The Measurement of Optimization Performance of Managed Service Division with ITIL Framework using Statistical Process Control

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***Abstract*— The purpose of the Configuration Management process is carrying and all IT assets, status, configuration, and relationship between each other being well documented. This documentation is useful, among others, for some purposes. The first objective is to create clarity in the relationship between key performance indicators (KPI) an IT services with the infrastructure. Changes to the configuration of those devices would obviously very disturbing the performance of IT services. The second objective is the accuracy of the information which will be used by the Service Delivery processes. So a Service Desk staff who need to get information about how a user at a branch office to connect to the network's headquarters, linked to issues of access to certain applications. Accurate network configuration information will be helpful Service Desk staff in helping the user solve the problem. The third objective is the accuracy of the information will be used for the IT audit.PT. XYZ is a telecommunications company which relatively new and aware of the increasing competitive competition in the telecommunications industry. PT. XYZ was starting its operation in 2006. The company's ambition is to develop progressively by increasing operational performance which closely linkages between operational performance improvements company with a bottom line of the company. Thus, it is a necessity / obligation for companies in the global era of integrated telecommunications services, to focus on Quality of services (QoS) provided to its customers, in order to survive in an increasingly competitive telecommunications business. (KS)**

***Index Terms*— Managed Service, ITIL, and Configuration management**

I. Introduction

Information Technology Infrastructure Library (ITIL) is a collection of best practices for Information Technology Service Management (ITSM). While the Information Technology Service Management (ITSM) itself is a guide to the processes of IT service that exists in the organization, which wraps all the functional types of IT, which was previously more oriented to an application or infrastructure. ITSM approach aimed at reducing disparities between the language of IT with business unit managers who use IT services, so that the alignment between business and IT can be realized from the very beginning of the IT life cycle [2].

In the world of cellular telecommunications services, the use of ITIL Service Management in the management of telecommunications networks continues to experience growth. The development of mobile telecommunications technology affects the cellular operators to continue to adapt in order to continue to expand its network capabilities that improve service to customers can be improved in order to achieve customer satisfaction.

One of the mobile operators who wish to enhance customer satisfaction is the PT. XYZ, developed a radio network capacity to accommodate 3G services to customer through upgrading BR10, which is implemented by PT. Nokia Siemens Networks as one of the mobile vendors. Prior to that PT. XYZ has a few problems in the network BSS on vendor. Therefore, the vendor implements BR10 software upgrade to resolve the issue. Use of ITIL Service Management is one of its components is Configuration management is used by PT. XYZ in managing this upgraded BR10. Assessment of the success of the activity of BR10 upgrade is done by looking at Key Performance Indicator (KPI), which translates as the level of quality expected after the upgrade BR10 (radio signal quality), so that the cellular customer satisfaction can be achieved. Apart from that the monitoring of cellular networks continues to be done as an embodiment of the process of Continuous Improvement efforts.

The rest of this paper organized as follows: Part 2 will discussed about development of GSM. next the Methodology and conclusion.

II. Global System for Mobile Communication

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A. The development of GSM (Global System for Mobile Communication)

Global System for Mobile Communication (GSM) was first recognized in 1982 and is the name of a committee under the umbrella Conference Europeenne des Postes et Telecommunications (CEPT) formed to define a new standard of mobile telecommunications to replace a wide range of mobile telecommunications standard that is widely used analog in several European countries. Telecommunications standards are designed to use digital technologies that are different from previous standards where analog technology is no longer used.

The first GSM network was launched in 1991 and shortly after its launch, soon most countries in Europe apply to the accompaniment of the spread of GSM technology GSM countries outside Europe. Because of the very rapid development, a term later changed to GSM Global System for Mobile Communications and the GSM standard proved to be the most widely applied on this planet.

At the beginning of the GSM standard is set, only operates on GSM 900-MHz frequency band, where most of the GSM network operates using the frequency band. The use of another frequency band occurred in England in 1993 which uses 1800 MHz frequency band with the commercial name of DCS (Digital Cellular System). Meanwhile, GSM was introduced in North America with the commercial name of the PCS (Personal Communication System) operating at 1900 MHz frequency band. [4].

B. GSM Network Topology

GSM network topology using a cell structure as listed in Figure 1. and on GSM cellular networks are included distribution of frequency bands into small parts and use the frequency spectrum in several Base Transceiver Station (BTS) that represents a cell that serves the Mobile Station (MS). Definition of BTS and the MS are clear that a cell covers an area of mobile telecommunications services. Air interface is the interface between the BTS and MS. Meanwhile, a device that handles multiple cell service is called a Base Station Subsystem (BSS) integrated with the core network to perform functions in the voice service (Circuit Switched) and data services (Packet Switched).

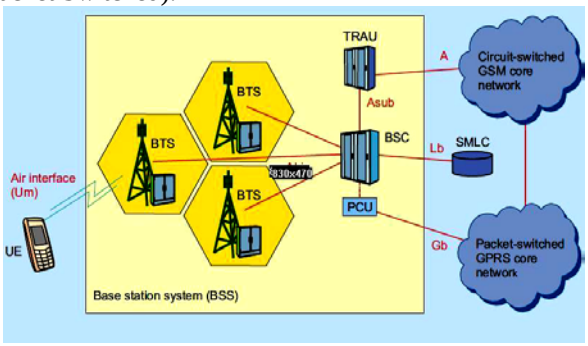

Figure 1. GSM Cell Structure [3]

C. GSM Network Components

In Figure 1 shows that a GSM network system consists of several subsystem elements are: Network Switching Subsystem (NSS), Base Station Subsystem (BSS), Network Management Subsystem (NMS). On the customer side there is a Mobile Station (MS) which is the tissue that is needed to establish a call consists of NSS and BSS. BSS function to control its radio network (Radio Network) and NSS serves to control the functions of control, therefore all calls would go through the NSS [2].

