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Creation and Deployment of End-User Services in Premium IP Networks

Presentation Programme

- Project Overview (M. Potts – Martel)
  - Partners
  - Objectives
  - Current work
  - Outline of the following presentations
- The Operator Business Case for the CADENUS Architecture (G. Morgan - Eircom)
- The CADENUS Mediation Components
  - Access Mediator (S.P. Romano - UoN)
  - Service Mediator (R. Fiutem - Sodalia)
  - Resource Mediator (A. Diacones – Teltec)
- Service Creation at the Network Level (M. Smirnov - FHI Fokus)

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Partners (1)

Operators:

- France Telecom R&D
- Eircom
- Telecom Italia (Sodalia)

Manufacturers:

- Flextel
- TieSse

Consultancies:

- Telscom
- Martel

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Partners (2)

Universities & Research Institutes:

University of Naples

Dublin City University

EPFL

FHI-Fokus

Fraunhofer Institute for Open Communication Systems

+ 2 institutes from the Newly Associated States:

ITTI (Poland):

Business Procedures (links to TeleManagement Forum and Poland Telecom)

SETCCE (Slovenia):

Security

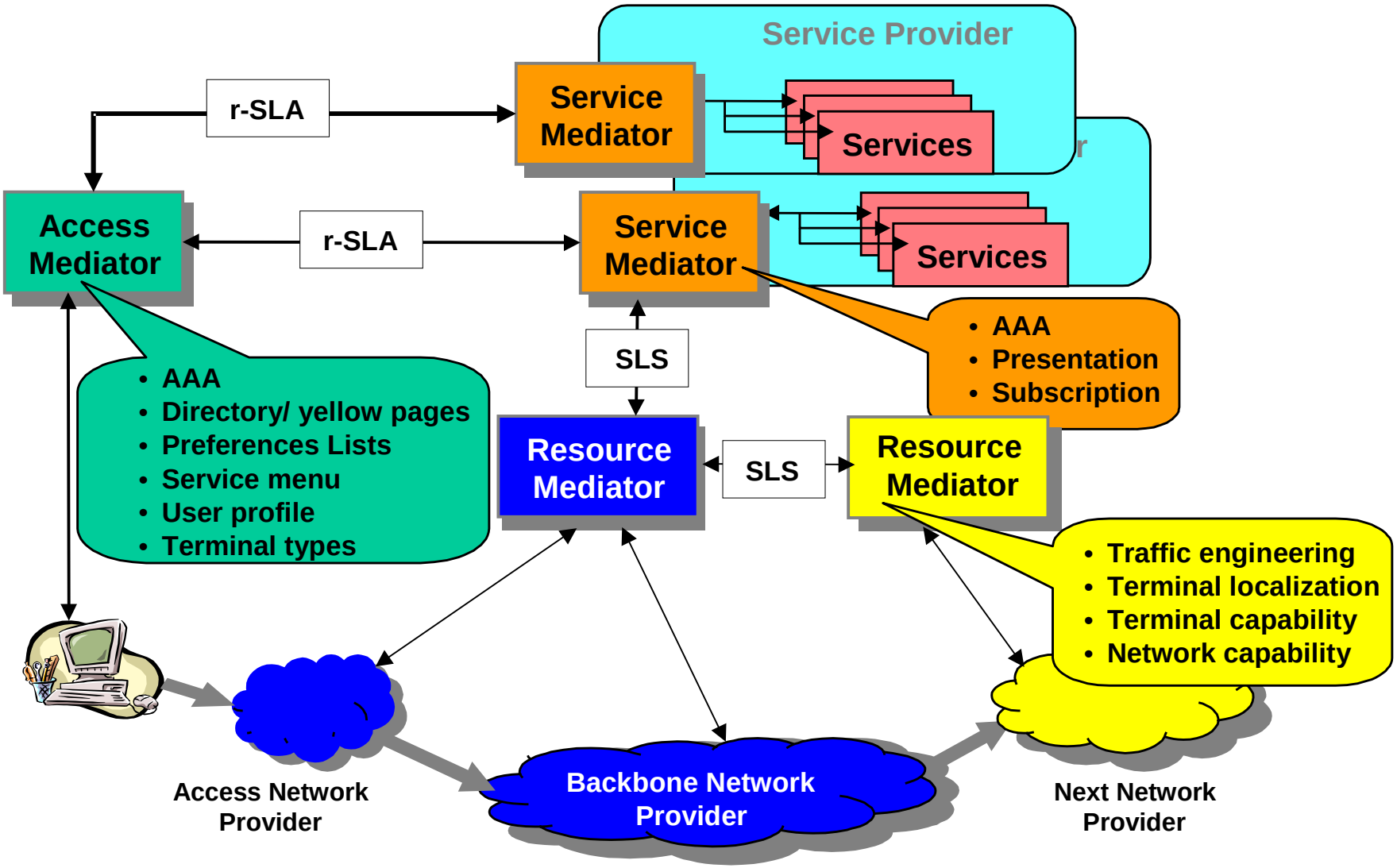
Objectives of CADENUS (1)

To propose an integrated solution for the creation, configuration and provisioning of end user services with QoS guarantees in Premium IP networks.

In detail:

- **Define an architecture** in which the relationship can be seen between end-user services requiring QoS, and the Premium IP network transport services, and to deliver these services

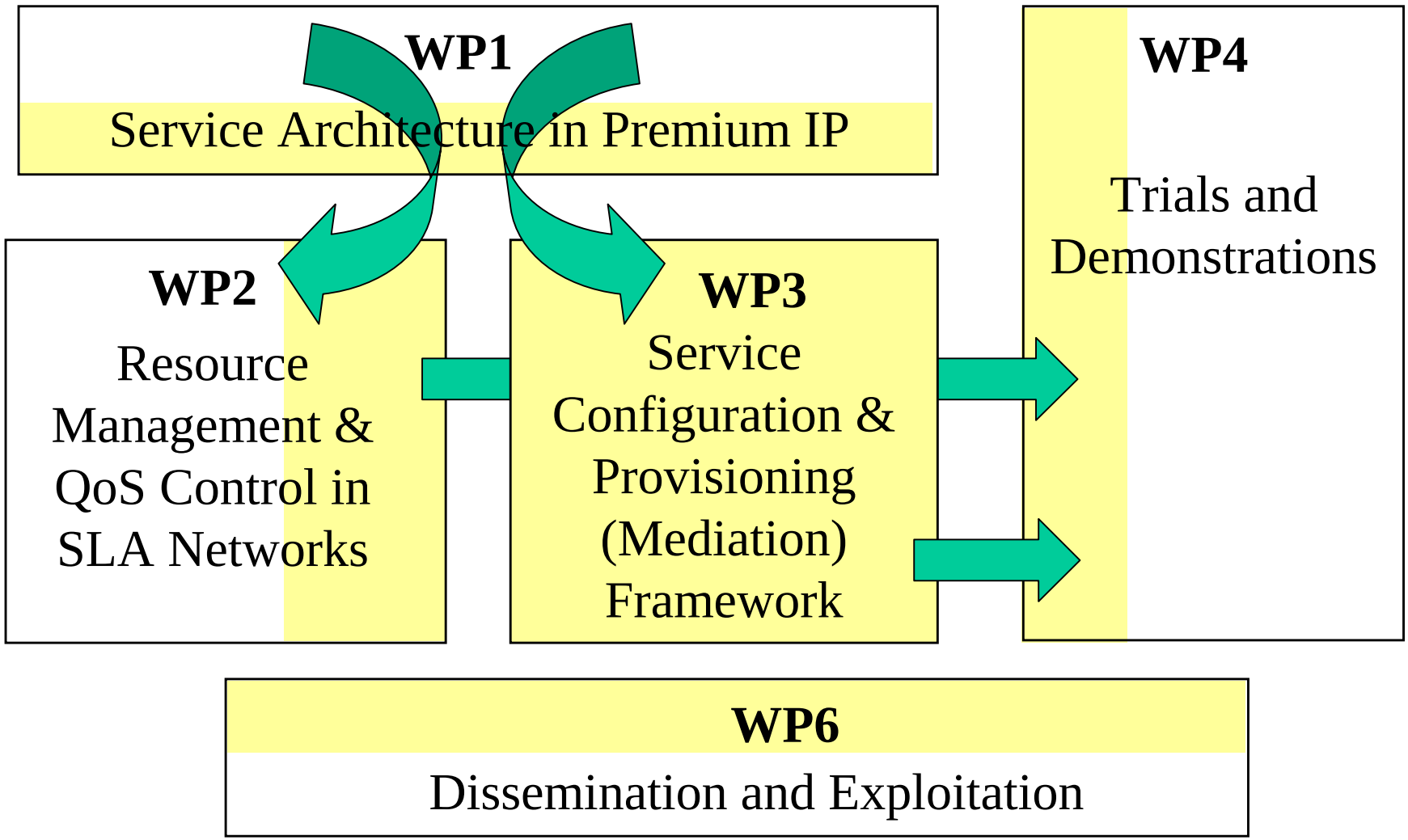
CADENUS Architecture



Objectives of CADENUS (2)

- Relate the architecture to current **business processes**, including especially the management of more flexible and dynamic SLAs and SLSs, trading agreements, etc (ebXML)
- **Trial and demonstrate** the efficient delivery of end-user services with QoS guarantees via this architecture
- Show how the **service creation and configuration** processes within the architecture have generic functionalities
- **Disseminate** the results in standards bodies and to the industry in general

Current Work



Outline of the following presentations

To show how the CADENUS architecture provides support for:

- Independence of service provision and network provision
- A Service Provider adding a new service
- A customer requesting information on all available services
- A customer subscribing to a new service
- A customer using/invoking a new instance of a service, and getting the QoS
- Network services being created/provisioned according to the demands of an application

…. and to relate these to the needs and procedures of network and service providers

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CADENUS Business Case

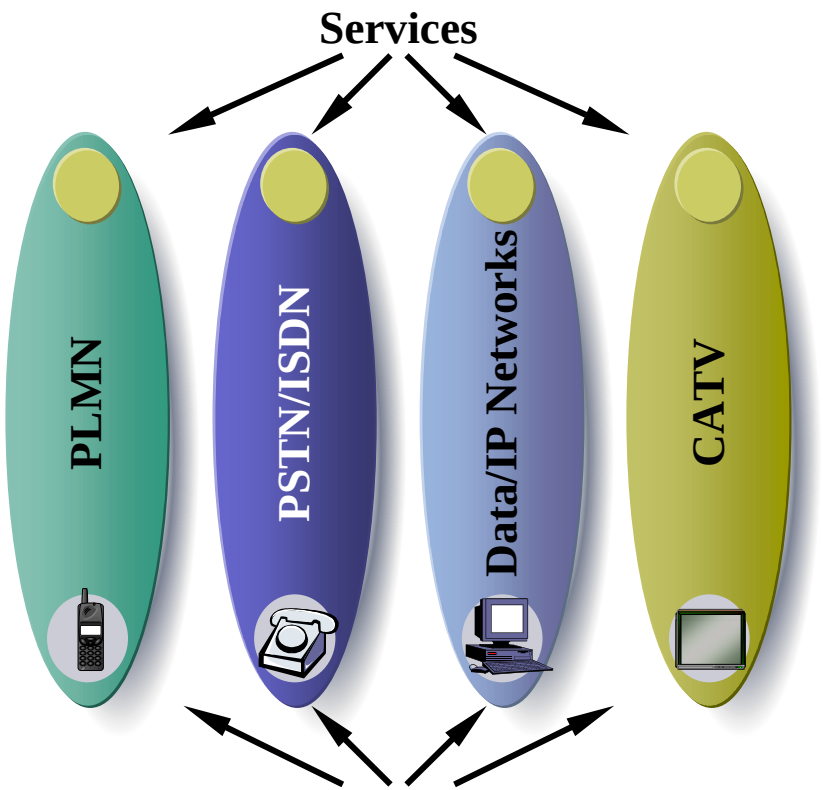
G. Morgan (Eircom)

& O. Dugeon (FTR&D)

Why NGN & Why CADENUS?

Today

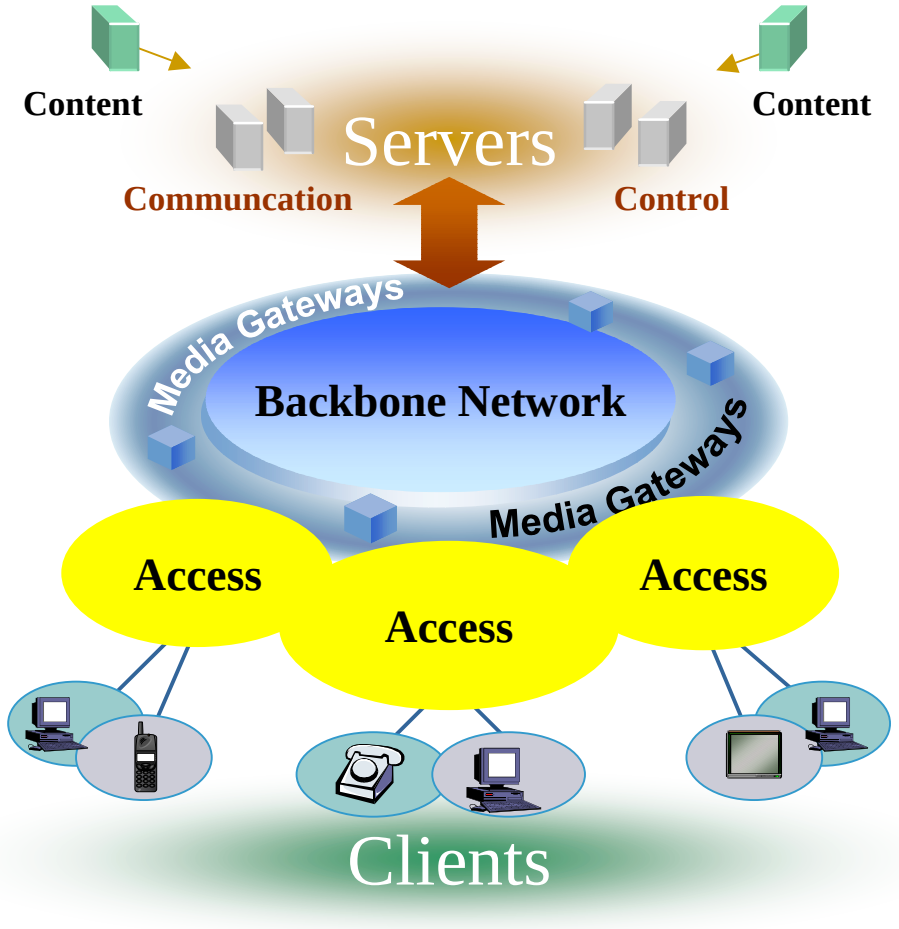
Single-service networks



Access Transport & Switching Networks

Future

Multi-service networks/client-server



What will NGN mean for Telcos?

- **Network operators will attempt to capture a huge slice of overall economic activity from proven conventional solutions to unproven online alternatives.**

- **Online alternatives must have the following characteristics:**
  - They must provide at least the same level of service (incl. ease of use, flexibility, security, quality etc.) as conventional alternatives.
  - They must deliver service at an acceptable cost that is comparable to conventional alternatives.
  - They must confer unique advantages that will overcome natural customer resistance to change from proven conventional solutions and justify initial cost premiums.

- **The single most attractive feature of network based implementation of services is the prospect of portability and mobility.**

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Essential Characteristics of NGNs

- BOD will be an essential characteristic on which the business case for investing in NGNs rests.
- In order that customers will be attracted to use new network alternatives the availability of good quality online services will also be essential.
- A further essential characteristic will be the ability to offer different classes of network services from low to high.
- Thus in the case of many services the ability to deliver Broadband BOD
- No single network operator can single handedly deliver BBOD in a cost effective manner.
- The emergence of dynamic markets in network resources will be a necessary ingredient
- A market enabling mechanism will be essential that will facilitate the various actors in transacting business

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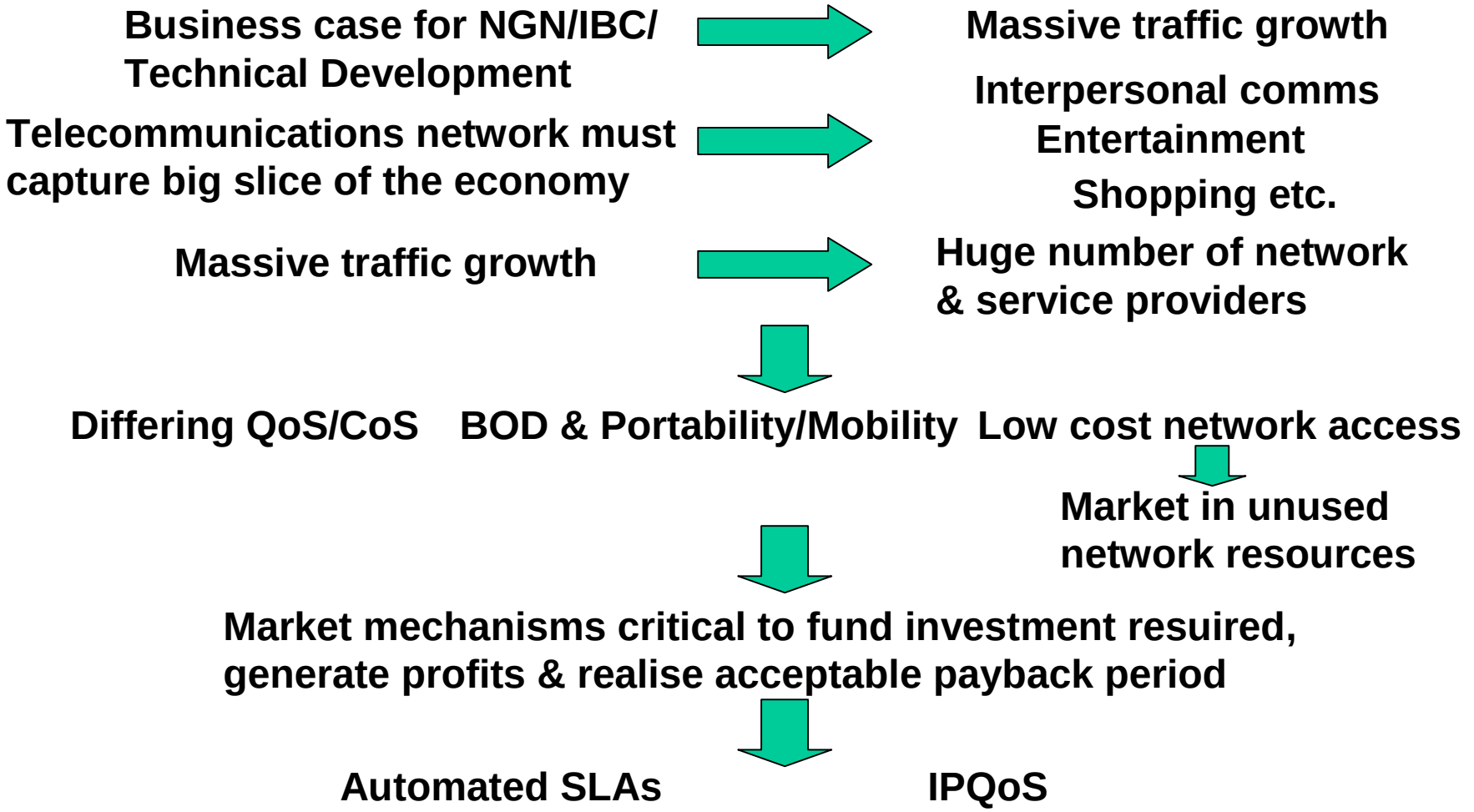
The Importance of SLAs

- An automated SLA framework will be important in ensuring the co-operation of business partners and rivals alike in the deliver of services to each other's customers.
- It will not be possible for each have a formal business relationship such as that which pertains today.
- Similarly it will be impractical to seek to connect each provider's management systems
- Logically the market enabling mechanism must dynamically ensure compliance.
- Therefore that end to end management will for the most part be effected by means of an interlocking hierarchy of SLAs

Business case & CADENUS



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How do we do it?

