In-Service Performance In Mobile Media Gateway
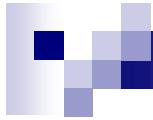
Kalervo Kujala   30.09.2003

S-38.310 Tietoverkkotekniikan diplomityöseminaari

Basic Information

- Thesis was written for Oy LM Ericsson AB
- Professor Jorma Jormakka
- Supervisor Juha Eloranta

Contents

- Problem description
- UMTS network
- Media Gateway
- In-Service Performance
- ISP Statistics Tool
- ISP Information
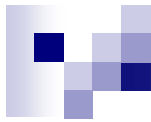- Requirements / Conclusions

Problem Description

- Ericsson offers In-Service Performance (ISP) statistics from MSC (GSM-network)
- Same needed from MGW (UMTS-network)
- ISP definition not formally defined

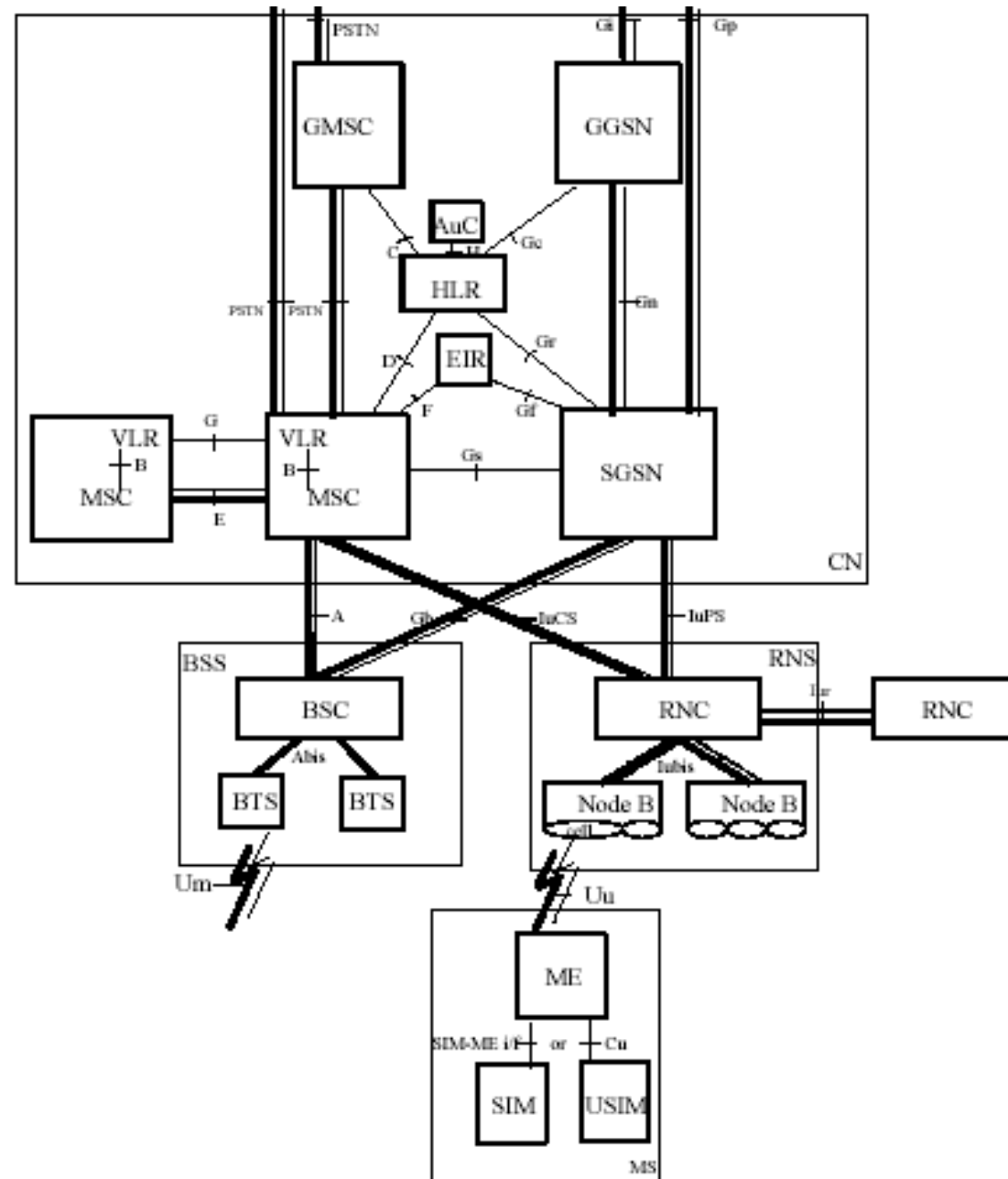- How to get ISP statistics from the MGW node and present it in an informative way?

