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Master's Thesis

Improving Test Environment Service Operations - Case: Remote Research and Development Centre

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The aim of this master's thesis was to find best practises and frameworks to improve test environment organization's service operations. The main objectives were to develop new ways of working and build clear interfaces that would help the service operation for a test environment user organization located on a remote site.

The study was conducted using case study and action research methodologies. The background data was collected by interviewing personnel from the test environment user organization and the test environment service provider organization. The improvement plan was developed based on the interview data.

The study focused on improving the processes related to requesting changes to existing test environment equipment and networks and requestig support from test environment organization. In addition, the process of handling support requests was introduced. Also, this master's thesis gives recommedations how the service operations should be improved using centralized service desk and technical management functions. Finally, the competence profle of onsite personnel was constructed and introduced.

The requesting changes to existing test environment equipment and requesting support from test environment organization were implemented in the operations. The evaluation of the results of the implementations shows the study meets the objectives of this master's thesis. The new processes will establish clear interfaces between the test environment service provide and test environment user organization.

Keywords
Test Environment, Service Operation, Remote, Process improvement

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Abbreviations

BUGS   Business Unit Global Services

CCTA   Central Computer and Telecommunication Agency

CR   Change Request

CSI   Continual Service Improvement

HW   Hardware

IT   Information Technology

ITIL   Information Technology Infrastructure Library

ITTE   IT and Test Environments

LOM   Local Operations Manager

LST   Local Service Team

MGW   Media Gateway

MSC   Mobile Switching Centre

OPO   Operational Product Owner

PDU   Product Design Unit

PTE   Product Test Environment

R&D   Research and Development

RBS   Radio Base Station

RECA   Region Northern Europe and Central Asia

RNC   Radio Network Controller

RTT   Request Tracker Tool

SUT   System Under Test

SW   Software

TCM   Test Configuration Management

TE   Test Environment

1 Introduction

The purpose of Test Environment operations is to provide test environment services for the test environment users. It is co-operation with test environment service provider, test environment users, and other stakeholders. Test environment service provider's main objective is to meet the needs of the test environment users so they can perform their daily activities in the test environment. If the test environment service provider is not well organized, it will affect daily work of the test environment user.

The service delivery and operations will come more complicated when the test environment user and test equipment are located in different locations than the test environment service provider. This kind of arrangement forces the test environment service provider to change the current ways of working so that it is able to maintain the test equipment and provide service to the remote test environment user. The test environment service provider must identify the new needs and challenges so that it can react to these and maintain good test environment service delivery and user satisfaction.

This study focuses on improving the service operations of a test environment organization for a remote research and development organization that is located on a different site than the test environment service provider. The research contains two parts, the theory and the improvement project. First the theoretical part creates an overall understanding about the frameworks that can be used to establish the service operations to a remote user. Second the improvement project was developed through data gathered from interviews conducted with personnel of test environment user organization. Based on the collected data conclusions were drawn and suggestions developed regarding how the current service operations should be improved and two new improved processes were implemented to the test environment service.

1.1 Background

Ericsson Product Test Environment (PTE) Finland is part of IT and Test Environments (ITTE) Service Delivery Operations and its mission is to optimize and deliver IT and test environment services according to agreed quality and speed requirements at the lowest cost possible.

ITTE PTE Finland, later ITTE, is providing IT and Test Environment services for its test environment users and customers such as Ericsson Product Design Units (PDU), local sales and support organization Region Northern Europe and Central Asia (RECA) and Business Unit Global Services (BUGS) in Finland. ITTE has also global assignment to provide test environment services to test environment customers inside Ericsson globally. ITTE is located in Kirkkonummi where most of its test environment customers and test environment users are located. The test environment customers are group who buys test environment services from ITTE and test environment users are using test environment services daily basis.

In 2012, Ericsson established Research and Development (R&D) Centre to Oulu. The Oulu R&D Centre is focusing on future radio network development. Oulu R&D centre develops modern hardware (HW) and software (SW) for future wireless products. The research and development environment is different compared to other R&D activity done in Ericsson Finland. The R&D centre is doing close cooperation with local and global partners.

Before the Oulu R&D Centre was established, ITTE was delivering test environment services to its local users in Jorvas. ITTE also delivered test environment services for other test environment users globally, but in these cases the test equipment was located in Jorvas. Now the Oulu development site and test environment generates new requirements for delivering test environment services, as almost all test equipment is located in Oulu. Beginning of the improvement project ITTE didn't have any permanent work force in Oulu and it made the service delivery more problematic. The starting point situation is depicted in figure one.
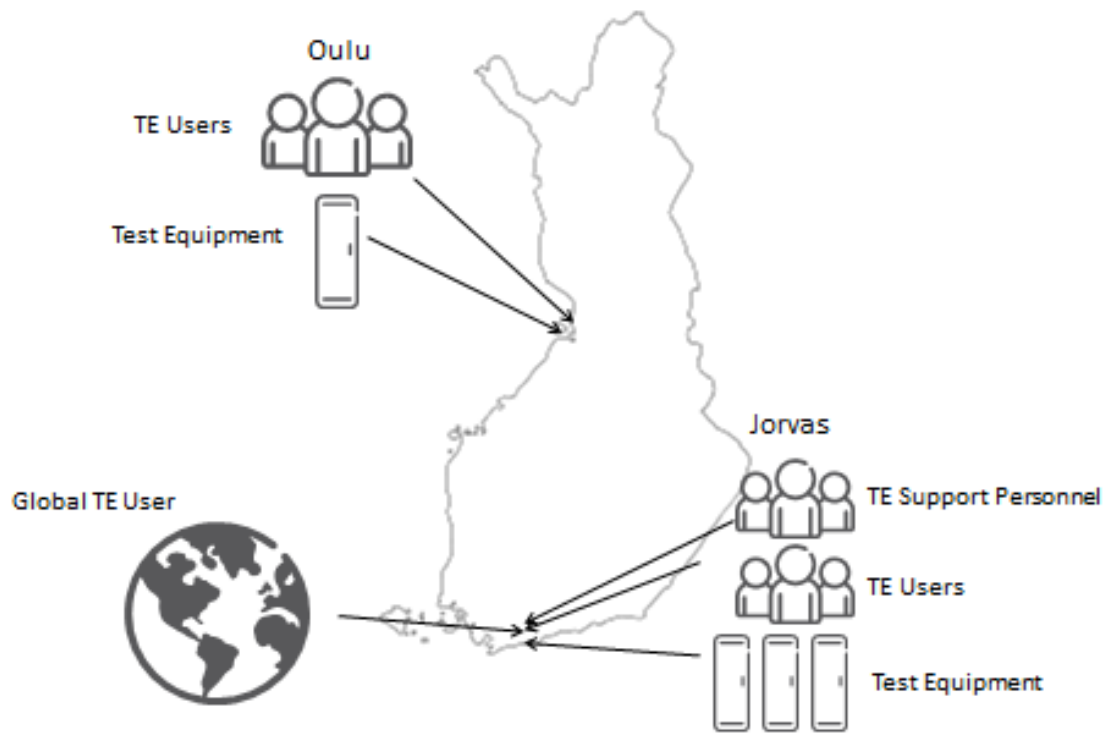
Figure 1. Test Environment Users and Equipment

1.2 Purpose

Purpose of this study was to investigate how centralized test environment operations could improve test environment service delivery for remote user.

From the company point of view, the centralized operations will make cost savings and it helps to deliver high quality services with low cost. As Bhatia points out (2013, 134) the centralized operations also eliminate redundancy through process and technology standardization and also centralized resources will generate cost savings when the resources are located in one location. When the non-core support functions are consolidated into centralized location, it enables efficient use of resources as the resources can be assigned from project to another if needed. The main purpose of centralized operations is to focus on user services and cost management.

1.3 Objectives

The overall goal of this study was to improve test environment service operations for test environment user that is located on a remote site. The objective can be divided to three parts. First part was focusing on making clear interfaces and processes between the test environment service provider and the remote user organization. The second part was focusing on improving satisfaction of the test environment user. The one of the reason for the improvement project was that one ITTE engineer was working in Oulu four days per week. This arrangement is not a cost efficient solution as the travelling and accommodations are expensive in the long run. Therefore, there was a need for local presence of test environment unit in Oulu. So, constructing a competence profile for a permanent ITTE employee was third objective of this study.

1.4 Research question and research scope

The purpose of this study was to explore improvements for test environment service operations inside a test environment organization. The research was conducted by using the action research and case study strategies. The research scope was limited to Oulu test environment deliveries and its test environment operations and maintenance activities.

The main research question of this study was:

How to improve test environment services and make remote support possible?

The main research question can be divided into four sub-questions:

1. How to improve user satisfaction of test environment user by developing new test environment processes to support remote test environment user from centralized location?
2. What kind of user interfaces there should be between test environment service provider and test environment user?
3. How to improve cost efficiency of the test environment operations?
4. What kind of competence profile local support person should have?

1.5   Motivation

In hardware and software development, testing is important phase before the product and software can be released to general availability. Without well functional test environment, the product and software cannot be tested efficiently and those cannot meet the quality expectations that users are expecting. Therefore, it is crucial to have clear interfaces and processes defined between test environment service provider and test environment user organization. The interfaces and processes will enable continuous cooperation between the organizations.

The author of this study is working as Local Operations Manager (LOM) in test environment organization. Due to LOM role, the author is responsible for securing user satisfaction and quality in all Information Technology (IT) and Test Environment (TE) deliveries for R&D center in Oulu. The Author is also the main interface for the test environment user organization. There was need for improvement project that improves current test environment operations and meets the test environment users' expectations.

1.6   Scope

The scope of this study was to improve test environment service operations. More specifically, process related to operations and maintenance activities of test environment setups used by product design unit. The operations and maintenance activities are adding new test tools and nodes or building testing infrastructure for testers needs, for example. Furthermore, troubleshooting of the test network and non System Under Test (SUT) related problems were also included to the scope of this study.

Usually, the test environments of mobile telecommunications are complex. The networks have several telecommunications nodes that are interconnected to each other. Often the nodes are vendor specific and it requires certain level of technical experience of that node to handle the operations and maintenance activities. Therefore, ITTE is only handling the systems that support the equipment under developing activities.

ITTE is responsible of changing broken hardware of supported equipment and changing the software level of the supported nodes. The software and hardware that ITTE is handling is usually in general availability state and it means that the SW and HW are available for all external customers, i.e. network operators. In this way, ITTE will have all needed information to handle the HW and SW and most of the developing bugs are corrected in general availability state.

Out of the scope are all processes and activities related to:

- Asset management
- Purchasing of test environment equipment
- Infrastructure management
- Installation of test equipment.
- Systems under test

The reason for above processes and activities are out scope is that they are not related to test environment operations and maintenance activities and author of this study is not involved on these processes and activities.

2 Test environment operations

Purpose of this improvement project is to improve the test environment operations of test environment organization. Therefore, it is important to understand the definitions of the test environment and data centre and how these terms are related to Ericsson test environments. In addition, the IT operations personnel and competence profile are introduced.

At the end of this chapter, Ericsson's IT and Test Environments are introduced in general level with high-level picture of test environment network. Finally, the test environment organization's current state of the test environment services is depicted.

2.1 Definition of test environment

A test environment is any development environment that is primarily used for incremental and iterative system testing. The test environment is for testing hardware or software design in an environment that simulates and protects the live or production network. In the test environment, it is possible to test hardware, software, or applications designed to run together before introducing them into customers. (Technet.microsoft.com, 2014; Opfro.org, 2014.)

2.2 Definition of data centre

The data centre is a facility used to house computer systems and telecommunication equipment. Usually, most critical IT operations equipment is placed to data centres and the data centres have high security level and the infrastructure is reliable to meet the needs of the IT organization. The data centre houses a network's most critical systems and are vital to the continuity of daily operations. (Palo Alto Networks, 2014.)

Almost all data centre designs are unique. Data centres can be divided to internal and external. Internal data centres are usually hosting many applications, but have few users. While external data centres are hosting few applications to many users. (Palo Alto Networks, 2014.)