- It is also necessary to make provision for likely business behaviours which will feature in the industry of the future
- It is important not to hinder the development of future markets in network based services by unknowingly building in technical obstacles to innovative business processes.
- Identify relevant analogous existing business behaviours from other industries which may be applicable to the ICT industry in the future.
  - Travel industry
  - Financial industry
- Having identified the elements essential to the business and investment cases for re-equipping conventional networks with NGN technologies, it is necessary to map these requirements onto the implementation of the CADENUS vision

Business case ➔Development Process

- Consider relationships between various actors.
- Allow for fact that various actors in the chain will require parameters passed in automated transaction.
- List of various actors information requirements.
- Identify internal processes of network providers which will be involved and effected in the context of automated SLA management.
- Define service negotiation process, service invocation process, service termination process in the context of multiple network & service providers.
- Specify role of third party services which will be required to ensure confidence between correspondent parties.
- Identify likely extreme customer behaviours to stress test processes
- Map on to CADENUS architecture onto the service delivery mechanisms envisaged.

Realisation

- **In the context of the NGN architecture**
  - Mediation at each level gives a unique entry point and opens the architecture to different actors.
- **CADENUS Business Model defined roles**
  - Access Mediator, Service Mediator & Service logic, Resource Mediator & Network Controller,
  - the different actors may assumed one or many of these roles.
- **Each network & service provider recognises the importance of QoS to the future of their business, it is unclear**
  - But don't know how provide this QoS
  - Don't know what sort of QoS
  - And for what sort of services
- **Network providers have another paradigm**
  - QoS is key to making money from value–added network services

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Implementation (1)

- **Widest possible range of QoS options should be offered to end users and ISPs**
  - Starting from Best-Effort
  - DiffServ class for relative QoS
  - Up to Bandwidth on Demand (based on IntServ or MPLS) for absolute QoS

- **Admission Control may solve both scalability and QoS guarantee issue**
  - Like in PSTN, the memory context is a resource
  - Traffic engineering and dimensioning bound call rejection to small value ie. < 0.005 %

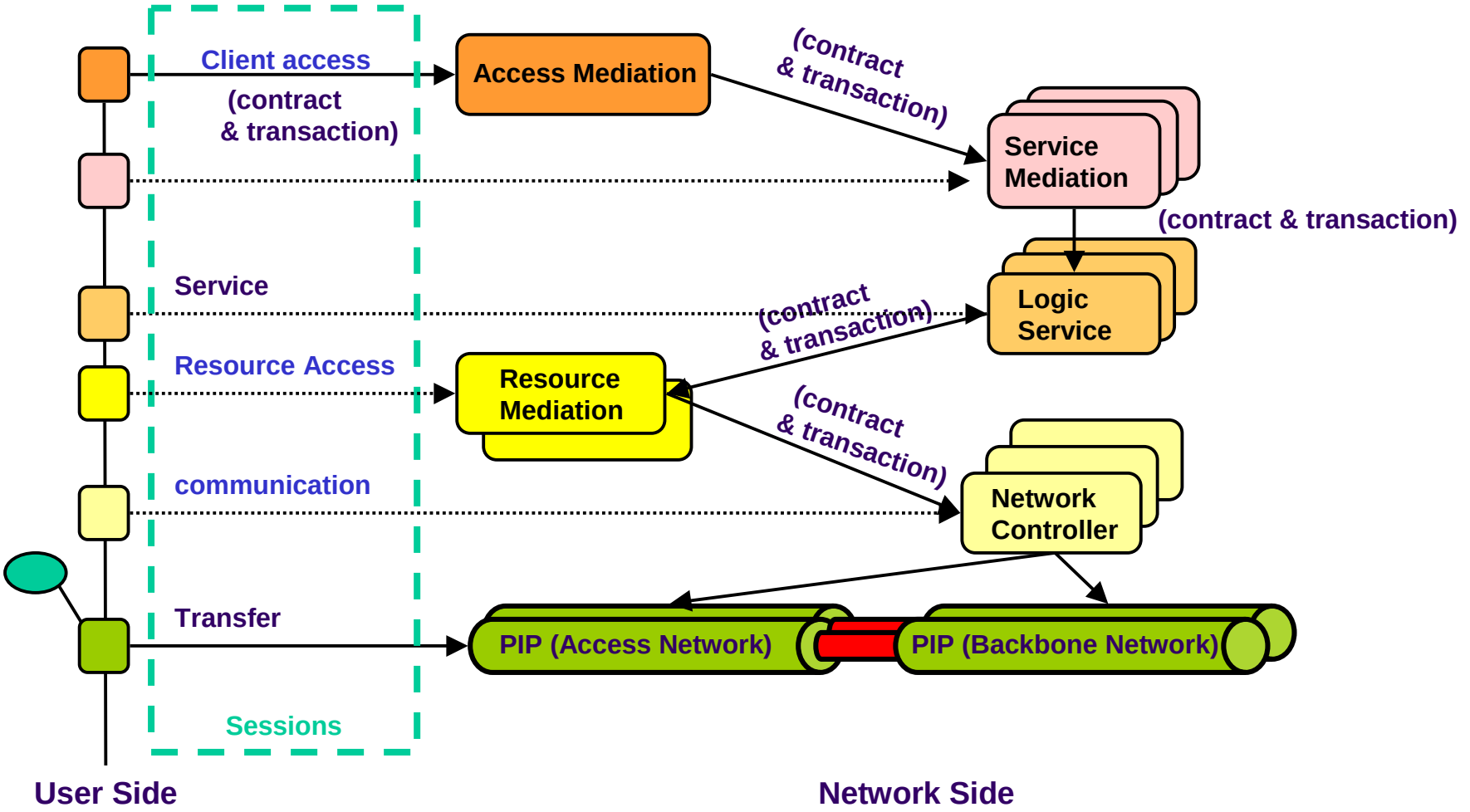
- **Because some services need relative QoS and others absolute Operators must provide Technology independent solutions:**
  - IntServ can provide individual and absolute QoS but it's not very scalable
  - DiffServ is scalable but provide only aggregate relative QoS
  - MPLS?
  - Other techniques?

Implementation (2)

- **For CADENUS development work it is not possible to take into account all service possibilities**

- **Focus on "generic services"**
  - VoIP (include p2m, m2p, visio)
  - VPN (include lease line)
  - VoD (all streaming application include audio only)
  - Internet basic access (Web, email, …)

Likely Full Functional Architecture



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Questions & Answers ?

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AM-SM interaction as a Business Process

S.P. Romano, S. D'Antonio

& G. Ventre (UoN)

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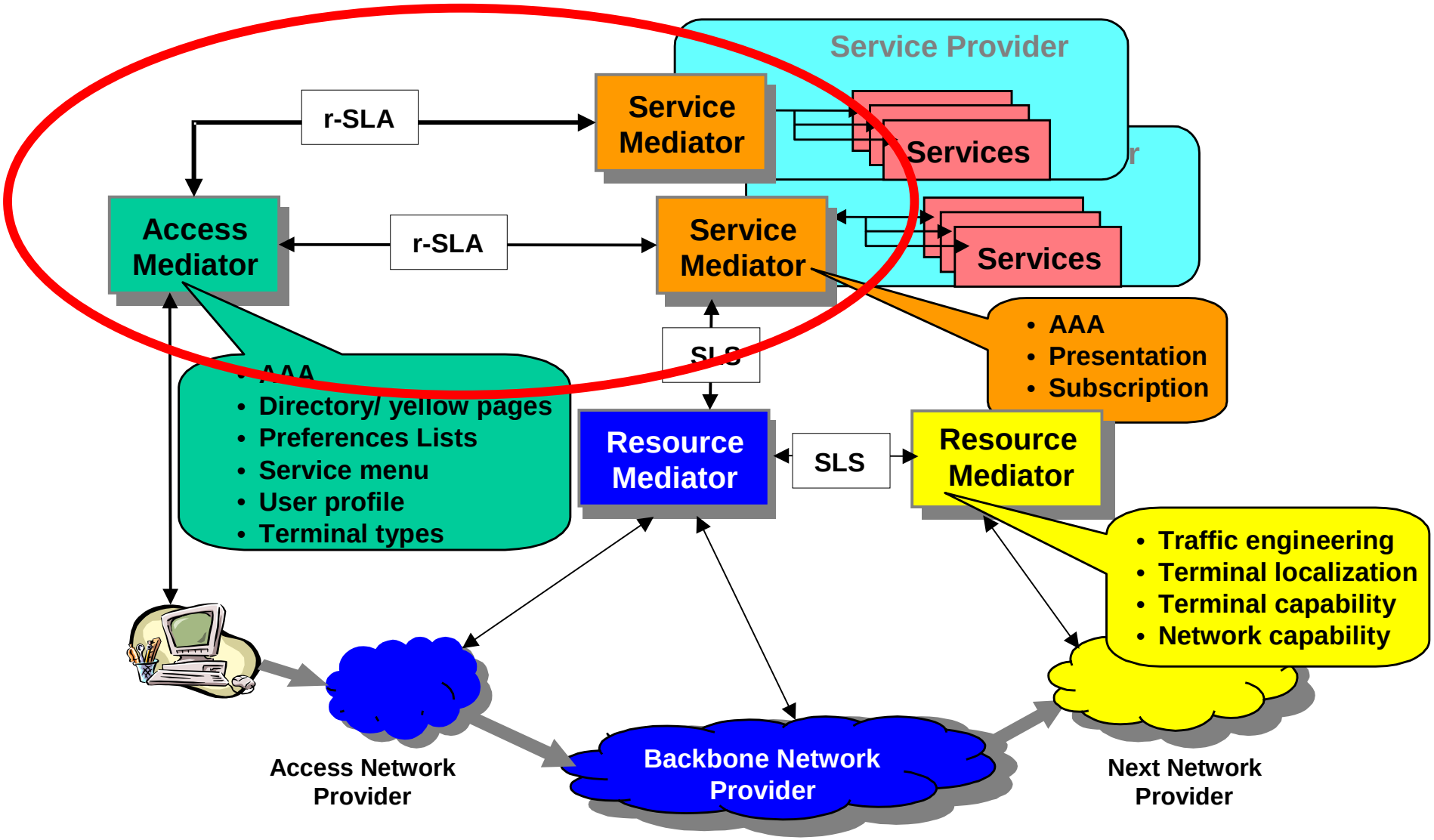
Rationale

- Exploiting the Unified Modelling Methodology
  - Business Model
- Representing the Business Model in the ebXML framework
- Demo about implementation strategies
  - focus on the VPN example...

Work positioning



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The Business Model

- Objective
  - an innovative EDI (Electronic Data Interchange) solution to the creation, offering and negotiation of new services
- Scope
  - specify services
  - source/select potential suppliers
  - request quotation and analyse quotes
  - negotiate prices
  - place and confirm a purchase order

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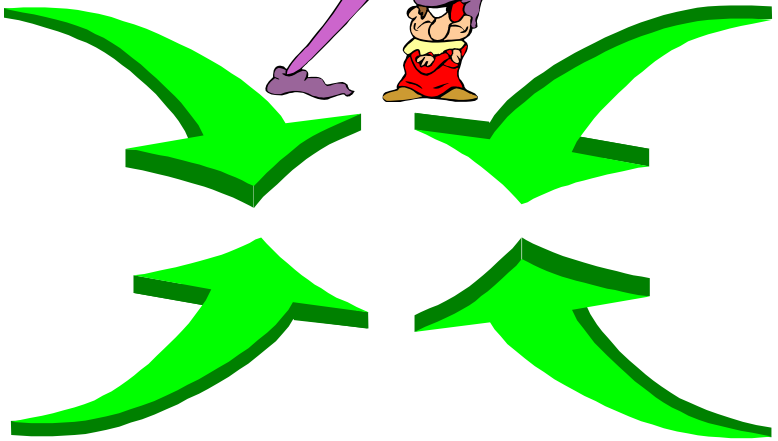
Business Actors

Access Mediator

Service Mediator



Service Directory

Service Authority

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The ebXML framework

- A project of the United Nations
- Putting together the efforts coming from:
  - the most popular enterprises in the IT scenario
  - lots of universities and research centres

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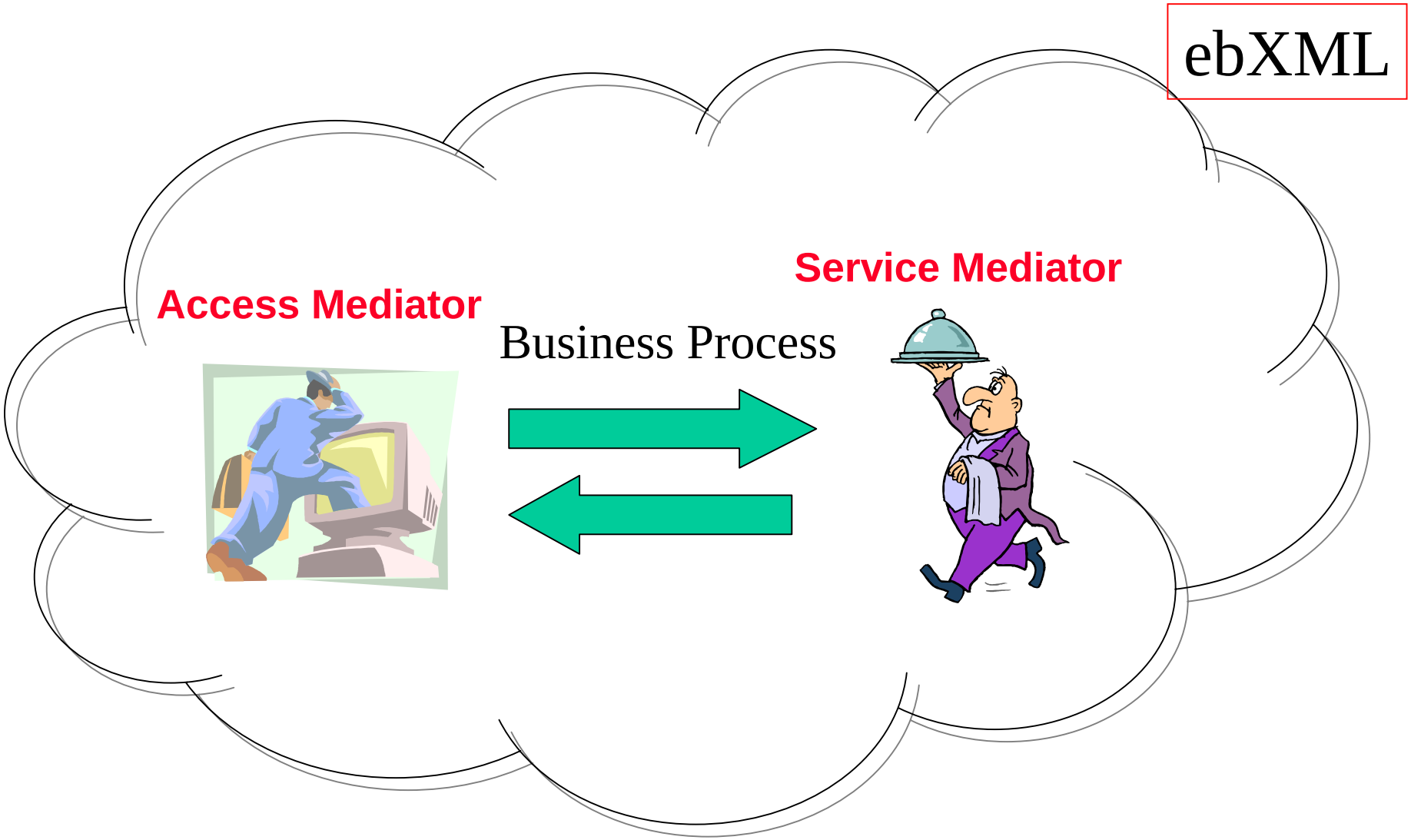
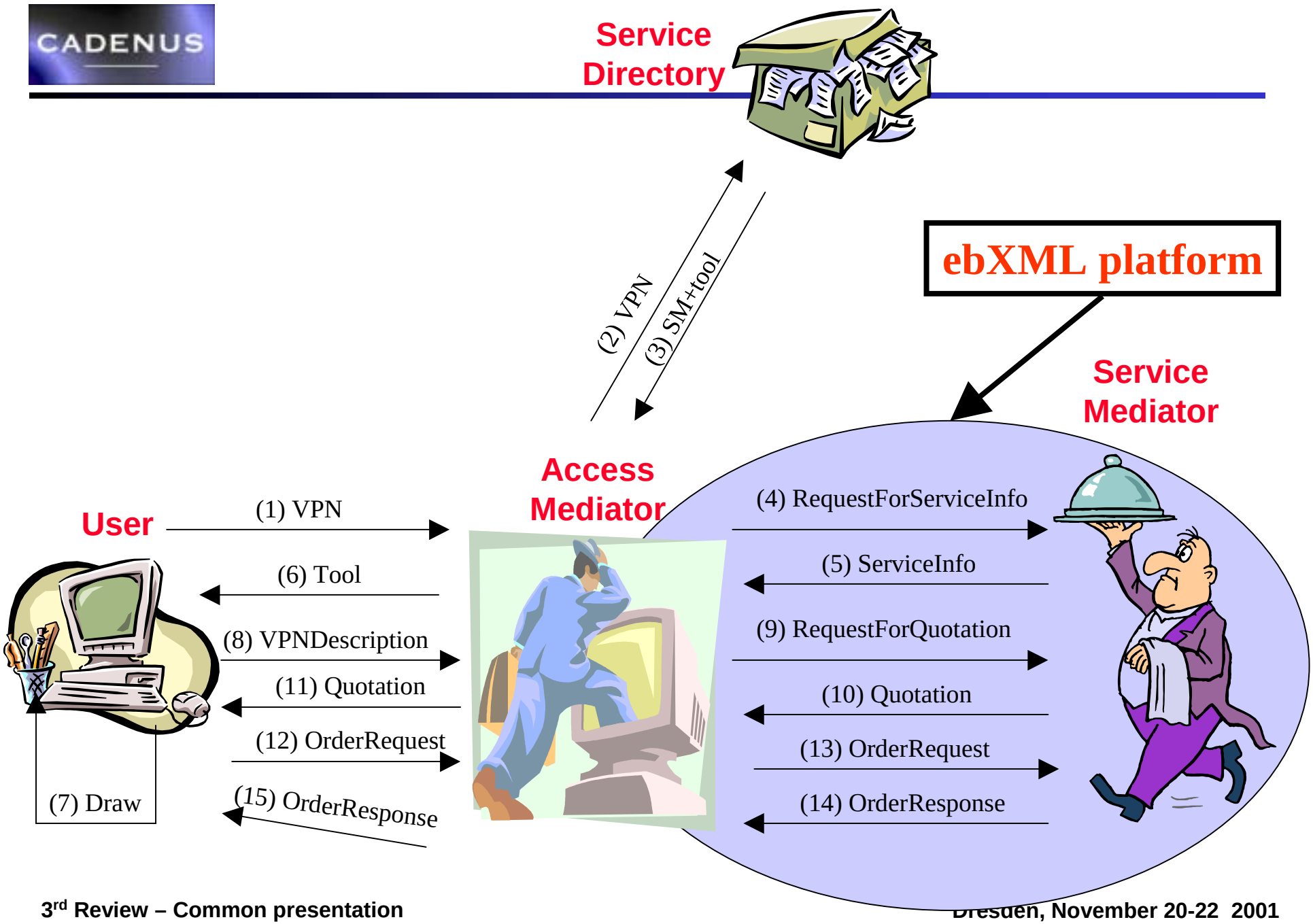
ebXML: objectives

