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A Survey on Service Oriented Architecture in Remote Collaboration Systems

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Abstract: ***Service Oriented Architecture (SOA) is an evolutionary step in enterprise application integration providing automation capabilities by integrating disparate systems with each other. It acts as a bridge between existing systems which runs on legacy applications with newer applications running on most modern technologies. It is typically an architectural pattern in which components provide loosely integrated suite of services to other components over a communication medium. It uses a wide variety of implementation platforms. One of the main advantages and the reason SOA is easily adapted in the industry is because it is based on an agile mode of development and deployment, hence changes to the applications and processes will not impact the smooth functioning of the system. The benefits of SOA has been adapted in many of the business domains. Remote collaboration with mobile devices is one such area where the benefits of SOA can be made use of. We present a survey of researches conducted on remote collaboration using SOA.***

Keywords: Service Oriented Architecture, Remote Collaboration, Mobility.

1. Introduction

The benefits of SOA has been studied in detail over the last few years and the benefits has been widely utilized in multiple domains like application integration in mobile space, cloud, Internet of Things etc. It is a progressive and evolutionary technological advancement in enterprise application and data integration field. In this paper we are presenting a survey of all state of the art researches and implementations that are happening in the integration of Service Oriented Architecture in remote collaboration and control of mobile devices. We will also understand the advantages SOA provides in remte collaboration through these studies.

Mobile devices and applications provide a solution to many of the agile automation requirements. It also expands the big potential of mobility in Human Machine Interface (HMI) and Information and Control Systems (ICS).

2. Service Oriented Architecture

Service oriented architecture is an integration pattern or technique that allows the interaction between loosely coupled functional units. It is designed in such a way that the components of an application or multiple applications that communicates with each other provides services and accept the services from other components over a communication network. The principles of SOA are independent of any product, vendor or technology [1]. SOA relies on service-orientation as its fundamental design principle. It aims to abstract the underlying complexity and provides the user the benefit of a simple interface to interact with which is usually independent of the underlying technology and platform. It also emphasis on reuse making modifications, maintenance and upgrades an easier task.

There are many alternatives to SOA. Distributed Component Object Model (DCOM) is an alternative to SOA for network integration within large enterprises. It implements transparent function calls between computers over a network. The progressive evolution of such technologies have led to the present state of SOA.

The purpose of SOA is to allow users to combine together fairly distinct chunks of functionality to form ad-hoc applications built almost entirely from existing software services [1]. To design a service oriented architecture we need to first understand the concept of services are and how they should be designed.

2.1 Service

A service is a self-contained unit of functionality which can be discretely invoked by the user of the service [1]. According to web services definition language (WSDL), a service is an interface definition that may list several discrete services or operations. It can also be viewed as a logical representation of some functionality which allows the interaction with other functional modules with a specified outcome from the interaction.

2.2 Design Principles of SOA

There is no one single industry standard for SOA. Many industry standards have published their own principles. Below are general principles followed by most of them [1].

- Standardized service contract: Services adhere to a communications agreement, as defined collectively by one or more service-description documents.
- Service loose coupling: Services maintain a relationship that minimizes dependencies and only requires that they maintain an awareness of each other.
- Service abstraction: Beyond descriptions in the service contract, services hide logic from the outside world.
- Service reusability: Logic is divided into services with the intention of promoting reuse.
- Service granularity: A design consideration to provide

optimal scope and right granular level of the business functionality in a service operation.
- Service location transparency: This refers to the ability of a service consumer to invoke a service regardless of its actual location in the network.

3. SOA in remote control and collaboration

Although there are studies and research publications which focus on the potential of SOA in collaborating and controlling mobile devices, not enough implementation details are available in literature. We will look at extending the benefits of SOA in remote machine control and collaboration with mobile devices.

Pablo Basanta-Val et al. [2] in their paper titled 'A Distributed Real-Time Java-Centric Architecture for Industrial Systems' discusses the trend in industry to use real time java centric systems to interact with each other. It provides a holistic model mainly based existing technologies interacting with upcoming technologies that may be particularized or extended to different industrial systems, according to application requirements. It describes Service Infrastructure for real time embedded networked applications extending the power of SOA to industrial automation. The proposed method expose SOAs at its business level (EJBs with SOA access) for industrial systems.

Kul, Seda et al. [3] presents a service oriented real time automated framework to detect abandoned objects and video tampering attempts in video surveillance systems. The surveillance cameras are integrated with mobile phones through the standard service interfaces. Real time surveillance data is sent to mobile phones and analyzed.

T. Lojka et al. [4] describes how SOA communication and integration facility can be utilized in Supervisory Control and Data Acquisition / Human Machine Interface (SCADA /HMI). Main contribution is increasing the agility of ICS with remote control via mobile devices and SOA. This implementations proposes to use wen services to develop applications for mobile devices using SOA and use its advantages and safety benefits in SCADA/HMI. For implementing the SCADA/HMI server and client applications they used SOA from .Net platform named as Windows Communication Foundation (WCF). It gives the advantage of implementing the solution for remote collaborating different mobiles devices like mobile phone, PDA, tablets etc. The main advantage of the proposed system is found to be the communication security of messages. Usually the messages are send as simple XML where data can be easily read. In this system WCF provides option to send secure messages y using the suitable binding.

Yuen Xing et al. [5] in their paper titled 'Remote Collaborative Experiments Based on Service-Oriented Architecture (SOA)' suggests an architecture for remote collaborative research experiments based on SOA. The key technologies and collaborative mechanisms are discussed. The architecture has characteristics like reuse, reliability, commonality, robustness etc. It is advantageous for all research users and efficient for all facilities which are located in different places. However it does not mention about the security problems or provide any suggestions to address them.

Fabio Terezinho in his research titled 'Remote access, any time, any place' details multiple SCADA server/client architectures [6]. SCADA server/web browser provides remote access via web browser and allows remote communication with mobile devices. Multiple SCADA server/client architectures are also described in the paper. The main disadvantage of these systems is hat in case of network failure HMI will be completely disabled.

Zolotova, I et al. [8] in their paper 'Architecture for a Universal mobile communication module' analyses the current trend of mobile devices in supervisory control systems and describes the problems arising from the development of visualization applications for mobile devices, focusing on the communication module. The solution to this problem is described in the scrum life cycle model that was used to create the application and its modules. It also highlights the issues of supervisory control of applications for mobile devices based on the operating systems.

Service orientation allows distributed clients to invoke remote operations using standard communication protocols, platform independent programming paradigms, design and architecture. The adoption of service orientation will be an easy step in remote mobile device collaboration due to the flexibility and platform independent nature of SOA implementation. Studies which proposes methods to prevent intrusion detection in web service implementation of SOA are also available in literature [9].

4. Conclusion and Future Work

This rapprochement of SOA with mobile devices opens up newer ways of integrating, collaborating and controlling different devices which are based on a disparate technologies and platforms. It makes it easier to utilize the data captured by the mobile devices and convert them to useful information. The model may be particularized based on industrial requirements and more research and studies are needed to tailor this generalized model to specific business domains.

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