Accounting and Charging in Mobile Grids

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Overview and Motivation

Multi-domain Service Provisioning

A4C Requirements

Architecture

Conclusions

Overview and Motivation

- Grids become platforms for commercial services
- Different providers interract to provide higher-value services
- Incentives for SP-NO interoperability
  - Faster and cheaper service deployement
  - Bigger variety of available services for users
- Existing Accounting and Charging mechanisms too *project-specific*
- An A4C architecture for Mobile Grids based on existing standards *(A4C = AAA + Auditing + Charging)*

Multi-Domain Service Provisioning

- IP becomes underlying protocol for voice/video/data transmission

- Performance gap between mobile/embedded systems and desktops is closing fast
  - ⇨Deployment of new IP-based services in traditional networks becomes more and more interesting

- One service provider to offer all the services a user might want → NOT FEASABLE
  - ⇨Multi-Domain Service Provisioning Environment

Interoperation Incentives

- Network operators:
  - manage large customer databases
  - own/control the service delivery infrastructure
  - want to keep the control of the users and the services delivered
  - not so interested in developing new services

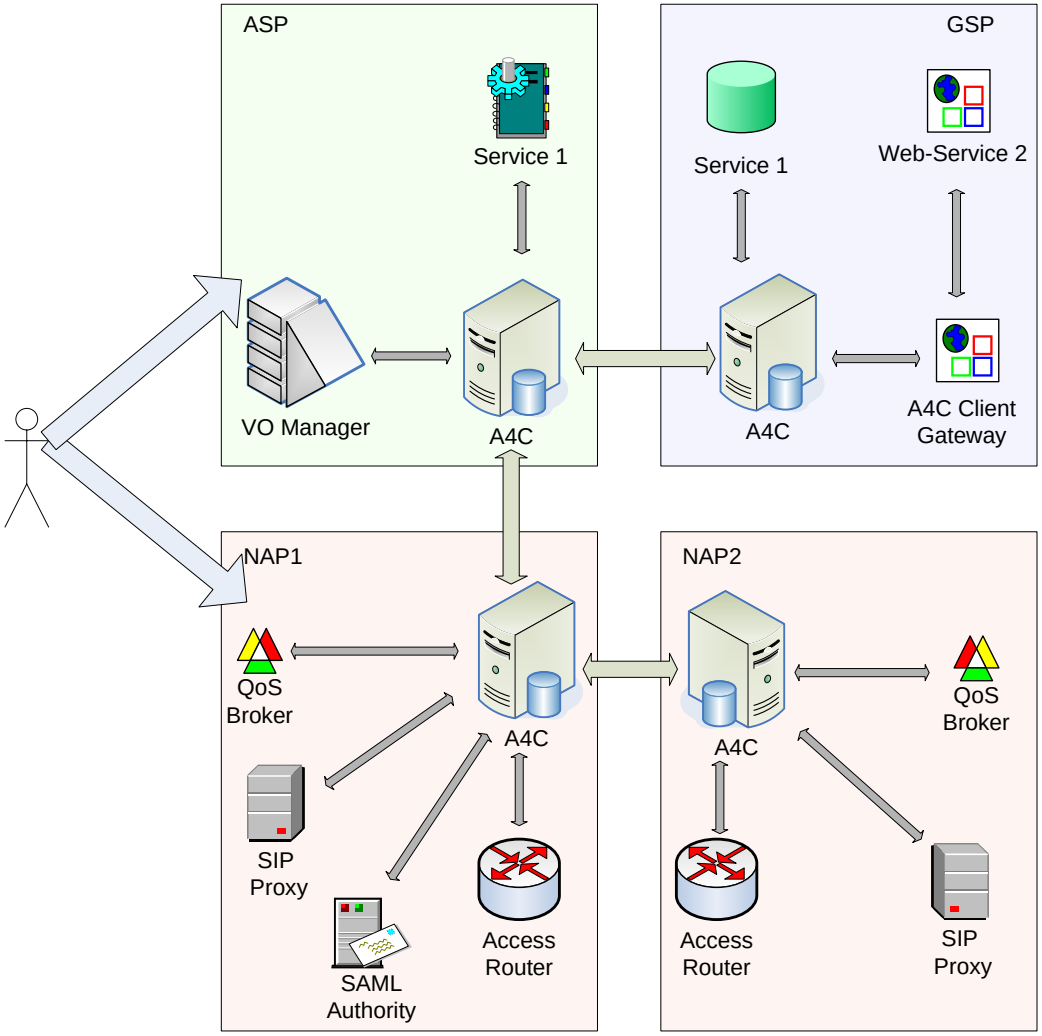
- Service providers:
  - interested in an easy way to deliver their services
  - looking for “subscribing” as many users as possible

