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The impact of proactiveness on WCDMA radio access network support services

Case: Oy LM Ericsson AB

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Proaktiivisuuden vaikutus WCDMA radioliityntäverkon asiakastukipalveluihin
Tapaus: Oy LM Ericsson AB

Vuosi 2009 Sivumäärä 48

Oy LM Ericsson AB on GSM- ja 3G-verkkopalveluita tarjoava perinteikäs yritys. Ericssonin yksikkö GSDC Suomi on maailmanlaajuinen palvelutoimituskeskus, joka tarjoaa Ericssonin asiakkaille tukipalveluita verkkohäiriöiden ilmaantuessa. Viimeisen kahden vuoden aikana proaktiivinen asiakastuki on nostettu esille yhtenä asiakkaille tarjottavista palveluista, ja sitä on testattu muutamassa kohteessa Ericssonin asiakkailla. Opinnäytetyön tekijä työskentelee GSDC Suomen liityntäverkon osastolla, joten opinnäytetyö on tehty liityntäverkon näkökulmasta.

Opinnäytetyön tarkoituksena on tutkia proaktiivisuuden vaikutusta WCDMA liityntäverkkoon sekä Ericssonin että asiakkaan näkökulmasta. Tavoitteina oli selvittää seuraavat asiat: mitä on proaktiivisuus, mikä on WCDMA liityntäverkko, tuoko proaktiivinen tukipalvelu lisäarvoa normaaliin reaktiiviseen tukeen verrattuna, ja kuinka proaktiivisuutta pitäisi hyödyntää liityntäverkko-osastolla tulevaisuudessa. Tutkimusmenetelmänä on toimintatutkimus, ja tiedon analysointiin on käytetty benchmarking –tekniikkaa.

Tutkimuksen tekninen viitekehys käsittelee aiheen kannalta olennaisia teknologioita. Koska työ on tehty liityntäverkon näkökulmasta, niin tekniset esittelyt ja selostukset on annettu. Liityntäteknologiat sekä opinnäytetyön kannalta olennaiset käsitteet on kuvattu viitekehyksessä ensin, minkä jälkeen pääpaino on WCDMA liityntäverkon laitteissa ja tekniikoissa. Nopea pakettidata, HSPA, on myös kuvattu yhtenä tärkeimmistä tulevaisuuden liityntäteknologioista.

Teoreettisessa osiossa työ käsittelee proaktiivisuutta yleisesti käsitteenä, sekä asiakastuen kehittymistä viime vuosien aikana. Opinnäytetyössä on käsitelty kahta Ericssonin tapausta, joissa on testattu proaktiivisen palvelun vaikutuksia. Proaktiivisen palvelun vastakohdaksi on otettu perinteinen tukipalvelu, ja näitä kahta on vertailtu keskenään benchmarking –menetelmällä.

Tutkimuksen tuloksina huomattiin, että proaktiivinen verkkotukipalvelu vähentää huomattavasti asiakkaan kokemia vikatilanteita. Molemmissa kuvatuissa tapauksissa asiakkaan tukipyynnöt ovat vähentyneet ainakin 50%:lla. Asiakkaat ovat kokeneet palvelun erittäin hyvänä lisänä perinteiseen tukeen ja se on lisännyt asiakastyytyväisyyttä runsaasti. Lisäksi havaittiin, että proaktiivisen palvelun seurauksena Ericsson on pystynyt tekemään niinsanottuja lisämyyntejä verkkotukitiimin suositusten pohjalta. Perinteinen tuki- ja hallintapalvelu on tuottanut tällaisia erittäin vähän.

Asiasanat: Proaktiivisuus, WCDMA, liityntäverkko, radio, asiakastuki, benchmarking, mobiili

Laurea University of Applied Sciences **Abstract**
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Oy LM Ericsson AB is a traditional mobile network company offering GSM and 3G services around the world. Ericsson's unit GSDC Finland provides customer support services 24/7. During the last two years Ericsson has promoted proactive customer support as one of the services, and it has been tested in a few sites globally. The author works at the access network department of GSDC Finland, so the thesis has been made from access network point of view.

The purpose of this thesis is to research the impact of proactive customer support on WCDMA radio access network from both Ericsson's and customer's point of view. The objectives were to find out the following: what is proactiveness, what is WCDMA radio access network, does proactive support service bring any add-on value when compared to reactive support, and how should proactiveness be used in access network department in the future. Research method was action research and data has been analyzed using benchmarking.

Technical framework of this thesis handles the essential technologies related to the research. WCDMA radio access network technical introductions have been provided because the thesis has been made from access network point of view. Access technologies and essential concepts related are described first, after which the emphasis is on WCDMA access network equipment and techniques. High speed packet access, HSPA, is described as well as one of the most important future access technologies.

The theoretical framework handles proactiveness generally and the development of customer support in recent years. Two real life cases of Ericsson, which have both been testing the impact of proactive customer support, are investigated and used as a source of data. The opposite way of working is traditional support, and it has been used for comparison to proactive support in the benchmarking analysis.

In the results of this thesis it was noticed that proactive customer network support service reduces the amount of fault situations experienced by the customer significantly. In both introduced case studies the amount of customer support requests has reduced at least by 50%. The proactive service has been experienced as an excellent complement for traditional support and it has increased customer satisfaction substantially. In addition it was noticed that as a result of proactive service Ericsson has been able to do add-on sales recommended by the proactive network support on-site teams. Traditionally customer support services produce very little or none add-on sales.

Keywords: Proactiveness, WCDMA, access network, radio, customer support, benchmarking, mobile

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1 Background

1.1 Initial situation

Ericsson, one of the largest Swedish companies, is a leading provider of telecommunication and data communication systems, and related services covering a range of technologies, including especially mobile networks. Directly and through subsidiaries, it also has a major role in mobile devices and cable TV and IPTV systems.

My current employer is Ericsson's Global Service Delivery Center (GSDC) Finland. Inside GSDC Finland I'm part of WRAN (WCDMA Radio Access Network) department. The WRAN department provides 24/7 support for customers of Ericsson in addition to providing new solutions.

I received my thesis assignment from the WRAN department. The idea was to create a general research on proactive support and further on go deeper to Ericsson's similar processes. Proactive support basically means preventing system problems from happening in the first place. Inside Ericsson, proactive support is a product that's being sold to customers by the name PSM – Preventive System Maintenance. In addition to that, proactive customer network support is an add-on to usual customer support.

My task was to study proactive support generally, study Ericsson's proactive processes and give an idea how it should be used in our WRAN support and sales. Also I was to study whether proactiveness brings any add-on value for Ericsson's customer support as a separate product or should it be given as a part of our normal support. WRAN technical introduction and specification are provided in this work as a help for me and possible newcomers in the future.

1.2 Need for development

Operations and maintenance support in general is a service that has a lot of competition. Every global corporation wants to polish their processes related to it. Consumers and customers are becoming more and more tech savvy with devices, software and applications that they use on a daily basis. Therefore service providers like Ericsson will need to be better prepared for a more diverse set of issues and challenges in the field of support. With services like proactive customer support, service providers are able to show real commitment to their customer base by going beyond traditional basic support.

1.3 Assignment

The assignment for this thesis is to research proactive support generally and from Ericsson WRAN point of view. Proactiveness in the field of support has become an important aspect of

business. As said, Ericsson offers a service called preventive system maintenance. Included in this thesis is a chapter about PSM. The chapter handles the main aspects in the PSM process and gives an overview of network impact and customer satisfaction. Because this thesis is done from WCDMA RAN point of view, the access technology is introduced and the technical specification is given.

Ericsson has promoted proactive customer network support a lot lately. Two big projects are ongoing at customers around the world. The projects are studied in this thesis from add-on value point of view. This thesis will focus on Ericsson's proactive customer network support processes and the outcome especially in the Radio Access Network part of WCDMA network. Proactive processes for other network segments are left out. Proactive support will be introduced generally, and the deeper inspecting is only from Ericsson WRAN point of view. WCDMA network will be introduced to give background information about Ericsson's products that make use of proactive support services. Core network is included only as a concept.

This research was executed by gathering material and documenting proactive support in several organizations. Data collection method was oral interviews without set guidelines and also Ericsson intranet digging. Ericsson's Intranet is huge and data about proactive service projects is more or less scattered to different places. One of my assigned objectives was to gather and manage this data in to this one document. Service delivery manager was interviewed to get information about the future development of proactive support services.

Ericsson's proactive customer network support, PSM and WCDMA network will be documented and questioned by the standards of the thesis' goals. Conclusions are drawn in final sections.

No extra financial resources were needed for this study from my side. Collaborative groups for this were all the proactive network support people inside Ericsson. WRAN services engineers were able to assist me in technical terms.

1.4 Objectives

The objective for this graduate study was to be able to answer the following questions:

- General view – what is proactive support and how should it be executed?
- General view – what is WRAN and how does it work?
- How should proactive support be used inside WRAN?
- What add-on value does proactive support bring for customer support and sales?

The objectives were met according to the scope of thesis.

The main personal objective for me during this graduate study was to develop both as a person and as a professional. Research- and project-work were both very familiar to me but a job of this size is a real challenge. In addition to "just writing a thesis" I had to learn and know a totally new area of networks for myself. Most of my orientation studies have focused on wired or wireless IP-networks; LAN, WAN and WLAN. I have had one course at school about telecommunications and mobile data transfer, so basically I started with very little knowledge in the area. Luckily for me, Ericsson provides an excellent learning environment and introduction program.

Before I started working, I set myself five goals. The goals were supposed to be met after the thesis was done. My goals were as followed:

1. Understand how the Ericsson customer support and O&M processes work
2. Understand and be able to discuss about WCDMA networks
3. Have the competence to handle customer support requests on WRAN
4. Have deep knowledge about preventive system maintenance processes
5. Develop my English language skills to excellent level

During the work I noticed myself developing all the time. These goals that I set myself when beginning the thesis were quite high standards though. I believe I meet the prerequisites now for personal goals 2, 4 and 5. Goals 1 and 3 are actually something that I will learn only after doing customer support myself, which I have not done yet.

1.5 Connection to other projects

There are several ongoing projects at Ericsson which relate closely to proactive customer support and preventive system maintenance. One of the biggest projects takes place at a big customer. Proactive support towards the customer started back in March 2008. So far it has been perceived by both Ericsson and the customer to have created and delivered high value. The project had several objectives, of which the most important one was to improve customer network quality by doing both proactive and reactive support. A proactive CNS-team (Customer Network Support) was created to carry out on-site support, communicate to both customer and Ericsson and act upon any observed issue. This project has so far been a huge success and stands as an excellent example of proactive way of working and the add-on value it provides.

1.6 Research method

This graduate study will be executed as a research for Oy LM Ericsson AB, competence area access. Research method will be action research. I will try to understand methods that already exist, and make potential improvement suggestions to related processes inside GSDC Finland.

Action research means a process of progressive problem solving. This process is led by individuals that are working with others in teams or as a part of community in order to improve the way issues and problems are solved. Action research is meant to improve organizational strategies, practices, processes or knowledge. The term "action research" was first published by a professor of MIT, Kurt Lewin 1944 and it was later released in his paper "Action Research and Minority Problems" 1946. In the paper Lewin describes action research as "a comparative research on conditions and effects of various forms of social action and research leading to social action" that uses a "spiral of steps, each of which is composed of a circle of planning, action and fact-finding about the result of action."

