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NGN Service Management Using CBR Approach

S.M.F.D Syed Mustapha*
Faculty of Information Technology
Universiti Tun Abdul Razak
Selangor, Malaysia
Email: *smfdsm@yahoo.com

Hui Na Chua
Faculty of Science and Technology
Sunway University
Selangor, Malaysia

Abstract—**Next Generation Network (NGN) services have been the focus to the researchers and practitioners as the new converging paradigm of IP-based telecommunication and Information and Communication Technologies (ICT) services. Even though, fundamentally NGN services have some common to web services mainly on the service composition, service discovery, service creation and service delivery, NGN services pose a more complex environment in its service management. The reasons are due to diversities in the communication network protocols and communicating devices, session control between subscribers and IP-based multimedia applications, to list the few. This paper suggests Case-based Reasoning (CBR) as the approach in managing the complex environment of NGN service layer by describing the profile of the service process, NGN environment and service execution. The approach presents several benefits that CBR can offer to be the suitable method through the introduction of service matching mechanism.**

Next Generation Network Services, Case-based Reasoning, Autonomic Computing, Intelligent Systems

I. INTRODUCTION

Literature has shown great interest among the academics and practitioners in developing mechanism for automation in the web services. While the web services are less complex in comparison the NGN services, the academic and industrial reports do not rule out the challenges that the researchers have encountered in developing the method as well as implementing the service automation in web services. The lessons learned from these works are the methods and approaches which can be extended to handle a larger scale environment that NGN services may require.

NGN architecture comes in various forms depending on the converging network architecture that it proposes. The convergence varies as currently there are several network types such as Public Switched Telephone Network (PSTN) network, Circuit Switched - Public Land Mobile Network (CS-PLMN) network and Internet Protocol (IP) networks. For this reason, it is quite complex for us to consider and predetermine all possible service execution and devices that may involve in the entire service operation. Hence, the effort to chart all possible execution paths in order to govern the entire operation is an impossible task. Unlike in web service environment, NGN service management may involve a user experiencing wide ranging protocols throughout the navigating NGN services. A user begins with using Google calendar to set his appointment schedule. Through IP Multimedia Subsystems (IMS) network, the appointment is synchronized with its capabilities to detect the presence of a person. If a visitor makes a call to his office through his Voice-over-IP (VOIP)-based phone, it will automatically route to the Instant Messenger for text-based communication. In addition, the visitor may receive an SMS to inform the unavailability of the person and make suggestion to proceed for instant messaging communication. This is a simple scenario of possible NGN services; one could imagine a more complex one would require a combination of several web services, IMS capabilities in detecting the multimedia accessibility and activation of external communication media such as IPTV, Session Initiation Protocol (SIP) phones, Skype, video feed, PC etc.

In the context of web service, Limthanmaphon and Zhang [1] had emphasized the use of CBR technique for the web service composition. The precompiled composition using the past cases of the web services would enhance the composition capabilities, reduce the composition time and subsequently allows automation. CBR is a known reasoning technique that is suitable for recommending solution where decision model is uncertain, context-dependent and solution is multifaceted. In this paper the same argument will be used for NGN environment due to its infinite possibilities of service composition such that it is proposed that services are stored as cases which are built over the time. Hence there is a need to introduce the mechanism of self-building service case which is capable to build new and modify the present case as new case and also adapting the present case if the given solution is reusable.

This paper presents in Section II, the NGN and IMS architecture to demonstrate the three-tier architecture and the interactions between them, in Section III, Case-Based Reasoning and finally the proposed CBR for NGN Section IV.

II. NGN AND IMS ARCHITECTURE

A. *Introduction to NGN*

Next Generation Network is a convergence evolution between telecommunication technology and information and communication technology such that NGN services and application can be delivered and accessed regardless of the underlying network architecture. In NGN environment, all media and services are operated in a single IP network. There

[1] Current address: School of Information and Communication Technology, Asia e University, Kuala Lumpur, Malaysia

are many literature discussed on the convergence aspects of several types of network such as NGN with integrated and IP convergence [2].