- The creation of a world-wide electronic marketplace
- A bridge between e-business process modeling and specification of e-business software components
  - allowing business partners to collaborate through the exchanging of xml-based messages

ebXML inside Cadenus




Service Directory
(2) VPN
(3) SM+tool
ebXML platform
Service Mediator
Access Mediator
User
(1) VPN
(6) Tool
(8) VPNDescription
(11) Quotation
(12) OrderRequest
(7) Draw
(15) OrderResponse
(4) RequestForServiceInfo
(5) ServiceInfo
(9) RequestForQuotation
(10) Quotation
(13) OrderRequest
(14) OrderResponse

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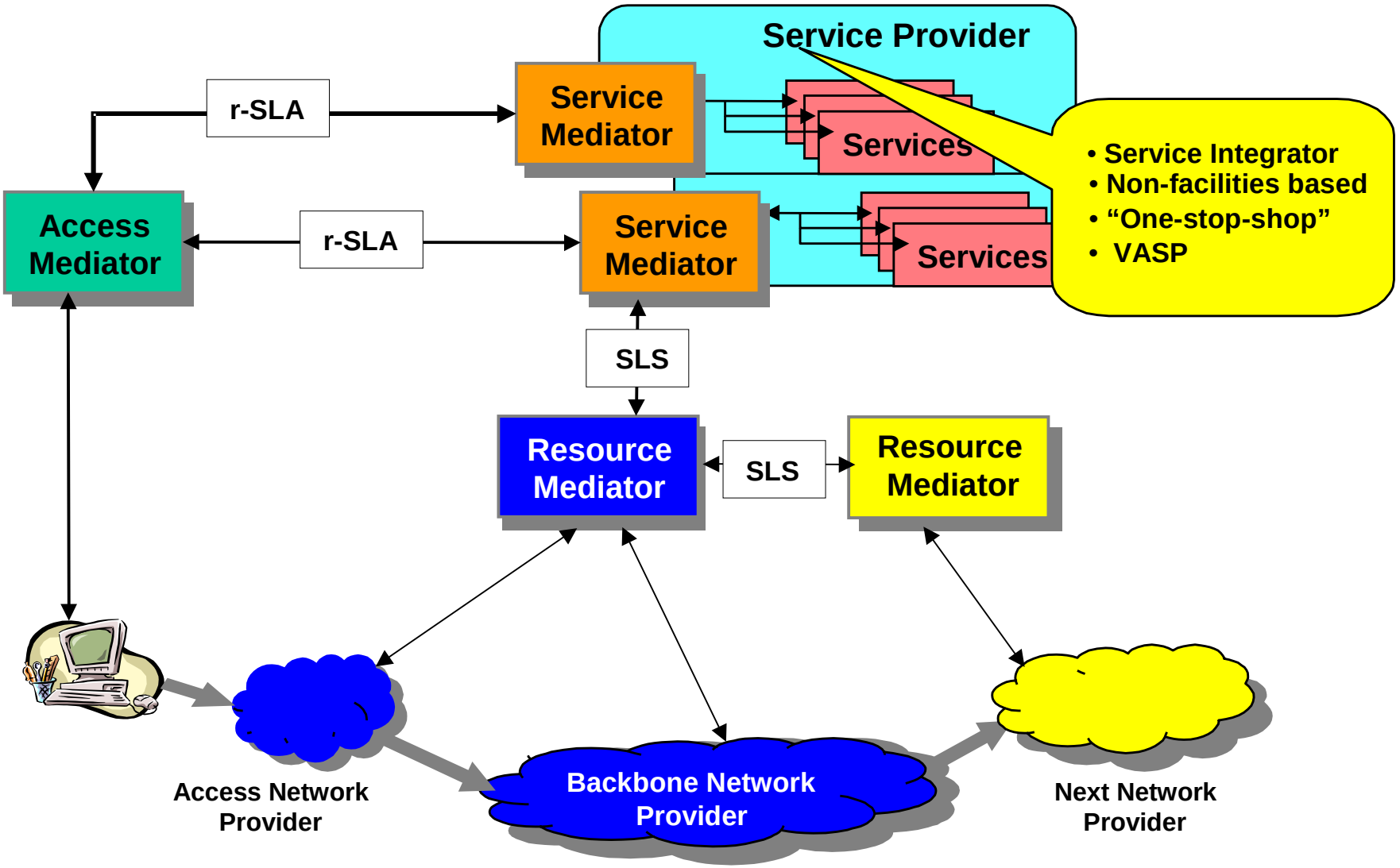
Service Mediator: Functionality, Architecture and Example Scenario

R. Fiutem (Sodalia)

Service Mediator: Context



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Service Mediator

- The SM basically supports three processes of a Service Provider:
  - service design
  - IP QoS resource negotiation
  - service fulfillment
- Such processes are typically executed independently of each other (though in certain scenarios, they might be executed in a synchronous way)

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Mediator Interfaces

- B2B interfaces for coordinating different providers in the value-chain
  - based on ecommerce frameworks/technologies (e.g. ebXML)
- AM-SM: retailer-provider interface
- SM-RM interface:
  - trading of IP QoS Connectivity
    - Setting up trading relationships
    - Exchange of Catalogue Data with Network Providers
    - Exchange Pricing and Availability information
    - Negotiation and ordering of IP QoS Connectivity
  - based on EURESCOM P1008 negotiation model
  - implemented on commercial e-commerce platform

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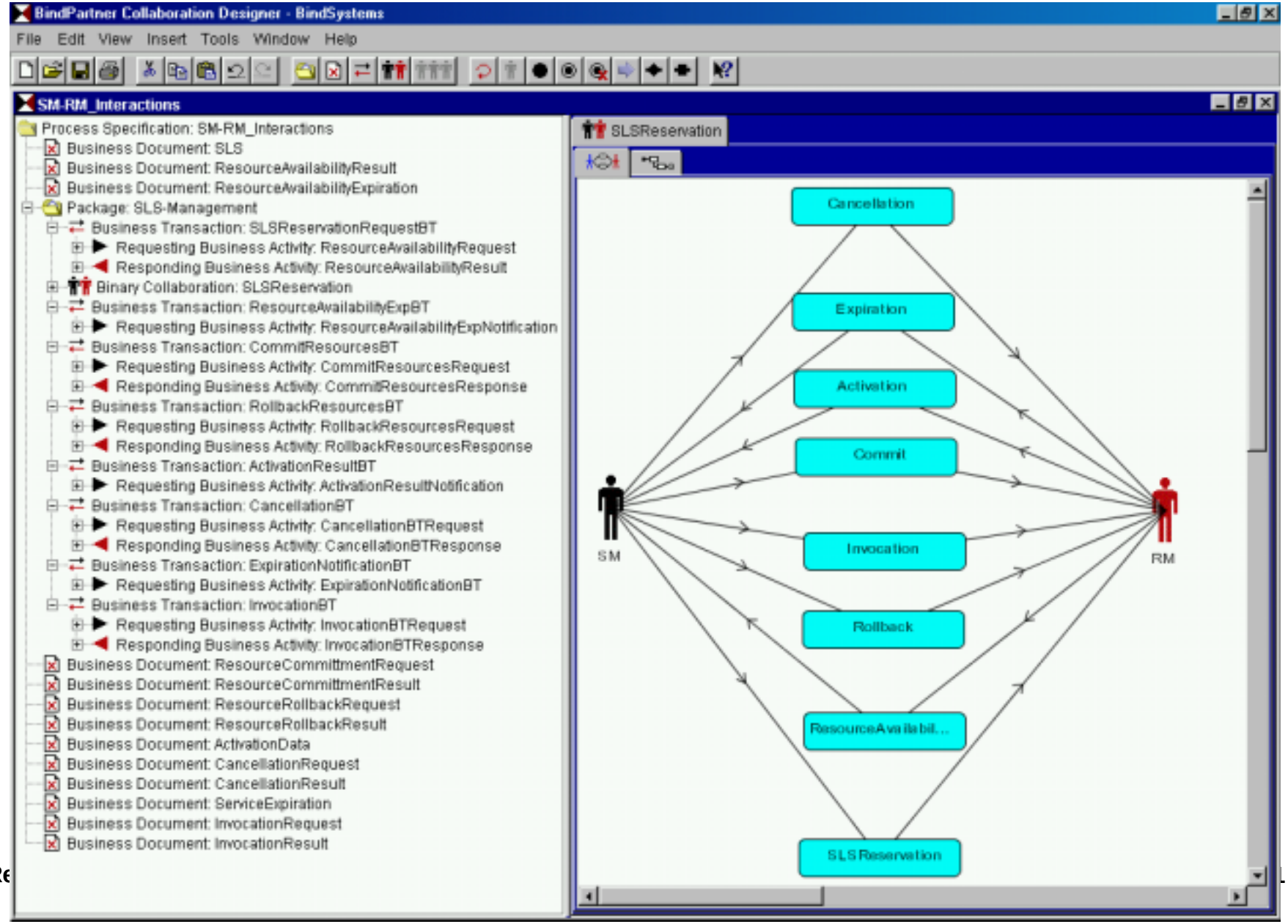
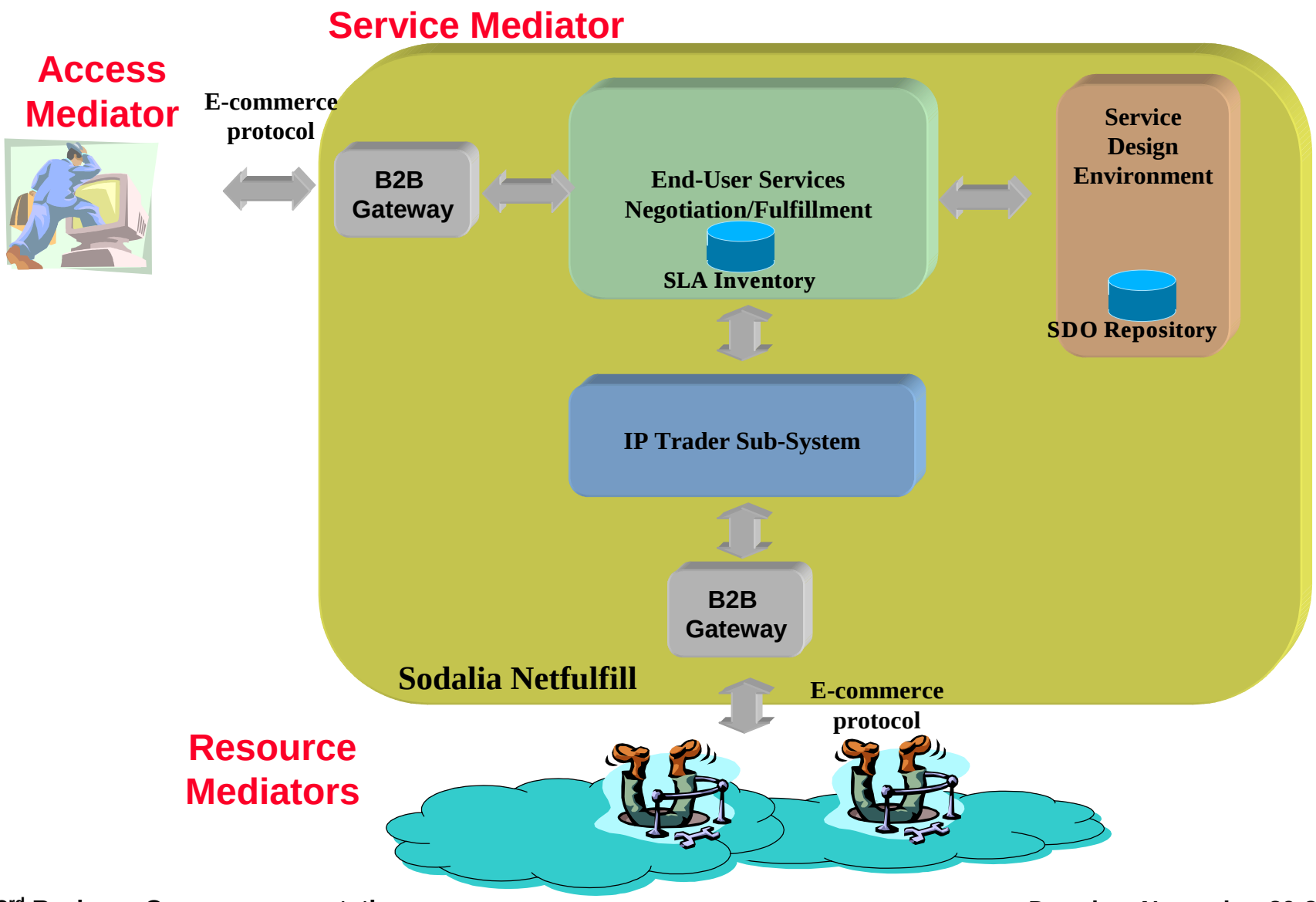
SM-RM Business Process



SM Architecture



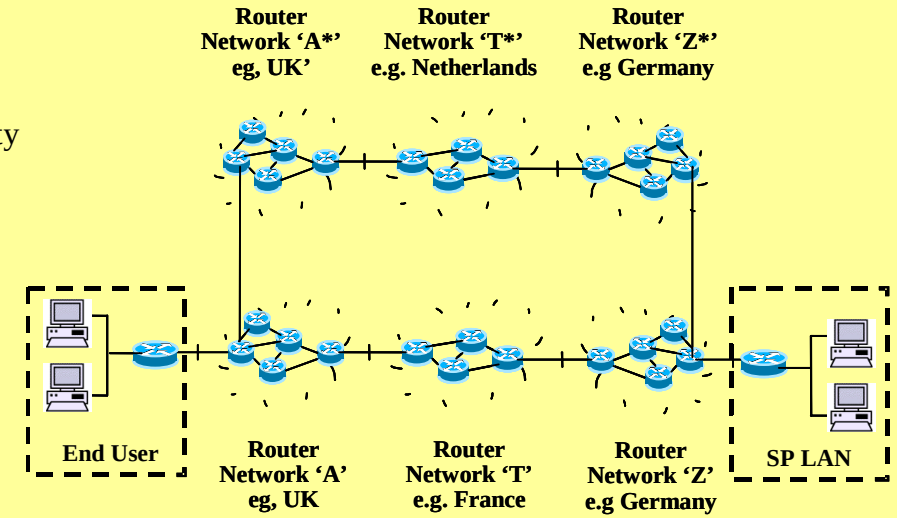
E2E QoS Connectivity Fulfillment: the E2E Analyzer

- Decision support system within the SM, helping the SP in the task of connecting any 2 locations across several interconnected domains:
  - analyse services advertised by trading partners
  - identify suitable offerings for the delivery of an e2e connectivity
  - rank them according to desired criteria

Example:

Fnding how to build a connectivity between the end-user and the Service Provider network having:

Delay < 100 ms



Source: Eurescom P1008

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E2E Analyzer Features

- Maintains a model of logical connectivity on SDs:
  - describing all SAPs and logical interconnections between SAPs
- Uses algorithms for reasoning about graphs will generate and recommend alternatives
  - Example: (A, T, Z) or (A*, T*, Z*)
- Criteria used to filter/rank offerings include:
  - QoS requirements
  - Advertised pricing
  - Number of hops
  - Custom policies (e.g. 'prefer domains belonging to provider 'X')

  filters may be extended

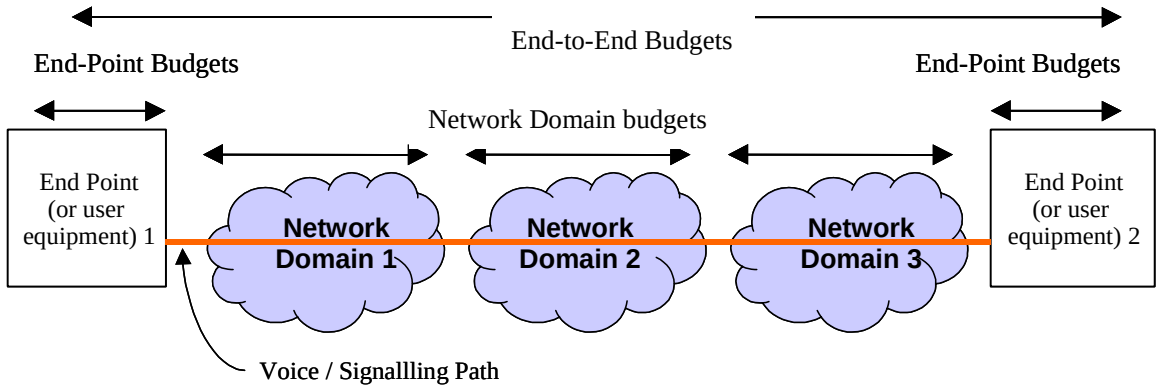
E2E Analyzer Composition Rules

The E2E Analyzer uses “composition rules” to compute the e2e parameters and verify constraints:

QoS Composition Rules for Transport service in the Multi-Domain case:

- *delay is additive, i.e. Dtot =D1 +D2 +..... Dn;*
- *packet loss accumulates on a probabilistic basis, i.e. Ptot = 1-[(1-P1)*(1-P2)*.....(1-Pn)];*
- *delay variation accumulates on an RMS basis, i.e. DVtot =sqrt[DV1 2 +DV2 2 +.....DVn 2];*

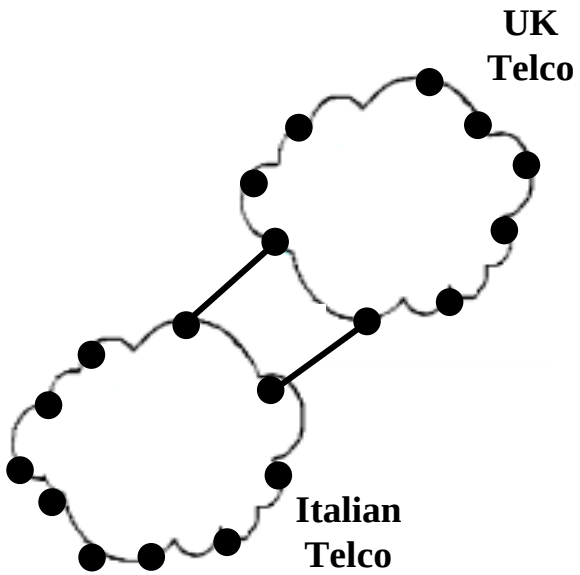
where Dn is the mean one-way delay of Domain n;
Pn is the packet loss probability of Domain n; and
DVn is the standard deviation of the delay variation of Domain n



Source ETSI TIPHON

Service Mediator: example scenario

- **Actors**:
  - A retailer
  - A Service Provider acting as Service Integrator
  - Two Network Providers:
    - Italian Telco
    - UK Telco
- The Service Provider buys IP QoS Connectivity services from NPs and delivers e2e connectivity to its customers
- The Service Provider has B2B agreements with NPs
- The retailer resells Service Provider services