D. The GSM network subsystems and components

Mobile Station (MS)

Mobile Station (MS) is a telecommunication device on the network users. MS consists of terminal equipment called a Mobile Equipment (ME) and customer data stored in a module called a Subscriber Identity Module (SIM). Valid driver's license as a database containing user identification number and a list of available networks. SIM is also a component to the process of checking the authenticity (authentication) and encryption (chipering). There is also a memory space to store messages and phone numbers.

Base Station Subsystem (BSS)

Base Station Subsystem (BSS) is a telecommunications device that serves to regulate the radio network. A BSS consists of BTS, BSC, TRAU and covering a wide area and comprises many cells with functions as follows:

Base Transceiver Station (BTS)

Base Transceiver Station (BTS) is a telecommunications device that regulates air interface and minimizing disruption for air interface transmission is very sensitive to disturbance.

To solve this problem BTS has 120 parameters that define the exact type of a BTS and how MS can know the network when moving into the area of BTS. The parameters of base stations to handle things as follows: the type of handover (when and why), paging settings, radio power level control, and identification of BTS. Some of the BTS processes undertaken include:

1. Air interface signaling

Several signaling related calls and non calls must be made for the system to work. Examples include when the MS is turned on for the first time, shipping and receiving much needed information to the BTS before you can make and receive phone calls. Signaling is required for initiating a call. Then the signaling is necessary to perform handovers.

2. The encryption (ciphering)

MS and base stations must be able to perform the encryption and cryptanalysis of conversation and information to protect data sent over the air interface.

3. Conversations Signal Processing (speech processing)

Speech signal processing includes functions such as speech coding in the digital to analog and analog to the digital downlink on uplink direction, channel coding for

protection against damage information, interleaving to improve the security of transmission, and burst formation.

Transcoding Rate and Adaptation Unit (TRAU)

Transcoding Rate and Adaptation Unit (TRAU) is telecommunication device that does the conversion between the two compression formats performed between base stations and the central network. At the air interface, radio frequency is the carrier of information. To produce a digital information transmission effective conversation over the air interface, the digital speech signal is undergoing a process of compression (compression). GSM networks also must be able to communicate with the PSTN network (wired telephone network) in which the speech compression format used is different.

Base Station Controller (BSC)

Base Station Controller (BSC) is a central component of the BSS network that serves to control the radio network base stations and TRAU.

Network Switching Subsystem (NSS)

NSS is a telecommunications device that consists of network components Mobile services Switching Centre (MSC), Visitor Location Register (VLR), Home Location Register (HLR), Authentication Center (AC) and Equipment Identity Register (EIR).

Mobile services Switching Center (MSC)

MSC is responsible for controlling calls in a GSM network. MSC is to identify the origin and destination of a call from MS or a landline as well as the type of call. An MSC acts as a bridge between GSM and the phone cable is called the Gateway MSC (GMSC). MSC is responsible for several important functions as follows:

1. Call settings

MSC identifies the type of call, destination and origin of a call. He is also responsible for the establishment, supervision, and cleanup call.

2. Originator of the paging process.

Paging is the process of determining the location of an MS call destination.

3. Billing data collection services.

Visitor Location Register (VLR)

Visitor Location Register (VLR) is a database that contains information about customers who are in a service area. Information that include:

1. Identification number of the customer.

2. Authentication security information for the process of driver's license and for encryption

(ciphering).

3. Customer service that can be used.

VLR register (registration) and site updates. When an MS enters a new VLR service area, the MS did an update location. VLR database is temporary, in the sense that the data about the customer stored in the VLR for the customer is located in the VLR service area. VLR HLR also contains the addresses of those customers.

Home Location Register (HLR)

Home Location Register (HLR) is a device for managing data telecommunication keep from customers such as customer identification numbers. Besides the fixed data, the HLR also update the location of the customer at any time. This information is used to locate the MS MSC is the destination of a call.

Authentication Centre (AUC)

Authentication Centre (AUC) is a telecommunications device that provides security information to the network. With that information the network can check / test the validity of the SIM card (the process of authentication between MS and VLR) and encode information emitted via the air interface (between MS and BTS).

Equipment Identity Register (EIR)

Equipment Identity Register (EIR) is a telecommunications device that also has a network security functions such as AUC. However, if the AUC provides information to check the SIM card, then the EIR serves to check the International Mobile Equipment Identity (IMEI). At the checking process, the MS was asked to provide the IMEI number. This number contains a code of type approval (type approval code), the final assembly code (the final assembly code) and serial number (serial number) from your mobile phone (Mobile Equipment). The EIR has three categories of ME:

1. ME in the white list (white list) is allowed to operate normally.

2. ME in the list of gray (gray list) can be controlled if the suspected damage to him.

3. ME in the black list (black list) is not permitted to operate within the network.

Network Management Subsystem (NMS)

Network Management Subsystem (NMS) is a telecommunications device that serves to monitor the various functions and components of the network. Operator workstation connected to the database server communication via a Local Area Network (LAN). Server database stores information about network management. Communications server is responsible for data communication between the NMS and the equipment in the GSM network, known as network components. Communication is done via a Data Communications Network (DCN), which is connected to the NMS via a router.

Functions of the NMS can be divided into three categories:

1. Management failure (fault management).

The goal of fault management is to ensure the smooth running of the network operation and rapid correction of various problems that are detected. Fault management notifies the operator about the status of harmful events and manages a database that contains signs of danger.

2. Configuration management (configuration management).

The purpose of configuration management is to manage the information up-to-date information about

operating status and configuration of network components.

3. Performance Management (management on performance).

In performance management, NMS collects data HSIL measurement of each network component and saved in a Database. Based on these data, network operators can compare the actual performance of the network with the planned performance and detect areas of good performance and is not well in the network.