⇨ Middleware to support NO-SP interoperation required!

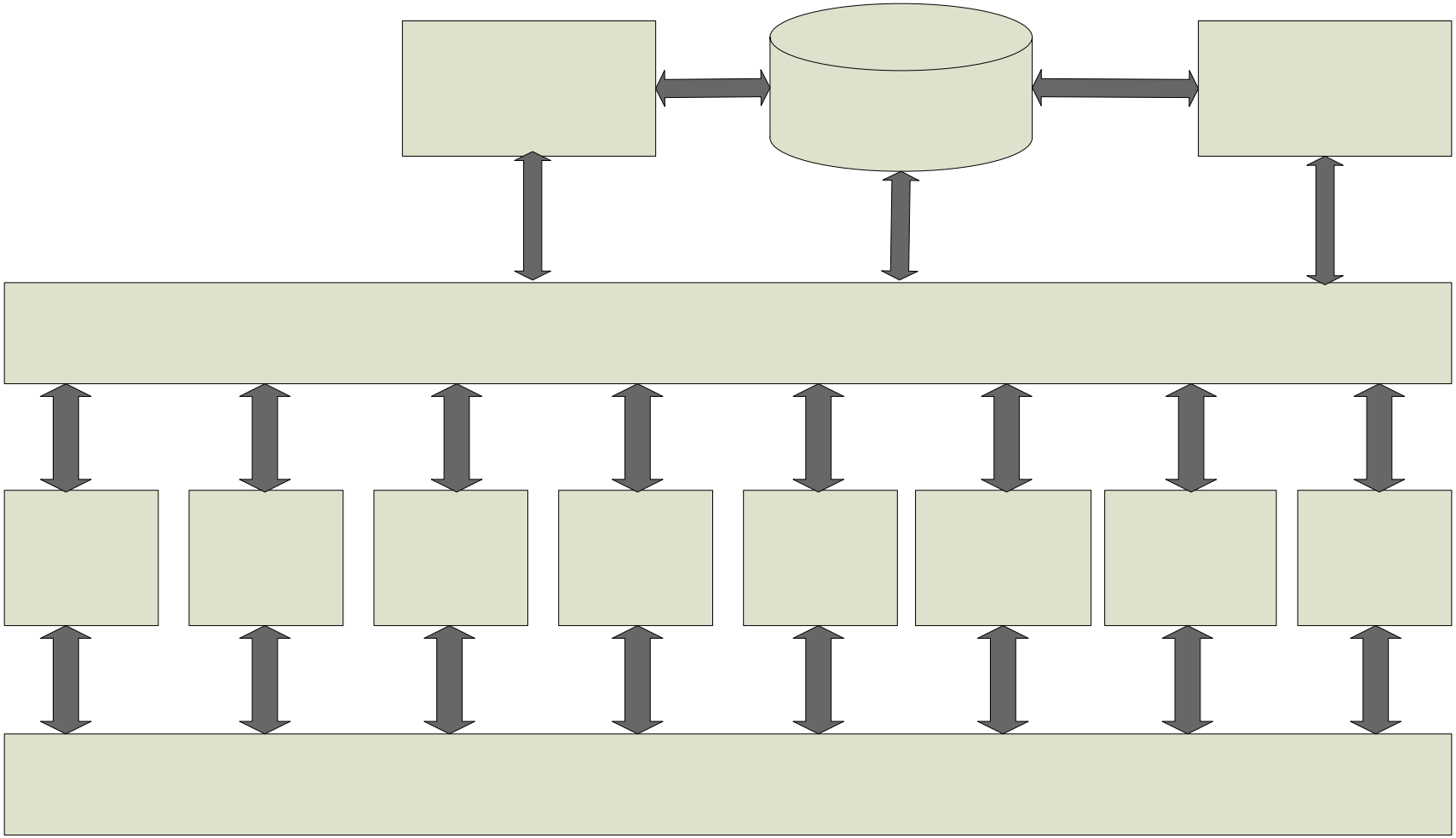
A4C Requirements

- Single Sign On
  - A single authentication operation of a users gives him authorizations to all services he is entitled to use
- Anonymity
  - User's real identity should be protected in multi-domain environments
  - Users should have control upon the anonymity level
- Flexible accounting
  - Accounting mechanism able to manage different accounting record formats
  - Multi-domain accounting support
- Auditing
  - Mechanisms for defining, measuring, (enforcing) SLA contracts across multiple domains
- Multi-domain charging
  - Standardized charging data exchange
  - Charging for sessions across multiple domains

