AN SOA BASED REAL TIME INFORMATION EXCHANGE BETWEEN MILITARY AND GOVERNMENT OWNED RESCUE SERVICES

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ABSTRACT

The purpose of this study is to examine an SOA based real time information exchange between military and government owned rescue services. Information sharing is always not an easy approach for any organization. In case of military and government owned sectors, it becomes more fragile. There should be some quality and well standard approach that can be used for the secure sharing of information. A detailed proposed architectures and real time scenarios have used to clarify the essential need for the proposed architectures. A considerable part is for the analysis based on the standard quality attributes that proves the necessity for the architectures based on use, purpose and scenarios. Service oriented architecture provides the sharing of information with flexible, secure and independent platforms and standards making the military and government own rescue services to share information when needed. Enterprise service bus is used for the transformation of messages to all existing services including in the information sharing. These all concepts work as a base for the information sharing between military and rescue services architecture. The proposed architectures are well formed on the information provided by real time surveys and research including resources from military and rescue services. This information sharing helps to reduce response time and time delays along with security, availability and message processing attributes. These features can help the authorities to save more lives using proposed architecture. This research paper contributes to the body of knowledge about service oriented architecture and proposed that service oriented architecture is best way to share information between military and government owned rescue services.

Keywords: Information management, Service oriented architecture, Military services, real time information management, government rescue services.

Paper Type: Research Paper

INTRODUCTION

Government authorities control the overall activities of a country. They have all rights for controlling and managing the important sectors of a specific country. Military is another major and master sector. It is nearly equivalent to the government in authority. Few armies are abiding
by the rules made by governments while others are not under the influence of any government. However, in both cases sharing of information is needed for the development and protection of a country.

Military sector for any country plays defensive role. They have strict and private rules and policies that they cannot afford to lose at any cost. If so, they have to bear strong consequences of enemy attacks. That is why; they cannot share important information openly. Especially, in the case of Pakistan and India war, the gateway is shared among both countries and online sharing is very crucial. In the changing world, trust and security are the most prioritized functions for both military and government level. It is due to the reason of increased terrorism from past decade. There is always a danger of terrorist threat on both sector’s private information. At this level of information sharing when everything is centralized, the sharing of information between two sectors is difficult and perhaps, no one wants to take risk. Therefore, there must be some other decentralized revolutionary technique that provides exchange of information directly from the sectors permission when agreed. The exchange of information should be independent, secure, reliable and shareable at the same time.

As we know that situations are getting crucial by every single tick of clock for the peace of the world. There is need for government and military to stand together and take positive steps together for the progress and defense of a country. For this reason, these both sectors need to communicate with each other using safe mode of information exchange. For the same reason, we need a platform that provides secure, reliable and independent information exchange to make sure that data traveling is according to the restrictions of both sectors. Another issue is that every department of information has different set of rules. Some can be the same but most of them are different. Mostly, with the change in government or the political crisis, the policies and rules of government change. While the military follows its strict and disciplined rules. Therefore, without changing the overall system of information like we do in centralized, only those sector change its services that is facing some problems.

For all of the above mentioned talk, a question arouses in mind that how this all is possible? We all know that mostly government systems are centralized or some are distributed. This makes data not in safe hands. On the other hand, military is trying to adopt new technologies and approaches to secure their information. Some militaries have converted their systems on the service oriented architecture including NATO forces which is safe, secure, independent and easy to use like NATO. However, still there is need for security for both sectors. To answer this question, we can use the service oriented architecture instead of centralized or distributed or we can convert the existing centralized architectures to the service oriented architectures via following some basics for its development. SOA provides independence, security, reusability and maintainability at the same time. It is based on single service, so that every single department can manage its information at their end without updating whole system. Hence, we can proof that merging both sectors through SOA would be a wise decision. SOA can be helpful for the sharing of cross cultural and cross boundaries information like NATO (Capt.Eng; 2010) forces are doing nowadays. It can be helpful for the management of good relations, development and investment in both sectors. SOA provides synchronization, governance and structural perspective for the easy maintenance of the system. Software development lifecycle steps are used side by side with the SOA development or implementation. They help to provide a structure and synchronization at the both ends of information sharing.
Finally we can say before defining the problem statement that purpose of exchange of information between military and government rescue sector is to built good relationships, managing the quality, provide security, emergency and disaster management for the purpose of life saving and progress to any nation. Along on the top of it, is the life saving at any cost.

The objective is to provide secure, reliable, interoperable, less time delay and high response time and independent medium for information sharing.

This research will provide solution architecture for the “An SOA based Real Time information exchange management between the government owned rescue and military”.

There is still need for some of the common and secure exchange of information modes. It is questions that how much of the services both sectors can share out of hundreds or may be more. The point is there are some services like health, disaster management (Cullen and Barker; 2008, Haubrock et al., 2007) that military is sharing with government and vice versa. However, most of the collaborations are not following the service oriented architecture as a base or the sharing of information.

SOA provides the flexible, independent interoperable ability that can be useful for any sort of information sharing no matter what service we need to share. There is need for the synchronization at both levels for sharing of information. SOA provides the synchronization without depending upon the same platform or interface. This can be useful new way for information exchange.

Rescue management is very important government organization. They tackle uncertainty and accidents and they have to be quick and responsive. However, there by (Cullen and Barker; 2008) is need for such systems that provide facility for the immediate reaction. Oasis is the project of Europe that is currently dealing with the collaboration of military and civil rescue services. The military is providing information and location through SOA on the demand of civil services. These services follow the locations and provide first aid or rescue as needed. However, there is still need for a system that works vice versa like delivering the rescue services on the call of military. Along with that, the Oasis is one room work and it can be converted to distributed properties. This issue can be solved using the SOA at advance level. This will be helpful when there is need for any war injuries or terrorist attacks and direct services can call anybody required. For example, if any military department like logistics needs fire brigade services then they can directly communicate with them.

Strategy management is again important between both of the sectors working with the government. These both can pre define the criteria for the disaster management and provide immediate responses when needed. By making strategies, both of them can tackle accidents better as compare to just calling each other for the help. Along with that, by sharing of strategies, the relations of government and military will become stronger which is very important in the era we are living.

