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Shared Services in Collaborative System Configurations

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Abstract— In network collaborative system, dispersed and co-located users work together to accomplish assigned task in order to achieve their shared goal. While working together, many work related activities are conducted such as interactive communication, sharing resources and manipulating media objects. Furthermore, these activities can happen in many ways either sequential, parallel, synchronous or asynchronous method. Hence, it is crucial to control and coordinate the shared resources, especially during the collaboration process. Currently, various kinds of effective, appropriate and sufficient shared services component used in supporting the collaborative activities. These services are important elements in the successful collaborative environment. However, the implementation involves some technical obstacle such as limited sharing of media objects, complexity in bridging the external sharing applications, lack of flexibility and ease to use sharing platform and neglect the ad-hoc sharing configuration by end-user. Thus, the shared-media are always under-utilized and services component management creates issues of object's access control and conflicts. This paper provides a general abstraction of service components and a comparative study on shared services on several collaborative system frameworks. Results show that existing shared services are not tolerably designed for end-users to design and develop their sharing methods easily.

Index Terms— Collaborative System Components, Collaborative System Framework, Media Sharing, Shared Services, Sharing Features, Usability, User Defined, Workspace.

1 Introduction

TODAY, rapid improvement in information and communication technology had influenced the growing of the internet availability, decrease the bandwidth cost and increase the computational power. These are some of the factors that make collaborative work become easier and accelerate various techniques for user to collaborate. Nowadays, distributed user can work under one organization that manage the shared resources in a flexible and secured manner among the collaborators. In addition, the collaborative work can occur between two or more organizations. These kind of working environment helps to solve issues in critical resources, personnel and logistics. Furthermore, naturally 30% to 50% productivity will increase by implementing this kind of working environment [1].

Dispersed users have various kinds of behavior, skills and experience, especially users from teams and group project from different organizations. Moreover, different organizations will have different information systems and communication structures that do not sufficiently support the collaborative works. Most of these applications are mainly created to be stand alone systems without considering cooperation and integrated features. Hence, simpler and ease to use technology that is well-suited with project group and organizational goals, work practices and standards should be adopted [2]. As for that, the development of information systems is evolving towards subsystem that can be easily integrated and configured [3] to make a successful collaboration process.

Most of collaboration process is about sharing activities. As an example, users shared the communication channel to communicate to each other, important documents or artifacts are shared to make important decisions, dispersed users are sharing the same view of the whiteboard and shared same context and virtual room during the online meeting. In fact, different scenarios of collaborative works will require different sets of shared services. Hence, a successful collaborative systems should overcome any sharing service issues such as difficulties in integrating diverse software tools with collaborative environment, able to manage various sets of service capabilities provided by the subsystems and configuration service for communication channels to allow the media sharing process [4].

Currently, the choice of shared services in a collaborative system is often determined by cost, technical boundaries and the ability to incorporate with the existing system. Though, web-based shared services were designed to support collaboration of distance users, it limits the scope for the user to integrate origin data into various systems. Hence, the role of shared services in the collaborative activity works has been investigated [5][6][7][8]. This research is initiated with the focus on various aspects of the design and implementation of the shared services in the collaborative system framework. Based on the study of various design and implementation of shared services in collaborative works, future research could provide guidance for effective media sharing mechanism.

The remaining content of this paper is organized as follows: section 2 introduces the collaborative system framework. Section 3 discusses type of sharing and shared services followed by a comparative study of the shared service features in section 4 and concluding remarks in section 5.

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2 Collaborative System Framework

The framework discussed in this paper described the de-

sign and implementation of collaborative systems in the working environment. Software framework is defined as a common and reusable platform to develop collaborative application systems. The framework consists of compilers, supporting tools, source code libraries, application program interface(API) and service components [9]. The synergy between these elements enable the creation of effective solutions in solving the collaboration problems. It is agreeable among the researchers [9][10][5], the software framework had eased the application development process by permitting the system designer and programmer to spend more time on other important matters such as software and technical requirements. Furthermore, application programmer would also spend less time on coding and debugging to give more space for creativity as a value added features to the system.

In developing collaborative systems, it is crucial to understand the way people collaborate in order to improve the collaboration process. Furthermore, the process is bound to the collaborative environment which consist of organizational structure and policy, technical setting, working culture, communication setting and information workflow. Hence, the collaborative system framework consists of three elements; environment, process and support [11] as illustrated in figure 1.

