Helsinki University of Technology
Networking Laboratory

Improving Service Level Agreement Processing in Network Operator Environments

Master's Thesis Seminar Presentation

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creaNORD

Research Methods and Composition of the Thesis

- Literature sources
- Interview study
- Analysis of Service Level Agreement (SLA) templates
- Developing improvement suggestions
- Partial implementation of SLA measurement platform

Agenda

- Motivation & Objectives
- Service Level Agreements
- Network Measurements
- Improvement Suggestions
- Creanord EchoVault
- System Integration
- Conclusions

Motivation

- Companies more and more dependent on network services
- Network convergence challenges the *best effort* nature of Internet services
- Companies need binding guarantees and protection for critical business services
- Internet and network services are getting more and more important for consumers

Objectives

- Research current SLA offerings
- Investigate related Service Provider support infrastructure
- Specify requirements and best practices for supporting SLAs with technical network quality (e.g. delay, packet loss) guarantees
- Enhanced functionality and cost savings through system integration and automation

Service Level Agreements

- Research methods
  - SLA templates from 3 network operators
  - Interview study (network operators + customers)
  - Literature
- Research subjects
  - SLA contents
  - Measurement practices
  - Compensations

Typical SLA Contents

- Service Provider and customer responsibilities
- Fault classification
- Service restoration time vs. response time
- Service accessibility, link availability
- Measuring and reporting SLA compliance
- Financial compensations and bonuses
- Contract termination

SLA Life Cycle

- An SLA evolves through distinct stages
- Each stage requires different management processes