ESB
According to (Thomas and Peter; 2008), ESB is defined as a service provider and service requestor that mediate the services and their interaction for the purpose of communication and exchange of information and messages.

For the proposed architecture, ESB is the proposed technology that is handling the overall exchange of messages and information among all the services from government and from the military end. It is safe, reliable, and rapid and reduces the response time by providing the message transformation properties on different channels at one time.

**WHY ESB NEEDS FOR PROPOSED WORK?**

SOA provides us with facilities to distribute services among different sectors, channels, organizations, departments and units. For the proposed architectures, there is need for various services to interact and communicate with each other at one time. ESB provides them synchronization (IBM) to share information no matter how far and how different are their platforms. ESB provides flow of information and exchange of messages, notification at different services. It provides the setup for interoperability and security. Having these properties ESB is one of the very important SOA technique that let the services work independently and share part of information which is required.

**HOW IT WORKS FOR PROPOSED SOLUTION?**

By gaining the information and background knowledge about ESB (Thomas and Peter; 2008), it is very clear that ESB works as a medium or middleware for the attached services. WS*, XML schemas, SOAP, HTTP works altogether to make ESB a unique message and information sharing technique that performance well, provide security, reliability, reduce response time and delays and is available when needed. There are many existing softwares that can be used for the designing of the ESB as required by the system needs. Some of them are IBM WebSphere, MSESb, Petal and TIBCO etc. protocols and web standards also plays vital role for the communication among different architectures. This property makes the ESB independent from both hardware and software dependency.

ESB act as a medium for proposed architectures. All services share their messages and notifications through ESB. ESB (IBM developers) message and directory bus provides the verification and validation for the services. ESB transfers the message to every service at the same time or rapidly. This feature helps to reduce time delay and response time unlike the wireless and telephonic communication. All attached services can communicate with each other without any restriction within the limits and rights provided to them for sharing of information. Moreover, priorities can be assigned for the designing or communication to make sure that if at one time all services request, highest priority should be deal first. This will make system synchronized and secure. Priorities can also be set according to the policies and rules and regulations of the government services and military.

**MOTIVATION AND SCOPE**

“An SOA based Real Time Information Exchange between the Military and Government Owned Rescue Services” provides the benefits of information share between two most important and major departments for any country. The service oriented architecture is backbone for this system.
as it provides the independence of information share using each other’s services directly when needed. In the current era, the number of uncertainties has drastically increased as the technology is advancing day by day. Terrorism, plane crash, ship drowning and natural disasters are all uncontrolled incidents. However, for saving life of people, there is need for government and military to communicate as quickly as possible to each other. They should make strategies together to fight against such uncertain circumstances. Keeping in mind this reason, the above mentioned research is proposed to make sure that both sectors can provide first aid or required help as soon as they get alarm of some uncertainty. Rescue agencies services like ambulance, fire brigade, and police etc can share their services with military to get guidance immediately about the incident. While military using its intelligent systems and C4I can help them to reach exact locations. This technique goes vice versa in case of military plane crash or in war. Therefore, it is need of time to collaborate these sectors together and service oriented architecture suits for providing the independent architecture at both ends.

In this proposed research, the service oriented architecture technique Enterprise Service Bus (ESB) is used as a mean of providing communication services separately. ESB is used because it is an architecture that let organizations work independently and share information on the request of other collaborated organization. In current era, government really needs to share its information with privacy with military sectors and so is the requirement for military. This helps to built strong relationship between these two sectors for prosper of any country. We know that these both sectors depend upon each other several times. However, current war situations and due to global warming, the ratio of uncertainty had increased. There is need for collaboration among the military and rescue services. In case of any disaster, both can communicate with each other to facilitate and provide help for the suffering people or soldiers. Therefore, the details about these two sectors will be considered in detail to fulfill the need of changing world.

We know that there is strong need for the government and military collaboration and information sharing in every country. The ongoing wars and uncertain disasters are increasing every year. Especially after the terrorist attacks, the situation and war tactics are getting worst. Thousands of people die every day due to such circumstances out of which some die because of late arrival of rescue services. There is need to get exact location for the rescue services to save life of people and same is for military when they need to save their soldiers. Therefore, this research will cover the overall aspects of information sharing independently and quickly using the service oriented architecture. By using SOA, the strategy management and their response time can be quick. Therefore, to solve this real time problem, proposed research will be helpful.

Service oriented architectures are policies and framework that allows different software’s and domains to share their services available. This makes SOA a technique that provides facility for the organizations to share their information independently. However, creating such an independent architecture was once impossible. Computer systems were not designed with the concept of interconnectivity and interoperability. At initial, they were designed to solve the self contained issues. If we analyze things are changing rapidly. Our requirements are distributed rather than depending on the simple one application. This was the reason behind the component based computing which soon gave the concept for running each application independently while merging and using only those services that are required. However, the cost is ever since issue for the deployment of such applications and architectures.
Don Box of Microsoft was the first person who defined the SOA in well mannered definition. His focus points were “four tenets” that were used for the “windows communication foundation”. By Don, the first idea was of explicit boundaries, then autonomous services, sharing of schema and contracts not the class and finally policy making was used as a base for service compatibility.

Keeping in mind, this diagram, we see that this approach can be implemented at any organization or at any application. This is the reason this technology is used for the topic of thesis. Military and rescue agencies both need the security, management, policy making, quick response, independence and interoperability. Following this architecture provides help for both organizations to communicate with each other without any delays. In case of any uncertain incidents, both can communicate and provide the:

1. Solution to cater the disaster or accident in form of strategy making and
2. Provide immediate rescue and response after the incident occurs to make sure they reach as soon as possible to the mentioned uncertainty.

Therefore, for quick response and immediate reaction, SOA can be used at both ends.

Duncan and Jie (2007) in their research “Service Oriented Architecture in the Provision of Military Capability 2007” have used the service oriented architecture at the level of Network Enabled Capability. This research has focused on the military assets to share information, keeping in mind the aspects of dependencies, operations, maintainability and other quality of services features. Heterogeneity is very common problem for the data sharing between networks. There are many risks associated with it. SOA acts as a middleware infrastructure that provides clean connections in separate domains of information sharing between assets like, people, process, products, access to technology and infrastructure. Loose coupling is another major property of SOA that provides the accuracy, timeliness, availability, cost saving and other legal factors. Therefore, by this search, we can conclude that loose coupling can sort out the problem of dependencies between the capability and assets of the military.