In our proposed research work, the main assumption is that the complete framework of NGN convergence architecture as deliberated in the literature is in place where fixed, mobile , IP-based networks are seamlessly interconnected [3,4]. Even though it may seem complex, conceptually, NGN can be modeled in two stratum, i.e. Service Stratum and Transport Stratum as shown in Figure 1.

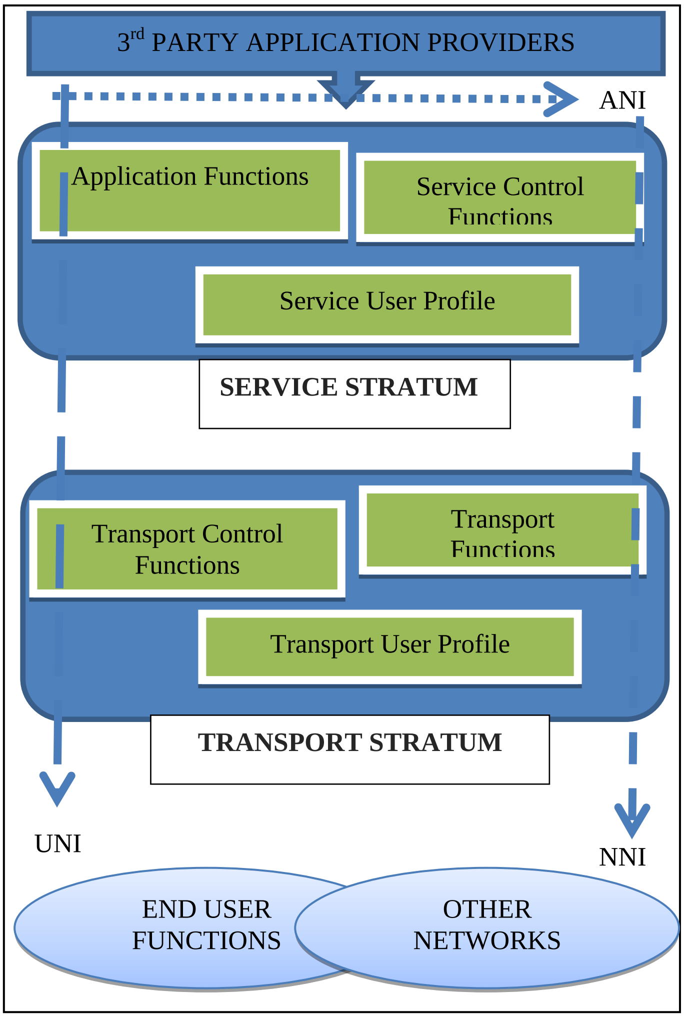

Figure 1. NGN functional architecture

NGN functional architecture describes a simplified view of a complex NGN architecture based on its function. The separation offers the independencies of service delivery method and media format to the available transport mechanism and capabilities [5]. For example, in the present situation Instant Messaging between two individuals is made possible even if they are connected to WiFi from different network devices, smartphones or PCs. However, what are the possibilities that text messaging could take place between two individuals who are on different legacy networks, SMS using the Short Message Gateway and Instant Messaging which is IP-based network. NGN advocates this possibility using the IMS which has been much discussed by researchers.

NGN core network has three major interfaces with user, other network and third party application. The interfaces offer a standard messaging and communication mechanism which provides interoperability functions for various 3rd party NGN applications, services and network technologies. ANI (Application Network Interface) provides the interactions between the 3rd party applications and NGN component. It offers capabilities and application functions needed for these applications to leverage on each other in realizing a complete NGN application services delivery. This subsequently allows an open environment for the 3rd party to produce and consume the applications via ANI.

NNI (Network to Network Interface) intermediates the communication between networks which enables the integration of external network to NGN architecture. In reality, NGN architecture is expected to be engaging with legacy network or any other non-NGN compatible network. UNI (User Network Interface) provides user functions for the users and 3rd party application developers in provisioning the communication among them. The user functions are among the value-added services that are provided to increase the users' accessibilities to applications via UNI.

At the service stratum, there are two main functions which are Application functions and Service Control functions. Service Control functions perform the registration and resource control as well as authentication and verification for both session and non-session control at service layer. Application functions perform at application for application's registration, authentication, authorization and also providing gateway to non-NGN application. Application function allows APIs from trusted and non-trusted application to be accessed and used as the enhanced application services. User Profile manages the user who may be using mobile or fixed equipment without any restriction and also it assists in mediating the access to the transport functions through UNI.