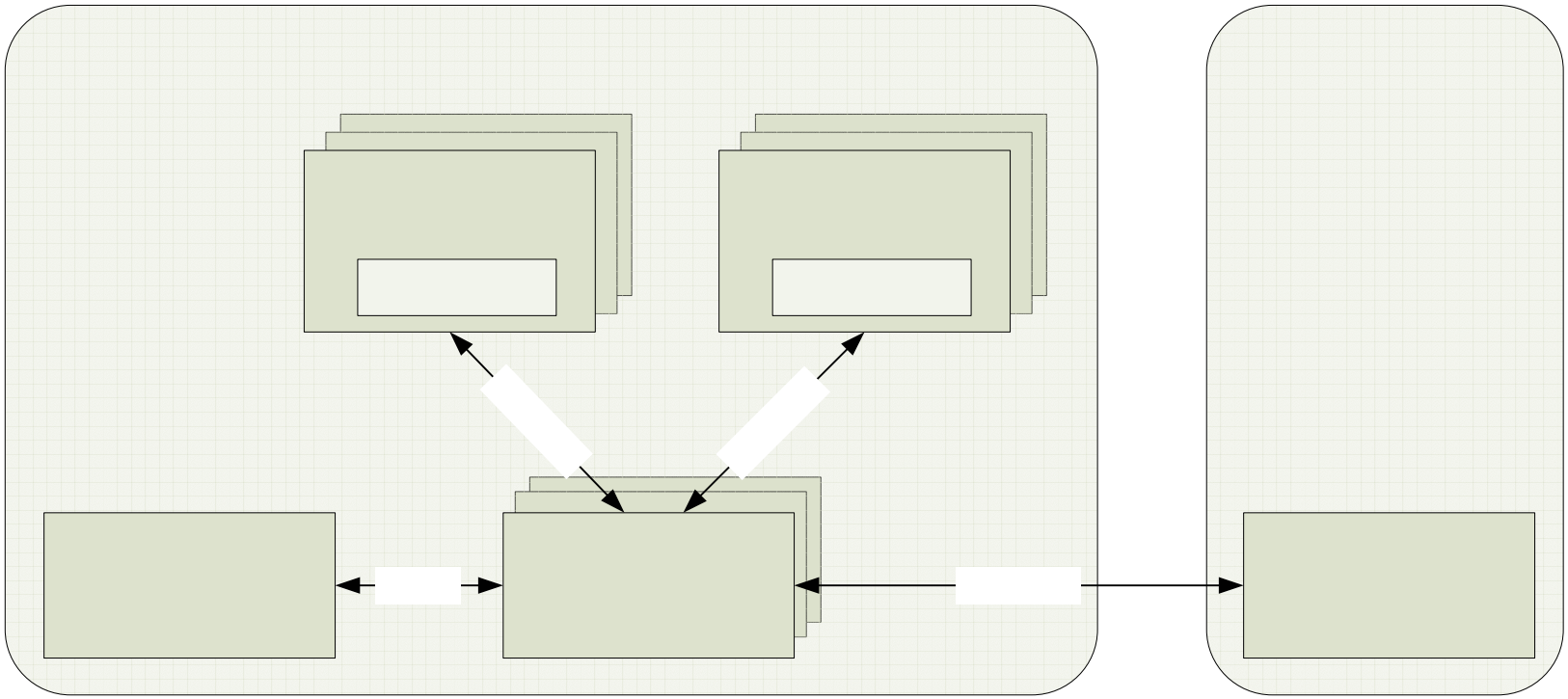
Network Architecture



A4C Internal Architecture



A4C Architecture

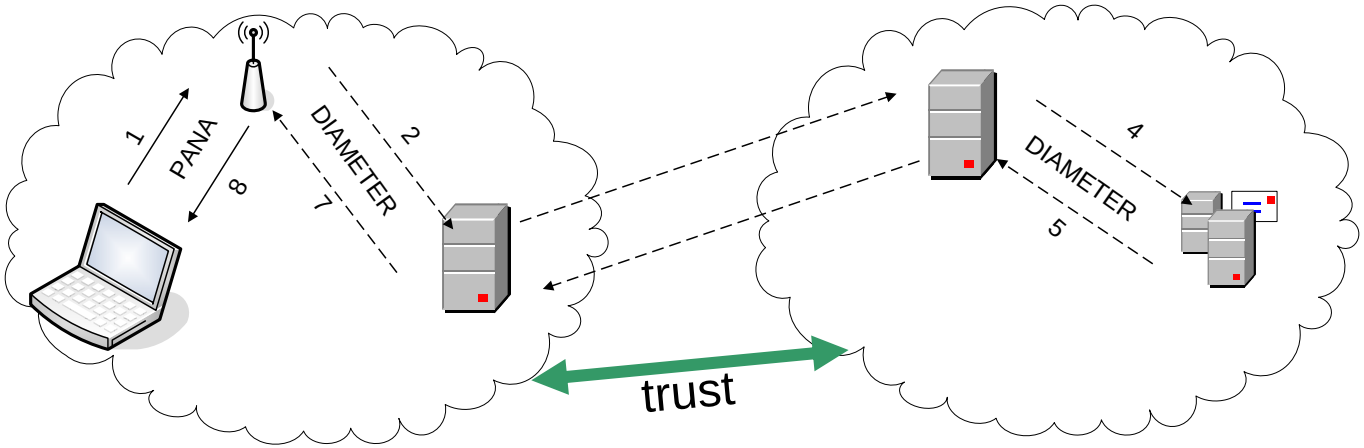


A4C Tasks and Objectives

- Provide A4C services to Grid and Network Components
- Manage the A4C services in a multi-domain environment
- Based on defined IETF standards