UMTS network

- MGW - 3GPP R99 (+R4 functionality)
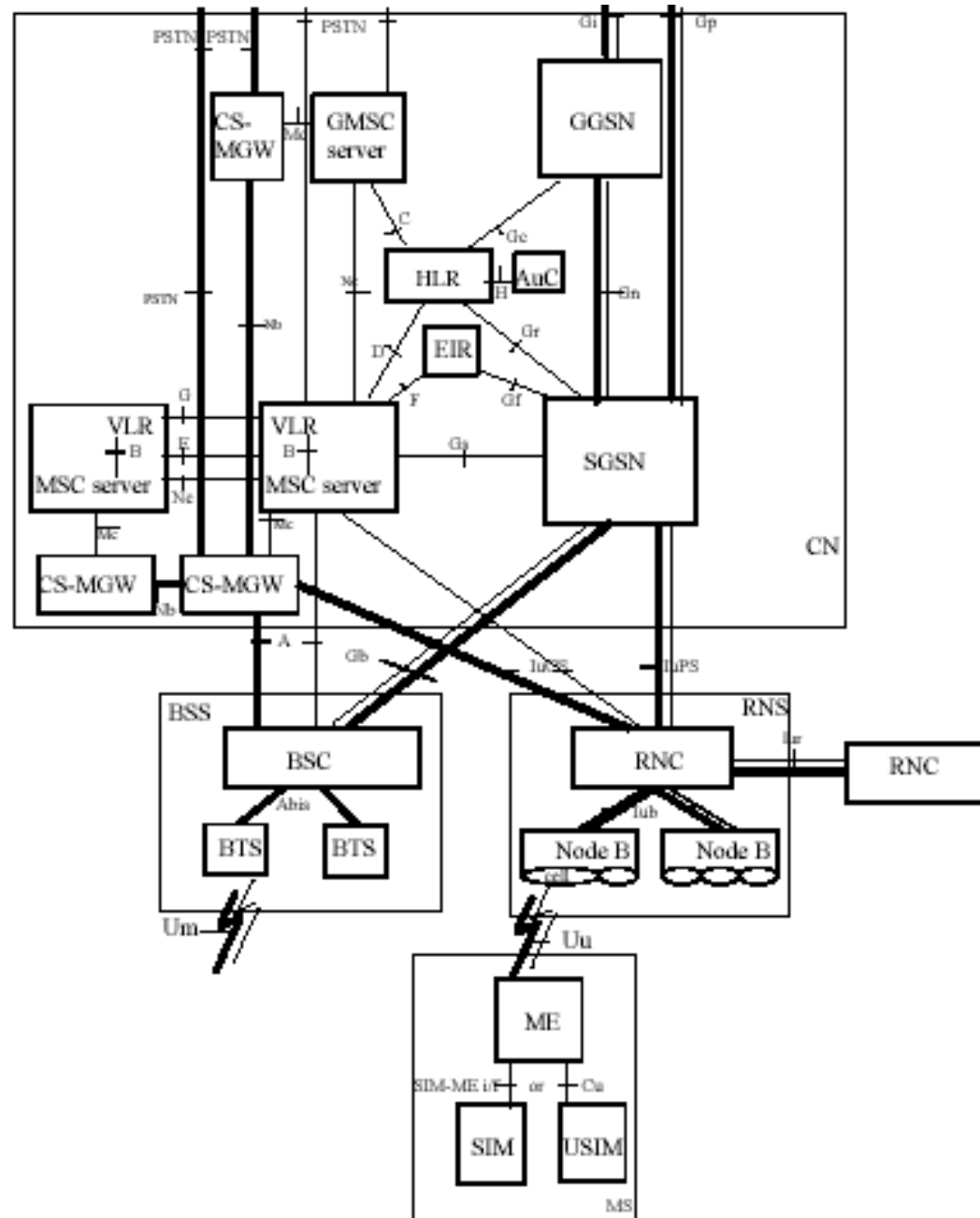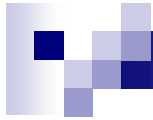- Both Release 99 and Release 4 presented