Brig (2010) has presented the wide diagrammatical architectures for the Finland military to solve the problem of C4I by using the Service oriented Architecture. Military depends upon the coalition and interoperability at home and global level. Therefore, means of communications should be safe and secure. In his research, a comparison of technology change has been mentioned from 2004 till 2020. The SOA had changed the concepts of messed up centralized systems and provided the organized architectures.

Capt. Eng. (2010) has highlighted the views on the SOA architecture that is being currently used by the NATO forces. In his research he explained that the information centric environment is a complex scenario that provides the dependencies on different sectors. For the NATO, dependency is the major issue because there are armies of many countries. Loose coupling is the best approach that can solve the problem of interdependencies. The use of SOA with the C4ISTAR and C4-ISIR proved the harmonization, coordination, test and validation.

Haider et al., (2010) provided the solution for the vehicular communication networks. They have provided experiments for the proof of statement. This particular research is based on the military as well as civilian vehicular systems for communicating about the upcoming hurdles or sharing
of information. The basic idea behind their search was to develop the intelligent transportation System and sorting out the issues and challenges related to the integrated communication among vehicles. Service oriented architecture had been used at the application level. SOA provides mobility and loose coupling that makes communication easier. On request services is another conclusion they have drawn in their work.

AEROSPACE IT in “Service- Enabled maintenance and Logistics Management a yearbook of 2010” provided guidance about using service oriented architecture for combing event-architectures. It focuses on the integration of defense and enterprise common businesses services. Logistics is the major department of any defense System. The use of weapons, traveling, operations, weather forecasting all are based on the equipments. Logistics department in military is responsible for providing needed equipments. When using SOA, it can provide the components of reusability of services and applications at communication level between the enterprises that provide the logistics to the defense departments. Adaptation of changes from the customer perspective is a common point of discussion that MIRO has solved using the SOA.

Federal Service Oriented Architecture (2008) by CIO Council has presented the detailed guidelines about the adoption of service oriented architecture at the level of federal government. A wide research has almost covered every issue for the communication of information at the level of different government sectors. What policies should be adopted, what steps should be taken to convert a typical centralized systems of government into the service oriented architectures are discussed in details. CMM is used as an SDLC model for the adoption of the policy of the service oriented architecture. Another important feature that has focused in their work is the trust. Government level data sharing is the work of reliability. Here, dependency is the issue. Service oriented architecture provides transparency and reliability by direct services. CMM model is covering step wise procedure at every level for the error free adoption of the government and technological rules. If their guidelines are followed, an organized dependant information medium can be created for the benefits of the government sector.

Yue et al (2010) proposed the idea to facilitate the sharing of information for the Army Command and Control system using SOA and ESB based integration model. The integration of different operations, data sources, removal of heterogeneous can be achieved using integrated Meta data and XML techniques of service oriented architecture. SOA has been used widely in the military research and projects to provide efficiency, security and reliability. However, there is still need to work on it to achieve the desired results. This can be done if we properly gather user requirements and adopt correct method.

In the comparison study of strategies and tactics used by India and Pakistan for the war has been widely discussed. In this research, the information warfare is the theme which is nowadays the most important growing war techniques used with the purpose to defeat enemy using information technology. This research provides a deep look into progress of information warfare C4I, strategy making and managing logistics and weapons of overall world including Pakistan. However, the main focus is on the trends of technology Pakistan and India is following. India is far more ahead as compare to Pakistan. They are creating their own silicon chips, processors and operating systems to prevent their special trained computerized systems from enemy attacks. They have created the spatial intelligent systems for mapping, message delivery and controlling war. However, Pakistan is still struggling to enhance its computerized technology. There are
same typical computer systems used for purpose of wars strategy making and even Pakistan does not have their own satellite. This makes Pakistan weak in the most rising information warfare. Still their main headquarters are using the landline telephonic communication system with only the CLI as a security tool. In this crucial situation, Pakistan needs to develop and use some of the common and major technological features like service oriented architecture. The place where right now Pakistan is standing, SOA will be really helpful because it can adjust in any existing architecture. SOA is one step back from the intelligent satellite technology however, it can be helpful for Pakistan military to create secure, transparent, interoperable systems.

Allan et al (2010) provides the framework for the sharing of information between very important civil rescue services and military sectors. These both sectors work side by side to facilitate their country on different grounds. In this research, the civil services like police, fire brigade, and ambulance can collaborate and share information with the military for the quick responses and immediate action. Military sectors can help the civil sector to locate the accidents using their intelligent services. While, civil services can react quickly. This interoperability is the positive step for the disaster management. They have given the example of the aircraft crash where the both sectors worked together and the life of pilot was saved. It is need of time to share some services for the welfare of the people who meet accidents by uncertain disasters quickly.

The Gazette of Pakistan “An act to provide for the establishment of a National Disaster Management system for Pakistan” explains the overall requirements, polices, procedures and people required for establishment, maintenance and managing the national disaster management commission. This act for disaster management authorities is derived under the supervision of president of Pakistan. It is implemented all over the Pakistan in case of its need. The act focuses on the disasters that can hit Pakistan any time. They can be both natural or man-made. It covers the issues like how many people and agencies will be responsible for management and relief after the disaster. It spotlights on commission of disaster, how they can perform their functionalities and duties under the supervision of federal government of Pakistan. It also looks at the responsibilities assigned at provincial and district level management of resources and equipments required at the time of disaster.

According to Disaster Management Policies and Systems in Pakistan (2010), a review of the strategies and policies was provided to see that how disaster can be managed and which authorities are involved. It also provides knowledge of which private and government level agencies are engaged when it comes to deal with disasters. The appointment and involvement of departments is based on the type of disaster. E.g. if the flood occurs, which agencies and human resource can take immediate actions. Further it covers how many departments will be required to deal with them and who will be those? If there is need for foreign aid or military call, how and what should be done? It also focuses on the roles and responsibilities of every department working under the supervision of disaster management authority.

