇒ In the context of the NGN architecture
  - ✓ We introduce the Mediation at each level to give a unique entry point and open the architecture to different actors.
  
- ⇒ The CADENUS Business Model defines the roles which are:
  - ✓ Access Mediator, Service Mediator & Service logic, Resource Mediator & Network Controller,
  - ✓ the different actors may assume one or many of these roles.

# From SLA to SLS up to QoS



# The Multi-Mediator Architecture



# Objectives of Test trial 2



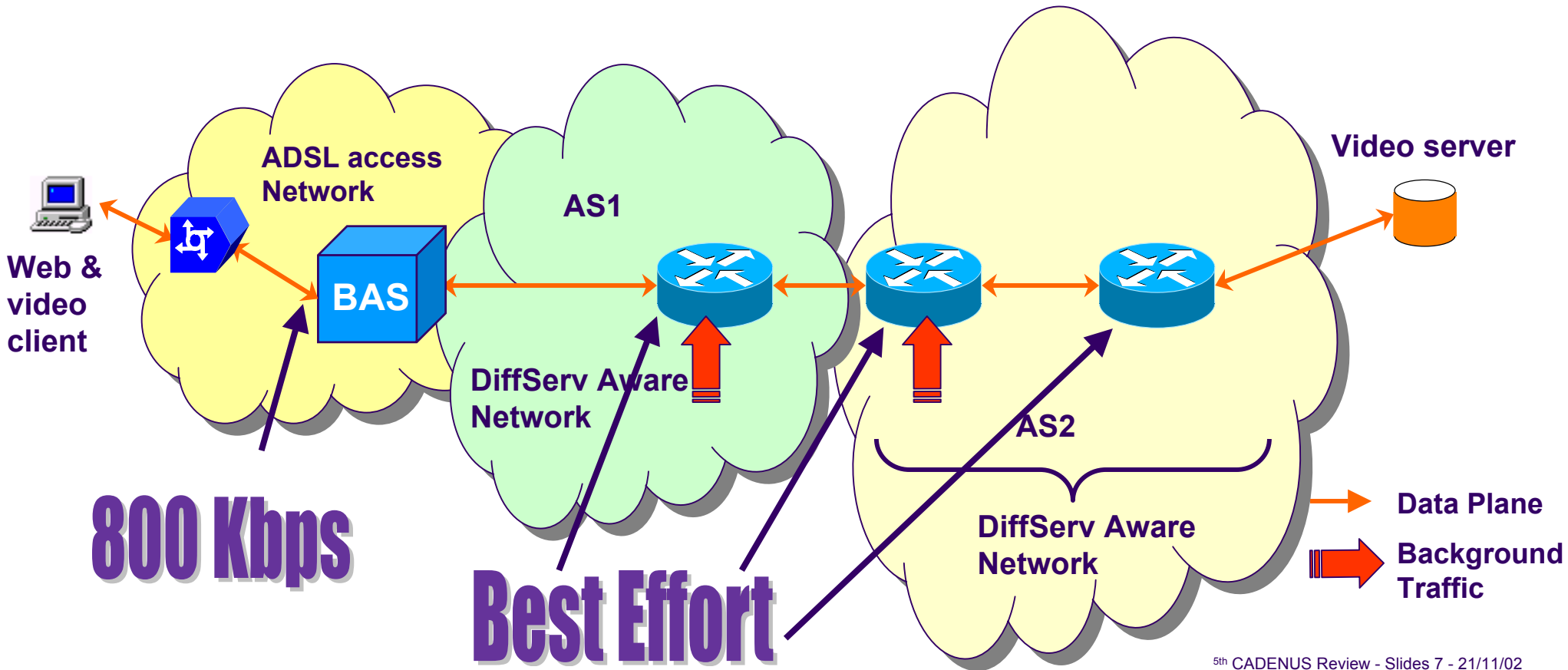
- ⇒ Build a CADENUS framework on top of commercial products
  - ✓ 3 commercial tools for RM and/or NC have been used
  - ✓ 2 available Service tools (not designed for CADENUS) have been adapted
  
- ⇒ Using real Networks
  - ✓ Two Premium IP networks built on Cisco Routers with DiffServ and One ADSL network (DSLAM, ATM switches and BAS) for the access have been configured
  
- ⇒ Using different network technology
  - ✓ Both ADSL and DiffServ have been setup
  
- ⇒ Skip AM and subscription process to concentrate on invocation process
  - ✓ Test trial 3 will merge both Test trial 1 and Test trial 2 results
  
- ⇒ And highlight inter-domain capability
  - ✓ Two Autonomous Systems (domains) have been setup
  - ✓ The RM performs the SLS splitting in the Cascade model configuration

# The VoD case study (1)



➡ First scenario do nothing: no provisioning and no reservation

- ✓ Quality is bad
- ✓ See it in action ...

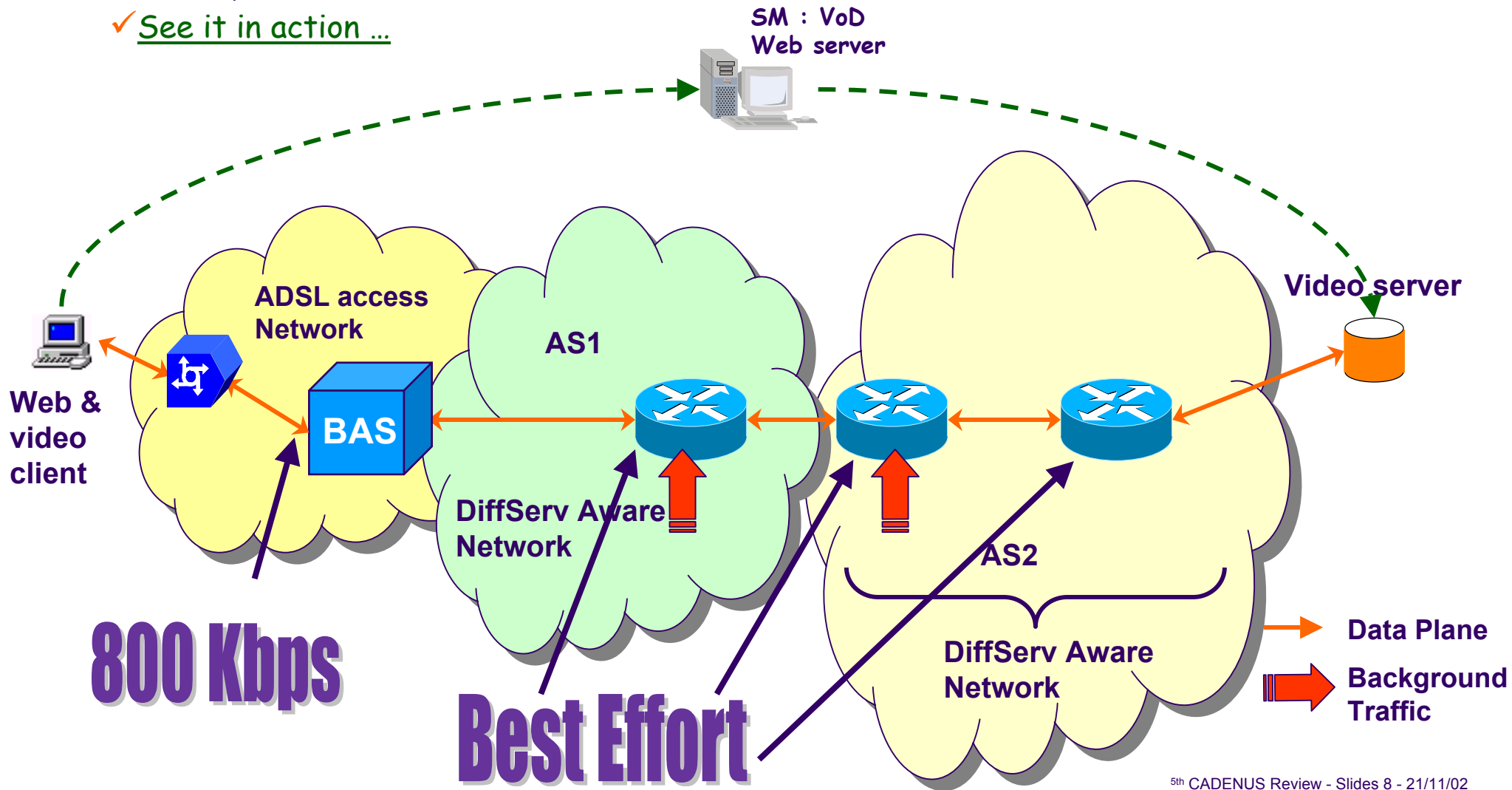


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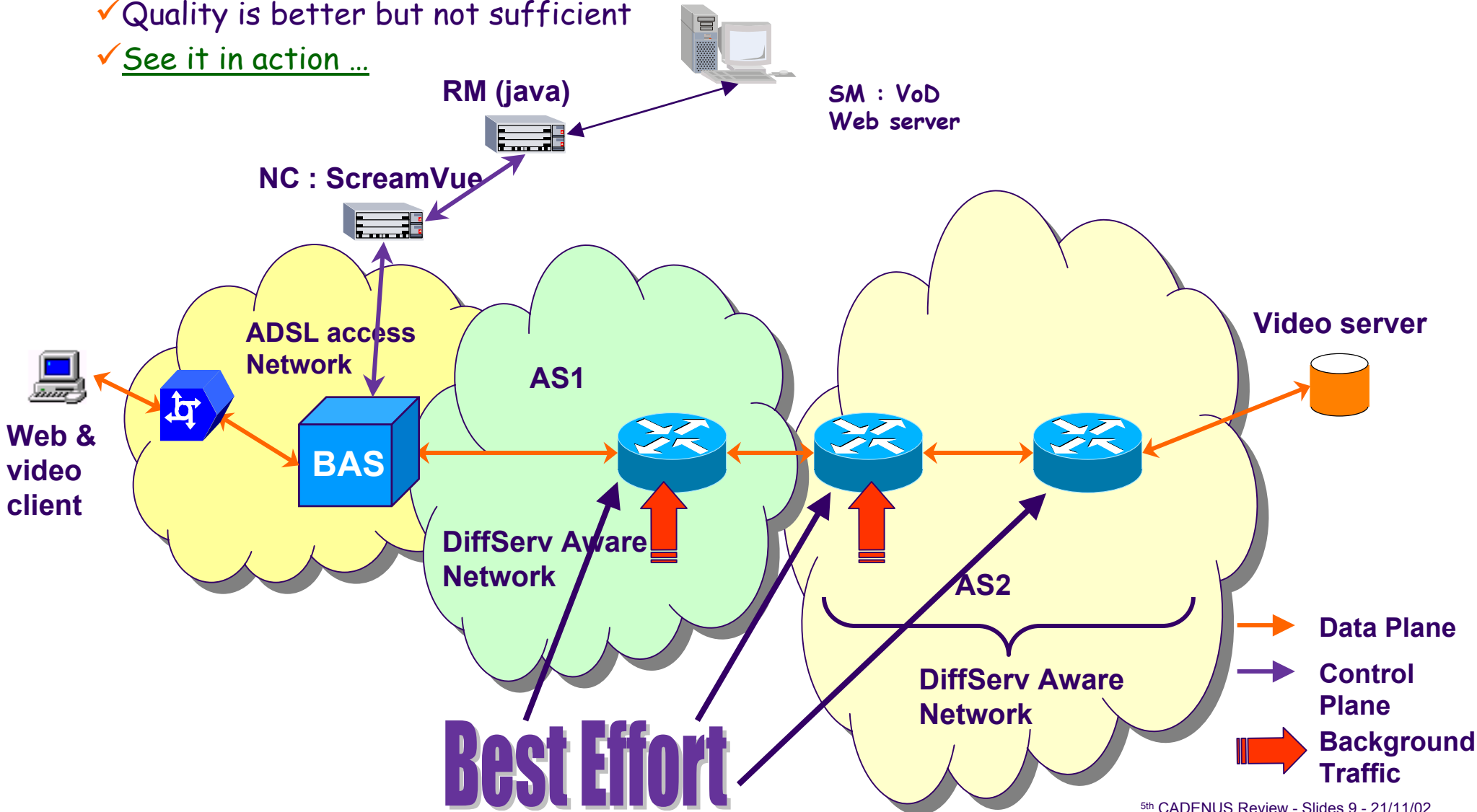


# The VoD case study (2)



⇒ Second step, BAS is configured but not the IP network

- ✓ Quality is better but not sufficient
- ✓ See it in action ...



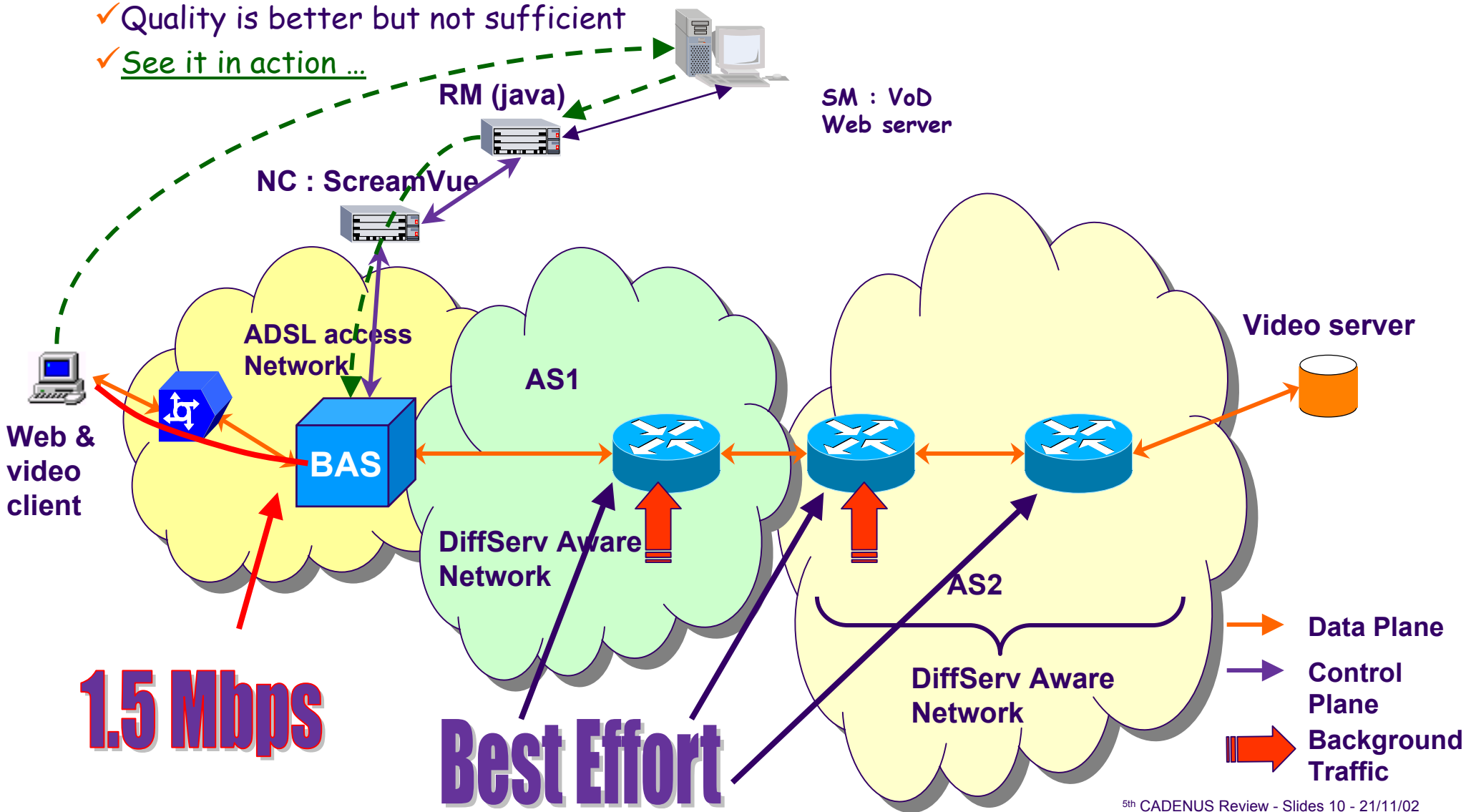
# The VoD case study (2)



⇒ Second step, BAS is configured but not the IP network

✓ Quality is better but not sufficient

✓ See it in action ...