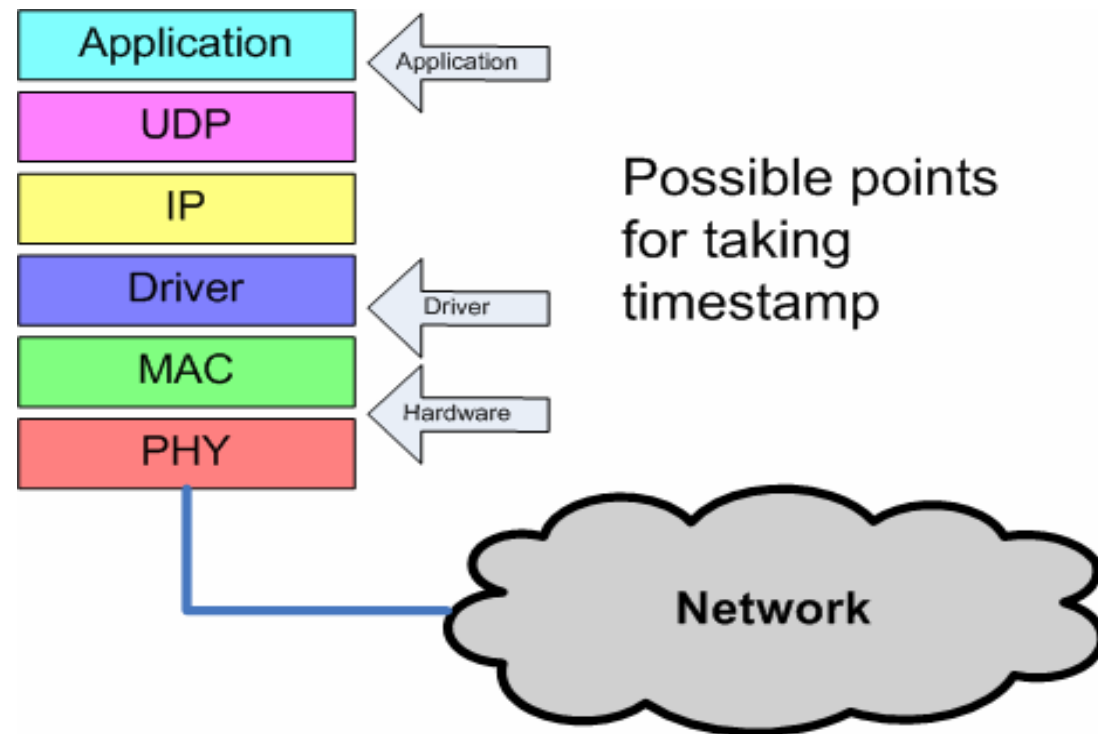TeleManagement Forum: SLA Management Handbook (GB917), 2001
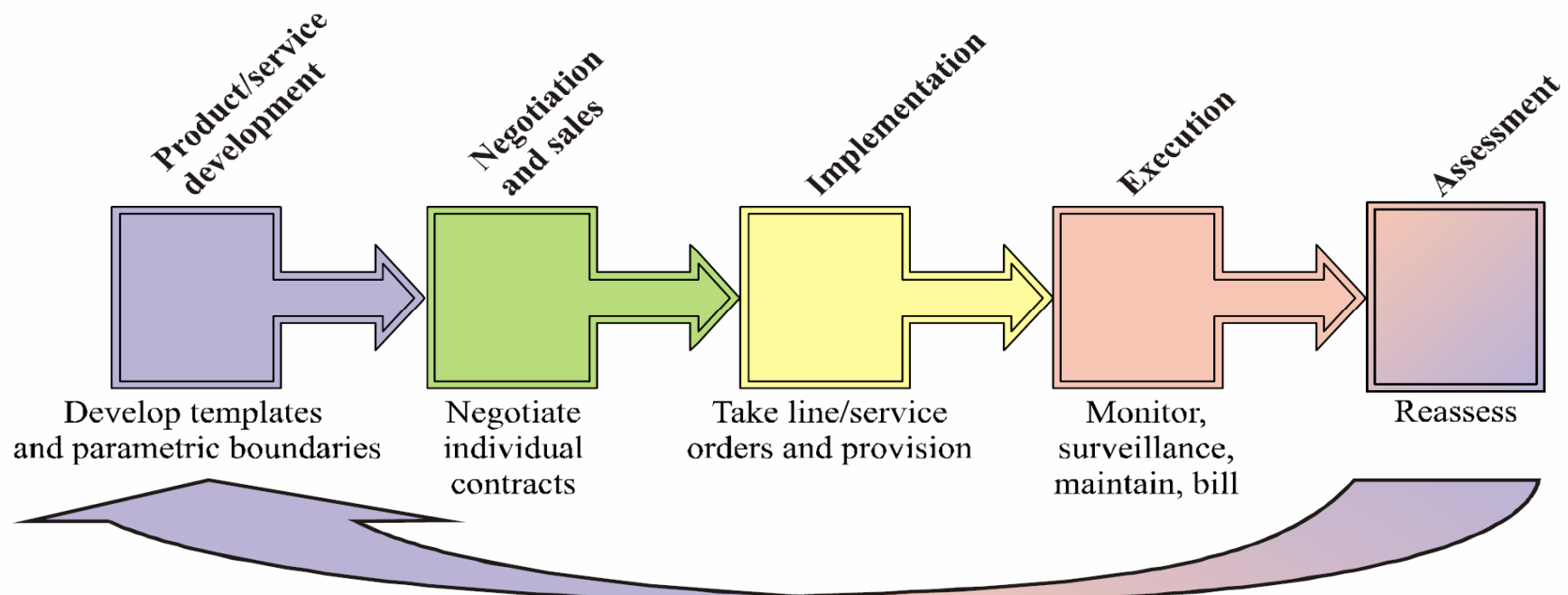
Network Measurements

- Study network measurements from SLA perspective
- Main topics
  - Measurement topologies
  - L2 Ethernet services (802.3ah, 802.1ag)
  - Accuracy
  - Service characterization, compound measurements