Liam (2005) provides the details of quality attributes for SOA and its techniques. Quality attributes provides the basis for the analysis of the feature SOA holds. They help for the implementation and designing of the systems constructed under the SOA. This report is an affiliation with department of Defence providing the accuracy for the analysis of quality attributes of service oriented architecture. They took different attributes and assign them different colors on the basis of pre-defined standards.
Phil et al., (2007) had discussed the issues related to the quality attributes for service oriented architectures. The quality attributes matters when designing any SOA. These attributes can control the failure risks of a system. Different applications are taken as an example and quality attributes are checked on them according the requirements. Some scenarios with the implementation of quality attributes and their findings are provided in this research for the clarification of the readers.

Grace et al., (2008) has introduced the SMART (Service Migration and Reuse Technique). This technique helps in analyzing the interoperability and loose coupling qualities of the service oriented architectures. The SMART solution also encounters the risks and failures involve in the building of SOA. The working and flow are determined by using various architectures and examples.

Yuri et al., (2008) has provided the overview of the mobile devices using service oriented architectures. As we all know that mobile phones are very common now a days and using the SOA features with mobile devices can be good combination. Many organizations have started working to introduce the SOA for the mobile devices. This research work focus on different existing database designs used for business purposes and have provided the solution using SOA. It focuses on how user can avail the services including business services using mobile phones with the help of SOA.

Jay and Richard (2008) provided the scenario based implementation of the service oriented architectures in banking systems. Architecture is proposed that is providing support to the online transactions and information handling using SOA. This architectures help in integration, collaboration and flexibility issues and managed the issues of data redundancy, inflexibility and interoperability using the modular approach.

HariGovind and Matthias (2006) describe the conceptual based model for handling the multi level security for SOA. The solution work by the Meta data approach and working is based on service layers. Security policies are defined and instances are provided for the clarity of the proposed models. This architecture enhances the flexibility and focuses on the flow and control of business process with enhance security features.

Azul Systems, Inc. in white paper as (High Performance ESB for SOA Implementations September 2007) focuses on the integration, interoperability and priority needs for the business. It focuses on the features of service oriented architectures that can provide support for the mentioned attributes. The ESB is a very common SOA technique that helps the multiple services to share information over one platform. The ESB provides support for the heterogeneous and independent systems. Multiple quality attributes are taken and with the help of example their verification is checked in this research.

**RESEARCH METHODOLOGY**

**Survey Facts:**

In this section, a deep and details for the proposed architectures and real time scenarios would be discuss that will clarify the essential need for the proposed architectures. A considerable part is
for the analysis based on the standard quality attributes that proves the necessity for the architectures based on use, purpose and scenarios.

HOW COMMUNICATION IS POSSIBLE?

Communication between military and government owned rescue agencies is possible if the higher authorities of both sectors agree on some predefined rules, regulations and policies. Every country owns some particular policies for communication and sharing of information. However, the security is the basic issue that led them to make strict policies and communication conditions. After implementation of such important policies, both can share information and resources as they need to. For example, rescue services can ask for ships and boats in the situation of flood and so is the army can avail the trained rescue resources.

WHAT ARE THE SOCIAL PROBLEMS THAT CAN TAKE PLACE?

There are many situations that can affect the exchange of information or rather change the ways of communication. These crisis can occur due to political instability, independent policies, rules and regulations of both sectors, civil wars, monetary problems, lack of training and lack of resources, economic crisis, natural disasters etc. these causes can directly or indirectly affect the performance, efficiency and effectiveness of communication and information exchange between both sectors.

HOW EFFECTIVENESS ISSUE CAN BE RESOLVED?

An organization cannot work effectively if any higher authorities are involved and they work centrally. Most of the time, government institutions work in the centralized architectures while military had their own chain of commands. For both of the sectors, independent working for managing the emergency and crucial situation is very important. The work of authorities like ministers and federal governments should be limited in the formations of policies. On the contrary, the operation work should be assigned at the individual unit level or responder level to ensure that causalities are treated within efficient response time. If they keep on waiting for the approvals from higher authorities to start operation, than it will be a disastrous situation for any nation. No doubt, the responsibilities of both sectors including military and rescue should be defined in the policies created at government level. However, for the efficiency at less response time, the working and operational level teams must become independent. For example, Punjab rescue services have assigned responsibility to the first responder to communicate with department authorities about the current situation at the place of emergency. They work independently without restrictions of ministries. On the other hand, they communicate their requirements with DCO, who further takes actions if required. This helps them to improve their work and provide effectiveness in the task assigned to them.

RESPONSE TIME

If the lower level staff of both sectors works independently under the predefined terms and conditions, they can manage the emergency and disaster situation in better way. Instead of asking permission from the involved authorities, they should have rights to operate on the place of disaster or emergency to save people life immediately. Same way, if rescue services or military needs each other resources for dealing with the disaster situation, they should have some
communication at independent level to make sure that average response time for saving life should be reduce. This is possible by sending message at one time to all people involved in the emergency and disaster management or for information sharing at one time. The authorities can response at the same time who considers themselves as a part of the required communication. For example, if military needs information of hospitals from the rescue services, it should send message at one time and in responses, the involved rescue officer and the senior hospital management should reply at once to make sure that response is quick.

TARGET DOMAINS AT BOTH SIDES

First of all, the important need is that both military and rescues agencies share their services at one time. There should be free move of information from high to low and from low to high domains. When ask for military, there should be no communication hurdles to make sure that emergency situations can be treated quickly. There is no doubt privacy issue related, but the ESB can provide the solution of the problem through its existing architecture. ESB sends message at the required destiny and if the respondent allows accessing the message from the sender, than the services can be provided. Therefore, the privacy issues can be control much better as compare to centralized or using filter guards.

SCENARIES BEHIND THE CONCEPT OF PROPOSED WORK

The very important question is still to answer that why there is need for communication of both military and rescue services? If we analyze the current situation of the world, we see natural disasters and wars in almost every continent. In Japan, the tsunami and earthquakes are taking place every single day; the global warming is causing floods in many countries including Pakistan, Australia and America etc, the civil war in Egypt, Libya, and Middle East, the war against terrorism in Iraq, Afghanistan and Pakistan is killing hundreds of people everyday. To overcome these issues, for life saving and for managing peace in the country, the military involvement is very important. Side by side, the rescue services provides their services for rescuing life of people, clearing the fires and providing first aid to suffering people. Sometimes, rescue services are not capable to operate on very high missions e.g., if after the blast, the road is damaged and there is no way out to reach to the victims. At that stage, rescue will approach the military to build the time being bridge or provide them with helicopters and airplanes so that the rescue can perform their duties. Therefore, in such crucial time, anytime can be a disaster time and there should be full preparedness for both of the sectors to control the emergency situations.

