A Framework of Service Selection and Composition for Flexible Network Architecture

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Abstract. Internet becomes a back bone of the communication network in the current era. People are very much dependent on the internet to connect from one end to another globally in todays environment. Internet suffers from the problem with the tightly coupled layered architecture. So there should be flexible architecture of internet. Flexible architecture will reduce the tight coupling of the layers. Selection of service and Composition of service is also an issue which will be solve through our framework. So we propose a framework of flexible network architecture which will provide flexibility to user for their application. This framework has many advantages like availability of services, load distribution, service discovery through the cloud technology. Cloud has a group of nodes which will act as single node to discover service and provide a service .It is a capable to create a mirror image of the broker node. Flexible network architecture is a combination of blocks. These blocks are functional module. Our framework will maintain also performance of the network.

Keywords: Future Internet, Service oriented architecture, Flexible network,Cloud management,Service selection and composition.

1 Introduction

Nowadays Internet is a well known term in the communication environment. Internet plays an important role as a medium to transfer the information from one end to another end of the world. In the current real communication, internet plays a role as a back bone and use to connect the entire world. Today in fast growing environment people are dependent on the internet to perform a various task such as information gathering, searching, resource sharing, software, audio, video data, selling and buying a goods like books etc. Internet provides a platform to develop a new thing such as software, instruments, architecture etc. which will be fruitful for the society.

In 1985 internet was a collection of 50 sites and 1000 nodes approx [1] to connect the group of people and researchers but today internet spread itself with very fast growing speed due to its characteristic. Billions of user depends on the internet as a logical resource. So it is responsibility, today's present researchers that all resources must be available, up-to-date, fault tolerance reliable. All these important factors can affect current architecture of the internet. Current internet

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architecture has various advantages but there is also some limitation. Current architecture of internet is layered architecture, one layer depends on other adjacent layer. In layered architecture upper layer use the service of lower layer and vice versa. Header format of the packet is also another overhead of the network which consumes the extra bandwidth to transfer the information.

Layered architecture is tightly coupled from each other if any change is perform in one layer then there must be a change in the adjacent layer. Always it is difficult to change in the functional module of all layers. It will increase the complexity in modules of the layers. In the current Scenario people thoughts, way of thinking and requirement dynamically change with fast growing speed at technological level. In layered architecture every time to fulfill the requirement of people is not easy because it require changes in every layer. So some researchers suggest an idea of loose coupling to remove these problems from the layered architecture. There is no need to change at every layer when user will perform the change at any layer of architecture. So they propose a new architecture after realizing these problems of layered architecture which is a loosely coupled architecture. It is also known as today's Flexible network architecture [16].

Flexible network architecture [22] is a block wise information exchange communication system. It is based on the loosely coupled approach that is a reason to say the flexible network architecture. Service oriented architecture is defined as a loosely coupled system. Flexible network architecture provides a facility to change the function or extend the function of module and there is no need to modify in the adjacent layers. Users are facilitated with flexible network architecture to do the modification according to rapid change at technological point. Future internet [27] is rich from the components (module),these components can be a procedure, structure of data etc. Future internet is very much useful for the future application. Modules in the future internet is described as block and these blocks are collection of functions. These services are used to perform a task which will select the users. Service oriented Architecture principle is helpful to remove the rigidity of the current network architecture.

Why Redesign the Network Architecture?

* The goal of network design is to improve the performance of network architecture [20], flexibility of user and selection of a service to complete the requirement of application. Service model is a solution to complete the requirement of application. Design of network architecture is crucial issue because various type of questions will arise such as:

- What should be the parameter?
- Why we should change the architecture of existing one?
- How we will evaluate the performance of network architecture?
- Which type of architecture will be feasible to fulfill the requirements of new application?

There are various other important Parameters on which network architecture will evaluate like speed, delay, packet loss, availability, reliability, flexible to select a service etc.