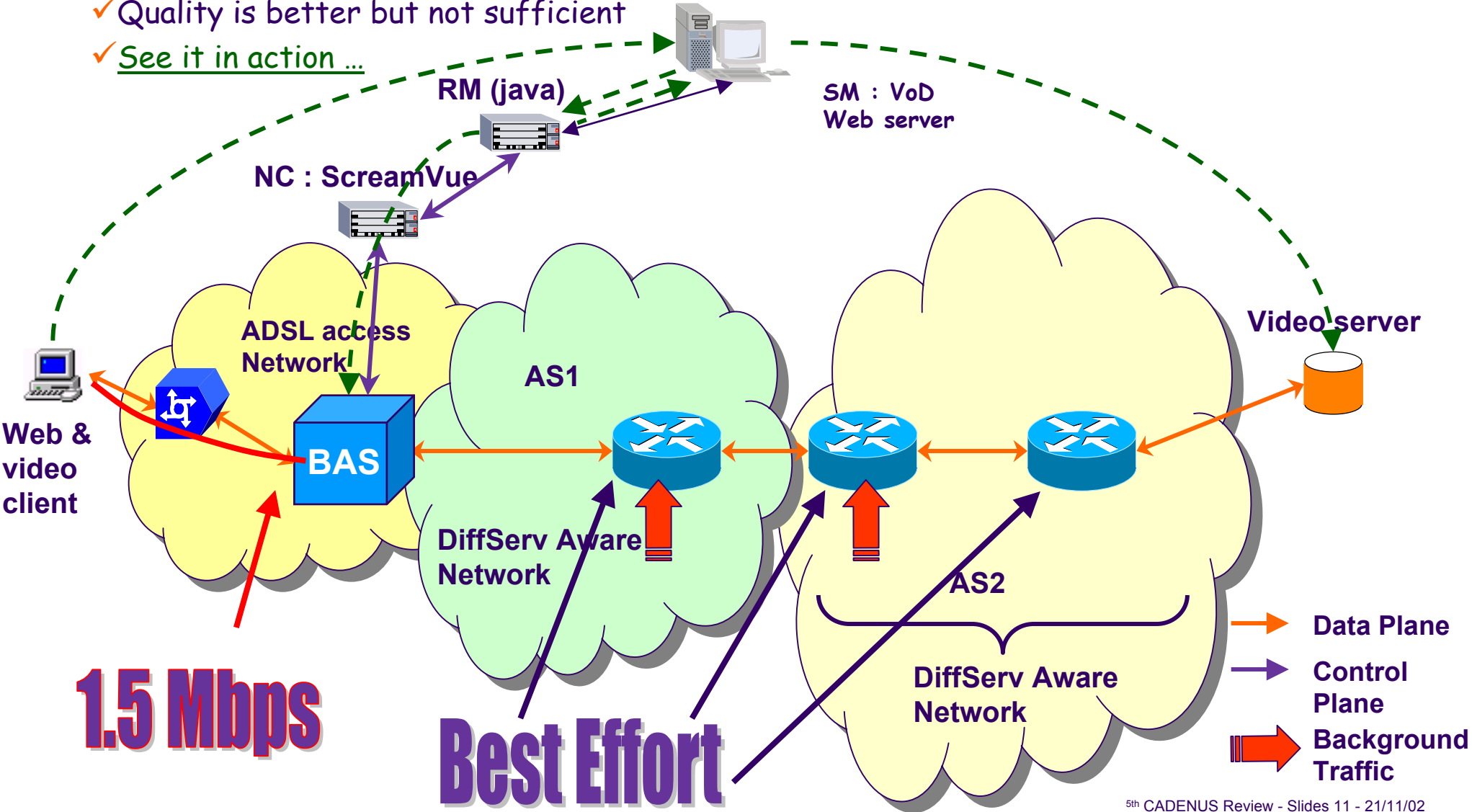


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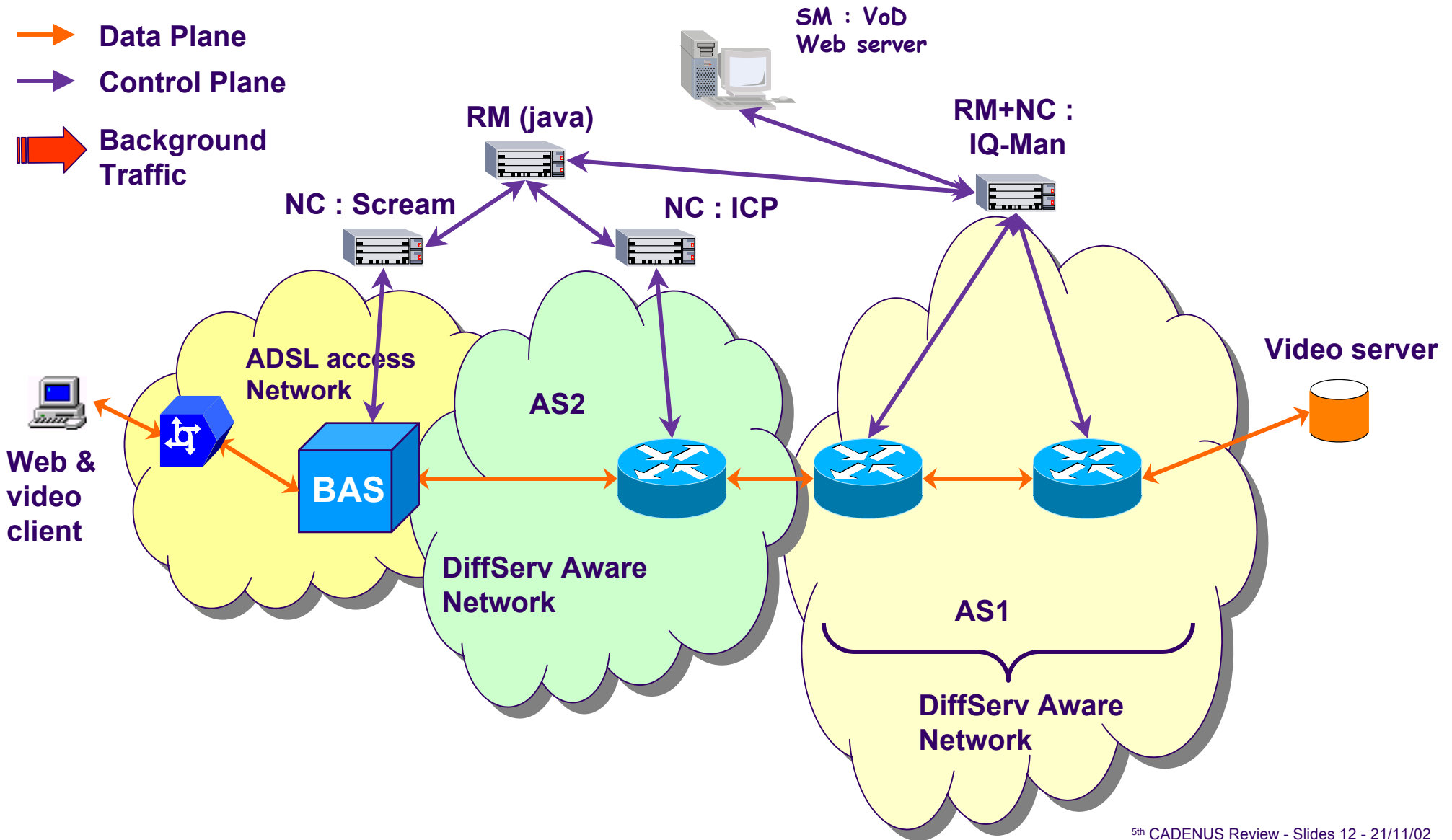


⇒ Final step, end-to-end QoS is setup

✓ Quality is as good as request

✓ See it in action ... and look at the start and stop log

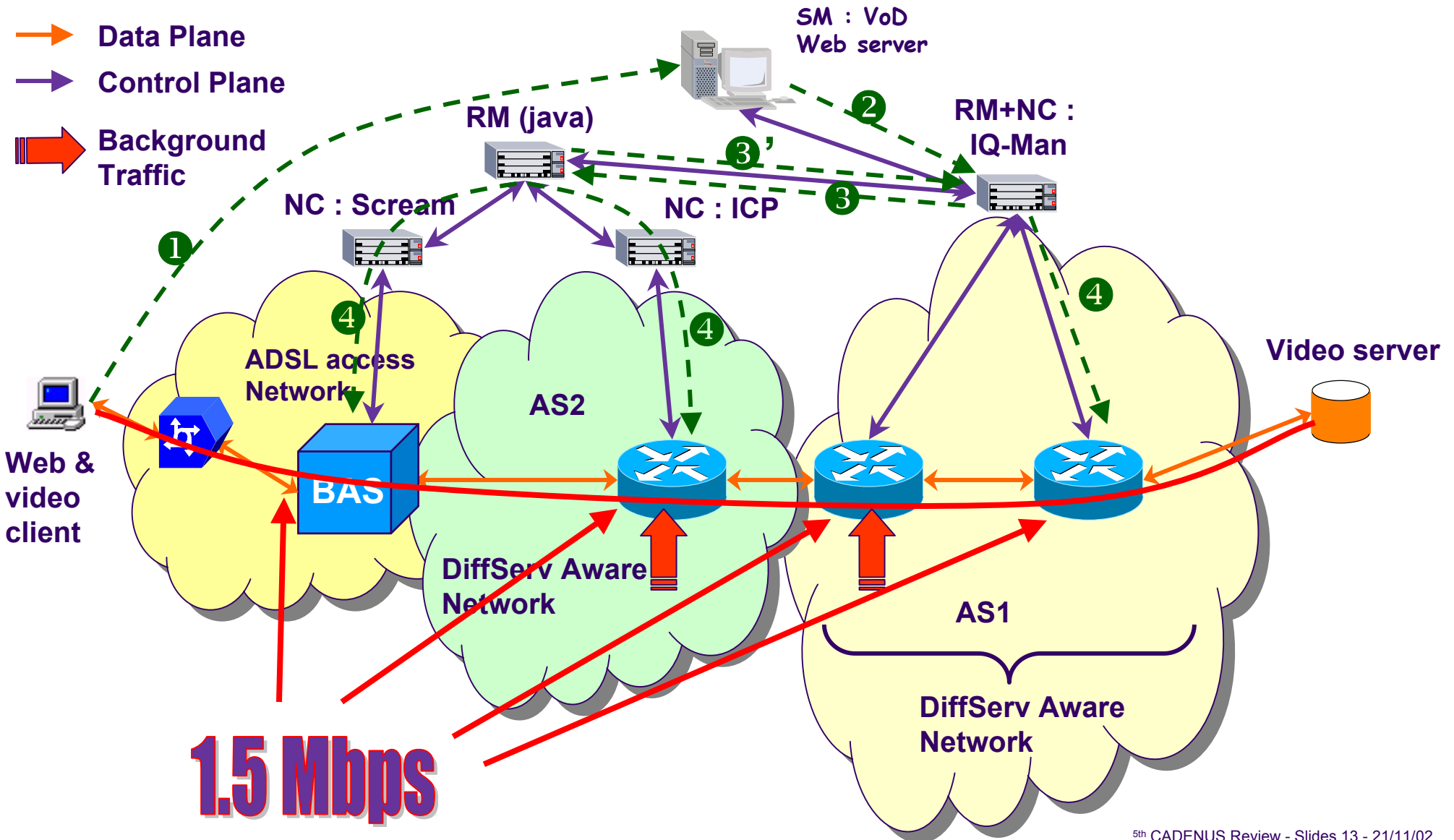
- Data Plane
- Control Plane
- Background Traffic



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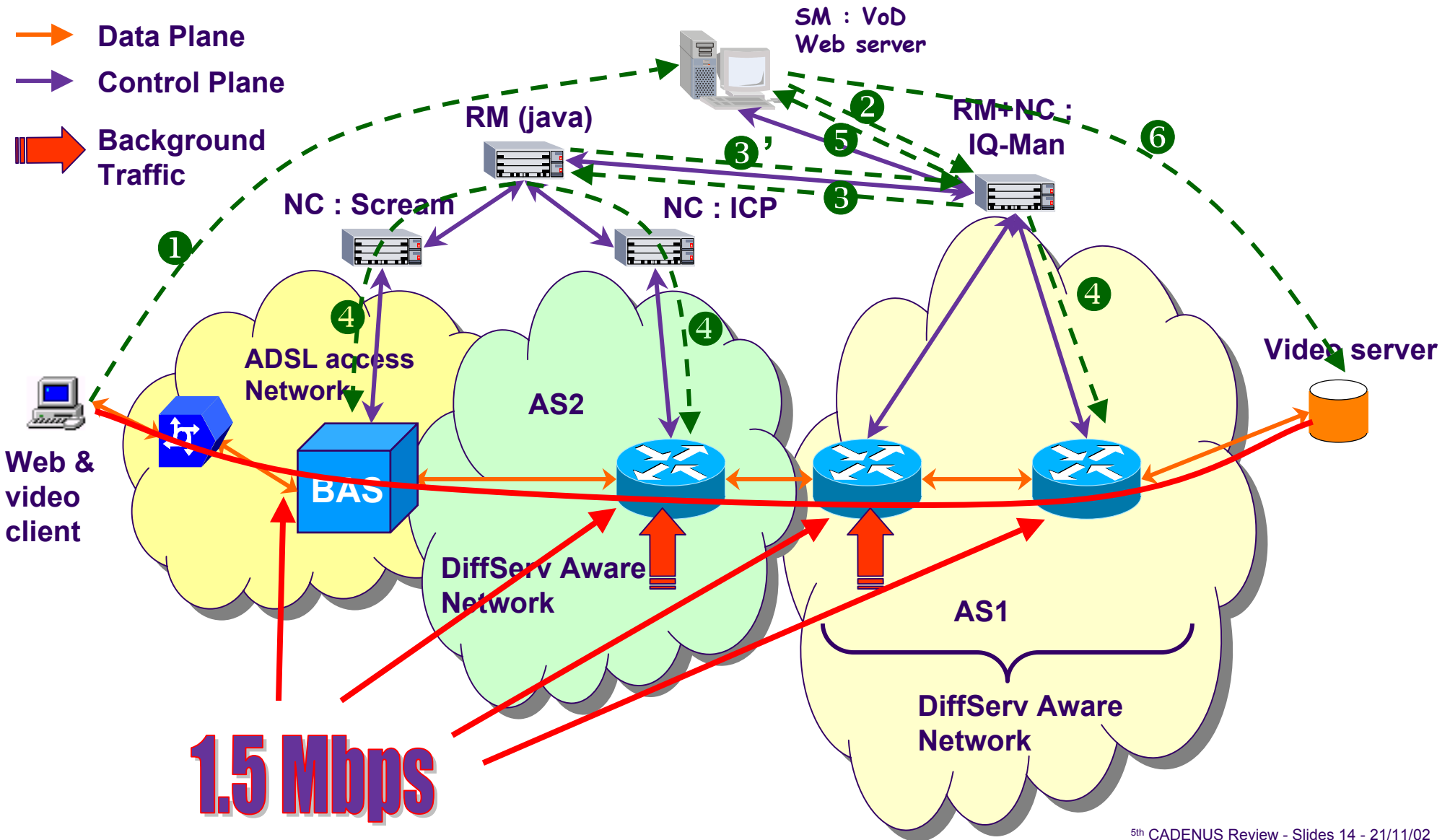


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- Data Plane
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# The VoIP case study (1)

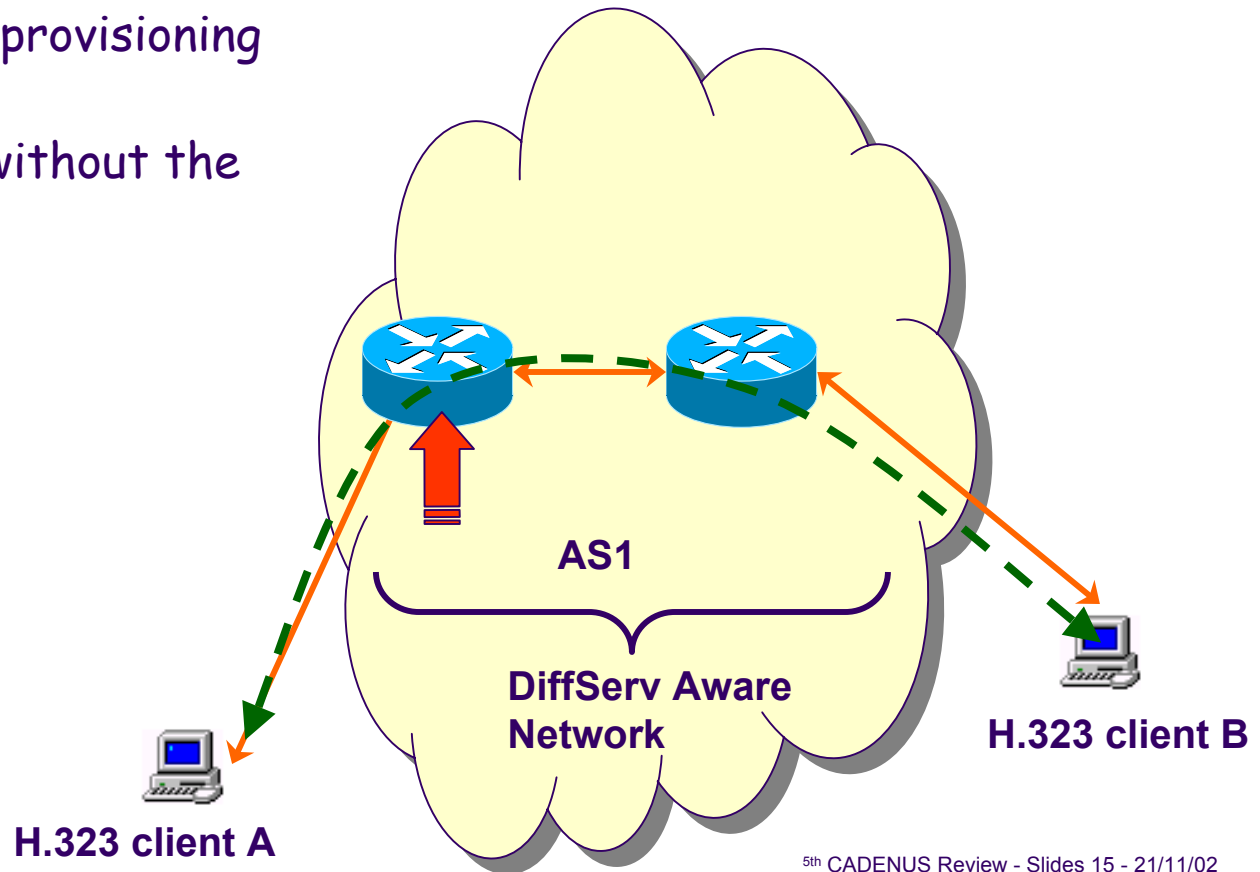


- Data Plane
- Control Plane
- Background Traffic

⇒ First scenario do nothing: no provisioning and no reservation.

⇒ The Netmeeting call is sent without the help of the gatekeeper

- ✓ Quality is bad
- ✓ See it in action ...

