Abstract—The ever increasing demand of customers for better and faster delivery of services contributes to the high rate of change within the telecommunications industry to meet these demands. Telecommunication operators need to rapidly react to these customer demands. In this paper a brief overview is given on the New Generation Operations Systems and Software (NGOSS) framework and Service Oriented Architecture (SOA) principles to assist a telecommunications operator in a dynamic environment. A case study based on SOA principles and guided by the NGOSS is also discussed.

Index Terms—eTOM, TNA, IPTV, SOA

I. INTRODUCTION

The current business of the telecommunications industry has changed dramatically from the past. Today’s telecommunications industry is faced with dynamic, complex and unintelligent networks with intelligent people, processes and systems to operate these networks. Thus the foundation of a successful telecommunications company is its people, processes and systems. There is however a cost associated with each of these entities to keep a network technology operational, i.e. the operational cost of the network. The ever increasing demand of customers for better and faster delivery of services contributes to the high rate of change within the telecommunications industry to meet these demands. Thus a telecommunications operator needs to rapidly react to changing customer requirements and be able to bring products faster to the market, i.e. becoming a lean operator.

In [1], a lean operator is defined as a highly efficient operator that can react to change and bring its products to market faster and better than the competition. The three main objectives of a lean operator are [1]:

- to increase the agility of the business,
- reduce the operational cost and
- increase the level of service delivery to the customer.

In order to attain to these objectives, emphasis needs to be placed on improving and optimizing the current end-to-end business process flow within an operator. Thus the support systems used within a business process needs to be integrated and automated in an attempt to optimize the business process for an increased level of service delivery and a reduction in operational cost.

In section II the cornerstones of a lean operator are discussed with an introduction to the New Generation Operations Systems and Software (NGOSS) framework that supports the lean operator. Section III gives a brief overview on the Service Oriented Architecture (SOA) methodology and section IV discusses a case study inspired and guided by the NGOSS and implemented with SOA principles. The paper is concluded in section V with a discussion on advantages of NGOSS and SOA principles.

II. THE LEAN OPERATOR

This section will give a brief overview on the cornerstones of a lean operator as defined in [1]. There are three cornerstones that highlight the capabilities of a lean operator, these are:

- Information architecture
- Process architecture
- Interaction architecture

Focusing on the information architecture, information is one of the biggest assets within an operator. It is thus of highest importance that the information is structured and modeled in such a way so that new technologies can be quickly introduced into the existing infrastructure. Information should also be up-to-date at all times with the highest level of integrity for real-time and accurate queries and statistics.

The introduction of a new technology is accommodated by business processes which define the different smaller processes within the fulfillment, assurance and billing domain to support the new technology. Since customer requirements and technology changes all the time, the defined business processes will also change and thus needs to be structured and architected to easily adapt to these changes, i.e. process architecture.

The function of the interaction architecture is to align the defined processes within the process architecture with the defined structures within the information architecture. The defined architecture within the interaction architecture can either be technology-specific or technology-neutral. The interactions between entities in a process are based on the information required by an entity and the information produced by an entity in the process, i.e. a defined structure in the information architecture is mapped to an entity in a
process within the process architecture. The interactions of information between entities in a process, defines the formal contracts between the entities within the interaction architecture. These contracts are technology-neutral and can be used to implement the necessary interfaces between applicable systems which are used in a business process, i.e. technology-specific.

Each of the previously defined architectures has four different views/phases in developing applications. These are the business view, system view, implementation view and deployment view [1]. In the business view use cases are defined to capture the information requirements and the necessary business processes and workflow. In the system view the applicable systems are mapped to the captured information requirements within the business view. It is also in the system view that the previously mentioned formal contracts are defined. In the implementation view, the formal contracts are developed as interfaces between the applicable systems with the necessary business logic, i.e. process automation.

An initiative to support the cornerstones of a lean operator is the TeleManagement Forum’s (TMF) New Generation Operations Systems and Software (NGOSS) technical framework [1]. Figure 1 illustrates the mapping of some of the different frameworks in NGOSS on the defined cornerstones of a lean operator. These NGOSS frameworks are the enhanced Telecom Operations Map (eTOM), Shared Information/Data Model (SID), Technology-Neutral Architecture (TNA) and the Telecom Applications Map (TAM).

Focusing on the first three of the NGOSS frameworks, the eTOM is defined by the TMF as a business process framework to guide the service provider with the definition and implementation of end-to-end business processes which will deliver value for both the customer and service provider. The SID is defined as a companion to the eTOM which provides an information and data reference model, i.e. aligning business entities to a business process to meet a business requirement or need. Figure 2 illustrates the mapping of the defined business domains within SID to the eTOM. The main purpose of TNA is to define the necessary contracts between these business entities irrelevant of the underlying implementation technology of the business process, i.e. a business process should not be affected or changed due to a change in implementation technology. The interested reader is referred to [1] and [2] for a more in-depth discussion on the different NGOSS frameworks.

### III. SERVICE ORIENTATED ARCHITECTURE

Service Orientated Architecture (SOA) is a philosophy or an architectural way of aligning your business needs with IT. SOA is not synonymous with web services. SOA is a set of architectural principles and web services is an implementation of these principles. SOA therefore strives to make business functionalities available as loosely coupled, well defined services [3]. Services are software components which have well defined contracts and interfaces [4]. These defined contracts and interfaces are platform and operating system independent, i.e. technology-neutral. The services are self-contained entities which does a predetermined task. The reusability of services by more than one client (customer) promotes service assembly.