At the transport stratum, there are two main functions which are Transport Control functions and Transport functions. All devices are connected through the transport layer function. Transport functions have four sub-functions which are Access function, Access Transport function, Edge function and Core Transport function. Access function manages the access technology which are connected to the NGN network such as Digital Subscriber Line (DSL), wireless, Ethernet, satellite etc.

Access Transport functions carry the information across the network to manage the QoS (Quality-of-Service) such as packet filtering, buffer management, queuing and scheduling, marking, policing, shaping, gate control, traffic classification etc. Edge functions are used to manage merging traffic from various networks connected to the core network. Core Transport functions are responsible to carry the information through the core network for the purpose of managing the traffic mainly on the QoS mechanism such as buffer management, scheduling and queuing, packet filtering, gate control and firewall.

Transport Control functions has two sub-functions which are Network Attachment Control function (NACF) and Resource and Admission Control function (RACF) [4]. NACF provides initialization of end user functions for accessing the NGN services and register the access level. It performs dynamic provisioning of the IP addresses on user equipment,

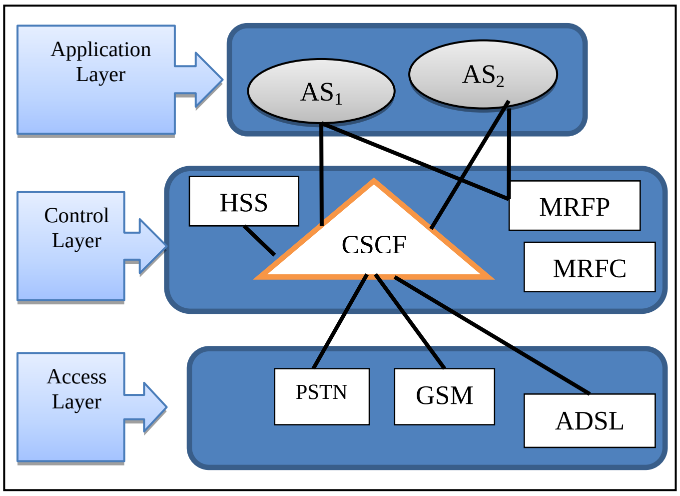

Figure 2 Simplified IMS architecture

endorsement of user, authentication and authorization, network configuration and location management. It interacts with Transport User Profile in building the functional database which contains the user profile and the control information. RACF mediates between the Service Control functions and Transport functions based on the Quality of Service (QoS), Service Level Agreement (SLA), Network policy and service priority.

This section describes briefly the management of NGN network through standardization and interfaces to allow interoperability among NGN compatible and NGN non-compatible network and devices. This is significant study for our research in determining the autonomic in managing the NGN network and services.

B. Introduction to IMS

IMS (IP Multimedia System) has strong association to NGN and sometimes it is called multimedia NGN as it has the same architecture separating transport layer and service layer [6]. Many literatures are available to provide introductory and hence we only discuss briefly here. IMS integrates mobile and fixed communication technologies and internet technologies as a single network that operates seamlessly. It supports multiple services, multiple protocols and multiple accesses of communication network and devices with provision that they are IP-based and in QoS compliance. IMS has three major layers which are application layer, access layer and session control layer. At access layer, IMS supports access from both mobile network such as GPRS (General Packet Radio Service), GSM (Global System for Mobile communication), EDGE (Enhanced Data rates for GSM Evolution), WLAN (Wireless Local Area Network) and fixed line such as ADSL (Asymmetric Digital Subscriber Line), DSL and cable network.

Leveraging the SIP protocol, IMS allows inter-network communication between mobile and fixed line and auto-switching of the communication protocol in a real time environment without any service interruption. For example, one using VoIP and video teleconferencing over GSM network while driving in the car could switch to telephony application running on the PC when one reaches home using WLAN.

SIP is built in server in IMS architecture that controls the session between users who subscribe to the HSS (Home Subscriber Server) through CSCF (Call State Control Session) which performs end-point registration and routing of SIP signaling messages to the application server.