Network Performance Evaluation

Measurements

Modeling

Active

Passive
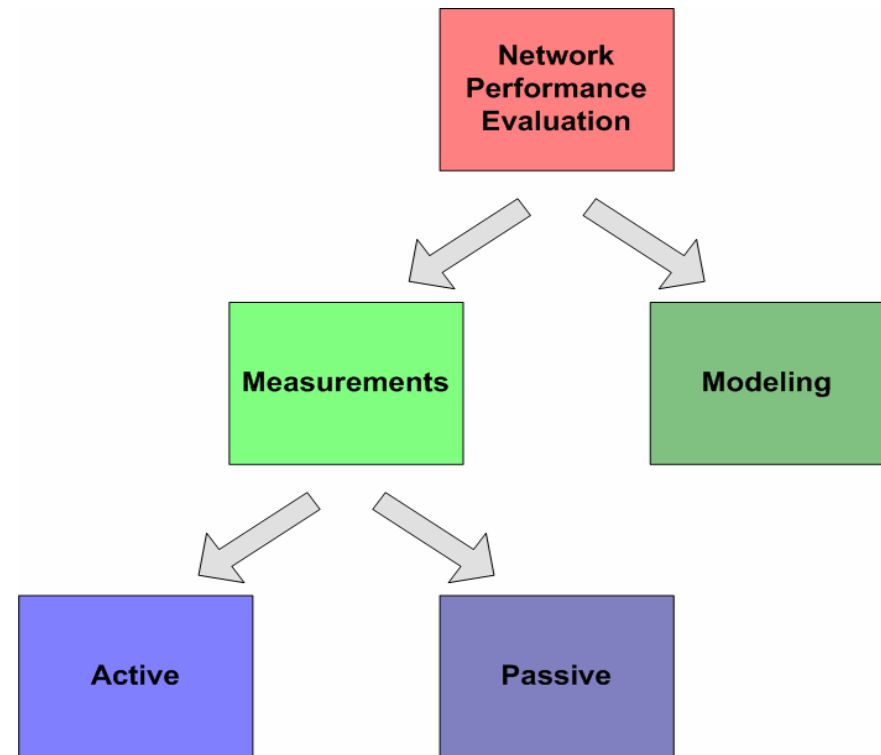
Network Measurements

- Accuracy considerations
  - Microsecond accuracy with driver timestamping
  - Measuring one-way delay requires clock synchronization
  - Frame sending time on 100 Mbps Ethernet varies from 7µs to 123µs (queueing times are significant)

Application

UDP

IP

Driver

MAC

PHY

Application

Driver

Hardware

Possible points for taking timestamp

Network

Improvement Suggestions (selected ones)