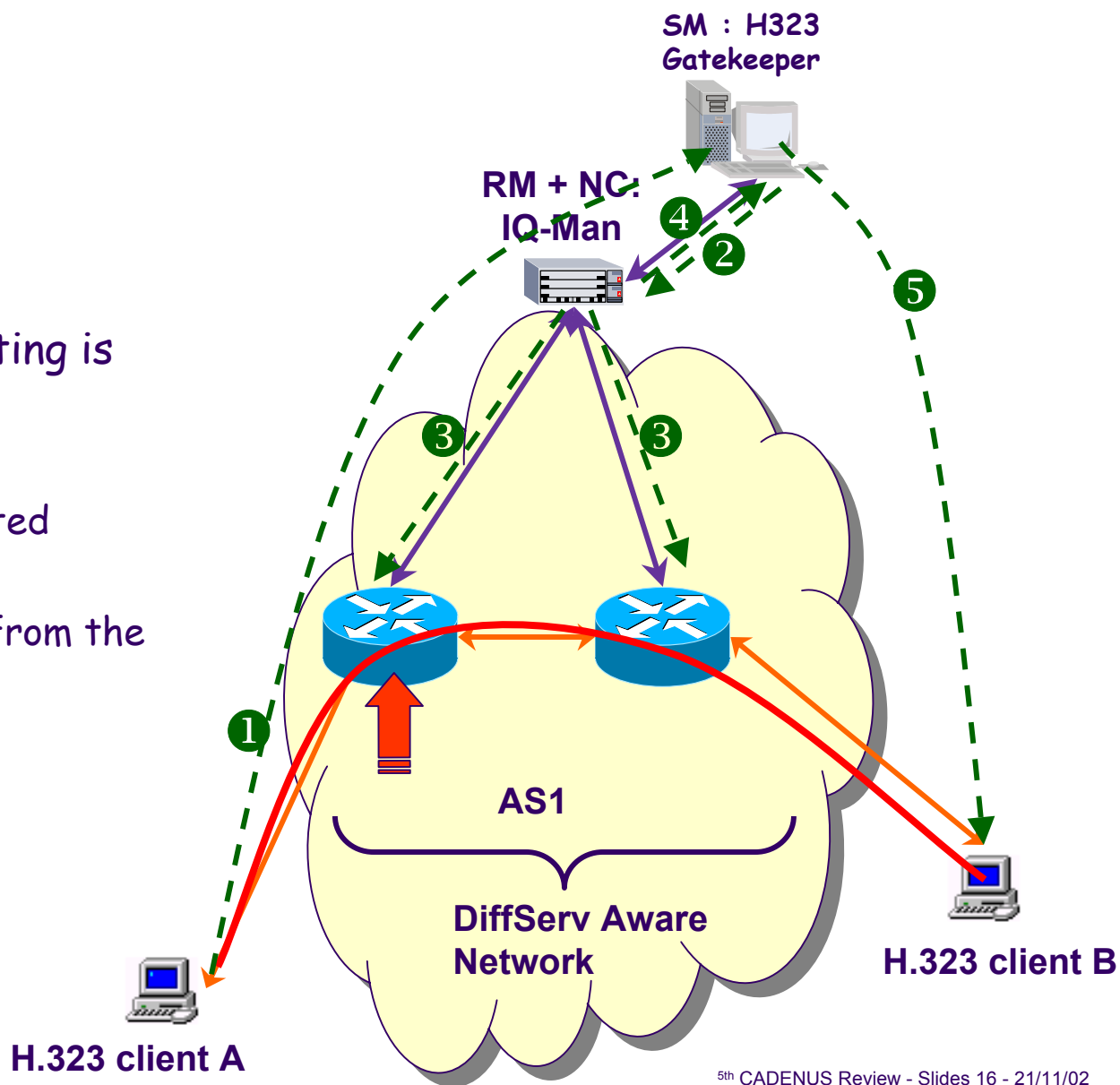


# The VoIP case study (2)



- Data Plane
- Control Plane
- Background Traffic

- ⇒ Second scenario, the Netmeeting is registered into the gatekeeper
- ⇒ before sending a call
  - ✓ Quality is as good as requested
  - ✓ See it in action ...
  - ✓ And the start and stop log from the H323 GK

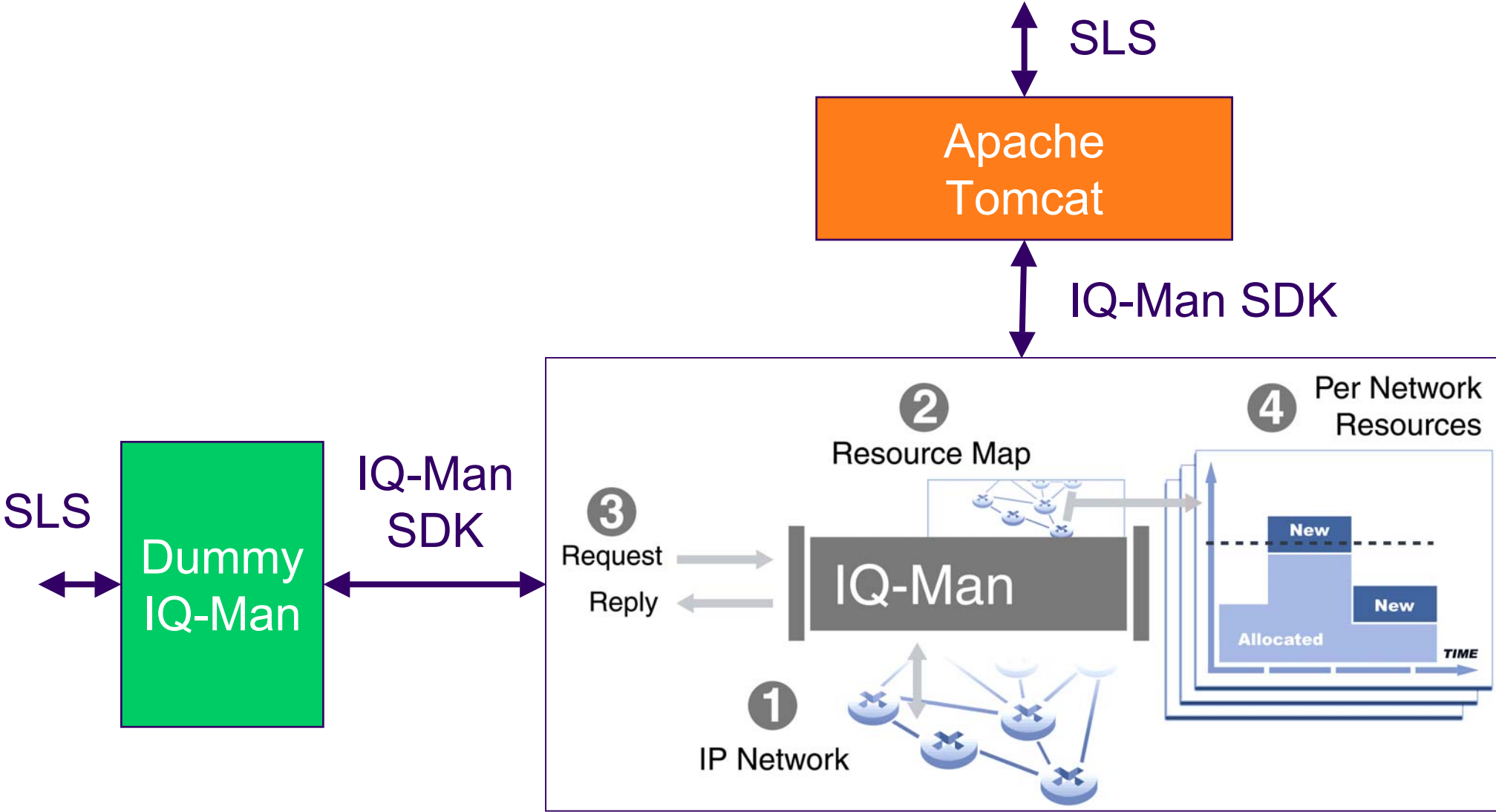






- ⇒ 3 commercial products are used
  - ✓ IQ-Man from Operax which implements both RM and NC functionalities
  - ✓ ICP from CPLANE which implements another NC
  - ✓ ScreamVue from NET.com which implements the BAS NC
  - ✓ A small java RM from FTR&D to handle the inter-domain
  
- ⇒ IQ-Man product have to be adapted to SLS and XML.
  - ✓ They provide an SDK to use their private protocol
  - ✓ SM-RM interface have been developed based on a tomcat web server
  - ✓ RM-RM interface has been developed based on a "dummy" IQ-Man
  
- ⇒ ICP and SCREAM products already have XML interface
  - ✓ XML format has been adapted to be in conformance with the CADENUS definition
  
- ⇒ OpenGK H323 gatekeeper has been modified to act as a SM
  - ✓ Interface with the RM has been added to the OpenH323 library

# IQ-Man adaptation



Courtesy of OPERAX AB.



- ⇒ We start doing some measurement
  - ✓ Available at the end of 2002
  
- ⇒ The bottleneck is actually located at the interface between the routers and the NC:
  - ✓ Cisco routers can only handle a few configuration per second (2-3/s)
  
- ⇒ Performance of platform (vendor product information)
  - ✓ IQ-Man can perform up to 10000 admission control per second without database storage
  - ✓ IQ-Man can perform up to 1000 admission control per second with database storage
  - ✓ But this fell to 2-3 per second if we configure Cisco routers
  - ✓ ScreamVue, which used IEEE P1520 interface, can perform up to 10-100 configuration per second



- ⇒ The CADENUS framework is well suited for QoS control driven by services
  - ✓ It is open, flexible and independent of the network technology

**BUT work is in progress**

- ⇒ To exchange SLA and SLS
  - ✓ There are many proposals AND we need only one standard
  - ✓ CADENUS uses eb-XML
  - ✓ COPS-SLS or Web-Services technology could be used
  - ✓ TEQUILA uses SLRN...

**CADENUS wants to publish its interface as a reference model**

- ⇒ To choose an appropriate flow process
  - ✓ Reference points are well identified : AM/SM, SM/RM, RM/NC
  - ✓ WHERE to open the architecture to 3rd parties ? Between SM/RM ? AM/SM ?
  - ✓ Who splits the first SLS ? Hub (SM) or Cascade (RM) flow process model ?

**Let the Service and Network Operators decide which is the most suitable one**

# NGN Architectures: ETSI and Cadenus current work

A. BRAJEUL  
France Telecom R&D

↓ **NGN Standardisation at the ETSI**

↓ SPAN

↓ **SPAN Architecture**

↓ Functional plane

↓ Functional entities

↓ **Cadenus Architecture**

↓ General framework

↓ Functional entities

- ↓ **ETSI wants to take a leading role in pushing for global consolidation of NGN standardisation**
  - ↓ NGN Implementation Group (NGN-IG)
  
- ↓ **6 specific NGN technical areas:**
  - ↓ architecture and protocols,
  - ↓ end-to-end QoS,
  - ↓ service platforms,
  - ↓ network management,
  - ↓ lawful interception,
  - ↓ security.

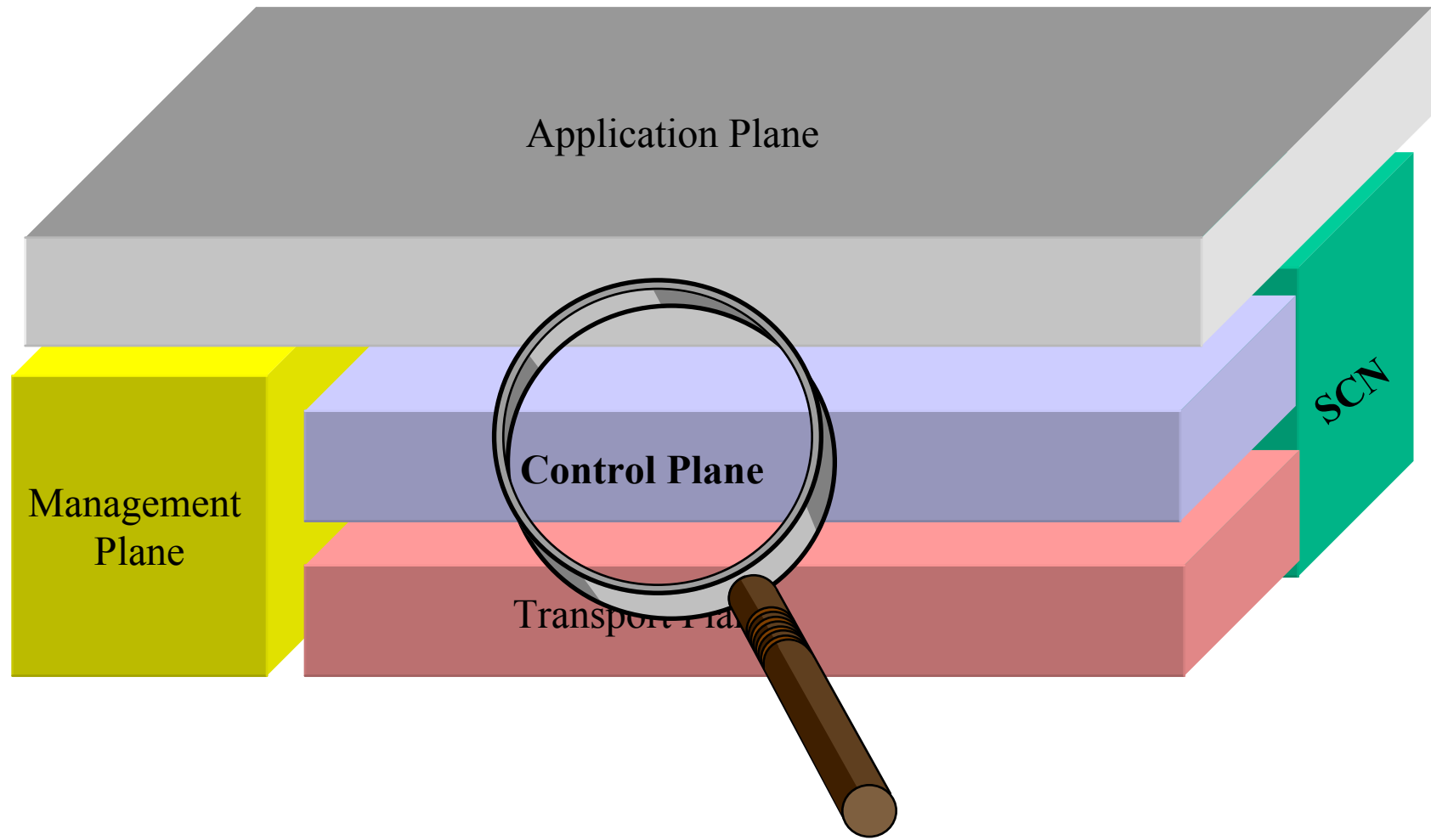
↓ **SPAN: *Services and Protocols for Advanced Network***

- ↓ To contribute to the working domain addressing the subject of architecture and protocols

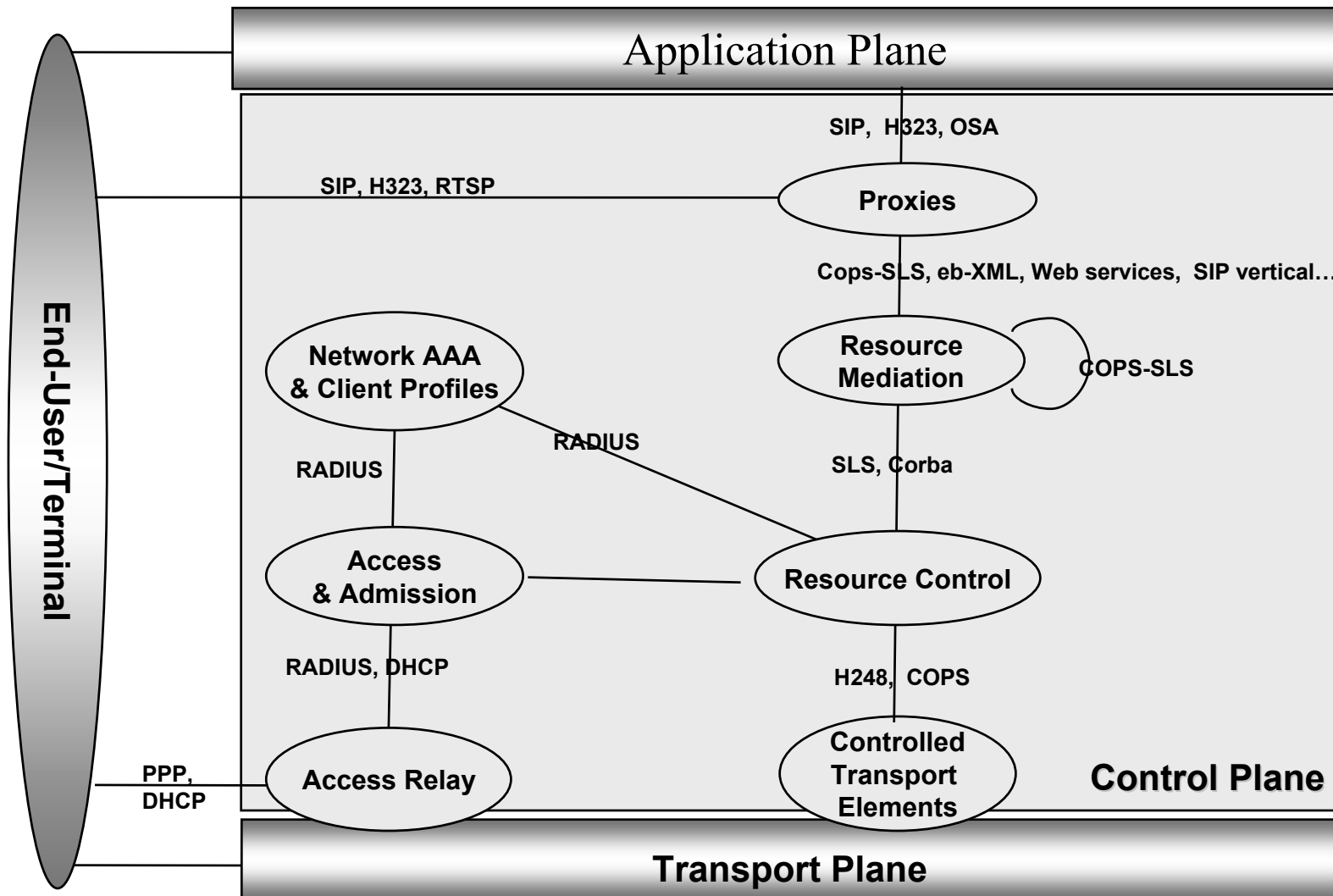
↓ **A contribution from France Telecom R&D to the SPAN Technical Committee**

- ↓ B.Chatras – September 2002
- ↓ To describe a technology independent functional architecture for supporting multimedia services in Next Generation Network
- ↓ A work in progress
- ↓ To be standardised in March 2003