Issues in Future Internet

Internet architecture was developed some years ago to provide a communication between the people but in current situation it has changed the shape of modern society. In the past there were less user, whose requirement were fixed but the present scenario has witnessed a change. Users demands are also increasing along with the growing population and education. There are various issues [25] which can be come in the future. Some issues are present and some will arise in future. Flexible network architecture can play an important role to solve theses issue which are given below:

- Processing power.
- Service impact on the network.
- Security.
- Context and location awareness of service.
- Mobility.
- Addressing scheme.
- Multimedia support.
- Heterogeneity.

1.1 Impact of Flexible Network on the Global Environment

Today good investment is not only reducing the cost at operational point, there are also various points for eg.reducing the management challenge, technology cost and energy consumption. Flexible network architecture can give a good result on the IT industry. Every organization needs the deployment of product, its services and use with very fast speed in current scenario. This will help to cut the investment of organization in terms of maintenance and management. When organization will monitor the cost then it will be easy to validate at architectural level. These are the reasons to validate like:

- Enhancement of resource sharing capability.
- Service and components are reusable.
- Interoperability between heterogeneous components.
- Integration of system at application level.
- Services are manageable using cloud technology.

All above things will be beneficial to improve the performance of organization and help to cut the budget of investment. Theses all reasons will affect the society in future directly or indirectly.

1.2 Technological View

Current Internet Architecture has various major issues which can be resolved with the Flexible network architecture. Loose coupling is a method which has been used to resolve the problem [26] of tightly coupled architecture. Loose coupling is a characteristic of Service oriented architecture. In this architecture there are three entities Service Provider, Service consumer and Service broker. Service Provider provide a facility of available Service, Service Consumer Send a request to consume the Service and Service broker provides information of available services. There are instances when services broker suffers from many request at the same time, Broker can be off due to failure of hardware or power. Service provider may also suffer from the same problem. These are the major problems related to the availability of t resources.

From the above study, the major issues essential for optimal procedures are:

- Efficient Service discovery using broker.
- Providing Fault tolerance broker mirroring and peer broker.
- Load balancing among the Peer broker and service broker.
- Auto configuration of peer broker during very high load period.

2 Related Work

Till now Service selection and service composition, availability, service discovery and delay management [24] are challenging in flexible network architecture. There are very few research suggestions present to address these issues till date.

Flexible network architecture is shaped to solve the problem of rigidity in layered architecture. Very few researchers discussed the issue of internet architecture. Scott Shenker [1] has been discussed some issue of current internet architecture will arise in future. Internet should accept a new service model, various other issues also covered [3]. What will be the cost of framework [19] and options of architecture? MIT Lab projected a research report [2] in which researchers tackle the problems like design of architecture from existing one, process to reshape that etc. In this report researchers discussed that we should work for future not for a a short period of time in order to get a result. Some little modification proposed to resolve the problem for short period of time but it is not a future vision because with these modifications in the current architecture some other difficulty may occur which will be tackled in future. According to the report there must a complete solution but previous solution are dependent to each other like the protocol for application is modified then the application needs to be modified. Service oriented model [5][9][10] gives a facility to select and configure the protocol separately according to the situation. Rudra Dutta et al [6] have suggested an idea for architecture to integrate, organize and optimize the service. In this approach framework is a group of building blocks [15], open control to connect these blocks for the communication and control fundamentals will provide a facility to interact at cross-layer [23]. Holistic concept [25] is used to do the service selection, flexibility of building block according to the

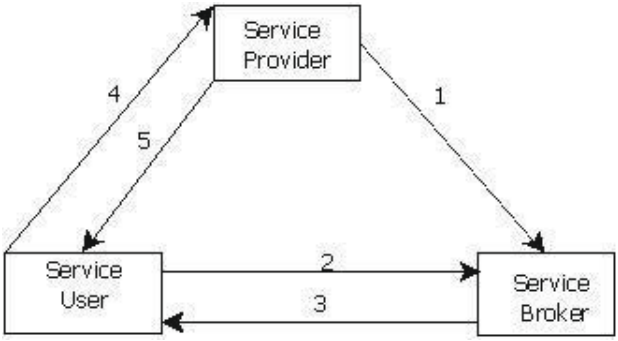

Fig. 1. Service Oriented Model

requirement of application. Flexible architecture can be modified at user end to support internet and integration process is used to solve the security issue with networking stack. Michael P. Papazoglou et al proposed an idea [7] [11] for service oriented environment to join the building block of application. Loose coupling is a key factor for flexibility and dynamic change in the architecture. Service oriented computing environment facilitate user to develop a new architecture.