WHO WILL GENERATE THE REQUEST?

Current project working in Europe (Cullen and Barker; 2008) works from rescue to military. In this situation, rescue will ask military to provide them help whenever they required. However, there is no dual communication because of the privacy reasons. Therefore, after analyzing the current world situation, we need the both sectors communication. Not only military services response to the request by rescue but they should be allowed to ask for services of rescue agencies and vice versa. The use of Service oriented architecture can resolve this issue. ESB is the architecture that enables both parties to communicate with each other whenever required by simply generating a request message. If any party thinks that they are capable to fulfill the request, they can response otherwise, they can reject the request. This removes the privacy issues
as well as the one side communication problem by providing multiple connectivity’s after acceptance of message.

**IS REQUEST COMING THROUGH PROPER CHANNEL?**

It is very important to know that if the request is through proper channel or is it fake. In normal circumstances, it is very difficult to find out whether the emergency is real or is it fake? The control rooms (Dr. Shahzad, Captain Khurram) of both military and rescue services are equipped with call blocking services and trained staff that instantly know by asking some questions whether the call is fake or not. However, this work is low level work and without proper approval, the control rooms do not engage their higher authorities to tackle such situations. The rescue services assigns the predefined call blocking time to make sure that the next time this person calls, should be granted. He/she might be in trouble. At the rescue services and military level, both agencies are responsible and they only need to communicate when they required otherwise, both are operating independently to resolve their day to day issues. The ESB architecture provides security by allowing or rejecting the sender request. However, the sharing of information must be mentioned in the communication policies between military and rescue services to make sure that no irrelevant or illegal information is transferring from any sector.

**PROPOSED WORK**

On the basis of all above mentioned real time information, surveys and literature reviews, following architectures are proposed as a mean of communicating between military and government owned rescue services for the solution of the existing problems both sectors are facing.

**FIGURE – 1**

![Figure 1: Ideology Overview](image)

Figure 1 is the basic architecture and ideology for merging and sharing of information between military and government owned rescue services. ESB (enterprise service bus) is acting as a central medium or mediating for send and receiving information. By using ESB, low to high domain and multi level communication is resolved for such secure systems. Along with that, ESB improves the response time by introducing exchange of information rapidly.
In figure 2, architecture is distributed sector wise. It provides the information about inclusion of all government owned rescue services. By resources (Dr. Shahzad, Captain Khurram), information from government and military is involved when there is need for sharing information. By (Dr. Shahzad, Captain Khurram) police, health, national crisis management cell and rescue services including (ambulance, first aid, fire brigade, water protectors, special emergency trained teams, bomb disposal squad etc) comes under the civil management. From the military end, it depends upon the situation and level of disaster or support to call for particular services. E.g., if there is building collapsed, and then military logistics and engineering department will be called for help. The third and most important role is of government confirmation authority. This authority plays vital and central role for communication between both sides. By resource (Dr. Shahzad, Captain Khurram), the confirmation authority provides synchronization. When military needs any civil help or information for dealing with any sort of crisis, they call the first spoke person usually governor or DCO of that particular area, state or province. It acts as a medium for exchange of secure information exchange and is a reliable source from both ends to make sure that help calls are not fake. It also verifies by analysis that generated request for military help is required in actual or things can go the other way. The ESB is capable for sharing information and sending information to all included sectors. ESB eliminates the hard ware and soft ware dependencies. ESB provides the interoperability which helps all included sectors to follow their own platform and architectures and share only that part which is required. This facility makes ESB reliable, secure and independent source for sharing of information between both sectors.
Figure 3 distributions are based on one time request. When designing the propose system architecture, it is very important to know that which authority should be prior for exchanging information. This judgment is first based on the policies and rules by both government and military and secondly for the quick response and eliminating time delays. First reason provides the guidance that which sector is most important for sharing or sending response at initial level. Suppose if in any case, all included authorities send message at the same time to military for help, than military will reply first to which sector. If the priority is fixed, then it will be easy for military to response back to the highest priority sector. This helps to improve synchronization, availability and performance of the system. The time delay and quick response time can be handled easily using priority setting approach for such systems. From the analysis of facts provided by resources (Dr. Shahzad, Captain Khurram), the first priority is provided to the government confirmation authority. It is declared as a first communicating authority from both rescue and military services. Therefore, both parties agree on the engagement of government confirmation authority and this makes it the highest priority authority among others. It confirms request from both sectors. This makes communication possible as it confirms that there is in real need for sharing information. If we consider, it is a time delay in direct communication. On the other hand, this delay can be bearable for security reason. Hence, it gets first priority because it responses for acceptance or rejection of the request from government level. Military works under the federal laws. This makes them second highest priority sector of a country after government. Military encompasses of both highest number of resources (equipment plus human). They are responsible to take decision for the benefit of the country after government. In case of civil law disorder, they take the charge of country. This makes them second highest among the welfare sectors for a country. This reason made them second highest in the proposed architecture. Third priority is assigned to rescue departments. They are the initiators for managing any emergency and disaster in a country. They have well trained staff and equipment after military. They also work side by side with military for the purpose of life saving. There information is third prior after military and government because they work independently for providing rescue services.
Their call for military or any activity permission is third highest in proposed architecture. At fourth point, the police is authorized. In the current era, there is strong need for the liaison between military and police department for exchange of information and this architecture provides support to police department to communicate directly with military when needed. Their coordination can contribute to overcome terrorism and natural disasters especially in under developed countries. Next priority is for national crisis management cell. It is combination of military as well as civil administration. They have pre planned policies and set of rules to deal with before and after disasters covering almost all disaster management sectors including military. Last but not least is health. Their work starts after the disaster or emergency. Therefore they are least prioritized in the proposed architecture. Health department provide information related to the causalities, deaths, available apparatus and medicines, requirements for the recoveries etc.