Release 99

Release 4

Mobile Media Gateway

- is in the border between different networks
- transports circuit- and packet-switched traffic
- routing, switching and signaling
- echo canceling and speech transcoding

In-Service Performance (ISP)

- Normally presented as '9s'
- Includes both negative and positive side of performance

9s	Availability	Downtime/Year	Examples
1	90 %	36d 12h	Personal Clients
2	99 %	87h 36min	Entry-level Businesses
3	99.9 %	8h 46min	Internet Service Providers, Mainstream Businesses
4	99.99 %	52min 33s	Data Centres
5	99.999 %	5min 15s	Carrier-grade Telcos, Medical, Banking
6	99.9999 %	31.5s	Military Defence System, Carrier-grade Goal

Literature

- ISO 9000, 9001 and 9004
- ITU-T E.800, E.860 and E880
- 3GPP Performance Management TS 32.104 V3.6.0
- QuEST TL 9000

ISO

- Customer Satisfaction
- Performance measurements and monitoring of the product
- Conformance to determined requirements
- Gathered statistics stored to database
- Valid data analysis methods and appropriate statistic techniques

ITU-T

- E.800: Terms and definitions for the Qos, network performance and dependability

- E.880: Service Level Agreement and measurement equations

- E.880: Guidelines to field data collection (both failures and successes) and storing to database

E.860 measurement equations

- Service Availability

$$SA\% = 100\% - UA\%$$

- Service Unavailability

$$UA\% = \frac{\sum Outage\_Interval}{Active\_Time} * 100\%$$

- Weighted Service Unavailability

$$UA\% = \frac{\sum (Outage\_Interval * SDF)}{Active\_Time} * 100\% \qquad 0 < SDF \leq 1$$

3GPP Performance Management

- Beginning and end times of the service unavailability

- Transfer of the data to toher systems for later processing (FTP)

- Results comparable to other vendors' results

- Measurement file format either ASN.1 with binary encoding (BER) or XML (Extensible Markup Language)

QuEST TL 9000

- Quality Excellence for Suppliers of Telecommunications
- TL 9000 documents contain a consistent set of requirements and measurements that aim for faster, better and more cost-effective telecommunications services.

Measurement Rules

- Over 30 seconds' duration of partial or total loss of primary functionality is counted to the System Outage.

- Over 15 seconds' duration for a scheduled event is counted.

- Outages due to natural disasters are not counted.

- System Down Time (SDT) == System Outage

Measurement Equations

- ## Annualised Down Time

$$DT = 12 * \frac{\sum_{i=1}^{m} P_i}{N}$$

Pi describes the duration of ith outage
M is the total amount of outages
N describes the number of systems in the service at the end of the month
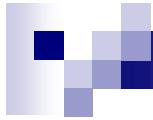Twelve is an annualisation factor.