# SPAN Architecture – Functional plane

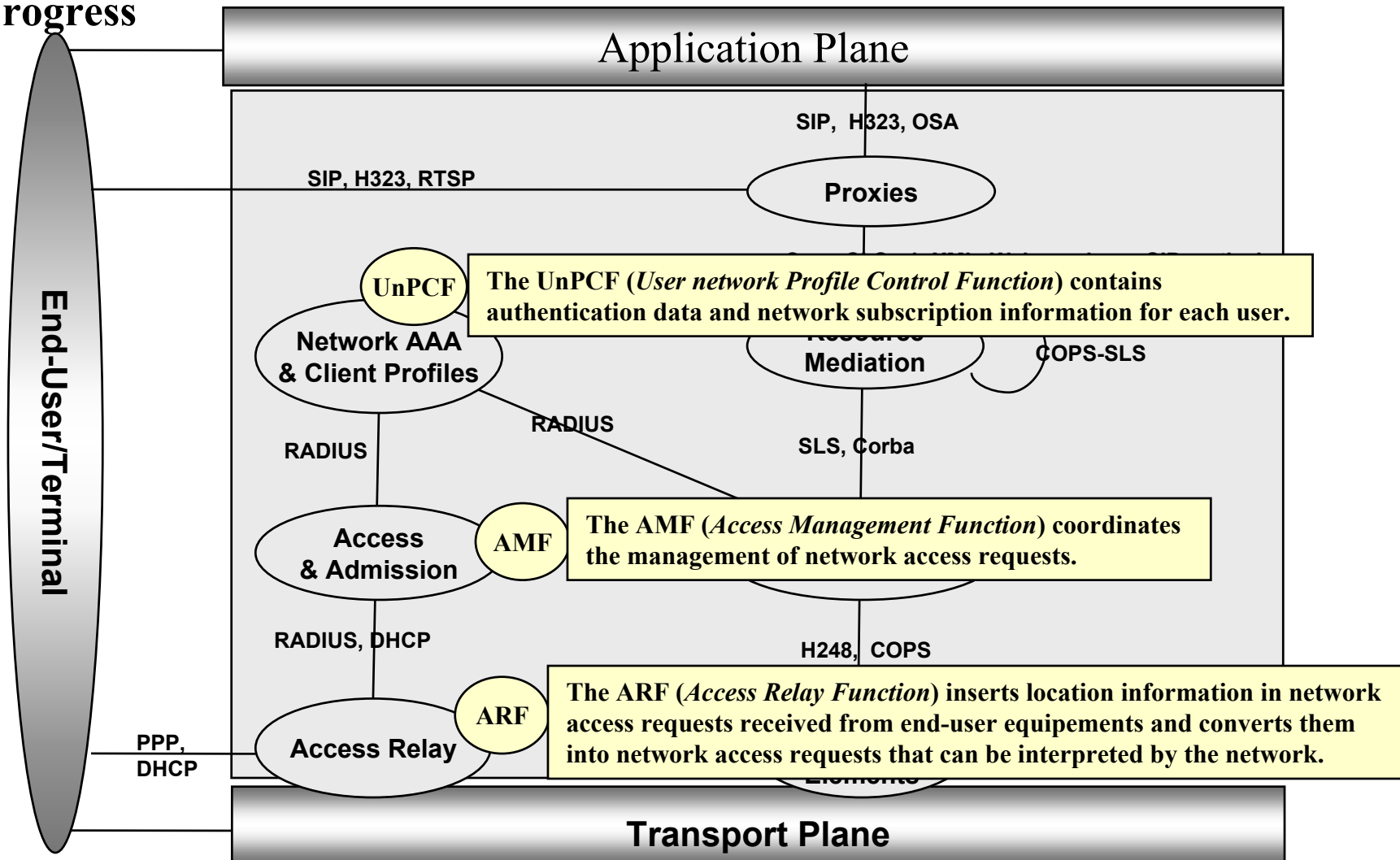


# SPAN Architecture – Functional entities



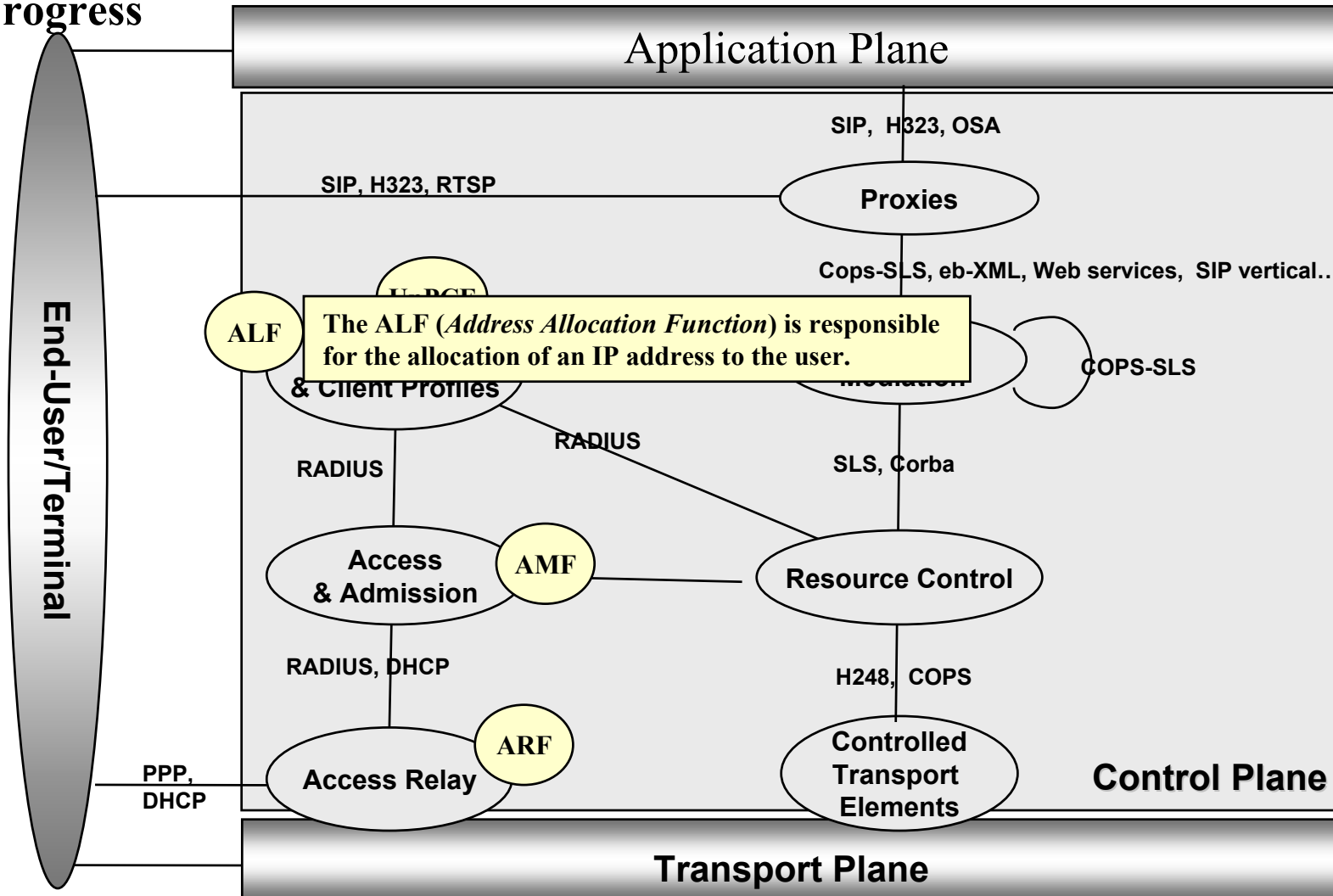
# SPAN Architecture – Functional entities

Work in progress



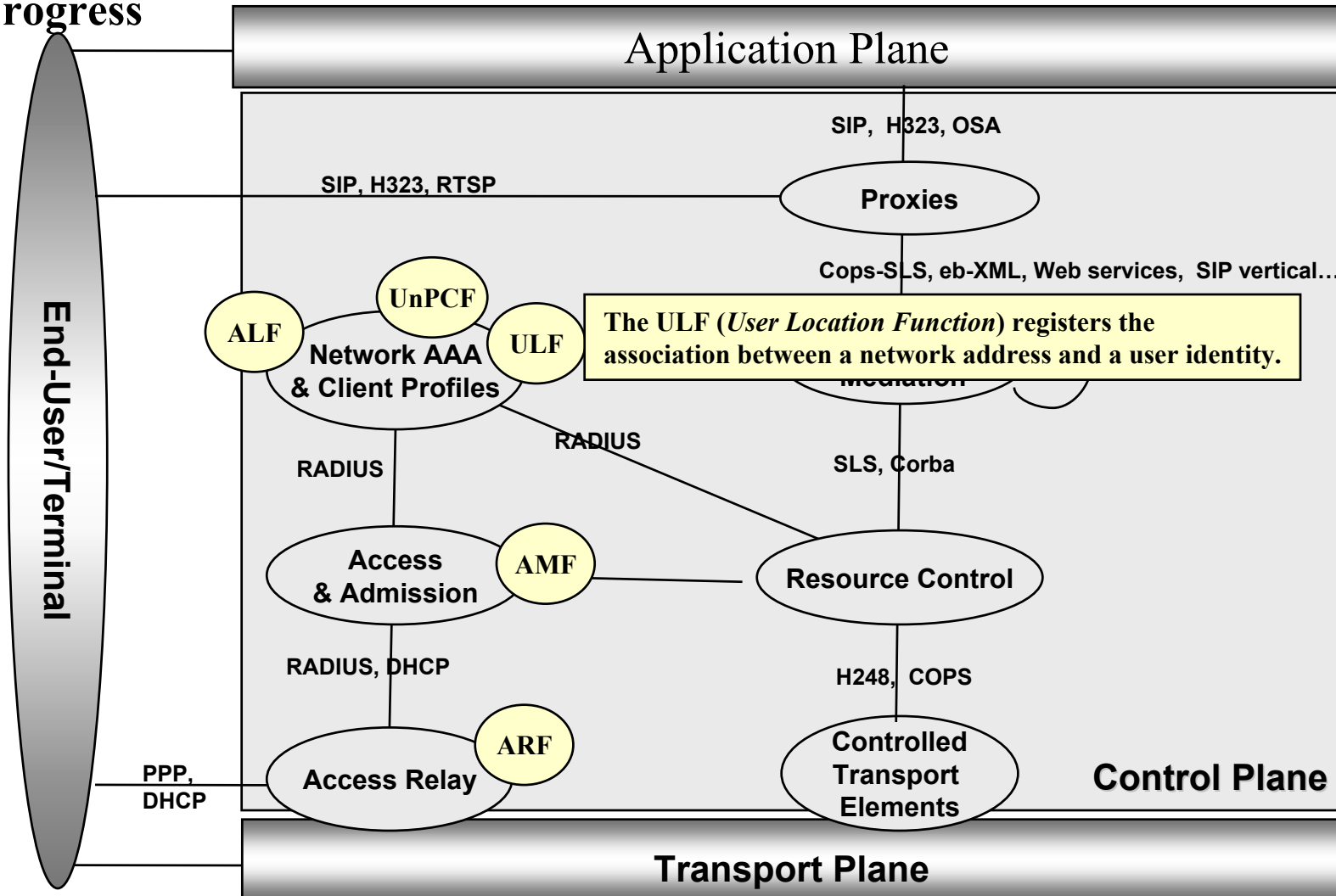
# SPAN Architecture – Functional entities

Work in  
progress



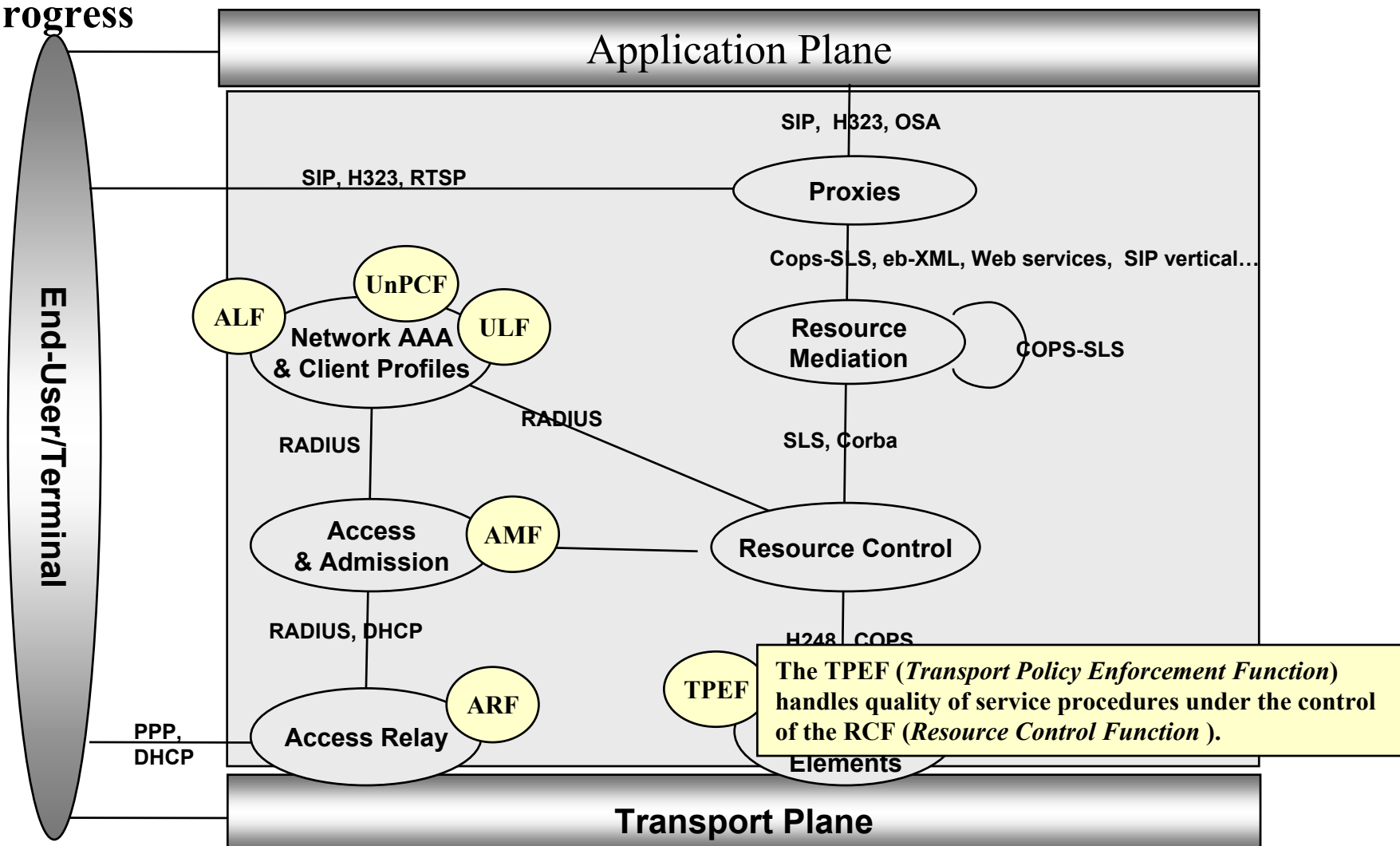
# SPAN Architecture – Functional entities