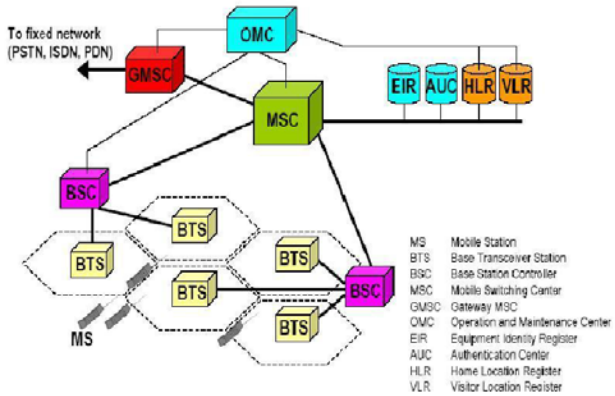

Figure 2 GSM subsystems [5]

E. Information Technology Infrastructure Library (ITIL)

Information Technology Infrastructure Library (ITIL) is a collection of best practices for Information Technology Service Management (ITSM). While the Information Technology Service Management (ITSM) itself is a guide to the processes of IT service that exists in the organization, which wraps all the functional types of IT, which was previously more oriented to an application or infrastructure. ITSM approach aimed at reducing disparities between the language of IT with business unit managers who use IT services, so that the alignment between business and IT can be realized from the very beginning of the IT life cycle.

In a cellular telecommunications network management, PT. XYZ uses ITIL as its network management technology. ITIL or Information Technology Infrastructure Library, is a framework that created and developed by the Office of Government Commerce (OGC) in England. ITIL is a collection of best practice corporate governance of information technology services in various fields and industries, from manufacturing to financial, industrial large and small, private and government, including the mobile telecommunications sector.

ITIL has grown along with the development of information technology. Figure 3 shows the components contained in ITIL version 3. Fundamental changes in this version is from the perspective of IT management, which in version 2 of ITIL service management as a set of processes and functions while in ITIL version 3 as a life-cycle services [7].

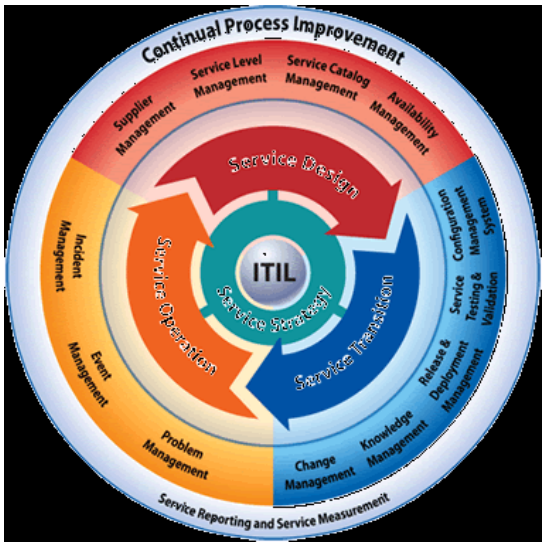

Figure 3. ITIL version 3 [16]

Difference in perspective between ITIL version 2 and ITIL version 3 is only a reorganization and restructuring of the groove, where IT and the business no longer have different views that must be bridged and aligned (alignment), but is expected to IT and business has been directed to view the services as end of all existing processes. Therefore, recycling services starting from the definition hidur strategy, design, transition, operations and continuous improvements made can be done together as well as from the same angle between business and IT. Thus, conceptually no longer required an effort to harmonize between IT and business outlook, because it should have been aligned.

For companies that have implemented ITIL version 2 and intend to implement ITIL version 3, it is advisable to create a blueprint and roadmap as well as identifying quick win from the whole process and the functions contained in ITIL version 3, for further mapping of the processes of ITIL version 2 which has now implemented. Then the implementation process became more focused and unambiguous. In ITIL version 3 more processes and functions involved and, if not structured implementation strategy and clear objectives from the beginning of the implementation will not be so successful.

Broadly speaking, ITIL version 3 consists of five sections and more emphasis on life cycle management services provided by IT. The five sections are:

1. Service Strategy
2. Service Design
3. Service Transition
4. Service Operation
5. Continual Service Improvement

2.4.1 ITIL Service Cycle

The five parts of ITIL above are also called as part of a cycle. Also known as ITIL Service Cycle. Briefly, each piece is described in the section below.

Service Strategy

The core of the ITIL Service Lifecycle is the Service Strategy. Service Strategy provides guidance to implementers on how to look ITSM concepts not only as

an organizational capability (to provide, manage and operate the IT services), but also as a strategic asset of the company. This guide is presented in the form of the basic principles of ITSM concepts, references and processes that operate in the whole core ITIL Service Lifecycle stages.

The topics discussed in this lifecycle stage includes the establishment of a market for selling services, the types and characteristics of internal and external service providers, service assets, the concept of service portfolio and implementation strategy for the overall ITIL Service Lifecycle. The processes covered in Service Strategy, in addition to the above topics are:

1. Service Portfolio Management
2. Financial Management
3. Demand Management

For the new IT organization will implement ITIL, Service Strategy is used as a guide to determine goals / objectives and expectations of the value of performance in managing IT services and to identify, select and prioritize a variety of operational and organizational improvement plans within the IT organization.

For IT organizations today have implemented ITIL, Service Strategy is used as a guide to conduct a strategic review of all processes and devices (roles, responsibilities, supporting technologies, etc.) ITSM in the organization are to enhance the capabilities of all the ITSM processes and tools.

Service Design

In order for IT services can provide benefits to the business, the IT services it must first be designed with reference to the business goals of customers. Service Design provides guidance to IT organizations to systematically and best practices to design and build services that IT or ITSM implementations itself. Service Design contains the principles and methods of design for converting strategic objectives into IT organizations and business portfolio / collection of IT services and service assets, such as servers, storage and so on.