- ## Annualised Outage Frequency

$$OF = 12 * \frac{m}{N}$$

ISP Statistics Tool

- Ericsson's proprietary and internal tool for generating ISP statistics reports
- produces graphical reports for various systems developed in Ericsson
- For example, in the GSM system the MSC is such an element for which reports are generated

- intended for Ericsson's design offices, customer support, management and comparison to Service Level Agreements
- valuable information from the operating nodes regarding fault tolerance and maturity of the system
- enables proactive actions in preventing disturbances with similar fault situations occurring in different locations
- management can set ISP goals and follow them up
- comparison of the actual statistics to the SLA made with the customer

Example graphs
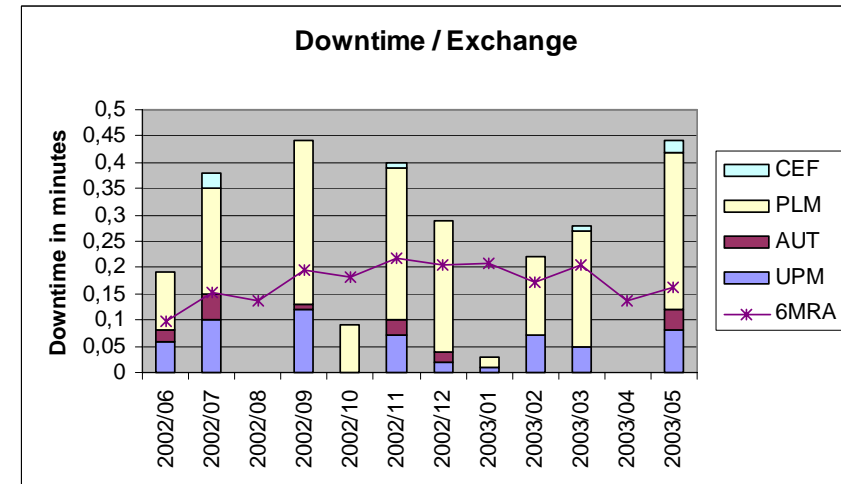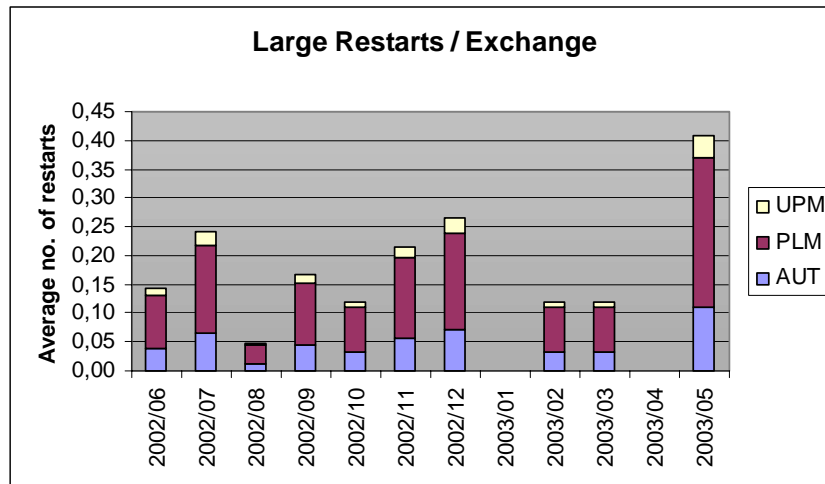
It should be noted that the figures in the graphs are fictional.

Equations used in ISP tool

- ## ISP tool's Unavailability

$$UA\% = \frac{\sum(SDT * SDF)}{Active\_Time * N} \qquad N > 0 \qquad 0 < SDF \leq 1$$

- ## Six months' rolling average

$$RA = \frac{\sum_{i=1}^{i-6} \dfrac{SDT_i}{N_i}}{6} \qquad N_i > 0$$

SDT labels

- System Down Time (SDT) is presented in the ISP statistics tool with four different labels: Unplanned Manual (UPM), Automatic (AUT), Planned Manual (PLM) and Complete Exchange Failure (CEF).
- UPM means a manually initiated disturbance that results in SDT.
- AUT means automatically initiated disturbance.
- PLM means manually initiated planned disturbance, i.e. software and hardware upgrade.
- CEF means an automatic or manual disturbance event that results in prolonged SDT, which cannot be recovered without a manual intervention