Within any IT environment, there is a plethora of back-end systems. All of these systems run different operating systems (Microsoft Windows, UNIX, Solaris etc.). These systems also utilize different databases (MS SQL Server, Oracle, MySql etc.) The applications than run on these backend systems are implemented in various languages (.Net, Java etc.). To make all of these systems integrate in a seamless fashion has always proved to be a daunting task. SOA provides a mechanism for these systems to offer their functionalities in a standardized and open way. An advantage of SOA is the reduction of integration costs and complexities. By implementing SOA, legacy applications can be re-used and business processes can be more easily defined from these services. Thus SOA provides the
capabilities to modularize end-to-end business processes which increase re-usability, agility and flexibility to rapidly deploy new customer services, i.e. increasing the level of service delivery to the customer. This is in accordance with one of the main objectives to become a lean operator and inspired the use of SOA as a TNA framework in NGOSS. The next section will discuss a case study of implementing the SOA principles, guided by NGOSS.

IV. CASE STUDY – IPTV

During the creation of an IPTV service, it was decided to adhere to and implement a Service Oriented Architecture (SOA). The motivation to use SOA principles was inspired and motivated by the TNA framework within the NGOSS. As illustration, the self-provisioning of the IPTV service will be discussed in this section, highlighting the use of web services based on SOA principles.

Figure 3: Architecture for self provisioning

A. Self-provisioning

For the purpose of this discussion it is assumed that the customer has bought an ADSL line and IPTV service and that the necessary customer information has been captured within the billing platform. A key field during this process is the capturing of the Directory Number (DN). It is assumed that the configurations on the network layer has been completed at this time, i.e. the ADSL router on the customer premises was configured to have separate Virtual Circuits (VC) to the internet, soft switch and IPTV platform. The customer can now buy a set-top box (STB) from any retailer.

Figure 3 illustrates the self provisioning process in an SOA environment and illustrates the system process flow for self provisioning based on AAA (Authenticate, Authorize and Access). Once the customer switches on the set-top box, the set-top box connects to the IPTV platform through the pre-provisioned VC. The IPTV platform will receive the connection request from the set-top box. From the resource facing services the GUID will be provided by the set-top box to the IPTV platform. The GUID uniquely identifies a set-top box. Because the user is not created within the IPTV platform yet, it will not recognize the GUID and it will break out to an External Login Server (ELS). The ELS will push a registration page to the customer via the IPTV platform. The contract between the ELS (which hosts a web service, containing the granular service for logon etc.) is developed using standards and open interfaces, in this case web services was chosen as the implementation technology. Once the customer receives this registration page, the customer needs to enter the applicable Directory Number (DN) number as captured within the billing platform during the purchase of the IPTV service. The DN number is captured by the ELS and a lookup is done on the external billing platform to authorize and activate the IPTV service. To illustrate and test SOA’s service interoperability it was chosen to run the billing platform and the IPTV platform on different operating systems, different databases and different application languages.

Adhering to the service contracts it was possible to integrate these systems to each other seamlessly and extract the business processes from the components. Once the billing platform has completed the lookup for the customer (based on the DN), it will then return with a success message to the ELS which will then activate the billing for the customer. The next step in the business process is to create the customer within the IPTV platform. An internal account is created for the customer on the IPTV platform by mapping the customer set-top box GUID to a valid account number within the billing platform. The ELS then signals the IPTV platform to reboot the set-top box.

![System Process Flow – Self Provisioning](image)

The boot-up process is repeated, but since the set-top box is now provisioned within the IPTV platform, once the set-top box connects to the IPTV platform, the set-top box will now be recognized as a provisioned set-top box with a valid internal account within the IPTV platform. The IPTV platform will now start to stream content to the customer instead of breaking out to the ELS for provisioning of the set-top box.

V. CONCLUSION

The case study discussed in this paper is only an example how to use the NGOSS to guide a Service Orientated Architecture implementation. This case study illustrated the ability to separate the resource layer from the service layer (as defined by eTom). By adhering to the TNA framework, it is now possible to replace any of the systems within the specified architecture, without changing the business
processes, i.e. adhering to the well defined contracts of the services. SOA also enables the automation of the business processes. The automated process reduces human intervention and interaction with the systems, thus not only reducing operational costs but also ensuring a higher level of data integrity among these systems [5].

REFERENCES

W.H.A. Senekal is part of the Managed IP Services (MIPS) group within Telkom SA. He obtained his B.Eng. Electronic Engineering degree at the University of Potchefstroom. His main focus in MIPS is the automation and optimization of processes within the IP domain.

A.J. Graaff is part of the Managed IP Services (MIPS) group within Telkom SA. He obtained his M.Sc. Computer Science degree at the University of Pretoria. His main focus in MIPS is the data integrity among systems in the IP domain.

J.J. Davis is also part of the Managed IP Services (MIPS) group within Telkom SA. He obtained his B.Tech. degree at the Tshwane University of Technology. His main focus in MIPS is online charging and billing in the IP domain.