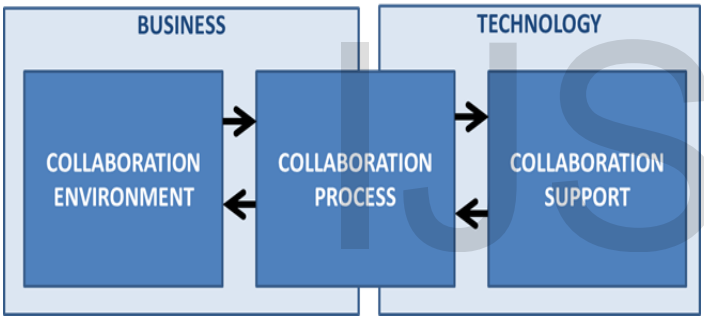

Figure 1. The Collaborative System Framework [11]

The first element is the collaborative environment. The environment is about the setting of the organizations that took part in the collaboration process and approached used in handling the collaborative activities. In addition, the environment attributes will vary from one collaboration process to another process which also influence the value of the other two elements.Hence, this element is divided into two levels: planning and requirement level. The planning level is the initial phase in setting up the collaboration process. It defines the scope and boundary of the systems concept, risk management, cost-benefits, project management plan, collaboration goals and the outcome. Meanwhile, requirement level specified the group of user requirements in order to perform their assigned task. It analyzed the requirement with respect to the task assigned, project planning, social protocol, organization and inter-organization policies and group characteristics [12] . It includes the supporting requirement for the various kinds of groups due to the size of the group, locations of the users and the computer platform.

As a second element, collaboration process is about a group of users working together regardless their location but still can communicate effectively to achieve the assigned goal. During the process, workflow management between all elements in the collaborative are important. Basically the workflow are between these elements' relationship; [1] user-to-user, user-to-device, device-to-data, application-to-application, application-to-device, device-to-platform, platform-to-network and organization-to-organization. Therefore, client/server and peer-to-peer (P2P) platforms are one of the key attributes of this element. These platforms provide user with various kinds of technology that suits with the organization background and capabilities. As an example, peer-to-peer platform support decentralization work management which communication between group of users are managed by agents and normally used JXTA technology in its implementation. While client/server that used centralized management approach rely on the server and a client network connection. Web services and extended markup language (XML) is common approaches used in developing the collaborative system on this platform. Currently, various kinds of method evolved from these two platforms to help dispersed users in the collaboration process, such as cloud computing and grid technology. On the whole, the collaboration process is about the decision making and the management of the coordination, cooperation and communication between the components of the collaboration towards the assigned task. The execution tasks are implemented in many ways. Several ways can be by integrating or incorporate external sub-system or compose new sub-process manually by the user.

The third element is the collaboration support. The collaborative systems must allow users regardless with the location and technology constraints, the user must be able to collaborate in effective ways. The involved organizations must take action and make it possible by providing users with effective and suitable tools and a range of services to support the collaborative practices. Hence, the collaboration support can be divided into three levels; capability, service and technology.

The capability level defines fundamental capabilities that support various kinds of collaborative tasks. Here, the tasks are matched up with services that contains special collaborative capabilities [12]. The matching process consists of two processes. First is the evaluation process. The available services are evaluated with its capabilities in supporting the current tasks. The second process is about the adaptation and acceptance process between the services and the group characteristics. Basically, the capability level is about the ability of the system to support the whole collaboration process. The service level identifies a right collaboration practices and tools by offering a list of services that can be used in executing the collaborative tasks. Some of the services are independent and autonomous by itself that can be directly used. Other services are created by composing different kind of services from different domain by using the platform and infrastructure services. Technology as a last level in the collaboration support element, deals with the implementation of the services that reflect the performance of overall collaborative work.

3 Type of Sharing and Shared Services

Although many systems and frameworks claim to be a collaborative system, but most of them only support certain features and criteria of collaboration [13][14]. These systems are

actually closed systems which means it provides a fixed set of services, tools and functions to support certain features of collaboration. These systems lack of flexible services which require dynamic changes in a collaborative process that in line with the current trend of business process. Due to that, services play an important role in new computing technology that support independence and distributed systems in developing flexible collaborative systems [15]. These services are actually autonomous computational agents that made the integrated and distributed collaborative solutions possible [3]. As there are various kinds of services in the collaborative framework such as session management services, data distribution services, message management services and device management services; this paper focus only on software shared services in the collaborative works.