Action research often leads to a process of change. The process can be described with a three stepped model. This model was first introduced by Kurt Lewin as well. "Unfreezing" or step one, of this model is the part where this thesis is focusing on. Possible process changes or future action planning will be excluded.

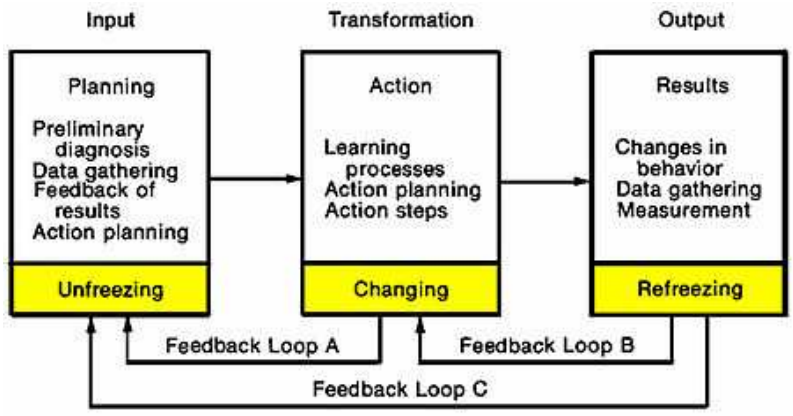

Figure 1 - Process of change

1.7 Data analysis using benchmarking

The analysis of information has been carried out by using benchmarking. According to Watson (1993, 23), benchmarking can be considered as a research project. It is an ongoing systematic process used for measuring and analyzing process performances by comparing cost, cycle time, productivity, or quality of a specific process or method to another that is widely considered to be an industry standard or best practice. (Niva & Tuominen 2005, 5) The idea of benchmarking relies to the fact that companies should be humble enough to accept that

something or someone else can be better than those traditional practices. Typically benchmarking is carried out with an external companion but in this case it's used to compare different support processes inside Ericsson.

Internal benchmarking is a fast and easy way for many companies to start improving their processes. This research is using benchmarking to find out which of the Ericsson's internal support processes is the most efficient by different standards. The drawback of internal benchmarking is the possibility that there is no top-notch process currently in use, so the measuring is just between two mediocre options. This research however does not try to bring new processes from external sources. Its goal is to show the differences between existing ways of working. Internal benchmarking can only be used to strengthen existing processes and standards, not to bring in new ones. (Niva & Tuominen 2005, 16)

This thesis uses Niva & Tuominen (2005) model of the benchmarking process in an applied way. The process model is as followed:

1. Define the target for benchmarking
- In this case the benchmarking target is the customer support process for Ericsson

2. Identify the best available practices for benchmarking target
- This thesis is focusing on comparing the results of two opposite ways of working, reactive and proactive

3. Measure the differences in performance
- Real case studies are used to measure the differences

4. Identify the good qualities that affect the processes
- The customer support processes are examined thoroughly

5. Learn the best practice
- By data analysis and comparing it's possible to identify the most valuable way of working

6. Set the goals
- Set the immediate and long time performance goals.

The model has three more steps in its original form but this research only focuses on parts one to six. The rest goals which relate to implementing changes can be possible follow-up projects for this research.

1.8 Risk management

Risk analysis diagram for risks that related to this graduate study is provided in this section. These risks are considered noteworthy according to their seriousness/probability relation.

Risk	Seriousness	Probability	Control
Lack of material	**90 %**	**10 %**	Search for external sources
Lack of guidance	**50 %**	**10 %**	Own iniative
Schedule failing	**20 %**	**40 %**	Two months of extra time reserved for the project
Know-how failure	**70 %**	**20 %**	Study more
Not enough answers for interview	**70 %**	**20 %**	Re-send survey to a wider range of people
Technical malfunc-tions	**80 %**	**10 %**	Work from home
Key-people summer absences	**30 %**	**70 %**	Concentrate on technical parts and language of thesis
Limitations and defin-ing too wide	**70 %**	**50 %**	Re-evaluate situation and make proper actions
Language limitations	**30 %**	**10 %**	Ask for language guidance

The risk managing worked out quite well during the thesis process. The biggest problem was actually something that wasn't on this list, which was the interviewing. Once I had more and more knowledge about the subject I started realizing that an interview in the way I had planned it wouldn't work. A structured form interview was in my mind in the beginning but in the end I came to the conclusion that it wouldn't serve this subject right. The thesis project escalated in to a point where I wasn't able to get any valuable information through mass in-terview so I decided to leave it.

2 Technical framework

This thesis' framework includes a big package of technical information related to the scope. The most important technologies will be introduced in this chapter.

2.1 Wideband Code Division Multiple Access and other access technologies

Wideband Code Division Multiple access (WCDMA further on) is a receive/send multiple access technology, where users are separated by unique codes. This means that all users can use the same frequency and transmit/receive the same time. Currently WCDMA is the world's leading 3G-technology providing data rates up to 2Mbps and even more with high speed packet access (HSPA, chapter 3.5.5). (Ericsson C 2008)

Other access technologies, mainly used in 2nd generation mobile networks, include:

- CDMA – Code division multiple access, with lower bit rate and less frequency than WCDMA
- FDMA – Frequency division multiple access, where users are separated with frequencies
- TDMA – Time division multiple access, where users are on the same frequency but separated by transmit/receive time blocks

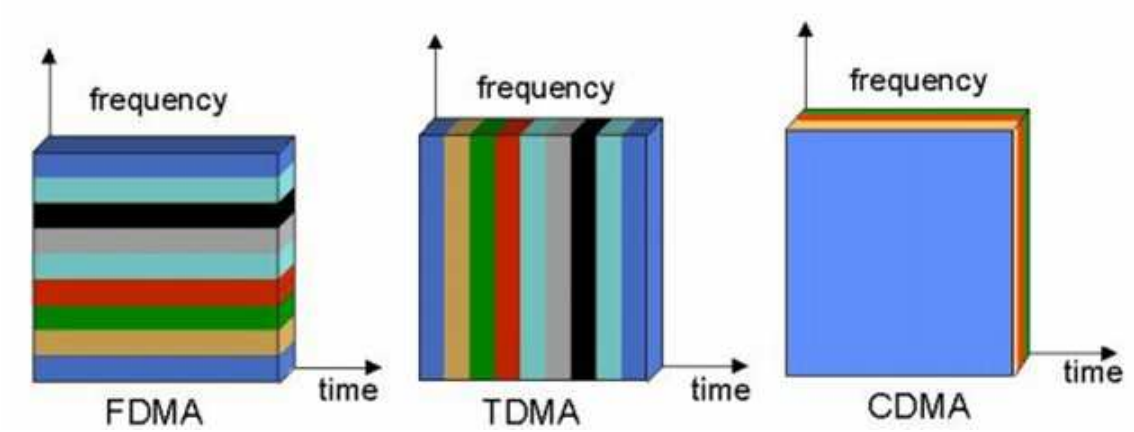

Figure 2 - Radio access technologies

WCDMA differs from CDMA by having higher frequency and chip rate, thus the name "wideband". It also offers some other advantages, which makes it ideal for 3rd generation mobile data communications.

The WCDMA network consists of core network (CN), radio access network (RAN) and service network (SN). CN includes the services that mobile users need to access. RAN is the gateway for these services and provides the link between user equipment (UE) and CN. User equipment can be mobile phones, laptops or other devices that take advantage of mobile services. The SN is a network server-based solution that enables seamless service delivery between the many different services and applications, access methods, underlying technologies and UE based on IP-technology. From service network point of view, RAN and core networks are seen as a bearer to access mobile users that request services. (Ericsson C 2008)

2.2 3rd Generation Partnership Project

3rd Generation Partnership Project (3GPP further on) is a collaboration agreement negotiated and signed back in December 1998. 3GPP is the WCDMA specification body with delegates from all over the world. Its task is to make sure that global standards of 3G telecommunication systems are in place. The bodies involved in 3GPP are the following ones:

- European Telecommunications Standards Institute (ETSI)
- Wireless/Mobile Services and Systems technical subcommittee of the USA's Committee T1 (T1P1)
- Telecommunication Technology Committee, Japan (TTC)
- Association of Radio Industries and Businesses, Japan (ARIB)
- Telecommunications Technology Association, Korea (TTA)
- China Wireless Telecommunication Standard group (CWTS)

Standardization of GSM was also moved from ETSI to 3GPP in the year 2000 in order to ensure the integrity of GSM/WCDMA networks. 3GPP is organized in five different technical specifications groups (TSG) which are: System and service aspects, core networks, RAN, terminals and GSM/EDGE RAN. (Ericsson C 2008)

2.3 Asynchronous Transfer Mode

Asynchronous Transfer Mode (ATM further on) is a digital data transmission technology first developed in the middle of 1980s. It was implemented as a network protocol and the goal was to design a single networking strategy that can transport real-time video and audio as well as image files, text and email. It is a packet switching protocol which encodes data into small fixed-sized cells and provides the data link layer services that run over OSI layer one physical transport links. The difference between ATM and other technologies based on packet-switching is that for example IP and Ethernet use variable sized packets (frames). ATM is a suitable technology for wide area data networking as well as real-time media transport. It uses a connection-oriented model which establishes a virtual circuit between two end-points before the actual data exchange starts. Currently ATM is the core protocol used in public switched telephone transportation networks. (Asynchronous transfer mode 2009)

2.4 WCDMA/GSM Core Network

Core network is the "service provider" in WCDMA network. It's a horizontally layered network that separates payload (voice or data), transport, session control and applications or services

into three layers (networks) with open interfaces. CN allows the unification of transport technologies such as IP, which brings telecommunications and data networks together. The main purpose of WCDMA CN is to handle the call requests. It offers control logic to establish connection between the RAN, the service network or external networks based on requested quality of service. CN consists of following domains:

- Circuit-Switched Domain (Tele) – Contains the nodes involved in voice call cases and is capable of providing complete mobile switching between GSM and WCDMA networks.

- Packet-Switched Domain (Packet) – Nodes in this domain handle the packet data calls. Provides functionality for both GSM and WCDMA.

- Transport Domain – Provides transport services for voice and packet data calls.

- Multimedia Domain – Contains multimedia gateway solutions

(Ericsson C 2008)

2.5 WCDMA radio access network overview

The main purpose of WCDMA Radio Access Network (WRAN from now on) is to provide a connection between user equipment and the core network. WRAN consists of two or three different types of nodes, depending on what's the topology. The main nodes in WRAN are:

- Radio Base Station, RBS
- Radio Network Controller, RNC
- Access Network Aggregator, RXI

In the picture, the black bold lines separate WRAN from the rest of the WCDMA network.