- Conformance measurements
  - Exact specifications for technical quality
  - Measurement topologies
  - Quality level definitions
  - Detecting customer bandwidth usage
- Compensation considerations
  - Workforce prioritization by minimizing short term compensations may not always be the best solution
  - *Business impact SLA*
- Multi-operator environments
  - Last mile delivery
  - No good solution for end-to-end multi-operator SLA
- Some customers may require that the service quality is measured by an independent 3rd party
  - A further driver for 3rd party SLA measurements is if the SP has inadequate measurement and reporting capabilities
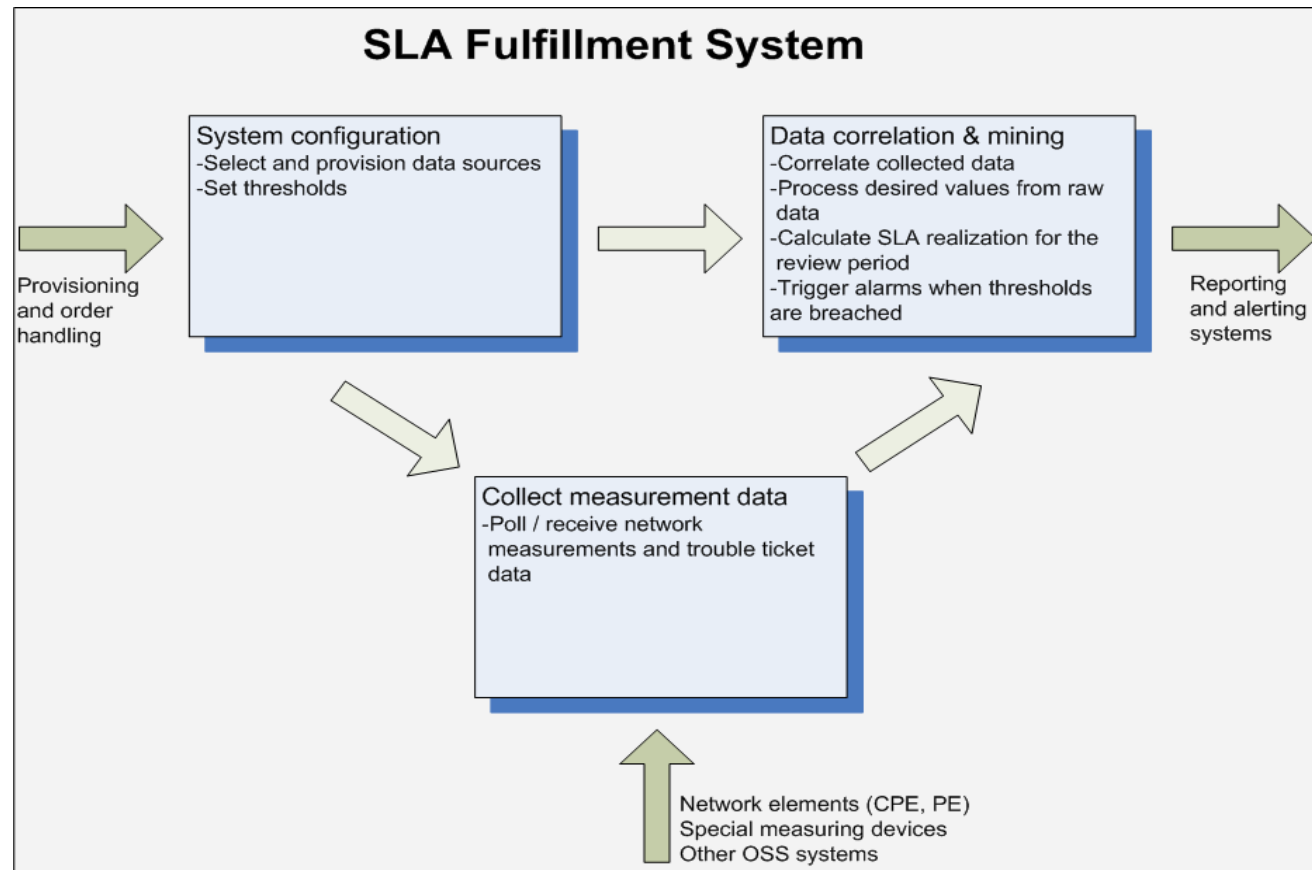
Example: Prioritizing Measurement Traffic