Conclusions about ISP tool

- No commercial softwares, which would fulfill the same functionality

- Expensive to build a new tool from scratch

- Adabtable for generating reports for MGW

- Need for modification, though

ISP information

- Two different logs in the MGW node: board log and availability log
- Which one is better and adequately fulfills the ISP definitions mentioned earlier

Board Log

- 9 entry places which are overwritten in a round-robin manner

- Expresses only down events

- Hard to modify

- Need to collect logs periodically from each board

Availability Log

- Format: XML version 1.0 (Extensible Markup Language)
- contains 1455 record places and the size is approximately 1 MB
- Works in a round-robin manner

```
<?xml version="1.0"?> <!DOCTYPE
greeting SYSTEM "hello.dtd">
<greeting>Hello, world!</greeting>
```

- The log clients can run on either MPs or BPs.

- The clients can store node availability, PIU (Plug-In Unit) and service availability events through Availability Log Interface (AVLI).

- The node and PIU events are Hardware (HW) events and the service events are Software (SW) events

Conclusions about logs

- Board Log is not adequate
- Availability Log has many good qualities

+ Up and Down events (for node not traffic)
+ Enough space
+ in accordance with 3GPP
- need to estimate when traffic is up
- SDT labels can only be divided to AUT, MAN and CEF
- log gathering manual process
- *Starting* unnecessary
-/+ need to secure the transfer of the logs to ericsson's facilities
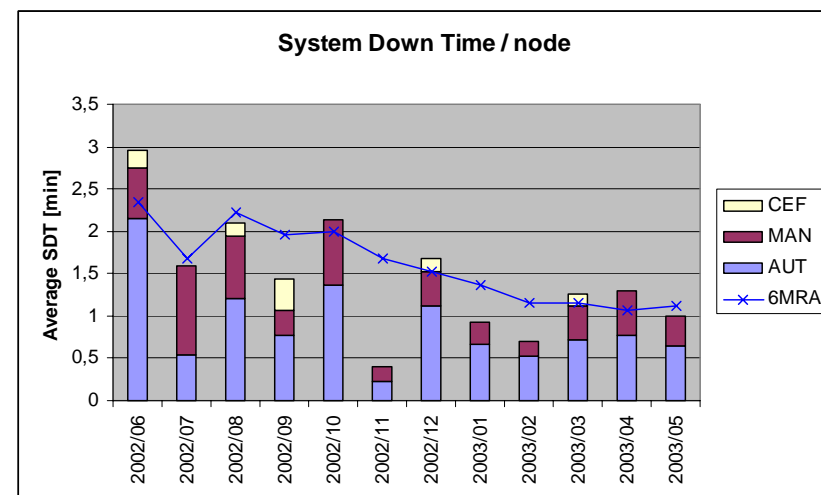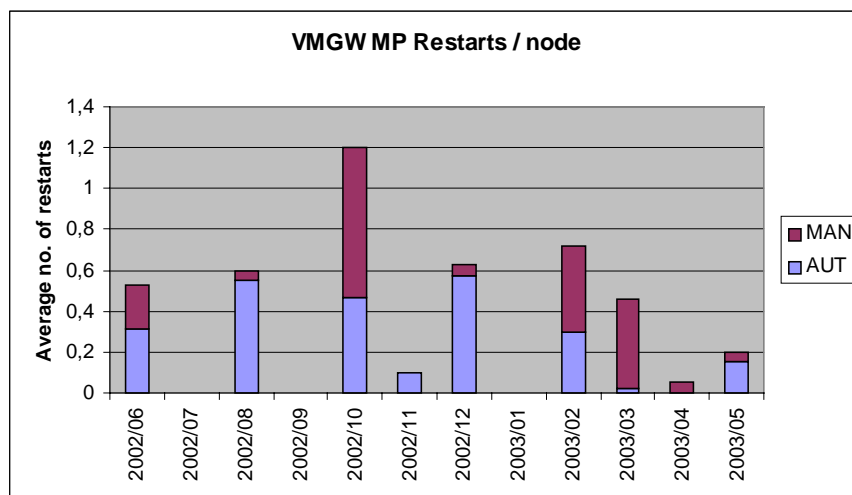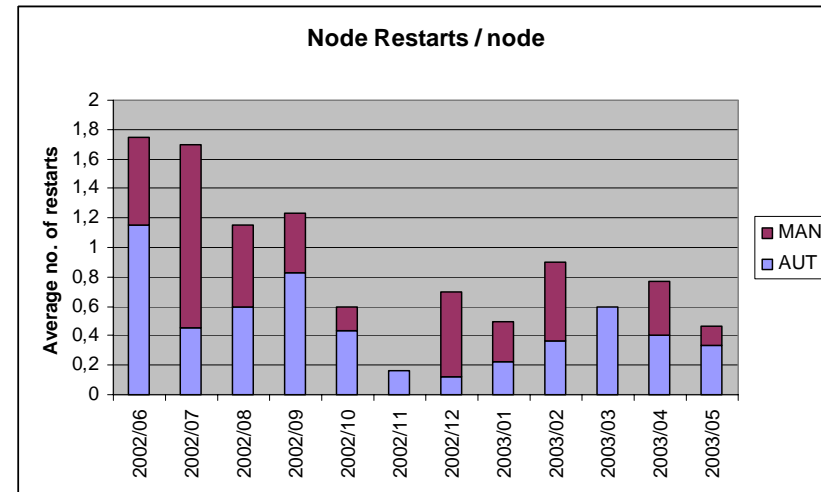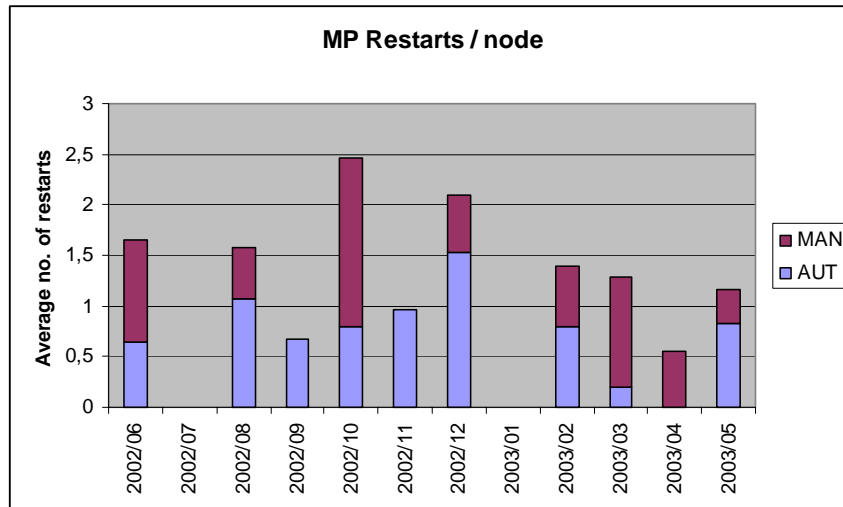
- Dedicated ISP log too expensive

Requirements / Conclusions

- ISP tool should be used
- Availability log is good enough for ISP
- Rolling average need to be changed

$$RA = \frac{\sum\limits_{i=1}^{n} SDT_i}{\sum\limits_{i=1}^{n} N_i} \qquad n \neq 0$$

- New graphs proposed

New proposed graphs

Future Research

- In this thesis a framework for a solution was given. However, it was left to the future research a specific implementation of the solution. A following list is provided of the issues that can be more closely researched:
- The division of the restart label MAN to UPM and PLM by an analysis of the platform availability log
- The division of downtime into supplier-attributable and MNO-attributable downtime
- Formal definition of the concept In-Service Performance for telecommunications systems
- Comparison of the format of ISP statistics between different equipment vendors
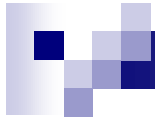
Thank you for listening!

Questions?