CADENUS

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

The registration, presentation, selection and delivery of a VoD service using the CADENUS Architecture over a DiffServ network („Trial 1“)
CADENUS Architecture

Service Authority

Resource Mediator (per administrative domain)

Service Provider

Resource Mediator (per administrative domain)

Access Mediator

Service Mediator

Service Mediator

Network Controller (per technology domain)

Network Controller (per technology domain)

Network Controller (per technology domain)

Access Network Provider

Backbone Network Provider

Next Administrative Domain

4th Review - Common presentations
Maastricht, May 15-16 2002
Outline of the Demonstration

To show how the CADENUS architecture provides support for:

- Independence of service provision and network provision
  - VOD
  - VoIP
  - VPN

- Capabilities for monitoring

Live interaction with our real remote Service Mediator (VoD)

Summary of tests that we will perform on this testbed
Multiple Applications
Flexible
Integrated Architecture
The Cadenus Video on Demand Service

Maastricht review demo

May 15th 2002
Demo roadmap

• **Service Creation:**
  – The birth of a new Web Service

• **Service Negotiation:**
  – Mediators interaction in the electronic market
  – Dynamic, policy-based network configuration

• **Service Invocation:**
  – SLA-based service ‘quality assurance’
Service Authority

Service Directory

Service Mediators

User

Access Mediator

Service Creation

Resource Mediators

QoS-capable Networks

Service Negotiation
Creation of a new Web Service

• **Four steps involved:**
  1. define and put in a standard format a description of the business process associated to service trading;
  2. define a standard Graphical User Interface to allow user’s customization of the service parameters;
  3. define a standard template for the Service Level Agreement;
  4. define the rules to be applied in the translation from the SLA to the corresponding SLS(s) at negotiation time.
Step 1: Business Process Specification

[Diagram showing business process with roles and transactions]
Step 2: The standard GUI (VoD)
Step 3: the SLA template (VoD)
Reminder...the SLA

<?xml version="1.0" encoding="UTF-8" ?>
- <SLA>
  - <Status>Active</Status>
  - <Renegotable>yes</Renegotable>
  <DateOfSignature>Mon May 06 22:13:54 CEST 2002</DateOfSignature>
- <BuyerInfo>
  - <buyer>
    - <name>UoN AM</name>
  </buyer>
</BuyerInfo>
- <SellerInfo>
  - <seller>
    - <name>SM</name>
  </seller>
</SellerInfo>
- <Service>
  - <ServiceName>video on demand</ServiceName>
  - <ServiceInfo>
    <ID>1</ID>
    <title>Cadenus Demo Clip</title>
    <language>italian</language>
    <subtitle>italian</subtitle>
    <quality>gold</quality>
    <startTime>2002-1-1T0:0</startTime>
    <endTime>2002-1-1T0:0</endTime>
    <vcrControl>no</vcrControl>
  </ServiceInfo>
</Service>