Application layer has three major components which are Application Server (AS), Multimedia Resource Function Controller (MRFC) and Multimedia Resource Function Processor (MRFP). MRFP processes the media content towards adaptation to the intended media format such as real-time transcoding, converting text to speech, video and audio streaming as well as non-telephony services (such as push-to-call). MRFC controls the media stream resources, manages information and communication from AS to CSCF. Figure 2 depicts the general architecture of IMS (Note: the function names may vary depending on IMS technological adoption).

III. CASE-BASED REASONING

Case-based reasoning has been one of the prominent approaches in the field of artificial intelligence for diagnosis, planning, error detection, fault management etc. It offers several advantages which are the followings:

i. Handling new problem – the adaptation capabilities allows new cases to be handled by comparing the past ones and measures the similarities to perform an adaptation to the solution.

ii. Maintenance – new knowledge can be created and built into the existing case library for the unmatched cases in a rapid manner since the knowledge is indexed for fast retrieval rather than structured as in rule-based approach.

iii. Scalability – knowledge is presented in a structured manner as an independent case of individual problem and solution such that building them in large scale is not directly proportionate to the development time of each case.

iv. Complexity – knowledge is presented with key features that are unique to differentiate the cases for retrieval. The key features can be assigned weightage to signify the importance for a specific problem situation. Key features can be categorized to different types and classes of the situation.

Case-based reasoning is highly considered for the automation in the next generation network considering the following reasons:

i. Formulation of the problem – NGN [7] poses complex problem in which the solution is difficult to be formulated in advance.

ii. Unknown network elements and components – in actual environment, the user's devices and equipment, network types, applications services are not known at design stage and the information about network elements and components' availability change dynamically over the time.

iii. Cross boundary – in actual environment, problem is not restricted to certain layer in the NGN/IMS architecture and the problem may involve more than one layer and the combinatorial of them. Hence, there is a need to look at across the boundary of the layer, physical and non-physical categorization, functional and non-functional aspect in managing the knowledge structure [8].

A. Related Work

In the literature there are few attempts towards building solution in managing the network problems in telecommunication industries and mainly in network management. For example, in fault management, several AI techniques have been resorted for different purposes in the area of network fault management. Neural Network is used to predict and monitor the potential threat in network security and failure based on several prediction models. Expert system is used to capture the shallow knowledge of the expert in diagnosing fault based on the previous experiences. BBN (Bayesian Belief Network) is used to build prediction model based on the correlation factors and probabilities of events. Our argument is that none of these AI techniques is suitable for our consideration. Neural Network is suitable to model unstructured data but it requires maturity in its data sets which is usually called training data set. The training data set represents the most general situation of the problem in which models can be built upon and tested on new data set for finding the best fit model that can be used for prediction. The training data set requires many events of similar characteristics in which the outcome are the same based on certain adopted solution. This technique is suitable for speech recognition, hand writing recognition, fraud detection and others that data set can be regenerated in a sizable amount for training purpose.

In NGN environment, the situation is contrary to this requirement since there will be many isolated cases which are insufficient in numbers that can be used for training. However, the isolated case is considered significant even though small in numbers. Expert System is suitable for solving domain-specific problem and usually single expert is consulted as the main source in building knowledge base. Expert System uses basic knowledge representation scheme such as frames, semantic network and rule-based system which is not suitable for problem that is cross-domain like in next generation network (refer to our reason on Cross Boundary). BBN is built on the dependency graph which is constructed based on the belief of one event to occur as a result of one or more events that already had taken place. The belief is determined based on the probability of the events. BBN is suitable for problems in which the domain knowledge is static as the cost in modifying the dependency graph is rather high and impractical. BBN is usually used in medical and engineering problems since the knowledge domain is unlikely to change. This contradicts to the telecommunication problems where the problems are not only confined to the technicalities of the telecommunication infrastructure and software applications but also non-technical issues such as government regulatory, business demands, consumer behaviors and workflow process which are subject to change on regular basis.