Work in progress



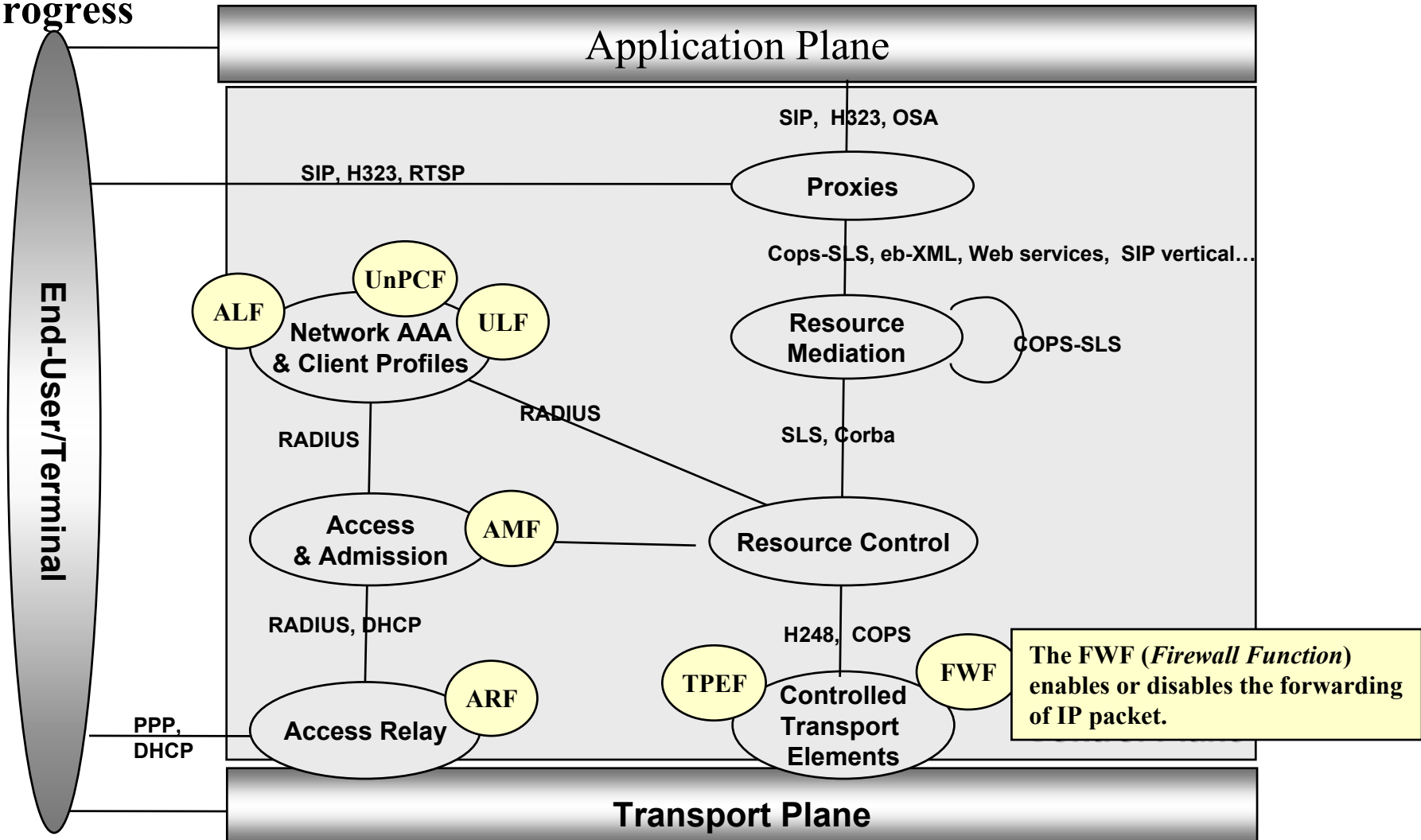
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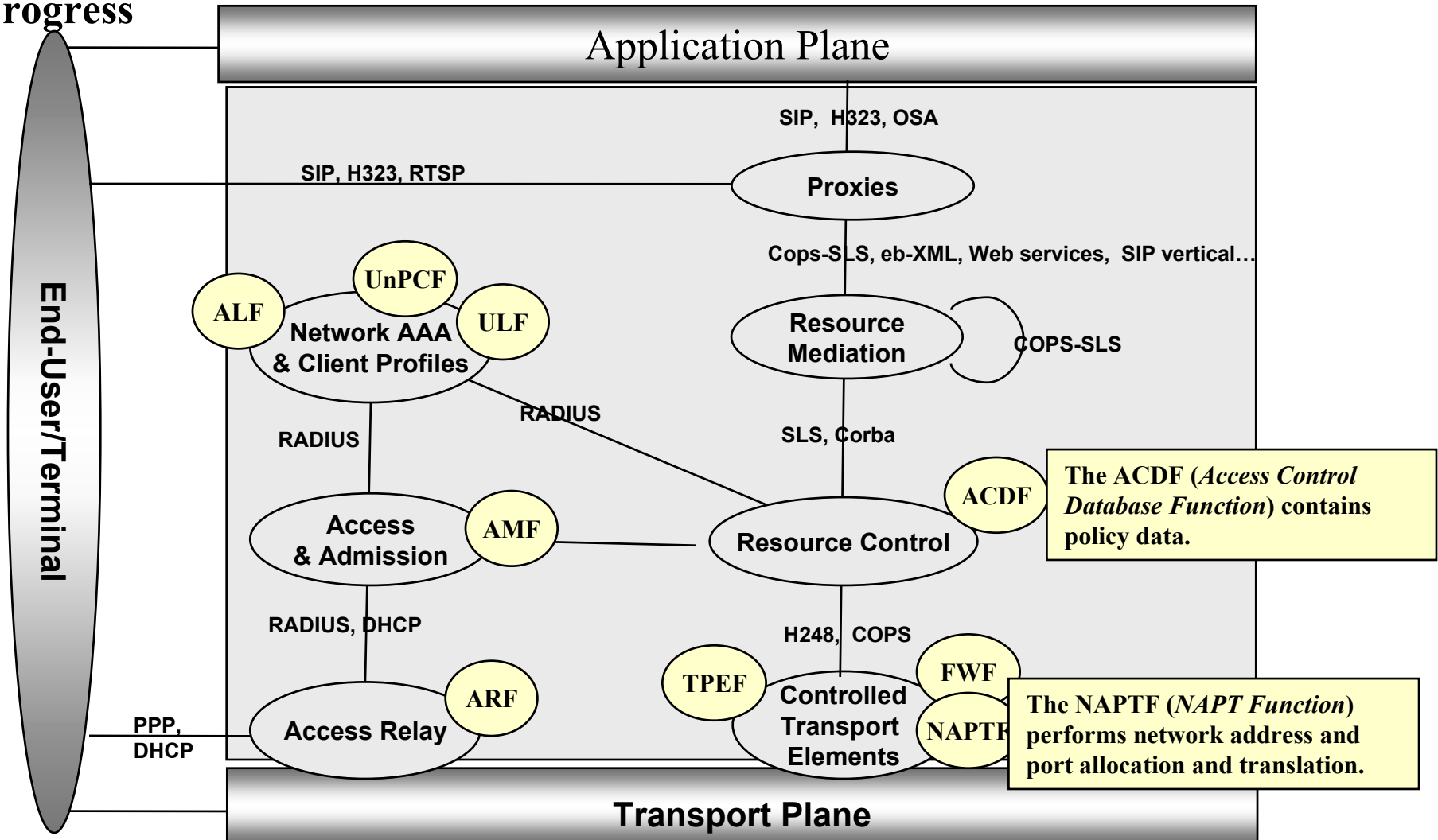
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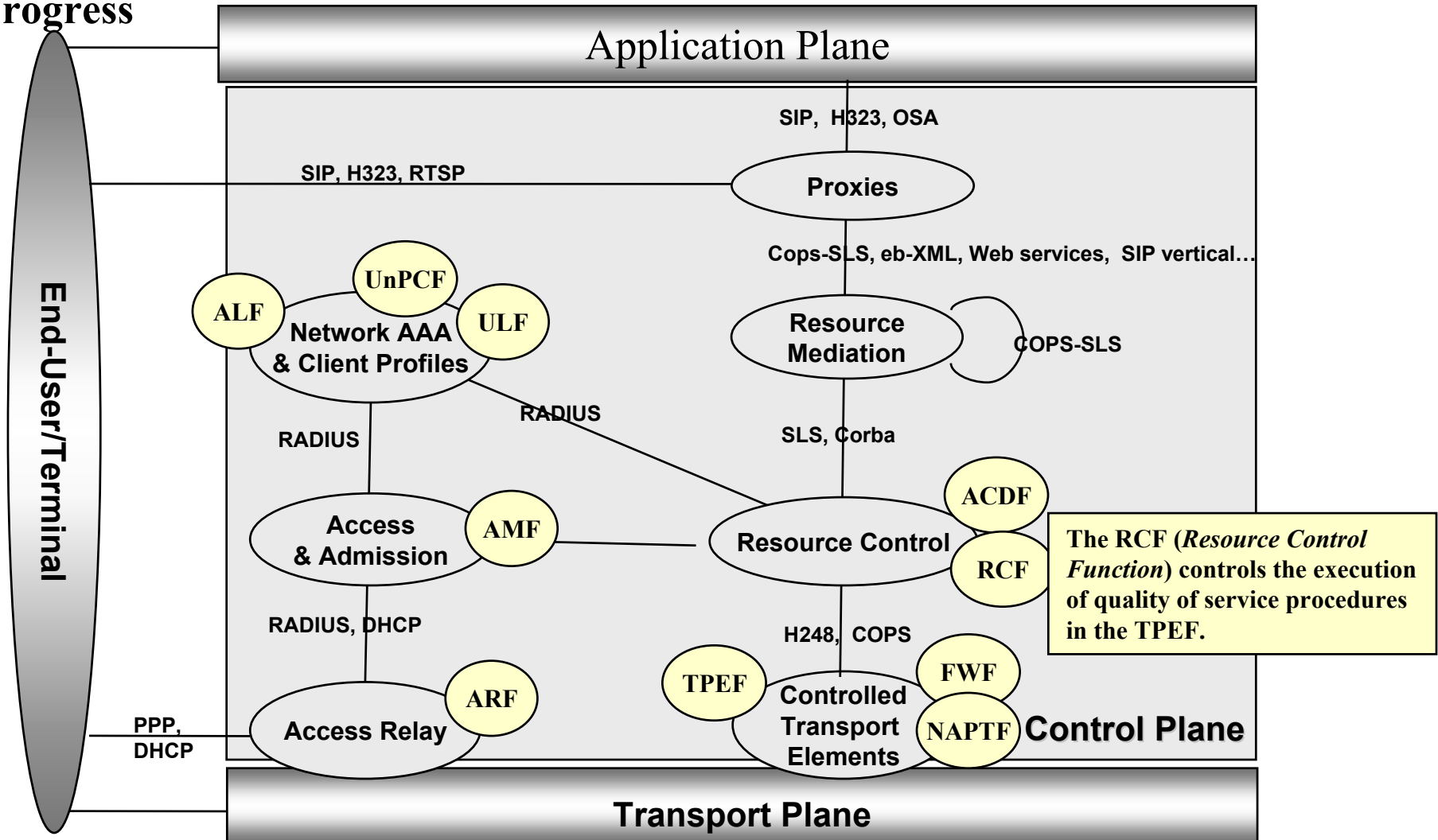
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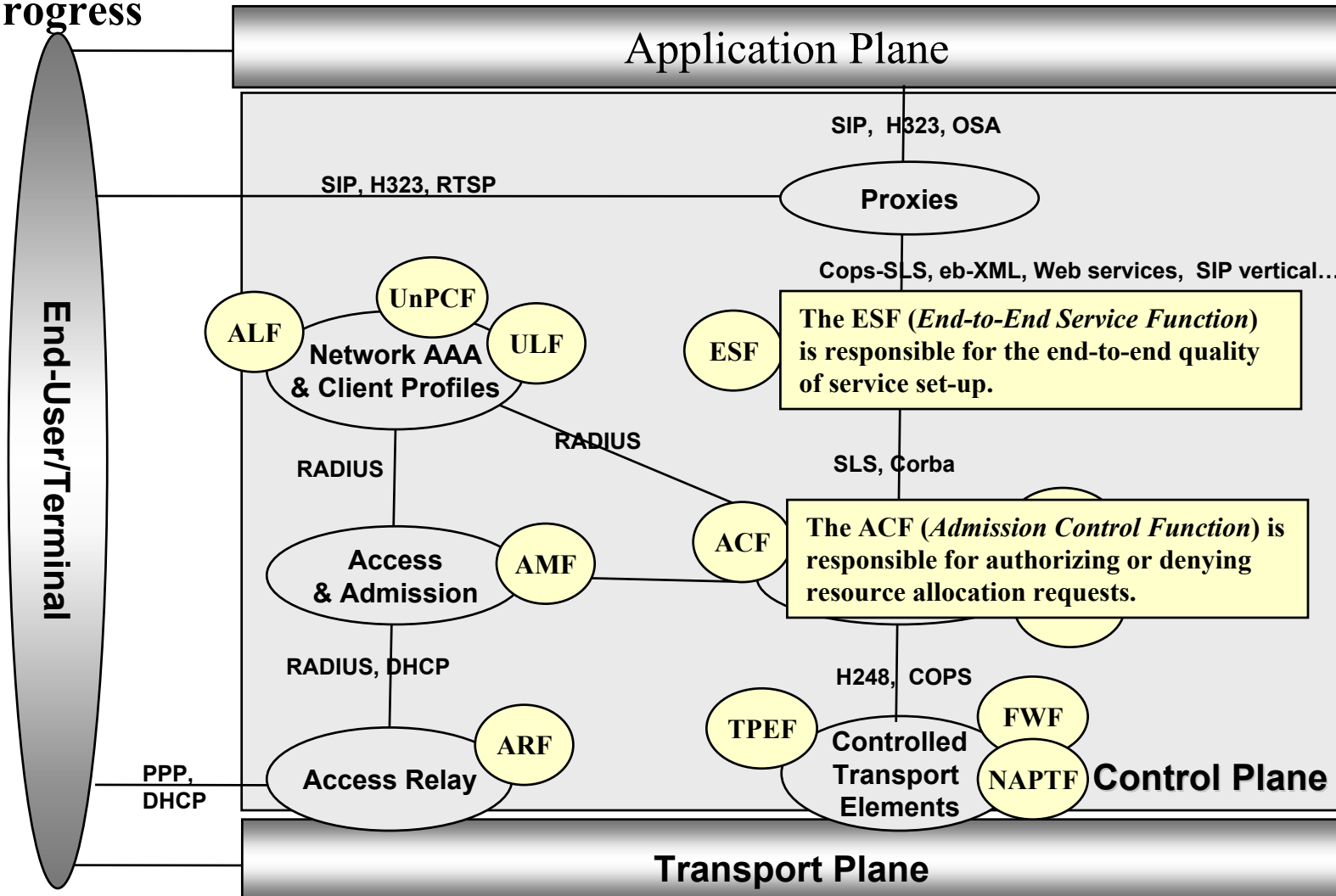
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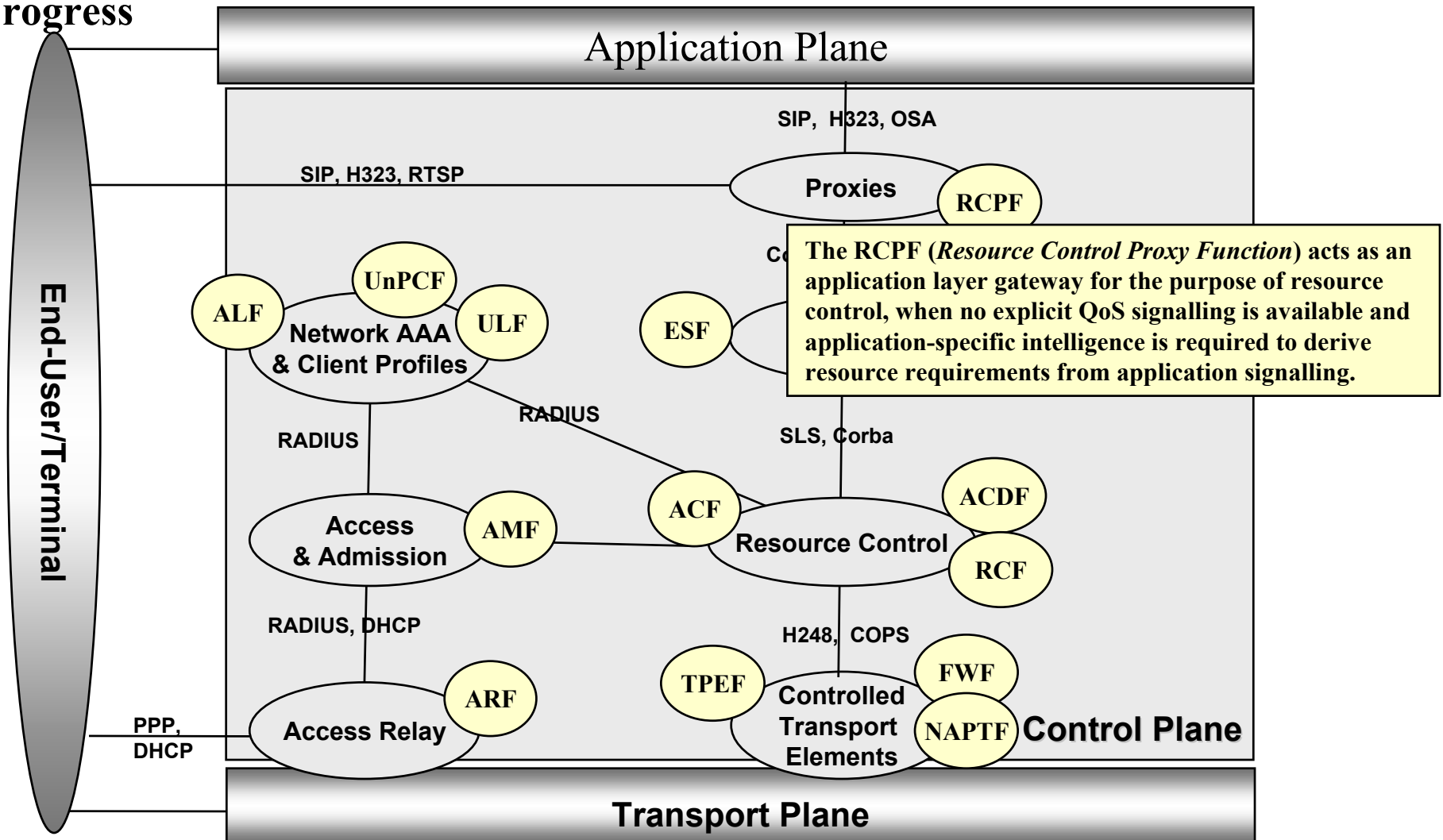
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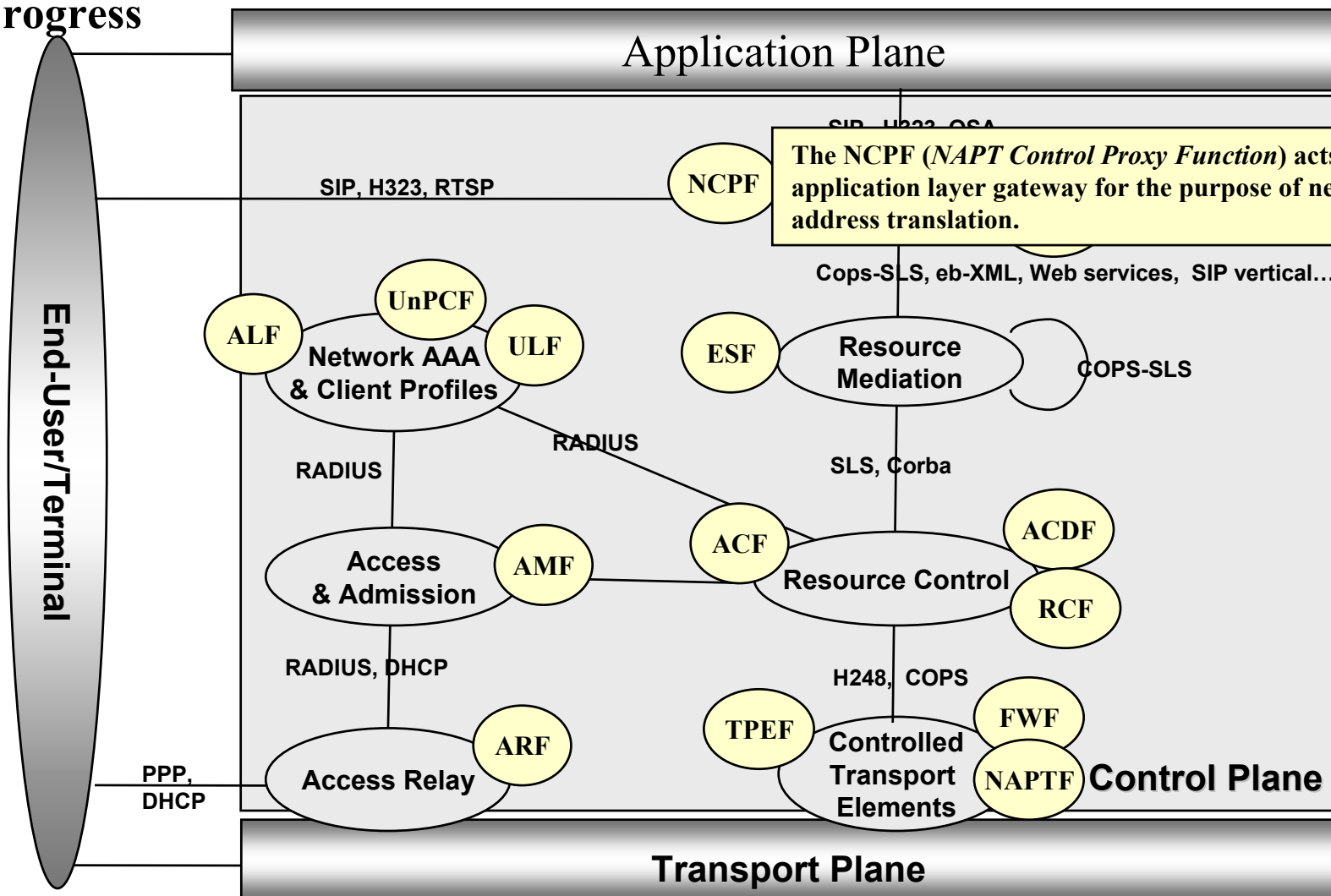
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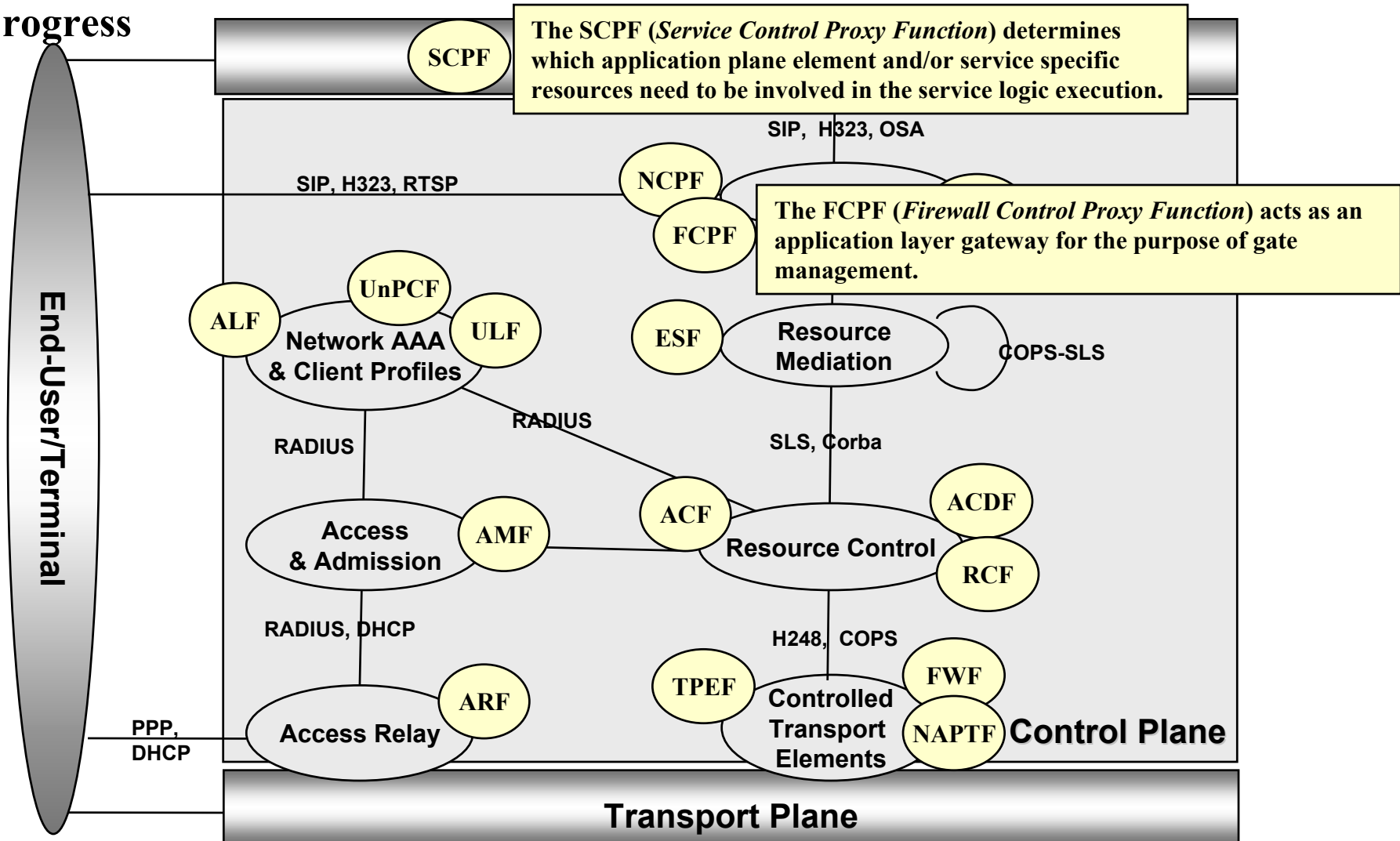
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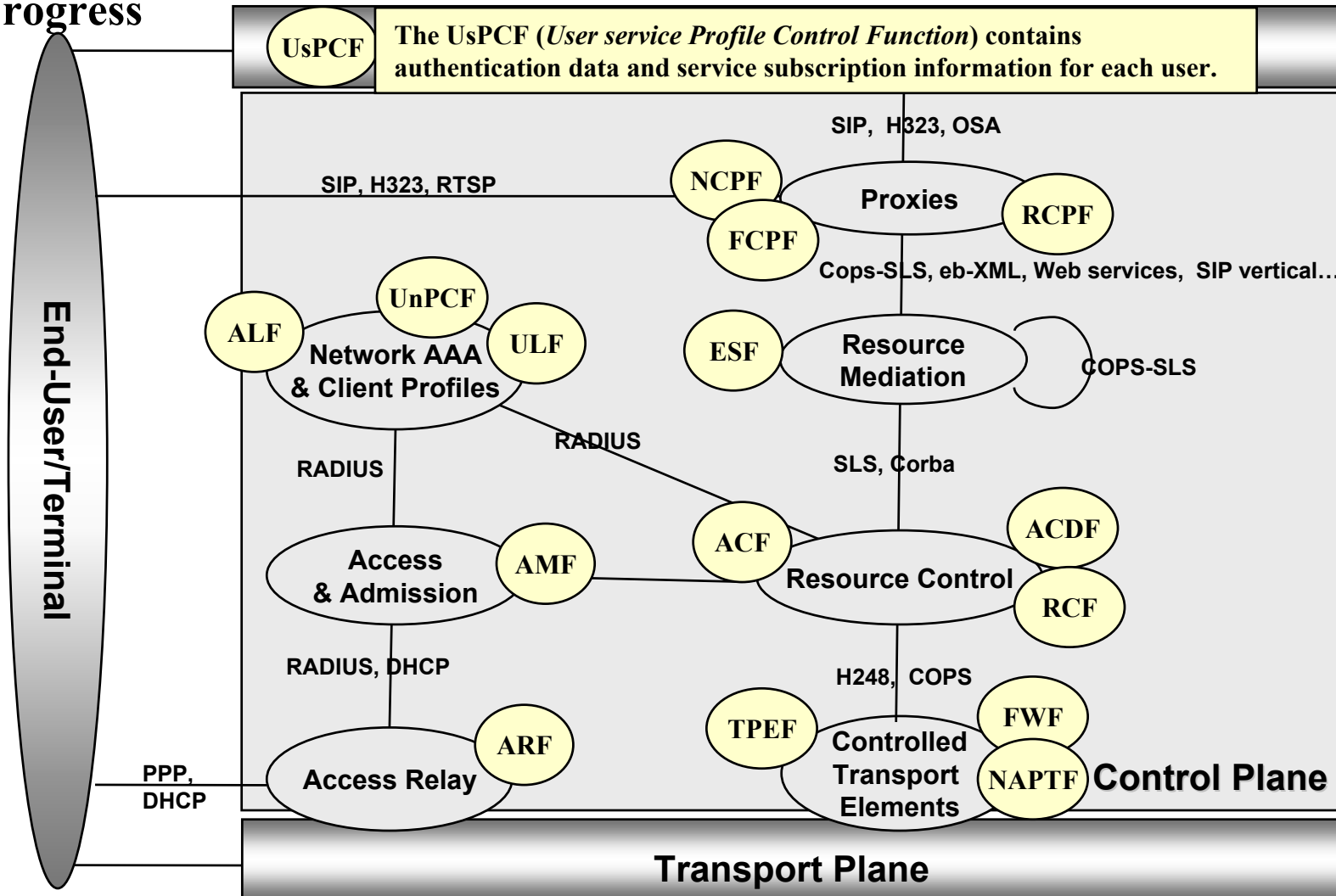
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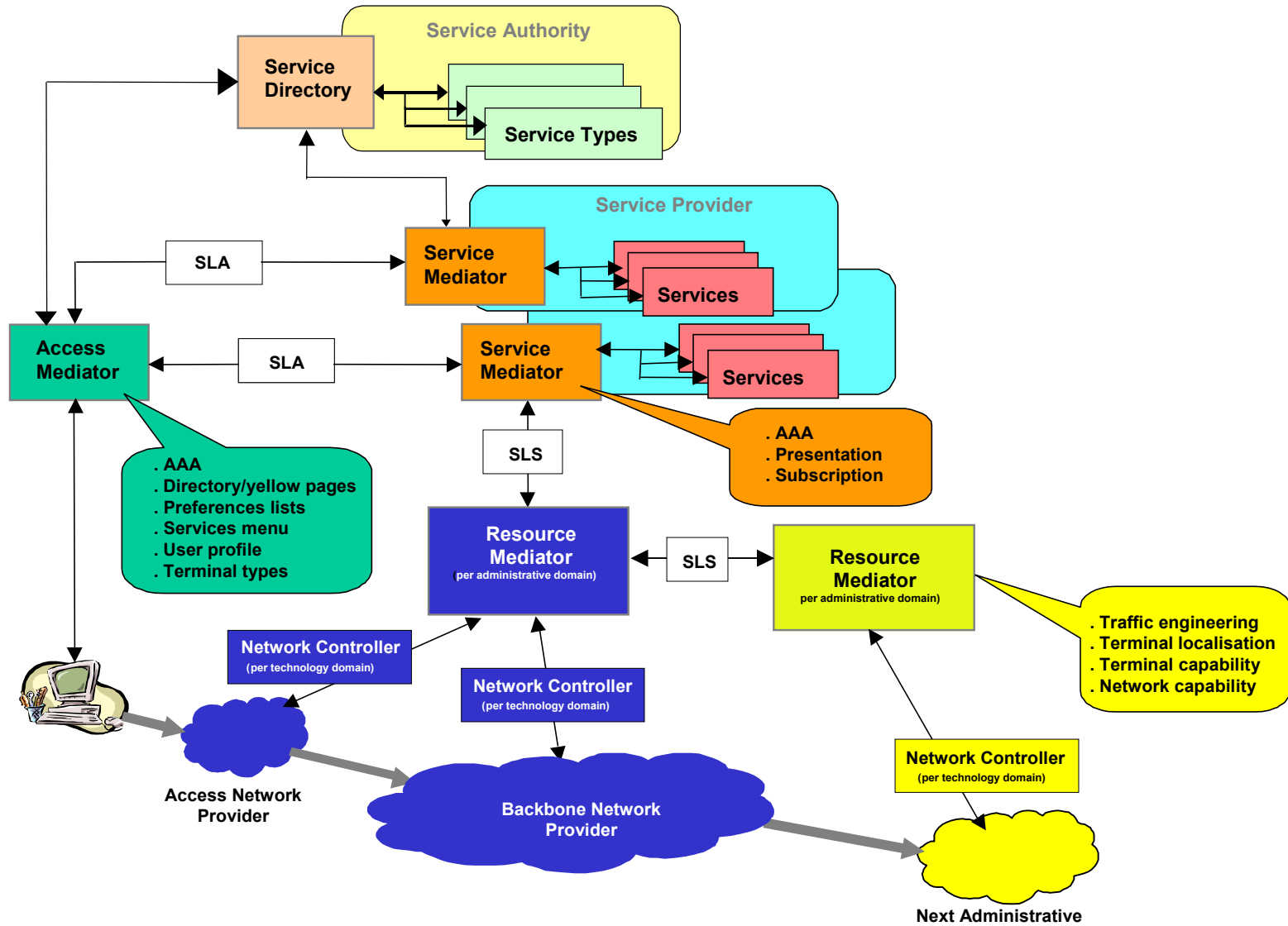
Work in progress