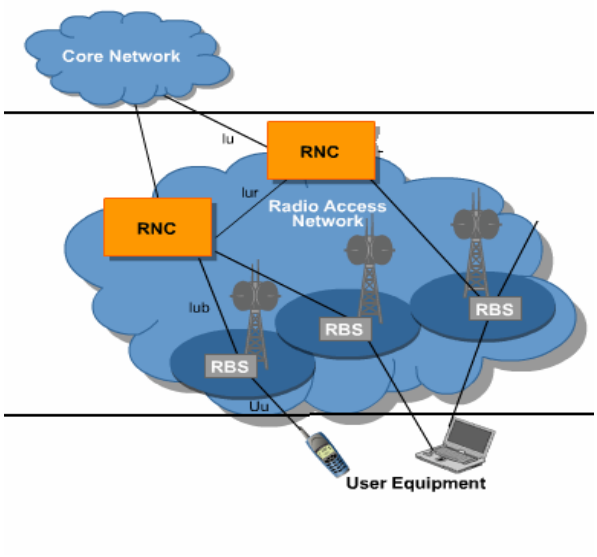

Figure 3 - WCDMA Radio Access Network (Ericsson C 2008)

The main service offered by WRAN is the Radio Access Bearer (RAB further on). RAB is the connection segment between user equipment and the core network. The characteristics of RAB depend on the type of information to be transported over RAN. 3GPP has defined four quality classes for RABs – conversational (used e.g. for voice calls), streaming (used for e.g. watching a video clip), interactive (used for e.g. web browsing with moderate delay) and background (used for e.g. file transfer). Conversational and streaming RABs both require a certain amount of resources reserved for them and they are both meant for real-time services. The difference between these two is that a streaming RAB can tolerate a moderate delay, especially in one-way traffic, while conversational RAB should be with very little or without latency. Interactive and background RABs are so called “best effort” RABs. No resources are reserved for them and the throughput depends on the load in the cell. Difference between these two RABs is that interactive provides a priority mechanism.

RAB is characterized by certain quality of service parameters, such as bit rate and latency. The core network will select a RAB with appropriate parameters based on the request of the mobile subscriber, and will then ask the radio network controller to provide such a RAB.

The WCDMA RAN nodes communicate with each other over a transport network consisting of optical fiber and microwave links along with other technologies. 3GPP provides a very clear split between the WCDMA related radio traffic and the transport traffic so they basically have almost nothing to do with each other. Traditionally transport network is ATM (Asynchronous Transfer Mode) based but IP has already begun to set foot on telecommunications transportation technology. In the future all transport traffic will most likely be IP-based. The platform

used in all WRAN nodes is the Connectivity Packet Platform (CPP further on) which provides a flexible solution for both ATM and IP interfaces. (Ericsson C 2008)

2.5.1 Connectivity Packet Platform

Connectivity Packet Platform is a platform for telecom and datacom functions for many node types. It contains scalable hardware and software with distributed real-time execution environment. It's based on C/C++ and Java and contains a real-time operating system with databases, processors and file systems. CPP supports packet switching and interfaces for IP, ATM and DTM. All the nodes in Ericsson WCDMA RAN are based on CPP. (Ericsson K 2007, 3)

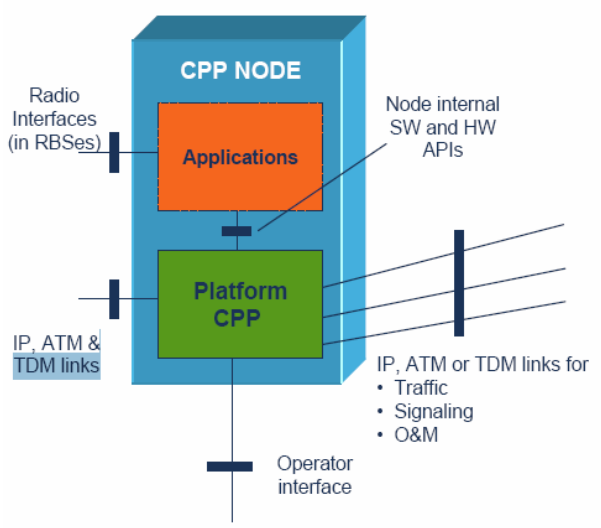

Figure 4 - Connectivity Packet Platform based WCDMA node (Ericsson K 2007, 4)

2.5.2 Radio Network Controller

Radio Network Controller (RNC from now on) controls all the traffic in WRAN. RNC manages and optimizes radio network resources, controls hand-over cases and assists the power control in radio base stations. (Laine 2008, 5-6) RNCs can be connected to four different places at once:

- RNC – RNC : Via the Iur interface
- RNC – RBS : Via the Iub interface
- RNC – OSS-RC : Via the Mur interface
- RNC – CN : Via the Iu interface

RNCs are based on connectivity packet platform. It consists of a transport system, a distributed real-time telecommunication control system, and a management support system. RNC uses cell switching for communication between hardware boards and racks. RNC can act ei-

ther as a serving RNC (SRNC) or a drifting RNC (DRNC). A single SRNC controls the radio connection between the UE and the WRAN. SRNC also handles the termination of Iu link between UE and CN. The purpose of a DRNC is to support the SRNC with radio resources in case it's needed. RNC provides a wide number of services and functions for end-users.

- Mobile telephony (voice)
- Unrestricted digital information
- Packet data, including High-Speed Downlink Packet Access (HSDPA) and
- Enhanced Uplink (E-UL)
- Short Message Service (SMS)
- Mobile positioning and localization
- Multimedia Broadcast Multicast Service (MBMS)
- Ciphering (security)
- Radio Access Bearer (RAB) service, establishment, release, modification, identification, coordination, and maintenance including both point to point as well and point to multipoint RABs
- Mobility within WRAN (moving from one base station link to another base station)

(Ericsson J 2007)

2.5.3 Radio Base Station

Radio Base Stations (RBS from now on) provide the radio resources and maintain the radio links to user equipment. RBS radio-coverage is divided into sectors, also known as cells. Capacity in a cell is divided between users. So basically, if there are more users in a cell, less bandwidth one will get. RBS is connected to RNC via the Iub interface and to user equipment via the Uu interface. RBS also has two maintenance interfaces; Mub, which is connected to operations support system (OSS-RC, chapter 4.1), and VMI - the visual and mechanical interface. (Ericsson C 2008)

2.5.4 Access Network Aggregator

Access Network Aggregator (RXI from now on) connects several RBSs to one RNC. RXI can function as:

- A real-time Ipv4/Ipv6 router
- An ATM/AAL2 aggregator
- A combined router/aggregator

RXI could most easily be defined as a hub in RAN. (Ericsson D 2007)

2.5.5 High Speed Packet Access

High Speed Packet Access (HSPA from now on) is a technique that enables much faster wireless connections to mobile user equipment by increasing the capacity of WCDMA through different channels. HSPA is divided to two different technologies: High Speed Downlink Packet Access (HSDPA, chapter 2.5.6) and Enhanced Uplink (EUL, chapter 2.5.7). In Ericsson Phase 6 systems the downlink speed can be up to 14 mbps and uplink up to 5,8 mbps. (Laine 2008, 8)

2.5.6 High Speed Downlink Packet Access

HSDPA was first introduced in WCDMA 3GPP release 5. It adds a new transport channel to WCDMA called High Speed Downlink Shared Channel (HS-DSCH). The channel provides enhanced support for packet data applications in downlink. (Ericsson B 2008, 8)

HSDPA introduces several new features for WRAN. The key features in HSDPA are:

- Shared channel and multi-code transmission
- Higher-order modulation
- Short Transmission Time Interval, TTI (2ms)
- Fast link adaptation
- Fast scheduling
- Fast Hybrid Automatic Repeat reQuest, HARQ

The shared channel transmission enables more efficient use of channelization codes and power resources in WCDMA. The shared code resource in HSDPA shared channel consists of up to 15 codes. The codes are then dynamically allocated every TTI for users in the cell as shown in figure 5. (Ericsson B 2008, 8-9)

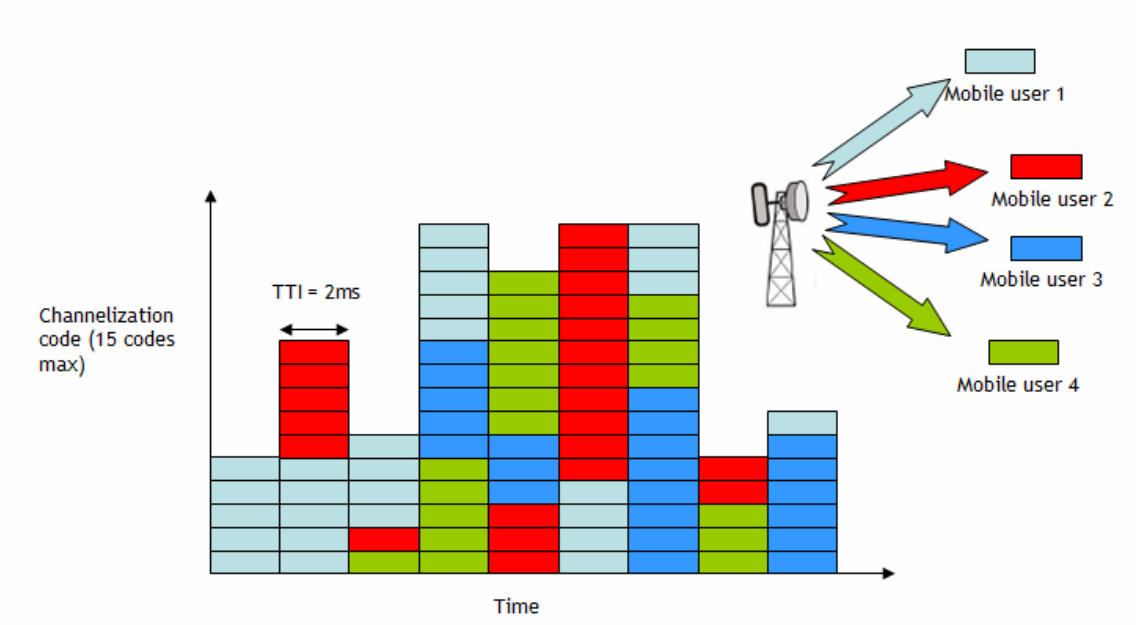

Figure 5 - HS-DSCH dynamic code allocation for users in a cell

Higher-order modulation means that HSDPA is able to use more symbols in a bit for downlink. WCDMA 3GPP Release 99 uses Quadrature Phase Shift Keying (QPSK) modulation. HSDPA can use QPSK as well as 16 quadrature amplitude modulation (16QAM) for much higher data rates. The downside is that using 16QAM requires better radio conditions to function. The different modulation schemes for HSDPA are illustrated in Figure 4. (Ericsson B 2008, 9)

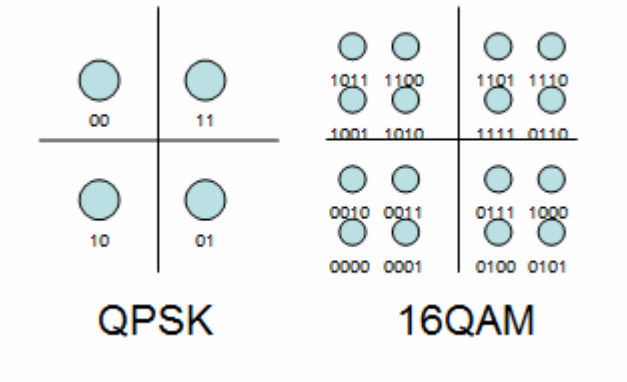

Figure 6 - HSDPA modulation schemes

As shown in the picture, QPSK carries only four symbols and two bits per symbol where as 16QAM carries 16 symbols and four bits per symbol. The reason for 16QAM good radio condition requirement is that with such a dense modulation there can easily be errors in decoding in case of poor radio conditions. In addition to these, Ericsson has also introduced 64QAM in the latest phase of WRAN. 64QAM carries 64 symbols and six bits per symbol.

