Accounting and Charging in Mobile Grids

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Overview and Motivation
Multi-domain Service Provisioning
A4C Requirements
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Overview and Motivation

- Grids become platforms for commercial services
- Different providers interact to provide higher-value services
- Incentives for SP-NO interoperability
  - Faster and cheaper service deployment
  - 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 FEASIBLE
  - 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 user 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

  - 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

  Diagram:
  - NPB – home domain
  - NPA – foreign domain
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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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!