...
Step 4: the SLS

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<Ingress>
  <Address ID="1">143.225.229.2</Address>
</Ingress>
<Egress>
  <Address ID="1">143.225.229.3</Address>
</Egress>
</Scope>
<FlowID>
  <Source>
    <AddressPrefix ID="1">
      <Address>143.225.229.2</Address>
      <Mask>32</Mask>
    </AddressPrefix>
  </Source>
  <Destination>
    <AddressPrefix ID="1">
      <Address>143.225.229.3</Address>
      <Mask>32</Mask>
    </AddressPrefix>
  </Destination>
  <TypeOfService>
    <TOS ID="1">184</TOS>
  </TypeOfService>
  <DestPort>5000</DestPort>
  <SourcePort>5500</SourcePort>
</FlowID>
<SLSID>1</SLSID>
<SLS>
  <BucketRate>1500</BucketRate>
  <MTU>1500</MTU>
  <MPS>50</MPS>
</SLS>
</TrafficConformance>
<ServiceSchedule>
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  </Date>
</ServiceSchedule>
<ExcessTreatment>Dropping</ExcessTreatment>
</SLS>
```
The Service Directory

• Contains the models of the standardized services (*service types*)
• Gives a SM the possibility to publish its own profile and the services it offers
• Gives the AM the possibility to retrieve information about the portfolio of services and about the SMs that are offering them
• Acts both as a *registry* and as a *repository*
The Service Authority

- Supervises the entire framework
- Defines, upon SMs’ requests, new service types
- Makes sure that any registered Service type is compliant with the current specifications
- Avoids service duplicates, by making sure that no registered service appears in the Directory in two slightly differing versions
UDDI (Universal Description Discovery and Integration)

- A framework for the *description* and *discovery* of services based on the creation of a world-wide registry aimed at facilitating *integration*
- Uses XML to represent data
- Uses SOAP (Simple Object Access Protocol) to exchange messages (query, registration, etc)
- A *logically centralized*, but *physically distributed* service
UDDI at work

1. Standards bodies and programmers populate the registry by describing services via metadata.

2. Companies populate the registry with information related to their own profiles and the technical descriptions of the services they support.

3. Inside the registry unique identifiers are assigned to each business entity and to each service.

4. Marketplaces, search engines and applications formulate queries to obtain information about the companies and the registered services.

5. The information may be used to invoke the desired Web service.

Cadenus Project
Publishing a new Service Type

- BP name
- BP Specification
- Taxonomy Specification
An example: registering a service
VoD - the SM’s Database

Cadenus Project
VoD - the SM’s Database
Dynamic network configuration

A policy-based approach
Dynamic network configuration

SLS = Service Level Specification
RM = Resource Mediator
PEP = Policy Enforcement Point
PIB = Policy Information Base
SLSR = SLS Repository
NC = Network Controller
PDP = Policy Decision Point
NDPR = Network Dep. Policy Repository
Other issues faced...

• Interdomain functionality:
  – SLS ‘splitting’ techniques.
  – MPLS infrastructure at the lower layer:
    • Traffic engineering (RSVP-TE)
    • Dynamic configuration of Traffic Trunks
      – COPS for Traffic Engineering
      – Complete implementation under Linux

• Monitoring:
  – Design of a Cadenus monitoring framework
    • D2.2
  – Liaison with MoMe (Monitoring and Measurement) cluster

Cadenus Project
SLA and Voice Over IP

SLA Parameters
Profiles: Residential (per call basis: e.g. through Dial-up)
Corporate (per monthly basis: e.g. to connect two sites)

SLS Parameters

<table>
<thead>
<tr>
<th></th>
<th>GOLD</th>
<th>SILVER</th>
<th>BRONZE</th>
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<tr>
<td>Latency</td>
<td>&lt; 100 ms</td>
<td>150 ms</td>
<td>200 ms</td>
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<tr>
<td>Loss</td>
<td>&lt; 0.2 %</td>
<td>5 %</td>
<td>10 %</td>
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<tr>
<td>Jitter</td>
<td>&lt; 20 ms</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>&gt; 100 kbps</td>
<td>80 kbps</td>
<td>&lt; 80 kbps</td>
</tr>
</tbody>
</table>
VoIP Application

- Connection topology: PC2PC
  (Extension coming) PC2Phone
- Connection mode: Full-duplex
- Platform Independent
  (O.S. tested) Windows 98/NT/2000/XP
  Linux

1st phase: SIP (Session Initiation Protocol)
2nd phase: RTP (Real time Protocol)
Service Mediator: VoD Service Demo
VoD Service Design

Steps for introducing a new service type in the Service Mediator:

- SLA Template and Service Template
- Service negotiation and configuration workflows
- SLA-SLO translation rules
- Data format translation rules
- Configuration policies
VoD Service Model

VPN SLA Contract

VoD SLA Contract
  orderDate
  customerData
  cost
  provisioningTime

VPN Service

VoD Service
  contentID
  schedule

IP Pipe Service

Service Dependency

L2 Access Service

IPConnection Service
  ingress
  egress
  schedule

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VoD QoS Characterisation

- Assumption:
  - the customer has an Internet access with bandwidth suitable to the required CoS
  - Video recorded at constant quality (e.g. MPEG 2)
  - VoD Class of Service imposes constraints on the IP connectivity service required
    - Bandwidth requirements
    - Performance parameters requirements for the different channels required (video, audio, control)
VoD Classes of Service

VoD Gold Quality
VoD Gold
VoD Silver
VoD Bronze

VoD-SLA-Contract
- customer
- orderDate
- cost

VoD-Service
- contentID
- schedule

IP-Connection-Service
- ingress
- egress
- schedule

IPConnectionSLO
- isExposed

IPLR-SLOEntry
- operator
- threshold
- unit

IPTD-SLOEntry

IPDV-SLOEntry

Throughput-SLOEntry

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VoD Instance

End-User-Request

Customer = “Mario Rossi”
Selected Title = “Rambo”
Schedule = 15-5-02: 20:30
Quality = Gold
IP Address = 192.45.127.57

VoD Gold Quality

VoD Gold

customer = “Mario Rossi”
orderDate = 15-5-02
cost = 10

IPDVSLOEntry
operator = “less-than”
threshold = 50
unit = ms

IPDVSLOEntry
operator = “less-than”
threshold = 400
unit = none

ThroughputSLOEntry
operator = “greater-than”
threshold = 600
unit = ms

IPLRSLOEntry

IPTDSLOEntry

Video IP Connection Service

ingress = 193.70.236.18
egress = 192.45.127.57
schedule = 15-5-02: 20:30

Audio IP Connection Service

ingress = 193.70.236.18
egress = 192.45.127.57
schedule = 15-5-02: 20:30

Command IP Connection Service

contentID = “Rambo”
schedule = 15-5-02: 20:30

IPConnectionSLO

ingress = 193.70.236.18
egress = 192.45.127.57
schedule = 15-5-02: 20:30

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SLS Generation

Access Mediator

Service Mediator

rSLA

Video SLS

Audio SLS

Command SLS

Resource Mediators

Service Provider

End User

Service Negotiation & Configuration

Service Invocation

Video Channel

Audio Channel

Command Channel

Backbone Network Providers(s)

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# SLS QoS Parameters

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<tr>
<th>VoD CoS</th>
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<th>IPLR</th>
<th>IPDV (ms)</th>
<th>Bandwidth (Kbps)</th>
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</table>
Tests and Measurement for Trial 1

- Functional testing of the architecture:
  - Service registration and partner localisation (AM, SM, SA)
  - Service design, SLA-SLS translation (SM)
  - Service negotiation and configuration (AM, SM, RM)
  - Service invocation (RM)
  - SLA monitoring

- Non functional testing:
  - Performance
  - Scalability
  - Usability