Service Descriptions:

Provided services have similar features:

•**POPs**: differentiated on access speed

•**QoS**: different CoSes for MC and RT traffic

•**Bandwidth**: different values depending on access type

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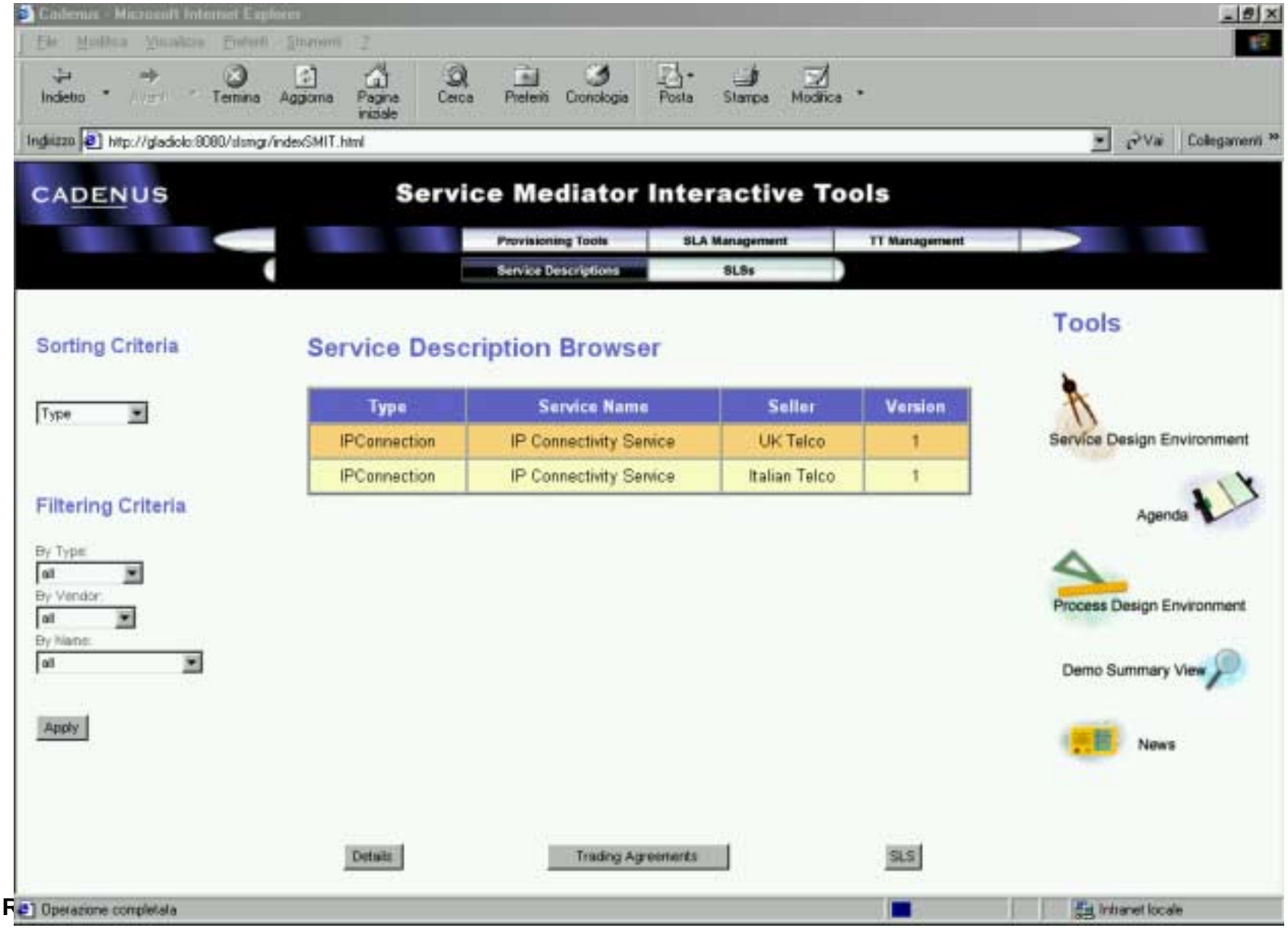
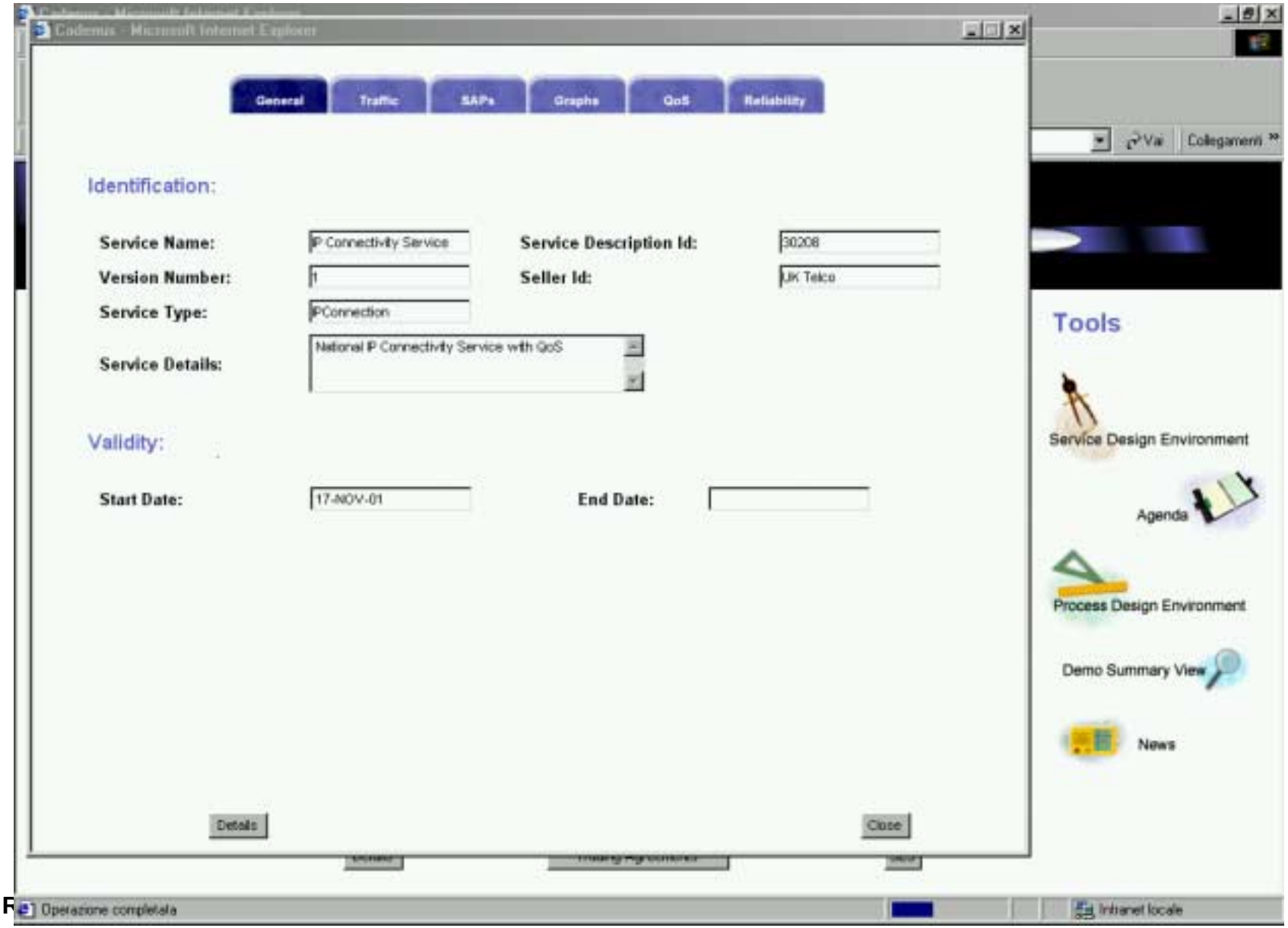
Example Scenario: SM GUIs “Tour”

- Continuation of AM demo example
- Browse the IP QoS resource negotiation functionality:
  - trading partner management
  - catalogue data management
- Follow the steps for end-user service fulfillment:
  - SLA/Contract instantiation
  - SLA-SLS translation with the use of the E2E Analyzer

