

# **An Evaluation Framework for Asynchronous Collaboration Tools**

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## An Evaluation Framework for Asynchronous Collaboration Tools

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## **Abstract**

### **An Evaluation Framework for Asynchronous Collaboration Tools**

Asynchronous teams continue to perform increasing percentages of distributed work. These teams are comprised of members in different geographic locations and operate in collaboration tools at different times. Many collaboration software tools exist to support these teams. Some tools make task completion difficult, and others make it impossible. The problem is that currently, there is no means to evaluate the effectiveness and efficiency of such collaborative tools. This paper proposes an evaluation framework for software collaboration tools that support asynchronous teams. The evaluation framework contains the collaboration tool characteristics of; Awareness, Context Persistence, Calendar Assist, Coordination and Visualization. This dissertation goes on to examine sub elements of the framework and how their need varies according to the needs of different types of teams. A discussion of some different collaboration team types will be provided and the needs of the team will be compared to framework characteristic sub elements.

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## 1. Introduction

The field of computer science has many sub-domains. These domains include computational problems, programming language theory, and computer graphics. The sub-domains of particular interest to this work are human computer interaction and software assisted collaboration. Both rely on computational support for communication. There are important aspects of face to face collaboration that are lost in long distance collaboration. These are; voice, intonation, facial expressions, gestures, and postures. The use of global collaboration is increasing because of the interest in using the most highly skilled people for the most challenging projects. (Garrison 2010). This trend creates a more important role or dependency on collaborative software tools for distributed teams.

When synchronous teams collaborate, they share information, develop new concepts and complete tasks as part of their joint work. Early synchronous collaborations were performed in the same locality. Team members worked on tasks by themselves and then held meetings to discuss results. They would share information and review work digital and paper artifacts.

Today asynchronous teams perform tasks in situations where members do not share the same work hours, physical location, time zone, or even the same tool environment. These tasks are performed as part of a distributed collaboration with the support of communication channels. The different parts of an organization can perform tasks and communicate their results using fax, mail, or phone. In addition, messages, images, and other artifacts can be sent via the internet. These artifacts can be altered and tasks can be completed more quickly when using tool that provides comport supported

asynchronous collaboration. This work can be successful and efficient when assisted by computational support that provides the human communication and social needs of the distributed team.

## 2. A Conceptual Distributed Team Process

Many distributed teams perform different kinds of work but use a same general process. Examples of distributed collaborations include; traders buying stocks, customers buying items through a retail website and software firms developing a new phone application. There is a process flow that is common to all of them. Members enter the workspace, and they examine the choices, perform the indicated tasks, the data logs are updated and the system is ready for more activity.

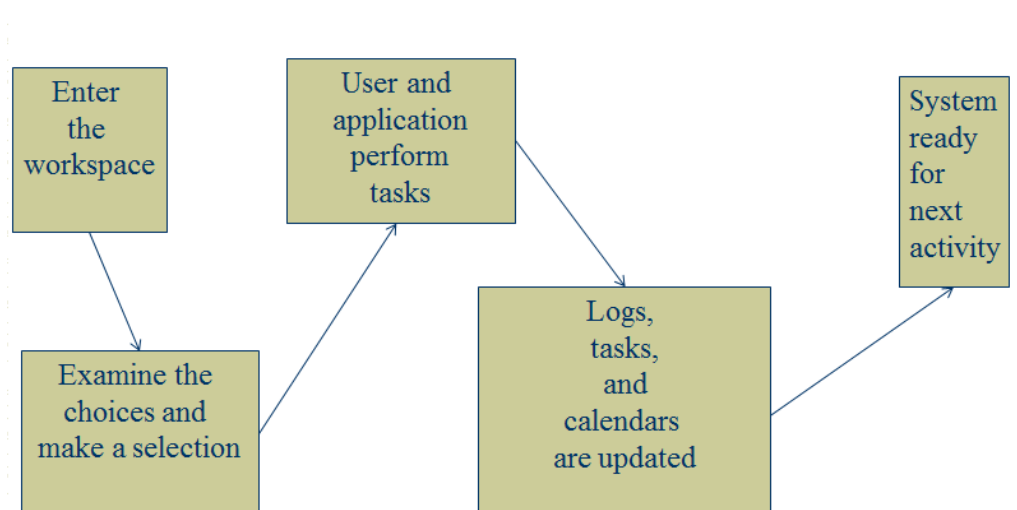


Figure 1 - A Conceptual Distributed Team Process

Various tools have been developed to support distributed teams. There are characteristics that are common to a number of collaboration tools. Distinguishing between useful tools and ineffective tools for asynchronous teams is a considerable



challenge. To compensate for the challenges of asynchronous collaboration, researchers must focus on what comprises good collaboration tools and how they solve the difficulties of asynchronous collaboration teams.

The plan for this paper is to examine the difficulties in performing asynchronous collaboration. These impacts are the motivation for this work. Distributed teams need collaboration tools that solve communication impacts. The next step is to introduce the concept of an evaluation framework with important characteristics for asynchronous tools. These characteristics will be developed from the literature review. The hypothesis is that useful tools will have the evaluation framework in common to some extent. The results of the literature review are intended to discover and support the individual characteristics of the framework. A set of characteristic sub elements will be developed. A generalized set of team types will be presented. The activities of these team types will be indicated and associated with sub-elements of the framework characteristics.

### **3. Synchronous and Asynchronous Collaboration**

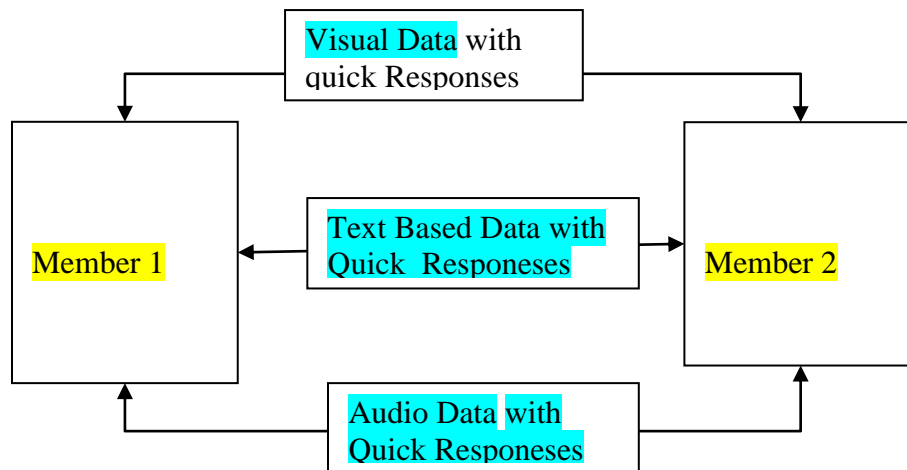
Define collaboration as the interactive process that team members work in. They use shared rules, norms, and structures, to act on issues related to that domain (Gray 1991). Members have tasks to perform, share information and indicate progress.

Synchronous collaboration occurs when team members are using the tool at the same time and possibly close geographic location. Members need to gain an understanding of other member roles. The team needs to become aware of the skills, abilities and status of all the other members so that they may take advantage of this information. Typical activities in a synchronous collaboration are reviewing agendas, task

lists, task execution, and task sharing results. When decisions are needed, the team reviews options and votes on the options to arrive at a decision.

		<b>TIME</b>	
		Same Time ( <i>Synchronous</i> )	Different Time ( <i>Asynchronous</i> )
<b>SPACE</b>	Same Space	<i>1<sup>st</sup> Quadrant</i> Spontaneous collaborations, formal meetings, classrooms	<i>2<sup>nd</sup> Quadrant</i> Design rooms, Project scheduling
	Distributed	<i>3<sup>rd</sup> Quadrant</i> Video conferencing, net meetings, phone calls	<i>4<sup>th</sup> Quadrant</i> Emails, blogging, authoring, voice mails, fax

**Figure 2 - Collaboration Quadrants (Rama 2006)**

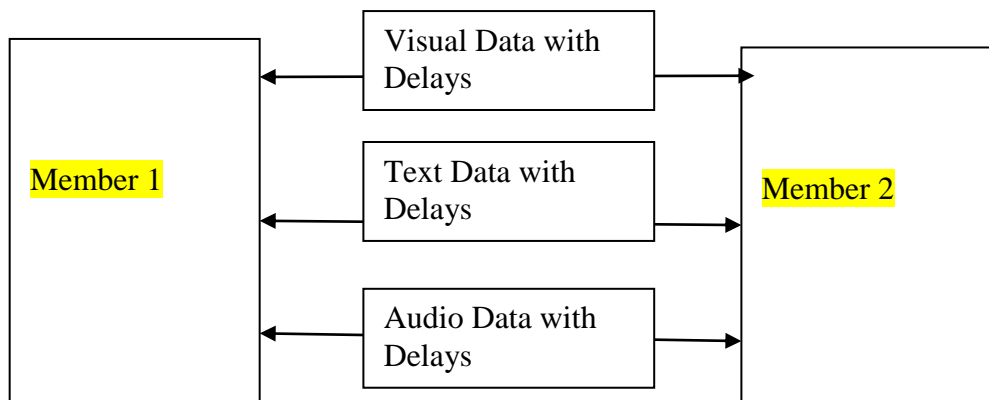


**Figure 3 – Synchronous Collaboration Channels**

Synchronous collaboration takes advantage of skilled members working together on tasks in the same proximity and time. Many endeavors require people with certain skills and

abilities and co-locate them for task execution. Feedback on tasks and worker status is immediate. Task completion is efficient due to shorter request-response cycle.