2.3 IT operations personnel and competence

According to Contributor (2013) IT systems have become complex and business critical systems in many companies and this applies also to test environment setups. There are many similarities between IT operations personnel and test environment operations personnel. Contributor (2013) points out that IT operations personnel must nowadays maintain performance, uptime, and quality of the systems that it meet the needs of the business requirements. This kind demand is set to test environment operations personnel from the test environment user organization too. Without well functioning test environment infrastructure, the developers and testers can't perform their activities. Therefore, like the Contributor suggests (2013), the test environment operations personnel should use different best practises, such as IT Infrastructure Library (ITIL) and agile, in order to deliver valuable services to its test environment users.

Warren (2008, 20) points out that personnel working with data centres can be divided to two teams, implementation team and operations team. According to Warren (2008, 20) the implementation team consist of an implementation manager who will also act a project manager and general engineers who will handle the physical installations and cabling. Warren (2008, 20) depicts the operation team as team of specialist in areas such as server management, database management, storage and backup, networking, and system monitoring.

ITTE has implementation and operations teams in Finland. The implementation team is called Hardware (HW) Test Configuration Management team (TCM) and operations teams are Servers and Tools team and Local Service Team (LST). The teams handle test environment related tasks like described above.

Contributor (2013) emphasizes that beside of strong technical background IT operations personnel must also have business prioritization and know how to meet the customer expectations. This means that IT operations personnel should have skill to thinking outside of their expertise area so they effectively solve problems that occur in IT environments. Business prioritization and how meet the customer expectation are

important in small organization where IT personnel are responsible of multiple expertise areas.

IT operations personnel should pursue frequent and effective communications via different kind of communication channels. Communication comes important when giving status updates of on-going incident to a customer. Finally, IT Operations personnel should be flexible due to changing requirements from customer side. The ad hoc meetings and frequent communication start to be daily activities in today's IT operations. (Contributor, 2013)

2.4 Ericsson IT and test environments

The Ericsson IT and test environments are combination of server rooms and data centres. The IT and test environment equipment is located in a server or machine rooms on an office building or a data centre. All equipment that is used in Ericsson's data centres and machine rooms are telecommunication network elements and normal server hardware. ITTE personnel or external contractors are handling operations and maintenance activities of the equipment.

The IT and Test environment can be divided to two parts, IT and Test environment. The test environment part consists of telecommunication equipment such as Radio Network Controller (RNC), Mobile Switching Centre (MSC), Media Gateway (MGW), and Radio Base Stations (RBS). Also, the test environment has several servers that are used for test tools and services that are needed in testing. The test equipment is divided to two parts: system under test (SUT) and non-SUT. The SUT is equipment that is under development and PDU is doing testing with that system. The non-SUT equipment is needed to get the SUT equipment working as it works in telecommunication network. Usually, the test environment is located close to PDU and quite often in an office building.
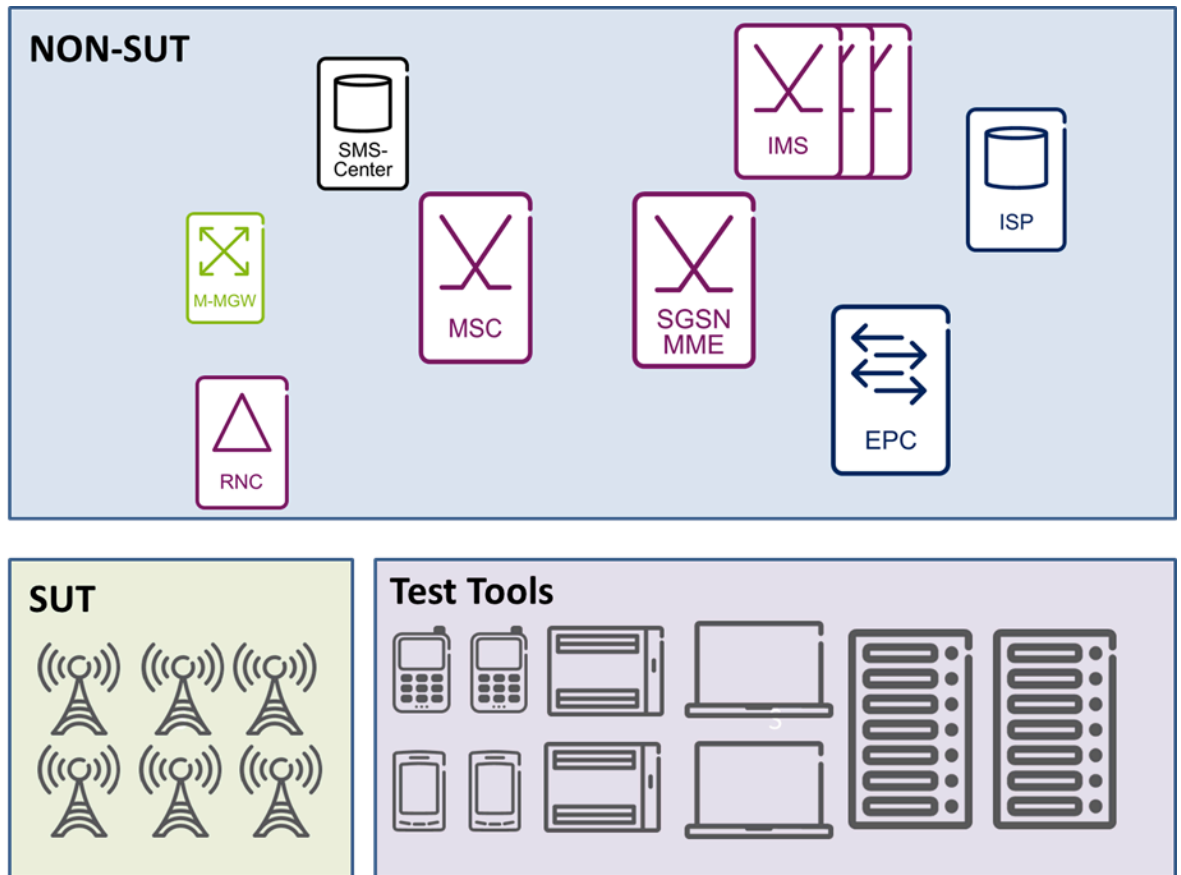
Figure 2. Logical Test Environment Network Picture

Figure two depicts a logical picture of test environment for radio base station testing. Non-SUT equipment and part of the test tools are managed by ITTE and the PDU is managing the SUT part of the test environment network. The SUT part consists of over hundred base stations that connected to test tools and non-SUT part of the environment. The test tools are mobile phones, servers, and mobile phone traffic generators. The test tools are generating traffic to the base stations so testers can test different kind of traffic loads and patterns to simulate real mobile network traffic to the base stations. Finally, the non-SUT part is needed to get base station working as in real mobile network.

The IT part consist of normal servers. The servers are used to host research and development applications and environments. These environments are used for continuous integration and building automation. Most of the IT equipment is located in IT hubs that are centralized data centres for research and development applications.

However, some PDU's have their own continuous integration and building automation environments in same place as PDU's test environment equipment are.

2.4.1 Current state of test environment services

Beginning of the 2012, Ericsson established a new R&D centre to Oulu with help of ITTE organization. The original plan was to keep all operations simple as possible and only mandatory test equipment would be installed to Oulu site and other test equipment would be used remotely from Jorvas site. However, after one year the current Oulu test environment and offices facilities were too small for current Oulu operations. Also the current test laboratories and server room were full and there were no room for new employees or test equipment. Therefore, investigations of moving to new premises started in Oulu on spring 2013.

During the spring 2013, the PDU organization in Oulu received new assignment from product management. This meant that PDU should start do system verification testing for the product that was developed in Oulu. The new assignment had impact to test environment services and due to new assignment the need for test environment services increased. ITTE did few changes to meet the needs of test environment user during spring and autumn 2013. Starting from spring 2013, one ITTE engineer started to work four times per week in Oulu. He was concentrating IT and TE related activities and also helped the PDU organization in development activities. Other change was that ITTE architect was released from administrative work of operations so he had more time to focus on planning and supporting the testers and developers. The author took the role as a main interface towards the test environment user and started to improve the operation and processes and also be the main interface for the PDU test operations related requests.

2.4.2 New test environment requests

The ITTE is providing different kind of test environment related services to its test environment users. The services are:

- Purchasing test environment related equipment

- Physical installation of the equipment and cabling it to existing test network
- Adding software and network configuration to a test equipment
- Integrating different test equipment to a test environment setup

Implementation work might take from few hours to six months depending size of a request. Normally, adding new test equipment or making a requested configuration takes one to two weeks. However, building a totally new test environment setup from scratch takes at least two months. In these bigger cases, purchasing and installation of the equipment takes approximately half of the time and configuration work takes the rest.

ITTE is also capable to provide test network planning related services. In these case ITTE designs the test network based on test environment user requirements. This kind of request is not so common. Usually, ITTE designs non-System Under Test (SUT), i.e. supporting network elements that are part of the test environment setups.

2.4.3 Test environment support request

ITTE is providing support for all test environment users who are using test equipment managed by ITTE. Usually, ITTE does not provide support to equipment that is not released for general availability. The equipment that is not in general availability is usually under development. The equipment might have software, hardware and features that are not tested and therefore ITTE can't support this kind of equipment. Product design units are responsible to resolve problems and incidents related to equipment that is not yet in general availability.

Normal support cases are fixing hardware related problems, i.e. changing faulty hardware board to new one in test equipment. ITTE engineers are also troubleshooting network or test environment equipment related support cases in daily basis.

2.4.4 Test environment services in Oulu

At the beginning of this improvement project, there was no support process or support requesting tools introduced. The testers and developers were requesting support by email directly from two ITTE engineers that they knew. Due to this, the two engineers were crowded of support requests. For example, one of the engineers got two to five support requests per day and sometimes he couldn't resolve the problems during the working day he received them. Furthermore, there were no clear processes for ordering new test environment setups or changes. The requests came by email from different people and without any prioritization or schedule. In other words, there was no control of the incoming requests and nobody could manage the requests.

This improvement project of test environment services started on December 2013. The project was focusing on test environment support requests and request of new test environment setups or changes to existing ones. The main user of the test environment services was a PDU located in Oulu.

3 Research methodology

This study was conducted using a case study and action research methodologies. The requirements management was covered by the practical interviews, interview data analysis, implementing improvements, and conclusions. Case study method was chosen as the primary research methodology and action research was the secondary research methodology.

3.1 Case study research

Case study was selected as primary research methodology for this study since its purpose is to use realistic data from real people on real organizations to make original contribution to knowledge. The case study also concentrate on special cases and often illustrates problems or best practices. According to Myers (2013, 76), the case study research should be related to a theoretical framework and the framework might be adjusted as the case study provides new viewpoints to used framework. Finally, Blaxter and Hughes et al (2001, 71) points out that the case study research is ideally for small-scale researcher since it focuses on one or two examples that case study investigates in-depth. The cases are usually related to researcher's field of work.

Advantages of the case study are that the cases are contemporary stories and are also useful to other organizations or companies that are facing similar problems. Another advantage is that case study research allows researcher to explore or test theories within real life situations. (Myers 2013, 82.)

The disadvantages of the case study research are that it can be difficult to focus on the most important issues. The context of the study can be large or small as research wants; a real danger is that an inexperienced researcher will think everything is relevant. Another disadvantage is that case study will take long time even for experienced researcher. Most time will go to empirical research and it takes long time to do the write-up. (Myers 2013, 83.)