The scope of Service Design is not solely to design new IT services, but also the processes of change and improvement of service quality, continuity of service or performance of services. The processes covered in Service Design, namely:

1. Service Catalog Management
2. Service Level Management
3. Supplier Management
4. Capacity Management
5. Availability Management
6. IT Service Continuity Management
7. Information Security Management

Service Transition

Figure 4 shows the functions of Configuration Management in Service Transition. Service Transition provides guidance to IT organizations to develop and the ability to change the design of both new IT services and IT services that changed the specifications to the operational environment. Lifecycle phases provide an overview of how a requirement defined in the Service Strategy is then formed in Service Design to further effectively realized in Service Operation. The processes included in Transition Service are:

1. Transition Planning and Support
2. Change Management
3. Configuration management
4. Release & Deployment Management
5. Service Validation
6. Evaluation
7. Knowledge Management

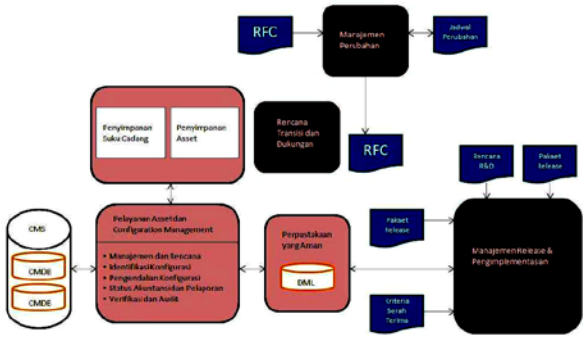

Figure 4. Service Transition of ITIL version 3 [5]

Service Operation

Service Operation is the stage lifecycle that includes all activities of daily operational management of IT services. Inside are various guides on how to manage IT services efficiently and effectively and ensure the level of performance that has been agreed with the previous customers. These guidelines include how to maintain the operational stability of IT services and management of design changes, the scale, scope and target performance of IT services.

The processes included in Transition Service are:

1. Event Management
2. Incident Management
3. Problem Management
4. Request fulfillment
5. Access Management.

Continual Service Improvement

Continual Service Improvement (CSI) provides important guidance in developing and maintaining quality of service of process design, transition and operation. CSI combines principles and methods of quality management, one of which is the Plan-Do-Check-Act (PDCA) or which is known as the Deming Quality Cycle.

F. Configuration management

This paper analyzes focus on configuration management in ITIL framework used by the PT. XYZ. Configuration Management Database or better known as the CMDB is a repository of IT infrastructure or a component called a Configuration Item (CI) is interconnected with each other to form an infrastructure configuration. CMDB in ITIL is a single point of truth that is expected to be the only valid reference for the

configuration of the IT infrastructure for all parties, including the processes and other ITIL functions.

The question that often arises is "what is the difference between Configuration, Asset and Inventory Management?" Basically this process has a third and manage the same data, but there is a difference of purpose of each process. Configuration management is intended to manage the data infrastructure or IT components and their relationships with others. Thus in Configuration Management, Relationships between IT components to the other one gets the emphasis. While aimed more Asset Management in managing the financial aspects of the Asset-IT assets. While the Inventory Management is a process that is intended to manage the stock level of inventory, in this case are goods included into consumable items or goods consumables.

The third difference of this process must be understood clearly, especially during implementation so that the scope of the CMDB implementation of the goals is not to be biased CMDB itself. However, in practice it should also be considered with selective requirements relating to the Asset and Inventory Management so that the CMDB can be more informative for users of the CMDB itself or an interest against the company's Asset and Inventory.

Building a CMDB

CMDB or Configuration Database management is a strategic repository used by the cross-section within the company. Not only IT, but also business, customers and vendors have an interest in the CMDB data. Strategic value of the CMDB can be obtained if part or all of the CI can be mapped into a CMDB that defines the relationship and the relationship between CI. CMDB can help companies and organizations in the management of IT infrastructure components, including conduct assessment on the impact of changes to be made (Change Request / RFC), find out what components are affected by an incident including location, users, and other components that can be affected impact, knowing that some or all of the infrastructure company involved in business services, and management decision making [8].

However, creation of the CMDB is not as easy to build a database and populate the database with data. The following things need to be considered in making the CMDB, especially for companies and organizations that have a lot of service and supported by the infrastructure in large numbers:

- Obtain commitment and support from management, if possible not only the support of IT management but also from Business Management
- Getting the commitment and together with the data owners, data users and data responsibility in maintaining the validity, accuracy and regency of data
- Conducted in several phases to prevent the collection, population and data management that are too large at a time
- Any changes to the data contained in the CMDB, should be managed through the Change Request (Request for Change - RFC). Thus any change, all interested parts of the data to know the change. Therefore the process of Change Management and Configuration management must first or jointly implemented by making the CMDB
- After the implementation process, should be a mechanism of Internal Audit (every 3 or 6 months) to keep the discrepancy of data between the CMDB, RFC and physical data is not too large
- Choosing the right tools to manage the CMDB and other ITSM processes (Incident Management, Problem Management, Service Level Management, Change Management, Release Management, Availability Management, Capacity Management, IT Service Continuity Management, Financial Management for IT, and Service Desk).

G. Key Performnce Indicators

We used data Key performance indicators (KPI) to analyze the performance of BSS network of PT XYZ. KPI is an indicator that defines a series of measures to determine performance and provide information to us how far we managed to achieve the performance targets imposed on us. KPIs can be a numerical value of the existing resource capability. One example is the BSS network KPI on Call Setup Success Ratio (CSSR).

There are a number of things that must be observed when we want to implement the KPI-based telecommunications projects. Ideally, each company can develop a kind of catalog of KPIs for each area of telecommunications, for example [6]:

Call Centre

- Waiting Times - The average speed in answering customer calls - Number of calls - A large number of customer complaints received - Revenue per call - The quality of the average phone call - The number of calls to be diverted - Average call duration - Customer satisfaction

- A large number of customer calls answered in 10 seconds - Efficiency agents.

Systems and Network Performance Analysis / Capacity Planning

- Availability of Services - Level of Service - The lifetime of the device - Bit error rate (BER) - Data Rate - Time of service when they fall - The level of telephone service - Cost of service system - Operational Costs - The average length of time the conversation - The level of data bottlenecks in service - Phone calls are dropped.

Revenue / Financial Analysis

- The average revenue per telephone user (ARPU) - Number of prepaid customer ARPU - Total ARPU by contract - Revenue per minute talks - Percentage of revenue for services beyond voice - Average revenue realization (ARR) - Amount of time the customer usage - Average revenue per employee (ARPE) - Average revenue per customer (Arps).