Mike P. Papazoglou and Willem-Jan van den Heuvel [8] have introduced the necessities of distributed computing with some other factor like standard and loose coupling. To construct service oriented architecture, distributed communication environment and integration of components [30] are highly required. This paper gives an idea of Enterprise service bus which will work as a back bone to connect the different homogeneous and non homogeneous system with its component [21]. Joseph D. Touch et al [10] shows the relation between network architecture and protocol through recursive network architecture. In this paper [31] author provide an interaction with cross layer to sustain dynamic service composition and discovery which will not generate another problem in future direction. Bernd Reuther et al [4] have introduced a model given in figure1. International telecommunication unit presented a report [12] where internet architecture was designed in 1970's with a simplified model to support protocols and its functioning at different layers. MIT Professor Dave Clark in 80s presented an article in which Internet is broken and will appear in future. Various modifications have been proposed to reshape the current network architecture like network virtualization, cross layer design, Security, Reliability etc. National science foundation has invested 20 Million for two projects, these projects are:

- Future Internet Design.
- Global Environment for network improvement.

Many other research communities are also working to redesign the structure of existing internet architecture.

Dennis Schwerdel et al [13] found that protocols have been developed many years ago without keeping in mind todays problem. Previous protocols

configuration and implementation is not easy because of fixed structure. So author proposed a way to select and compose dynamically based on the SOA principle. Thomas Ristenpart et al [14] have proposed an approach to manage the memory and operation on the virtual machine that may be placed in the internal network or beyond it. Paul Muller [17] has suggested an idea to manage the architecture of internet and cloud [29] with the service oriented principle. Internet is software system which is deployed in distributed environment to achieve a goal for future internet [32]. Ivan Seskar et al proposed approach [18] to solve the issues of mobility and wireless access. They provides a method to any cast, multicast, multipath [28] for the application of internet. In this author has implemented a mobility stack of protocol on the GINI platform.

3 Proposal to Major Issue

Many proposals have been give to solve the problems of current architecture of internet. We proposed a framework for flexible network architecture to solve the issue of the existing internet architecture. In this framework we are using the principle of service oriented architecture to provide the flexibility in the layered network architecture. This framework is able to tackle the issue of current layered architecture. Framework consists with various types of services which will facilitate to the internet application. These services provide flexibility to the user select the service as per the requirements. The proposed frame work is given in fig 2.

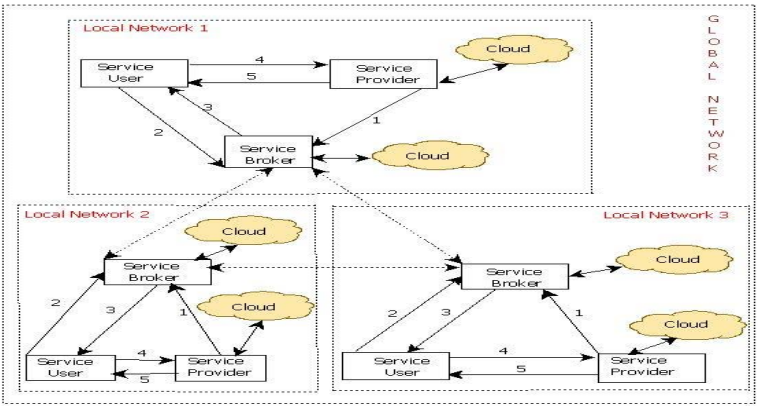

Fig. 2. Framework of Service selection and Service composition

Proposed framework consists of four major modules which are 1.Service provider 2. Service user 3. Service broker 4. Cloud of service. In this framework following process should be follow to get the reply for a service.