3.2 Action research

According to Myers (2013 59), the purpose of action research is to improve practice and it aims to solve practical problems while expanding scientific knowledge. He also depicts the main idea is that action research uses scientific approach to study problems together people who experience them and it is a way of producing concrete and desired results for the people involved in the research project. During the action research process the researcher is concerned to create organizational change and simultaneously to study the process. According to Myers (2013,59), action research is excellent way to improve practical relevance of business research.
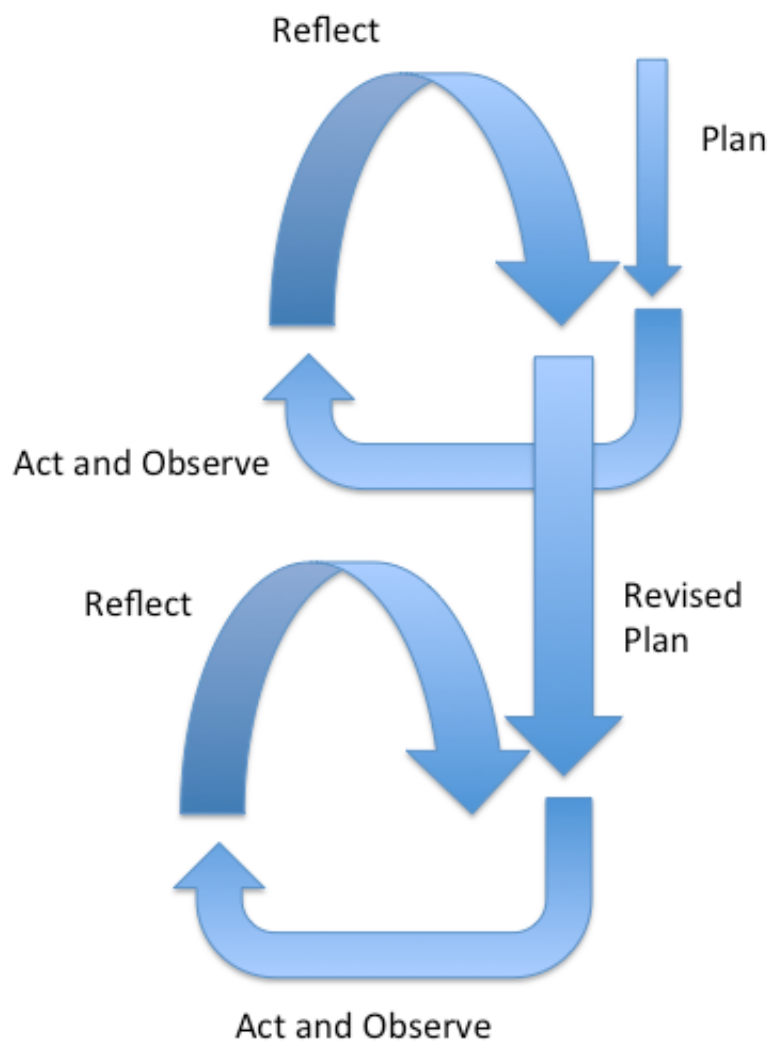
Figure 3. Action Research Cycle

Figure three indicates that action research is cyclical process going through repeated cycles. The process starts from identification of primary problems that is followed by planning the action steps that should be taken to tackle the problem. After the plan is ready, planned actions should be implemented and observed whether the actions achieved their intended efforts. At the end of the cycle, researcher should reflect what was learnt during the cycle. Learning from reflects phase might lead to new research cycle, especially if the outcome of the cycle was unsuccessful. (Myers 2013, 63)

The action research process on this study had only one cycle. The cycle started with identifying the improvement areas by interviewing people in Oulu. Based on interview data the action plan was done and it was implemented to improve the service operations for remote test environment user. The action plan achievements were collected with questionnaire and observing if the new improvement were taken in use. Finally, the author of this study reflected what was learnt during this action research cycle and gives suggestions how to continue after the study.

Myers (2013, 65) describes the main advantage of action research is that it helps to ensure that research is practically relevant. The action research aims to solve practical problems and involves working with people in business from start. Action research also can help to improve the impact and image of business research within the business community.

According to Myers (2013, 66) disadvantage of action research is that there is tendency for action researcher overstates the importance of the intervention in the organizations and the contribution to academic research. Action research is also risky as the real world project might delay. Months of delay in projects might the action research come unviable.

3.3   Data collection

It is important that distinction is made between primary and secondary sources of data sources in researches. Primary sources are those data which are unpublished and which the researcher has gathered directly from the people or organization. Primary data usu-

ally includes interviews, fieldwork, and unpublished documents such as minutes of meetings. Secondary data include previously published books, newspaper articles, and journal articles. (Myers 2013, 120.)

The primary data of this study is the data collected during the interviews. The secondary data is the published books and articles related to IT service management and what kind of competence needed to successfully handle IT service management tasks.

Myers (2013, 120-121) emphasizes that the primary data represent part of the added value that the researcher brings to the work. The reason is that the researcher gathers primary data and it is unique to researcher and research project. So the important point is that primary data add richness and creditability to qualitative documents.

3.4 Needs assessment

According to Donna Knapp (2010, 23) customer satisfaction survey gives good overview how current services are offered to a customer. However, throughout a needs assessment customers or users can give their expectations to the services that are being offered, or that should be offered.

Conducting a needs assessment has three techniques that can be used to gather user requirements. First one is direct interviewing customers or users. The interviewees should contain representatives from different level and functional areas. It is also good to have counter parts from your own organization. Second is documentation review and analysis. This technique is studying current processes, reports, policies and etc. Third technique is physical review. Physical review involves tours, demonstrations, and informal visits to the relevant areas. (Knapp 2010, 23)

The subject of this research is depended on test environment user expectations to received service from test environment unit. Therefore, interview was chosen as a data collection method. The interviewed people had different roles and they had own expectations of the services delivered from test environment organization. With interview

session the author of this study was able to gather data from them and have an inside look of the examined subject.

Myers (2013, 121) depicts three types of interviews:

1. Structured interviews
2. Semi-structured interviews
3. Unstructured interviews

The semi-structured interview was chosen as an interview method of this study. Author of this study prepared seven pre-formulated questions and sent them before hand to interviewees. Author was using semi-structured interview technique, so it gave possibility to ask new questions during the interviews, which might emerge during the interview sessions and Myers (2013, 122) points out that this kind of improvisation is encouraged in semi-structured interviews. However, all interview sessions were started with pre-defined questions as the semi-structured interviews are done so.

The interview sessions were focused on questions prepared before hand. However, there was improvisation during the interview sessions. Usually, it was interviewee adding important insight information about discussed topic, as it was arise during the interview. According to Myers (2013, 123) this kind activity is advantage of the semi-structured interviews.

3.5 Questionnaire

Questionnaire was used to gather feedback of the implemented improvements in this improvement project. According to Blaxter, Hughes and Tight (2001, 179), questionnaire is good for collecting feedback from those whose opinions and experiences the researcher is interested in. The questionnaire was conducted using Ericsson internal web poll application that enables to create questionnaires. Blaxter, Hughes and Tight (2001,179) points out that the web-based questionnaire has advantages and disadvantages. The web-based questionnaire won't take too much time, but the response rate and quality of the answer might be lower than the face-to-face interviews.

The questionnaire consisted of four open questions and one questions was for rating the implemented processes from one to five, where one is very poor, three is neutral, and five is very good. The all questions were related to how the improvements have affected service operations of the test environment organization to test environment user.

3.6 Translating user requirements

Knapp (2010,28) suggest that customer needs assessment data should be labelled to specific categories. She suggests five categories that are useful for categorizing the data:

- People
- Process
- Technology
- Information
- Awareness

People category is for improvement or needs related to personnel, their skills and local presence of the organization. The process category is for process related needs. According to Knapp (2010, 29), interviewer might find that service provider might have needed processes in place, but the user is not engaged in the process due to bad experience in past. All infrastructure and equipment related improvement or needs would go to technology category. Information category is for needs that are related to information of service provider that is available for the user. It might be related to infrastructure, processes, or service provider personnel. Finally, Knapp (2010, 28-29) points out that awareness could be used to reflect the gaps between communications and education programs used to manage customer expectations relative to IT services

The author collected lot of data after conducting the customer needs assessment. The data was translated into user requirements using categorizing recommended by Knapp. Knapp (2010, 29) points out that during the categorizing data trends or common needs will be apparent and as these needs emerge the interviewer will begin formulate recommendations. Knapp (2010, 29) also emphasizes that during the categorizing and

translating phases it crucial avoid making conclusive decisions until the analysis is completed.

Other factors that were considered during the interview analysis were opportunities, options, and priorities. Opportunities were areas where ITTE realizes significant improvements and benefits. Knapp (2010, 29) describes that opportunities may also focus on management practises, more efficient use of existing IT resources. According to Knapp (2010, 29), options answers to what kind of options there are available for the solutions. The options may be related technical, administrative, managerial, or a combination. Finally, Knapp (2010, 29) indicates that priorities will prioritize the recommendations or improvement areas. This will be done to identify the areas that have greater impact to customer satisfaction. The priority scheme was decided to be:

- Priority 1 – High Impact or major impact to ITTE performance
- Priority 2 – Medium Impact, positive impact to ITTE performance
- Priority 3 – Low impact, positive longer-term impact on ITTE performance

The interviews were analysed, categorized, prioritized as mentioned above and the improvement areas that ITTE should consecrate at the beginning of the improvement project are discussed in prioritized order on chapter 5.

4 IT service operations

The test environment services are similar to IT service operations. According to ICT Standard for Management (2012, 127) the main objective of service operation is to deliver services efficiently and without interruptions and the definition is suitable for test environment service operations. Therefore, the Service Operations lifecycle from IT Infrastructure Library (ITIL) was good starting point to improve test environment operations. The Service Operation lifecycle describes best practices for service desk functions, which gives a good framework to improve test environment support processes. Furthermore, the technical management function gives structure to handle test environment design and consultancy related requests.

4.1 Information technology infrastructure library

ITIL is set of best practises and it gives guidance for professional management of IT services. British Government's Central Computer and Telecommunication Agency (CCTA) developed the ITIL in 1980s with goals of developing a framework for efficient and financially responsible use of IT resources. (Knapp 2010, 9)

The ITIL 2011 was used in this study, as main framework. ITIL2011 consists of five lifecycle publications and each publication addresses capabilities having direct impact on a service provider's performance. The ITIL 2011 publications are:
- ITIL Service Strategy
- ITIL Service Design
- ITIL Service Operation
- ITIL Continual Service Improvement

Figure 4. ITIL Service Lifecycles (Itservicemanagement-itil.com, 2014)

The figure four depicts all service lifecycles and how they are related to each other. The core of ITIL is service strategy and it's objective is to decide on a strategy to serve customers. The service strategy processes determines which services the IT organization is to offer and what capabilities need to be developed. The service strategy gives input to service design which designs new IT services. Service design has also scope of changes and improvements of existing IT services. The new services are taken to use with service transition lifecycle. The main objective of service transition is to build and deploy IT services designed by service design. (Steinberg and Rudd et al. 2011, 7)

The service operation makes sure that IT services are delivered effectively and efficiently and therefore service operation is chosen as framework for test environment operations. Steinberg and Rudd et al (2011, 7) describes the main objective of service operation is to ensure that daily operations of the users are working without interruptions and that is also main objective of test environment operations.

The ITIL core is surrounded by continual service improvement (CSI) lifecycle. According to Steinberg and Rudd et al. (2011, 7), the CSI process aims to continually improve the effectiveness and efficiency of the IT process and services by data received from other lifecycles. They also describe that the CSI provides guidance in creating and

maintaining value for users through better design, introduction, and operation of services. Processes and functions of all lifecycles are depicted on figure five.

Service Strategy	Service Design	Service Transition	Service Operations	Continual Service Improvement
Demand m.	Service Calatologue m.	Knowledge m.	Incident m.	Service Measurement
Financial m.	Service Level m.	Change m.	Problem m.	Service Reporting
Strategy Generation	Capacity m.	Asset and Configuration m	Event m.	Sercvice Improvement
Service Portolio Management	Availability m.	Release and Deployement m	Request Fulfillment	
	Service Continuity m.	Transition Planning and Support	Access m.	
	Information Security m.		Operations m.	
	Supplier m.	Service Validation and Testing	Service Desk	
		Evaluation	Applicationm	
			Technical m.	
			IT Operations	

Figure 5. ITIL Processes. (Reddy, 2014)

4.2 ITIL service operations

The ITIL service operation lifecycle was the starting point of improving the test environment operation. The test environment operation includes several test environment services that are delivered to test environment user in a common environment. According to Steinberg and Rudd et al. (2011,7), the ITIL service operation describes best practices for managing services in supported environment and therefore it is useful framework to improve test environment operation. Finally, Steinberg and Rudd et al (2011, 7) emphasises that the service operation gives guidance on achieving effectiveness and efficiency in the delivery and support of service to ensure value for the customer, user and the service provider; and that was the main purposes of this study.