As a result of this, two major attempts have been made as reported in the literature towards building the automation in the network management in the field of telecommunication. The first one is building the domain ontology for telecommunication service by Qiao, Li and Chen [9]. They have built 430 telecommunication services-related ontological concepts and terminologies with 245 properties. Ontology allows knowledge to be built across the sub-domain which is suitable for telecommunication problem. The ontology is structured into common ontology, domain ontology and application ontology. Hence, the scope of the domain is defined to cover the network type, network carrier, billing policy, user terminal, service quality, service customer, service category and etc [9](pp 185, sect 2.1.1, line 8 – 9). The domain ontology is further developed into several more sub ontologies which are terminal ontology, network ontology, service role ontology, service category ontology, charging ontology and service quality ontology. Even though ontological approach is best as it could handle multiple domains compared to other AI approaches previously mentioned, it has maintenance issue. The author has acknowledged that the maintenance is the major issue in ontology as it has to be maintained to ensure it is in tandem with the technological growth in the telecommunication industry. NGN and IMS have not reached maturity that the ontology needs appropriate maintenance mechanism. As such the authors had emphasized on ontology integration (through equivalence mapping or subsumed) and reuse. It is believed that the burden in building the proposed ontologies are made as community effort in which the ontologies will be integrated and shared.

Another work by Farha on her PhD thesis was her initial attempt in building Autonomic Service Architecture [10]. Even though the proposed architecture is robust and promising but it has been admitted in the finding that it will take a long away before it can be materialized. The initial attempt took P2P as operation model for distributed computing and service oriented architecture as the basis for building autonomic service environment. What is learned from the thesis is that, building architecture for autonomic service requires a holistic approach to understand the overall operations which involve wide-ranging aspects includes charging mechanism, service delivery and provisioning, service layer agreement, resource management and others which is practically a challenging approach.

Both approaches in building ontology and autonomic service architecture require an overarching understanding of the entire service operation which can be daunting task due to lack of standardization, dynamism in its operating model, and unpredictable environment. For that reason, researcher has attempted to use Case-based reasoning in the field of autonomic computing so called "self-healing" service delivery software systems [11]. Self-healing problem has the same basic requirements with autonomic computing that it must have the ability to monitor its own performance based on the prescribed objectives, to make analysis on the problem in order to identify the gap, to construct remedial planning and action and finally to execute the plan. Montani and Angalo have demonstrated the method of self-healing using case-based reasoning [11]. Case-based reasoning has also been applied in other related problems in autonomic computing such as self-configuration (enabling self-configuration in autonomic system by Khan, Awais and Shamail [12] and service composition [1]. Hence, the research work reported here is to explore the use of Case-based Reasoning for the management of NGN network based on its architecture and operation aspects.

IV. CBR FOR NGN

The fundamental CBR life-cycle is known to researchers who have adopted the technique for different applications and the illustration shall not be repeated here. However, problems in NGN environment are different compared to other applications, that we postulate the problems are detected and diagnosed partially via human intervention and network management software tools. In most CBR applications, the problems are attended by the human experts and the problems/solutions are captured and stored as cases. In NGN environment, the NGN components have the built-in monitoring and diagnostic mechanism that allow self-healing. For this reason, not all problems have to be addressed by CBR or require human expert's intervention. The purposes of having CBR for NGN environment, are redefined as follows:

i. Process Modeler – building case that captures a complete scenario from system error detection, system and business workflow and also business and user requirements. CBR builds the cases from the actual experience on real time basis as processing of knowledge building. This is required since processes in NGN environment are multitude and could not be pre-determined by merely human expert.

ii. NGN Service Recommender – the services are captured as "success" and "failure" in the case. The failure could occur at service or transport layer due to service unavailability or application error. Hence, CBR shall search for the cases with similar business or user's request and determined the cases with "success" factor and prioritize them based on the value of similarities. The cases will be selected as potential cases that can be considered as solution. For example, few application services may be available for payment system but CBR will select the one that matches QoS requirement. This is different from traditional CBR where only successful cases are kept in the case library.

iii. Network Manager – case contains the workflow which describes the NGN elements, activities, sequences and processes that are referred in order to formulate strategy for execution. The Network Manager determines the relevant CBR based on the nature of the problem. The detail description on how case is managed is mentioned in Section IV.