**FIGURE – 4**

![Diagram](image)

*Figure 4: Communication Authorities Distribution Architecture*

Figure 4 is based on real time information provided by the resources (Dr. Shahzad, Captain Khurram). It is working scenario example that covers the top level management of every included sector for sharing of information. They are the authorities involved in the policy formation and providing permission for the acceptance or rejection of the request.

The system will work under the supervision mentioned authorities. The authority distribution depends upon the individual department policies. However, from the information provided by resources, the mentioned authorities are involved for the sharing of information. From military end, major general is first spokes person who shares their information with the governor or DCO level. He obeys the orders from GHQ and then further guides the government institutes and his own staff for getting situation out of trouble. Director General from rescue, NCMC and Health services provides information and communication. Finally from the police side, DSP (deputy superintendent of police) is responsible to deal with communication scenarios. ESB is used as mediation for sharing of information under their supervision services.
Figure 5 provides flow of information and actual working process. It is a demonstration of working of this system. Suppose there is flood in any particular area of Pakistan. Rescue services reach that location, conduct survey and analyze that they do not have enough boats to complete their rescue operation and save life of people. By the information provided by resources (Dr. Shahzad, Captain Khurram), the first correspondent from the rescue department calls to his senior officer to inform about the current situation. This message is forwarded to the Director General of rescue department. DG sends the request for the boats to the military using ESB. This message reaches every included authority at one time. Military after getting the message waits for the government confirmation authority response. On the other hand, this request was for the military and all other departments send the rejection. Government confirmation authority received the request and allows military to further precede the operation by sending request. If by any case, government confirmation authority does not reply to the message, military system automatically generate reminder message. This works as an alarming call and then confirmation authority responses within five minutes. (This scenario works for all associated systems attached through ESB) This technique reduces the response time and manages the time delays of wireless and telephonic communication.

FIGURE - 6
Figure 6 identifies the technical details of the proposed architecture. ESB is capable to incorporate and work with and under any platform regardless of language, architecture or system state. The services are interoperating using ESB. The ESB can work with any client/Server, distributed, mobile, LAN or Wireless network [21] ESB use the HTTP, SOAP, WS* and FTP for sharing information, designing code and sending messages.

**FIGURE - 7**

Figure 7: Alternative Confirmation Architecture
Figure 7 architecture works when the government confirmation authority does not response within five minutes. It is to reduce the response time and time delays. This architecture works under the agreement and approvals of government, military and national crisis management cell authorities. NCMC services are based on both military and civil people. They have authority to work with every rescue and military service to provide aid and emergency handling. Therefore, their involvement can be a great contribution for quick response.

CRITICAL ANALYSIS FOR THE PROPOSED SOLUTION

Interoperability:

According to Liam (2005), we come to know that interoperability allows services and different platforms to interact with each other. In our case, interoperability is the major factor that needs to focus for the purpose of sharing information among different domains at the same time. ESB acts as a message transport facility for all the services that needs to share information. In proposed architecture, military and government owned services might have different architectures, languages and platforms working. ESB as an SOA technique (Liam; 2005) deals with these architectures that are sharing information and providing synchronization. There are standards available that can be followed when designing the ESB based architectures making it a possible solution for the architectures proposed in this work.

Reliability:

The proposed architectures deals with the military and government owned rescue departments. Reliability can become a major issue when we talk about sharing information among such fragile levels. Therefore it is very important to focus on the reliability factor when dealing with sensitive institutes. This reliability need can be fulfilled using ESB available standards for the designing and implementation of architectures (liam; 2005). On the other hand, some pre defined rules, regulations and policies must be followed according to the need of the services and for the sharing of information at the level of military and government. In this case, access rights and sharing should only be allowed for the verified services for the reliability and protection of data. The public and private settings, the involvement of government confirmation authority, the limited login rights for the proposed architecture not only makes it reliable but provides the security and privacy to individual independent service. Existing JMS and WS provides the feasible solution of reliability to the SOA.

Availability:

Considering the importance of proposed architectures we can see that the 24/7 availability of all included services is very important. Whether it is military, government confirmation authority, police or health sector, all of them need to be there when there is need for their help. We know that emergencies or disasters can take place at any time and delays can be very dangerous. Therefore it is one of the major requirements of the proposed system. One important step can be taken at every individual level of the rescue and military service for the maintenance of their own service architecture. By (liam; 2005) responsibilities are divided to the service providers and service user for maintaining the systems working under such crucial sectors. The physical distribution of services at different location and connecting then with ESB makes their
availability possible. Every independent architecture can share information that is needed. On the contrary, the considerable rights are assigned to the government confirmation authority and their presence is very important for this architecture to work. Alternative access or priority rights based on the government and military policies can solve the problem of availability if in any case the government confirmation service reach at failure state. In this condition by resource authority is transferred for the confirmation to the NCMC to deal with the crucial situation.

Security:

By reference (liam; 2005) security is the major challenging issue for service oriented architecture. The reason behind is the absence of proper standards and pre defined protocols to deal with security. The techniques of authentication, logins, and confirmation can resolve the problem of security to some extent but not at the standard level. In proposed architectures where there is need for the high security and privacy systems, security issues are kept on top. Here to sort out this problem, the government confirmation authority plays vital role. No action can be taken or information can be flow from one service to another without asking permission from the government confirmation authority. This technique along with the authentic logins solves the general security issue for the proposed architectures. It helps to manage the fake identities and fake calls from all services. On the other hand, security measures can increase the response time a little bit.

Performance:

Like mentioned in (liam; 2005), performance feature is little inconsistent in service oriented architectures as compare to other developed systems. Fact is again the lack of proper standards. Although work is going on and new techniques are being introduced and this progress will sort out the issue very soon. We can implement the same concept on the proposed architectures. Although, the system will perform better than the other available techniques of wireless or telecommunication, but from dependant architectures, the performance will be little slow. The delay in response time also affects the performance from the government confirmation authority. This flaw can be considerable because this technique is designed for the purpose of secure information exchange for such delicate organizations. The synchronization and well organized communication makes this flaw a smaller issue and increase the productivity of the design. The use of ESB architecture increases the performance by rapidly transferring the message on every included service. The ESB platform provides the quality features that enhance the performance of the proposed architecture by providing availability, interoperability and message processing at the same time. The WS* standard is the base for the ESB systems increasing the performance ratio of the proposed architectures.