One of the reasons for choosing ITIL service operation for main framework of this study was that it provides guidance on how to maintain stability in operations. Steinberg and Rudd et all (2011,7) depicts that ITIL operation has also detailed process guidelines, methods and tools that are suitable for test environment service operations.

They also point out that ITIL service operation helps IT responsible personnel make better decisions.

The ITIL service operation consists of several processes and functions. Only the following functions were used in this study:

- Service Desk Function
- Technical Management Function

The main objectives of this study was to build clear interfaces between test environment user and test environment service provider and improve service delivery and support processes. ITIL service operation service desk and technical management functions are good frameworks for improving the interfaces and service delivery. Furthermore, the incident management process was used to improve support-handling process in test environment operation.

4.2.1 Service desk

Steinberg and Rudd et al. (2011,156) depicts the service desk as single point of contact for users when there is a service interruption, for service request or a change to existing service. There was also a need for this kind of setup in test environment organization. The ITTE should have one interface from where the test environment user could contact and ask service related to test environment. Furthermore, communication of the test environment and the coordination of the test environment support teams and processes should be coordinated from one location as the Steinberg and Rudd et al. recommends.

The ITTE should follow the service desk function described by Steinberg and Rudd et al. (2011, 157) and have number of dedicated people handling different kind of service requests such as incidents and change requests that requested via web based tool, telephone or email. Finally, ITTE could improve the test environment user satisfaction with good working service desk as Steinberg and Rudd et al. (2011, 158) points out that good service desk can often compensate for deficiencies elsewhere in the organization.

The service desk function is suitable for test environment support handling as Steinberg and Rudd et al. (2011, 158) depicts the main objectives of service desk being a single point of contact between IT services and users and also restore normal-state of service operation with incident and event management processes as quickly as possible. The above statement was already partly used in test environment services. However, the interfaces and processes were not clear between the test environment user and service provider before the improvement project started. Therefore, the ITIL service desk function was one of the main frameworks to improve interfaces and processes.

The test environment user organization is located different location that the test environment service provider. Therefore, the location and structure of the service desk was one of the development areas on this study. ITIL service desk function depicts three different options how located and structure the service desk. Steinberg and Rudd et al. (2011, 158) defines the first priority of service desk to meet the business needs even it would lead to use combination of the three depicted service desk simultaneously.

Steinberg and Rudd et al. (2011, 158) introduces three service desks and two special solutions. The service desks are a local service desk, a centralized service desk, and s virtual service desk. The specialized solutions to handle service desk functions are follow the sun and specialised service desk groups. This research focuses on centralized service desk function so local service desk and centralized service desk function are introduced more detailed to get understanding the difference of those functions.

Local service desk, see figure six, is co-located near to the user organizations it serves. The main advantages of the local service desks are easier communication between the service user and service desk and it also gives clearly visible presence of service provider towards service user. Disadvantage of local help desk is inefficient use of resources and expensiveness to have a service desk on every site. (Steinberg and Rudd et al. 2011, 158)
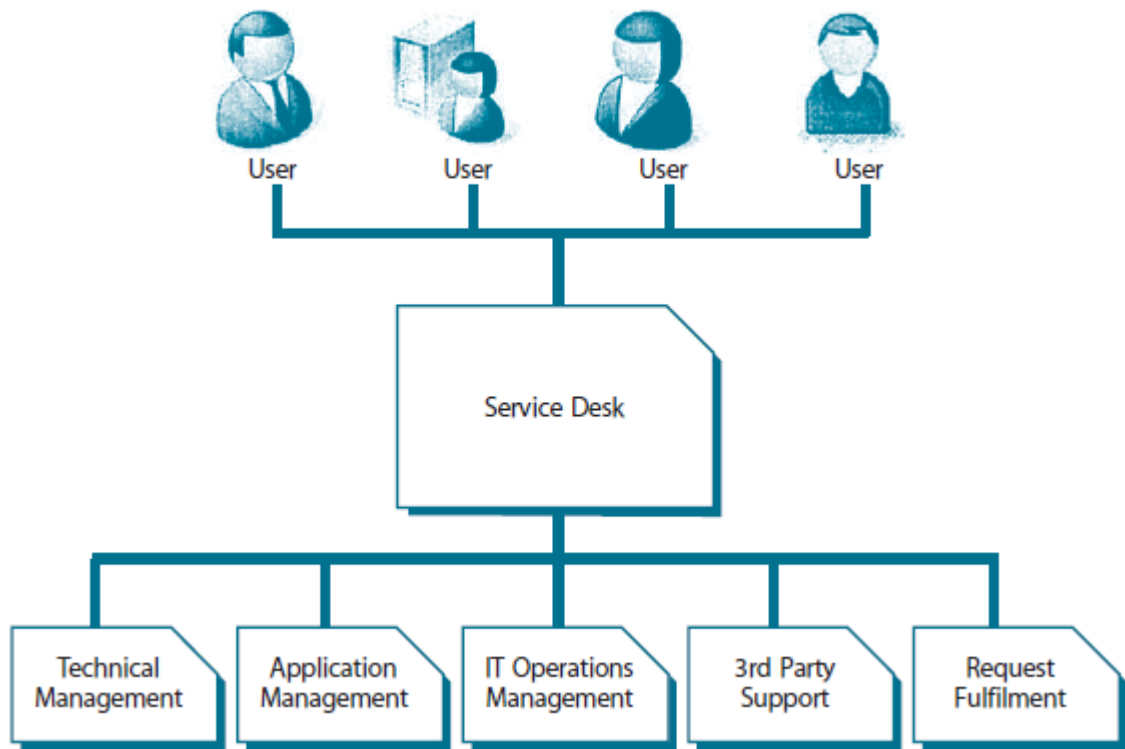
Figure 6. Local Service Desk (Steinberg and Rudd et al. 2011, 159)

Centralized service desk, figure seven, was one of the main frameworks used in this improvement project since the purpose of this improvement project was to move the service operation to one location. Steinberg and Rudd et al. (2011, 158) emphasize that the centralized service desk can be more efficient and cost-effective solution than local service desk. As identified in this improvement project, there is still be necessary to maintain some form of local presence to handle physical support requirements, but as Steinberg and Rudd et al. (2011, 158) suggest such staff can be controlled and deployed from the central location.
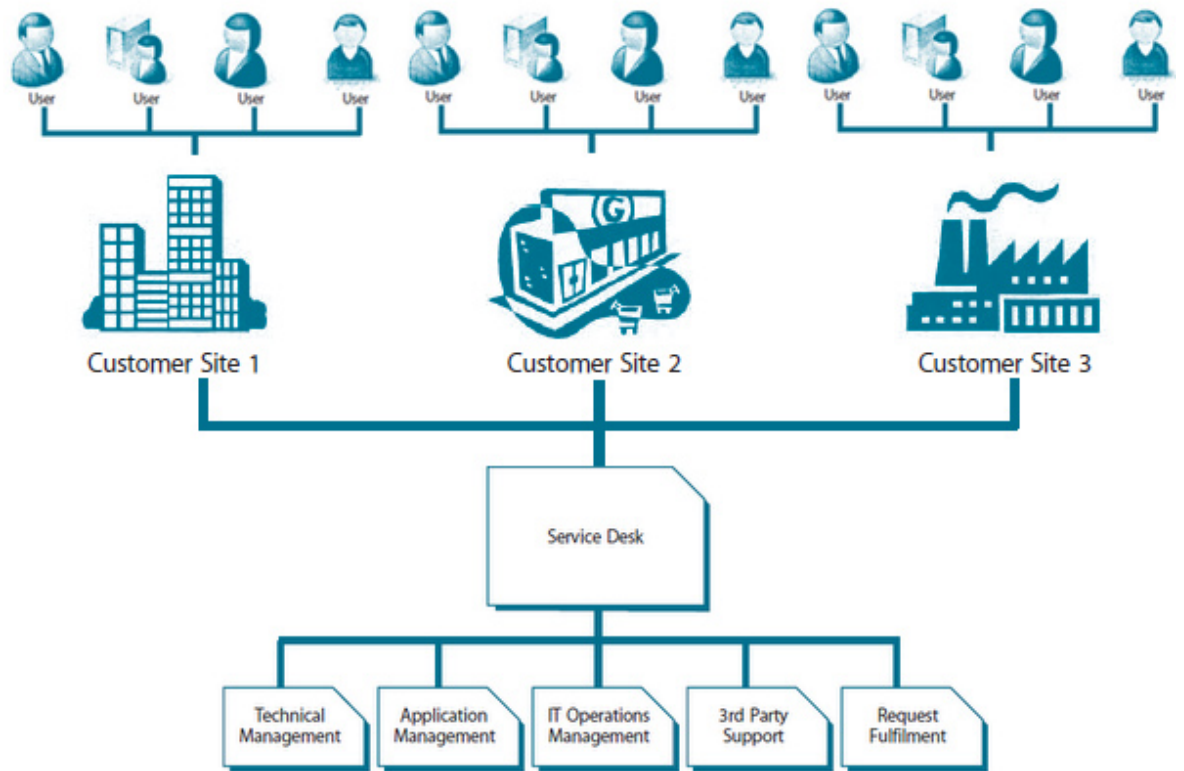
Figure 7. Centralized Service Desk (Steinberg and Rudd et al. 2011, 159)

The centralized service desk is close to the setup that the test environment organization had at the beginning of the improvement project. The centralized service desk provides frameworks for handling the incoming service requests from remote location and gives recommendation how to have local presence on the remote site. Overall, the centralized service desk is efficient and cost-effective solution and that was one of the research scopes of this study.

4.2.2 Technical management

Test environment operation purpose is to support test environment user with their daily activities. There is also need for new test environment services and improving already established test environment services to meet the need of the user organization. The ITIL technical management function was also a good framework to improve the test environment operation as test environment operation has similarities to technical management. Steinberg and Rudd et al. (2011,170) depicts the technical management

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as group, department or teams that provide technical expertise and overall management of the IT services and infrastructure and also has important role in the designing, testing, release and improvement of IT services.

The test environment organization must have technical knowledge and expertise to manage the existing test environment infrastructure. With help of technical management function ITTE could improve the operation related to the infrastructure. Steinberg and Rudd et al. (2011, 170) points out that one of the role of technical management function is to ensure that the organization has the required knowledge required to design, test, manage, and improve IT services. This kind of role comes useful when test environment users needs new test environment services to theirs existing test environment infrastructure and ITTE must do the test environment infrastructure design.

One of the research questions was to build competence profile of the local personnel on remote site and service operation's technical management is suitable for that purpose. Technical management second role is to provide resources to support the services provided by test environment organization. According to Steinberg and Rudd et al. (2011, 170) technical management ensures that resources doing IT service work are effectively trained and deployed to design, build, transition, operate, ad improve the technology required to support and deliver IT services. Furthermore, the technical management should identify the needed skills and consider is that skill needed in-house or should external contractor hired got those tasks.

Steinberg and Rudd et al. (2011,171) describes the third role of technical management to balance the skill level, utilization, and cost of these resources. The third role is very suitable when the IT service department has central pool of resources and technical management is controlling these resources by ensuring they are well used and minimizing the need of hire external contractor. Depicted setup is well suited for test environment organization delivering the services from centralized location. The test environment organization has a central pool of resources in Jorvas and the external contractor will be used for test equipment installations done in Oulu. The technical management

will control the need of external contractor by controlling what kind tasks the external contractor will do.

5   Defining and analysing user requirements

This chapter describes the needs assessment that was conducted to gather test environment users expectations. The needs assessment results was translated to user requirements and categorized and finally, the opportunities of the test environment operations improvement are introduced.

5.1   Needs assessment

The background data of this study was gathered via needs assessment. The needs assessment was conducted in Oulu at the beginning of the year 2014. The used techniques of needs assessment were semi-structured interviews and visiting the Ericsson Oulu Research Centre simultaneously. The interviews were lasting between 10 minutes and 35 minutes and informants interviewed were Oulu Research and Development site manager, partner manager, test managers, verification engineers, and test environment engineer. The total number of interviews held was nine. The interviews consisted of five questions (attachment 1.). All interviews were tape recorded for after interview analysis and the interviews were transcribed after all interviews were conducted. Finally, the transcribed interviews were labelled using categories introduced on chapter 3.6 and relevant information was extracted, compiled, and summarized in an interview report. As the interviews were conducted in Oulu, it was good opportunity to make observations of on-going activities in there.