1. Service provider will develop a service and register itself to the service broker.

2. Service user will request to the broker through the API to Service broker.
3. If service identification details are present the broker will reply to the user.
4. When user will get the reply from broker then user will request to the service provider.
5. Service provider will reply to the user after execution of request.

Above framework has a facility of service cloud which will manage the services, that is not available at service provider. It is capable to manage the availability of the resources. Availability of Service provider and Service broker will be controlled through the cloud management. Management of service broker is also issue because if broker will goes down then what will happen for request. To manage service broker ,we will use the principle of cloud computing but in the cloud computing, security issue will arise. Security issue can be solved in that scenario through the authorized and authenticated system. Geographical area will also be one of the constraints which can affect the efficiency of network management. Cloud of the system cannot be far away from another service broker. Request of many users at a time will also be handled with the help of cloud computing. If service provider has many requests than its capability, then performance of the service provider will decrease and then it can transfer the request to another service provider of the cloud to balance performance of network . Each system of the cloud has some threshold value according to its hardware and software devices.

Request of the users, if greater than threshold then Service provider will transfer the request to another provider, maintain the balance of execution otherwise Service provider process and reply. So from the above discussion we can say that our proposal is feasible to target the given issues.

Proposed Algorithm

The algorithm explain various phases to find the service which is the part of proposed Framework. In this requester query will be raised to discover the service at broker site. Broker will search the service in to reply the user . User will select the service from list of services and execute at service provider end. Service providers will be reply to user in the form of service. Hence the algorithm will break in three phase .

1. Service provider to Service broker.
2. User to Service broker.
3. User to Service Provider.

Service_id is a unique identification number of service. *Service_list* is the collection of all existing service in database. List is structure type data which consist of address of service provider,type, *service_id* and some other essential parameter. Broker cloud is a function which search *broker_id* of appropriate service for requester.

Algorithm 1. Algorithm of Service selection and composition

▷ Requester to Broker

while true **do**
  if ($Service\_id = true$) **then**
    $list \leftarrow list[Addr, Service\_id, Type, parameter]$ **return** $list$
  else
    Broker_cloud($Service\_id$)
  end if
end while
function BROKER_CLOUD
  list_Broker;
  while true **do**
    if ($Service\_id = Broker\_service$) **then return** $Service\_list$
    end if
  end while
end function

New_service is type of newly developed service which will identified by *Service_id*.

▷ User to Service provider

while true **do**
  if ($Service\_P\_id = Addr$) **then**
    ▷ $Service\_P\_id$ is a unique identifier for service provider
    $execute(Service\_request)$ **return** $Service$
  end if
end while

▷ Service provider to Broker

if ($New\_Service = true$) **then**
  while $New\_service\_type = exist\_service\_type$ **do**
    Add $Broker\_list[] = New\_service$
  end while
end if

4 Advantage of Proposed Approach

A proposed framework is feasible for service selection and composition. It has various advantageous over the existing layered architecture. This framework provides a flexibility to select the service among various other related services. Due to this reason users have options for selection and composition of a best service according to requirements. Framework provides a facility to connect the global environment in terms of services. Each and every user think and perform the things in terms of service on the internet .In this user can change the functional module of service according to requirement on application layer but there is no

need to change in adjacent layer. Framework will support the dynamicity of user and environment to fulfill the demand of users. This framework will remove the rigidity of tightly coupled layered architecture.

5 Conclusion

In this paper we have converse all the issue in our solution. Internet will have various issues in the future, some of them has been discussed in this paper. Our framework is able to handle the issues of the current internet architecture. This proposed framework will maintain the performance of the network and provide a facility to user for selection and composition of a best services according to the requirements of application. So from above discussion management related issue of framework like resource updation, availability and reliability will be solved in future.

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