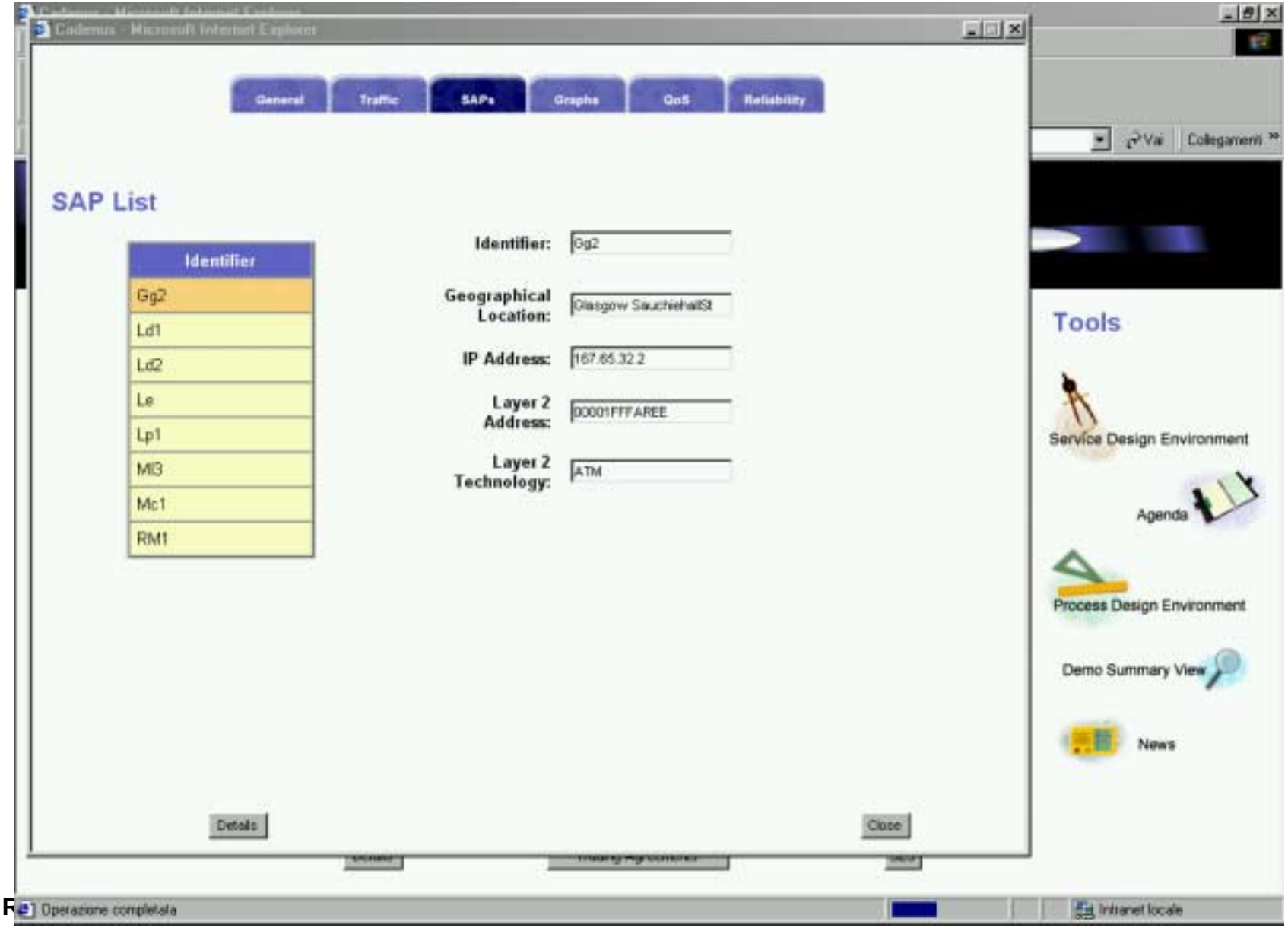
Service Description Browser



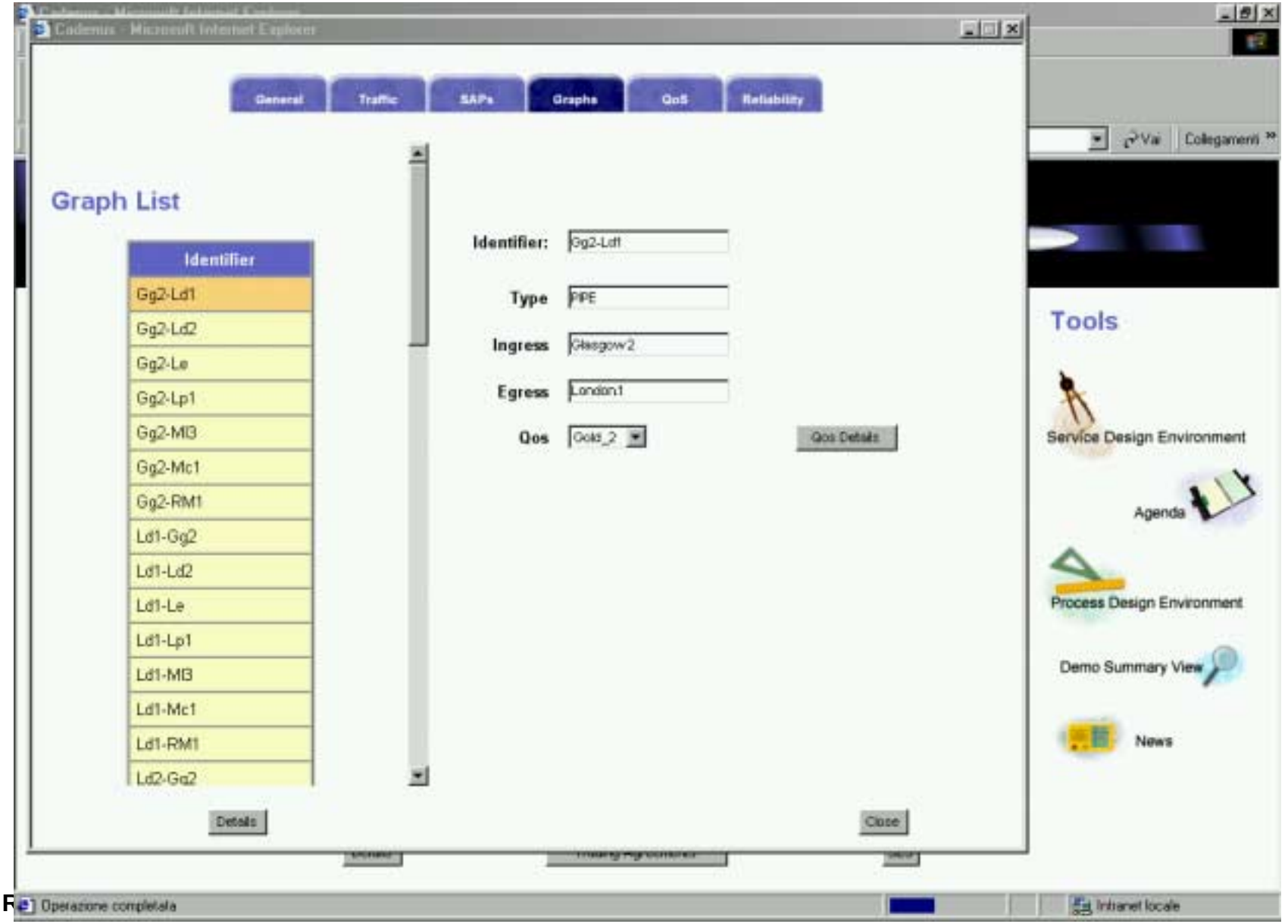
Service Description Details



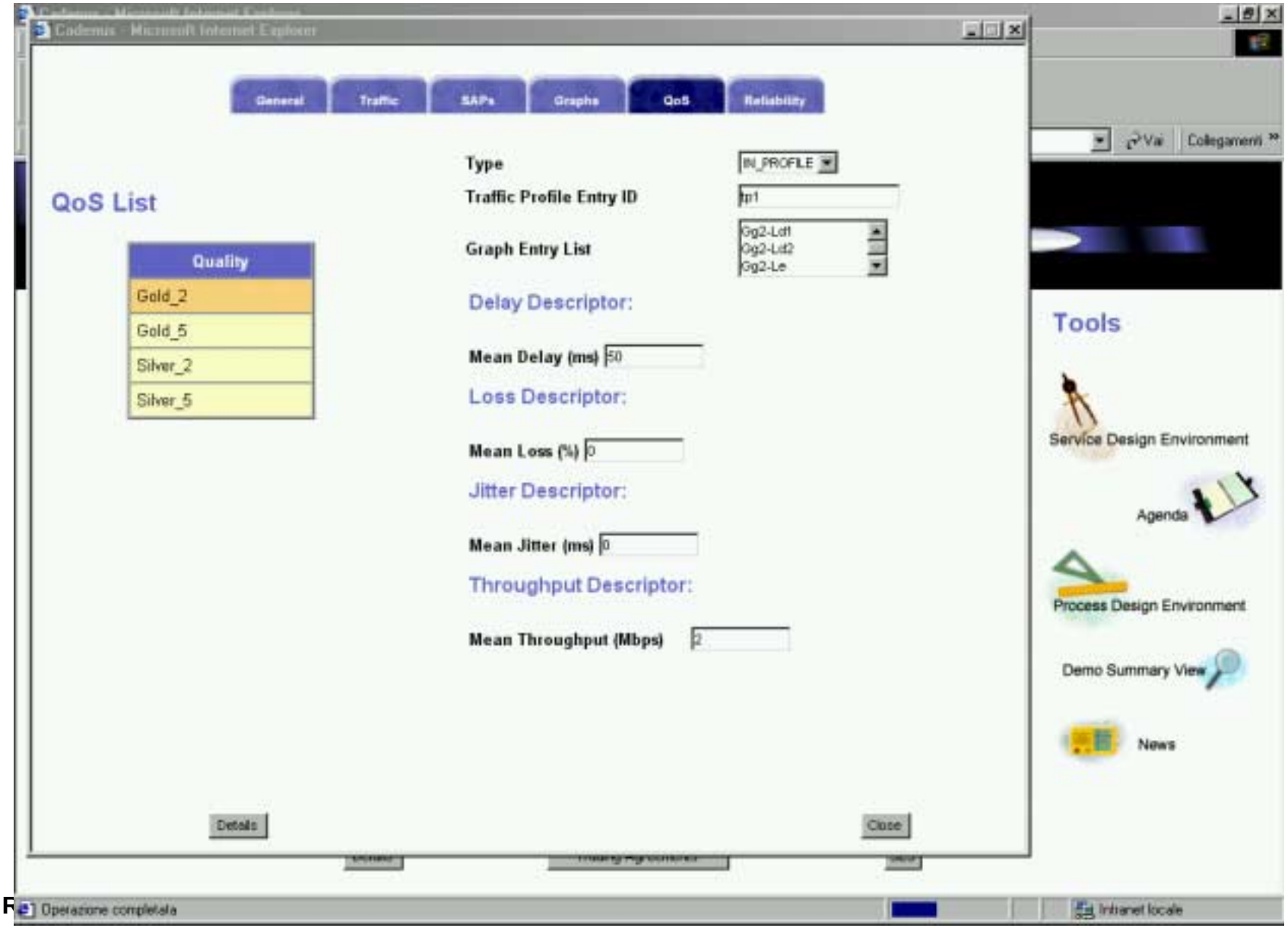
Service Description SAPs



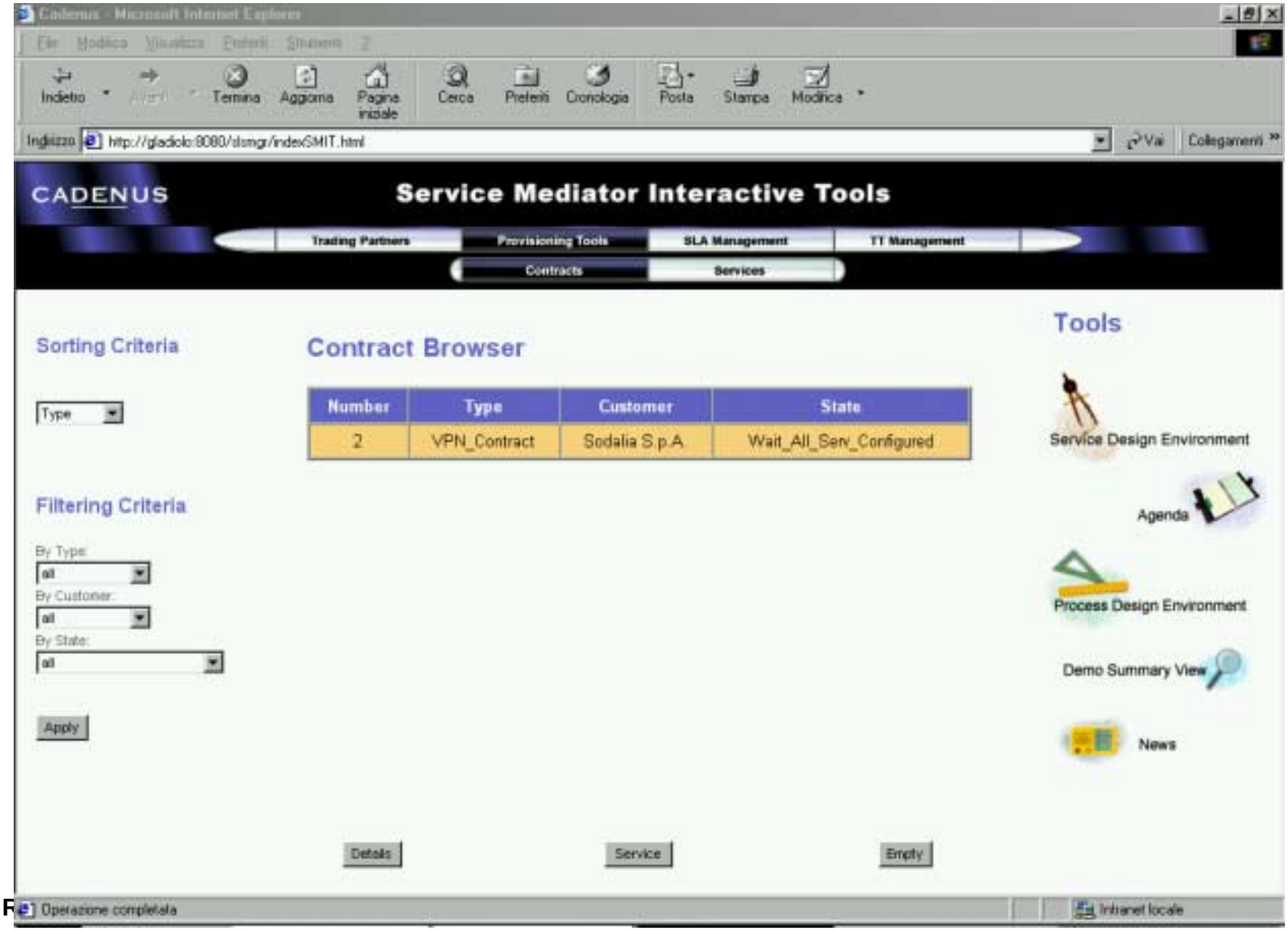
Service Description Topology



Service Description QoS



Contract Browser



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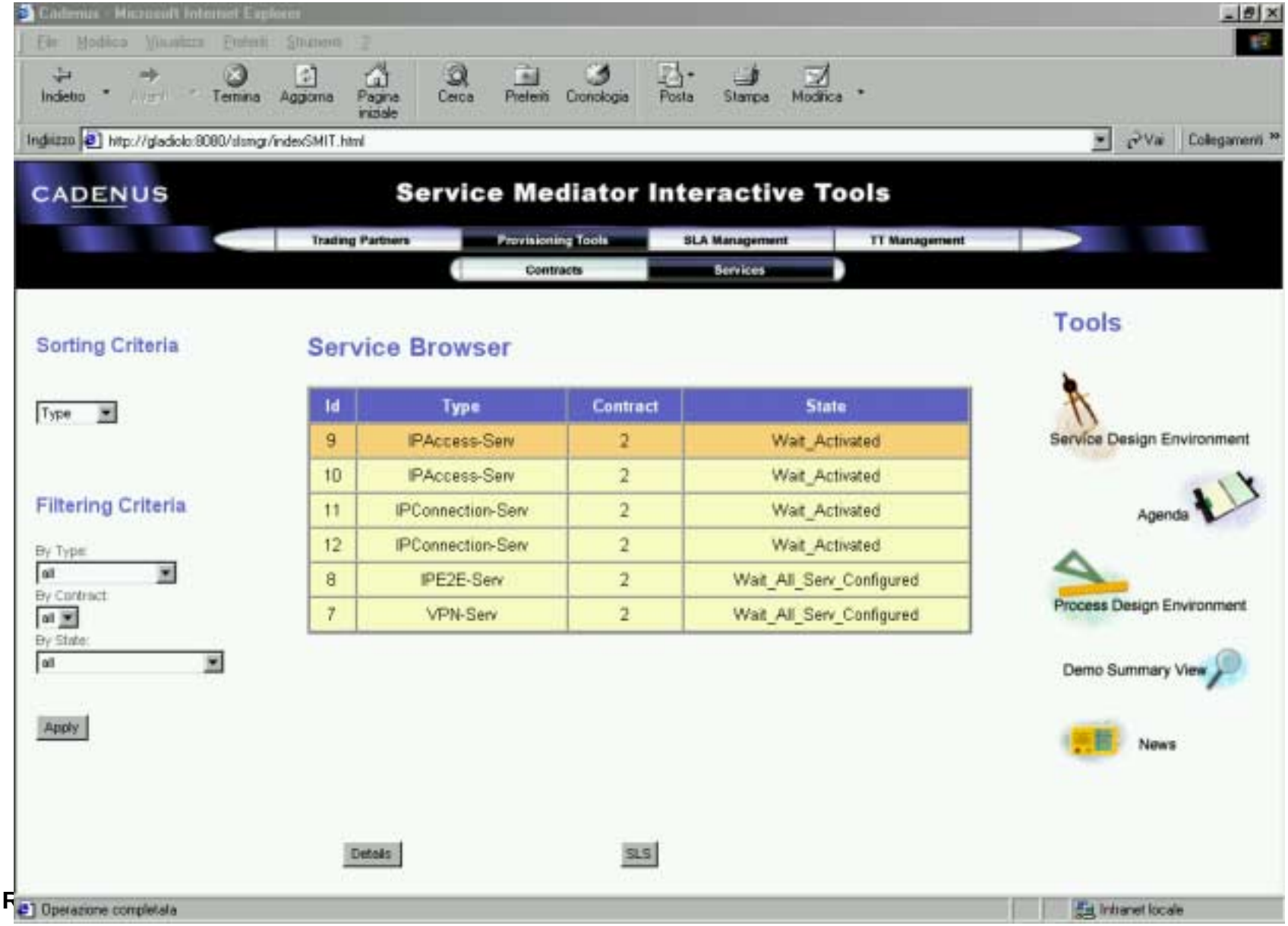
Service Browser



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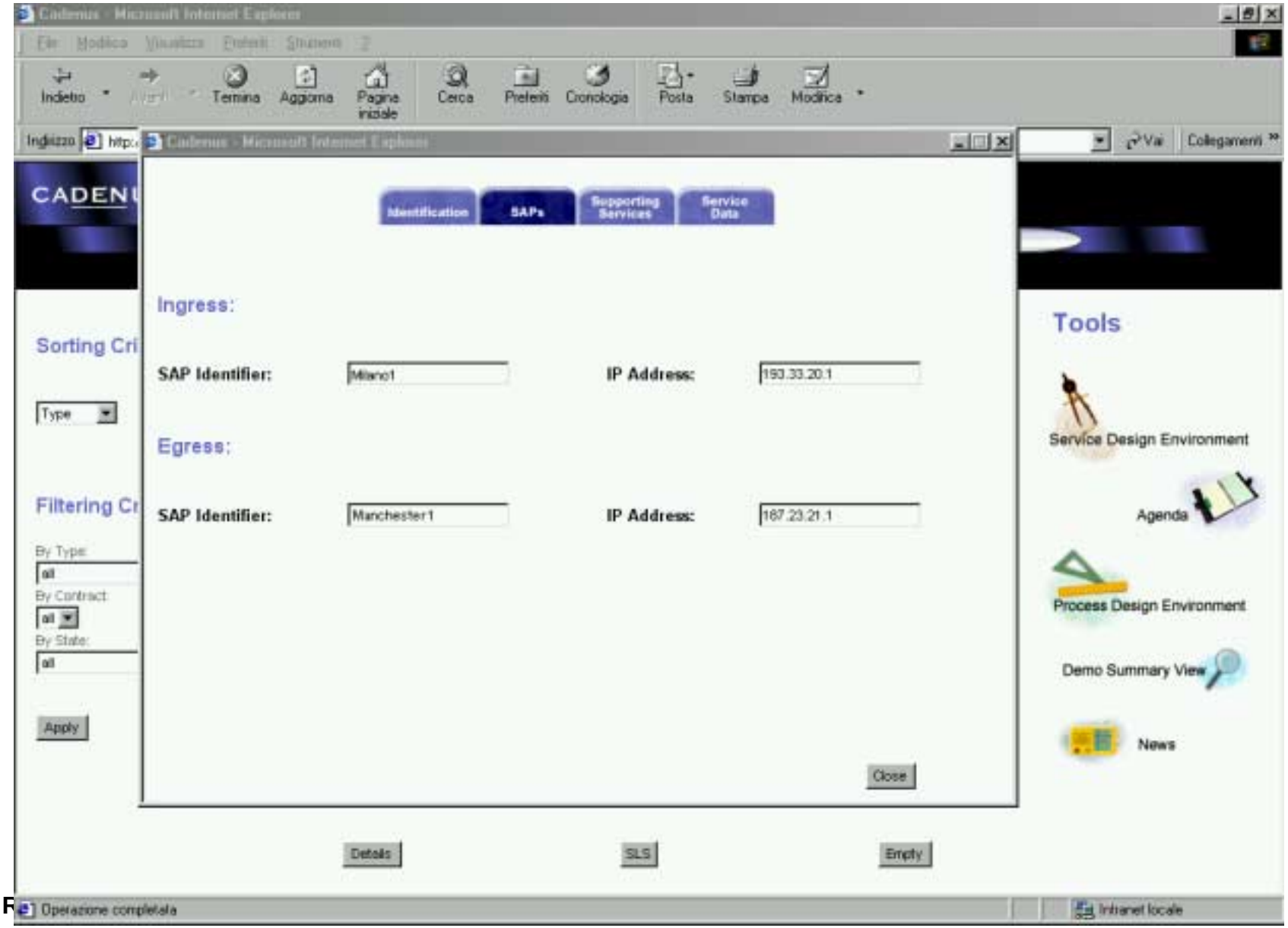
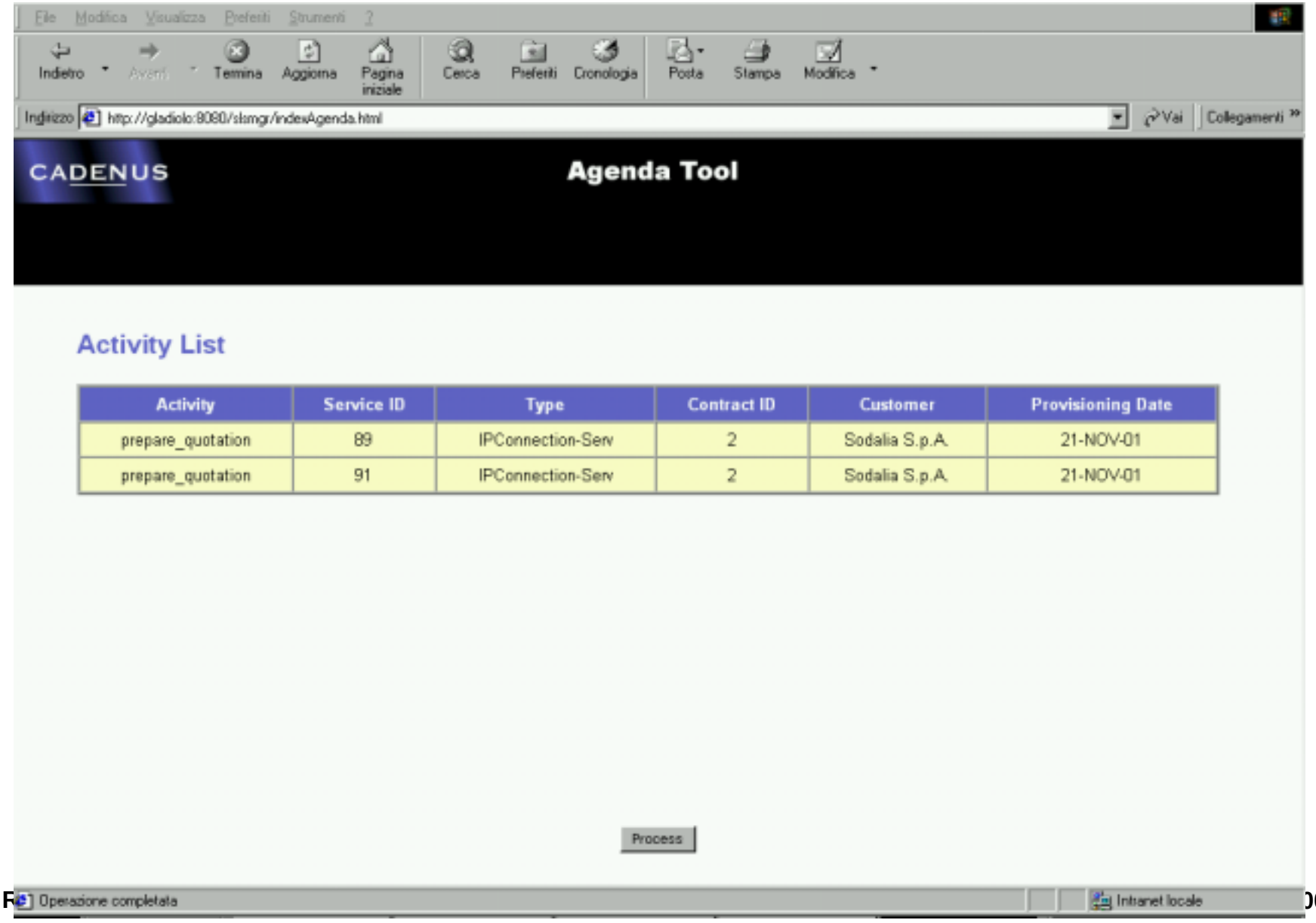
E2E Service SAPs