- Conformance measurements must not fail due to customer traffic using all access link bandwidth
- Other than the access link, measurement traffic must be treated as customer traffic
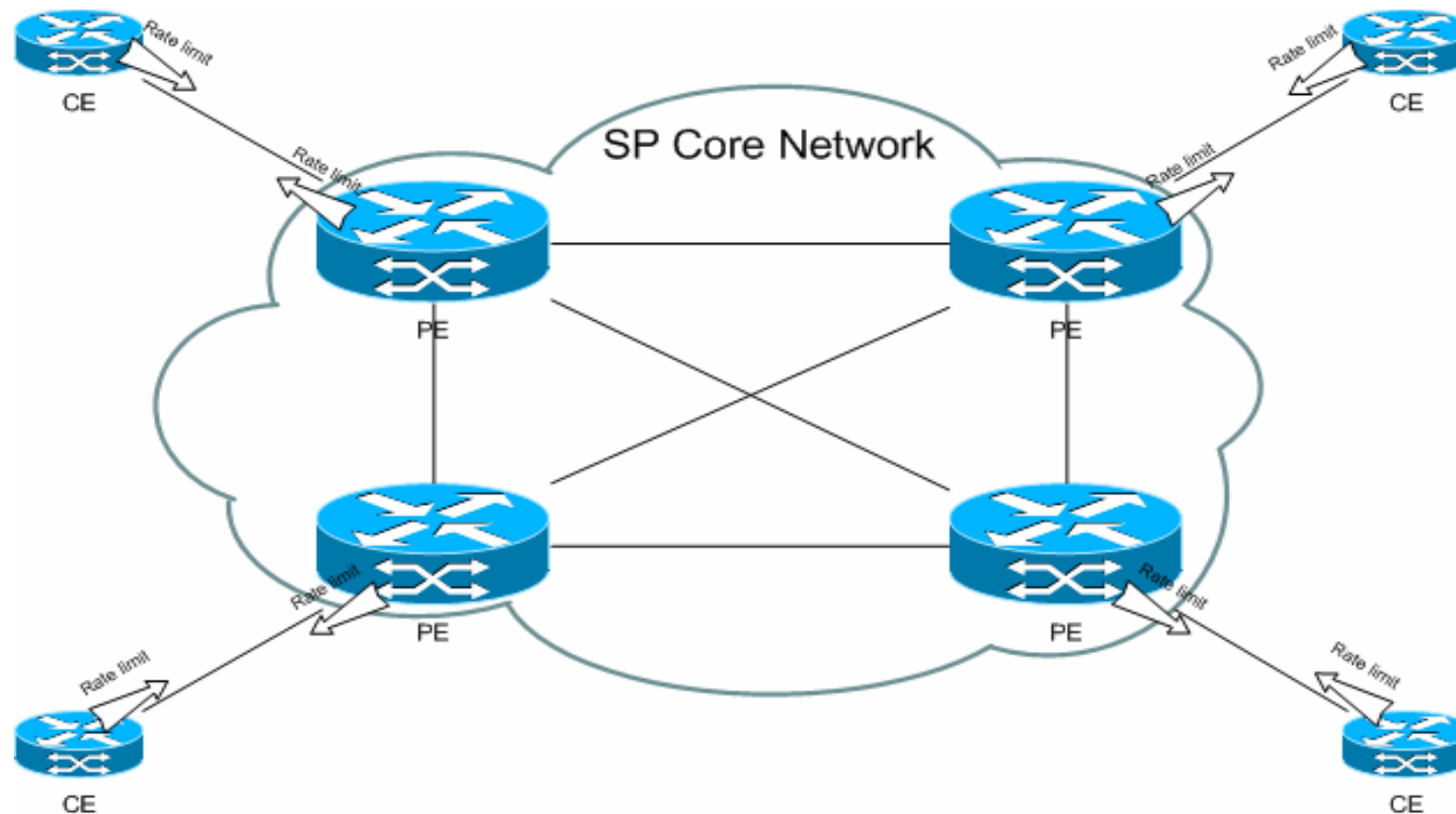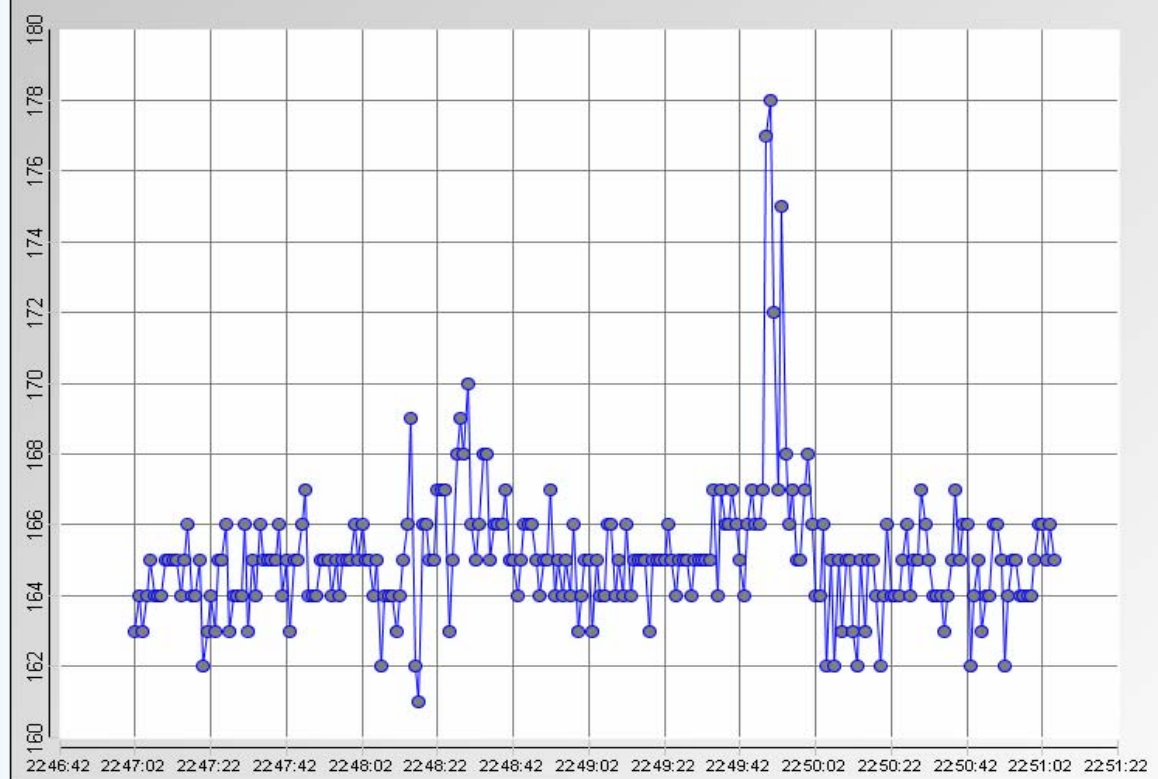
Creanord EchoVault