Two of the interview questions were related to cooperation and hinderers of the cooperation's between ITTE and Product Design Unit (PDU) in Oulu. In addition, the author asked how the support of the test environment services has been working when ITTE people have been onsite and offsite. Final question was related ITTE resource competence profile if ITTE could raise the headcount on Oulu site.

The interview data was summarized to interview report and the main points of the interview were collected to a PowerPoint presentation. The PowerPoint presentation was presented to Head of ITTE Finland and as a result of the presentation, it was decided

that ITTE personnel who are working closely with Oulu should be also interviewed as ITTE personnel might have a different point of view to the questions.

An ITTE Engineer and ITTE Architect were identified to good candidates for interviews. Both of them have been working with the Oulu test environment from the beginning and they have good knowledge how the Oulu test environment operations has been worked earlier. Author interviewed the ITTE persons in Jorvas few weeks after the Oulu interviews were finished. The ITTE personnel interviews consisted only three questions. The questions are introduced in attachment 7.

Overall, all interviews went well and lot of background material was collected during the interviews. The interviews are analysed and translated to user requirements on next chapters.

5.2   People category

Two subjects were labelled to people categories that were asked or raised up during the interview session. First one was presence of ITTE in Oulu and second one was the competence profile that ITTE resource should have if resources are hired to Oulu.

The local presence of ITTE was mentioned on all interview sessions. All PDU informants thought that due to lack of ITTE resources in Oulu site, ITTE couldn't handle its responsibilities on satisfied level on Oulu site. The informants also felt that communication between ITTE and PDU and receiving support to on-going incidents was not working properly due to lack of onsite resources. It was also raised up that PDU personnel must do IT and test environment related tasks and that hinders the testing and developing that they should primarily do. According to informants, the local presence of ITTE personnel would make the daily operations easier in Oulu.

Interview question related to ITTE resource competence profile was asked from both PDU and ITTE interviewees. Both parties gave similar characters in few competence areas when they answered to the question. However, the role of the resource in Oulu

was different from PDU and ITTE point of view. The interview answers related to competence profile is introduced more detailed level on below.

PDU interviewees' opinions for technical competence profile was that the resource should have a good knowledge of Internet Protocol and network equipment like network routers and switches. According to interviewees, the resource should also have basic knowledge of Linux, Windows, and virtualized servers and know how to troubleshoot problem related to servers. Furthermore, the resource should have experience on setting up test position and test tools that are used on testing in Oulu. The test tools usually are mobile phones, traffic generators and network emulators. Finally, recommended soft skills that resource should have was service mindedness, proactive, and doer.

According to ITTE interviewees, the resource should act as remote hands for ITTE personnel who are working in Jorvas. This means that the resource should know how to do Ethernet and fibre optic cabling between test environment network elements. He or she should know how to fix hardware related problem on servers, telecommunications nodes, and test equipment. Basic understanding of IP technology, virtualization, and Linux and Windows servers are preferred. It would be benefit, if the resource has earlier experience of test tools and analysers that are used in Radio Base Station (RBS) testing.

5.3   Processes category

There was only one question that was labelled to processes and the questions was "How the test environment support has been working when ITTE personnel has been a) onsite and b) remote". During the interviews, the informants gave their opinion of the current support process.

All PDU personnel though that support has worked well when the ITTE personnel has been onsite and quite well when there has no been ITTE personnel on site in Oulu. Also the lack of support process and tools was one of the hinderers for receiving

support from ITTE. Finally, the unclear support contacts also make raising the support request difficult.

5.4 Awareness category

Awareness of what customer and service provider are doing is important for both sides. Two of the interview questions were related to cooperation and challenges between the PDU and ITTE. The overall impression was that cooperation is working well between the units and there are no big challenges that prevent the tasks between these two organizations. However, two matters that were raised on the interviews are depicted below.

The division of work between ITTE and PDU in Oulu is not clear according to PDU and ITTE informants. The main problem is that the development work is done with several external partners in Oulu. The partners are using the Ericsson test equipment for developing work and part of the partner developers is located in Ericsson premises, but they also have developing work done in partner premises. This setup makes the test environment support complicated, as there is no clear decision how the partner support should be handled. The PDU thinks the partner support belongs to ITTE and vice-versa. Another problem related to partner support, but also to other support and test environment delivery is unclear interfaces and key project members of different projects.

Few interviewees from PDU thought that ITTE should take more proactive role on test environment services and advertise its knowledge on this area. ITTE has several year of experience on test environment design in telecommunications area so they could give consultancy to PDU. ITTE should be active player when PDU is planning to add new test environment setup and give its recommendation how to build the test setups. In most cases, PDU personnel don't have enough knowledge of setting up a test environments setups and therefore they will need support from ITTE.

5.5   Opportunities for improvements

This subchapter introduces the opportunities for improvements from requirements that were identified from interview data. Also an options how to improve the requirements are introduced and finally the requirements are prioritized according to scheme that was introduced on chapter 3.6.

As introduced on earlier, there were several areas that have opportunities for improvements and most of them have several options how those can be improved. However, it is almost impossible to improve all areas at the same time so the improvement areas must be prioritized. The improvement areas are depicted more thoroughly below starting from priority one improvements. Every improvement is explained what kind of impact it has to ITTE performance from author's point of view. The opportunities for improvements are shown in table 1 and introduced below.

	People	Process	Awareness
Priority 1 – High Impact	Lack of onsite support	Missing support processes	
Priority 2 – Medium Impact			Proactive ITTE Services
Priority 3 – Low Impact			Division of the Work

Table 1. Opportunities for Improvement

The missing support process have high impact to on-going ITTE operations in Oulu. Introducing support process will have positive impact to ITTE performance and simultaneously it will clarify the interfaces, as it was one of hinderers. The support process has several options available. The options used here are technical and administrative and both contain a solution to this improvement. The support process improvement is high priority improvement that is implemented as soon as the process is defined.

Lack of local ITTE presence in Oulu has also high impact to ITTE performance. Having resources would improve the ITTE operations in Oulu significantly. This improvement was most important from PDU point of view as they see lacking of ITTE onsite personnel is hindering their own activities. This improvement will be implemented also in high priority. The role of the ITTE local personnel would be handling

the physical support request and he or she would be controlled from Jorvas. The setup would be very similar than ITIL centralized service desk function suggests. However, the process of increasing headcount is very time consuming and there is no guarantee that ITTE will get a permission to increase the headcount. Therefore, this improvement comes after the support process improvement.

Final improvement area is to improve the proactive ITTE services. As mentioned in interview analysis chapter the ITTE has good knowledge of setting up the test environment setups and there is a need for this kind of service in Oulu. This improvement has medium impact to ITTE performance and has two options that contain solution for this. The options are technical and managerial and this can be improved using technical management framework.

One of the needs raised during the interview session was to clarify division of work and roles. This will be left out from these improvement areas. The division of work would have long-term impact to ITTE performance. Reason why the division of the work will out is that the partner support will need decision from higher organizational level. The roles will be clarified in support process and local presence improvement areas.

6 Improving service operations

Introducing new or improving existing processes and services have always impact to current ways of working and therefore the improvement project should be considered as a change project. Changing old habits is always difficult and without preparation there is big possibility that the change project fails due to change resistance. This chapter depicts how the change should be managed and how the test environment service operations of ITTE were improved based on improvement areas identified in the chapter five. The improvement areas are incident handling process, change request process, centralized ITTE function, and local presence of ITTE in Oulu. At the end of this chapter, the results of improvement areas are analysed.

6.1 Managing change

Improvement projects are change projects and discomfort is usually associated with the change. This is true when the change is big and will affect the ways of working or processes. The major changes will need the support from top management throughout the organization otherwise the change might fail. The change project will usually introduce new responsibilities and also employees and employer need to learn new skills and adopt new behaviour. This will take time for people to accept these new roles and responsibilities. The change project must help people to learn these new skills and behaviour with proper training and information. (Knapp 2010, 133-134)

Donna Knapp (2014, 134) points out that every change project has change resistance even the change is needed and usually, the change resistance is related to second-hand information that may - or may not - be accurate. The change project can reduce the change resistance with proper communication plan and providing accurate information about the project to people under change. The communication plan is introduced on chapter 6.1.2.

Knapp (2010, 134) emphasises that people cannot be forced to change nor can people change instantly over night. The change will take time and effort and it is important to

follow up the change after the change is implemented otherwise people will go back to old ways of working and behaviour.

According to Donna Knapp (2010, 135) a successful change program should have following key components:

- Change preparation
    - o Step 1: Identify and empower change agents
    - o Step 2: Create a communication plan
- Education and Training
    - o Step 3: Create an education and training plan

These components were used in this improvement project to make the change possible.

6.1.1 Identify and empower change agents

Change agents play important role in on-going changes. According to Donna Knapp (2010,141), change agents help people to move towards the change via demonstrating willingness embrace to the new processes. As on this improvement project, the change agents are usually subject matter experts of using the support tools and they also were first trained to new processes and procedures. The change agents were also encouraged to give and collect feedback of the new processes.

At the beginning of the change project three possible change agents were identified, two in Jorvas and one in Oulu. The Jorvas change agent nominated to be change agents because they have been earlier contacts for support and change requests Therefore, they were asked to help the test environment users to create support and change requests. The Oulu change agent was not officially nominated, but he had also critical role in this project, as he had earlier experience on the RTT and also been the contact person for test environment requests in Oulu.

6.1.2 Create communication plan

Donna Knapp (2013,138) emphasises that without proper communication plan the change effort is useless. Poor or inadequate communication is common reason that changes fail so it is important to send and receive timely and appropriate communication about the progress of change project. The communication should be continuous, consistent and aimed at keep the focus on the change goal. Donna Knapp also (2010, 138) suggests that communication plan should continuously communicate following:

- Why the new or improved process is needed
- The goal and objective of the new process
- The progress and plans to relative to process design and implementation activities

Communication of the change started after the interviews were held. The first information session was kept to persons who participated to interviews and during the information session the new processes were introduced. The communication continued with info session to all personnel located in Oulu at end of February. Main agenda of this info session was the new processes, main reasons for the change project and how the change project will continue after the info session. In addition, the info session material was also sent to all Oulu personnel via email. After the all personnel info session, the trainings of the new tools and processes were started.

The communication of the change project started too late. The communication plan was prepared at half point of the project and therefore, the benefit of the plan was smaller than it would prepared at the beginning of the project. The detailed communication plan is attached as attachment (attachment 2) in this research.

6.1.3 Education and training

Education and training are important factors when planning to introduce or change a process. Education and training are forms of study and learning but they serve different purposes. Education means acquiring general knowledge and developing capabilities. In the other words, education means learning to know. Education is very im-

portant for managers, supervisors and individual who are serving as change agents. While training is practical education and it means building skills and competencies that people need to perform a given role within a process. (Knapp 2010, 140-141)

As the improvement project introduced new processes and tools for requesting services from ITTE, there were training sessions for the Oulu personnel. First training session (attachment 5.) was for project managers and the training contained knowledge how request new test environment setup or change to existing setup and how to raise a support request with Request Tracker Tool (RTT), the tool is introduced more thoroughly on chapter 6.2.2. Second training (attachment 6.) was for all Oulu employees and the purpose of this training was to give knowledge how to raise a support request with the RTT. The latter training was split to two sessions due to winter vacation period in Oulu and most of the Oulu personnel were on vacation during the first session.

6.2   Introducing new processes

One of the objectives of this study was to build clear interfaces between the test environment and the user organizations. The change request and requesting support processes will make the interfaces as single point of contact for changes to existing test environment setups and requesting support to on-going incidents from test environment organization.

During the analysis of improvement opportunities, the priority number one improvement was identified to be the missing processes for requesting new test environment setups or changes to test environment setups and requesting support for on-going incidents. Two processes were introduced to improve these areas. Change Request (CR) process was introduced for requesting new test environment setups or change to existing setups and Requesting Support process for requesting support for on-going test environment incidents.