Based on the literature, in general, there are two types of sharing process; context and resource sharing processes.

3.1 Context Sharing

A group of users might work on a small part of a big project, but at the same time are interested of the changes made by another group of the related parts of the project. Hence, all users working on the same project shall share the same context in the same manner. Here, the awareness mechanisms work as shared services between the group of users. It will facilitate awareness of changes done to one part of the same product to the other users.

3.2 Resources Sharing

As mentioned above, collaborative is about sharing process. Distance users shared the same goals and same resources in doing their work. The resources are anything that needed to support the assigned tasks and can be retrieved by the users. It can be information, document, multimedia objects and file. As depicted in figure2, the data is represents the resources and media is represents the medium of communication between the users. Each of these resources has their own method of control and coordinate to govern its activities. Furthermore, the collaborative activities also govern by its important attributes, such as policy, organization protocol, computer platform, context awareness, space and time.

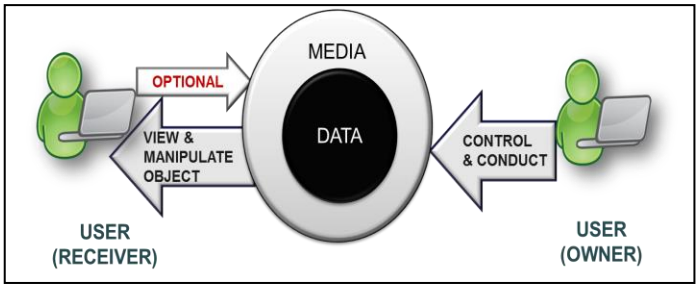

Figure 2: Resources Sharing Logical Model

Dispersed users need services to assist them in managing the shared resources, as they are manipulating the same objects. The shared services in resource sharing are varied and relative to the objective of the collaborative activities. Table 1 shows the type of shared services related to the work task. These shared services can classify into four categories[16]; objects sharing services, communication sharing services, sharing collaboration space services and workflow sharing services.

Table 1: Type of shared services related to the activity

Activity	Shared Services	Type of resources
Editing Document	Edit, Update, Delete View, Storage Context Awareness Version Control Message Merge Locking Concurrency Session Management	File Document User
On-line Meeting	Drawing Presentation View Context Awareness Chat Space Control Locking Concurrency Session Management	Multimedia Objects File Document User
Learning	View Forum Locking Session Management Message Context Awareness	Multimedia Objects File Document User
E-Conferencing	Concurrency Space Control Session Management Context Awareness	User Multimedia Objects

1) Object Sharing Services
Collaboration means sharing something important among the participant users. It is crucial to share any supporting objects such as text document and slide presentation in any collaborative works. Hence, it is important to coordinate the changes made by activity related to this sharing objects. Edit, delete, add and view are examples of common activity related to the shared object. As this object are shared by many users, shared services have to make sure the same version of objects can be viewed and interpret in the same way by all the users. The shared services also should equip with conflict management to handle any conflict that arise during the collaborative activity.

2) Communication Sharing Services
Effective communication is a key success factor in achieving activity objectives. It is important to avoid any misunderstand and discrepancy during the interaction. As users are sharing the same communication media, the shared services will make sure users will get the same message at the same time with a user friendly user-interface and easy to understand error message.

3) Collaboration Space
Shared services will provide users with the same context in the same style as all the others are located in the same room.

4) Workflow Sharing Services.

Users will know the chairperson or the owner of the collaborative activity, expertise and role of the existing members are examples of services provided by this category.

Most of the shared services are built-in as a functional requirement of the systems and others are stored as source code library and API that ready to serve when needed. Some of the collaborative work such as an online meeting will face difficulty when dealing with ad-hoc matters. In this situation, users probably need editing sharing application urgently that enables them to formulate new marketing strategy. As the existing systems are not supplied with functions to connect to the external standalone applications, it forces the developers to change the hard code of the existing system. As an alternative way, in these situations the developers can choose from the range of available external shared services applications and tools that map to the collaborative activity's objective [17]. This process is referred as shared service composition [18]. It allows developers to customize the shared services from dynamic searching of available standalone applications, integrate and implement the shared services in a proper order to achieve the activity objective.