In Asynchronous collaboration there is no such limitation on members to be closely located. Members can form and disband groups as needed. Those members with extensive education and experience that do not wish to relocate are able to collaborate. Even musicians on many different continents can compose and annotate each other's work in a highly distributed fashion. It is possible for hundreds of performers to contribute to one musical performance. This work is focused on quadrant 4 in Figure 2.



**Figure 4 – Asynchronous Collaboration Channel**

Asynchronous collaborators may work in different locations with different time zones. This distributed work continues to increase while experiencing unique challenges associated with task completion. Asynchronous collaborators enter a tool workspace

without knowing the status of the project. Members need the knowledge of what artifacts have been modified and who has made the changes. They review the history of artifact modification, decisions, and activities to understand how the team arrived at various stages of the project. The only information provided to members is the access to the data. For communication to occur, collaboration tools are needed for technical support. These tools will help teams understand individual roles, gain knowledge about other members, and review agendas or task lists. In the event where a decision is required, electronic review of potential choices will occur, and this allows for comments and suggestions. Voting can be utilized to decide the outcome if decisions are not unanimous. Or, an authority figure may collect suggestions and make a determination.

There are team using asynchronous collaboration experience significant challenges. As shown in the difference from Figure 3 to Figure 4. By its very nature, asynchronous collaboration assumes that members can perform cooperative tasks, while they are not in the same physical space and not in the same time zone. Task completion is a difficult in this type of tool. Many communication channels are lost in asynchronous collaboration. These include communication of visual information that includes; facial expressions, gestures, eye contact, body positioning, and voice intonation. Members have little or no feedback on their efforts and thus have an impaired sense of team participation. Software tools need improvements to overcome this deficiency.

Note that there are many older collaboration software tools. These are infrastructure-type of tools that include, chat, e-mail, video conferencing, and single user calendars. There are also tools that support social networking and knowledge building.

These are not task oriented. These mostly support synchronous work and not the focus of this research. The focus of this research is on a framework for evaluation of collaboration tools for asynchronous work. The characteristics and sub elements of asynchronous work will be examined to determine how they relate to different types of teams.

#### **4. An Evaluation Framework for Collaboration Tool**

Early attempts to solve asynchronous collaboration problems focused on group memory and software design. A later development was a knowledge depot concept that contained categories for setup, input, formalization and retrieval. In addition there was the project compendium that included categories for definition, assumptions, requirements, and costs/benefits (Zimmerman 1997). These efforts provided organization to the work, but did not address communication channel loss due to the asynchronous mode.

Another work focused mostly on synchronous collaboration. This provided a basis for an awareness framework that supports both synchronous and asynchronous collaboration. This awareness framework contained; information access, communication, coordination and computation (Bharadwaj 2003).

User surveys may be applied to collaboration tools. Previous surveys supported claims of usefulness for the tools (Furmanski 2004). Tools help facilitate task completion. They can provide descriptions of the nature of the collaborative process. They can provide evaluation metrics of how a tool fits a collaborative process (Klein 2005).

The studies of coordination mechanisms used in the London Underground (subway) provided the basis for support techniques in collaboration tools (Heath 1991). Examining the way these mechanisms worked for transportation systems, provides the

basis for what the computer supported teams should do. By prompting commuters with status of next trains, riders may experience shorter traveling time or receive guidance with a detour. These activities are very common in collaborative teams.

As tool research continued, a number of asynchronous collaboration issues were identified. The issues identified included the loss of information transfer when shifting from co-located teams to distributed ones. Status of changes in the system and in artifacts needed to be monitored. Distributed team tasks are prone to delay. Distributed teams benefit from specially designed tools that compensate for communication channels lost in asynchronous collaboration. Members need tasking immediately when they are in the system. The design of these tools presents challenging problems. Information exchange is more difficult with increasing geographical distance (Herbsleb 2000). The reduced information exchange requires computer support to compensate for the loss. The context of the collaboration artifacts describes the situation surrounding members and their actions on artifacts and the collaboration tools need an architecture that provides context support that is needed for asynchronous collaboration (Dey 2000) When asynchronous members enter the tool repeatedly or for the first time, they need the background about who was in the tool, what has changed and what needs attention (Gutwin 1995).

Previous work has identified individual characteristics of useful collaboration tools individually. These are a set of five characteristics for this study's proposed evaluation framework. These characteristics include Awareness, Context Persistence, Calendar Assist, Coordination and Visualization. The strength of the presence of the framework characteristics in a collaboration tool implies the tool will be more useful.

## 4.1 The Proposed evaluation Framework for Asynchronous Collaboration Tools

**Table 1- Evaluation Framework Characteristics**

1. Awareness
2. Calendar Assist
3. Context Persistence
4. Coordination
5. Visualization

Table 1 is the proposed evaluation framework for asynchronous collaboration tools. This is the first level of inspection for collaboration tool. The next sections will discuss the individual characteristics.

### 4.2 Awareness

The requirements for awareness are; knowledge of who has been in the tool, what the changes in the artifacts are, and what tasking remains to do. This provides the sense of a member's role in the larger effort. Members need awareness signals or alerts to know when they need to complete tasks and review updated objects (Dourish, 1992).

An early example of awareness was in the form of shared document editing application called Bayou. Bayou allows asynchronous editing while detecting file share usage and resolving issue (Edwards, 1997). A later awareness feature allowed asynchronous members to find information on changes when they enter the system so they are up-to-date in the form of an awareness monitor (Cadiz, 1998). Shared editing is where multiple users in different time zones are to make contributions and annotations. Team members may observe other peoples annotations. A project coordinator can

monitor and direct progress. The ability to look forward and backward in time at the contributions is very useful to team members.(1997 Edwards)

#### 4.2.1 Social Translucence Sub-Element

Social Translucence is an aspect of the IBM collaboration tool named Babble(Erickson 1999). The presence of members is indicated on a map with location information in this tool. Their amount of communication is indicated by the closeness of the icons that represent the individuals. Members provide status and discussions in a persistent chat.

#### 4.2.2 Action Sub-Element

Asynchronous members need to have a public awareness of actions to fully understand efforts in the workspace and coordinate with them (Robertson, 2002). Awareness that is lost when members are not in face-to-face meetings. Providing asynchronous teams with the information on; tasks and the members executing them is a goal for collaboration tools.(Schmidt 2002) (Pinelle 2005).

#### 4.2.3 Avatars Sub-Element

Avatars provide low level communication in a non-verbal form. They exist as an adjustable form of a cartoon image of the user that provides nonverbal communication that is not present in asynchronous collaboration. Avatars are changed by the user to indicate emotion, understanding or status (Persson 2003), (Cheung 2010). These can express the emotions of support, dislike or confusion in the collaboration.



#### 4.2.4 Maps Sub-Element

Many ideas occur in a collaboration without the ability for the team to observe when, and who made them. A tool will log will can be implemented that contains important aspects about activity. These include; ideas as they develop, who made them and how they adapt over time. This log can support two important modes of collaboration tools operation. The first case is when new team members come into the workspace. They can observe idea formation and understand how ideas change and evolve. And the second case is where new members are in the system. Members can analyze historical data to find the source of an idea that leads to success or failure. Awareness maps can show the status of efforts and who is doing them. (Farooq 2007). Activity Awareness has been demonstrated in process maps. Process maps are used to show what had been done, what was needed and who needed to contribute. These process maps provide activity awareness and status of task work (Cabitza 2007).

#### 4.2.5 Activity Logs Sub-Element

In order to provide better awareness of activities, a computer application may provide an automated status of team member work. This could be an repository of activity logs that would provide members with history as well. It is possible to evaluate the amount of creativity over time (Farooq 2007).