Usability:

For this particular system, usability is not a major issue. Every system is working independently and only part of the required service is shared using ESB. It can be considered minor at the level of designing. Following proper standards and ESB developing platforms can resolve this issue in the proposed architectures.

Time Delay:
The proposed architectures are designed by keeping in mind to provide the best option that reduces the time delays for the communication between military and government owned rescue services. In case of any emergency, time delays can lead to real problems including high death rates. The 24/7 availability of this architecture is also very important to make sure that communication and information exchange is possible at anytime. Time delays for the proposed architectures hold some good and some bad aspects. The good aspect is by using ESB, message can be send at the same time without any delay within second. Every included service can start preparing for taking action soon after getting notification. Different services are informed at the same time to make sure that time should not be waste. The only bad reason is for the sake of security purpose. The confirmation from the government authority introduces little time delay in the proposed architectures before actual action can be taken from services. This condition is a government and military policy therefore; we can not deny the importance. Along with that, it provides the secure communication by allowing the transfer of information after generating acceptance request. If we compare five minute maximum response time, than still it is less than the other existing communications like telecommunication. Therefore, we can consider this time delay a realistic approach. ESB also plays important part for reducing the time delays by sending messages rapidly. Alarm generating after five minutes is also a plus point to reduce the time delays. Introducing the alternative authority like NCMC if government confirmation does not response is another way for reducing time delays.

**Communication:**

The purpose of proposing these architectures is to improve the communication among various government and military sectors of a country. It is need of time for a proper channel where all agencies can share information in case of any disaster or emergency (man made or natural). This all situation especially for under developed countries makes this attribute very important. The communication not only needs to be fast but it must cover all other quality attributes required for the system development. E.g. quality factors like security, reliability, interoperability, availability etc. the overall activities, the architectures design selection, the protocols and standards all are based on the level of communication. a table describes the capability of the communication that works in the same way for the proposed architectures. Using ESB, message are sent and received at every included service. The message is routed through the mentioned address using communication protocols and ESB directory in (IBM). Further confirmation authority confirms the acceptance and rejection and then response is generated from required destination. This further depends upon the design and requirements to use synchronized or asynchronized ESB. Routing one message at the same time on all services makes communication and response faster which is need of time and need for the development of proposed architecture. A part of communication depends upon the existing rules and regulations mentioned by government and military involved authorities. However, using ESB makes it possible to implement the communication policies by providing the facilities for collaboration of the included services. This works for the heterogeneous, independent and transparent locations.

**Response time:**

Communication using ESB makes it possible to reduce the response time by sending messages or notifications at the same time to multiple included services using proper standards, protocols and coding languages. Using ESB, response time can visibly reduce the time comparing it with other
available means like wireless or telecommunication. The alternative architecture connection and alarm facility is a major step for reducing the response time.

**Message Processing:**

Message processing determines the actual logic, coding, the data transformation, checking verification and validation, mediation, object identity, mapping and data handling among all the included services. These features provide the ESB as a supportive architecture base for the information exchange system between military and government rescue services. The development can be done by keeping in view all the ESB support features, the standards and the protocols.

**Comparison Table:**

Following are the details for the comparison of the proposed architecture with the other existing architectures based on SOA and ESB concepts. These are some real time applications and architectures based on the concepts of services architectures.

**Explanation:**

The table 1 is a comparative study of different existing Service oriented architecture based architectures and application. The features are analyzed on the basis of quality attributes using qualitative approach. (Liam; 2005) provides the details of the quality attributes that can be part of the SOA. The existing applications are compared with the proposed architectures on the basis of features and quality attribute it holds. It depends upon the use and requirement of the system to add the necessary quality attribute. However, some attributes are must for the SOA and ESB based systems. E.g. Interoperability, security, reliability are some common features that must be present when there is need for sharing information via services. In the proposed architectures, the interoperability, security, availability, message processing, response time and time delay management are highly important attributes. They must be present and followed by well defined standards and protocols to avoid risks along with some general attributes that are used by almost all SOA based application. If we compare proposed architecture with the other available systems, we see there are many features this system holds well than other especially with OASIS that is base for the proposed work. Oasis only deals with sharing of data with high to low domain but not vice versa. Along with that, multiple levels sharing of services is not available. In addition to this, it is hardware based and uses a filter guard for the purpose of security. Therefore, proposed architectures works better than the OASIS in several ways. It deals with multiple services, holds interoperability, security, no hardware dependence.

The qualitative analysis for the mentioned architectures is based on the scenario, use and purpose and requirements of the systems. The analysis is based on the presence of quality attributes. If the mentioned architectures hold any attribute that is mentioned, than we measure it as a support for that architecture. The probability depends upon the importance of that quality attribute, its feature and requirement for that particular architecture. If the quality attribute is present and features of the system highly depend upon the attribute, we say that its probability is HIGH. If it is present and comes up with standards or little effort is required, than it is mentioned as MEDIUM. If the attribute is missing, or if it is not required, than probability is LOW. Otherwise
it is not applicable if it is not required for the system. This all measurement is based on the purposes and scenarios for which the systems are designed. For example, time delay is an optional attribute and depends upon the need of the architecture. In proposed architectures, it is highly important and it should be taking into account when designing the systems from architectures. On the other hand, in most other systems, time delay is not required like in SMART. Therefore presence and absence of any attribute for finding the working performance highly depends upon the scenario or need of the system especially in SOA.

Following are the details for the mentioned architectures and system holding the quality attributes in table 1.

**Interoperability:**

It is the main feature of SOA and ESB systems. Mostly services are defined to provide the interoperability. In all application including proposed architecture, interoperability is present as a main attribute. Interoperability provides transparency to shared services using SOA. Therefore, it is highly important.