Achievement of KPI monitoring system needs to be done. Many companies have set KPI quite well but stopped midway due to lack of support systems and good

monitoring. For example, the company already has a KPI of Score Systems and Network Performance Analysis / Capacity Planning, but apparently they do not have the tools to measure it. Or another example, the KPIs of IT has an average duration of the repair servers, but do not have monitoring tables to record how long the average of their improvement process. Take another example, a section has a KPI on the number of customer complaints that can be completed thoroughly; but then did not develop mechanisms to measure the process. The above examples show the importance of monitoring and supporting system for the realization of data documenting the KPI. Only with the support of this monitoring scheme, the achievement of KPI every month or every quarter can be managed and controlled to the optimum.

Without good monitoring systems, performance improvement can ultimately culminate in what is referred to as "IEC Gaming" or KPI game. And this gaming is usually susceptible to parts or the administrative support function. KPIs should be recognized dimensions usually boils down to two things: the level of accuracy of reporting and timeliness of report preparation.

Without a monitoring system is neat, the achievement of KPI data can be filled with not careful. As a result, which is often visible achievement of KPI data they tend to always be "good" (e.g., always 100% accuracy, and timeliness is always stated on time; timeliness own criteria when they may not have the default standard).

In this paper used a performance measurement by using one of the components of the IBC on the network BSS Call Setup Success Ratio (CSSR). CSSR is a comparison between the calls that managed to occupy the traffic channels (call seizure) with the number of attempted calls (call Attempt). CSSR CSSR is good with high scores. At minimum standard GSM operators CSSR used was 98%. The greater the CSSR obtained from the data traffic (> 98%) show more and more calls that managed to occupy the canal. If CSSR <98% then the number of calls that are not managed to occupy the canal will be many more.

CSSR data in this paper are taken from Inspur system, according to the time of the incident to be retrieved daily, weekly, or monthly. Of the CSSR data is then analyzed the extent to which influence the activity of BR10 software upgrades on the performance of PT. XYZ.

H. Statistical Process Control (SPC)

SPC began 1920 by Steward concerned that management processes to produce a favorable situation for businesses and consumers, promote the importance of SPC control chart. Harold, Eugene, Deming develop SPC process. Formation Control chart limits have been transformed from initially limits the original concept of economic profitability of limits, based on variations of the group. Problems arising from the complexity of modern processes and variable polynomial, which will make the technologies grow more sophisticated. Therefore, controlling the future models should consider the number and the correlation relationship between variables, characterized by the co-variance matrix, caused by the relationship between variables and the process [7].

False Alarms are used in SPC in a batch processes. Such problems can be solved with the help of multi variance SPC. M-SPC multidimensional compresses into a few variables that explain the diversity of variables to be measured, including relation to one another. This chapter will discuss the use of SPC and the M-SPC by using some components parameters.

Normal distribution in this paper is used to determine the sample from the process to be observed under controlled conditions or beyond the control of the system, namely by carrying out statistical sample calculations and to plot the sample into the normal distribution graph regularly. If the resulting distribution patterns do not change over time, it can be said that the process is in a phase controlled statistically. Pierre Simon LaPlace said the central limit theorem that if there is a random sample for a number of n observations selected from a population of data (any probability distribution) with the average value / mean value μ and standard deviation σx-bar = σ / √ n . The larger the size of a sample of the better forecasts will be generated for the sample average value.

The goal is about to find out when the time of a process that is beyond control (out of control) so that adjustments can be done at the right time. The whole process has variability, which causes the incurrence of costs and conditions that are not desirable; therefore, these conditions must be suppressed as much as possible. Process adjustment requires additional costs due to the slow throughput and requires no small amount of resources. Measurement process is also not cheap because it does not take a short.

Therefore, it is important to determine what should be measured from a process and when it is appropriate to make changes to the process.

Control charts

Control chart consisting of the y axis and the x-axis, dashed lines depict the standard deviation of the sample (below and above the interval), center line which is the average value of the distribution of samples will be used to show the picture of the processes that are observed in the period with some specific rules that can be used are:

1. One point which is outside the standard deviation than a third are upper control limit (UCL) and lower control limit (LCL), which has a probability of 100% up to 99.7% or 0.003 or 3 possibilities in every 1000.
2. Two points are located between the second and third deviations are on the same side of the center line, ie the square root of the reduction of 99.7% and 95.5% divided by two equals 0.0004.
3. Seven pieces of adjacent point which is entirely located above or below the average value (every point has a probability of 50%).
4. If there are five points up or down sequentially forming a pattern, it indicates the change process.

2.7.2 Attributes and Variables

There are many kinds of control chart is used, but must be selected in accordance with what is to be measured

and statistically calculated. One way to determine the appropriate chart is the first to define the method used, i.e. qualitative or quantitative, where both methods use numbers.

Numerical values are to qualitative data is the number of defects / damaged data is calculated as a percentage or fraction defect. Both are used to measure the attributes, characteristics of the quality of a discrete value, for example, is a measurement process that defect versus non-defect. In this case use c-chart obtained from the errors that appear on the sample data or the p-chart obtained from the percentage of errors in the data sample.

After that these quantitative data which is the variable data is calculated and the data is ongoing (continuous data) and use rational values. Rational values are values that can be expressed in terms of comparison / ratio. (For example, a 4.4 foot long board is 2:1 than 2.2 foot board. The same can be used for the thickness, length, weight, etc.). When it comes to control variables, c and p charts should be used because it requires X chart to see if there is a shift in central tendency, while the R-chart notify changes in the spread that must be done in a range of standard deviation to measure the magnitude of the spread which is an estimate derived from the collection data.

Trouble Ticket System and Inspur (TT)

Inspur system is a network management tool PT. XYZ in the Network Management Subsystem (NMS). How it works Inspur system refers to the ITIL concept which includes incident management and configuration management. The data used in this paper was collected using Inspur system. Inspur system has been used by PT. XYZ during the three years since April 2008.