Many of the approaches require single CBR engine to handle the entire reasoning process. Since NGN setting is complex, a CBR engine is assigned at each layer of the NGN architecture to handle cases relevant to its layer and a global CBR engine for interlayer cases. The separation also allows cases to be indexed and managed within its layer called local CBR engine (LCE), while the cases crossing more than one network layer will be stored at Global CBR Engine (GCE). The LCEs are mediated by the Case Manager (CM) who will trigger the respective LCE to attend to the case. The CM performs simple syntactic and semantic analysis on the case which is presented in textual form. The details of the operation as described in the subsequent subsections.

A. Modeling Case

A case is represented in two parts which are the problem and the solution. In the traditional CBR, case is handcrafted by a knowledge engineer who recorded the problem and solution during the process of problem solving. For NGN environment, the creation of the problem case has to be automated. Case creation is not an easy process when it comes to automation as it requires an understanding of the problem, selecting the key features of the problem, generating text to write the story about the case. In order to handle this situation, the case problem is presented with error code generation which is commonly found in most network management software. To illustrate an example, the Internet Control Message Protocol (ICMPv4) has the following segment structure as shown in Table I.

TABLE I. ICMP SEGMENT STRUCTURE

Bits	**0 - 7**	**8 - 15**	**16 - 23**	**24 – 31**
0	Type	Code	Checksum	
32	Rest of Header			

Type – ICMP type
Code – Subtype to the given type
Checksum – Error checking data
Rest of Header – four byte field

Example of the Type could be Destination Unreachable, Source Quench, Redirect Message and each code is numbered and it is denoted with description such as Destination Port Unreachable, Source Route Fail etc. Problems can be determined based on the non-compliance to QoS or SLA (Service Level Agreement). For example, in service quality monitoring, the network management software could trigger command to capture some QoS related information such as Round Trip Time (RTT), Packet Loss, Latency between Packets, Type of Service, Delay, Bandwidth out and in, Result of Verification and Result of Correction which can be done automatically. Beside the error code information, the workflow is another piece of information that needs to be captured. Workflow contains a series of activities and control flow structure that determines the path of the unit activity. Each unit activity describes the list of tasks for execution Workflow can be captured in real time manner and stored as a case.

A workflow can be presented as the "successful workflow" and "failing workflow" by determining the output of the workflow. The "failing workflow" is kept as future reference under the list of cases to be avoided. Workflow can be represented using Finite State Automata (FSA) [13], a graph where each node represent the activities followed by controlled-flow-structure [14]. BPEL is workflow language that was used to describe workflow for web services [15]. The other classical methods that could be considered in modelling the workflow are such as Petri Net [16] and Workflow Net [17]. The workflow modelling is not discussed in detail in this paper since there are many past works that had been done as discussed in the literature deliberating the methods and approaches.

The third consideration in case modeling is building the scenario. Scenario describes the application scenario of the business and user's request. The ability to capture key features of the scenario is important as they are used as unique identifiers in retrieving similar cases based on similar business or user requirement. For example, a user who is making an international call through mobile network passes through a WiFi-enabled zone will be prompted with the option to switch to use IP network to continue the conversation. The key features are the requirements to switch voice protocol from GSM network to VOIP, to check the mobile phone is WiFi ready for both caller and receiver before connection is established and what are the unanticipated problems. Theoretically, the switching should be seamless as IMS has the ability to control the session and manage the switching automatically. In reality, this is not always the case as there may be delayed in response to the server's request or other network instability. The network errors usually that are captured in ICMP are self-generated. Other symptoms are also being detected from the non-compliances to the SLA which is auto-detected based on the existing software that is designed to measure the performances. For this particular example, if the switching is not successful, there are few possible technical reasons which range from user's device to the IMS server configuration or network availability itself. Some of the problems at user's end can be fixed automatically depending on capability of modern operating system such as to enable the WiFi function. While in other situations, there is a need to inform network administrator to manually configure the server, for example, to inspect whether the user profile has subscribed to the requested service.