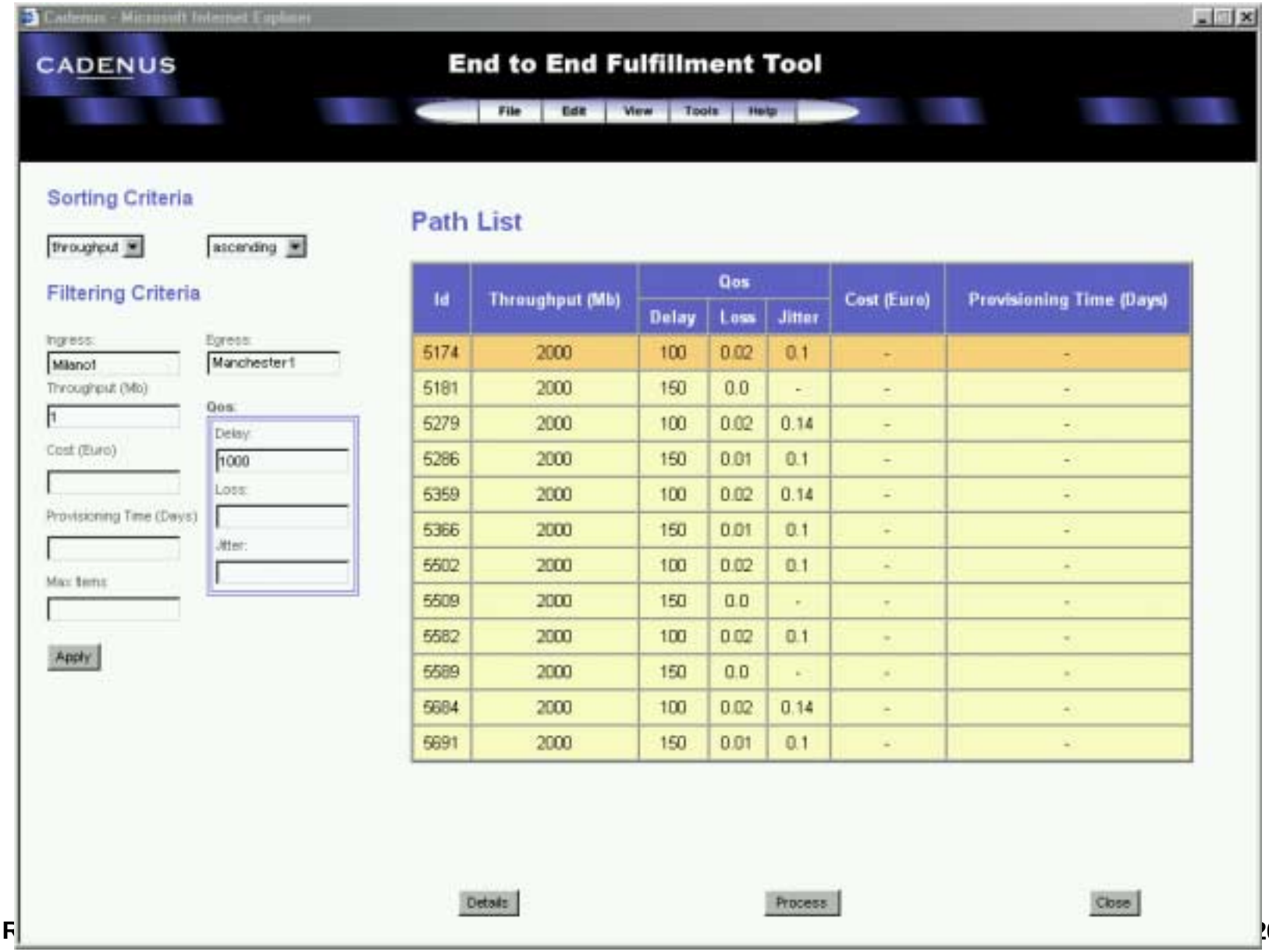
E2E Service Data

E2E Agenda Tool



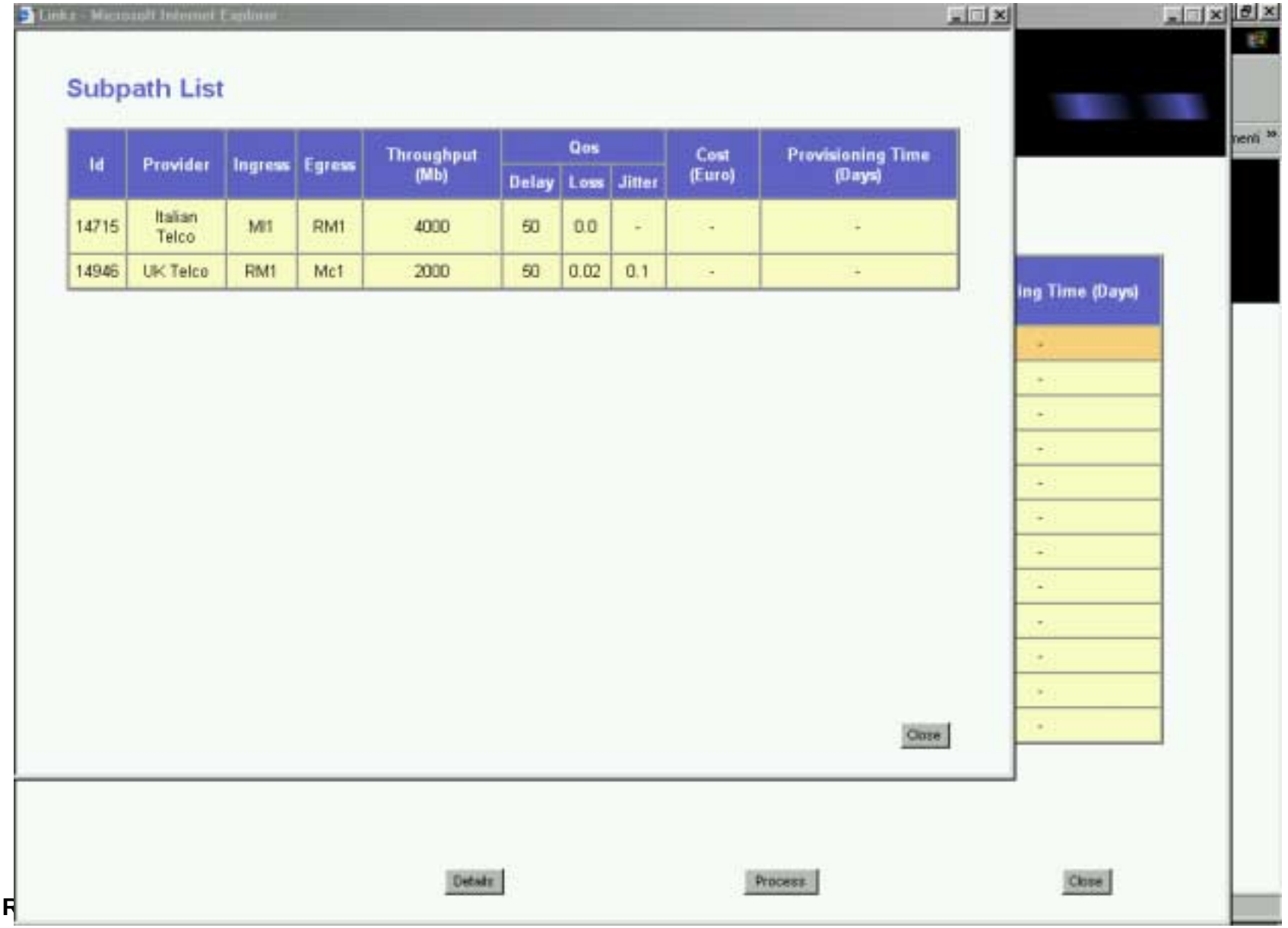
E2E Analyzer

E2E Analyzer Results

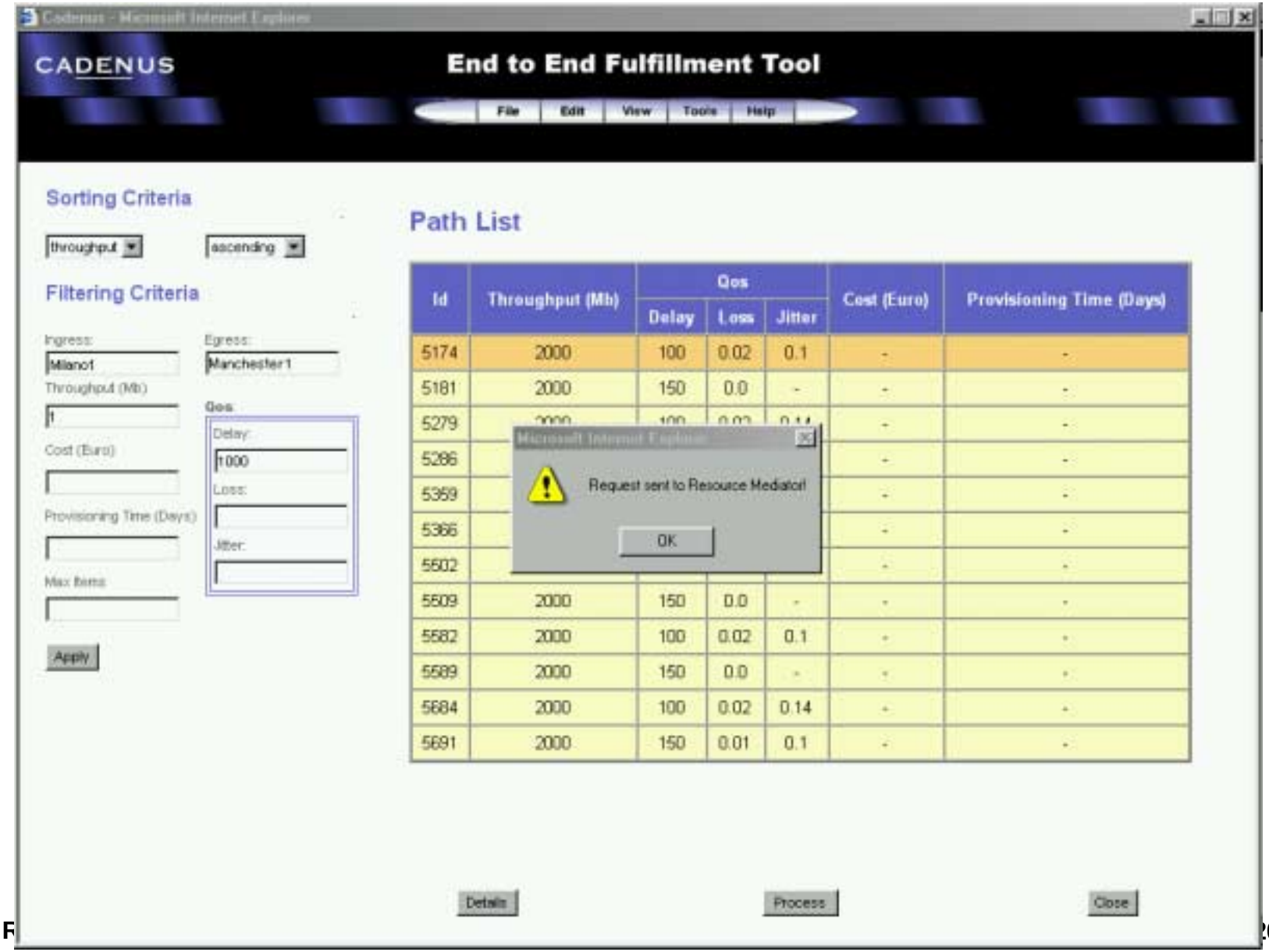


Id	Throughput (Mb)	Qos			Cost (Euro)	Provisioning Time (Days)
		Delay	Loss	Jitter		
5174	2000	100	0.02	0.1	-	-
5181	2000	150	0.0	-	-	-
5279	2000	100	0.02	0.14	-	-
5286	2000	150	0.01	0.1	-	-
5359	2000	100	0.02	0.14	-	-
5366	2000	150	0.01	0.1	-	-
5502	2000	100	0.02	0.1	-	-
5509	2000	150	0.0	-	-	-
5582	2000	100	0.02	0.1	-	-
5589	2000	150	0.0	-	-	-
5684	2000	100	0.02	0.14	-	-
5691	2000	150	0.01	0.1	-	-

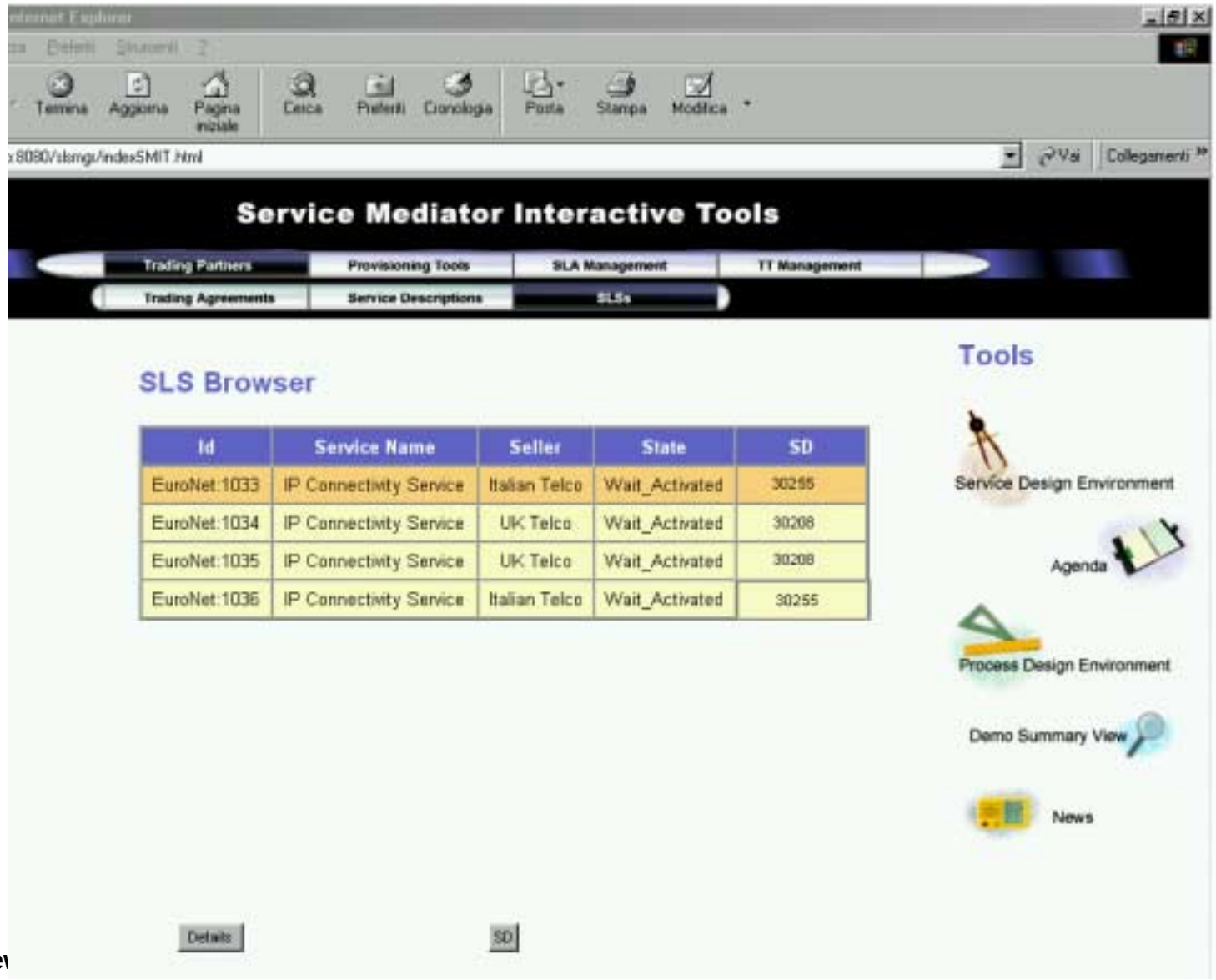
Details of a selected alternative



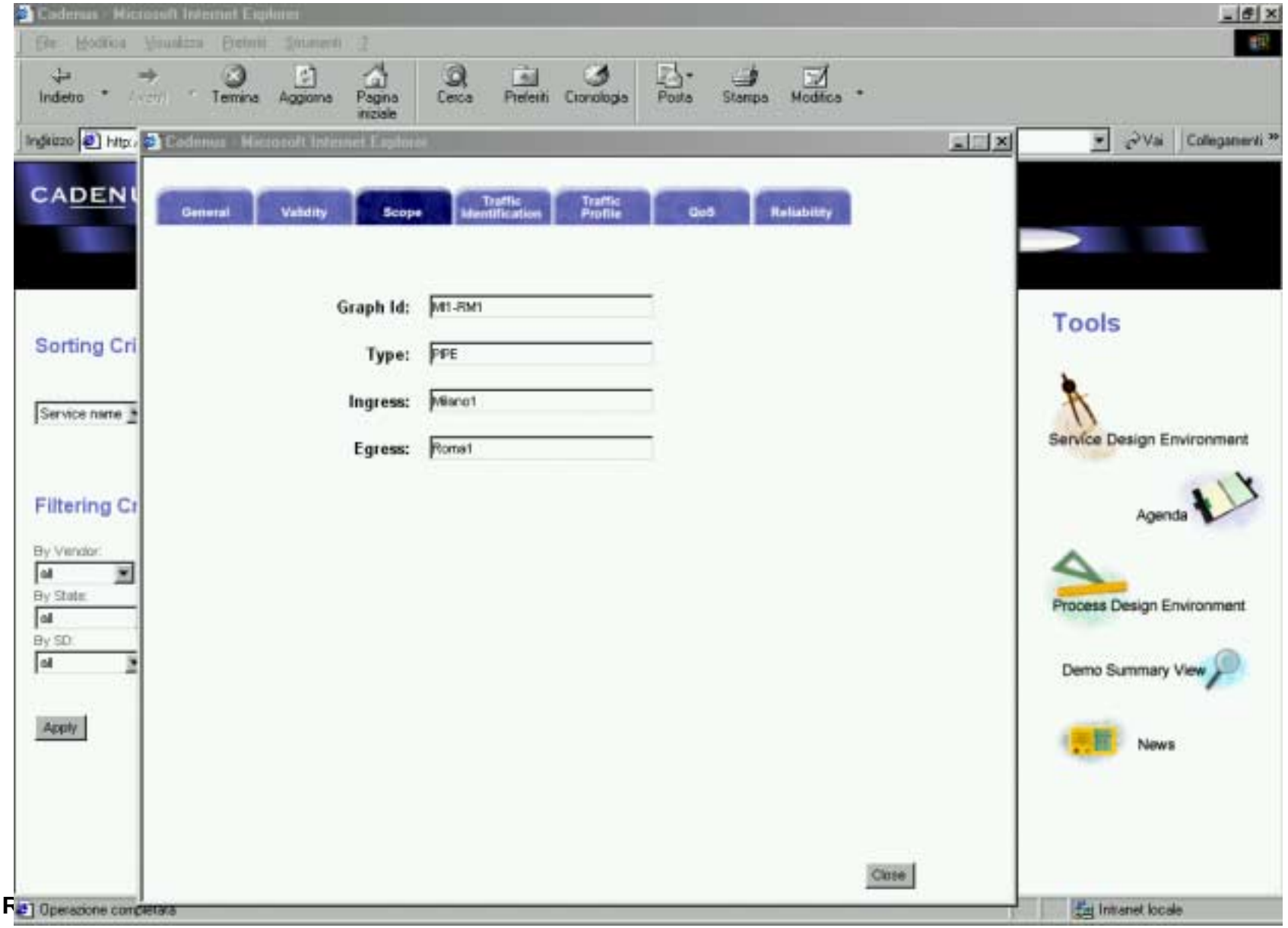
SLSs sent to Resource Mediator



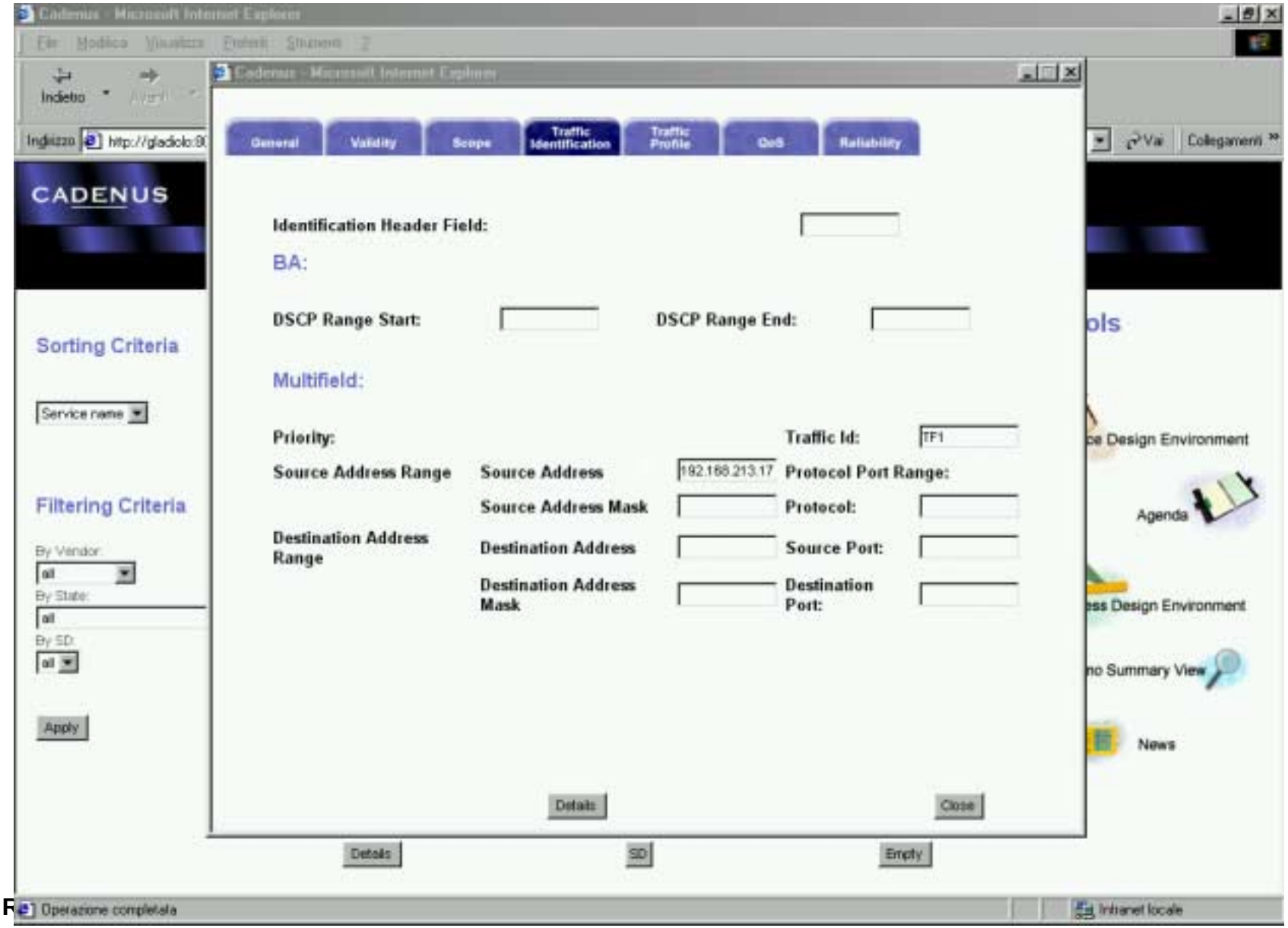
SLS Browser


Service Mediator Interactive Tools
Trading Partners
Provisioning Tools
SLA Management
TT Management
Trading Agreements
Service Descriptions
SLSs
SLS Browser
Id | Service Name | Seller | State | SD
EuroNet:1033 | IP Connectivity Service | Italian Telco | Wait_Activated | 30255
EuroNet:1034 | IP Connectivity Service | UK Telco | Wait_Activated | 30208
EuroNet:1035 | IP Connectivity Service | UK Telco | Wait_Activated | 30208
EuroNet:1036 | IP Connectivity Service | Italian Telco | Wait_Activated | 30255
Details
SD
Tools
Service Design Environment
Agenda
Process Design Environment
Demo Summary View
News