Inspur is a system to support the operation of the NMS that can be divided into three categories namely:

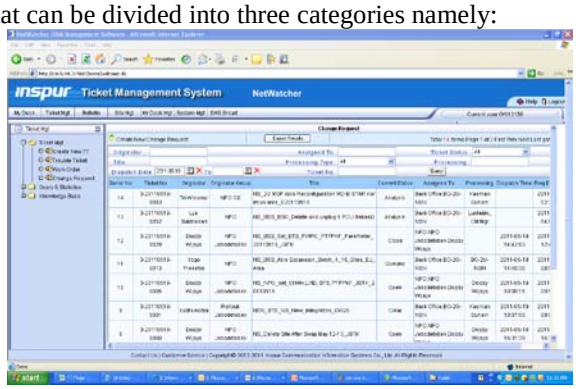

Figure 5 Inspur system [9]

1. Management failure (fault management).

The goal of fault management is to ensure the smooth running of the network operation and rapid correction of various problems that are detected. Fault management notifies the operator about the status of harmful events and managing a database that contains signs of danger. In the system used the term Inspur Trouble Ticket (TT). TT is a tool in the system Inspur as a record for any problems / failures that arise in telecommunication networks of PT. XYZ.

2. Configuration management (configuration management).

The purpose of configuration management is to manage the information up-to-date information about operating status and configuration of network components.

3. Performance management (on performance management).

In performance management, NMS collects data HSIL measurement of each network component and saved in a Database. Based on these data, network operators can compare the actual performance of the network with the planned performance and detect areas of good performance and is not well in the network [11].

TT data is part of incident management (fault management), are used to support the analysis in the paper . So one goal of this paper is to determine and analyze the extent of the influence of the BSS software upgrades on the performance of PT. XYZ can be achieved. Furthermore, TT data is processed by the method of Statistical Process Control (SPC), and analyzed based on the results obtained.

The relationship between ITSM with TT in the PT. XYZ is that ITSM which is the manual processes that exist within the organization in this case PT. XYZ with the aim of providing customer satisfaction in the IT services / network in accordance with Service Level Agreement (SLA), use the TT as a tool to monitor effectively and efficiently some IT or network problems that arise. So the management can follow the development process of the IT or network problem solving and follow up to the parties involved in the process of solving the problem in order to meet SLA expectations.

III. The Research Methodology

In this paper the authors identify problems with the Managed Services division of PT. XYZ and collect problem data in the form of Trouble Ticket (TT) obtained from observations carried out comprehensively in the past nine months. The type of TT include regional problems that occurred in south Sumatra, central Sumatra, Bodetabek, Jakarta, North Sumatra, Central Java, East Java and West Java. The problems are obtained, grouped in two categories based on the transmission and total TT (TT + TT transmission BSS). In writing this paper Inspur system used to obtain data from the second TT in the above categories, which the system is a system that has been used PT. XYZ for five years.

Inspur System is integrated into the radio system commander so that the data obtained is most accurate data.

Furthermore, the author uses methods Statistical Process Control (SPC) to process the data obtained from Inspur system. In the SPC method, the data is processed based on the timing of the problem and then calculated the mean (average) and range of data. After that, do the calculations to find the upper control limit (UCL) and lower control limit (LCL). UCL and LCL obtained mapped into a graph with all observational data in the can.

So it can be observed clearly chart pattern that occurs to see if the problem is still controlled or out-of-control.

Having obtained the results of the analysis of these problems, the authors provide recommendations for process improvement solutions Managed Service by first find the root cause of each problem that out-of-control.

Model and Analysis Method

The first thing to do is determine the central line and control limits using data already collected during the observation time on the process conditions in controlled circumstances. A process cannot be determined that in controlled conditions, until it made by control chart of the process. Thus, when the control chart is made first time, the center line and control limits is a trial value which will be experiencing adjustment.

In this paper used as many as 8 samples for Managed Service covers the operational areas of regional South Sumatra, Central Sumatra, North Sumatra, Bodetabek, Jakarta, Central Java, East Java and West Java for each of the Trouble Ticket (TT), then do the calculation in samples that expressed in the chart and determine the control limits based on these statistics, then the authors performed statistical values obtained plotting. If the eight samples taken from a deviation occurs, it is necessary to investigate certain cases, followed by process improvement and re-measurement.

So the first step to create a control chart there are three main considerations that need to be decided, namely:

1. Determining the quality characteristics need to be measured.

2. Determining the sampling plan will be created.

3. Establish how much error will be tolerated on the evaluation of control, quality characteristics to be measured are a very important factor, considering closely related to the costs that will result from the output obtained. Meanwhile, the sampling plan is designed to accommodate random data and obtained from a different time each week.

Therefore, fault tolerance (risk of error) is used for ± 3σ, then the risk of errors that will occur is at 100% - 99.7% which is equivalent to 0.3%. The following are the steps taken to make the control chart, namely:

1. Collect as many as eight or more samples (n samples) for n scale measurements.

2. Calculate the statistical sample to be used in a control chart.

3. Determining the center line on the average value / mean of n statistical sample.

4. Estimate the standard deviation (σ) of a process. Estimated value of σ will vary and depend on the type of chart used.

5. Determine upper and lower control limits on the ± 3σ control limits (approximate).

6. Doing all samples plotting on the chart statistics on a regular basis.

IV. Research Result

The author reinforces the importance of using ITIL methods in the management of BSS network of PT. XYZ. because it supports the performance of services to its customers. At this stage the transition is a performed configuration management service to support the development of an existing BSS network, in order to continue to accommodate the needs of customers PT. XYZ increasing.

Based on observations on the operation of the network of PT. XYZ is known that the interplay between one subsystem to another subsystem. Thus we need a reliable Network Management System. Configuration Management conducted by PT. XYZ must be well planned, as well as in the implementation stage should be controlled to the optimum.