Radio channel conditions might vary a lot depending on both time and position in a cell. Each UE that uses high-speed services like HSDPA transmits channel quality reports regularly to the RBS. HSDPA fast link adaptation adjusts the transmission parameters accordingly, and when conditions are met, enables or disables higher order modulation. WCDMA uses power control to act on differences and variations in downlink radio channel conditions. In other words, power control gives worse radio links a bigger part of the cell power. Using power control ensures almost similar service quality despite the differences in radio channel conditions. The downside in this technique is that available power is not always fully taken advantage of because some power needs to be reserved for ongoing connections in case their radio conditions change to worse. (Ericsson B 2008, 10)

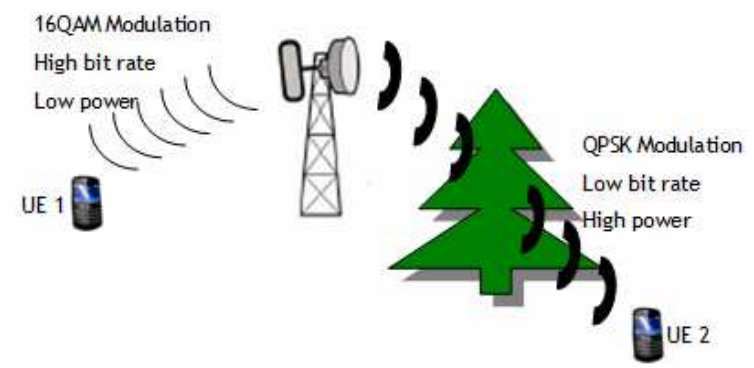

Figure 7 - Data rate and power adjusted according to radio conditions

Fast scheduling in HSDPA means the decision process for shared channel transmission usage. The ideal situation is to transmit for users with favorable radio conditions. As said before, each UE sends regular channel quality reports to the radio base station. Based on the reports the scheduler determines HSDPA performance. Every single TTI (2ms), the scheduler decides which users the HS-DSCH should be transmitted to. Also the scheduler co-operates with the link adaptation mechanism in order to determine the modulation method and number of codes to be used. (Ericsson B 2008, 11)

Fast hybrid Automatic Repeat reQuest (HARQ from now on) is the technique used by UE to request retransmission of missing data. The information will be combined from the original information and the re-received data before attempting to decode the message. This kind of technique is called soft-combining. It improves performance and provides robustness. If the UE receives missing or corrupted data it sends a negative acknowledge (NACK) back to RBS. The missing or erroneous data is then sent together with the next package as shown in figure 8. After the UE receives the correct data, it sends an acknowledge (ACK) back to the RBS. Previously retransmissions were handled by RNCs, but after the introduction of HSDPA this functionality has been moved to RBSs. Basically this means that retransmit function is closer to the air interface which reduces connection latency. (Ericsson B 2008, 13)

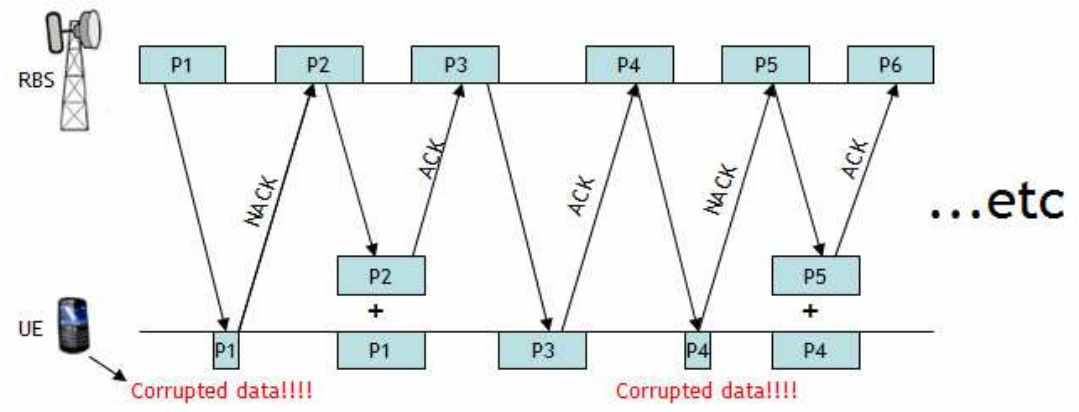

Figure 8 - Hybrid ARQ working between UE and RBS

2.5.7 Enhanced Uplink

Enhanced Uplink (EUL from now on), also known as HSUPA, was introduced in WCDMA 3GPP release 6. Like HSDPA, EUL adds a new transport channel to WCDMA called Enhanced Dedicated Channel (E-DCH). It improves uplink performance with reduced latency, increased data rates and capacity, thus making it a natural complement to HSDPA for high-bandwidth packed data applications. EUL supports several new features in order to attain these performance improvements: (Ericsson B 2008, 15)

- Multi code transmission
- Short transmission Time Interval
- Fast hybrid Automatic Repeat reQuest
- Fast scheduling

The techniques are similar to the ones in HSDPA except that there is one big difference between the uplink and the downlink. HSDPA uses transmission power and channelization codes as the shared resource and they are centralized to the RBS where as uplink's shared resource is the total interference (total received power) at the RBS. This interference depends on the decentralized power resource in each UE. (Ericsson B 2008, 15-16) Unlike HSDPA, EUL uplink channel E-DCH is not shared between users. Instead it's dedicated to a single user. Multi code transmission means that up to four codes can be used to increase uplink data rate. Like HSDPA, EUL uses short TTI. It operates with a TTI of 2ms or 10ms in the uplink. A short TTI in uplink allows a significant reduction in latency and also provides the means for other features to adapt rapidly. (Ericsson B 2008, 16)

As said, in the uplink the common resource shared among the UE is the amount of interference, which is the total received power at the base station. Generally speaking, the higher the data rates, the larger the required transmission power. Fast scheduling in EUL enables

rapid resource reallocation between UE. Like HSDPA, EUL fast scheduling is now located at the RBS instead of RNC. Reduced uplink- and overall latency should be vast because the air interface is much closer and rapid responses to changed situations can be made.

2.6 Managed services & network operations and maintenance

"Managed services" is a product for total O&M and support of customer networks. It's usually preferred in case the customer, usually an operator, wants to concentrate on their core business and leave the network administrating for other companies. Managed services can be considered valuable for both the customer and the service provider as seen in the next table.

Key customer benefits:

- Customer peace of mind – monitored network 365 days per year
- One single contact for all network issues and problems
- Single supplier – benefit for troubleshooting and consistency
- Predefined levels of service for service delivery scope
- Known costs for management and fixed price contracts
- Avoid costs caused by own management and reporting systems
- Lower total cost of ownership for client
- Can concentrate on core businesses

Key service provider benefits:

- Extended longevity in business contracts
- Increased customer 'stickiness' & average revenue per user
- The possibility to interact with customer in decision making level

(Managed services 2009)

Typical network operation and maintenance (O&M) is reactive. As the problems arise they are solved, and perhaps the root cause is inspected. O&M includes on-site installations, support, auditing, field-services and supply of equipment and new technology etc. O&M belongs in managed services –package and it can also be customized for different customer needs. Year 2008 Ericsson managed networks with up to 200 million subscribers worldwide. Typical O&M is not proactive.

3 Theoretical framework

The purpose of this chapter is to give a theoretical knowledge base about proactiveness. Ericsson offers several tools which can be used in proactive O&M and they are introduced in the chapter as well.

3.1 Proactive behavior

3.1.1 What is proactive behavior?

The word 'proactive' was originally used by a German psychiatrist Victor Franki when he described a person who took responsibility for their life and didn't blame outside circumstances or other people. Nowadays proactive behavior means acting in advance of a future situation, rather than just reacting to it after it has happened. Taking control and making things happen are the key elements in proactiveness. The word itself came to general consciousness when Stephen Covey included it in his book of influential management, The Seven Habits of Highly Effective People. Wikihow explains that if you want to be proactive, you need to think and act ahead; it's all about using foresight. Proactiveness is a great method for avoiding unnecessary extra work down the road but it's also used for preventing disasters to happen. Being proactive makes life easier if planned well for the future. Proactive people are looked upon as the instigators of action and creative idea generation in work places. (How to be proactive 2009) Greta Thornbory and Claire White point out in their article of being proactive (Thornbory, G. & White, C. 2009), that if you take the time to use proactive habits, you will probably find out that you have more time available for normal tasks than before. They say that if we anticipate and plan for 80% of our tasks, when the 20% unplanned comes along, we will have a lot more time to deal with it effectively.

In operations and maintenance proactiveness means the same in exception that it isn't the people that are proactive, it's the surveillance of technological products. Hardware and software need to be under constant surveillance for proactive reactions to be possible. Small signs of performance problems can be a sign of bigger problems in the future – this is where proactive O&M support is aiming on. Preventing the big malfunctions to happen is a big thing for customers; it will shorten the downtime and save them money. However, proactive support requires a lot of resources as well, since almost everything should be under constant surveillance in order to detect those minor issues and catch the bad trends.

3.1.2 How to be proactive

Thornbory and White (2008) discuss in their article about the steps of being proactive. The first step should be making a list of all our regular tasks. It's mentioned that on a busy day we may feel that we should start working on our usual tasks rather than writing all of them down. However, if we invest and do this once, it should yield rewards in the long run. There should be regular tasks in every man's life whether these happen once a day or once in a week. We should be taking a good look at them and ask ourselves whether they are worth doing, whether we are the right person for doing them and whether they are being done in the most efficient way. Next up would be examining the tasks and taking a good look at them with fresh eyes. We shouldn't be "reinventing the wheel" every time we execute a routine task. Perhaps it would be more efficient to use a template for something. Regular reports are an example which often requires the same type of information, so creating a template would allow us to fill them in more quickly. Another example would be a checklist to ensure that vital parts of a process are not forgotten, but it should be used without leaving common sense behind. (Thornbory, G & Co. 2008)

It's rare that people remember things they do rarely. For infrequent repetitive tasks it's recommended by Thornbory and White (2008) that a flow chart and process out step by step should be made. Then it should be tested by either disciplined creator or better yet a colleague without any input from the author. The benefit in these procedures is also that when leaving the job for new challenges, the instructions and process guides are already waiting there for the next person taking the tasks. This is a benefit only from organizational point of view of course. Naturally problems and difficulties can have even more benefit from being proactive. If similar problems or situations appear regularly, a root cause investigation should be in place. Fixing the root cause of a problem reduces the chances of problem recurring greatly. Addressing just the immediate and obvious symptoms of a problem will only fix it momentarily and the situation is most likely going to reappear.

Anticipation is an extremely useful mental skill in proactiveness. Anticipating and preparing for seasonal issues and rushes can turn out to save a lot of time in the future. This might require connecting with colleagues in other departments or attending work planning meetings so it's possible to know what is going on in the company. Knowing what's going on gives a feeling of being in control of a situation, which is an important asset in organizational behavior. In knowledge of organizational changes booking a course supporting the change could be a good idea. Being proactive is all about bringing the future into present in the way of doing all the possible things to ensure future success. A classic example of proactiveness is arranging an annual budget for professional updating with the employer. On a bigger scale, proactiveness can help corporations avoid disasters and in case of occurring, it's extremely impor-

tant to proactively help recover from them. A concept called disaster recovery planning is under proactiveness.

Thornbory and White (2008) close up the subject by giving five key elements in being proactive. Remembering just these five should be enough to get us going in proactive way of working.

