CADENUS

Creation and Deployment of End-User Services in Premium IP Networks
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)
Operators:
- France Telecom R&D
- Eircom
- Telecom Italia (Sodalia)

Manufacturers:
- Flextel
- TieSse

Consultancies:
- Telscom
- Martel
Universities & Research Institutes:

University of Naples
Dublin City University
EPFL
FHI-Fokus

+ 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

Access Mediator
- AAA
- Directory/yellow pages
- Preferences Lists
- Service menu
- User profile
- Terminal types

Service Mediator
- r-SLA

Resource Mediator
- SLS
- Traffic engineering
- Terminal localization
- Terminal capability
- Network capability

Backbone Network Provider

Next Network Provider

Access Network Provider

Service Provider
- Services
- r-SLA
- AAA
- Presentation
- Subscription
- SLS
- Traffic engineering
- Terminal localization
- Terminal capability
- Network capability
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
WP1
Service Architecture in Premium IP

WP2
Resource Management & QoS Control in SLA Networks

WP3
Service Configuration & Provisioning (Mediation) Framework

WP4
Trials and Demonstrations

WP6
Dissemination and Exploitation

Current Work
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
Presentation Programme

➢ Project Overview (M. Potts – Martel)
  ➢ Partners
  ➢ Objectives
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➢ Service Creation at the Network Level (M. Smirnov - FHI Fokus)
CADENUS Business Case

G. Morgan (Eircom)
& O. Dugeon (FTR&D)
Why NGN & Why CADENUS?

Today
Single-service networks

Future
Multi-service networks/client-server

Services

PLMN
PSTN/ISDN
Data/IP Networks
CATV

Access Transport & Switching Networks

Cadenus

January 20-22 2001

3rd Review – Common presentation

Dresden, November 20-22 2001
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.
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
The Importance of SLAs

➢ An automated SLA framework will be important in ensuring the co-operation of business partners and rivals alike in the delivery 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

Business case for NGN/IBC/Technical Development
Telecommunications network must capture big slice of the economy
Massive traffic growth

Massive traffic growth

Interpersonal comms Entertainment Shopping etc.

Huge number of network & service providers

Differing QoS/CoS BOD & Portability/Mobility Low cost network access

Market in unused network resources

Market mechanisms critical to fund investment required, generate profits & realise acceptable payback period

Automated SLAs IPQoS
➢ 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
➢ 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.
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
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 i.e. < 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?
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

User Side
- Access Mediation
- Service
- Resource Access
- Communication
- Transfer

Network Side
- Access Mediation
- Service Mediation
- Logic Service
- Network Controller
- PIP (Access Network)
- PIP (Backbone Network)

- Sessions
- (contract & transaction)
Questions & Answers ?
AM-SM interaction as a Business Process

S.P. Romano, S. D’Antonio & G. Ventre (UoN)
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

Access Mediator

Service Mediator

Resource Mediator

Backbone Network Provider

Next Network Provider

- r-SLA
- AAA
- Directory/yellow pages
- Preferences Lists
- Service menu
- User profile
- Terminal types

Service Provider

Services

• AAA
• Presentation
• Subscription

• Traffic engineering
• Terminal localization
• Terminal capability
• Network capability

3rd Review – Common presentation

Dresden, November 20-22 2001
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
Business Actors

Access Mediator

Service Mediator

Service Directory

Service Authority

3rd Review – Common presentation

Dresden, November 20-22 2001
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
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

Access Mediator

Business Process

Service Mediator

3rd Review – Common presentation

Dresden, November 20-22 2001
Dresden, November 20-22 2001

3rd Review – Common presentation

ebXML platform

Service Mediator

Access Mediator

User

(1) VPN
(6) Tool
(8) VPNDescription
(11) Quotation
(12) OrderRequest
(15) OrderResponse

(2) VPN
(3) SM+tool

(4) RequestForServiceInfo
(5) ServiceInfo
(9) RequestForQuotation
(10) Quotation
(13) OrderRequest
(14) OrderResponse

(7) Draw

VPN
Tool
VPND: VPND: VPNDescription
OrderRequest
OrderResponse
Quotation
Service Mediator: Functionality, Architecture and Example Scenario

R. Fiutem (Sodalia)
Service Mediator: Context

- Service Provider
  - Services
    - r-SLA
    - Access Mediator
      - Resource Mediator
        - SLS
          - VASP

- Access Network Provider
- Resource Mediator
- Backbone Network Provider
- Next Network Provider
- Service Integrator
- Non-facilities based
- "One-stop-shop"
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)
➢ 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
SM-RM Business Process
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:
Finding how to build a connectivity between the end-user and the Service Provider network having:

Delay < 100 ms

Source: Eurescom P1008
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
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. $D_{tot} = D_1 + D_2 + \ldots + D_n$;
- packet loss accumulates on a probabilistic basis, i.e. $P_{tot} = 1 - [(1-P_1)(1-P_2)\ldots(1-P_n)]$;
- delay variation accumulates on an RMS basis, i.e. $DV_{tot} = \sqrt{DV_1^2 + DV_2^2 + \ldots + DV_n^2}$;

where $D_n$ is the mean one-way delay of Domain $n$;
$P_n$ is the packet loss probability of Domain $n$; and
$DV_n$ is the standard deviation of the delay variation of Domain $n$.
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
Example Scenario: SM GUls “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

Identification:
- Service Name: P Connectivity Service
- Service Description Id: 30208
- Version Number: 1
- Seller Id: JK Tekco
- Service Type: PConnection
- Service Details: National P Connectivity Service with QoS

Validity:
- Start Date: 17-NOV-01
- End Date: 

Tools
- Agenda
- Process Design Environment
- Demo Summary View
- News
Service Description Topology
Service Description QoS
Contract Browser
Service Browser
E2E Service SAPs
E2E Service Data
E2E Agenda Tool

Activity List

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E2E Analyzer
E2E Analyzer Results

**End to End Fulfillment Tool**

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<th>Jitter</th>
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SLSs sent to Resource Mediator

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SLS Browser

Service Mediator Interactive Tools

SLS Browser

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Tools

- Service Design Environment
- Agenda
- Process Design Environment
- Demo Summary View
- News
SLS Scope
SLS Traffic Identification

Identification Header Field:

BA:

DSCP Range Start:  
DSCP Range End:  

Multifield:

Priority:  
Source Address Range  
Destination Address Range  
Source Address  
Destination Address  
Source Address Mask  
Destination Address Mask  
Traffic Id:  
Protocol Port Range:  
Source Port: 
Destination Port: 

Details
Close
SLS QoS
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 depend on the underlying network or means of providing QoS
- The RR provides a logical view of the network domain
➢ Provides a logical image 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

Resource Repository

- Database Name: String
- getFreeResource(saalID: String, sql): String
- markResources(markType: String, sql: String)

ConnectionPool

- ConnectionPool()
- getInstance(): ConnectionPool
- acquireImpl(): ConnectionImpl
- releaseImpl(): ConnectionImpl
- setMaxPoolSize(maxPoolSize: int)
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
Check Resource Availability for new SLS

1. Resource Availability Request (SLS)

2. Get SLS Info
   - Scope
   - QoS
   - Schedule

3. Check Intra Res Avail

3.1 Uses Resource Availability Info
   - Mark Res. as Pending

4. IF Res are Available
   4.1 Mark Res. as Pending
   5. Store SLS
   - Uses Resource
   - Check Retry
   - Check Pending
   - Store SLS
   - QoS
   - Schedule

5. IF Res are Available
   5.1 Store SLS

6. Resource Availability Response
   - Success/Failure
   - Cost (IF success)
   - Details
   - Exceptions

3rd Review – Common presentation

Dresden, November 20-22 2001
Submission Phase

Commit/Rollback Resources

1. Commit Resources Request (SLS_ID)
2. IF Resources Pending for SLS_ID
   2.1 Mark Res. as Committed
   3.1 Use SLS Info
   3.2 Store NIPs
3. Register SLS with a Timer
4. Notify to Create NDPs
5. Create NIPs
6. Commit Resources Response

SM → RM → NC → RR → NIPR → NDPR
➢ 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
Access to Stored Info:
• ResourceRepositoryClient
• SLSRepositoryClient
• NIPRClient

Communication with Other Components:
• RMProxy
• SMAAdapter
• NCAdapter

Time tracking:
• SLSsTimer
Questions & Answers ?
Service Creation in Premium IP with Group Event Notification: network side

M. Smirnov &
C. Reichert (FHI-Fokus)
Service Creation with GEN

- Analysis
- Negotiations
- Design
- Components
- Policies
- Resources

Components:
- AAA
- FW
- NAT
- PT
- TT
- SIP
- RTSP
- LB
- ALG

Group Event Notification

Premium IP

3rd Review – Common presentation
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
➢ 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**
Phases of Service Creation

- **Off-line**: make Service Design Object (SDO)
  - prefixed set of RULES
    - RULE: event $\rightarrow$ 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
➢ 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.
Conclusion

➢ GEN scales
  ➢ events → service independence
  ➢ groups → network independence

➢ GEN is robust
  ➢ redundancy is easy
  ➢ self-organisation

➢ GEN meets nearly all midcom requirements
Questions & Answers?