In this paper used data network that supports the analysis of the activity of BR10 software upgrades that support the performance of PT. XYZ. There are constraints that look at the implementation of planning in configuration management activities. Based on data obtained from these constraints, conducted Further analysis to be drawn a conclusion and a recommendation was made to the performance of PT. XYZ can be Increased. Here is the data in question:

1. The number of events (Trouble Ticket / TT) was recorded, caused by transmission problems in a period of 7 months (September 2010 - April 2011). The total is the sum of TT transmission with BSS.

2. Total events within a period of 7 months (September 2010 - April 2011).

3. Time plans are made to perform a software upgrade activities BR10.

Throughout the above data is processed using the method of Statistical Process Control (SPC), so it can be known at the time when a process is out of control. Then it can be drawn a conclusion and recommendations with the aim to Improve company performance.

In accordance with one of the goals of this paper , namely to know and analyze the extent of the influence of the BSS software upgrades on the performance of PT. XYZ based data processing with the SPC method, as the data in the form of 8 samples, the data for areas of Java and Sumatra, which includes the regional South Sumatra, Central Sumatra, North Sumatra, Bodetabek, Jakarta, Central Java, East Java and West Java.

The following steps to create control charts:

1. Collect as many as eight samples.

2. Calculate the statistical sample to be used in a control chart.

3. Determining the center line on the value of 8 samples rata-rata/mean statistics.

4. Estimate the standard deviation (σ) of the transmission process.

5. Determine upper and lower control limits on the ± 3σ control limits (approximate).

6. Plot on the chart makes the entire statistical sample.

We get the calculation result obtained can be seen in Table 1 below.

TABLE 1. TROUBLE TICKET DATA CALCULATION RESULTS

Pengolahan Data W36 2010 – W18 2011	Pengolahan Data setelah dikurangi W47 2010
$\bar{R} = \frac{\sum_{i=1}^{k} R_i}{k} = \frac{71}{35} = 2,0286$	$\bar{R} = \frac{\sum_{i=1}^{k} R_i}{k} = \frac{67}{35} = 1,9143$
$\bar{\bar{x}} = \frac{\sum_{i=1}^{k} \bar{x}_i}{k} = \frac{24,375}{35} = 0,6964$	$\bar{\bar{x}} = \frac{\sum_{i=1}^{k} \bar{x}_i}{k} = \frac{22,625}{35} = 0,6464$
$A_2\bar{R} = 0,373 \times 2,0286 = 0,7567$	$A_2\bar{R} = 0,373 \times 1,9143 = 0,7140$
$UCL_{\bar{x}} = \bar{\bar{x}} + A_2\bar{R} = 0,6964 + 0,7567 = 1,4531$	$UCL_{\bar{x}} = \bar{\bar{x}} + A_2\bar{R} = 0,6464 + 0,7140 = 1,3604$
$LCL_{\bar{x}} = \bar{\bar{x}} - A_2\bar{R} = 0,6964 - 0,7567 = -0,0603$	$LCL_{\bar{x}} = \bar{\bar{x}} - A_2\bar{R} = 0,6464 - 0,7140 = -0,0676$
$UCL_R = D_4\bar{R} = 1,864 \times 2,0286 = 3,7813$	$UCL_R = D_4\bar{R} = 1,864 \times 1,9143 = 3,5683$
$LCL_R = D_3\bar{R} = 0,136 \times 2,0286 = 0,2759$	$LCL_R = D_3\bar{R} = 0,136 \times 1,9143 = 0,2603$

From the data obtained in Table 1 above, Average and Range charts obtained as in Figure 6 and 7 The graph is very useful to know and analyze the extent of the influence of the BSS software upgrades on the performance of PT. XYZ data processing method based on SPC.

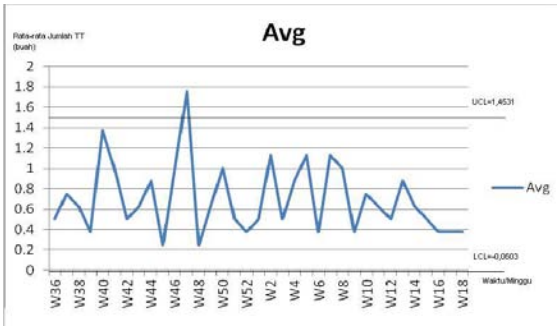

Figure 6. Average (mean) TT Transmission Graph

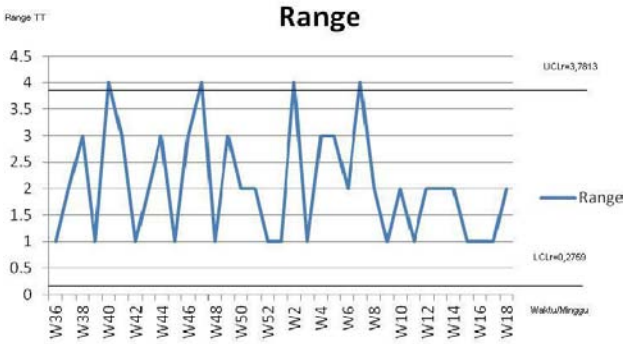

Figure 7. TT Transmission Range Graph

With reference to the SPC method, can be known whether the observed processes can be categorized under controlled circumstances [10]. Here is a reference to the observation pattern SPC are:

1. The process can be said to be controlled, if not there is any point outside the control limits (UCL and LCL).

2. Number of points above and below the center line is almost the same.

3. Has a random pattern of dots above and below the center line.

4. More the number of points that approach the center line (but not all the points), and only there are fewer points near control limits.

In Figure 7 there is a point that lies outside the UCL, namely the events in the observation at week forty-seven (W47). These events are usually caused by an unusual cause. After analysis of the incident, found that when there are events that damage to the module as part of the hardware components of the BSC, but do not have the equipment spare parts to replace.

Dupont has proven in his journal that the SPC method is a very good approach to solve existing problems associated with the system of Quality Assurance and Materials Management Databases [12]. Further comparison for the total of TT (TT + TT Transmission BSS) and the TT transmission is shown in Figure 8. Figure 8 shows that the performance improvement is taking place after week 47 (W47) in 2010. There is a Decrease of 50% in TT BSS by looking at the data the number of TT.

