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Auditing and Charging in the A* Architecture

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– Introduction
– Scenario and Problems
– A* Architecture: Auditing and Charging
– Conclusions

Mobility Growth – Subscribers, Handsets

Be careful on any projected extrapolations!

Erosion and Opportunities

Necessities:
– Careful definition of services: cost-sensitive.
– Service differentiation: reliability, QoS, pricing.
– Service support: mobility, secure access, auditing.

Scenario and Problems

Technology and Application Scenario

– Ensure:
  – Mobility:
    – Privacy
    – User identity
  – Charging:
    – Payment
    – Auditing
  – To charge:
    – Access
    – QoS
    – Content

AAA Architecture and Weaknesses

• Policy decision and policy enforcement not separated:
  – AAA Server decides on authorization, but enforces accounting.
• Difficult enhancements:
  – Enforcement located in the AAA server or the Application-specific module.
• AAA applied to transport, but not content, charging, and auditing.
• QoS support not provided.
Overall A^n Requirements

- Major requirements for an A^n Architecture (AAA and Beyond: ^ stands for Auditing and Charging):
  - A^n for charging, pricing, and auditing (meeting business requirements) and special security issues.
  - A^n for QoS support:
    - Multi-provider and Service Level Agreements as well as
    - Profiles
  - A^n for mobility support:
    - Inter- as well as intra-domain and
    - intra-technology.
  - Scalability considerations.

A^n Architecture

A^n Model: Service Interactions

- Objective:
  - Support of multiple user services with configuration req's.
  - Generic A^n services.
  ⇒ Logical separation

- Sequence of action:
  - Phases

A^n Model: Levels and Partitions

- Horizontal levels:
  - Internet connectivity
  - Transport
  - Application
  - Content

- Vertical partitioning:
  - Control path (signaling)
  - Data path (payload)

Horizontal structure leads to service classes with similar characteristics and similar A^n requirements.

Policy Model of the A^n Architecture

Generic, Policy-based A^n Architecture

- Major assumptions:
  - Macro-/micro-mobility support.
  - Independent A^n services: Authorization, Authentication, Accounting, Auditing, Charging.
  - Behavior by policies.
  - Single/multiple repositories.
  - A PDP per policy type.
  - All PEPs part of architecture:
    - For authorization, metering located in Service Equipment
    - Others in dedicated modules.
    - Real-time auditing PEP fully distributed, otherwise local.
A² Auditing

Definition — Auditing

- Auditing is the process of examining information on a provided service to check whether the service has been provided correctly or the contractual negotiated parameters have been met.
- Logging of events and actions is based on information transmitted in messages between A² entities.
- A² support services:
  - Provider – Provider: A², Service Compliance
  - Provider – User: Mobile Network Access, A², Service Compliance
  - Provider security: Attack, Misuse, Bugs

From Use Case Maps to Message Sequence Charts

Messages — Example of an A² Service

ID | Message | Parameters
---|---------|-------------
req1 | MN Authentication Request (MNARq) | NAC, Credentials
req2 | Access Router Request (ARRr) | Session ID, Host Information, User Information
res2a | Access Router Answer (ARA) | Result Code, Session Information
res1a | MN Access Response (MNARP) | Keys, Profile Sub-Set, Session Information

Message Formalization — Sample

Parameter References

Sample Log Entry

- Action:
  ‘AAAC.h has granted MN access and send an ARA message back to AAAC.f’

  event: logger; from; to;
  time [Hrs:ms:date]; session-id, result-code, origin-host, session-timeout
  ... etc ...

  Sample:
  ara_sent: aaach::123; aaach::123; nar:121; 2000-0020:08162002; ses01; res2000, fe80::201::feca072, 2010:0000:08162002
Main Auditing and Logging Policies

- P1: A valid request should not be turned down.
- P2: An invalid request should be rejected.
- P3: The active entity, taking an action is responsible for logging this action, not the entity experiencing the event triggered.
- L6: Whenever a log entry is made, the actual time the reported action took place must be logged.

Logging and Auditing Mechanisms

- Centralized main log: mySQL or similar
- One Auditor per main task: E.g., per process (Registration, Flow Termination)
- Local DBs store individual log entries.
- Main log entries with embedded SQL code
- White-Box logging:
  - Different logging levels implemented in Ax entities
  - Dynamically control of logging levels

Auditing Framework

- Addressing service level guarantees and violation conditions.

Charging Databases

- AX Instantiation — IST MobyDick Project
Conclusions

Issues

- Convergence:
  - Fixed and mobile Internet services define a service mix.
  - E.g., Video-on-demand vs. location-based services, telemetry.
  - All, A^* and pricing essential for commercially operated wired and wireless networks.

- Current limitations:
  - Content charging/pricing.
  - Existing infrastructure not optimized for mobile IP use.

- Opportunities:
  - A^* and their extensions on auditing, charging.
  - Handover and roaming support.
  - Both, service and network management for mobility.

Future Work

- Mobile networking:
  - Adaptation of Mobile IP to UMTS/Wireless LAN.
  - UMTS pricing models: class-of-service.
    - Underliner: To achieve interoperability between fora, standardization organizations, and business solutions.

- Mobile content and service quality:
  - C4C: Content-for-cash or Cash-for-content?
    - MPEG-7 and MPEG-21.

- P2P systems and networks with wireless links.

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