### **4.3 Calendar Assistance**

The first software Calendars supported the single user (Mackinlay 1994). Members could view the day, week and month. Appointments could be scheduled and rescheduled. Translating this to an electronic calendar proved very useful tool due to

modification ability (Kincaid 1985). Single user electronic calendars were quite useful for repetitive and long term event scheduling. A significant drawback with the single user calendar was that team members could not share calendar information without sending entire calendars. Changes in other single user calendars will not affect each other.

The development of multi user calendars has allowed many team members to make joint appointments. These calendars have the ability to check other member's calendar for availability and make a joint appointment. Further developments to calendars made them function more like a communication device. Calendars need support the social needs of the project group letting members feel more in touch with the group and a important part of the effort . A multiple user calendar can serve as a temporal storage device. "To do lists" placed in calendars enhance work coordination. The calendar provides a time orientation to artifacts and members. The scheduling of events can be automated. The calendar can orchestrate complex tasks with multiple users. There are times when members want less knowledge of other work in process so that they can complete critical tasks. Calendar activity priority filtering can support this. Other times where members need to significantly increase their sense of other work activities. The sum of these techniques provides for better cooperation (Palen 1999).

The need for multiple event modification by multiple users became apparent as more users modified calendars. Architectures needed to allow for annotation, prediction of meeting success and have the ability to view another personal calendar for availability to schedule a meeting (Tullio 2002). Calendars can sense activities important to the user and provide alerts for those members that need it. Calendars were then improved to

accept numerous changes from a variety of users and applications could coordinate that information in one central location. One primary purpose for multi-user calendars is the scheduling of meetings. Members can negotiate with the calendar for time availabilities. A series of suggestions and declines or acceptances can be accomplished easily and remotely. Members can analyze the workload and availability of another member and predict success of future meetings (Tullio 2003).

#### 4.3.1 Restoration Sub-Element

Asynchronous calendars by their nature must accommodate disruption. When communication is broken, the assisted calendar must update the returning collaborator. In some cases a reconfiguration or recalibration of the collaboration may be necessary (calendar restoration). If the disruption is long term, and current members are not available, then new members may be nominated for work. If there is cyclic disruption, then the schedule can be adjusted periodically to accommodate this. (Mark 2008)

#### 4.3.2 Large Scale Events Sub-Element

Software Calendars by their very nature are scalable to very large numbers of users. This makes them very effective in guiding large numbers of people. Of particular interest is the use of large events calendars for conferences. Conference attendees may select their track of interesting talks and attend or adjust. These requirements can break a major calendar into a number of sub-calendars. Other data analysis toolkits can provide insight from patterns and statistics(Wang 2010).

#### 4.3.3 Managing Privacy Sub-Element

Members in a workspace may have lower or higher levels of friendship. As calendars develop in capability, management may be interested in adjusting these levels of friendship as part of project team effectiveness. If team workers are very interactive then maybe the project team is working well, and vice versa. This sub element provides for analysis of team collaboration activity (Thayer 2010).

#### 4.3.4 Task flow in Mobile Systems Sub-Element

Computer based workflows have existed for some time in the pc environment. But as applications move to mobile environments, workflows are still needed. Mobile environments have unique challenges for the similar view screen and reduction of the number controls. Task flow monitoring is possible if the applications can migrate to these new environments. Touch controls can replace a mouse and two fingers operations can generate zoom in and zoom out capability (Karlson 2010).

#### 4.3.5 Policy Decisions in Workflow Sub-Element

Collaboration systems that require security can be supported with the ability to employ policy decisions. If the members adjust policies involved with the collaboration impacts may be reduced. New designs can prevent impacts on the work being done by distributed teams (Karp 2011).

### **4.4 Context Persistence**

Context persistence started as a method to improve the collaborators' understanding. This understanding can be provided with the use of spatial context information (Moran, 1994). In addition, the temporal context of an artifact can be stored

in groupware systems (Palen 1999). The context persistence, both spatial and temporal, provides a record of what actions were taken on what artifacts and by whom. Context persistence architectures will allow for the storage of this interaction (Dey 2000).

#### 4.4.1 Temporal Sub-element

A major improvement in context persistence was the design of a meeting information context viewer. This viewer can be adjusted forward or backward in time to examine program history to see who contributed to decisions and what the results were (Fuchs 2002). This feature provided significant assistance for the orientation of new members into the collaboration.

#### 4.4.2 Storage and Retrieval Sub-Element

Recent developments in context persistence provide the capability for storage and retrieval of context. This includes: context of use, context of actions, and the correct context to the right people. The context of artifacts can be used to make information exchange more understood (Soules 2005). One implementation is a tree structured java architecture provides a mechanism for sorting the artifact with the context of other information (Wang 2005), ( Kinns 2004). This provide the ability to search for a context or similar context.

#### 4.4.3 Activity Diagrams Sub-Element

Activity Diagrams are useful for keeping members informed on what activity has been completed, what needs to be done, and includes an indication of urgency. The application of this work was to focus on medical procedures for groups. The resulting capability easily applies to other collaborations (Cabitza 2007).

#### 4.4.4 Chat Records Sub-Element

Making decisions is an important process for collaboration. Linking the task data to their context in a shared workspace has been demonstrated. The method is based on analysis of persistent chat records even in the asynchronous mode. This was shown to facilitate decision making through improved event understanding (Poon 2008).

#### 4.4.5 Context Sharing

A conceptual state of the art approach for context persistence is a temporal record of work efforts that is computer generated and supports queries and trend analysis. This context of multiple workers is stored in a single hierarchy of a context aware framework. This framework provides a total context of what workers are doing and members can access and review of this total context for better a understanding by providing a macro level group context (Joly 2011).

### **4.5 Coordination**

Define coordination for collaboration tools as the group of methods that includes; procedures, conventions, and rules for support of task completion. Coordination is the smooth execution of tasks. Procedures are the particular path of execution. Conventions are agreements between parties to participate together. Rules are a guide to action and usually associated with a particular situation. Members serving in collaboration roles, will execute a specified collection of procedures.

A study on the London Underground provided the basis for early concepts of coordination mechanisms for collaboration. These cooperation rules were developed from observations of mass transit systems. Coordination information was provided before

travelers entered the systems in order to move more efficiently (Heath 1991). Distributed tasking later became an important goal of coordination. This construct provided members with a "To Do List" in the form of a task manager is needed to execute concurrent tasking. A system of shared to do lists for a distributed team defines what is done within the tasking, and will log the results for review (Kreifelts 1993). These lists would guide members on tasks as they enter and leave the system. A more formal development was a framework of rules proposed for a team is to use group memory. This framework standardized the usage of group memory, access and helped coordinate efforts as well as providing assertions for costs and benefits (Zimmerman, 1996).

Rules for team members were later defined as conventions that align individual work styles. Members need to know what other artifacts are affected by the artifact that they are editing (Mark 1997). Tasks can be coordinated using conventions for shared artifacts and those using them. Then all members must comply with these conventions. Conventions can be programmed into the tool using the configuration settings (Mark 2002). These conditional predefined actions build trust among users.

Procedures can serve as a long duration guide for tasks. Group Task Analysis was a procedural approach to following tasks and logging their completion, resources used and participant actions. (Van de Veer 2001). Later the use of social protocols was discussed but was not robust enough to accommodate collaboration conflicts. A better method was to focus on multiuser coordination procedures. This will handle the problem with latent defects in networks (Morris 2004). An approach to rule application to data was needed. Data can be made accessible or inaccessible for the various parts of the

collaboration with the use of tags. Business rules can be set up for proper tagging. Tags can make an artifact part of a project and can allow for time tags or decision points.

Tool driven role definitions for members can guide the collaboration work to be more efficient. If we define the roles of the members, then we can monitor and support them with a collaboration workspace tool set. Tools can assist interactions with suggestions of expert or prior experience in the same role. Role definition provides guidance on tasks in an asynchronous environment where team leaders may not be available to direct the work. This can prevent task overlap, and allow for monitoring of concurrent tasks. Roles can define interactions that can be monitored for accuracy. This role definition will provide better quality output. (Boess 2008)(Zhu 2005).



#### 4.5.1 Rules Sub-Element

Coordination Policies are principles applied to achieve outcomes. For distributed teams, these coordination policies are applied to a number of services being offered. Blocking policies are used to allow individual input access. But minimal blocking is useful for shared read access. (Wang 2009)

#### 4.5.2 Interorganizational Sub-Element

Highly distributed organizations exist and may interact on an infrequent basis. These may occur in the form of disaster relief, and security organizations, or large building construction companies. Groupware has been developed for large organizations. This tool indicates dependency. Organizations are allowed to observe and understand other groups' activity and understand how activities relate (Stoll 2010).