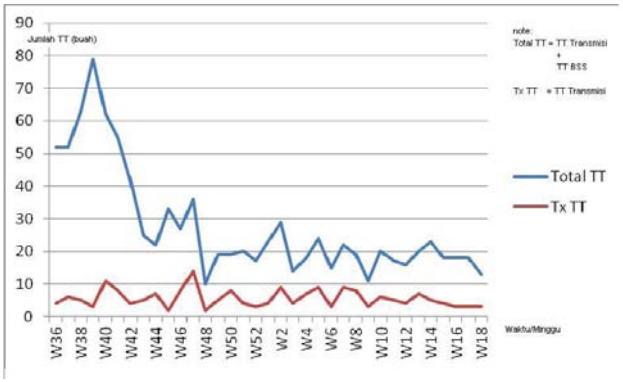

Figure 8. Comparison Graph Total TT and TT Tx

V. DISCUSSIOIN

In the ITIL framework, the results obtained from an activity can be measured using Key Performance Indicator (KPI). PT. XYZ uses KPIs to measure the performance of the entire network. The software upgrade activities BR10 PT. XYZ, also performed measurements of the BSS network performance before and after the activity of BR10 is a software upgrade. From the measurement results can be analyzed whether there was improved performance after software upgrade BR10.

In this paper the data displayed KPI Call Setup Success Rate (CSSR) for the month of October 2010, November 2010 and December 2010. CSSR data is also processed by using a system that is integrated with the system Inspur Network Management System (NMS). CSSR is the percentage of Successful calls for talks.

In accordance with the second objective of this paper that is to determine and analyze the extent of the influence of the BSS software upgrades on the performance of PT. XYZ value-based Key Performance Indicator (KPI), then used the data obtained from the IBC CSSR Inspur system.

Figure 4 displays the KPI graph to CSSR in October 2010. While Figure 5 displays the KPI graph to CSSR in

November 2010. And Figure 6 displays the KPI charts for the CSSR in December 2010. According to the graph, it was found that there was BSS network performance improvements on KPI CSSR occurred in November 2010 and December 2010. In the activity of BR10 software upgrades have been done on some network BSS PT. XYZ. In addition the Inspur system also had taken CSSR data on average in October 2010, November 2010 and December 2010.

The results of performance analysis is used to meet the expected network operating conditions and also can provide a guide in designing the development of BSS networks in the future. In addition to this performance analysis can be obtained accurately from the last condition that the customer needs so the company can optimally determine the next steps in terms of further development of the BSS network [14].

Under the second objective of this paper that is to determine and analyze the extent of the influence of the BSS software upgrades on the performance of PT. XYZ in accordance with the Key Performance Indicator (KPI), it is used as Tables contains average CSSR data obtained in Inspur system. CSSR data this average to support the KPI analysis of the BSS network. Of the CSSR data is obtained average performance improvement that occurred BSS network of 0.8% in the CSSR. With the increasing value of CSSR, the more calls from customers who succeeded in occupying the BSS network. Thus customer satisfaction in using the services of PT. XYZ can be increased.

VI. Conclusion

From the results of the discussion and analysis of the data processed by SPC and data analysis method IEC CSSR, it can be concluded in accordance with the purpose of this thesis are:

1. Activity BR10 software upgrade provides a positive effect for the performance of PT BSS network. XYZ. This is shown by a reduced number of Trouble Ticket (TT) of 50% in the operations of PT BSS network. XYZ. This indicated that the BR10 software as new software that replaces the old software, reducing some of the problems that exist in the BSS network.

2. The results of data processing and analysis using Statistical Process Control (SPC), show that there is a process in the Managed Services division of PT. XYZ needs to be improved based on the ITIL framework. That process is management of spare parts. There is an event of unavailability of replacement parts for the hardware module of the BSS network.

3. The results of data analysis based on the value of PT BSS KPI CSSR network. XYZ indicates that the BSS network performance improvement occurs with increasing value of CSSR. With the increasing value of CSSR, the more calls from customers who succeeded in occupying the BSS network. Increasing the value of CSSR in this thesis by 0.8%. Thus customer satisfaction in using the services of PT. XYZ can be increased.

4. As a guideline to direct the organization's IT and IS firms toward fulfilling the needs of customers better then the development of PT BSS network capabilities. XYZ to address the existing experiences to the BSS network can be done by software upgrades BR10, which is implemented by Nokia Siemens Network (NSN) as one of the mobile vendors. Activity BR10 software upgrade has been managed effectively and efficiently through the ITIL framework, especially in the configuration management so that the results obtained in accordance with the expected value of the KPI.

BR10 solution software upgrades as part of the ITIL framework in the configuration management, undertaken to improve the performance of BSS Network PT. XYZ. Monitoring Network BSS still needs to be continued, to find out if there is a new symptom related to software or hardware problems BSS. For the BSS performance monitoring needs to be done simultaneously and if the new problems arise can be quickly acted upon. So That the BSS's significant performance degradation can be avoided. In addition management of spare parts as part of configuration management activities, needs to be done properly to avoid problems due to unavailability of spare parts at the time it takes for the network BSS in order to function properly. So it needs to be done as a spare part dimensioning parts availability plan in all areas of the BSS network in accordance with its needs of each area.

Preventive Maintenance is needed in the operations of PT. XYZ for all network elements that are either BSS Network, Transmission Network, Core Network, Datacom Network and VAS Network. From the Preventive Maintenance activities can be prevented at an early stage, problems that require considerable time to mitigate them. To obtain the results of Key Performance Indicator (KPI) is good.

Future studies can be performed on an already unstable situation after the software upgrade process is complete, at a certain time. Researchers are advised to use SPC as a tool for controlling operational processes that exist in the Managed Service PT. XYZ. So that it can be seen on which the process in PT. XYZ out of control, to then be taken a number of steps to improve the process.

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