In NGN environment, a single problem could be due to one or more related or separated symptoms that could be addressed by the system automatically or manually attended by a network administrator. The variations in the symptoms could lead to variations in the solution. Cases are built for all of these problems, symptoms and solutions where the problem could be

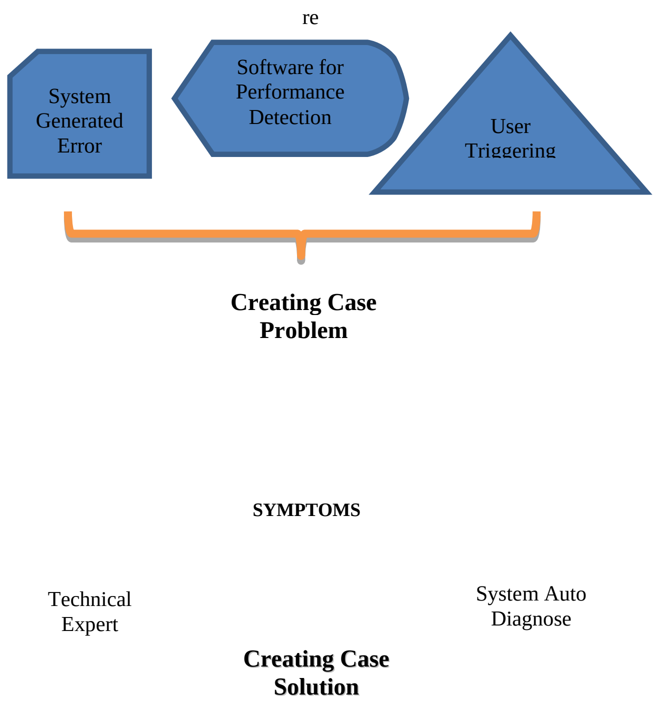

Figure 3. Problem Identification and Case Building

indexed to uniquely identify the problem. The technical support could view the problem, symptoms and solutions for further investigation to rectify the problem in which if new solution is adopted, new case will be created. The entire process of case building and management is shown in Figure 3.

The three sources of identifying the problem are from the system generated error messages, non-compliances to SLA detected from the network software or the users who triger the problem. The sources provide the symptoms for the technical expert review or the symptoms can be addressed by the diagnostic tool made available. The case solutions are built in semi and fully automated manner depending on the level of human intervention required in solving the case.

B. Reasoning with Local and Global CBR Engines

Unlike in traditional CBR structure, NGN requires separation of CBR engine that deals with local problem and interlayer problem. The separation allows the case format to be different between the local and global CBR engine due to different information needed to be captured as key features. It is proposed that each local CBR engine is assigned to a function-specific component in the NGN architecture as shown in Figure 4. The symptoms to the problems are gathered based on the business/user requirements or network messages that are generated from the network management software. The case manager determines the adequacy of the symptom once the collected symptom matches with one more cases. The symptoms are analyzed to determine the nature of the problem in terms of which layer that is more involved and the NGN component (e.g. NGN equipment, NGN application etc) in order to select the LEC.