#### 4.5.3 Thought Swapping Sub-Element

An effective tool for collaboration systems is thought swapping. The approach is to blend the experience of the team members. Groups of questions and answers are displayed in a persistent tool and these conversations can be annotated. A further refinement is the sorting of content by author and the ability to query the system (Kurdziolek 2010).

#### 4.5.4 Handoffs and Handovers Sub-Element

As part of normal distributed work, members complete work and forward to other members. There are numerous errors associated with these handoffs. Errors include: did the actual transfer take place and was received by next member, was the information in

the handoff correct, and is the information understandable for the next user. Specialized policies, strategies and associated computer frameworks to support them will improve handoffs (Sharma 2010).

#### 4.5.5 Routines Sub-Element

Dual income families with children perform distributed work in the form of routines. The approach is that the parents make decisions the night before and then perform tasks including dropping off and picking up children. These activities fall into routines of repetitive work. With the use of sensors with computer applications could capture and map these routines and adjust the tasking to take advantage of distributed worker availabilities (Davidoff 2011).

## 4.6 Visualization

Define Visualization as the computer graphics that provide information and understanding in forms that consider human perception. Visualizing data can be performed in methods that include geometric projection, icon display, hierarchical graphs and combinations of these (Sawant 2009). Visualization in collaboration tools needs to support members performing tasks with the adjustable information views on relevant artifacts, activity, and status of work.

In the 1980s, collaborative visualization environments were restricted to the small space of a desktop display. In order to view large amounts of information, members had to close one screen and expand another. Two or more screens had to be open so members could copy and drag items from one screen to another. This problem is referred to as window thrashing.

Information system research provided the beginnings for collaboration support with visualization. One important concept is for shared object versioning (Grief 1985) that provides for multiuser editing using tokens. The token would be given to the next person to perform changes and all other had to wait. Another method of visualization is where it is possible to view shared artifacts, references to artifacts, icons, and text with annotations on tool whiteboards (Donahue 1986). Whiteboards provides the workspace for object annotation.

The concept of “Virtual Rooms” was proposed as a collaboration workspace. Team members could enter and look around the room, placing files as one would place a book in a library. An artifact be selected and examined and annotated. Rooms could be grouped together in an association if they had a relation (Henderson 1986). Further work proposed the need for a visualization of knowledge that could provide details about how events evolved and are related (Travers 1989).

More adjustable data viewers became very useful in visualization. A form of hierarchical views provided a high aspect ratio combined with ability to view items in detail (Robertson 1991). Research in modeling and languages lead to a method of concurrent visualization editing (Wood 1997). An application called “Team Space”, allow team members to manage shared work. Team Space supports asynchronous work by retaining records of activity, and storing artifacts. The application has the ability to annotate documents.

#### 4.6.1 Private and Public Workspaces Sub-Element

More recently, interfaces have private and public user spaces. Individuals can modify artifacts without distracting others. In 2004, there was a demonstration of an artifact that is modified in a private user only region, and then members can move artifacts back into the shared region for the next member to review and modify (Africano, 2004).

#### 4.6.2 Dependencies Sub-Element

There has been a significant improvement in a number of recent visualizations. Visualization of dependencies provides insight on the impact of changes. A visualization of collaboration strength shows the frequency of member working together (De Sousa 2007). Over time the change in visualizations will reveal team formation trends.

#### 4.6.3 Artifact Activity Sub-Element

Communication logs and other work data artifacts are by their nature actually puzzles in one form or another. If collections of data are considered as puzzles, then this will allow users to tag and discuss how various pieces relate to each other. Tags can be used to link data regions. Then the visualization can provide new and different ways to analyze data. The collaboration tool can generate thumbnails of recent activity and or topic hubs. Users gain a better understanding of the nature of the data and the trends involved in the recent activity. It is possible to assess the gaps in the work that we are trying to accomplish and address them (Danis 2008).

#### 4.6.4 Expert Finder Sub-Element

An example of a visualization need is where a team member lacks a skill or ability and needs assistance from another member. The employee is not sure where this needed skill and member with the expertise are located. A team member searching for expertise could navigate a set of hierarchal tree whose branches are skill sets and the closer to the base of the tree the stronger the person's skill set (Afzal 2009). A more formal means of fostering collaboration by sharing information about members approach is to provide computer support that recommends a expert person to assist you with a problem that you have no experience in. The assistance chosen is based on a query generated by the knowledge seeker (Macdonald 2000).

#### 4.6.5 Stuck Work Monitors Sub-Element

Team members are constantly updating their artifacts and completing tasks. But if task are blocked or stopped, managers don't know until they query the system workflow. A recent work suggests this is a significant problem for distributed work and the requirement for computer alerts if artifacts or even multiple scheduled tasks have not had activity. These are referred to as stuck work monitors and notify the team or selected individuals on non-activity or impacts (Carter 2010).

This completes the discussion of collaboration tool Evaluation Framework with sub-elements. The following is an addition to this work to answer the question "How can the evaluation framework support different types of teams in different ways?"

## 5. Types of distributed teams

The following is a short list of team types that commonly occur in the asynchronous team collaboration.

### 5.1 Academic

An academic team of specialists doing research and the activities they perform.

Eight individually read papers on research topics and annotate documents shared environment. This work is not strongly driven by schedule, rather it is my creativity and discovery.

- Activity
- Search
- Annotate
- Schedule
- Roles
- Artifacts

### 5.2 Retail

Shoppers buying items in sales of produced goods, stocks and bonds, data and services. Buyer's review items available for sale. They make a series of additions to the shopping cart performed check out. The goods are then delivered to them at some later time.

- Search
- Processes
- Rules

- Financial processes

### 5.3 Composers

Teams create music or literature or art. These contributors have significant experience in some creative area. This allows them to start a work or contribute to an existing one. This collaboration is interesting from a musical standpoint as the contributions added to the work are sequential or concurrent.

- Annotate
- Visualize
- Translate
- Artifacts

#### 5.4 Developers

Teams of software or other technology creators. This is the most rigorous of the team types and makes extensive use of the framework. This team has numerous important areas to make achievements in. These include: schedule, cost, quality and responsiveness performance requirements. The result is that they use all sub-elements in all areas of the evaluation framework.

- Requirements
- Schedule
- Artifacts
- Task scheduling
- Task completion

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## 6 Tools that contain the Evaluation Framework

This work has provided concepts for the beneficial characteristics contained in the framework. A small number of collaboration tools were examined that contained the framework characteristics of awareness, context persistence, multi-user calendar, rules and visualizations. The following is a series of examples of tools that have characteristics of our framework.

The Awareness Monitor has a number of interesting features (Cadiz 1998). It contains an awareness tree. Within this tree, the member can see who has been in the workspace with various indications. There are also visible metrics as to what artifact has changed and by how much. An Awareness Time Object Activity Diagram displays the document object (Pankoke 2004). The author and time of artifact creation is indicated. Then annotations with editor and date can be applied.



Wetpaint is a context persistence tool example. This is a adaptation of a Wiki that supports work. Basically the group creates a posting space. Access is controlled and members can post material, with change notices going to all members. The Temporal State of material and contributions is adjustable. Another context persistence tool example is that of the Daisy Phone (Kinns 2004). Members can compose a song by writing new material or editing previous material. The user can view previous work was graphically and what changes that were made and save the annotation. A third context persistence example is the IBM History Flow tool. This tool is used for working with document and multiple editors. There are different colors to show who contributed an annotation, what the revision version is and what is the level of contribution by each contributor is.

Multi-user calendar examples include MS Share point, and Yahoo Groups. MS Share point has individual calendars for projects or tasks. This allows users to invite people to an event and track their acceptance of the calendar event. These calendars provide alerts or announcements to assist users to keep up to date with events. The Calendar information artifacts can be annotated and there is a task status tracker. The multi-user calendar in Yahoo Groups has a significant set of features. Access to the workspace can be controlled by use of administrative rights. The Calendars are arranged on the web with programmable alerts. Artifacts can be placed in the calendar dates and other objects stored in the workspace.

Asynchronous tools need process rules, configuration setting prompting rules and use algorithms to support coordination in asynchronous teams. Some researchers maintain that we use admin rights to configure most tools with Rules in the form of

access protocols and operations restrictions to enhance task completion (Mark 1997).

This can include prompting rules for task completion.