- Designed for complete automation
  - Configuration through XML
  - Reporting with XML, direct DB access or charts
- Measurements through dedicated "*Echo*" measurement devices or 3rd party systems

SLA Fulfillment System

Provisioning and order handling →

System configuration
- Select and provision data sources
- Set thresholds

Data correlation & mining
- Correlate collected data
- Process desired values from raw data
- Calculate SLA realization for the review period
- Trigger alarms when thresholds are breached

→ Reporting and alerting systems

Collect measurement data
- Poll / receive network measurements and trouble ticket data

Network elements (CPE, PE)
Special measuring devices
Other OSS systems

Spotlights
Content Tags
Provisioning
My Echoes
Export Admin
User Admin
Charts
Logout

Average Round-trip Latency (2007-09-23, 601, 908)

Select parameters:

Select Spotlight: RT netvertest

Select Content Tag: RT netvertest

Select KPI: Average Round-trip Latency

Select Source: 601

Select Destination: 908

Reporting period: 5 minutes

Refresh interval: 0 minutes

Submit

Home   Help   Logout

System Integration

- TeleManagement Forum: New Generation Operations Systems and Software (NGOSS)
  - Enhanced Telecom Operations Map (eTOM)
  - Shared Information/Data Model (SID)
  - Technology Neutral Architecture (TNA)
- Integration methods
  - Real-time vs. delayed methods
  - Application Programming Interface (API)
  - Data formats
  - Data access
  - Network transfer

Example: XML Controlled Binary

```
<record>
    <data order="1" type="uint" length="4" name="timestamp"/>
    <data order="2" type="string" length="10" name="status"/>
    <data order="3" type="float" length="4" name="delay"/>
    <data order="4" type="float" length="4" name="jitter"/>
</record>
```

Conclusions

- *Productized* SLAs with technical network quality guarantees not yet available in Finland
- Commoditization of networking services may pose a challenge for SLA evolution in future
- Compensations in excess of Monthly Recurring Charge (MRC) not available
- We believe that the field has much market potential, developing standardization may lead to rapid development in near future

Questions?