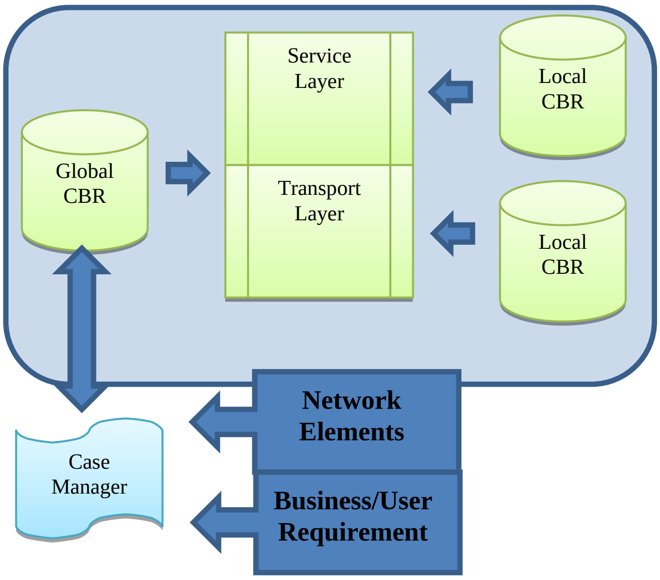

Figure 4 Schematic diagram for Local and Global CBR

Figure 5 shows the steps to identify a case. Step 1, ζ is a collection of symptoms from Business/User Requirements (BU) and Network Elements (NE). c is a case with a set of key features, f_i. Step 2 states that for all cases, c, in case library, K, there are key features, f, in case/s and there are cases c such that the number of symptoms in ζ and number of key features in c overlap larger than the ε value. The ε value, is an adjustable value as set by the system designer to manipulate for higher or lower matching requirements. Step 3 describes that if the number of key features in c inclines towards service layer (SL) then activates LCE for service layer and similarly, activation for LCE for transport layer. In Step 4, within the selected cases, the case with the highest similarities (i.e. above the σ threshold and Ψ is similarity measure function) will be considered as reference for solving the problem.

The steps shown in Figure 5 assume that there exists at least one case that would match with the symptoms. In reality, the assumption is not always true as the factorial of possible cases is infinitely large that it is impossible to build a complete K case library. The new case is continuously built when no existing case is available. In determining a case, a serious consideration to be given is to be able to find the differential value between two cases that warrant a new case to be created or otherwise, an adaption process to the solution. In Figure 5, the statement in (1) from Step 2 can be used to identify the degree of similarities between the symptoms and the available cases such that if ε value is small, the subsequent step in searching for cases will be suspended.

$$\eta\left(\left(\bigcup f \in c\right)\bigcap\left(\bigcup s \in \zeta\right)\right) \geq \varepsilon \qquad (1)$$

1. *Given* $\varsigma_{BU} = \{s_1, s_2 \ldots s_n\}$ *and* $\varsigma_{NE} = \{s_1, s_2 \ldots s_n\}$ *where* $\zeta = \varsigma_{NE} \bigcup \varsigma_{BU}$.
   Given $c = \{f_1, f_2 \ldots f_n\}$ *where* $f_j \neq f_k$
2. *For* $\forall i$, *find* $c_i \in \mathrm{K}$ *where* $\exists\, f \in c \wedge \exists\, c$
   $\therefore \eta\left(\left(\bigcup f \in c\right)\bigcap\left(\bigcup s \in \zeta\right)\right) \geq \varepsilon$
   Given $\eta(c)_{SL} \in GCE$ *and* $\eta(c)_{TL} \in GCE$ *and*
3. *if* $\eta(c)_{SL} > \eta(c)_{TL} \Rightarrow activate(LCE)_{SL}$ *else* *activate* $(LCE)_{TL}$
4. *for* $\forall i$, *find* $c_i \in LCE$ *where* $\Psi(c) \geq \sigma$

Figure 5 Steps to identify cases

If the ε value is sufficiently large for further searching of cases, the similarity function has to be able to discriminate the cases by the key features that are categorized into three sections which are system generated input, network management software and user input.

V. CONCLUSION AND FUTURE WORK

Managing automation for NGN services pose great challenges due to varieties with the network types, network protocols, network elements and business processes such that managing NGN environment is much more complex than merely web services. We propose the use of CBR approach to handle the increasingly complex environment in NGN services after the comparison with other AI techniques that have been used for automation. There are three new attempts in the approach of using CBR which are, first, to store the "failing" and "success" cases as the former suggested cases to be avoided while the latter are the useable ones, second, to use local and global CBR and hence, it is required to have the ability to segregate the cases by the functions that they serve, thirdly, the semi-automation of problem case formulation. In the first attempt, the new techniques have to be introduced in terms of indexing the "failing" and "success" cases, building the searching space and measuring the similarities of the cases as this is not common in traditional CBR. The second attempt requires the new mechanism to manage two sets of cases which are used as local and global CBR in terms of matching the real world scenario to the available cases, identifying the relevant key features for the local and global CBR and determining the method to measure the similarities based on different sets of key features. The third attempt is the complex one as the case is built based on automated and semi-automated case building. This requires new technique in the case building automation as in NGN environment, the network elements are not definite, the number of problems is a combinatorial of the number of network elements, business processes, user requirements and network and communication problems. A detail study of the case building automation for non-deterministic environment poses an interesting research work in future. The paper intends to lay down the essential aspects of the implementation for NGN service management in which it concludes that CBR is the proposed solution given the reasonable arguments and also illustrates the CBR architecture and steps for case selection which are the contribution of the paper.

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