- Take control of your simple, routine tasks
- Test out your systems to make sure they work
- Anticipate future events
- Seek out training
- Expect the unexpected

3.1.3 Customer support development – from reactive to proactive

Customer service report cards for many telecom providers are showing alerting results in the last few years. Communications providers from all sectors including mobile and fixed networks are all under fire for poor customer service. Waiting times are increasing all the time because it's much harder to reach the personnel that have the expertise and experience to resolve the issues. An MSN survey (Oster 2008) actually gave six of the top ten positions in "Customer service hall of shame" for communications providers. As David Messina tells in his article (2008), many of these providers are just trying to find detours around these damaging surveys, while the successful ones are implementing customer support as strategic service in their product portfolio. In the past, service providers had to turn down customers reporting problems with applications, devices or services that were not traditionally covered in the provider's service offering. Nowadays instead of telling the customer that they are not equipped to resolve the issues, providers are accepting these support requests for an extra fee and working as a strategic partner to resolve customer's issues. But still, support services have mostly been reactive and critical emergencies have escalated in to even longer waiting times for support requests.

According to David Messina (2008), some service providers are actually considering customer service as a way to protect their subscriber base. Some are even trying to lure subscribers away from the competition by offering support services outside of their territories and even to competitors' customers. Every means is allowed in the war for subscribers ongoing.

A small portion of small to middle-sized communications providers is following a different route. Instead of addressing customer problems already happening, they are using the service to proactively detect issues before the customer even knows that there is one. As an exam-

ple, an American Internet service provider called Mikrotec started offering a support service called Pro-Alert last year. The service allows the provider to proactively take action on an issue before the customer even reports a problem. Pro-Alert is based on subscriber analysis, which detects users that have undergone significant changes in their usual application behavior in the past 24 hours. After detecting, a designated customer service representative will immediately notify the customer about a potential issue. According to Messina's article (2008), after the months Mikrotec first introduced the service, they have been consistently identifying and resolving issues for dozens of subscribers before critical problems occur. Most common issues identified with Pro-Alert have been spambots. Spambots are hard to detect by a normal user, since it doesn't usually show unless it's so active that it consumes so much upstream bandwidth that it affects the performance of what the user is trying to accomplish. (Messina 2008)

In the past with just break/fix type of reactive support, customers called and reported these already affecting issues to customer support. The support requests had to often be escalated beyond service representatives to network operations personnel and to people with different expertise. Still it might have taken hours to actually find the problem, where as with proactive service like Pro-Alert the issue is immediately seen from the reports. When Mikrotec can alert customers before they even know there's a problem, it leads to hugely increased customer satisfaction and longevity. Mikrotec's example in proactive customer support will surely lead the way for many ICT-corporations in the years to come. In most corporations proactiveness is still taking babysteps but the direction is right. Communication provider's managers are starting to figure out the value of customer service and promoting premium service options like proactive customer support because of it. Currently telecom subscribers are in a great situation since customer support has been made a core business for many providers and development is happening all the time. With proactive customer support service providers are able to show subscribers that they are not just listening to their problems, they are also preventing them from happening in the first place.

3.1.4 Proactive customer support benefits analysis

Mack Coulibaly, Cisco Systems director of operations engineering took an analytical perspective in to benefits of proactive support services in his article published in SSPA news. (Coulibaly 2006) As networks become platforms for business operations they must meet certain acceptable and pre-established levels of service in order to gain and maintain business continuity and customer satisfaction. All of this must be done in a way that the business maintains low cost of ownership to achieve decent return on investment. The simple fact is that hardware will fail, software will have bugs and networks will experience disruptions and downtime. As Coulibaly says, in order to control these disruptions, proactive support services are

needed to reduce network disruptions and increase network capacity. Proactive services can be the key to maximize the benefits of network business operations by increasing the return on investment substantially. However, there needs to be something to measure the benefits of these services in order to see the true value of proactive support.

Disruption is used as a measurement index where escalation, bug, outage, severity and time to resolution are taken into account. Disruption is used for comparing products, networks, customers and vertical segments. It allows computation of cost benefits analysis linked to products, support and services. (Coulibaly 2006)

Coulibaly gives an example about total benefits counting through an imaginary company called Acme Inc. The company provides a broad range of financial services to consumer and corporate customers and currently has customers in over 100 countries and territories. Services delivered are banking, lending and investment services. Company's network infrastructure consists of 70% Cisco network devices. 2005 Acme had 13000 devices in its network and the number increased to 15500 year 2006. Company's network is globally covered by Cisco support and services contracts which include proactive services like Advanced Services Network Optimization and High Touch Technical services in addition to other minor services. These proactive services rely heavily on face to face interactions with the customer. The provider has a consultancy role in which it helps the customer design, implement and operate his network in a way that minimizes disturbances and downtime. The costs of these services are counted in the table below.

Year	Device count	Support service	Cost of service support per device
2005	13000	€ 5 950	€ 455
2006	15500	€ 6 790	€ 437,50
Percent increase	19 %	14 %	-4 %

Table 1 – Cost of support per device and year to year changes for Acme Inc.

The next figure shows the total disruption before and after the imaginary proactive services delivery. As we can see, there's a total drop of 40% in network disruption in one year. The effectiveness of proactive support services can be calculated through these tables, when all the other things are equal. Further information came up as well and Acme inc. noted that disruptive impact of each network incident has been reduced, disruption caused per device has been reduced and network capability has vastly increased.

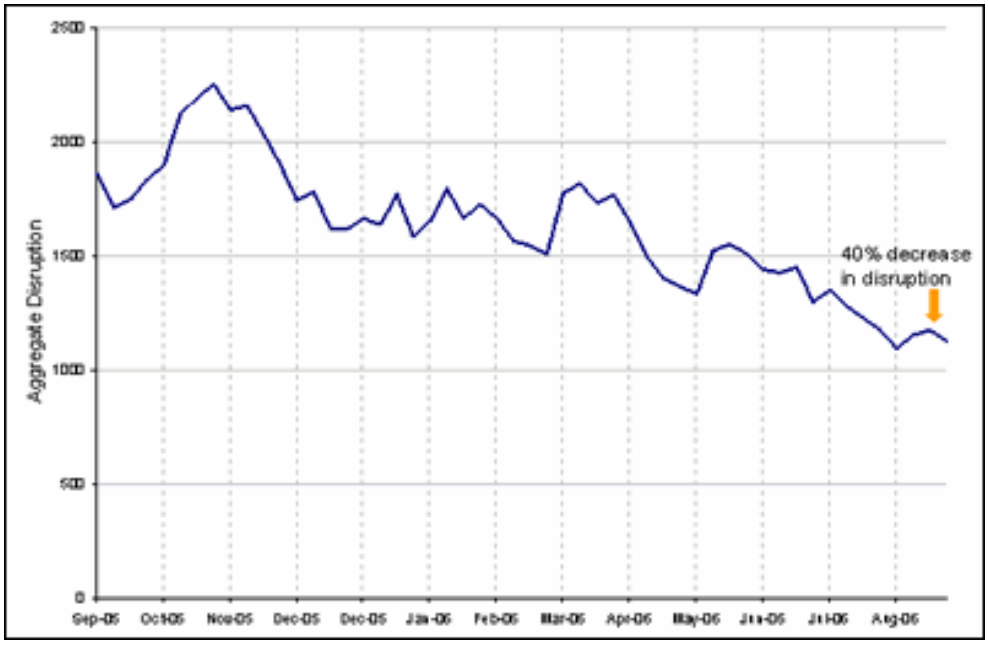

Figure 9 – Acme Inc network disruption in one year cycle. (Coulibaly 2006)

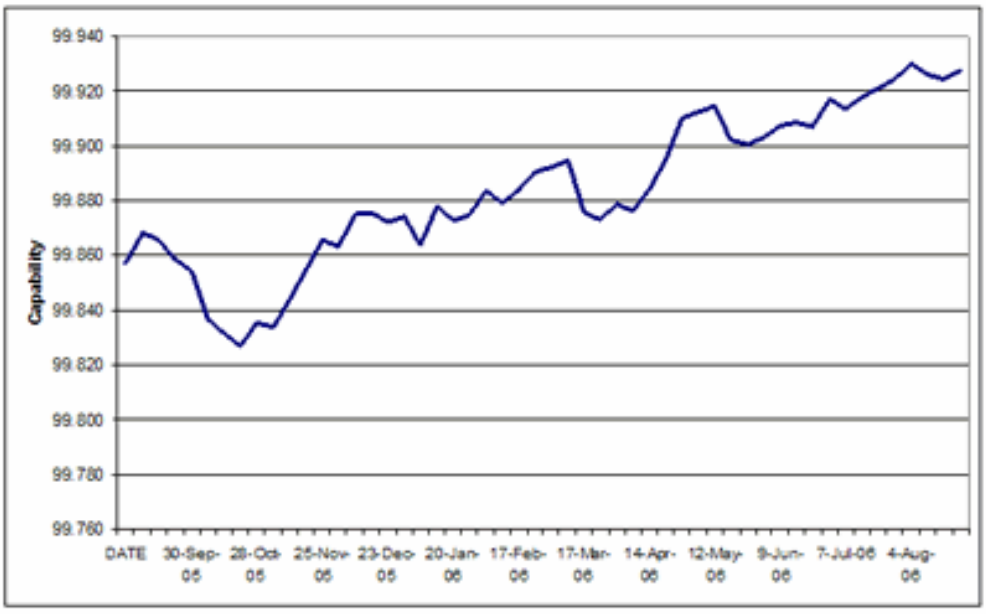

Figure 10 – Acme Inc network capability in one year cycle. (Coulibaly 2006)

The numbers in the table and the figures tell that the device count of Acme Inc went up by 19% but total disruption to business operations went down by 40%. Figure 10 shows it in the form of network capability, which has improved greatly. If disruption is used as the measurement index, one can see that proactive support services provide great benefits for overall business operations. One of the most disrupting events for business is naturally network downtime because network outages are very costly to business of this sort. “The average financial institution experiences 1,180 hours of downtime per year, costing 16 percent of annual revenue, or $222m. Manufacturers are losing an average of nine percent of their annual

revenue" (Infonetics Research 2005). InternetWeek published a research on the cost of network downtimes year 2000 for different areas of service. It's easily understandable, that current costs have only increased since then. Table 2 shows the estimations nine years ago.

Brokerage operations	€ 4 515 000
Credit card authorization	€ 1 820 000
Ebay	€ 157 500
Amazon.com	€ 126 000
Package shipping services	€ 105 000
Home shopping channel	€ 79 000
Catalog sales center	€ 63 000
Airline reservation center	€ 62 300
Cellular services activation	€ 28 700
Online network fees	€ 17 500
ATM service fees	€ 9 800

Table 2 – InternetWeek 3/2000 cost of one hour network downtime year 2000

Computation of disruption establishes a relationship where 23 units of disruption equal to one hour of network downtime. Using the values from the transformation one can convert disruption to network downtime and count the monetary value of support services through network downtime prices. In this situation, Acme Inc has calculated that one hour of network downtime will cost them 280 000€. Table 3 shows the calculation of disruption converted to network downtime compared to costs by proactive support services and the return on investment.

Total invested in proactive services 2008	€ 6 790 000
Cost of new hardware and other remediation suggested by proactive service	€ 17 500 000
Total cost	€ 24 290 000
Benefits gained in 2009 (compared to 2008)	
Reduction in Disruption (D) (average monthly)	800
Disruption (D) equivalent to 1 hour of downtime	23
Hours of network downtime avoided per year (all businesses)	417
Cost of one hour of network downtime for Acme Inc	€ 280 000
Yearly value in reduction of disruption	€ 116 869 565
Return on Investment	381 %

Table 3 – Cost benefits analysis for proactive services by reduction in disruption

In this example case the total return on proactive service investment was huge 381%. Although it's imaginary, it still gives an overview about how things could be.