Authentication

- SAML + trust relationships → Single Sign-On

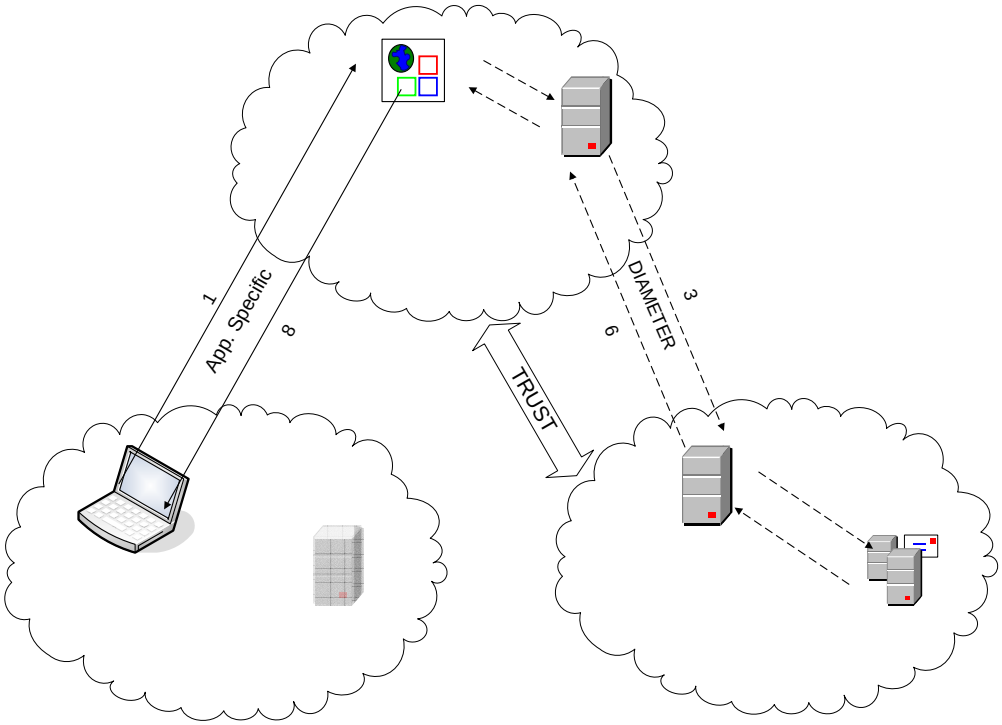


NPB – home domain

NPA – foreign domain

- Real identity hidden by the home domain
- New virtual identity generated for each domain (pseudonym) or for each request
- MT holds an IDToken after successful authentication

Authorization



- Service requests contain IDTokens
- The IDToken is forwarded to NPB for validation
- SAML Authority checks the validity of the token
- A4C Server in NPB replies with the validation answer
- A profile of the user can be sent in the validation answer
- Based on the answer (and profile) the A4C Server in SP1 can make local authorization decisions