Even there are same tools used in CR and requesting support processes, the processes are not related to each other. Both are individual processes and used for different purposes. The differences of the processes are depicted table 2.

Change Request	Requesting Support
Ordering a new TE setup	Requesting support to ongoing incident
Ordering changes to existing TE setups	

Table 2. Differences of processes

6.2.1 Change request

The change request (CR) process was introduced for requesting new test environment setups or changes to existing setups. The purpose of this process is to get transparency of the test environment request coming from the user. Advantages of CR process are that all changes of test environment will be documented and stored for later use. Furthermore, the CR process will improve communication between the test environment user and ITTE. With help of this process it will be easier for ITTE to prioritize and schedule incoming request from user. The CR process is based on similar process used in other Ericsson test environment sites, but it is modified to meet the needs of test environment user in Oulu.

The size of test environment request varies from big to small. Building or implementing the big request to test environment might take several months, but adding small request might just take few man-hours. Therefore, two CR process was introduced to test environment user. The processes are normal CR and minor CR. Just having only one process would make requesting small changes complex and time consuming.

The minor CR is intended to small test environment changes and small change means that implementing the change to existing test environment setup will take approximately 24 man-hours or less. Examples of minor CRs are:

- Upgrading SW of non-SUT node
- Adding new test tool to existing test setup

Test environment user can request minor CR with RTT. The RTT request should contain descriptive description what kind of action should be performed. ITTE will review the request after the minor CR is requested through RTT. If the request contains all needed information, ITTE will implement the change to test environment setup through ITTE work backlog.

The normal CR is for other test environment change requests that don't meet the minor CR requirements. The normal CR is requested by filling a CR template. A project manager or test environment responsible person of that test environment setup, which the change affects, should fill the CR template. Examples of normal CRs are:

- Need of new test environment setups
- Adding a new node to existing test environment setup
- Adding new features to existing test environment setup

When the template is ready, it should be sent to ITTE person who is responsible of that test environment user. First, ITTE will keep internal preview meeting about the change request and after the internal meeting ITTE will invite the requestor for CR review meeting where the CR will either approved or not approved. Approved CRs will be prioritized and scheduled during the review meeting. After the review meeting ITTE will add the CR to the ITTE work backlog.

The normal CR and minor CR can be requested only by project manager or test environment responsible of that test environment setup. The project manager can nominate one person to make the CRs, but the project manager must have awareness of all changes related to his or hers test environment setup that are requested from ITTE.

6.2.2 Requesting support

The support request process was introduced to test environment users for requesting support from ITTE to on-going test environment incidents. The purpose of this process is providing single interface for all test environment support requests. With this process ITTE can give support faster to on-going test environment related incidents. This process will also tackle earlier problem where the support requests came to few

engineers by email. Furthermore, ITTE can identify recurring incidents and provide fix to that or training if user causes the incident.

Test environment users can request support to on-going incidents with Request Tracker Tool (RTT). It is globally used inside Ericsson's ITTE units for handling test environment support requests. Therefore, it was natural choice for handling test environment support request from Oulu. It is also beneficial that ITTE personnel have already experience on using the RTT. Even the same tool is used for raising CRs and requesting support, the processes are not related to each other.

The RTT is web-based tool and it is accessible from corporate network and Internet. The tool is quite simple to use and it has predefined mandatory fields that requestor must fill before he or she can create the request. The mandatory field of the RTT are:

- Priority: Low, Medium, High, and Top
- Subject: Requestor should start the subject with "Oulu:" and add descriptive subject
- Requested Due Date: The date when the request should be resolved at the latest.
- Request Type: Support HW or Support SW
- Equipment or Solution Type: Requestor should choose the applicable equipment that the ticket concerns from the drop-down list.
- Description: Requestor should write description of the on-going incident and give details what the requestor was doing when the incident occurred.

After the requestor has created the support request, ITTE engineer will take the ticket and starts the troubleshooting. If the ticket doesn't have enough information, ITTE engineer will contact the requestor and asks more information. When the incident resolution is found and recovery action are done, ITTE engineer will contact support requestor and verifies that incident is solved. After the verification the ticket can be closed. The support handling process is depicted in more details on chapter 6.4 and attachment 3.

6.2.3 Task force

At the beginning of this project, there were only two engineers supporting the Oulu test environment operations. Obviously, this was not enough and there was need to increase the number of persons who would support the activities in Oulu. The solution was to establish task force team for all Oulu test environment operations. The task force team was located in Jorvas, but also few of the team members visited Oulu site few times during the improvement project.

The purpose of this team was to handle all incoming support requests and change request coming Oulu test environment users. The task force ensured that all requests were handled fastest as possible and in proper manner. The team consisted of three ITTE engineers and one ITTE architect. All team members have been working more or less with Oulu test environment activities before and the test environment setups were familiar to them. All of them have been visiting Oulu site during the year 2013.

The task force team was the first ones to take the support handling and change request processes into use. This way ITTE could ensure that the processes were implemented successfully and people would follow those processes. Finally, with smaller team the processes were easier to test and implement.

As the main purpose of the task force team was to answer to urgent request and answer to the need of the test environment user. However, it is not reasonable to keep the task force active long time, because then the fire fighting comes a normal state in the operations. Therefore, it was recommended that task force team would ensure smooth transfer of Oulu test environment activities to local service teams after the new processes are implemented and the Oulu operations were in steady state.

6.3 Centralized ITTE function

The purpose of the centralized ITTE function is to be a single point of contact for test environment users when there is a need for change or support in test environment service. The centralized ITTE function provides a point of communication to the test

environment users and a point of coordination for ITTE local service teams and processes.

It was recommend that ITTE should centralize all test environment activities in Finland that are possible into Jorvas. Of course, there will be need for resources onsite, but these resources should be controlled from Jorvas. The benefits for centralizing is reduced operating costs as ITTE will have centralized pool of resources in one place and there is no need to have similar pool of resources on other sites. Simultaneously, resourcing different projects and support cases will come easier as ITTE resource managers can transfer resources from different projects to another. Finally, ITTE in Jorvas will have broader group supporting the Oulu operations, as now it has been just one task force team. Logical picture of centralized ITTE function is depicted on figure eight.
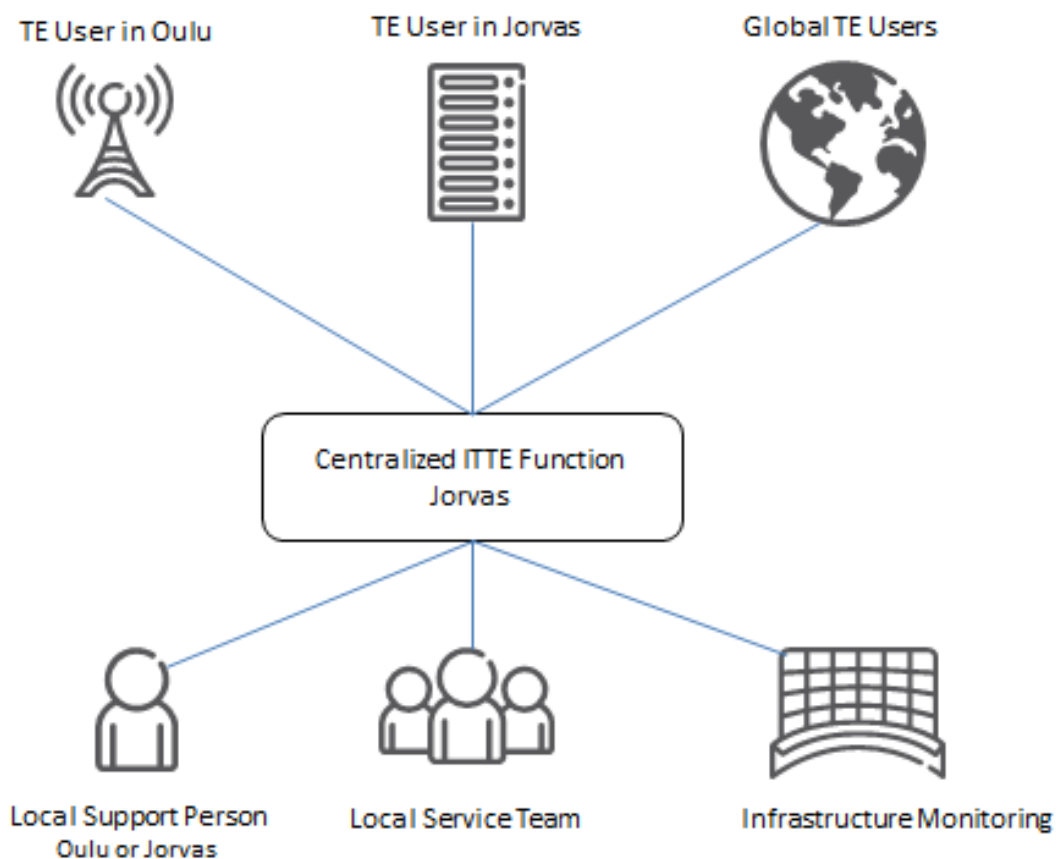
Figure 8. Logical Picture of Centralized ITTE Function

The centralized ITTE function should consist of one Local Service Team (LST) that supports and builds test environment setups. Even the LST would be centralized the naming will stay as Local Service Team as it is standard name for the support teams inside regional Ericsson Test Environment. The team would be able to handle almost all requests coming from the test environment users. The LST should have two team leaders, Operational Products Owners (OPO), who would be responsible that all user requests are fulfilled. If local service team will need physical interaction with equipment located in remote site, the OPO could use ITTE local support person to make that request. The local service team would handle support request and change request at the same time and the resource inside the team should be assigned to monitor the incoming support request from RTT.

The centralized ITTE function should also monitor test environment infrastructure centrally. All equipment that are critical for delivering test environment services should be monitored with monitoring application from Jorvas. The monitoring application should trigger a service request if the state of the infrastructure equipment changes. The local service team should take the service request in handling and investigate why the state of infrastructure equipment was changed. If the reason was fault or incident, then local service team should fix that. Otherwise, the monitoring application rules should be adjusted so that it doesn't raise service requests of that kind of state change anymore.

6.4   Support handling

One of the critical test environment processes is support handling or incident handling. Purpose of support handling process is to restore the normal state as quickly as possible and minimize the impact to the testing done by PDU. The support handling process of ITTE is introduced next.

ITTE support handling process is based on ITIL Incident handling process. The process depicts what kind of activities the ITTE support personnel must do to resolve support request successfully. The process diagram is depicted on attachment 3 and it is also explained below.

The support handling process starts with taking the RTT ticket in handling. Sometimes test environment user thinks that some change requests are incidents. However, the incidents are when there is a service interruption in already delivered test equipment or test setup, but change request is when the user needs new features or configuration to new or already delivered test equipment or test setups. Therefore, the support engineer needs to check is the ticket a support request or a change request, i.e. is there an incident on-going or is the user requesting something new. If the ticket is a support request, ITTE engineer will continue following the process description. Otherwise, the ITTE engineer should inform the Local Operations Manager (LOM) that there is a new CR requested and then the request goes to CR process.

The resolving of the support request starts with initial diagnosis of the on-going incident. ITTE engineer must decide based on initial diagnosis is there need for escalation. The escalation could be related that the ITTE engineer doesn't have competence to resolve the incident or there is need of prioritization of the on-going requests. If the escalation is needed, the ITTE engineer will assign the ticket to LOM who will continue working with that ticket. The LOM will either find needed person to solve the incident or negotiates with test environment user the prioritization of on-going test environment requests. If there is no need for escalation the ITTE engineer will continue following process description.

Next step is to investigate and diagnose the reasons for on-going incident. This step starts the loop of the process. If the ITTE engineer can identify the resolution for the incident, he or she should immediately resolve the on-going incident and recover the normal state as soon as possible. Otherwise, the process goes back to escalation phase and start the process again from that step, i.e. ITTE engineer needs to decide again is there need for escalation and either escalate or continue troubleshooting.

The final phase of support handling process is to update RTT ticket with description of the resolution that solved the on-going incident and inform the user that the inci-

dent has been fixed. The process ends when ITTE support engineer closes the RTT ticket.