SLS Scope


General
Validity
Scope
Traffic Identification
Traffic Profile
QoS
Reliability
Graph Id:
M1-RM1
Type:
PIPE
Ingress:
Milano1
Egress:
Roma1
Close
Sorting Cri
Service name
Filtering Cr
By Vendor:
By State:
By SD:
Apply
Tools
Service Design Environment
Agenda
Process Design Environment
Demo Summary View
News

SLS Traffic Identifcation



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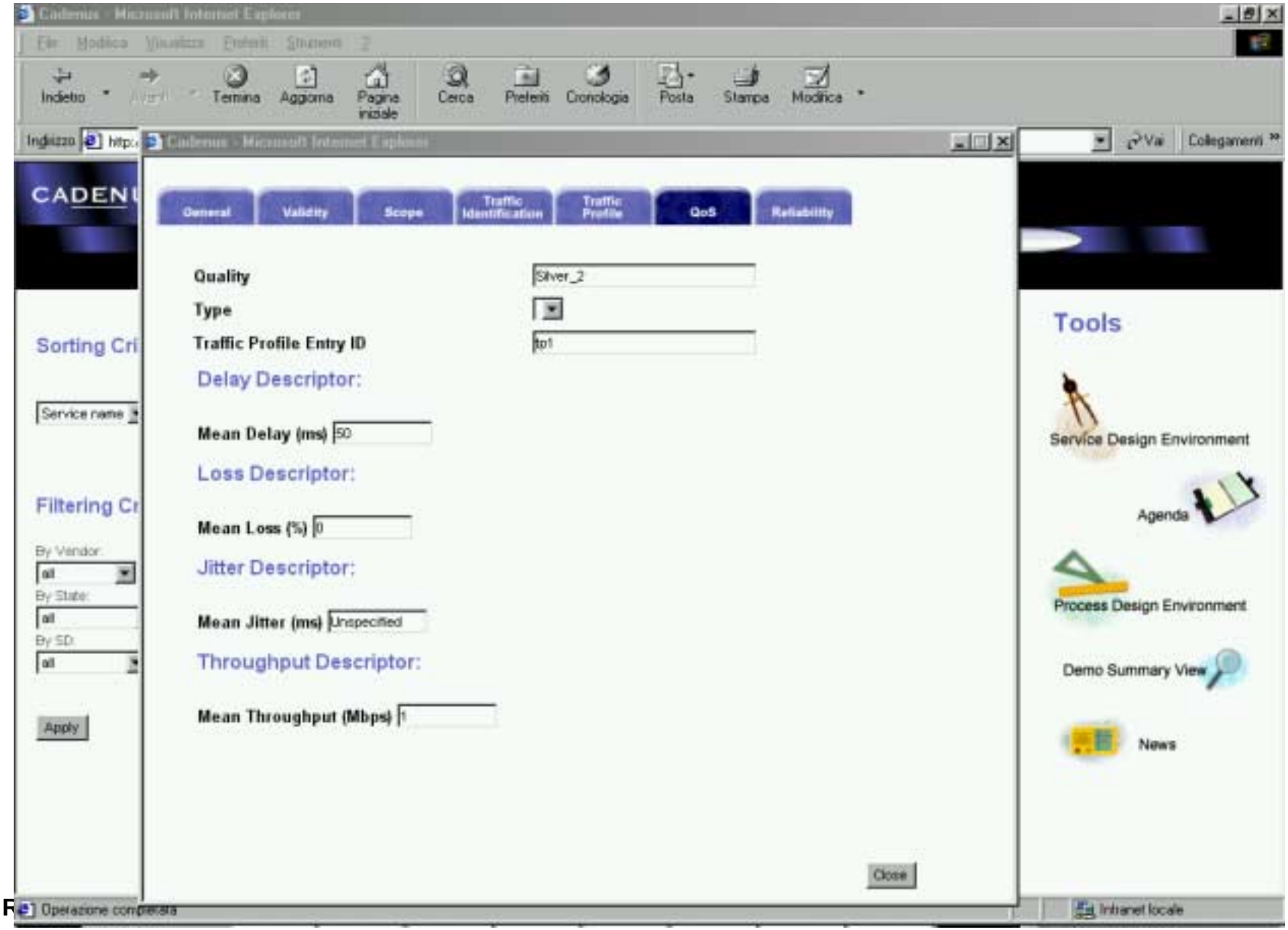
SLS QoS



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Resource Mediator

A. Diacones (Teltec)

RM - Main Topics

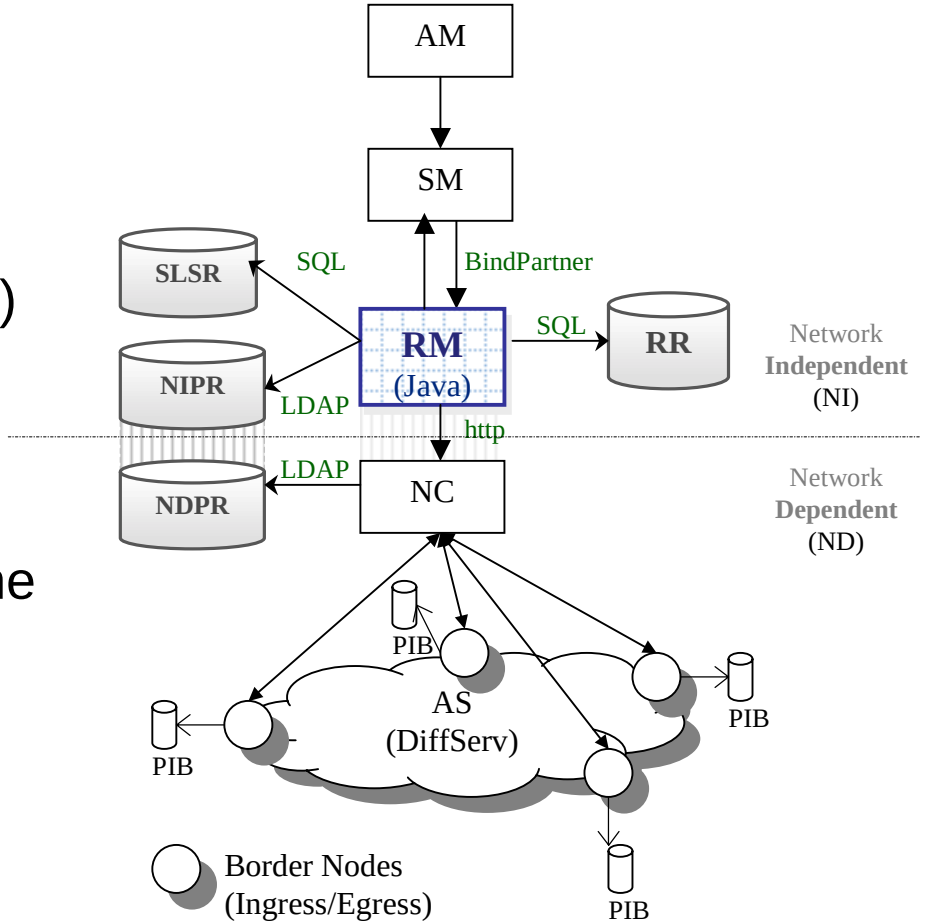
- Responsibilities, characteristics and integration in the Cadenus architecture
- Involvement in the SLS creation process:
  - Submission phase: check, commit/rollback
  - Activation phase
  - **Invocation phase**
  - **Operation & Assessment phase**
  - Deactivation, Expiration and Cancellation phases
- Design and implementation

RM Responsibilities, Characteristics and Integration

- Main role: managing network resources
- Belongs to a Network Operator (NO)
- Network independent

  Does not deppend on the underlying network or means of providing QoS

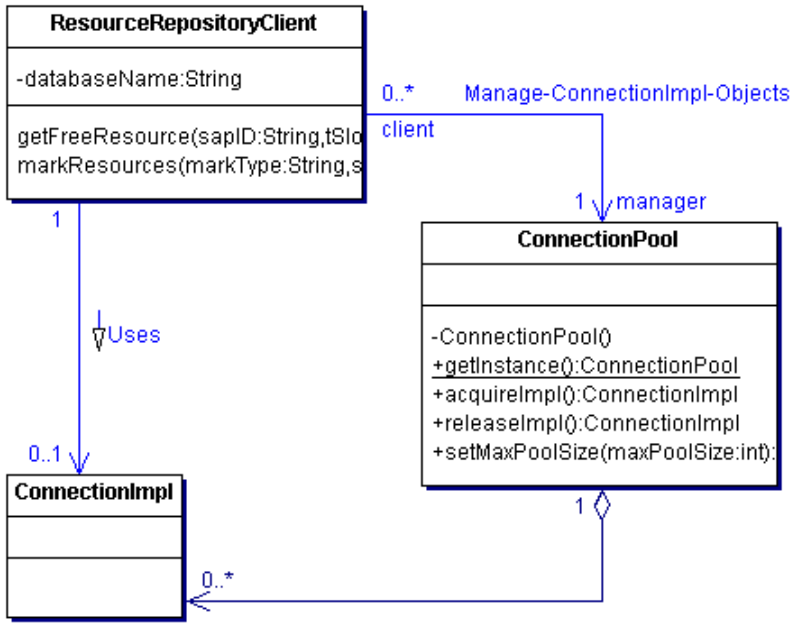
- The RR provides a logical view of the newtork domain



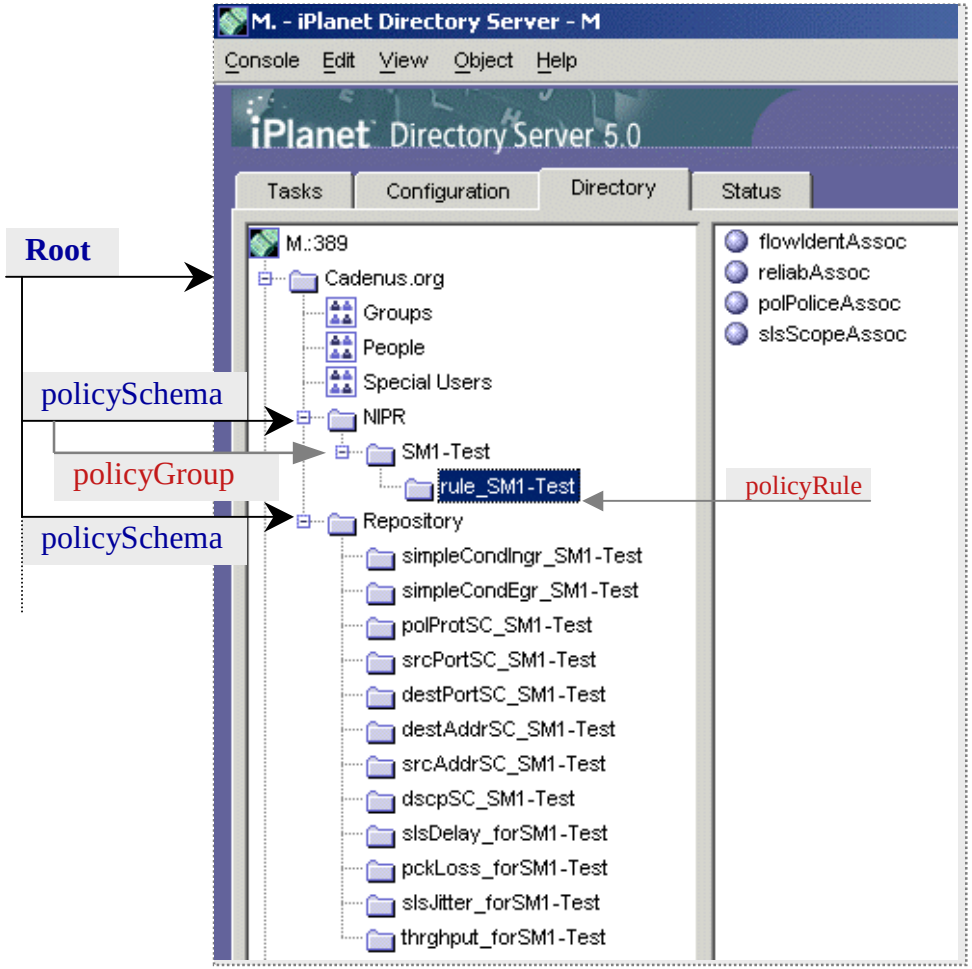
Resource Repository

- Provides a logical immage of the network domain
- Stored information:
  - For border nodes only
  - On total available and already reserved resources as a function of time
  - Only bandwidth is considered as a network resource
- Relational DB
- Manually populated with initial information

the ObjectPool Pattern for managing DB Connections



Network Independent Policy Repository



- **Stores policies for all committed SLSs**
- **Each SLS is translated into one policy rule:**
  - Scope condition
  - Flow Ident. condition
  - Reliability condition
  - Schedule condition
  - Policy Police action:
    - Excess Treatment
    - Performance Guarantees
    - Traffic Conformance
- **LDAP Directory: tree structure**

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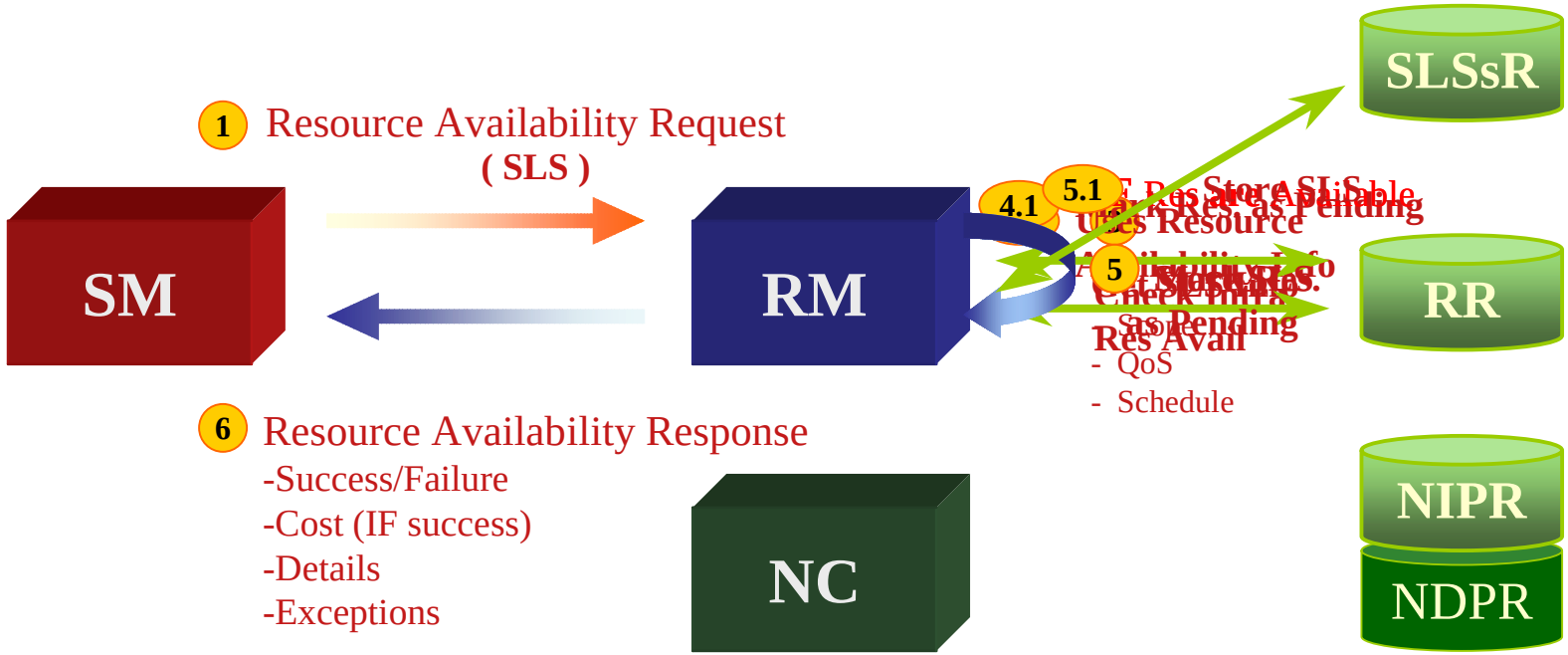
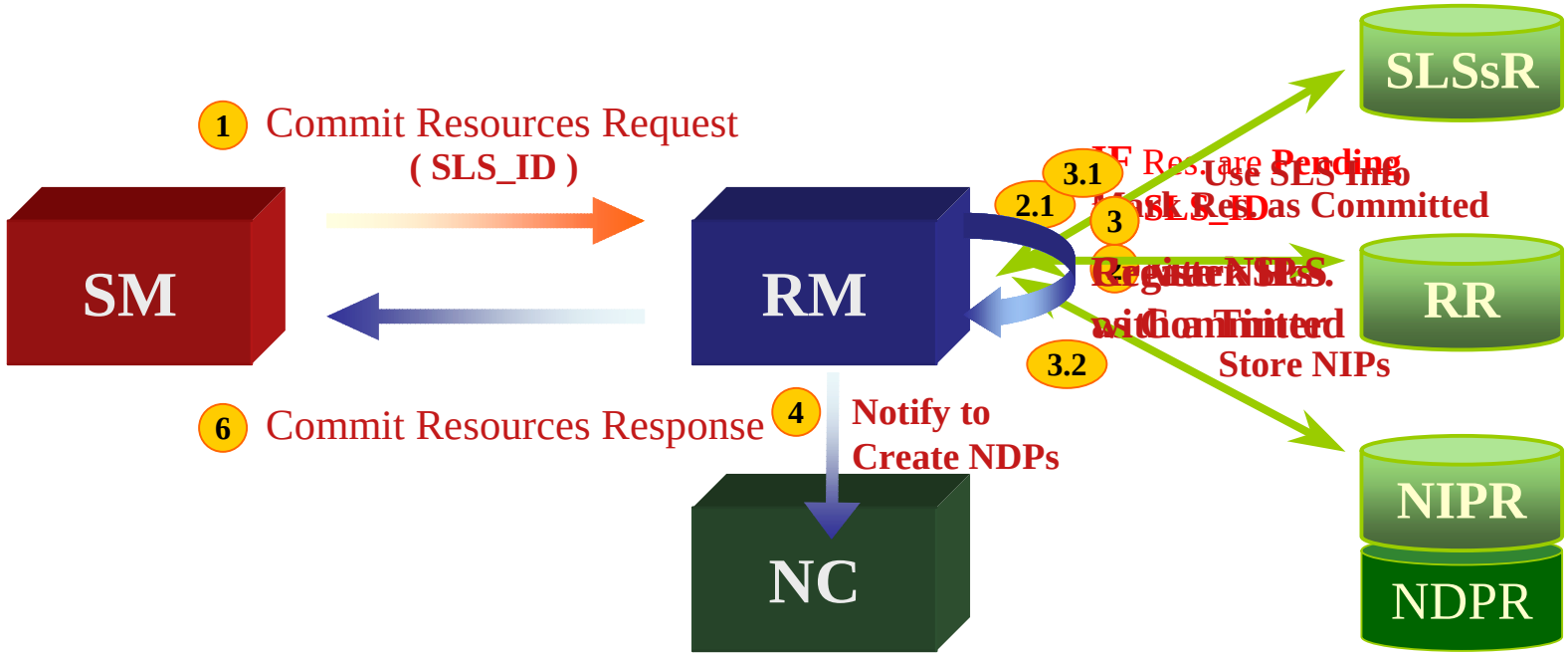
Submission Phase