**Reliability:**

Reliability depends upon the secure way for transferring information over services. Most applications focus on reliable architectures that must work in worst case scenarios. It is need for today’s technologies to built reliable systems that can work in abnormal scenarios. Predefined standards (Liam; 2005) are available that automatically provides reliability to systems built under the SOA. Following those standards makes applications reliable. As we see SMART works for the migration and reusability. Therefore, reliability is not highly focused and can lead to risk for the SMART. Other than that, all other mentioned systems covers reliability including proposed architectures. WS* standardization provides the reliability to the proposed architecture.

**Availability:**

This attribute depends upon the scenarios and use of the system. If like proposed architecture, there is need for 24/7 working services because disaster or emergency can take place at any time, the availability attribute is highly required. Same is for Banking and OASIS that works in real time and they must be available to fulfill the user needs. On the contrary, for the other mentioned architectures the availability is not an important feature because they are not real time systems.

**Performance:**

It is very common quality attribute for judging the capability of the systems. Performance is supported by every system. However, its presence and importance depends upon the working of the system. If the system using SOA is built according to existing standards, protocols and policies than performance is High. For example, proposed architecture is designed on the real time information provided by the professional resources. Along with that government and military policies are considered as a backbone for the proposed system. In addition to this, the standards like WS*, HTTP and SOAP are used for building the actual system. Therefore, system performance is HIGH. Same is the case with the SMART, AZUL, BANK systems as they are work of the IBM, one of the initiators for service oriented architecture.
Usability:

SMART works well for usability because it is component based that supports and provide attention to usability. AZUL also focuses on usability. OASIS has some other scenario where usability is not so important. It focuses more on secure transfer of information. Same is for the banking and proposed architectures that work in real time. Usability can be introduced in the systems if the standard followed provides the built in.

Time Delay:

For the proposed architectures, time delay management plays vital role. A little delay in communication can lead to high causality and death rate in case of any disaster. It is highly required to focus on the time delay issue and it is highly important to introduce all possible solutions to overcome this issue in proposed architecture. That is why it is mentioned high in comparison table. In most other architectures, time delay does not matter or less important. Bank is also a real time case where time delay can become an issue but proposed architecture needs to sort it out more than others.

Communication:

It is very important feature and work as a back bone for SOA Usually purpose of building architectures. Using SOA is for communication of different domains, platforms and channels at one stage. Communication is mean of transferring information to all associated services. All of the mentioned system support communication. However, it depends upon the requirement of system for the probability of presence of communication in particular architectures. In proposed architecture, the main focus is on communication between military and government rescue services. Therefore it is most considerable attribute that must be taking into consideration in every phase of system development. Bank system is also a strong communication and so is the OASIS. However, they are not very much concentrated directly on the communication. In MLS, the scenario goes same.

Response Time:

It is an optional attribute depending upon the requirement and use of SOA based systems. In proposed architecture response time matters a lot because it is real time system and deals with emergency and disaster management. A small delay can create many issues. It is need for system to provide facility within very less response time. There can be alternative approach or overcome option to meet the need for system. For SMART, AZUL, MOBILE and MLS systems, response time is not a big issue to cover. It works for OASIS and BANK system as well. However, the technology behind OASIS does not support quick response time.

Message Processing:

Message processing is again one of the attribute that is optional. It is very important attribute for the proposed architecture. The main purpose of the proposed architecture is to deliver the messages and notifications to every involved service at same time. Message processing features are predefined and follow existing protocols and standards for communication. For Azul, OASIS, Bank, mobile and MLS, it is not a must feature to support working. SMART also focuses on
exchange of notifications so it supports the attribute but is not very major feature so probability is not high.

Security:

It is highly important for almost every system and application based on the SOA. The sharing of information on different channels should be secure. For that purpose some de facto standards are followed. Therefore, it is still issue for SOA based systems. In proposed architecture multiple efforts and solutions are provided to cover the security issue. Other than that none of the mentioned architecture focuses to overcome security issue.

ADVANTAGES AND DISADVANTAGES

- The architectures are proposed for the real time information management between military and government owned rescue services. This makes the proposed architecture a very useful contribution in the communication of fragile sectors.

- There are as such no proper existing architectures that are providing the communication between military and rescue services. Although, it is need of time to have such a strong communication but still there is not much work done in this field. The proposed architecture is a positive step towards the communication making it a platform where originally military and government departments can communicate with each other.

- The privacy issue for the communication is managed by using ESB that will not only provide secure transfer but fast data transfer. It will save the time, reduce the time delay and response time at the same time.

- This proposed work built strong relationship between military and civil departments which is really a good step in such hard time especially for the third world countries that are facing war against terrorism and high ratio of natural disasters.

- Its 24/7 availability makes it a reliable mean of communication. Whenever any sector needs help from the other involved, it can just send one request that will be fulfilled within maximum time of 5 minutes. This time is far less than telecommunication that can take up to half an hour for only delivering one message to the respected authority.

- The proposed architecture is designed by taking real time information from the military and rescue services resources. The data provided is according to the government and military policies upon which the architecture is built. This makes it highly acceptable for the use in government and military sector.

- SOA makes availability of this service independent. This architecture can be used with any architecture or domain. This makes it convenient to implement in any environment.

- There is still need for the improvement of time delay in the proposed architecture. The only reason for time delay is the involvement of government confirmation authority which is must
for complicated communication. Removing this issue can make this architecture work in actual for communication between military and rescue services.

CONCLUSION & FUTURE WORK

As we know that there are so many issues when the government asks for the help from military to overcome that problem and same is for military that asks for help from government institutes in worst situations. Especially, in the era where everyday any sort of natural or man-made disaster hits world. The situation goes worst after 9/11 scenario and half of the world is engaged in war against terrorism. In such crucial circumstances, there is need for the medium or platform where government and military institutes word together and help the victims in very less time. The proposed architecture was designed to keep in mind the whole changing world scenarios and solution was provided using service oriented architecture to reduce response time and save life of more people in less time in time of disaster. The ESB provides the fastest way of independent communication for this particular problem. It is able to send message to all attached services at one time and within few seconds. This quality makes it a worth architecture to use for the multi level communication providing security, 24/7 and response time of less than five minutes professionally, availability, less response and time delay etc. however, there can be further work to reduce the time delay using some other SOA approach or perhaps some other way of communication medium that can minimize the time delay that occurs due to the acceptance from the government confirmation authority. Though, alternative solutions are provided but still work can be done to overcome time delay issue in better way.

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