4 Ericsson WRAN maintenance tools

In order to manage customer networks, Ericsson possesses several different tools for usual maintenance and different operations. The tools are introduced briefly in this chapter roughly in order of importance. The last of these, automatic data collection (chapter 4.4) is often used in proactive services.

4.1 Operations Support System, Radio and Core

Operations Support System for Radio and Core (OSS-RC from now on) is the system for Ericsson mobile network management. It supports O&M for 2G, 3G and upcoming mobile networks. OSS-RC is a fully integrated solution that makes gathering data from network elements, such as RNC, RBS or RXI, easier. It can be used for both WRAN and CN management, and collects data from node databases, managed objects, where all the information concerning network behavior is located. OSS-RC is mainly used by operators to monitor and manage their networks, and is therefore a key concept in proactive customer support solutions. (Ericsson F 2008)

OSS-RC functionality can be divided in to four different areas, which all provide different network-wide management capabilities (Ericsson F 2008):

- OSS-RC Supervisor
- OSS-RC Configurator
- OSS-RC Deployer
- OSS-RC Optimizer

4.2 MoShell

MoShell (Managed Object Shell) is a text-based network element manager for Ericsson CPP nodes such as RNC, RBS and RXI. In WCDMA RAN, MoShell is used for network monitoring, troubleshooting, integrating, upgrading and tuning. MoShell gathers its information from node managed objects (MOs), which contain all the data related to the specific network element.

4.3 Remote Support Gateway

Remote Support Gateway (RSG further on) is a collection of security products that allow secure access between private networks, used for support and supply in customer networks. At Ericsson RSG is used for providing a connection from Ericsson to the customer site. RSG is usable for all systems with an IP-address and connection allowed by the set of rules applied in

secure support gateway. All Ericsson systems are able to use RSG, and the point is that everything that can be done on-site should be possible to do via remote connection as well, with an exception of hardware installations. RSG operates via secure shell connection (SSH) in the following way. (Ericsson H 2008)

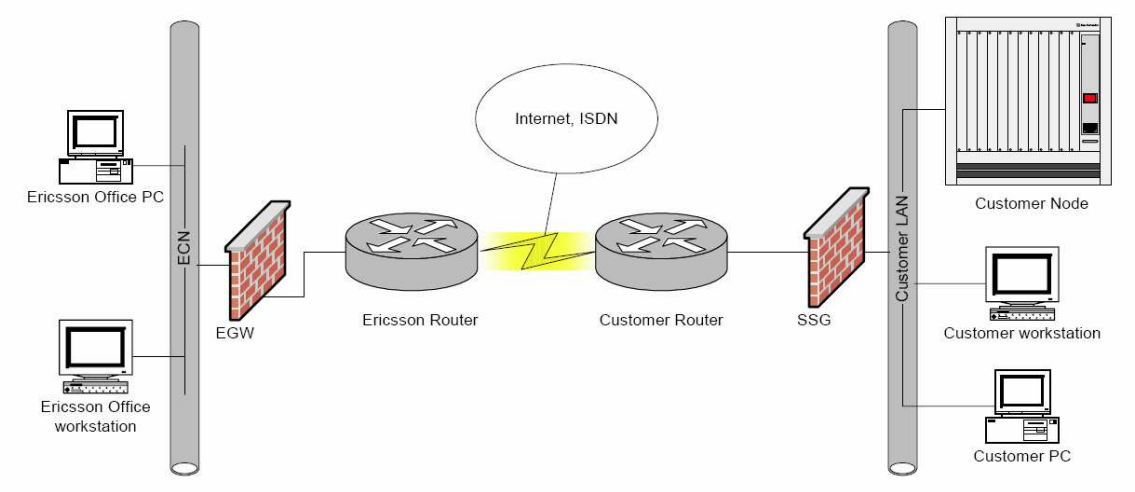

Figure 11 - Remote support gateway communications concept (Ericsson H 2008)

When connected to Ericsson network, access is gained to customer nodes by first logging in to the Ericsson Gateway (EGW) and from the EGW in to the Secure Support Gateway (SSG). (Ericsson H 2008)

4.4 Automatic Data Collection

Automatic Data Collection (ADC further on) is a feature of RSG that collects data from customer networks and sends it to Ericsson servers that make use of the data. Tools that use ADC are for example ISP Tool Kit (chapter 5.2.3) and NetSA health check (chapter 5.2.2). Figure 12 shows the workflow of ADC via RSG. The need for automatic collection of data is big. Manual collection requires a lot of work and it's rather hard to ensure that all the data is up to date. ADC uses the RSG infrastructure to automatically and securely collect predefined data from customer nodes with modifiable collection script while saving many working hours from personnel of Ericsson.

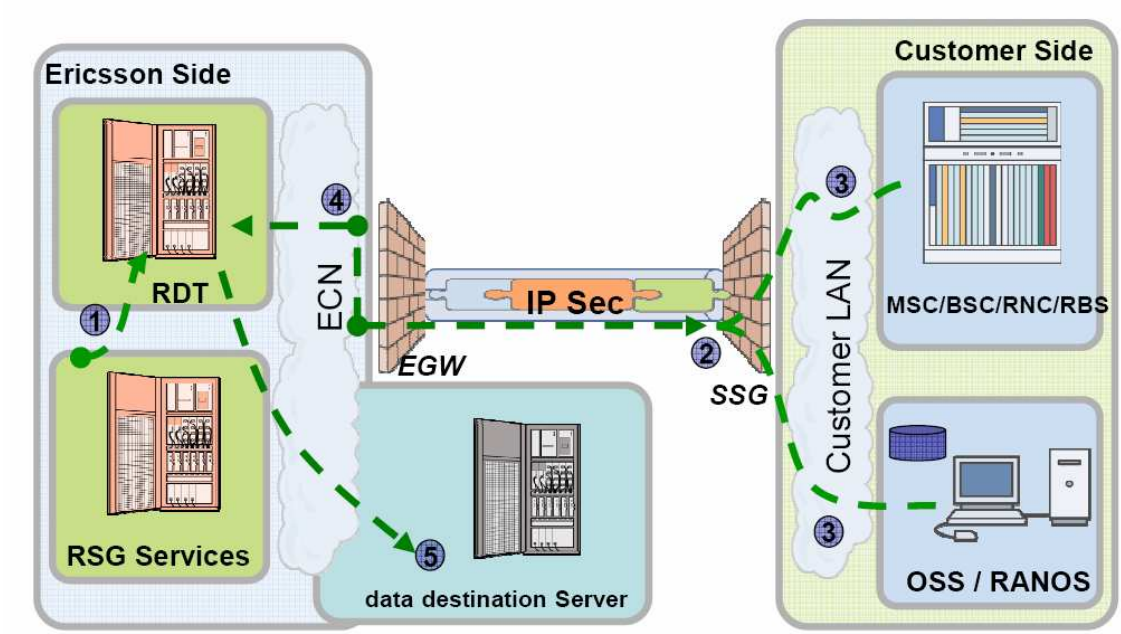

Figure 12 - Automatic Data Collection workflow (Ericsson I 2008, 6)

1. Technician logs into RSG services and orders a data collection from a specific node for a specific tool
2. RSG sends the ADC configuration to SSG nodes. Includes scheduling information i.e. when the script should start collecting the data
3. Data collection script starts according to schedule in the nodes
4. When the data is collected, Remote Data Transfer (RDT) server fetches it from the SSG
5. When all the data is at the RDT, it is sent to the destination tool for analyzing

(Ericsson I 2008, 6-7)

ADC is especially useful for proactive network support services. Engineers are able to run automatically scheduled data collections, which provide important information considering network behavior.

5 Ericsson proactive customer network support

5.1 What is proactive customer network support?

Proactive customer network support (CNS) for Ericsson is a concept, which includes an on-site team that carries out health-checks regularly towards the customer and Ericsson. The team is also required to act upon any observed issue. CNS-onsite team logs their proactive initiatives as “Proactive customer support requests (CSR)”. Reports of these proactive CSRs are sent monthly to the customers. By translating these reports to customer severity terminologies, the customer can easily see the value and convert it to monetary.

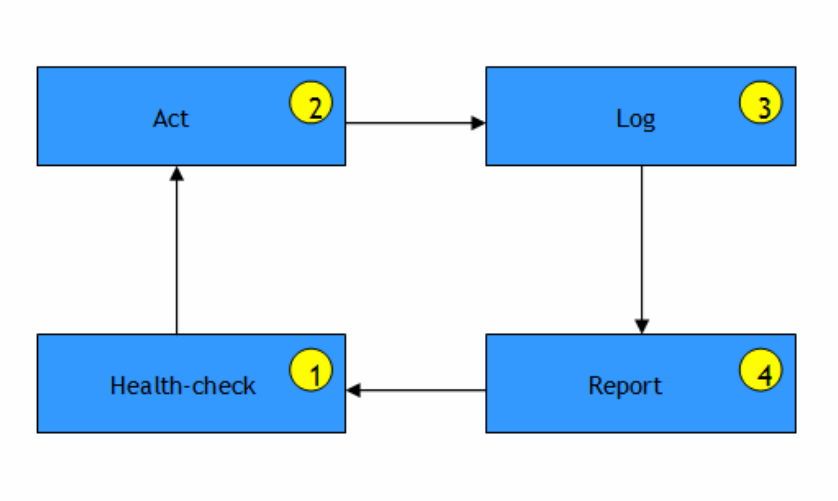

Figure 13 - Proactive Customer Network Support process cycle

Proactive CNS onsite team differs from a normal operational assistance team quite a lot. The most important differences are noted below.

Traditional break/fix team	Proactive CNS team
- Problem CSRs	- Onsite
- Reactive	- Proactive and flexible
- Node based view	- End to end view
- System based	- Service focused
	- Proactive CSRs
	- Consultative and communicative

Proactive customer network support can lead to potential up-selling opportunities as well. These opportunities are clearly an advantage for Ericsson, because more sales mean more income. Currently Ericsson has two major proactive CNS project going. The projects are further on referred to as cases 1 and 2.

5.2 Preventive system maintenance

5.2.1 Preventive System Maintenance Overview

Preventive System Maintenance (PSM further on) is a proactive customer network support service offered to customers of Ericsson as a comprehensive package of service elements. These elements are meant to attain and maintain peak performance in customer nodes. The package can be customized for different needs in different situations. The main purpose of PSM

elements is to proactively address specific risk areas within different nodes in order to minimize potential downtime of customer networks. (Ericsson E 2006, 3-4)

As said, PSM consists of different service elements. Each of these elements complements each other for customer node maintenance.

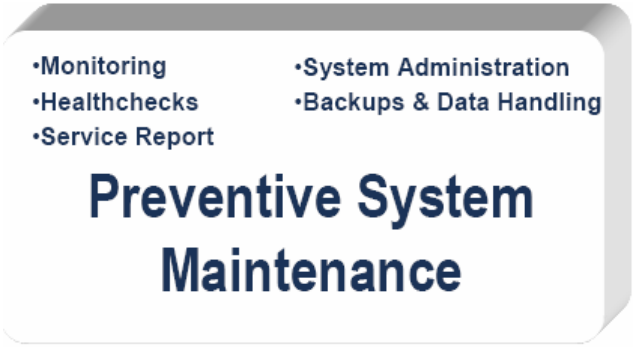

Figure 14 - PSM elements (Ericsson E 2006, 5)

These elements can be packaged to match customer specific situation. The elements are used with secure remote access solution. From marketing point of view, this service is offered as an optional service that can be added to existing system support or solution management. (Ericsson E 2006, 4-5)

5.2.2 NetSA health check

NetSA health check (HC) is an application developed by practice area customer support for automating proactive customer support and PSM service delivery routine activities. The following activities can be automated with this tool.