These are examples of third-party or external standalone applications that can be used as shared services in the collaborative works [17]:

1) Version-control Systems
   It facilities the version control systems either by peer-to-peer and client/server platform. Examples of the systems are Subversion , Git, Mercurial and Darks.

2) Online Meeting
   This system allows users to edit documents while others view it, whiteboard drawing, co-browsing and support synchronous and asynchronous activities. Examples of this system are WebEx, NetMeeting, conference and WorkSpace3D .

3) Document Sharing
   This system allows users to review and edit concurrently with other users. Examples of this system are GoogleDoc and Google Wave.

4) Project Management
   This system facilitates project information such as project milestone, planner and overview ongoing project through the web. Examples of this system are ActiveCollab, WorldView, WorkspaceActivityViewer.

5) Electronic Conferencing
   The system facilitates the conference activity such as data conferencing, voice conferencing, video conferencing and discussion forums. Examples of this system are CU-SeeMe and NetMeeting [19].

These applications allow developers to customize the shared services from dynamic searching, integrate and implement the shared services in a proper.

4 Limitation of the Available Shared Services in Collaborative System Framework

Most of the available collaborative software framework deals with various kinds of sharing process that involve with different types of objects. The shared services offered by the frameworks are almost the same though develop on different architecture and platform. It shows that, different type of sharing activity will use almost the same set of shared services regardless the type of problem they are.

However, in comparing these frameworks, it was found that different kind of approaches are used to develop and execute the shared services. This approach mainly influenced by the availability of the experts, the organization background technology and collaborative environment. Furthermore, this service that supposedly support groups of user which engaged in the same activity are limited with flexibility and usability. This is due to most of these services are pre-defined and embedded into the system. Although some of the frameworks allow these services to be integrated with other collaboration tools, the processes are still not dynamic. The users are served with pre-defined external tools by the system. Users are not allowed to choose from the range of external tools that they prefer to use. On the other hand, some of the frameworks provide users with service composition that allow users to create new service operation. But this function is not for end-user and difficult to operate. Table 2 summarizes the software framework shared services category with it's strengths and limitations.

5 Conclusion

Collaboration technology should develop in small stages. It starts with the design of configurations which is required at each of its components thorough consideration. As sharing is a nature of the collaborative activity, the configuration should provide modules that facilitate sharing among dispersed users. Hence, appropriate shared services are important facilities in the system to produce efficient and consistent collaborative works. In this paper, we give detail explanation about collaborative configurations. We also discuss sharing process focussing on four categories of sharing services; objects, communication, workspace and workflow. Each category has a different set of services which serves collaborative activity in its bounded territory. Currently, there are lacks of research work that are capable of providing such services. Moreover, most of the configurations have their own shared services which are being pre-defined and hard coded into the system. Therefore, the sharing platform cannot allow end-users to flexibly choose their own preferred shared services from common applications. In addition, their ability is limited to certain types of ca-

Table 2 : Shared Services Comparison among Collaborative System Framework

Shared Services	Shared Activity	Shared Approach	Usability	User-Define Configuration	Ad-hoc	Reference
Communication	Media Transmission, Communication, Data Management, Simulation, Activity Management, Communication Interoperability , Translation, Image Detector, Planning, Notebook, Communication, Remote Control,Viewing, Editing, Modeling	Embeded , Integrate	Easy to Moderate	Static , Dynamic	Allow	[13][20] - [28][36]-[38][38][40]-[42][45]
Resources	Planning, Media Transmission, Communication, Data Management, Activity Management, Planning, Notebook, Communication, Remote Control, Planning, Virtual Lab, Media Sharing, Storage, Display, Composition Models, Sketching	Incorporate, Embeded, In	Moderate to Hard	Static, Dynamic	Not Provide	[4][21]-[24][26][28][29][31] - [45]
Workflow	Media Transmission, Communication, Data Management, communication Interoperability, Planning, Access Control, Sketching, View, Editing, Modelling, Access record	Embeded	Moderate to Hard	Static	Not Provide	[22][25][26][30][33]-[40][45]
Collaboration Spaces	Media Transmission, Communication, Data Management, Simulation, Planning, Virtual Lab, Media Sharing, Storage, Display	Embeded, Incorporate	Easy to Moderate	Static	Not Provide	[20][26][4][29][43][45]

tegory only. In general, collaborative working environment is branded by flexibility, usability and ad-hoc communication service requirements. Moreover, such services are very significant in promoting flexible controlling and coordinating mechanism in distributed media sharing activities.

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