Automating SLA negotiation: a policy-based approach

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Presentation Outline

- The FORM project environment
- Current policy issues
- Towards a generic policy model
- Automating SLA negotiation
  - The SLA negotiation process
  - A SLA negotiation engine
  - SLA negotiation policies
- Technical issues
- Further work
FORM: Main Goal and Approach

**Goal**
To enable FORM’s industrial partners to exploit services, software systems and software components for the management of an outsourced Inter-Enterprise Service (IES) supporting B2B communication requirements.

**Approach**
Definition of an Open Development Framework addressing operational needs for IES management and development of management systems based on software components (Building Blocks).
FORM: Anatomy of an Open Development Framework

- Business Roles + RPs (TINA)
- Business Processes (TMF)
- BBs in 3 tiers
- BB platform services
- BB contracts

Map BB to specific technologies:
- BBs to EJB
- BB platform to container services
- Contract specs to interface implementation (IDL, HTTP/XML..)
- Mediation - multi-protocol BBs

Open Development Framework

- Logical Architecture
- Technology Architecture
- Development Methodology
- Reusable Element

RPs, Contracts and BB definitions:
- Bindings
- Implementation independent specs
- Packaged with analysis and design info
- Variability and Constraint specs

Business models
- Business process
- OOAD
- Contract/BB definition
- RUP
- Notation: UML + XML?

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Policies
Background

- TMF SLA Group
- Imperial College work
  - Ponder language
- DMTF: PCIM and CIM
- IETF
- IST project Tequila
- Other IST projects (CADENUS, AQUILA, etc)
- Active Networks
Policy Issues

- Are policies useful? Why?
- What functionality can be policy-based?
- Generic policy language
- O-O Policies
- Hierarchical policy organisation
- Transformation from high to low level policies
- Transformation from low to high level policies
- Policy meta-model
- Policy semantics
- Security concerns
Generic Policy Model (GPM)
**polML**: Generic Policy Model DTD

```
<PolicyRule>
  <PolicyCondition>
    <PolicyConditionValidator/>
    <PolicyConditionStatement/>
  </PolicyCondition>
  <PolicyAction>
    <PolicyActionValidator/>
    <PolicyActionStatement/>
  </PolicyAction>
  <PolicyParameters>
    <TypeValuePair/>
  </PolicyParameters>
  <PolicyRuleAssociations/>
</PolicyRule>
```

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**Generated with XMLSpy Schema Editor**

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GPM Features

• Meta-model
• Policy language independent
• Applies to different application areas
• Provides for hierarchical policy organisation
• Provides for policy transformation functions
• Policy semantics are out of the model
• Security information can be added
• Compatible with current IETF/DMTF policy models
• A base for the implementation of policy-independent PDP/PEPs
• Separation between PDP/PEP infrastructure and policy specification, interpretation and enforcement
Relating the GPM to the DMTF/IETF Policies

- Policy Identification
  - Rule usage description

- Policy Parameters
  - Enabled, priority, mandatory, condition list type, sequenced action, policy roles

- Policy Rule Associations
  - Policy roles?

- Policy Condition(s)
  - Policy condition(s), time period

- Policy Action(s)
  - Policy action(s)
FORM: Areas of Policy Use

- Automating the SLA negotiation process
- Generalising use of policies for controlling BB behaviour in general
- Policy-based SLS negotiation
- Policy-based network configuration and monitoring (assurance)
- Policy-based configuration of the IPSEC tunnel
SLA Negotiation
Structure of a SLA

- SLA Identification
  - SLA ID, SLA title, etc
- Times
  - Activation Times, etc
- Parties, Obligations & Rights
  - Service Provider, Customer(s) and their obligations and rights
- Service Level Objectives
  - SLO configuration ID, SLO parameters (or SLS parameters)
- Tariff
- Monitoring
- Penalties
  - Penalties for not meeting the stated service level objectives, obligations or rights. Consequences, including discounts
- Other Clauses
SLA Negotiation Process

Customer Admin.

:OH Customer Interface

Includes SLA/SLO parameters or SLO ID. Customer details are optional here.

Service Provider Admin.