- Data collection from customer nodes
- Data transfer from customer network to the NetSA health check server
- Data analysis
- Production of analysis reports

NetSA HC is based on automated data collection (ADC), which can be installed on remote support gateway (RSG) or on the OSS-RC. Integrating ADC with RSG and OSS-RC can bring the following benefits.

- Reduced startup costs – no need for additional servers or licenses
- Supports RSG – RSG is often the only access method allowed by customers
- Reduced administration – Uses node access addresses and credentials provided by OSS-RC
- Easy extraction of data already collected by OSS-RC

(Ericsson G 2009)

5.2.3 ISP Tool Kit

ISP Tool Kit (ITK from now on) is a tool for monitoring and analyzing the performance of WCDMA networks. ITK is a very helpful tool for proactive maintenance of WCDMA nodes and should be used in synergy with NetSA HC. ITK provides the following features.

- Able to collect statistical, configuration and event data from the WCDMA RAN nodes
- Data stored in scalable database
- Highly configurable web interface with very powerful reporting mechanism
- Automated alerting capabilities, for sending alerts when configured conditions not met
- Automated report creation and mail out
- Low cost
- Based on freely available open source components: No license fees
- Able to run on low-spec hardware (even a desktop PC)
- Extremely flexible - Open development approach makes ITK completely customizable

(Ericsson G 2009)

5.3 Ericsson case study – Case 1

Ericsson started proactive support towards a customer with further reference of case 1 in March 2008. The objectives of this project were to improve customer network quality substantially and establish close working relationships with the customer in addition to creating new selling opportunities for Ericsson. The project started to show its value soon after it was started. The trend for support requests and emergencies went up in the beginning because the proactive onsite team discovered several problem possibilities, which were then logged as proactive CSRs or emergencies. After the beginning, the amount of emergencies and high or medium severity CSRs started vastly reducing.

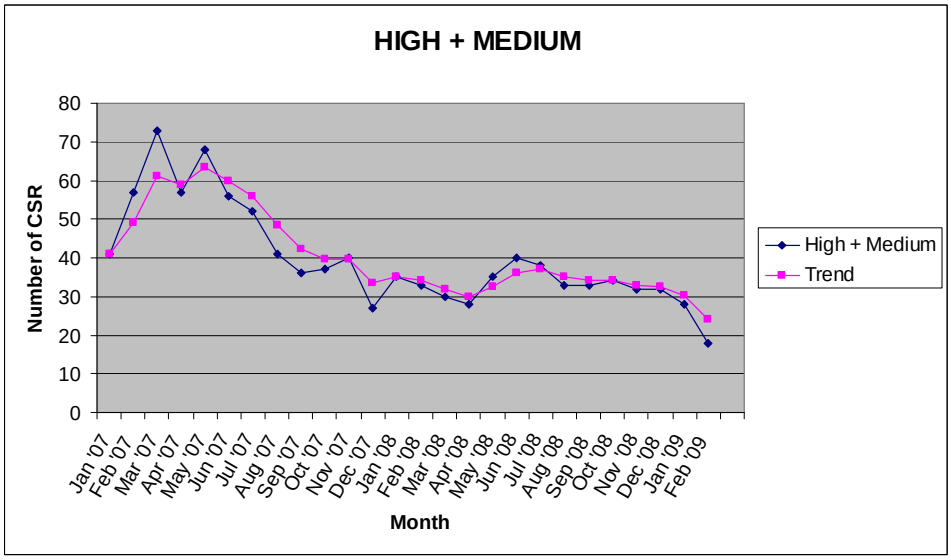

Figure 15 - CSR trend for case 1 customer with proactive CNS onsite team

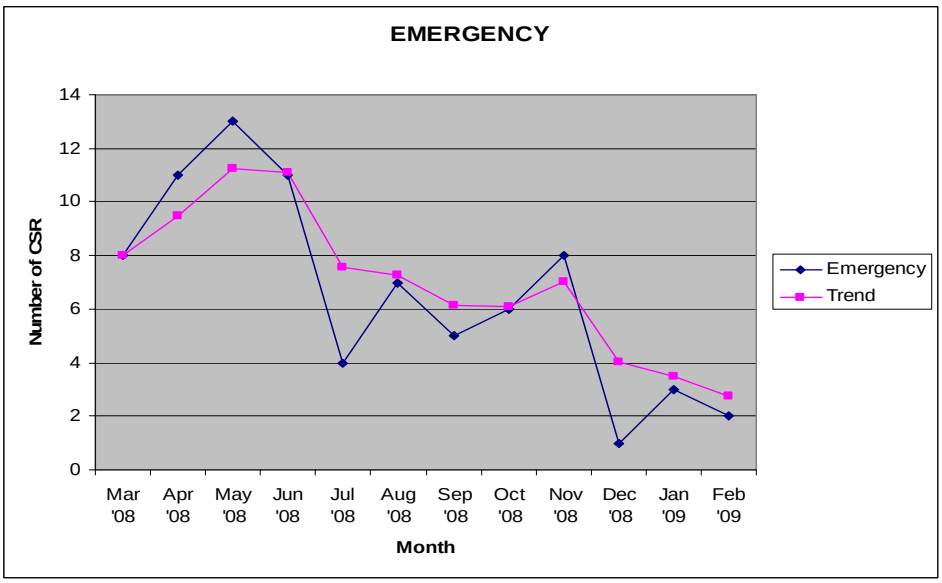

Figure 16 - Emergency trend for case 1 customer with proactive CNS onsite team

The figures above clearly show the value of proactive support from customer point of view. Reduced support requests and emergencies convert directly to monetary savings and reduced network downtime, which is of course also monetary saving indirectly. From Ericsson point of view, increased customer satisfaction leads to more close co-operation and even managed services deals. It was calculated that proactive maintenance reduced network emergencies worth over 1 M€ a year and disturbances worth 600 000€ a year. Also, the CNS onsite team for case 1 will most likely discover several issues, which can only be fixed or handled by product upgrades and purchases. These so called “leads” are valuable from business point of view,

since they often generate more sales and thus more income. This project has shown that a proactive CNS onsite team could bring leads worth up to 60 000€ a year.

Since the beginning of proactive support for case 1 customer, Ericsson engineers have been able to prevent and solve problems that could have escalated into much bigger malfunctions and more network downtime. As said in previous chapter, proactive health checks are being done regularly. Next are a few example cases which illustrate the effectiveness of proactive behavior.

In the first case, an engineer noticed while performing RBS software upgrade that it didn't install successfully. As a result of this, a proactive CSR was logged. The most common reason for failed upgrade attempts is that the node diskspace is low. Engineer checked the diskspace in current node and not surprisingly found out that it didn't have enough space to complete the upgrade. Normally this kind of behavior wouldn't be counted as proactive, but there is one major difference in the follow-up of this case when compared to traditional reactive support. In reactive support, case would have been closed here. But in this case, engineer realized that perhaps he should also check other RBS and RNC diskspaces at the customer. By doing this now, he would possibly prevent a number of failed upgrade attempts in the future and thus save a lot of time. This is what made the case proactive – thinking ahead.

In another case, a regular hardware check was executed for an RNC and an engineer noticed that an ATM interface card wasn't carrying any transport network traffic in site. Usually transport network hardware faults result in many nodes going "offline". This wasn't the case yet but it had to be handled quickly to prevent serious network downtime. Often card faults are solved by rebooting the malfunctioning equipment. Engineer decided to reboot the ATM interface card using MoShell. As a result of this action, card started to route traffic normally again and none of the other sites did get any downtime because of this fault. Without the proactive network support concept, the fault would have probably been noticed only after it would have escalated in to many nodes going down. Just by this one hardware health check customer managed to evade perhaps hours of network downtime.

In the last example case, an engineer noticed that OSS-RC fault manager had roughly about 4000 unacknowledged alarms for an RBS. The alarms consisted of low severity cases that are usually added to auto-acknowledge lists of the OSS. Having this many unacknowledged alarms may lead to performance problems of OSS-RC fault manager. The situation was addressed proactively - engineer didn't just ACK the alarms, he also made the necessary changes for OSS fault manager to prevent it from happening in the future.

The cases mentioned here are only a small portion of total proactive CSRs logged during the case, but still only these three cases have solved numerous possible issues in the future. Total number of proactive support requests during January was up to 30, and if all of them reduce network downtime by an estimate number of 0.25 hours, the total downtime reduced would be 7.5 hours which is a huge time when speaking about WCDMA networks. The monetary value of those hours is operator sensitive. The severities of the CSRs were also translated to customer severity scale, which shows them clearly the value of this service.

5.4 Ericsson case study – Case 2

Another case was carried out during a time period of 18 months with proactive OSS-RC support. The idea of this case was originally to illustrate the technical benefits of proactive services. The case was compared to another region without proactive support in order to show the differences. The regions are Y, with reactive support, and X, with proactive support. Both regions had one WCDMA OSS-RC and two GSM OSS-RCs during the measured time period. The results of this experiment were absolutely astonishing, proactive services really showed its value. In the following figures I will illustrate some CSR statistics from this case. The first figure shows both regions with reactive support in order to compare them in terms of CSR statistics.

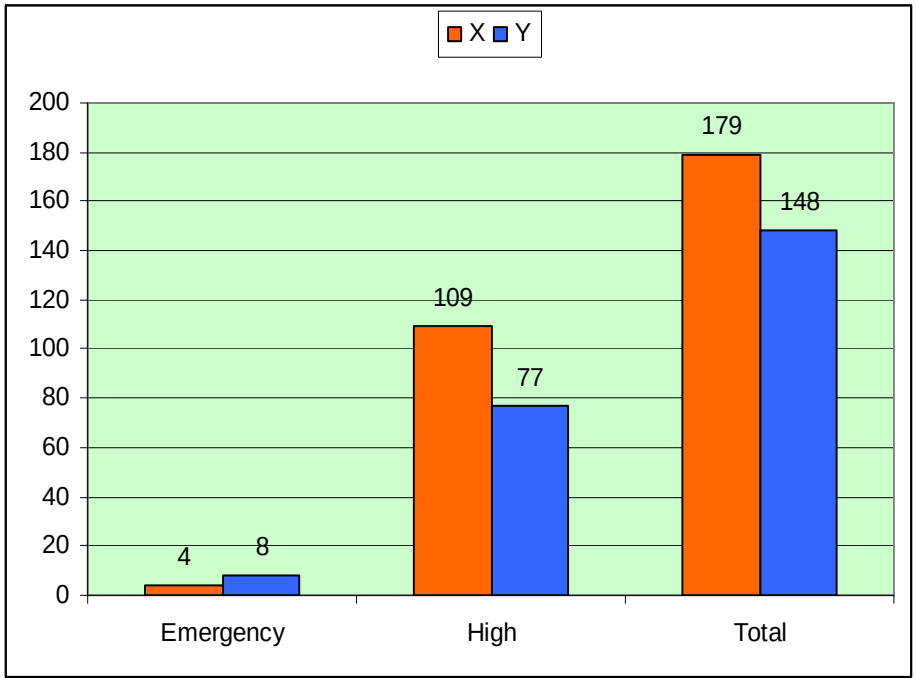

Figure 17 – Regions X and Y with traditional support

As the figure shows, region X has had more malfunctions than region Y with both on reactive support although the emergency statistics are other way around. This situation is ideal for

benchmarking after the proactive service was implemented for region X. The measuring period is long enough to produce reliable data on the impact of changing the way of working. These statistics have been gathered from a three month period during year 2007. In the next figure there are statistics from the same regions with the difference of region X having proactive support service working. The statistics selected for benchmarking are emergency CSRs, high severity CSRs and total CSRs.