Tool support for asynchronous visualization is provided by JSPWiki. One kind of tool may use a mix of java molecular graphics and JSP wiki to show what the basic pieces of some work are and who did them and when and then annotate with new information( Marchese 2007). The tool also indicates the work yet to be done.

Web based collaboration tools

[http://en.wikipedia.org/wiki/List\\_of\\_collaborative\\_software#Web-based\\_software](http://en.wikipedia.org/wiki/List_of_collaborative_software#Web-based_software)

## **7. Inspection of tools for framework sub elements**

7.1. Inspection of 20 asynchronous collaboration tools for the presence of the framework characteristic sub elements .

The evaluation framework has been presented in detail, the next step is to examine some tools. The following is an inspection of twenty tools that support asynchronous collaboration for the presence of the framework and the sub elements. The tools include; project management, shared writing as well as music composition. The majority of the tools are known as project ware. Project ware tools that are used to manage developmental or manufacturing efforts. These efforts include; a project team, schedule management, cost management delivery and provides collaboration support to ensure task completion.

Table 2 – Twenty collaboration tools with framework sub elements

Characteristic	Sub Element	Tool 1 Adobe Connect	Tool 2 MS Share Point	Tool 3 Yahoo Groups	Tool 4 Google +	Tool 5 Pablo draw	label
Awareness	Actions		X		X	X	A
Awareness	Avatars	X	X		X		B
Awareness	Maps		X		X		C
Awareness	Activity Logs	X	X		X		D
Awareness	Social Activity		X		X		E
Calendar Assist	Large Scale Events		X				F
Calendar Assist	Managing Privacy		X	X	X		G
Calendar Assist	Task Flow		X	X	X		H
Calendar Assist	Policy Decision		X				I
Calendar Assist	Restoration		X				J
Context Persistence	Activity Diagrams		X		X		K
Context Persistence	Chat Records	X	X	X	X	X	L
Context Persistence	Context Sharing		X		X	X	M
Context Persistence	Storage and Retrieval	X	X		X		N
Context Persistence	Temporal	X	X				O
Coordination	Inter- organizational		X				P
Coordination	Thought Swapping	X	X		X		Q
Coordination	Handoffs	X	X		X		R
Coordination	Rules		X				S
Coordination	Routines		X		X		T
Visualizations	Artifact Activity		X		X	X	U
Visualizations	Dependts		X		X		V

Visualizations	Public + Private	X	X				W
Visualizations	Stuck Work Monitor		X				X
Visualizations	Expert Finder		X				Y

Characteristic	Sub Element	Tool 6 Wrike	Tool 7 Huddle	Tool 8 Aceproj	Tool 9 Google +	Tool 10 Binfire	label
Awareness	Actions	X	X	X	X	X	A
Awareness	Avatars				X		B
Awareness	Maps						C
Awareness	Activity Logs	X		X	X		D
Awareness	Social Activity						E
Calendar Assist	Large Scale Events						F
Calendar Assist	Managing Privacy						G
Calendar Assist	Task Flow	X	X			X	H
Calendar Assist	Policy Decision					X	I
Calendar Assist	Restoration			X			J
Context Persistence	Activity Diagrams	X		X			K
Context Persistence	Chat Records		X		X	X	L
Context Persistence	Context Sharing			X	X	X	M
Context Persistence	Storage and Retrieval	X	X			X	N
Context Persistence	Temporal					X	O
Coordination	Inter-organizational						P
Coordination	Thought Swapping			X			Q
Coordination	Handoffs						R
Coordination	Rules		X	X			S

Coordination	Routines			X			T
Visualizations	Artifact Activity	X					U
Visualizations	Dependencies						V
Visualizations	Public + Private						W
Visualizations	Stuck Work Monitor			X			X
Visualizations	Expert Finder						Y

Characteristic	Sub Element	Tool 11 Daisyphone	Tool 12 Eproppure	Tool 13 Pivot tracker	Tool 14 Owis	Tool 15 Proto share	label
Awareness	Actions	X	X		X	X	A
Awareness	Avatars		X				B
Awareness	Maps	X					C
Awareness	Activity Logs					X	D
Awareness	Social Activity						E
Calendar Assist	Large Scale Events		X				F
Calendar Assist	Managing Privacy		X	X			G
Calendar Assist	Task Flow		X	X	X		H
Calendar Assist	Policy Decision		X				I
Calendar Assist	Restoration		X				J
Context Persistence	Activity Diagrams	X					K
Context Persistence	Chat Records	X				X	L
Context Persistence	Context Sharing	X	X				M
Context Persistence	Storage and Retrieval	X	X	X		X	N
Context Persistence	Temporal		X			X	O

Coordination	Inter-organizational						P
Coordination	Thought Swapping	X					Q
Coordination	Handoffs						R
Coordination	Rules					X	S
Coordination	Routines						T
Visualizations	Artifact Activity	X		X	X	X	U
Visualizations	Dependencies						V
Visualizations	Public + Private	X					W
Visualizations	Stuck Work Monitor	X	X				X
Visualizations	Expert Finder						Y

Characteristic	Sub Element	Tool 16 Teamwork	Tool 17 Zimbr a	Tool 18 Webex	Tool 19 Project spaces	Tool 20 Zimbr a	label
Awareness	Actions	X	X	X	X	X	A
Awareness	Avatars						B
Awareness	Maps						C
Awareness	Activity Logs	X	X	X	X	X	D
Awareness	Social Activity						E
Calendar Assist	Large Scale Events						F
Calendar Assist	Managing Privacy						G
Calendar Assist	Task Flow	X		X	X	X	H
Calendar Assist	Policy Decision						I
Calendar Assist	Restoration	X		X			J
Context Persistence	Activity Diagrams						K
Context Persistence	Chat Records	X					L
Context Persistence	Context Sharing				X	X	M
Context	Storage and		X		X	X	N

Persistence	Retrieval						
Context Persistence	Temporal						O
Coordination	Inter-organizational						P
Coordination	Thought Swapping						Q
Coordination	Handoffs						R
Coordination	Rules						S
Coordination	Routines						T
Visualizations	Artifact Activity						U
Visualizations	Dependencies						V
Visualizations	Public + Private						W
Visualizations	Stuck Work Monitor						X
Visualizations	Expert Finder						Y

Table 3 – Table of Tools vs. Characteristics – Letter = Characteristics, Number = tool

	1	2	3	4	5	6	7	8	9	10
A		X		X	X	X	X	X	X	X
B	X	X		X				X	X	
C				X						
D	X			X		X		X	X	
E				X						
F										
G		X	X	X						
H		X	X	X		X	X			X
I										X
J								X		
K				X		X		X		
L	X	X	X	X	X		X		X	X
M		X		X	X			X	X	X
N	X	X		X		X	X			X
O	X	X								X
P										
Q	X	X		X				X		
R	X			X						
S							X	X		
T				X				X		
U				X		X				
V		X		X	X					
W	X	X								
X								X		
Y		X								



	11	12	13	14	15	16	17	18	19	20
A	X	X		X	X	X	X	X	X	
B		X								
C	X									
D					X	X	X	X	X	X
E										
F		X								X
G		X	X							
H		X	X	X		X		X	X	X
I		X								
J		X				X				
K	X									
L	X				X	X				
M	X	X						X	X	X
N	X	X	X		X		X	X	X	X
O		X			X					
P										
Q	X									
R										
S					X					
T										
U	X		X	X	X					
V										
W	X									
X	X	X								
Y										

This table of collaboration tools is comprised of mostly project-ware. Project-ware is a set of tools characterized by; scheduling of tasks, tracking of efforts, and use the calendars to check status. Other collaboration software is included that supports writing literature, composing music, and creating art. These are only a few of the collaboration tools listed.

When reviewing the chart, an X indicates that the tool can easily support the sub element of the collaboration framework. If the sub element is not checked then this indicates the tool does not readily support the sub element. Many of these tools have a set configuration and operation mode. Other tools are very flexible and can be reconfigured in many ways. In some cases, with a good deal of work, these tools can be reconfigured to support the sub element.

## **8. Inspection Two Tools for the Framework sub-elements**

The following is an inspection of the “ SharePoint” Tool and The “Daisyphone” Tool for the presence of the evaluation framework characteristic sub elements. The Daisyphone tool has one graphic user interface with a lot of components. Whereas the SharePoint tool is a server that can be configured in many different ways and this includes the graphic user interfaces.