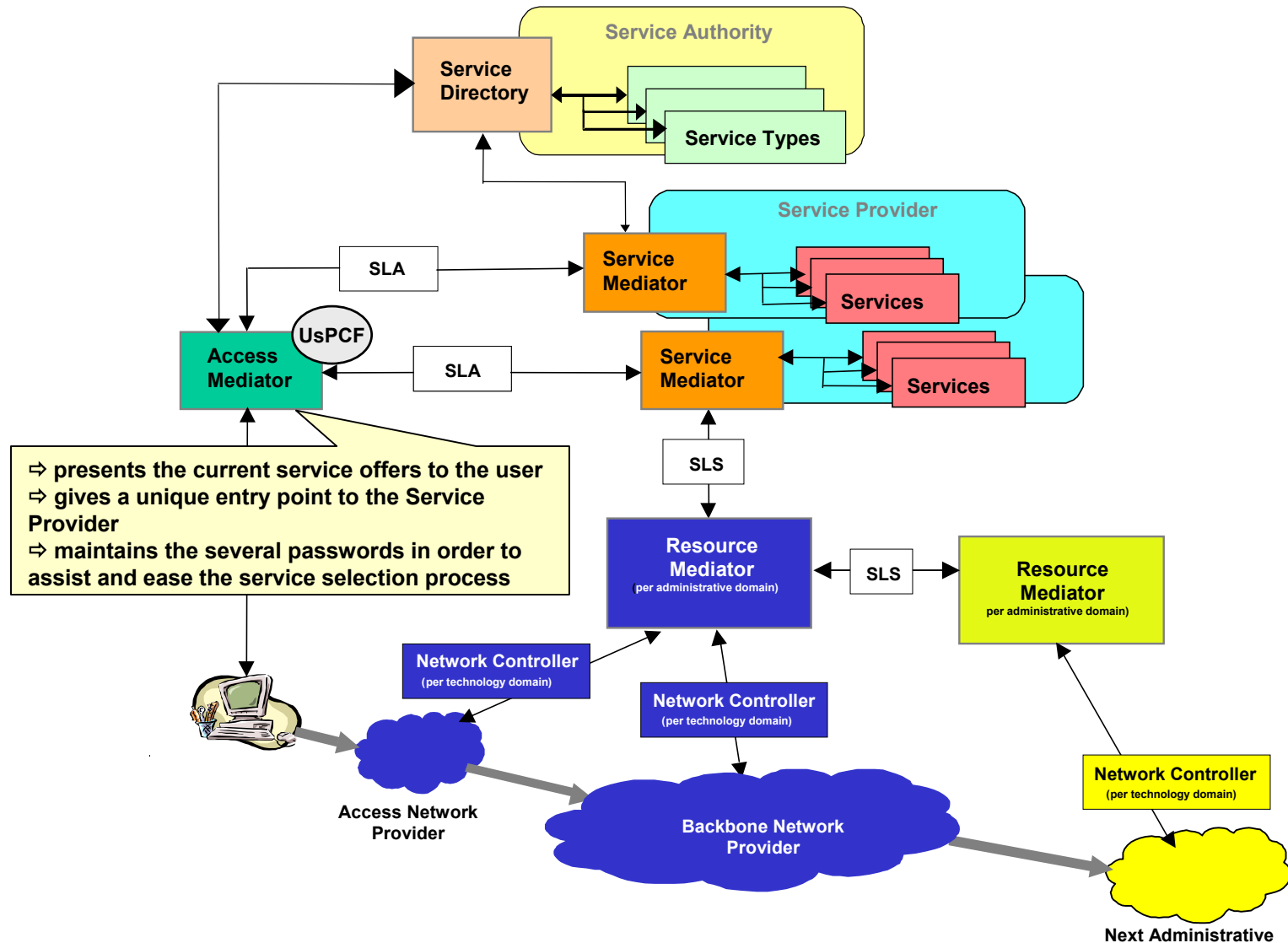
# SPAN Architecture – Functional entities

Work in progress

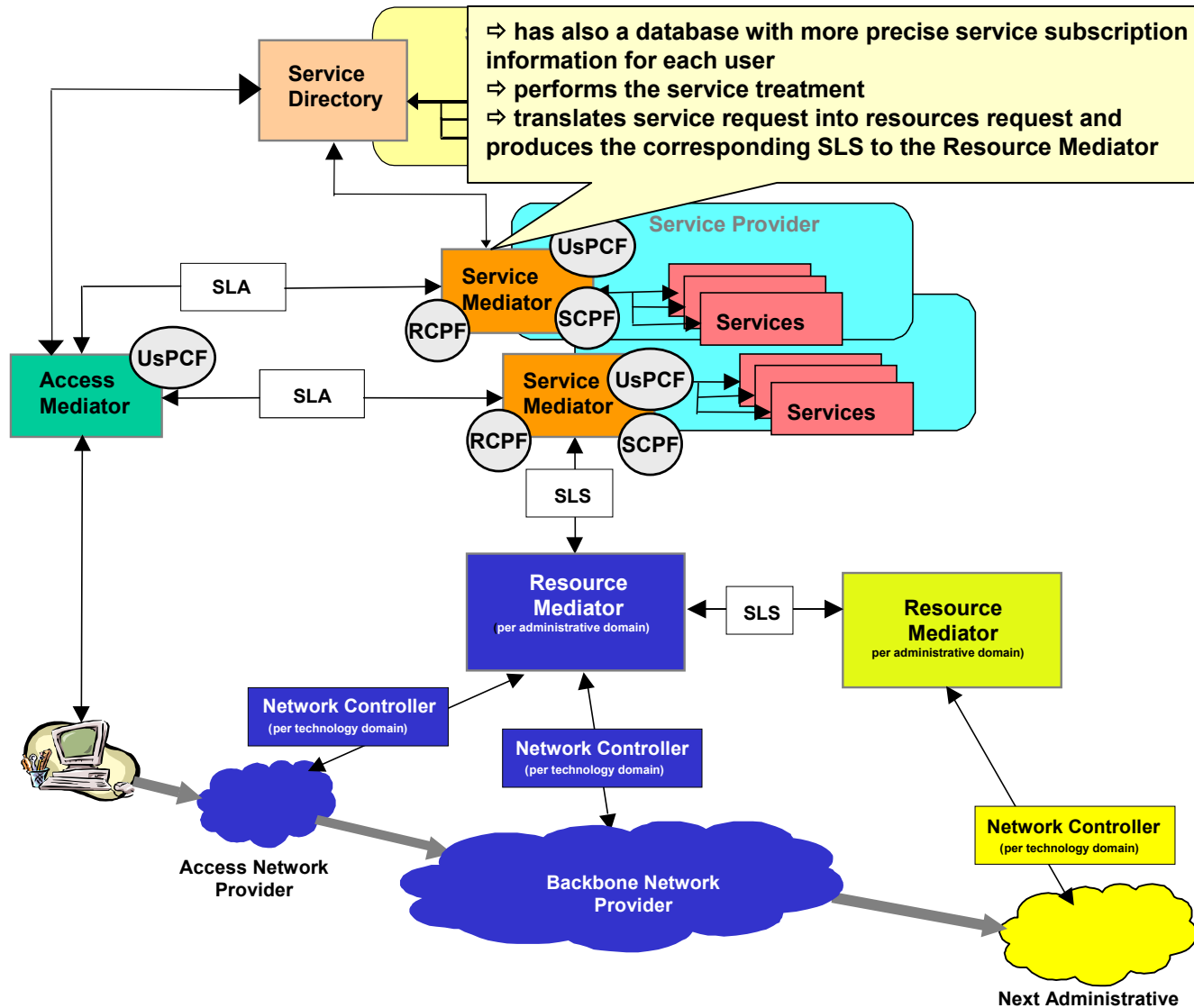




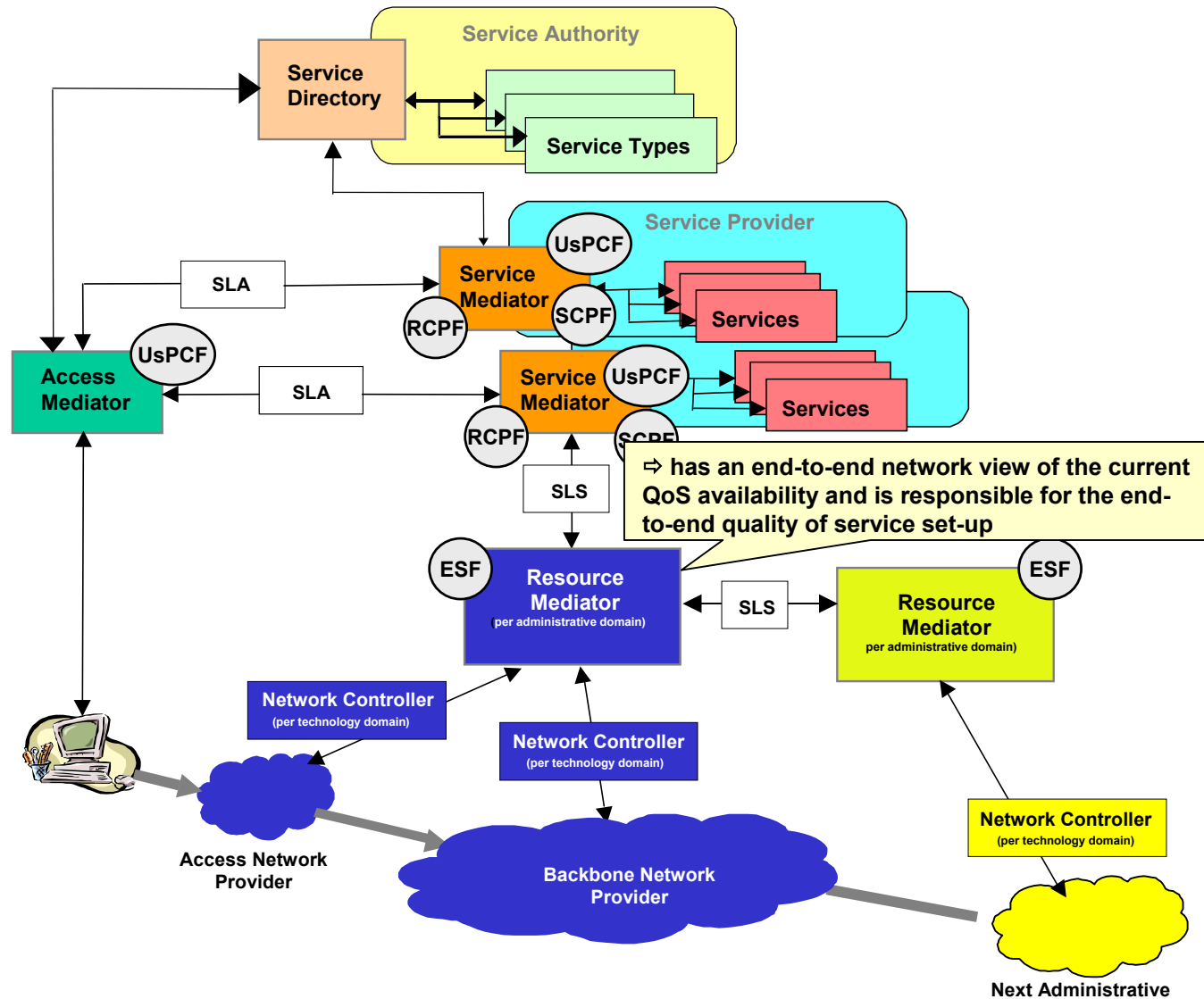
# Cadenus Architecture - Functional entities