6.5 Technical management

ITTE technical management is a group that consists of technical expertise and overall management of the test environment services. It also provides technical skills and resources needed to support change or support requests that local service team is handling. The ITTE technical management will have an important role in designing of the test environments requested by test environment user.

ITTE technical management would have two roles as ITIL recommends. Technical management would provide technical knowledge and expertise related to managing the test environment infrastructure and it provides resources to support the test environment operations. Managing the test environment infrastructure is same as ensuring that ITTE has knowledge required to design, test, manage, and improve test environment services. Technical management should also ensure that ITTE resources are effectively trained and developed to support and operate the test environment services. Moreover, the technical management in Finland would be the main contact towards Ericsson's global technical management.

The ITTE technical management would consist of line managers, ITTE architect, network specialist, and local operation managers. ITTE architect and network specialist would ensure that test environment infrastructure and test environment setups are planned, implemented, and maintained to meet the needs of test environment users and ensure that planned solution are long-term solutions and aligned with the Ericsson's global test environment regulations. ITTE line managers and LOMs should identify the needed skills and consider is that skill needed in ITTE or should ITTE ask other instance to handle that skill. The possible instances are other ITTE sites inside Ericsson or external contractor.

The group which ensures that test environment infrastructure and test environment setups meets the future needs of the test environment user will have close cooperation

with test managers and designers of test environment user organization. With this co-operation ITTE can identify the future needs and proactively make needed changes to existing test environment infrastructure or setups. The Local Operation Manager (LOM) acts as a facilitator between the ITTE and PDU organizations so the cooperation would be possible. It is also recommend to have quarterly long-term planning meetings with the PDU organization. During these meeting PDU organization can introduce their coming needs and ITTE could plan their activities accordingly.

ITTE Line mangers and LOM should identify the resource and skills needs based on input data coming from PDU organization in long-term design meetings. Line Managers and LOM should make decision if the skill or resource is one-time need or does ITTE need this kind skill or resource in long-term. One time need should be getting from external contractor or utilizing other Ericsson ITTE sites. If the need is seen as long-term, the resource or skills should be handled inside ITTE Finland.

6.6 Onsite personnel competence

This study will give recommendations that what kind of competence profile the ITTE local support person should have in a remote site. The recommended competence profile is based on material gathered from the publication, interview data, and need ITTE had during this study.

During the Oulu and Jorvas interviews it turned out that both sides have different expectations for the ITTE resources in Oulu. Test environment user organization would liked to have the decisions related to test environments made in Oulu. On the other hand, the ITTE is planning to centralize all test environment activities to Jorvas and just one or two local support personnel would be on remote sites. Due to promoting the centralized ITTE functions, the competence profile will be based on more ITTE needs. The resource will act as remote hands for ITTE engineers in Jorvas and also he or she will perform basic maintenance activities for the test environment equipment. Later, the resource will have wider role operating Oulu test environment equipment as he or she will have more experience on working the equipment and can work individually with the test equipment.

The competence profile was build based on the requirements that Oulu and Jorvas interviewees have pointed out during the interviews, but the emphasis is on ITTE needs. Furthermore, the ITTE resource will be based on implementation team that is depicted on chapter 2.2. The description of the competence profile will start describing the technical skills that the resource must have and what technical skills are preferred. Finally, the preferred soft skills of the resource are described.

The onsite resource must have earlier experience on hands on work with servers and equipment that is under test so he or she will have understanding what kind of activities are allowed in this kind of environment. Most of the equipment that the resource will work with is server or telecommunication equipment that is used on testing purposes. Earlier experience on these will make the orientation phase much shorter and he or she can start doing the work individually earlier.

Ethernet and fiber optic cables and cabling work should be familiar from earlier work experience. The onsite resource will make almost all test environment related cabling after he or she starts the work. Therefore, it is important that he or she would have earlier experience on cabling work.

It would be also benefit if the onsite resource would have earlier work experience on Radio Base Station testing and equipment related to that, i.e. signalling generators, oscilloscopes, and traffic generators for example. At the moment, ITTE personnel haven't any knowledge of test environment tools and test environment users have managed these tools so far.

The soft skills of the onsite personnel are equally important to technical competence areas. On this case, the soft skills are highlighted, as the resource will present whole ITTE organization on the remote site. Next the preferred soft skills of ITTE resource on remote site are described.

The onsite person should be service minded, as he or she will interact directly with the test environment users onsite daily basis. In addition, the resource is controlled from Jorvas and there might be cases when Jorvas coordinators are not always aware all needed work in Oulu so the person should be proactive and do ITTE related work when there is need for that. It would be beneficial if the person would have doer attitude and experience on working in multicultural environment.

6.7   Feedback

Two improvements were taken to use during this study. The improvements were change request and requesting support processes. The feedback of these improvements was collected using questionnaire and it was sent to nine people who have been working with these processes. The questionnaire (attachment 4) was sent to participants two weeks after the process training sessions and they had two weeks time to answer the questionnaire.

Six out of nine were answering to the questionnaire. That can be considered as minimum amount of answers to get overall picture if the processes were successfully implemented and what kind of improvements there still are.

The opinions of RTT and CR processes were varying. Half of the participants kept the RTT process good and second half thought the RTT is not very useful to request support from ITTE. Almost all participants thought that Change Request process is good but still it could be improved with collaboration of test environment user organization. Finally, one key message was that there is need for face-to-face collaboration to improve the processes and get them to work better.

All participants thought that these processes have helped the test environment user organization to receive better service from ITTE. However, common opinion was that these processes won't replace the need of local presence of ITTE in the remote site and these processes can't reduce the face-to-face collaboration between the organizations. Furthermore, there was still improvement needs for prioritization of the tasks

and need for collaboration with test environment organization and user organization's project stakeholders.

The participants thought that RTT and CR template are easy to use. Few participants suggested that CR template could be more simplified, because it is quite complex at the moment. The participants also graded the processes from one (1) to five (5). Five was that the processes are very good and one was that processes very poor. Average of the answers was 3.8, minimum given number was 3 and maximum number given was 5. Rating is depicted in figure 9.
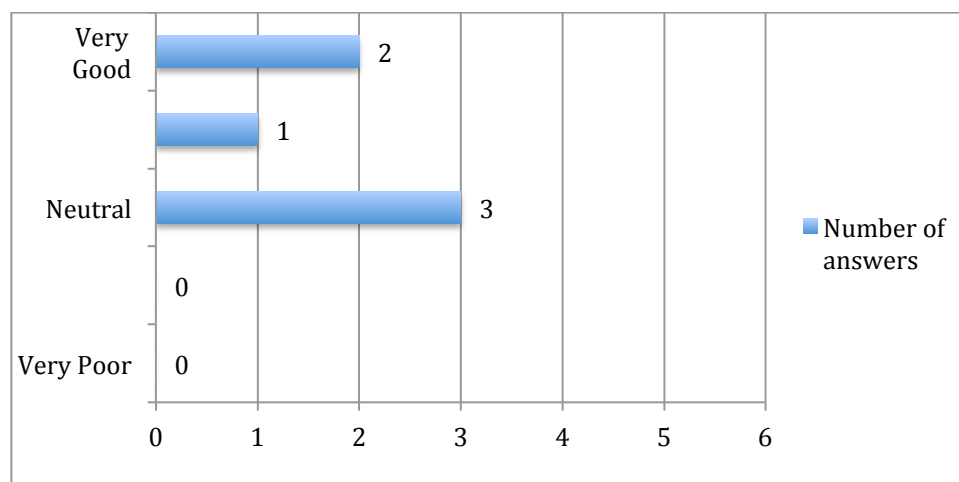
Figure 9. Rating of Processes

Other feedback was related to need of local presence of ITTE personnel in the remote site and how the processes should be improved so that the task lists and risk management have transparency between the test environment and user organization. Also need for partner support and how to handle confidential test environment request so that the needed data is also available for partners too.

Based on the questionnaire answers the results of the improvements were on-track. The overall impression of the RTT process was successful and the CR process was considered as semi-working process. The questionnaire gave improvement ideas how to start improve the CR process so that will meet the needs of the user organization. The overall conclusion of this improvement project is on next chapter.

7 Conclusions

This improvement project has been conducted in order to improve the test environment service operations to a remote test environment user organization. The remote location of the test environment user created a need to improve the existing service operations processes and ways working of test environment service provider. The ITIL Service Operation provided a framework that was used to improve current service operation of the test environment service provider and the conclusions of the improvement project are introduced next.

7.1 Conclusions of the improvement project

The new processes and tools were introduced to test environment user during this improvement project. The results of implementing these processes and tools were looking promising and it was decided to continue the improvements after this improvement project was over. At the beginning of the improvement project there were no clear interfaces between the test environment user and test environment service provider and with the new processes ITTE was able to build the interfaces. However, all test environment users are not using the requesting support process and ITTE engineers are still receiving support requests by mail and mobile phone.

The improvement project started at the same time as the test environment user was moving to new premises in Oulu. The moving preparations were affecting the improvement project, as the test environment user organization seemed to be more focused on moving activities than paying attention to the improvement project. Furthermore, ITTE personnel did not pushed the test environment user to use the new processes enough and allowed them to use the old ways of working.

The improvement project also suggested improvements that ITTE should do to manage its test environment service operation better. The Centralized ITTE function will introduce single points of interface for all test environment request and makes the resource handling more efficient. These activities will also generate cost savings, as there is no need to build competence pools on every ITTE sites in Finland. Technical man-

agement will help ITTE to design and implement the new test environment requests and also it makes sure that ITTE test environment infrastructure will meet the users needs. Technical management will help ITTE to foresee what kind of resources and skills it will need in future and what kind of tasks ITTE can transfer to external contractor or to another ITTE site inside Ericsson. The Centralized ITTE function and technical management were not implemented during this improvement project.

The improvement project also built competence profile for ITTE resource that was need for Oulu test environment site. The competence profile was based on the need that Oulu site had during this improvement project. The recruitment permission was not received for Ericsson personnel but for external contractor. An agreement with external contractor was not yet signed when this improvement project ended.

7.2   Suggestions for future improvement

The findings and implemented improvements done during this project created a baseline for future improvements. The improvement project went the improvement cycle through only once so there are a need for implement the reflections collected from the first cycle. In addition, the centralized ITTE function and on-site personnel competence were only suggestions on this study so those need to be tested in operating environment to get the results of the improvement suggestions.

Furthermore, some test environment processes were left out of scope due to author was not part of those processes. Of these topics purchasing test equipment and asset management leave room for separate research to allow exploring deeper the scope of this study. The improvement of asset management and purchasing process will have affect the user satisfaction as the test equipment availability could be improved by improving of the processes.

Finally, this study was limited to one test environment user organization located in Oulu due to author is responsible of the test environment operations. Further studies could be carried out all test environment users that ITTE Finland has. This way ITTE

Finland could standardize the test environment operations in Finland and improve the test environment service delivery to its test environment users and customers.

7.3 Personal learning experience

The process of writing this study has been interesting. As responsible of test environment operations of remote test environment user, I felt it was my obligation to improve the service operation and use the master's thesis as an opportunity to make proper research project. Finally, I felt the improving of the IT service operations interesting area and I saw here an opportunity to grow professionally.

Conducting the research work and implementing the results in the operations felt rewarding as I then could see the results of actual work that I have done. The master's thesis has taught me lot of making research in a business environment and how to implement new processes into operations. Furthermore, I learned how to make a change in a company and evaluating the outcome when the change was done.

My opinion is that the overall project went well and the learning outcome for me was huge. As the results of this master's thesis were implemented into the operations and for me it is an achievement that I can be proud of.

References

Bhatia, A. 2012. Value creation. Dallas, TX: Brown Books Pub. Group.

Blaxter, L., Hughes, C. and Tight, M. 2001. How to research. Buckingham: Open University Press.

Contributor, G. 2013. IT operations is king: How to find the best people. [online] Available at: http://www.techrepublic.com/blog/tech-decision-maker/it-operations-is-king-how-to-find-the-best-people/#. [Accessed: 8 Mar 2014].

ICT Standard for Management. 2012. 3rd ed. ICT Standard Forum.