### 8.1 The SharePoint Tool – What is it?

SharePoint is a server based software tool that is accessible through the web. The tool can be arranged to support processes, provide status of activities, manage

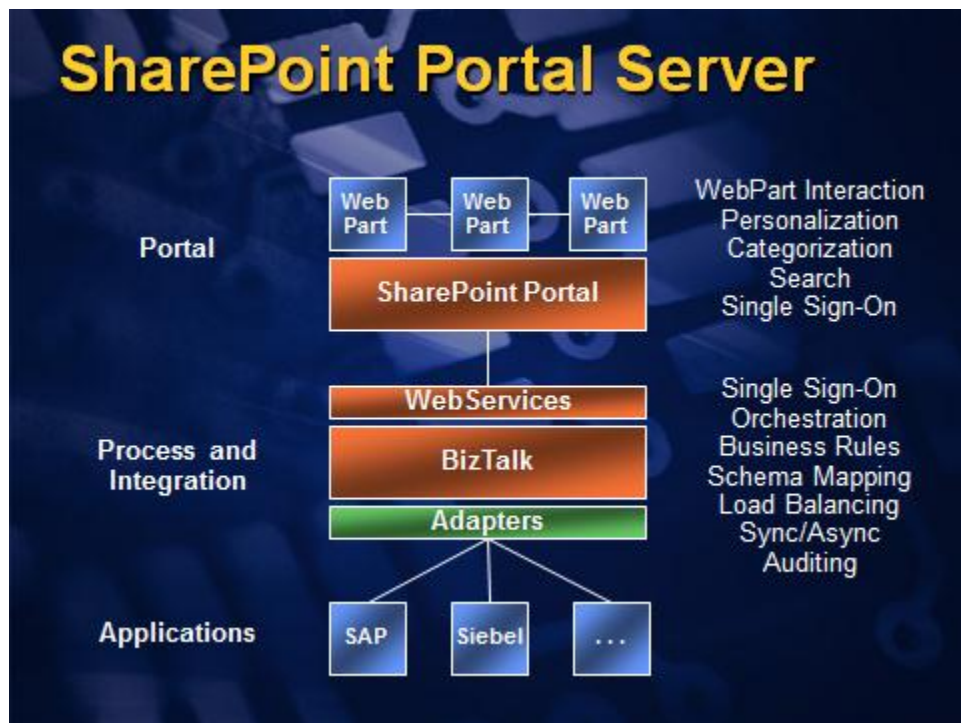
the data and manage the access to the data. The tool allows for design of graphic user interfaces. The work that is managed through calendars reminders and process flows. A key feature is that SharePoint is fully searchable. SharePoint tool can create and support internal postings. It is accessible from any connection to the internet. Users can approve work, collect group feedback, and annotate artifacts. It has a central document storage location. The tools are adjustable in the way they share information across teams or groups. SharePoint artifact modification can be made at any time. This is exactly what the asynchronous teams require. SharePoint's workflows can be edited very easily. Projects can be divided easily into tasks that are assigned to individual members. When the project is complete, an automatic report can be created to review project activity. Team members are regularly prompted when artifacts are available in tasks need to be completed. SharePoint can integrate with Outlook calendars. Any changes in the Outlook calendar are updated to the SharePoint software. Several adjustable alerts are available on the system. It is possible to set the system so that when updates occur or maybe are complete then various team members can be notified as to the status. Alerts can be set up for particular items artifacts or workflows. It is important to note that the SharePoint tool is a platform/server and not just a software tool with one configuration. It is an adaptable set of services that can be tailored towards particular type of project team use.

## 8.1.1 The SharePoint Tool

<http://sharepoint.microsoft.com/en-us/product/capabilities/Pages/default.aspx>

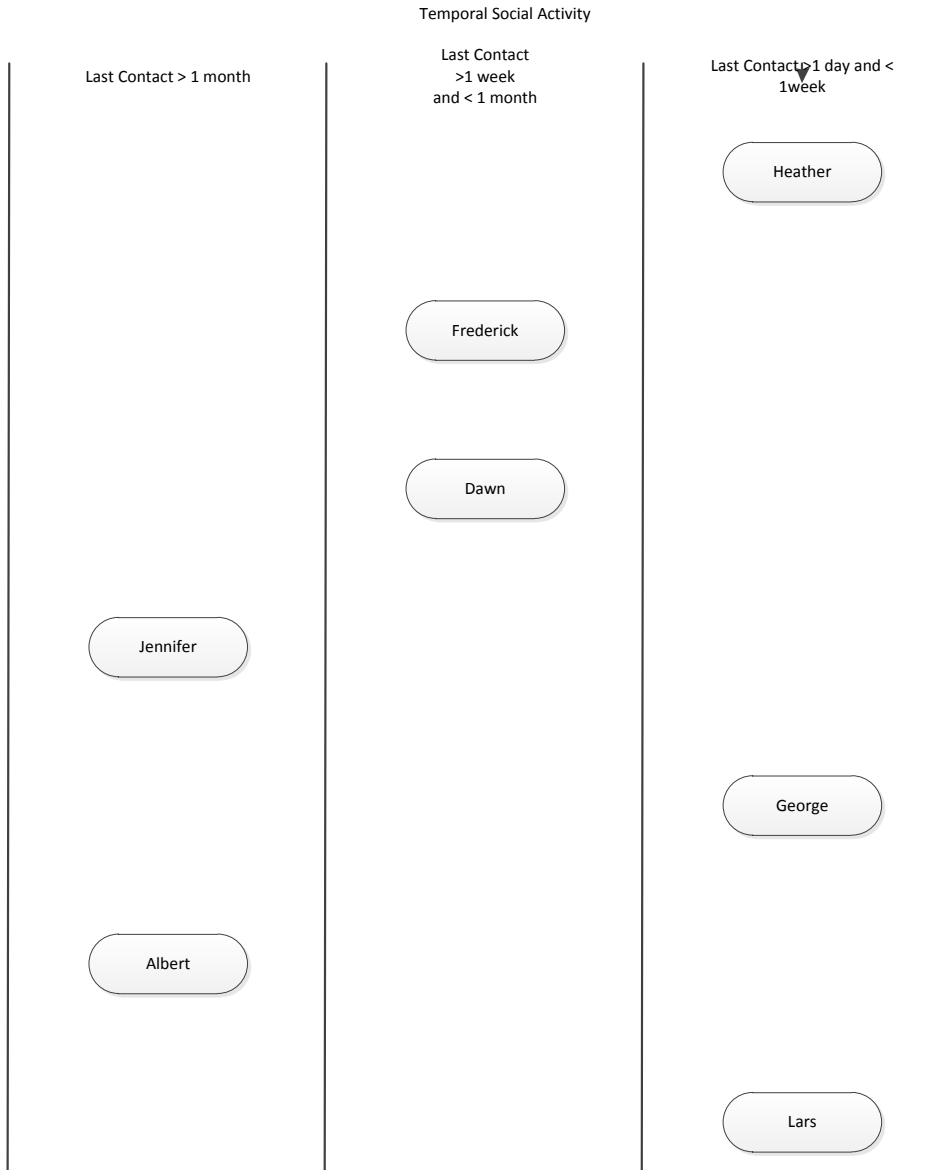
# SharePoint Team Services

- **Rich out of box team collaboration**
  - **Enable Communication**
    - Integration with e-mail, instant messaging and free/busy information
    - Team focused notifications
  - **Capture information**
    - Dynamic Lists
    - Rich and flexible views
  - **Group Coordination**
    - Event Calendars, Tasks, and Contacts



### 8.1.2 SharePoint Tool - Awareness – Temporal Social Activity Sub-Element

The SharePoint tool can be configured to examine the logs of tool use. The frequency of access per team member can be determined and visually displayed. The following diagram indicates what team members have been very active in the tool and who has not. A team leader would be very interested in activity on the left which could be an indication of some problem. It would be a concern if there was no appearance of team member in the in this sub element tool. Communication within days would most likely be an effective team member.



### 8.1.3 SharePoint Tool - Awareness – Actions

The SharePoint tool has a section known as recent activities. This section has a number capabilities that include; community content, voting and surveys, status of team members, and a dashboard of content activity. These can be configured as feeds on the team members project homepage.

The screenshot shows a SharePoint 'Home' page for 'Information Technology'. The page includes a navigation sidebar on the left with sections like Documents, Lists, Discussions, Sites, and People and Groups. The main content area features a 'Welcome to the Awareness Sharepoint' message, a post titled 'Get Started with Windows SharePoint Services!', a rating system, and a 'Nearby Status' section. A right-hand sidebar contains 'Solstice - Recent Activities' and a 'Group File' bar chart. Several blue callout boxes with checkmarks point to specific features: 'Voting & Comments' (rating system), 'Integrated Search' (search icon), 'Community Content Visibility' (post content), 'Status, Profiles & Friends List' (user profile), 'Single Sign-On' (login area), and 'Dashboard of Community Activity' (bar chart).