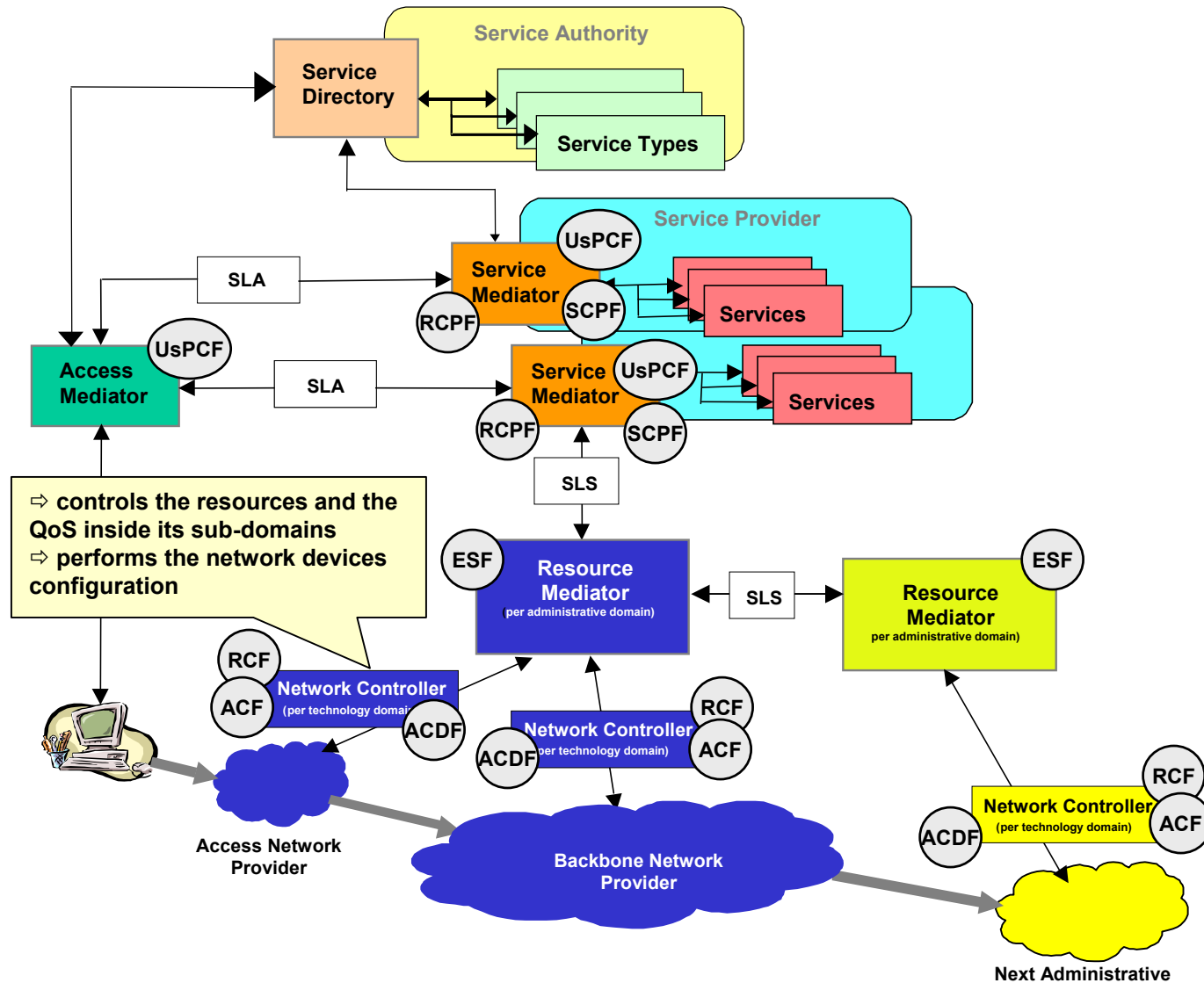
# Cadenus Architecture - Functional entities



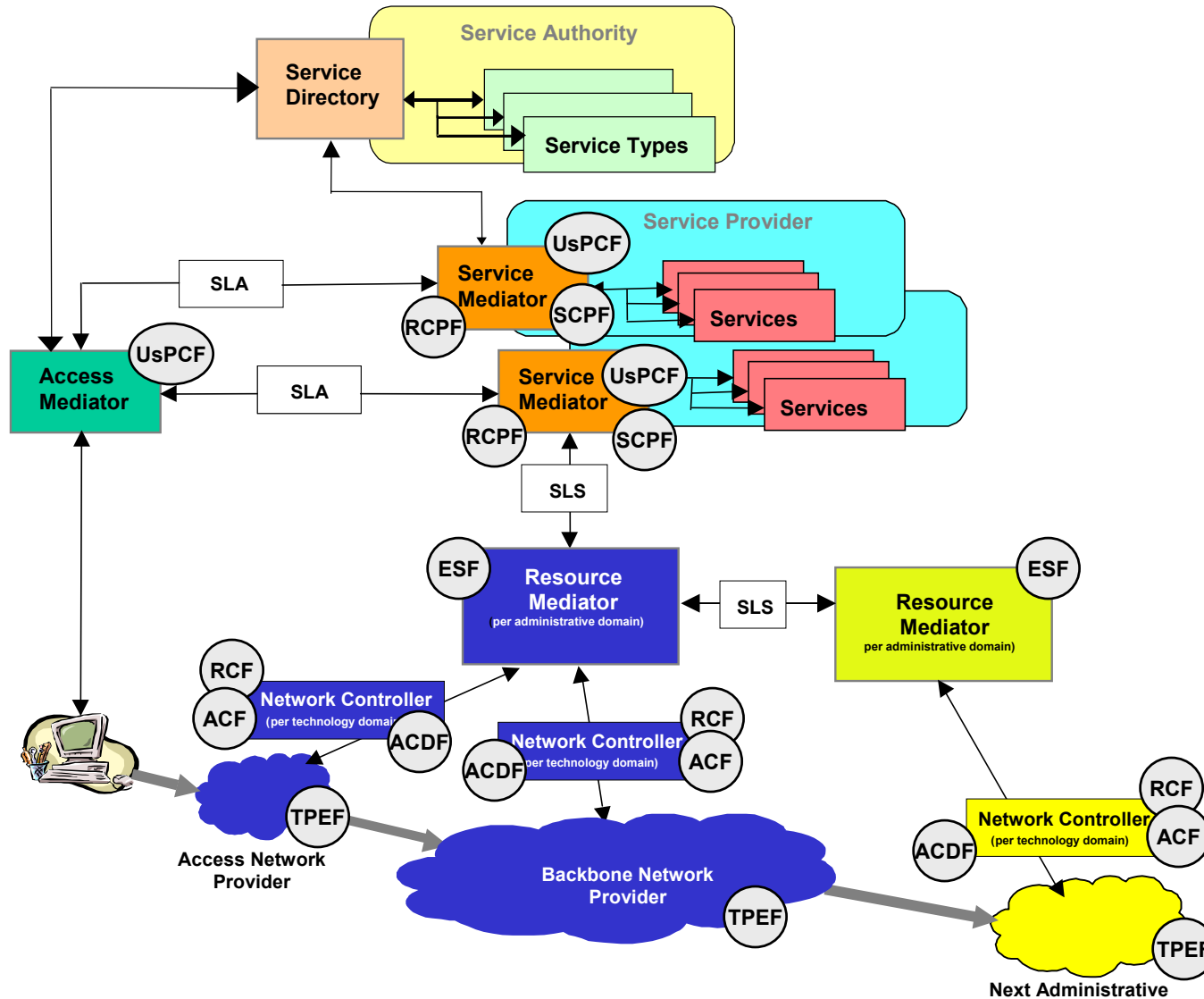
# Cadenus Architecture - Functional entities



# Cadenus Architecture - Functional entities



# Cadenus Architecture - Functional entities



- ↓ **Cadenus architecture is in compliance with SPAN NGN Architecture.**
- ↓ **SPAN NGN Architecture is under study. This contribution is a work in progress. The functional entities are not standardised at the moment.**
- ↓ **The contribution aims to identify the functional entities which are contained in the Control Plane, in order to standardise them.**
- ↓ **A future work could be to identify the interfaces between these functional entities, in order to standardise these interfaces.**
- ↓ **Cadenus project aims at publishing the different interfaces between AM and SM, SM and RM, RM and NC in order to show how implement these interfaces.**

***Is there any question?***

# Cadenus and TMF model

**Krzysztof Samp**  
**(ITTI, Poland)**

- **TeleManagement Forum (TMF)**
- **TOM (Telecom Operations Map) and eTOM**
- **Mapping of Cadenus functional architecture to eTOM**
- **Conclusions**

# TeleManagement Forum

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- **Non-profit global consortium focused on Operations Support Systems (OSS) and management issues for the communications industry**
- **Mission - help service providers and network operators automate their business processes in a cost- and time-effective way**
- **Members of TM Forum:**
  - ✓ **service providers,**
  - ✓ **hardware and software suppliers**
  - ✓ **system integrators**
  - ✓ **network operators**
  - ✓ **etc.**

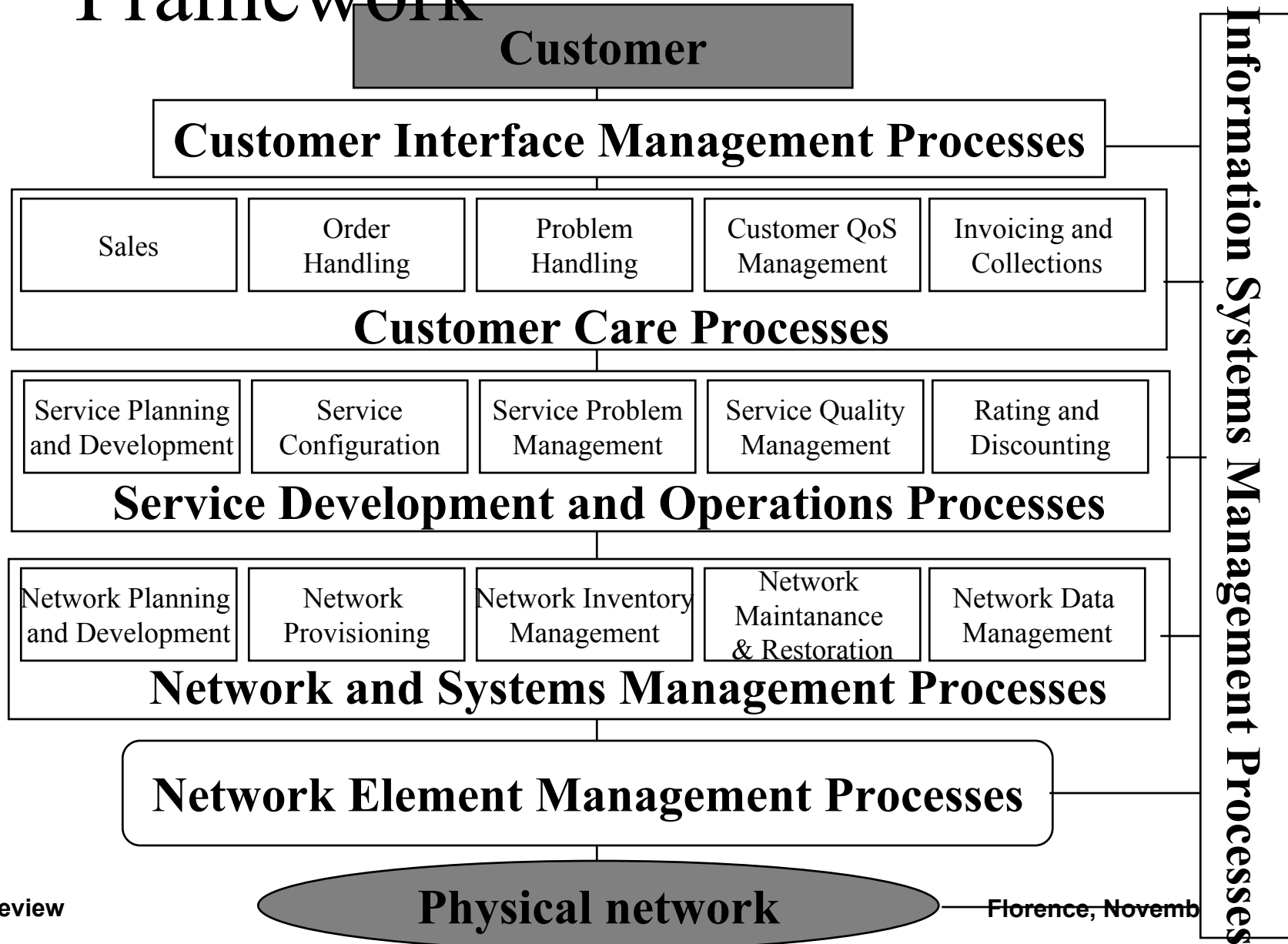
➤ **Key areas of interest:**

- ✓ New Generation Operations Systems and Software (NGOSS)
- ✓ Business Process Modeling and Automation
- ✓ Managing Next Generation Network Technologies
- ✓ Systems Integration and Implementation
- ✓ Service Management
- ✓ Web-Based Customer Care (E-Care) and Customer Relationship Management (CRM)

➤ **Selected results of work:**

- ✓ Telecom Operators Map (TOM) - industry's de facto standard to Business Process Automation
- ✓ SLA Handbook - assisting two parties to develop an SLA with practical view of fundamental issues

# TOM Business Process Framework

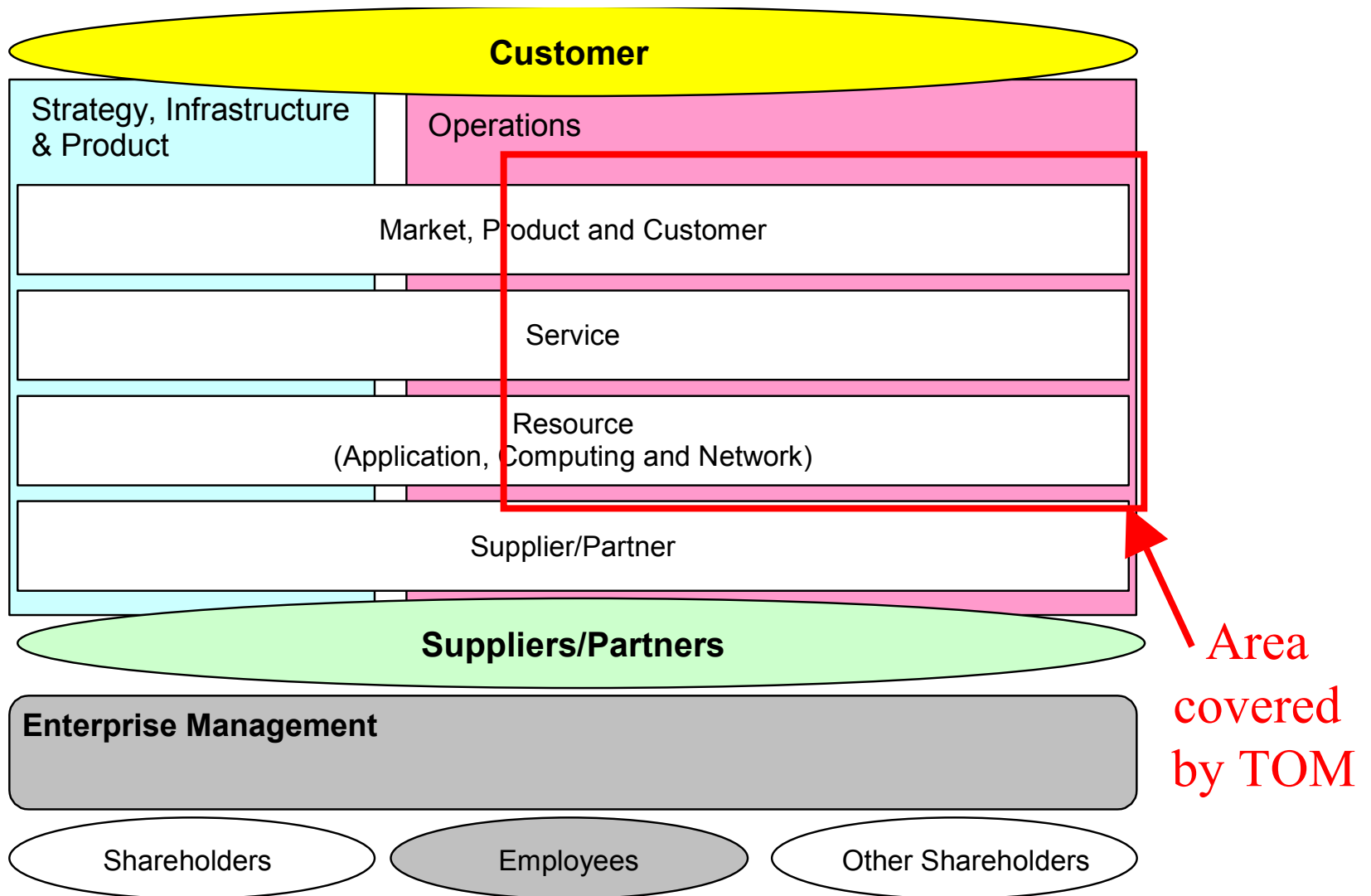


## ➤ Extension of TOM

- ✓ Enhanced
- ✓ Enterprise process
- ✓ eBusiness enabled
- ✓ Expanded
- ✓ Everything, Everywhere, Everytime
- ✓ Etc.