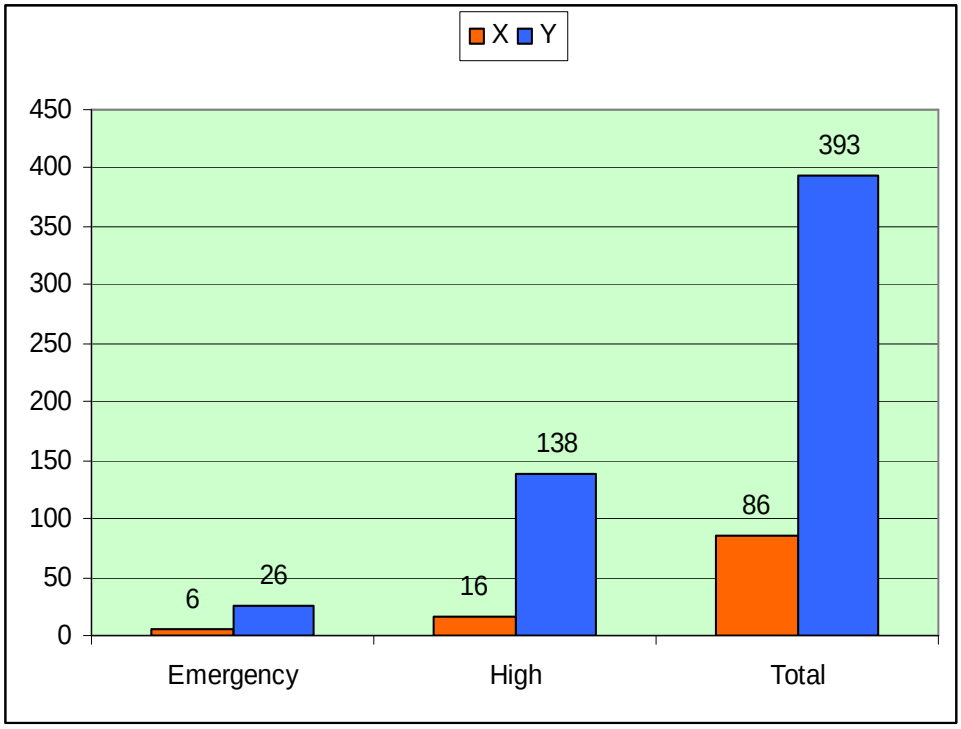

Figure 18 - Region X with proactive and region Y with traditional support

One can see the change of statistics just by glancing at this sheet. The region with proactive support has dropped the number of support requests substantially.

This project also produced add-on sales for Ericsson. A new OSS was sold to the region. Monitoring of the serviced network size was part of the proactive support delivery which enabled Ericsson to keep a close eye on the difference between the system's supported limit and the current network size. Combined with information on predicted network growth and time to order and install a new OSS it enabled Ericsson to recommend, sell and implement a new OSS before reaching the supported limit. Also an advanced software correction loading service was sold to all OSS-RCs in the region. Monetary value of these add-on sales is not provided, but one can expect that the sum is substantially bigger than the cost of maintaining proactive support services during the period. The following quote is from the end-customer of this service clearly quite satisfied of the results: "I recommend you ask Ericsson to provide you with the same service. It's basically a monthly benchmarking of how the system is performing and

what can be done to improve it, to prevent disasters, be ahead of the game, find out what the trend is, where you might need additional memory or processing power. For example it's nice to know something is being done effectively, and as the result we have less system errors."

By introducing these two real life cases of Ericsson, it has come quite clear that proactive support services stand very well against reactive way of working. I've collected data that's proven to be authentic and therefore it's possible to use this data for benchmarking these two ways of working in the following chapter of case study analysis.

5.5 Ericsson case study analysis

The two cases introduced in previous chapters have provided lots of valuable data to use for benchmarking. In this chapter the measurements are made between the two working ways calculated as benefits and drawbacks. We have learned that proactive support services for WCDMA RAN have produced significant reductions in numbers of customer support requests. Ericsson has been able to sell additional products recommended by the proactive support team on-site. Reactive support however is always necessary. The benefits and drawbacks listed here are from both provider and customer points of view.

5.5.1 Reactive way of working

Reactive way of working has always been the base model for customer support, and it will always maintain its position since there will always be unpredictable events to occur. Complex technical environments such as WCDMA RAN can never be totally controlled by doing proactive checking.

Benefits:

- Lower costs
- No unnecessary work
- Possibility for prioritizing issues
- Knowing what to look for
- The scope of service is clear for both customer and provider

Drawbacks:

- More issues to handle
- Can't prevent disastrous malfunctions

- Doesn't usually produce add-on sales
- Not so customer-focused
- Customer is less tied to provider -> easier to switch

The customer satisfaction related to traditional support is often nothing special, since it's something that customers expect. However, negative occurrences cause the satisfaction KPI to drop substantially, after which it's rather difficult to get it back up again. It doesn't offer the surprise of proactive service and can't produce equal satisfaction results with it just because it is expected.

5.5.2 Proactive way of working

Proactiveness has proved its usefulness in all the cases studied here. It has been said that it's the future of many companies. Proactive services shine in the quality of service perceived by the customer.

Benefits:

- Prevents malfunctions before they happen
- Reduces system network downtime
- Customer oriented -> customer feels that something is happening all the time
- Customer gets addicted to premium service -> possibility for better deals for Ericsson
- Significantly reduces the workload of reactive support with CSR reductions
- Produces valuable add-on sales
- Service provider gets more familiar with the network equipment handled
- Eliminates time wasted during emergencies through collected data
- Makes support work often more motivating -> better utilization of work force

Drawbacks:

- Produces unnecessary work if no malfunctions are present
- Can be quite costly
- Prioritizing is hard when you're not sure what to look for

The proactive service has been perceived as very efficient and necessary service by customers. Because it is still in the state of testing and it's not officially introduced in Ericsson service portfolio, there is no official customer satisfaction key performance index related to it. However, several customers that have heard about current cases have been contacting Ericsson and asking about implementation of proactive network support service. Because it hasn't

been produced as an official service yet, it is kind of hard to ask for payment of it although there are expenses related.

6 Future development

This section refers to an interview with an Ericsson service delivery manager, further referred to as Jeff Milton (name changed). The interview took place via email August 5th.

When asked about the future, Milton sees a great one for proactive services. He states that it is clearly a win-win proposition for both Ericsson and the customer. For customers it ensures good network availability as long as Ericsson recommendations are implemented. For Ericsson, problems can be identified and fixed before they have a possible service impact. And for both parties it encourages open communication and co-operation where Ericsson can become a partner and more consultative.

Possible integration of proactive support to traditional CSR handling at practice area customer support is also possible according to Milton. First it's compulsory to change the focus from number of CSRs as a key deliverable to node / network / other agreed performance metrics availability instead. If we want to integrate proactiveness, local support organizations and especially the customer network support teams should spend time with the customer. Tool usage and CSR related key performance indicators such as % assigned to 2nd line support should be taken looked at and adjusted according to what is offered and sold to the customer.

Proactive customer network support will most likely be added to the new customer support portfolio. The main proactive support options are currently being developed for top tier support services. When questioned about the promoting of these services Milton agrees that promotion of proactive support has not been adequate, but states that the new support portfolio will hugely improve this. Everyone in practice area customer support should put more effort in developing and delivering the supporting material and provide this help for Ericsson market units.

In conclusion, the management of Ericsson has now really noticed the value of proactiveness. Features around the concept are being developed all the time. It's not just about the product or the service, it's about the people. People need to be able to change their view on things in order to implement full proactive way of working.

7 General conclusions

Proactive support clearly stands in its advantage in comparison to traditional reactive services. Ericsson has been promoting proactiveness a lot lately and the results have already been excellent. The benchmarking results do not tell the whole truth about the monetary value differences because this kind of data is not available. However, proactiveness undoubtedly should be promoted more and more, since it makes an excellent complement to traditional support. From customer point of view it truly is a premium service – the results of downtime reduction have been astonishing. By offering this kind of service Ericsson is able to show the customers that they are important and that good customer service is Ericsson's main objective.

WRAN as an environment is difficult to handle and support requests are really common. Proactive services of Ericsson have been able to reduce the number of issues experienced by customers thus making it easier for them to operate their networks. The technology of WCDMA RAN is evolving all the time thanks to HSPA which is under development constantly. The new 4G techniques will make it even more difficult to handle the amount of CSRs in the future, so developing proactive services is definitely the way to go (which is proactiveness itself actually).

The research did meet all its set objectives. Proactiveness was viewed from theoretical point of view and WRAN was introduced in the technical framework. The add-on value of proactive support is undeniable just by glancing at the benefits in chapter 5.5.2. Proactive support services make both the customers and Ericsson's lives easier, and the sales department is happy for getting lots of valuable add-on sales through this way of working. Ericsson possesses the tools to make truly proactive service a reality. It's just the matter of using them.

Abbreviations

16QAM	16 Quadrature Amplitude Modulation
3GPP	3rd Generation Partnership Project
64QAM	64 Quadrature Amplitude Modulation
AAL2	ATM Adaptation Layer 2
ACK	Acknowledge
ADC	Automatic Data Collection
ARQ	Automatic Repeat reQuest
ATM	Asynchronous Transfer Mode
CDMA	Code Division Multiple Access
CN	Core Network
CPP	Connectivity Packet Platform
CSR	Customer Support Request
CNS	Customer Network Support
E-DCH	Enhanced Dedicated Channel
EGW	Ericsson GateWay
EUL	Enhanced Uplink
FDMA	Frequency Division Multiple Access
GSDC	Global Service Delivery Center
GSM	Global System for Mobile communications
HS-DSCH	High Speed Downlink Shared Channel
HSPA	High Speed Packet Access
HSDPA	High Speed Downlink Packet Access
Iu	3GPP specified interface between WRAN and CN
Iur	3GPP specified interface between RNCs
Iub	3GPP specified interface between RNC and RBS
Mu	External interfaces from WRAN to OSS-RC
NACK	Negative Acknowledge
O&M	Operations and Maintenance
OSS-RC	Operations Support System, Radio and Core
PSM	Preventive System Maintenance
QPSK	Quadrature Phase Shift Keying
RAB	Radio Access Bearer
RAN	Radio Access Network
RBS	Radio Base Station
RDT	Remote Data Transfer
RNC	Radio Network Controller
RSG	Remote Support Gateway
RXI	Access Network Aggregator
SN	Service Network
SSG	Secure Support Gateway
TDMA	Time Division Multiple Access
TTI	Transmission Time Interval
UE	User Equipment
WCDMA	Wideband Code Division Multiple Access
WRAN	WCDMA Radio Access Network

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Figures

Tables