#### 8.1.4 SharePoint Tool - Awareness – Avatars

In SharePoint, define an avatar as the image and data that represent the individual team member and their social/emotional state when they were last in website. SharePoint has the ability to load, adjust, and display avatars of the team members. These images can be emoticons, avatars or actual photo icons. These images help other team members to recognize each other. The social emotional state of the team member can be indicated with these avatars. Other team members can respond based on the avatar configurations. For example, if a member avatar looks unhappy or upset. then other team members may respond compassionately. If a member avatar looks very happy other members may investigate further to determine what this great success was. The following is a set of employee photos combined with biographies of the individuals. This is important because team bonding tends to occur more readily when members of the team know more detail of the individual's background, education and experiences. Another modification to the avatar is a downloadable virtual business card with contact information.



Figure 5 – Photographs and Biography as Avatars

The screenshot shows a website layout with a header 'About Us Our Team' and a navigation menu on the right. The main content area features three team member profiles, each with a photograph, name, title, contact information, and a short biography. A 'Download vCard' link is provided for each profile. The profiles are for Jeremy Anderson (Founder), Patrick Dowell (Head of Backend Team), and Dan Andreescu (Backend Programmer). A 'View Full Profile' link is also present for each profile. The navigation menu on the right includes 'About Us', 'Our Philosophy', 'Our Team', and 'Giving Back'. A RSS feed icon is visible in the top right corner.

#### 8.1.4 SharePoint Tool - Awareness – Maps

Define the sub element of awareness maps as an indication of the most recent task completion. This allows a team member entering the environment to see what has been happening recently so they have an understanding of what's been going on and how they fit in to the project effort. A text based awareness map could appear as a list that has been completed within the last few days.

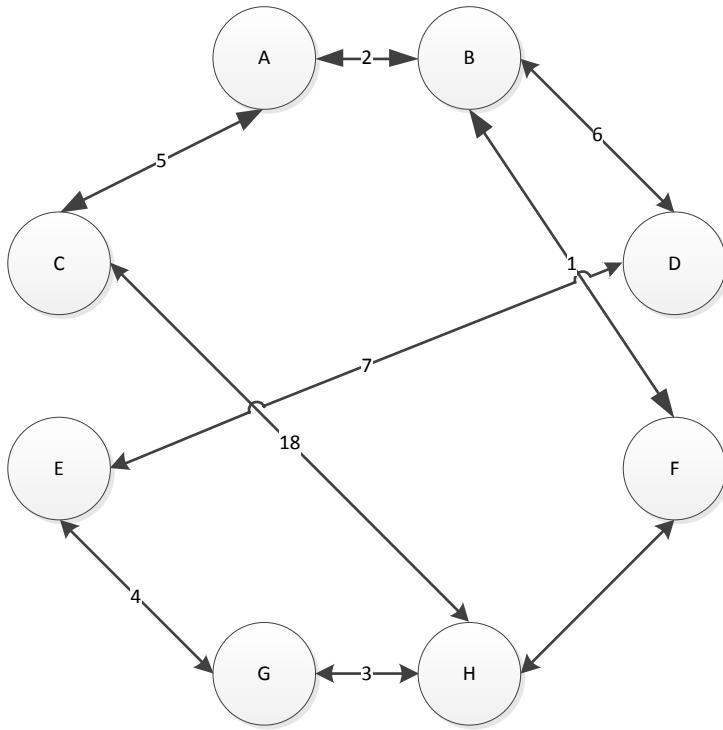
- John                      project 3                      task 10                      initiated
- Elaine                      project 2                      task 8                      in process

- Francis project 1 task 2 completed

### 8.1.5 SharePoint Tool - Awareness - Activity Logs

The SharePoint tool can be configured to monitor the activities, create a log and represent them in a graphical manner. One example, as seen in the following diagram is where team members are represented by nodes with letters or names in them and the number of collaborations is represented as the number in the connecting arcs. This diagram poses a number of questions. Is it appropriate where there are no connections as in the case of node A and node G? Or is the collaboration between node C and node H with a frequency of 18 appropriate or are they having difficulties? These are just two examples of how a collaboration frequency diagram can provide useful information about activities.

Figure 6 – Collaboration Frequency Chart



Collaboration Frequency Chart

### 8.1.6 SharePoint Tool – Calendar Assistance – Restoration

The following diagrams provide examples of workflows that have time periods attached to them. Work is assigned to various team members. Process calendar one is a simple and straightforward workflow. Process calendar 2 is where team members have been reassigned. And process calendar 3 and 3A indicate where there is been a schedule impact, and the work has been rescheduled.