Check Resource Availability for new SLS



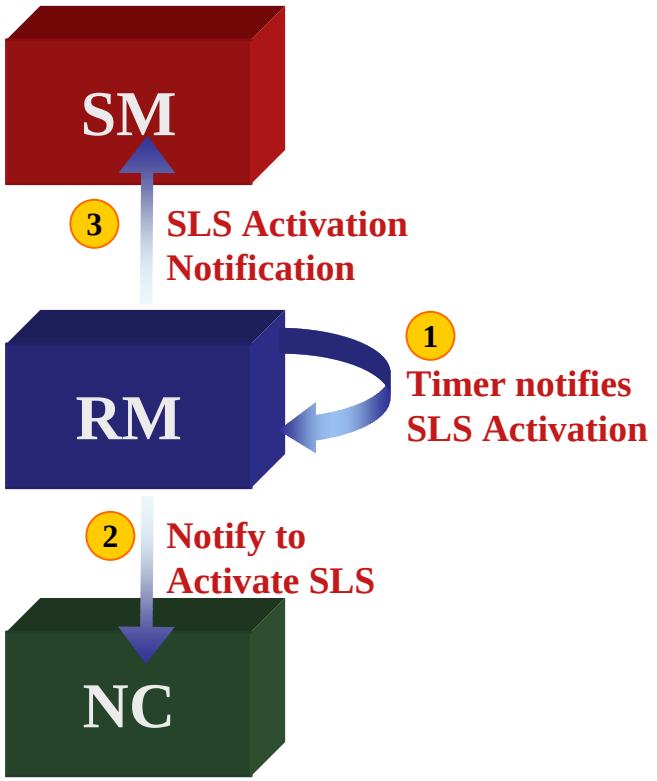
Submission Phase

Commit/Rollback Resources



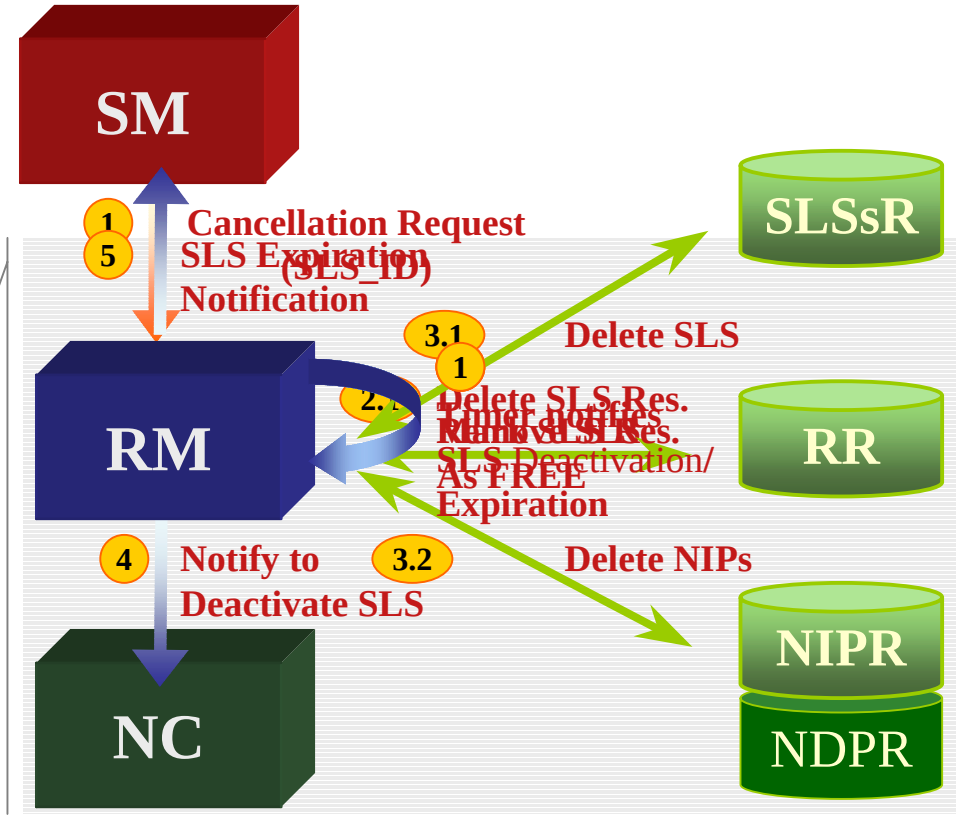
Activation Phase

- The moment when the NC configures the underlying network and the service becomes available
- The RM notifies the NC to activate the service:
  - SLS start time is due
  - Invocation request accepted



Deactivation, Expiration and Cancellation

- SLS Cancellation:
  - Initiated by the SM
  - All SLS info/Res. are deleted
  - If SLS is active, the NC is notified to deactivate it
- SLS Deactivation:
  - Initiated by the SLSs Timer
  - NC is notified to deactivate SLS
  - SM is notified
- SLS Expiration:
  - Initiated by the SLSs Timer
  - All SLS info/Res. are deleted
  - NC is notified to deactivate SLS

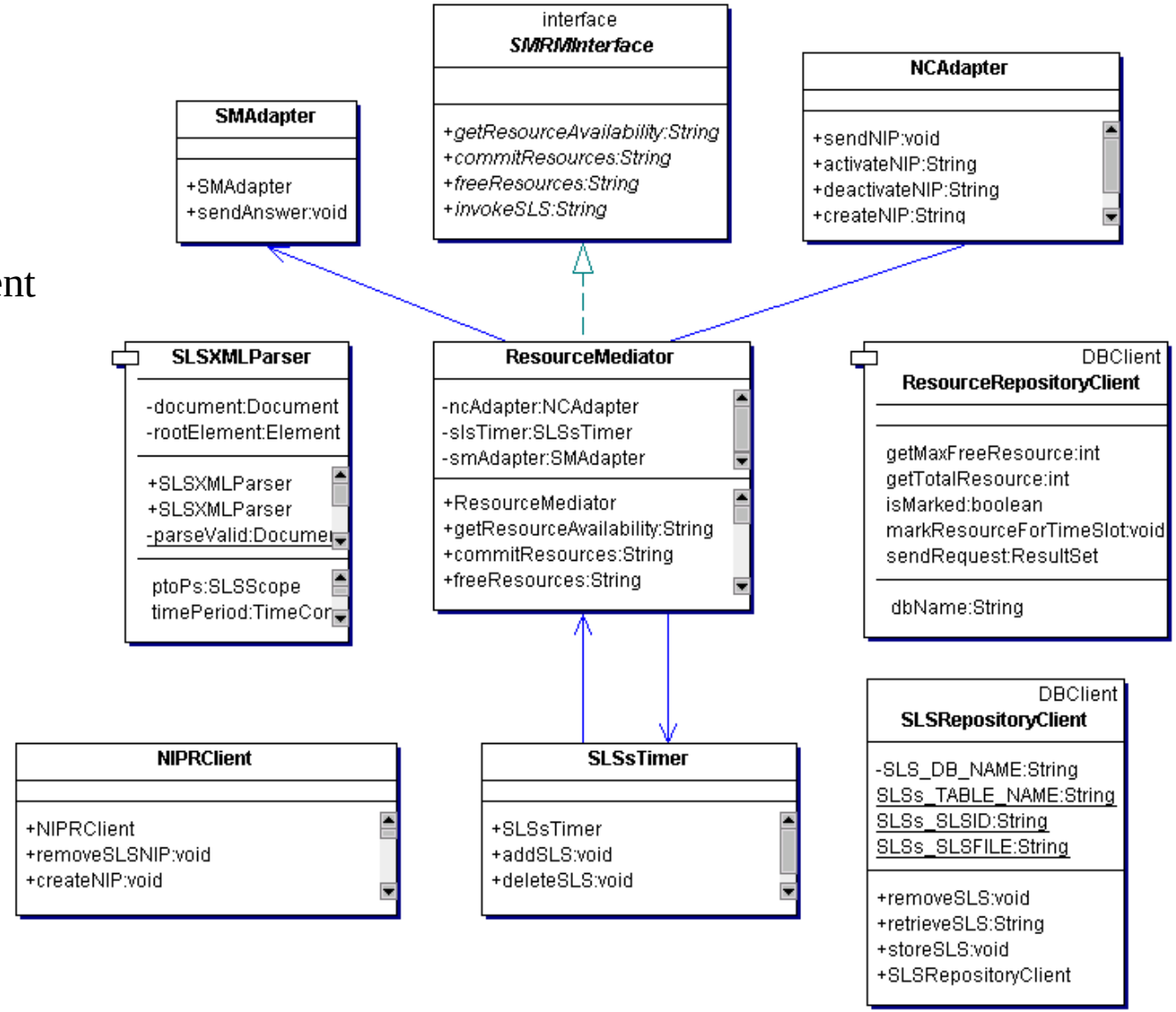


RM Main Components

Access to Stored Info:
- ResourceRepositoryClient
- SLSRepositoryClient
- NIPRClient

Communication with Other Components:
- RMProxy
- SMAdapter
- NCAdapter

Time tracking:
- SLSsTimer



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Questions & Answers ?

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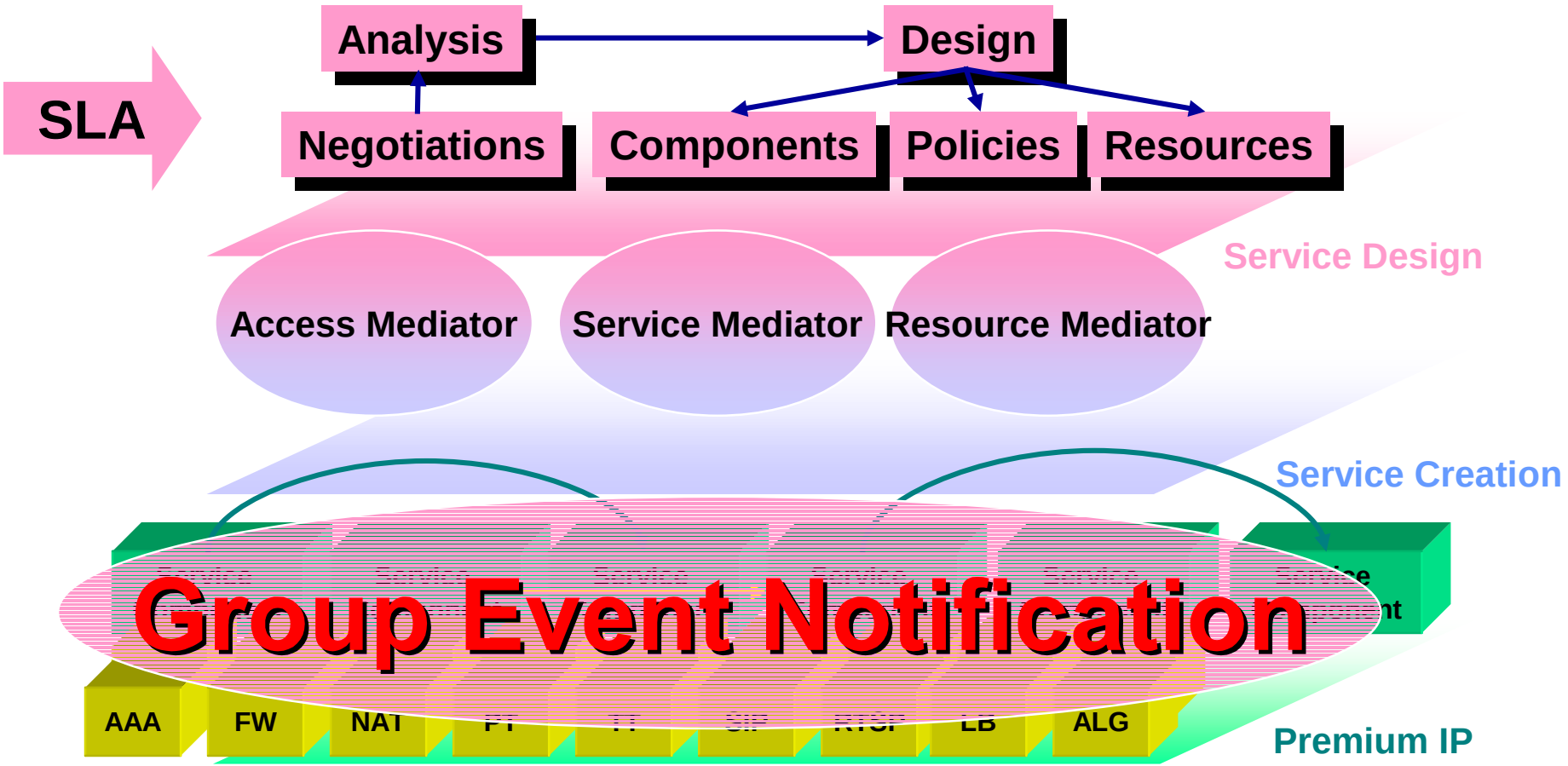
Service Creation in Premium IP with Group Event Notification: network side

M. Smirnov &

C. Reichert (FHI-Fokus)

Service Creation with GEN



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Service Creation

- Given: Middle Boxes providing atomic network services (like AAA, SIP, RTSP, Meters, BBs...)
- Goal: Compose at run-time MBs into a system which provides required end-user service
- Solution: Group Event Notification (GEN) orchestrates communication between Middle Boxes

Basic Concepts

- Service Group
  - set of MBs necessary to provide a composed service
- GEN-Agent is CATCH
  - CATCH runs at each service creation aware MB
  - interprets a language based on rules
  - when triggered by events executes MB-specific actions
- Group Communication
  - CATCH communicate
    - via group channel (=IP multicast group)
    - listen/send EVENTS
    - per service

CATCH – CADENUS Transaction CHorus

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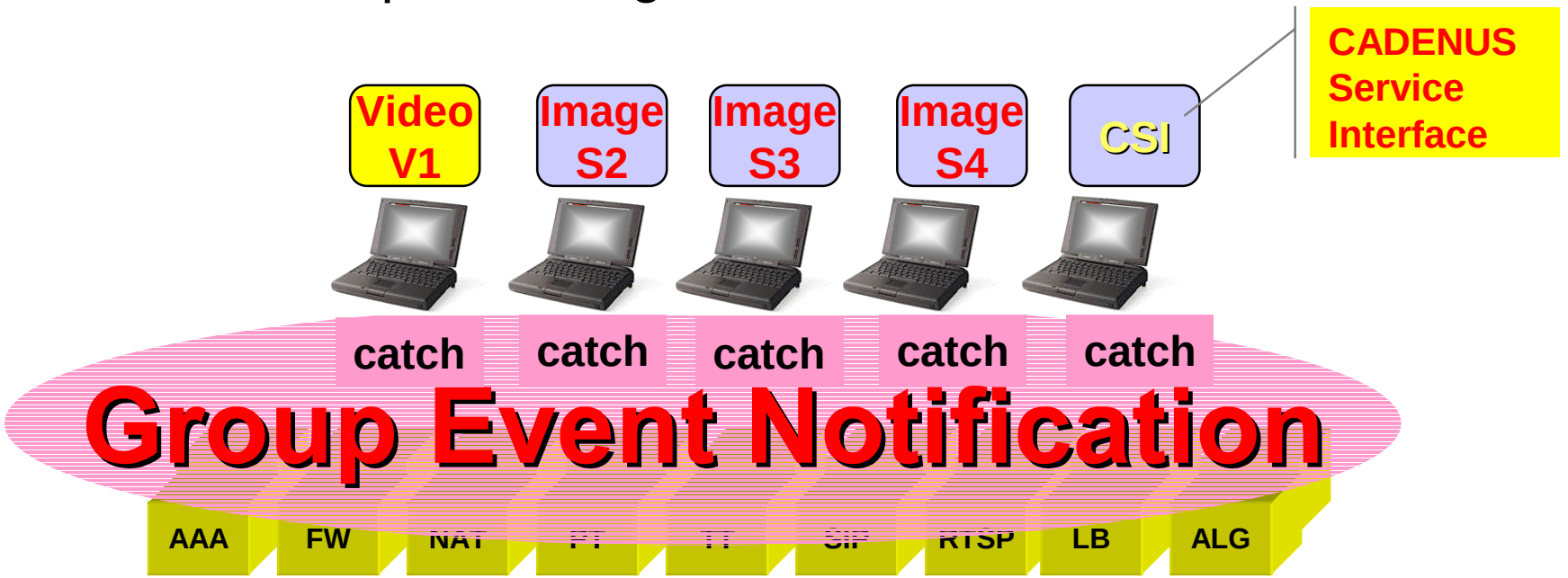
Phases of Service Creation

- Off-line: make Service Design Object (SDO)
  - prefixed set of RULES
    - RULE: event → action
    - PREFIX: defines group members by e.g. ONEOF(condition)
- On-line: Service Configuration
  - send SDO to the service group
    → self-organisation of the group
    - leader election
    - conflict resolution
- Run-time: Service Invocation
  - send START event to the group

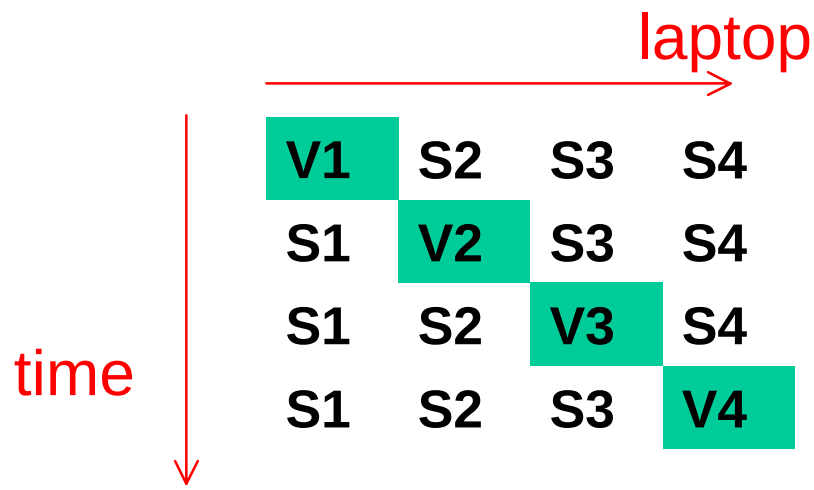
How to demonstrate?

- Visualise GEN → straight-forward approach:
  MB action = {show movie | image}
- Self organisation in case of failures
- Complex enough



Demo Scenario

- 5 laptops as MBs (displaying video/images)
- 4 images and 4 video clips are replicated to all 5 laptops
  - video content explains the concept
- Play Schedule:



- During Execution

If a CATCH module crashes (ctrl-C), the service group reconfigures itself automatically and repeats the last step.

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Conclusion

- GEN scales
  - events → service independence
  - groups → network independence
- GEN is robust
  - redundancy is easy
  - self-organisation
- GEN meets nearly all midcom requirements

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Questions & Answers ?