:SLA Negotiation Engine

:OH Subscription Manager

SLA request

SLA proposal

SLA confirmation

Initiate subscription

Includes complete details and SLA/SLO parameters, and, optionally, an alternative SLA

Customer details compulsory. Also, it is stated which of the alternatives is confirmed

Includes SLA/SLO parameters or SLO ID. Customer details are optional here.
slaML: SLA Negotiation Request
SLA Negotiation Process (2)

- **Customer Admin.**
  - SLA request
    - Includes SLA/SLO parameters or SLO ID. Customer details are optional here.
  - SLA rejection
    - Customer may confirm the rejection or the suggested alternative SLA proposal
  - SLA confirmation

- **Service Provider Admin.**
  - SLA Negotiation Engine
  - :OH Subscription Manager
    - Optionally, it may include an alternative SLA proposal
    - Initiate subscription

The process involves the negotiation of Service Level Agreement (SLA) terms between the customer and the service provider, with options for confirmation and alternative proposals.
Main SLA Negotiation Components

- OH customer interface
- SLA negotiation engine
- SLA template repository
- SLA negotiation policies

XML/HTTP
Operation of the Negotiation Engine

1. **Initiate SLA negotiation**
   - SLA request received
   - Operation success
   - Operation failure

2. **Parse and validate syntax of SLA request**
   - Operation success
   - Operation failure

3. **Validate SLA request against SLA template(s)**
   - SLA request acceptable
   - SLA request not acceptable

   - **Accept SLA Request**
     - No alternative
     - Wait confirmation of SLA from customer
     - Operation success
     - Operation failure

   - **Reject SLA Request**
     - Alternative available
     - Suggest Alternative SLA
     - No alternative
     - Subscribe customer
     - Operation success
     - Operation failure

4. **Report operation error**
   - Operation failure

End State
SLA Negotiation Policy Examples

- **SLA Negotiation Policies**
  - If $\text{SLASuccessfullyProcessed}$ then ($\text{AcceptSLA}$, $\text{ConcludeSLANegotiation}$)
  - If $\text{SLANegotiationConcluding}$ then $\text{CheckForAlternativeSLA}$
  - If $\text{SLOParameterRejected}(bw)$ then $\text{CreateAlternativeSLA}(bw, 2Mbps)$

- **SLO Processing Policies**
  - If $\text{SLOParameter}(bw) \geq 2Mbps$ then $\text{RejectSLOParameter}(bw)$
Technology Issues

• XML for policy specification
  – Portable policies
  – Human readable policies
  – Interoperability with applications/databases
  – Definition of meta-policies as DTDs
  – Efficient policy processing, presentation and transformation (XPath, XSLT)
  – No O-O
  – Semantics?

• XML over HTTP for SLA negotiation
  – Efficient negotiation using a web browser, bypassing firewalls
  – SLA in human-readable form
Open Issues and Further Work

- Work on a policy specification language, parsing and enforcement components
- Develop a generic PDP/PEP based on the Generic Policy Model
- Develop a SLA policy negotiation engine based on the generic PDP/PEP engine
- Provide a policy transformation function for specific SLA policies
- IETF/DMTF policy parsers and enforcers
- Investigate using a generic PDP/PEP for IETF/DMTF policy processing
- Address security concerns
Backup Slides
Policy-based BB behaviour

- Policy Enactment Engine (delegate to container?)
- Core BB code
- Policies
- Action set
- Contract handler
- Condition set
- Related BB
- 3rd party BB
- 4th party BB
- Policy to code binding

Related BB contract
(use to set policies)

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FORM: Scope of the Open Development Framework

Framework Structure
- Logical Architecture
- Technology Architecture
- Development Methodology
- Reusable Element

FORM Framework Output
- Generic Mgmt Framework
- IES Framework
- Other specific Frameworks
Architecture Bindings

**Customer Domains**
- User or customer administrator

**Service Provider(s)**
- = ASP/IESP

**Connectivity Provider**
- = ISP(GQIPS)

Reference point instance
Refined Business Processes

Order Handling
SLA Mgmt
Report Generator
Assurance Config
Perf monitoring & reporting
Accounting Mgmt Reporting
Charging and Billing
IES Provider

VPNS-PM
IES-CM
VPN Service Configuration
Security Configuration
VPN Provisioning

Provider Console
3rd Party Provider (ASP)

Customer Reporting

IES Customer

CPE Mgmt

VPNS-CM

GQIPS-PM

IES-AS

VPN-GQIPS-PP

GQIPS Provider (3rd Pty)
slaML: SLA Template