Itservicemanagement-itil.com. 2014. [online] Available at: http://www.itservicemanagement-itil.com/wp-content/uploads/2009/10/ITIL-V3.jpg [Accessed: 22 Feb 2014].

Knapp, D. 2010. The ITSM process design guide. Ft. Lauderdale, FL: J. Ross Pub.

Myers, M. D. 2013. Qualitative research in business and management. London: SAGE.

Opfro.org. 2014. OPEN Process Framework (OPF) Repository Organization (OPFRO) Website. [online] Available at: http://www.opfro.org/index.html?Components/WorkProducts/EnvironmentsSet/TestEnvironment/TestEnvironment.html~Contents [Accessed: 4 Jan 2014].

Palo Alto Networks. 2014. What is a data center?. [online] Available at: https://www.paloaltonetworks.com/resources/learning-center/what-is-a-data-center.html [Accessed: 11 Jan 2014].

Reddy, V. 2014. Designing an Effective IT Service – ITIL® v3 approach. [image online] Available at: http://blog.simplilearn.com/wp-content/uploads/2012/09/Effective-IT-Service.jpg [Accessed: 8 Mar 2014].

Steinberg, R. A., Rudd, C., Lacy, S. and Hanna, A. 2011. ITIL service operation. London: TSO.

Technet.microsoft.com. 2014. Designing a Test Environment: General. [online] Available at: http://technet.microsoft.com/en-us/library/cc778654(v=WS.10).aspx [Accessed: 4 Jan 2014].

Warren, L. 2008. Stack up your skills in the datacentre. Computer Weekly, 20th May, p. 20.

Attachments

Attachment 1. Interview questions

1. What are / have been biggest challenges working with ITTE Finland during year 2013?
2. What is your opinion on ITTE Finland's performance during 2013?
3. How the Test Environment Support has been working when the ITTE Finland personnel is
    a. On-site?
    b. Remote?
4. What is your opinion on LMR Oulu and ITTE Finland Co-operation during 2013?
5. Any other comments/questions?

Attachment 2. Communication plan

Communication Plan						
Audience	**Materials**	**Project Phase**	**Venue**	**Key Message**	**Media**	**Comment**
Oulu Task Force	RTT and CR process descriptions	Planning	Meeting room	Introducing RTT and CR processes to internal peers	Power-Point Presentation	DONE: 8th of January 2014
All Oulu Employees	RTT and CR process descriptions Why these processes are needed	Implementation	Video Conference	Introducing RTT and CR processes to Oulu employees Explain why these processes are needed	Power-Point Presentation	DONE: 28th of Feb 2014
Oulu Developers and testers	RTT and CR training material	Implementation	Teleconference	How to raise support requests to ITTE	Power-Point Presentation	DONE: 6th and 19th March2014
Oulu Task Force	RTT and CR training material	Implementation	Meeting room	Support and CR handling training	Power-Point Presentation	DONE: 7th of April 2014

Attachment 3. Support handling process
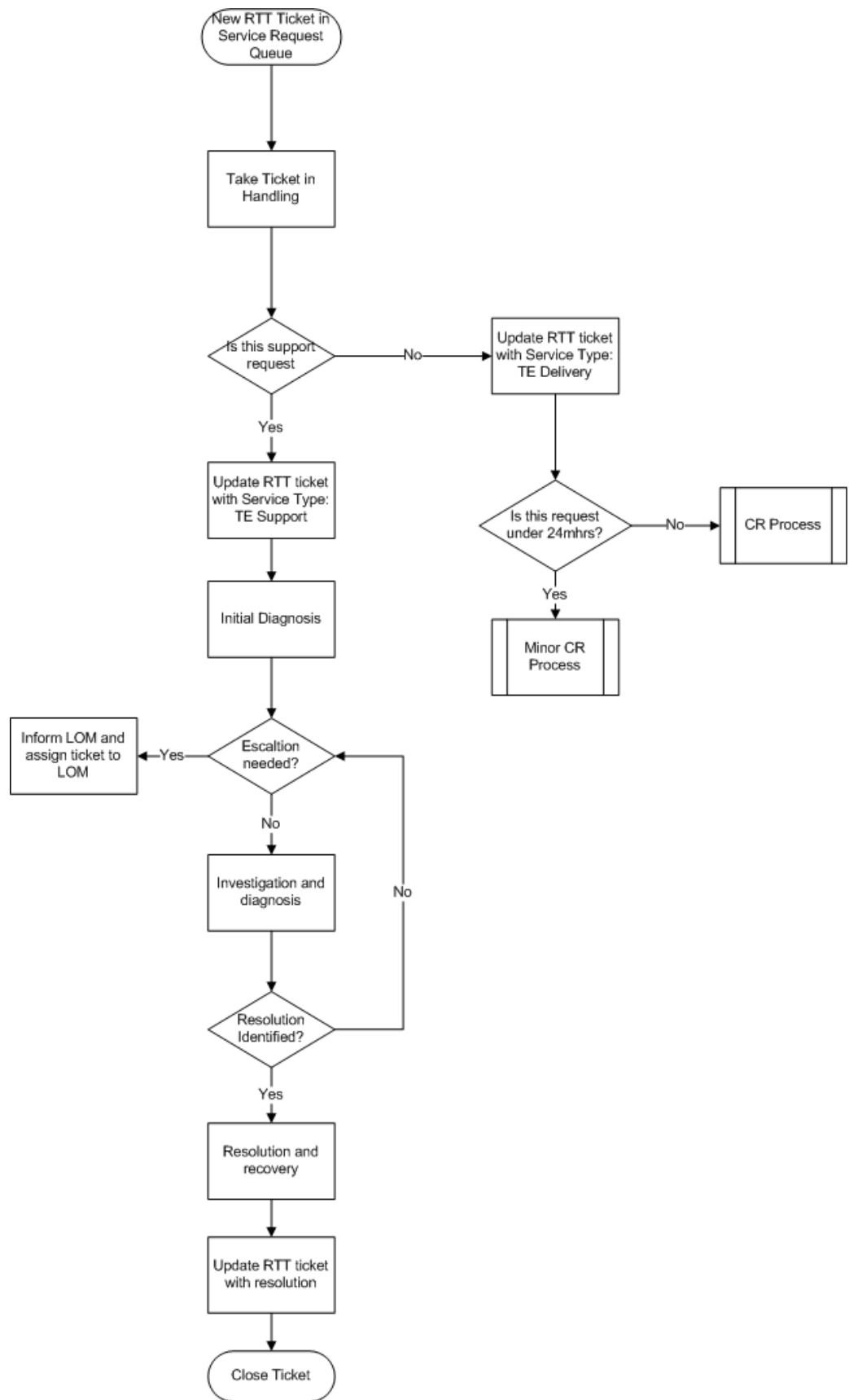
Attachment 4. Questionnaire

- What is your opinion of ITTE's RTT and CR processes?
- Do you think RTT and CR processes will help PDU LMR Oulu to receive better service from ITTE Finland?
- Do you think RTT and CR template are easy to use?
- How would you rate the processes (1-5)?
- Any other Feedback?

HOW TO RAISE A CR AND SUPPORT REQUEST TO ITTE FINLAND

Kariantti Laitala

REQUEST TRACKER TOOL (RTT)

REQUEST TRACKER TOOL

› Request Tracker (RT) is a tool used by IT and Test Environment (ITTE) in Ericsson to handle test environment support requests.

  – IT support requests must be raised via IT help desk

› RTT is used on all ITTE sites

› X-user accounts are possible

WHY USE RTT FOR SUPPORT REQUESTS

› The RTT is used already as a support tool in Jorvas
  – PDU MC and PDU Routers are using it

› One interface for requesting support from ITTE

› Faster support to ongoing incidents

› Visibility to support requests
  – We can identify recurring support requests
  – Requests are not hanging out in somebody's email box

INFORMATION ABOUT RTT

› RTT – Login

› Instructions for using RTT:
  – ITTE Finland specific Instruction
  – Global RTT instruction

› RTT Ericoll site

› RTT training sessions on W10 and W12

CREATING RTT TICKET

CHANGE REQUESTS (CR)

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CHANGE REQUESTS (CR)

› Change requests are used for
  – ordering new lab setups
  – ordering changes to existing lab setups

› Similar process is used on other PDU LMR sites (eq. Kista)

› Two types of CRs
  – Normal CR
  – Minor CR (less than 24 mhrs of work)

WHY CR PROCESS

› Get visibility to test environment changes
  – Change might effect to other projects

› With CR process all changes are documented

› CR process improves communication between PDU LMR and ITTE
  – Prioritization
  – Scheduling
  – Awareness of ongoing work

(NORMAL) CR

› To be used when requesting change that requires more than 24 man-hours of work

› Examples
  – Need of a new test environment/string
  – Adding new node to existing test environment
  – Adding new features to existing test environment

› CR template and instruction how fill template is in Oulu Verification Lab Ericoll site

› You can add or remove headers/section in the document

HOW TO USE CR

› The CR template contains instruction how use the template
  1. Make a copy of a template
  2. Fill needed information of the change
  3. Store it to !!Oulu CR folder in Oulu Ericoll
  4. Inform ITTE that new CR has been created

› After this ITTE prereviews CR and calls CR review meeting

MINOR CR

› Is for small (<24man-hours) changes to existing test
  environments

› Examples:
  – Non-SUT node SW upgrade (RNC, Macro-RBS, & CN Nodes)
  – Adding new tool to existing network
  – ERNC-SIM order

› Instruction can be found in Ericoll

› RTT is tool for raising minor CRs.

SUMMARY

› RTT is used for support request and minor CRs

› CRs process must be used when requesting new test
  strings/setups or change(s) to existing ones.

› RTT training sessions on weeks 10 and 12

› Contact: Kariantti Laitala
  – Questions
  – Improvement ideas

ERICSSON

Attachment 6. Training 2 material

ERICSSON

HOW TO RAISE A SUPPORT REQUEST TO ITTE FINLAND

Kariantti Laitala

INTRODUCTION

› This training outlines key information PDU LMR and Partners in Oulu need to know in order to request support from ITTE Finland

› All support requests need to raised in RTT

› User will use Ericsson user id and password to login
  – X-accounts will work

› RTT is accessible from Internet

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CREATE USER ACCOUNT

› Go to RTT webpage

› Login with your LAN user id and PW

1. Click Contact Us
2. Click NEW RT ACCOUNT
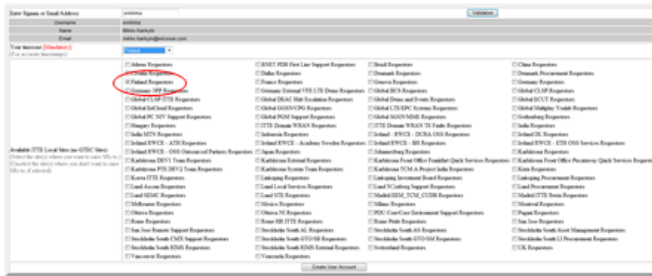3. Enter your Signum or mail address
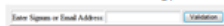
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CREATE USER ACCOUNT

› Select Time Zone (Finland)
› Select Finland Requestors
› Click Create RTT account

HOW TO RAISE A ITTE SERVICE REQUEST

› A RTT ticket should be raised by selecting Finland – Service Request Queue

HOW TO RAISE A ITTE SERVICE REQUEST

› A RTT ticket should be raised by selecting Finland – Service Request Queue

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PRIORITY DEFINITIONS

PRIORITY	RESPONSE TIME	COMMENT
TOP	2 hrs	Emergency. Direct influence on Ericsson business
HIGH	4 hrs	Major problem which affects many people
MEDIUM	1 day	Problem makes working complicated
LOW	2 days	A minor problem which doesn't need a rapid response

AFTER TICKET IS CREATED

› Once a ticket is created appropriate personnel will pick up the ticket and contact you for more information if needed.

› At any time you may login to RTT in order to check the status of your ticket.

› When the request is accomplished, the ticket will be closed and you will be informed.

ERICSSON

Attachment 7. ITTE employee interview questions

1. How the Test Environment Support has been working when the ITTE Finland personnel is
    a. On-site?
    b. Remote?
2. What is your opinion on LMR Oulu and ITTE Finland Co-operation during 2013?
3. What kind of competence profile ITTE resource should have in Oulu?