➤ **eTOM Business Process Framework is the ebusiness, enhanced TOM that addresses the total Service Provider enterprise**

# eTOM – Level 0 Processes



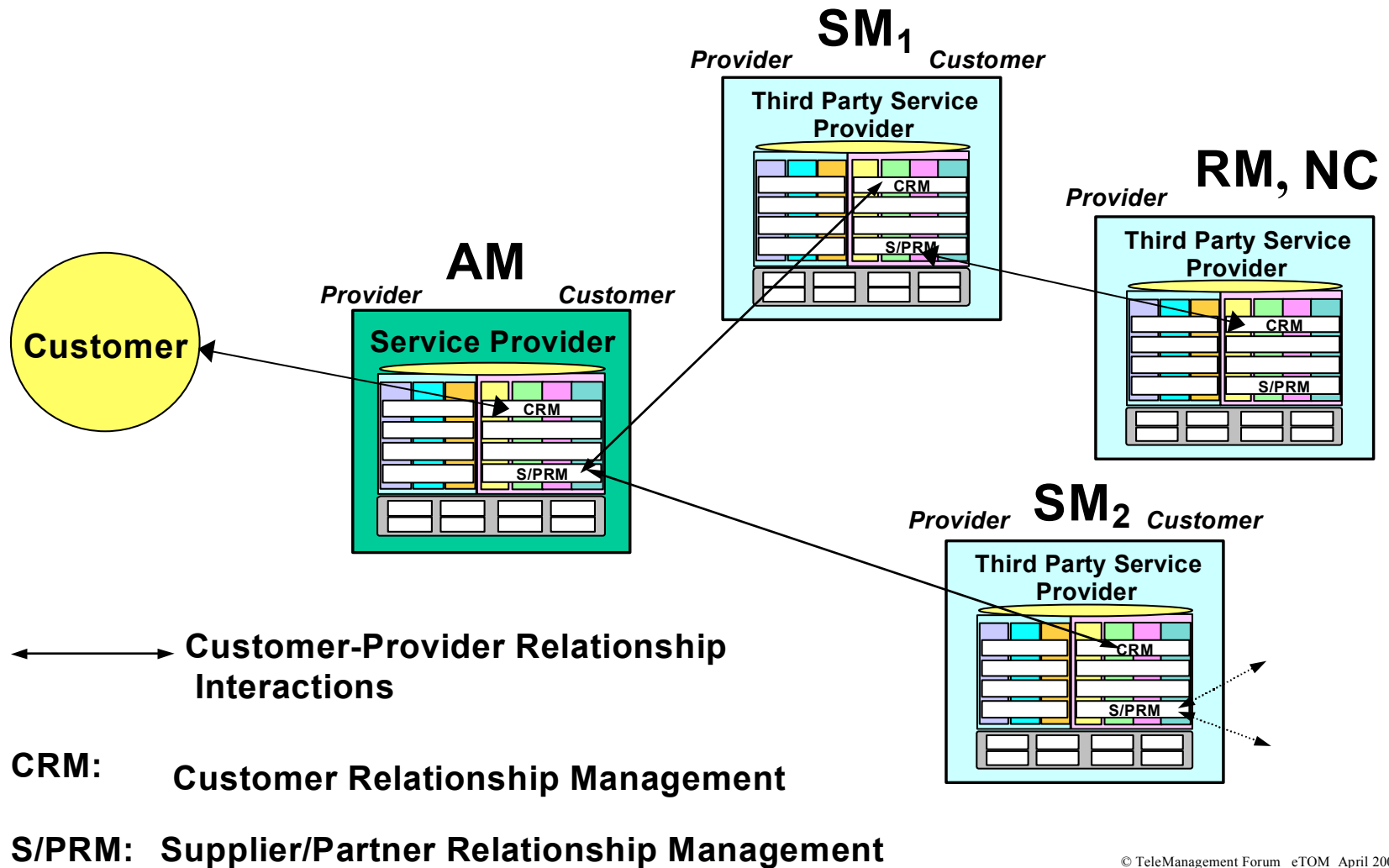
# Mapping Cadenus to eTOM

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## Reasons ?

- **Automation of processes:**
  - ✓ Cadenus architecture focuses on automation of service provisioning
  - ✓ Main aim of TMF – automation of crucial processes in operators' activity
- **High importance of TOM/eTOM**
  - ✓ integral part of NGOSS
  - ✓ good reference point in communication with operators and service providers (in dissemination activities)

# Example of business relationships



**Operations AM**

**Customer Relationship Mgm.**

CRM Operations Support & Process Mgm.	Sales & Channel Mgm.	Marketing Fulfillment Response	Selling	Problem Handling	Billing & Collection Mgm.
	CRM Operations Readiness		Order Handling	Customer QoS&SLA Mgm.	

Customer Interface Mgm.

Retention & Loyalty

**Service Mgm. & Operations**

SM&O Support & Process Mgm.	SM&O Readiness	Service Conf. & Activation	Service Problem Mgm.	Service & Specific Instance Reporting
			Service Quality Analysis, Action & Reporting	

**Resource Mgm. & Operations**

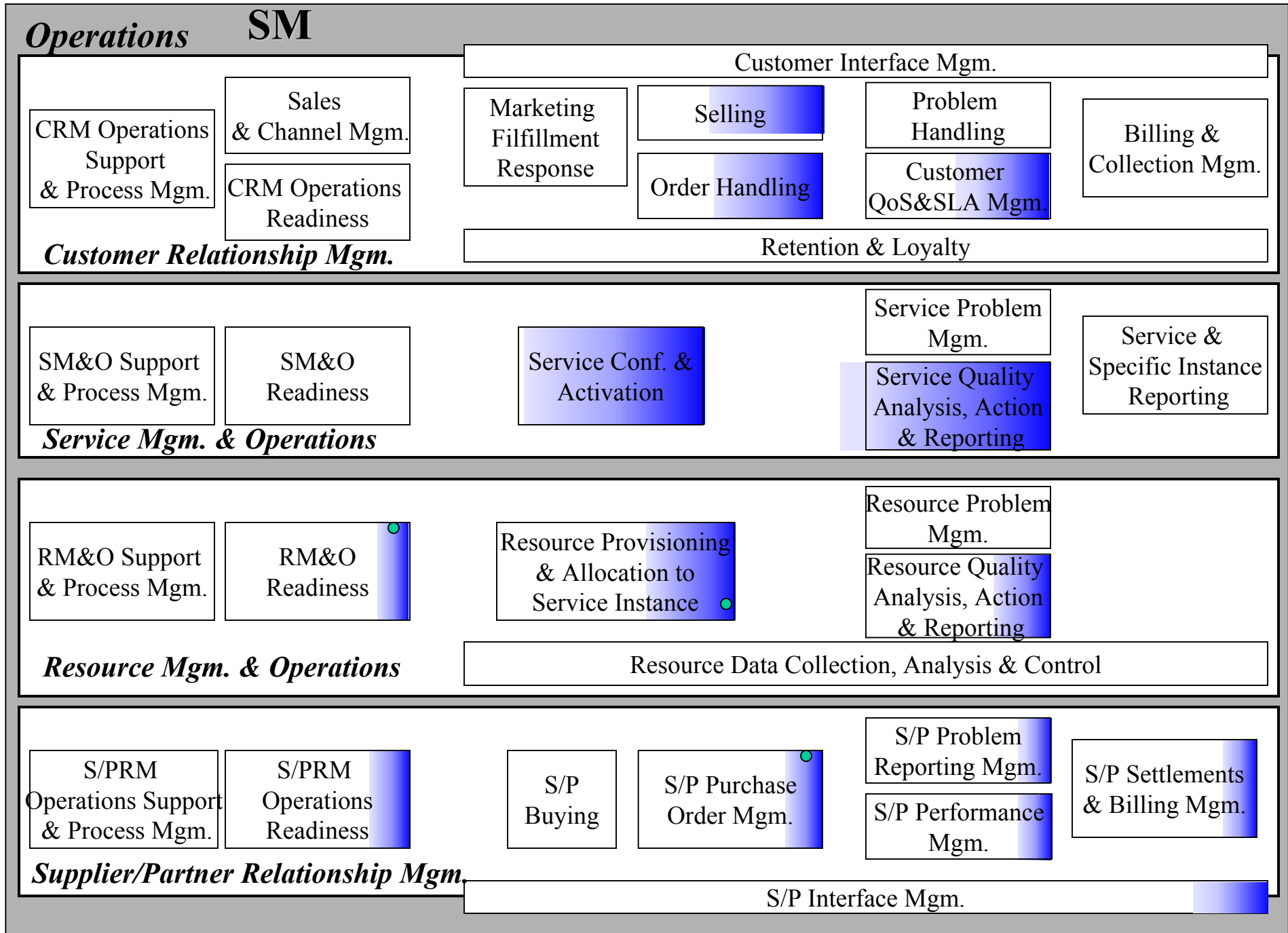
RM&O Support & Process Mgm.	RM&O Readiness	Resource Provisioning & Allocation to Service Instance	Resource Problem Mgm.
			Resource Quality Analysis, Action & Reporting

Resource Data Collection, Analysis & Control

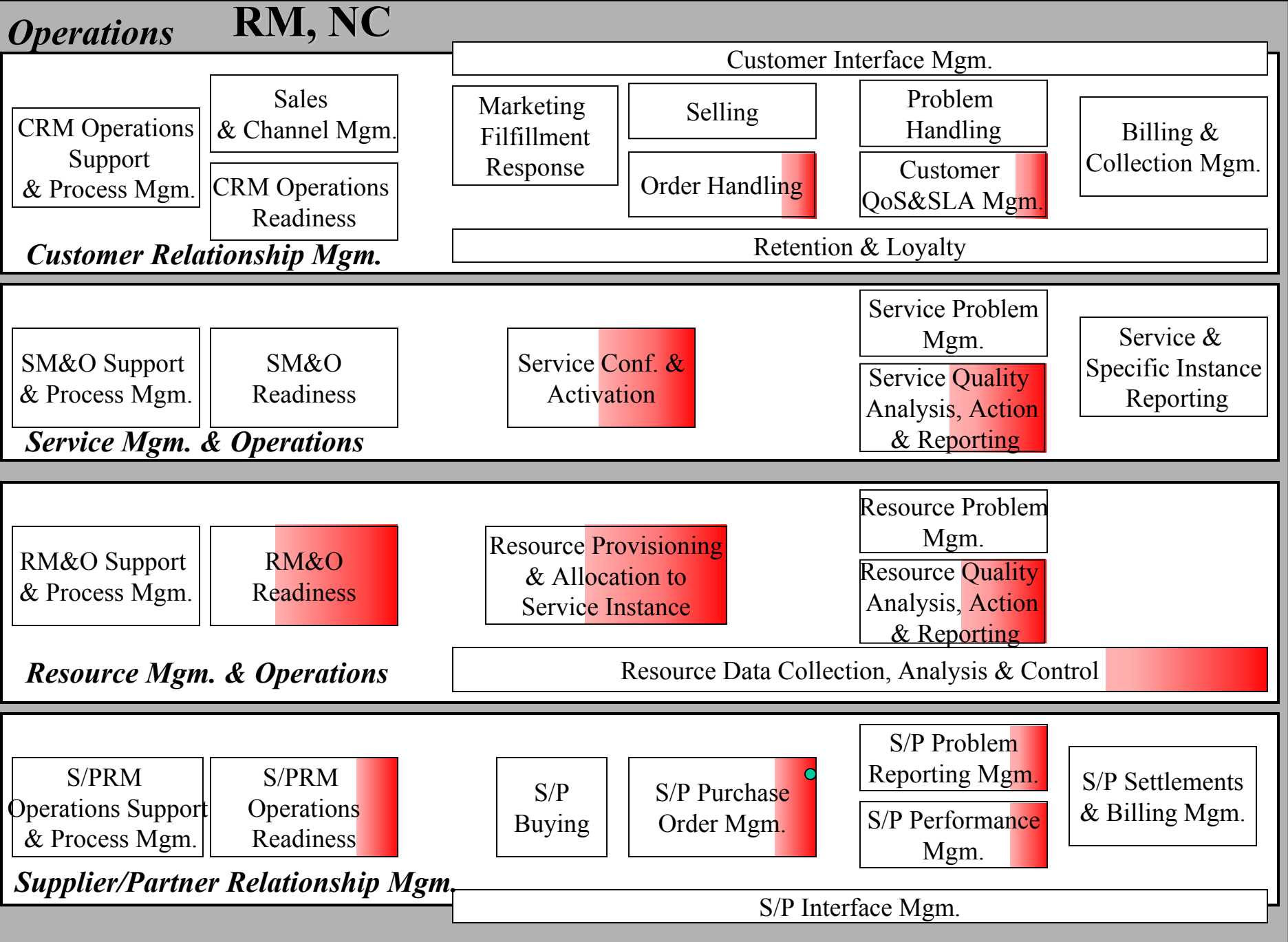
**Supplier/Partner Relationship Mgm.**

S/PRM Operations Support & Process Mgm.	S/PRM Operations Readiness	S/P Buying	S/P Purchase Order Mgm.	S/P Problem Reporting Mgm.	S/P Settlements & Billing Mgm.
				S/P Performance Mgm.	

S/P Interface Mgm.



● In HUB organizational model



● In CASCADE organizational model

# Strategy, Infrastructure & Product

# AM

Market Strategy & Policy

Product & Offer Portfolio Strategy, Policy & Planning

Product & Offer Business Planning & Commitment

Product & Offer Capability Delivery

Marketing Capability Delivery

CRM Capability Delivery

Product Development & Retirement

Sales & Channel Development

Marketing Communication & Promotion

Product, Marketing & Customer Perf. Assessment

## Marketing & Offer Mgm.

Service Strategy & Policy

Service Planning & Commitment

Service & Operations Capability Delivery

Service Development & Retirement

Service Performance Assessment

## Service Development & Mgm.

Resource & Techn. Strategy & Policy

Resource & Techn. Planning & Commitment

Resource & Operations Capability Delivery

Resource Development

Resource Performance Assessment

## Resource Development & Mgm.

Supply Chain Strategy & Policy

Supply Chain Planning & Commitment

Supply Chain Capability Availability

Supply Chain Development & Change Mgm.

Supply Chain Performance Assessment

## Supply Chain Development & Mgm.

# Strategy, Infrastructure & Product

# SM

Market Strategy & Policy

Product & Offer Portfolio Strategy, Policy & Planning

Product & Offer Business Planning & Commitment

Product & Offer Capability Delivery

Marketing Capability Delivery

CRM Capability Delivery

Product Development & Retirement

Sales & Channel Development

Marketing Communication & Promotion

Product, Marketing & Customer Perf. Assessment

## Marketing & Offer Mgm.

Service Strategy & Policy

Service Planning & Commitment

Service & Operations Capability Delivery

Service Development & Retirement

Service Performance Assessment

## Service Development & Mgm.

Resource & Techn. Strategy & Policy

Resource & Techn. Planning & Commitment

Resource & Operations Capability Delivery

Resource Development

Resource Performance Assessment

## Resource Development & Mgm.

Supply Chain Strategy & Policy

Supply Chain Planning & Commitment

Supply Chain Capability Availability

Supply Chain Development & Change Mgm.

Supply Chain Performance Assessment

## Supply Chain Development & Mgm.

**Strategy, Infrastructure & Product**

**RM , NC**

Market Strategy & Policy

Product & Offer Profotlio Strategy, Policy & Planning

Product & Offer Business Planning & Commitment

Product & Offer Capability Delivery

Marketing Capability Delivery

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Resource Development

Resource Performance Assessment

**Resource Development & Mgm.**

Supply Chain Strategy & Policy

Supply Chain Planning & Commitment

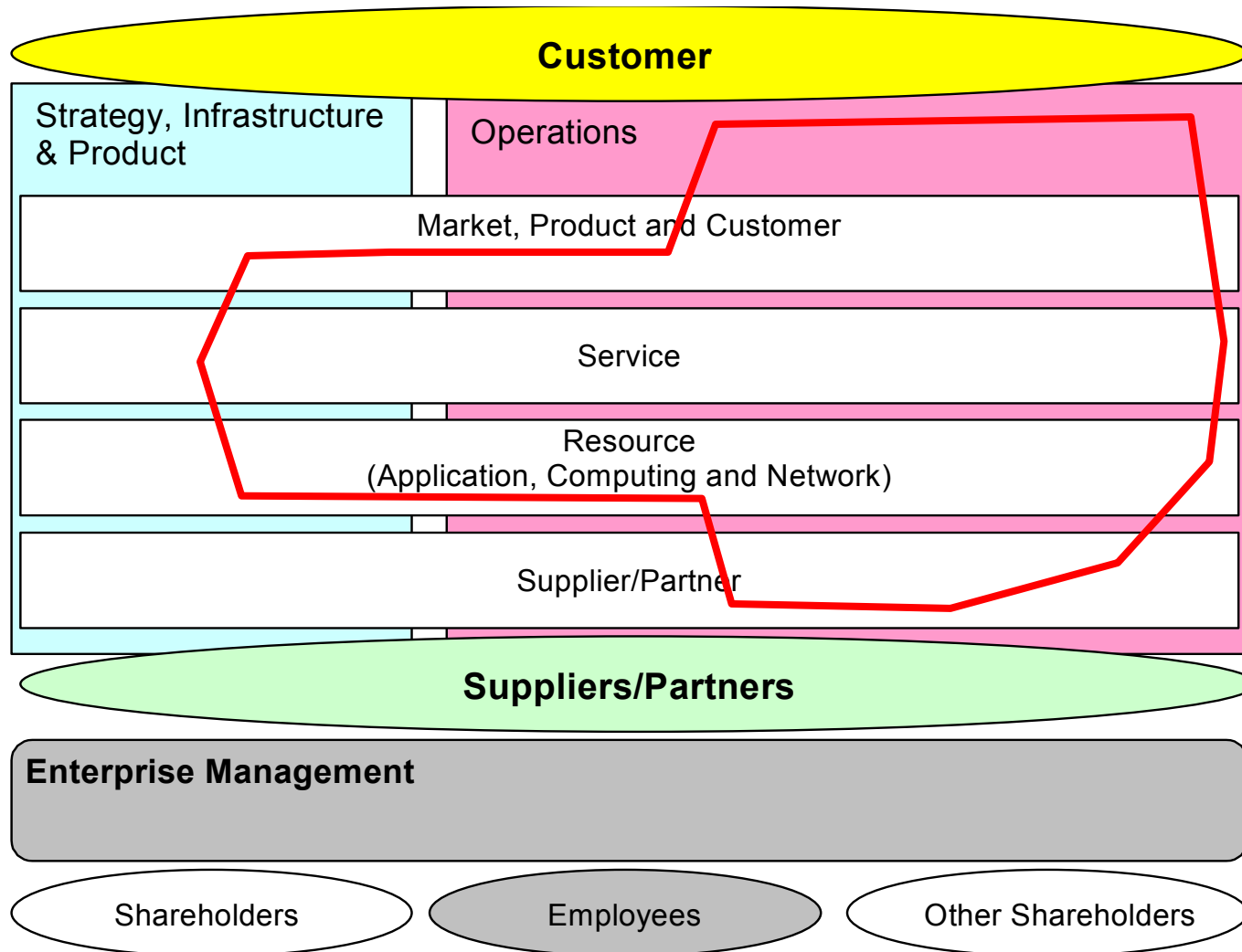
Supply Chain Capability Availability

Supply Chain Development & Change Mgm.

Supply Chain Performance Assessment

**Supply Chain Development & Mgm.**

# Mapping Cadenus to eTOM



# Conclusions

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- **Cadenus architecture is focused on eTOM Operations:**
  - ✓ AM - Market, Product, Customer layer
  - ✓ SM - Service layer
  - ✓ RM - Resource layer
- **Impact of bussines model on results of CADENUS/eTOM mapping**
- **Plan of future work**
  - ✓ Mapping of Cadenus trials to eTOM
  - ✓ Contributions to TMForum
  - ✓ Development of Cadenus business model