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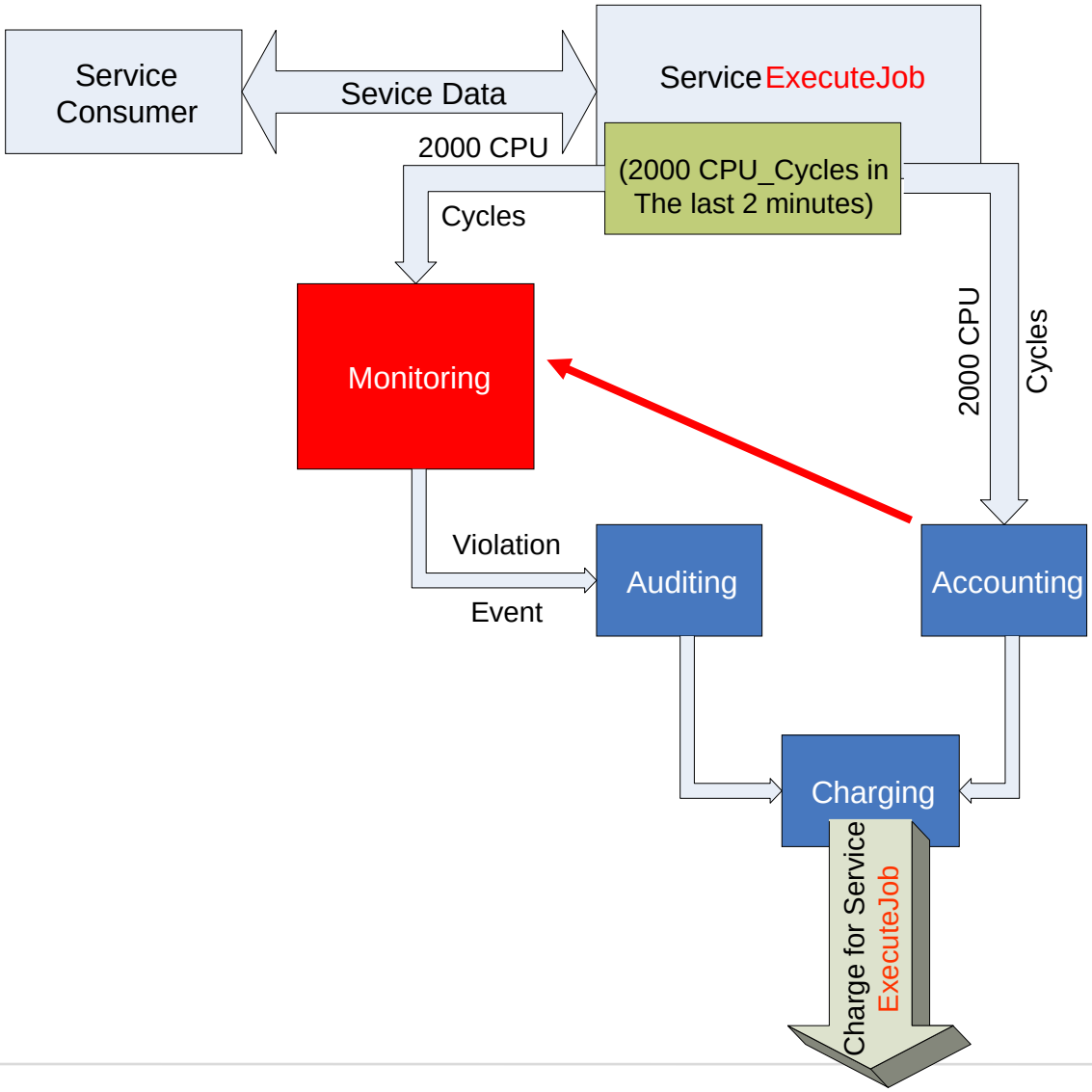
DIAMETER
Service X
7

Accounting, Auditing and Charging



- Every service needs to implement a meter for the parameters it wishes to account for
- The meter will feed the **accounting** and monitoring components
- All the accounting records and audited events generated in a service session will be fed to the charging component
- According to the charging scheme the service charge is calculated and added to a user's monthly bill

Grid and Network Accounting Extensions

- CPU-Time, CPU-Type
- CPU-Cycles, CPU-Count
- Node-Count

- Memory-Size
- Memory-Usage-Average
- Memory-Usage-Maximum

- Disk-Usage-Average
- Disk-Usage-Maximum

- Host-Name, Job-Name
- Process-ID, Process-Status

- QoS-Bandwidth
- QoS-Delay
- QoS-Jitter
- QoS-Priority
- QoS-DSCP
- QoS-Score

- Accounting-Dropped-Octets
- Accounting-Dropped-Packets

- Request-Count
- Successful-Request-Count
- Failed-Request-Count

Charging Specification

- Defines the rules and prices to be applied for charging
- Enables user, service, and domain-specific tariffs and discounts.
- Support of accounting and charging record based charge calculation
- Generic format of the charge calculation:

$$C_S = P_S + \sum_i T_i$$

$$T_i = \prod_k AVP_k \cdot P$$

$$CR_f = CR_v \cdot (1 + T_r) + T_c$$

C_S: session charge

P_S: service price

T_i: term

CR_f: charging record fee

CR_v: charging record value

C_r: relative charge

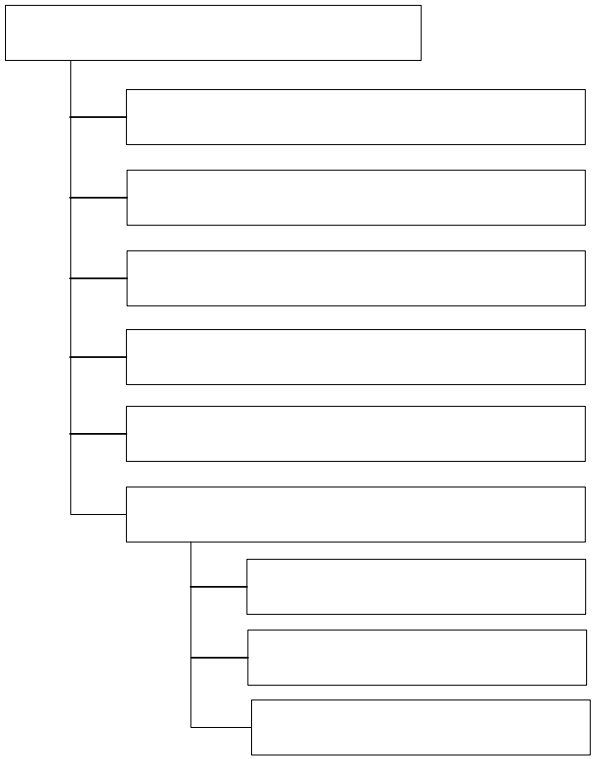
C_c: constant charge

AVP_k: a particular accounting attribute (AVP)

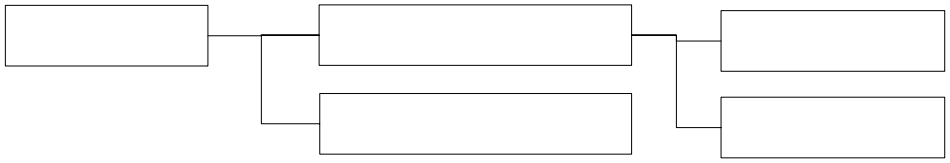
P: a particular price for the term

Charging Specification Language

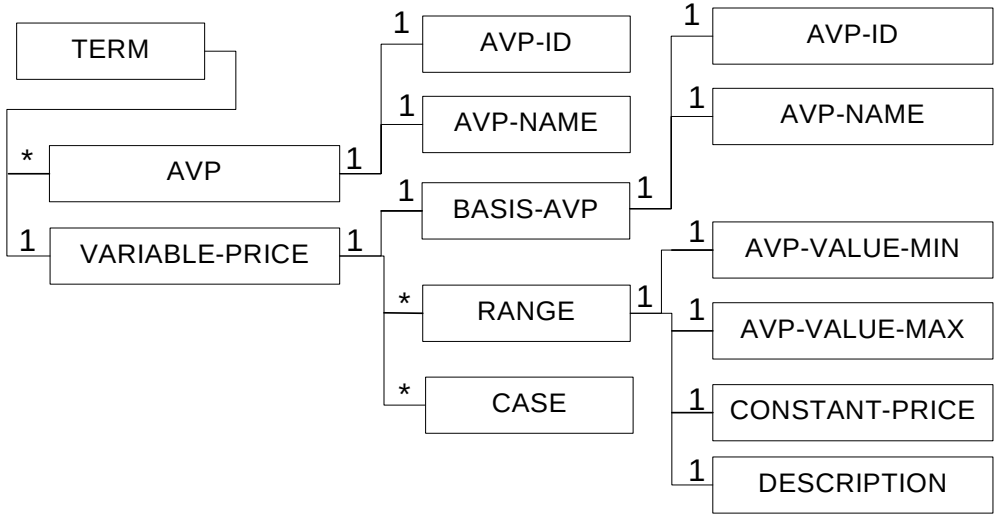
- Defined in XML format



- The applied price can be:
  - Constant



  - Variable depending on a value of a particular AVP



Conclusions

- Incentives for interoperation of Serv. Providers – Net. Operators become more and more attractive
- Grid Service are a possible platform for collaboration
- Mobile Grids look very interesting
  (power of grids + penetration of mobile devices)
- Accounting and Charging mechanisms need to support the multi-domain services paradigm

Thank You!