Figure 7 – Calendar Process 1

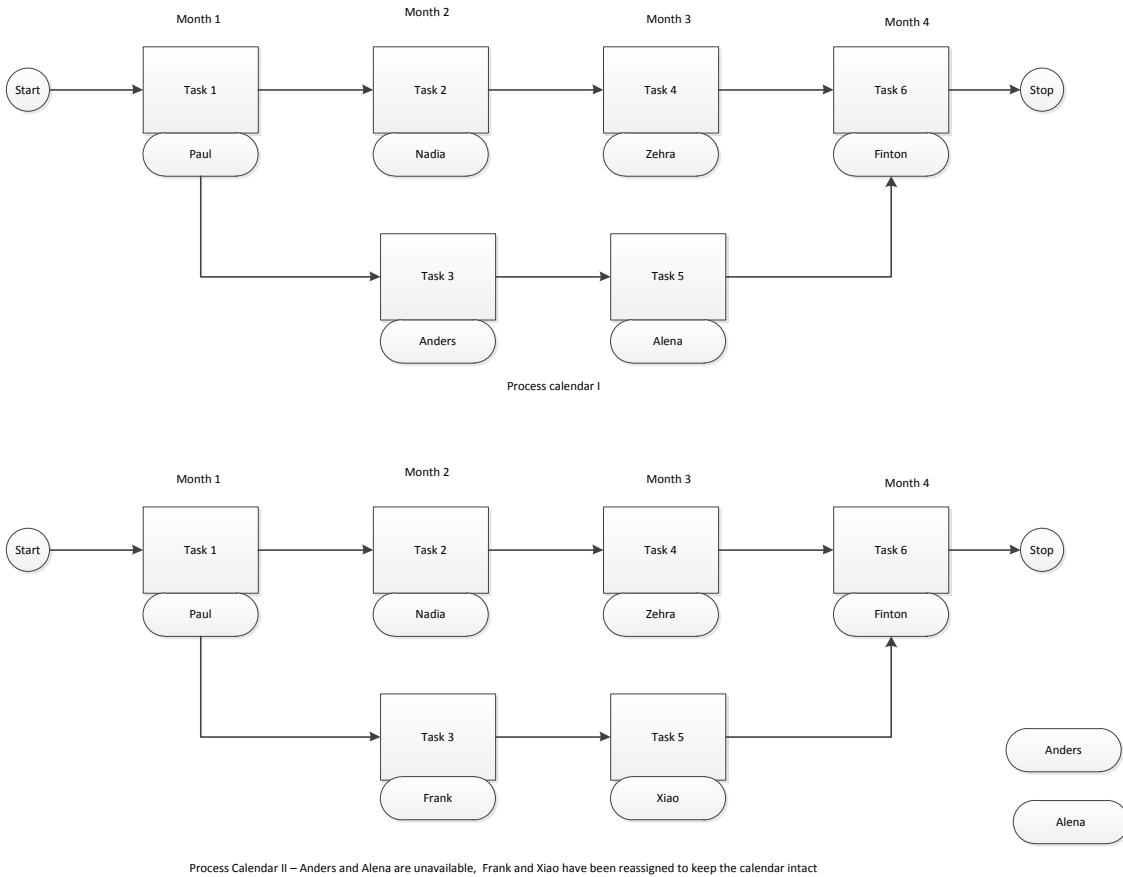


Figure 8 – Calendar Process 2

Figure 9 – Calendar Process 3

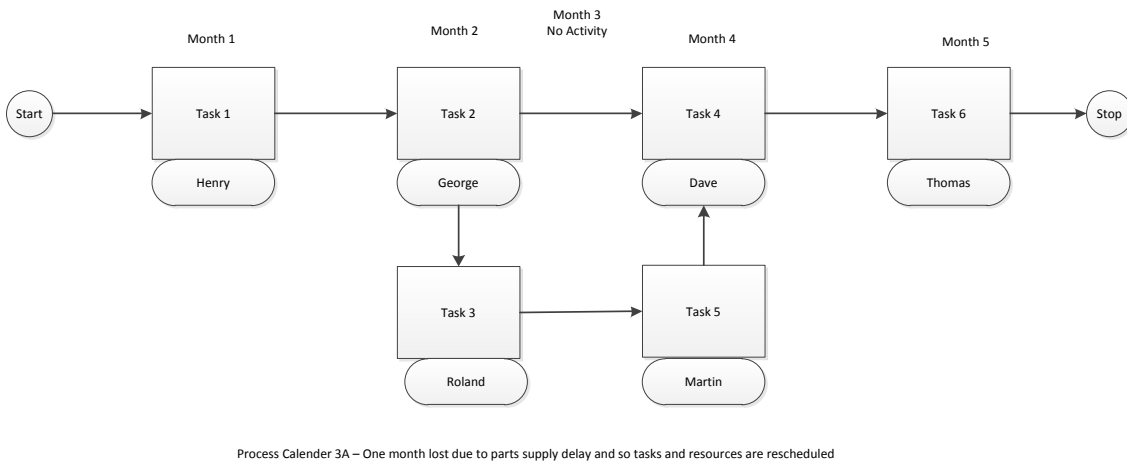
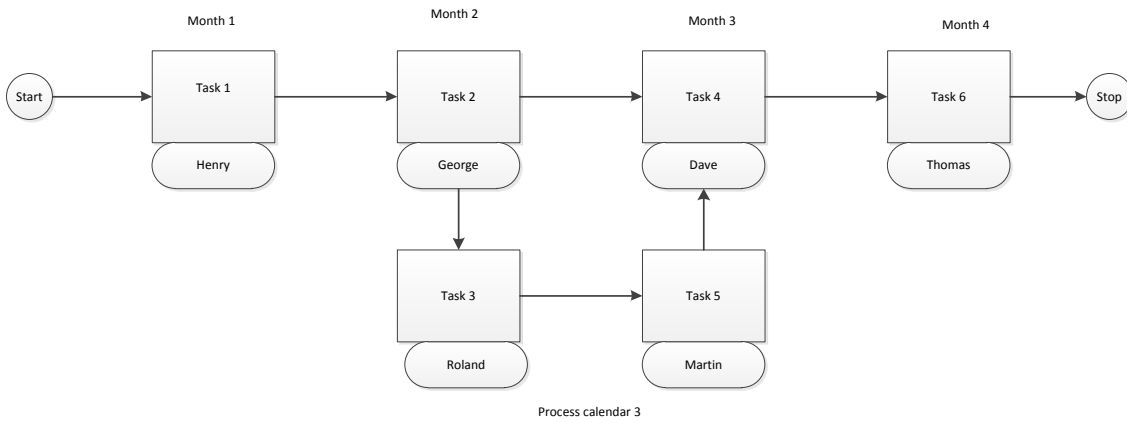


Figure 10 – Process Calendar 3A, a restored process calendar

### 8.1.7 SharePoint Tool – Calendar Assistance – Large Scale Events

SharePoint tool can support thousands of users. The actual capacity is determined by number of transactions, the number and size of documents stored per user and is slightly impacted by the number of visualizations required. Server farms can be provided for load-balancing and improve speed of access. SharePoint has been used to support a number of conferences where individuals have several different interests and are seeking to attend various program tracks.

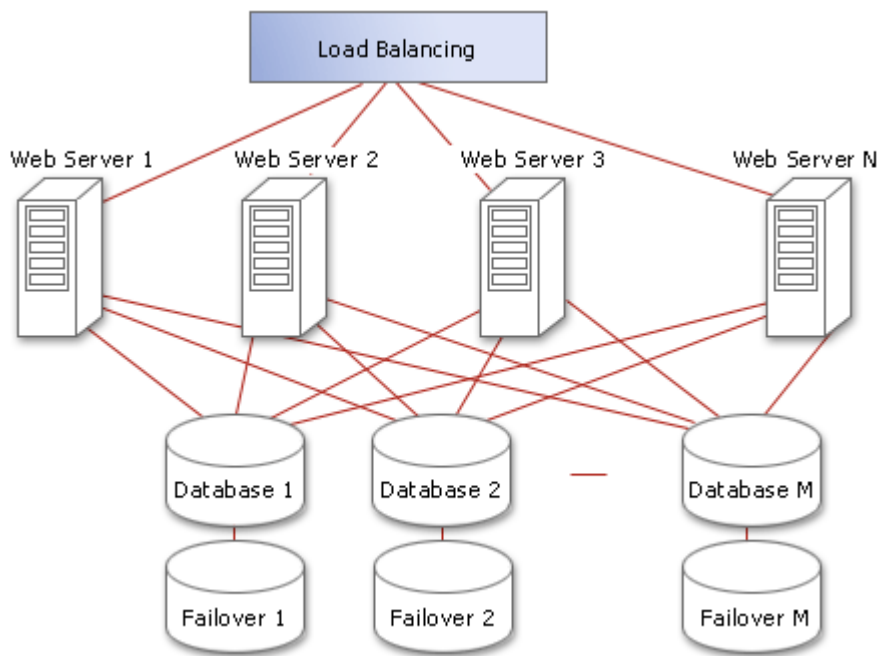


Figure 11 - Server Load balancing

#### 8.1.8 SharePoint Tool – Calendar Assistance – Managing Privacy

SharePoint has a built-in feature called “Sandbox solutions”. This feature maintains security and manage system performance. Sandbox Solutions is a separate code from other processes, improving the security and helping you control resources and prevent performance problems. SharePoint allows you to select access range for

your various data artifacts. This could be adjusted to "only me", "my manager", "my team", "my colleagues", and "everyone".

### 8.1.9 SharePoint Tool - Calendar Assistance - Task Flow

SharePoint has the ability to do traditional task flow. In addition we can add special automated activities to raise team member task flows to include efforts like: formal approval, set up a meeting, send an e-mail or task approval.

Figure 12 - A Notional Workflow

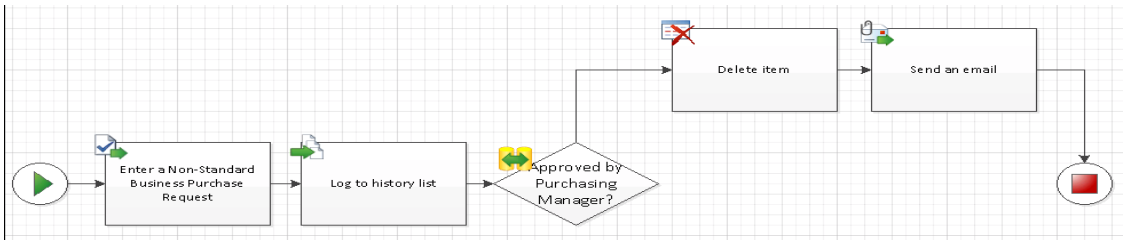
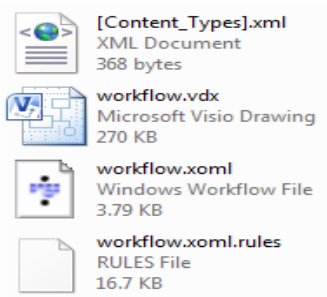


Figure 13 – Workflow tools in SharePoint

SharePoint Workflow Actions (US units)	
SharePoint Workflow Conditions (US units)	
SharePoint Workflow Terminators (US units)	
<b>SharePoint Workflow Actions (US units)</b>	
Assign a to-do item	Collect data from a user
Start approval process	Start custom task process
Start feedback	Send an email
<b>SharePoint Workflow Conditions (US u...)</b>	
Compare data source	Compare document
Title contains keywords	Created by
<b>SharePoint Workflow Terminators (US u...)</b>	
Start	Terminate

Figure 14 – Tools for workflow in SharePoint



#### 8.1.10 SharePoint Tool - Calendar Assistance - Policy Decisions

An interesting part of SharePoint is where the team member may adjust the calendar assistance and policy. The following are some examples. Members can set a policy that insists on having the team leader present for all project meeting and if they are not that the meeting was canceled and rescheduled. We could also set team meetings in the calendar to have a quorum. That is to say a minimum number of attendees must be available for the meeting to occur.



### 8.1.11 SharePoint Tool – Coordination – Rules

SharePoint has the ability to apply rules to the workflow. Example of a workflow rule is where an e-mail sent out to a contract reviewer when a new contract has been entered into the site and the next in line to review the contract will be notified in process and coming their way. Then if the reviewer rejects the rule then the artifact can travel the other way back up the chain to find out what part of the contract is incorrect. This is an example of the basic rules for contract review.

Figure 15 – Rules for contract review

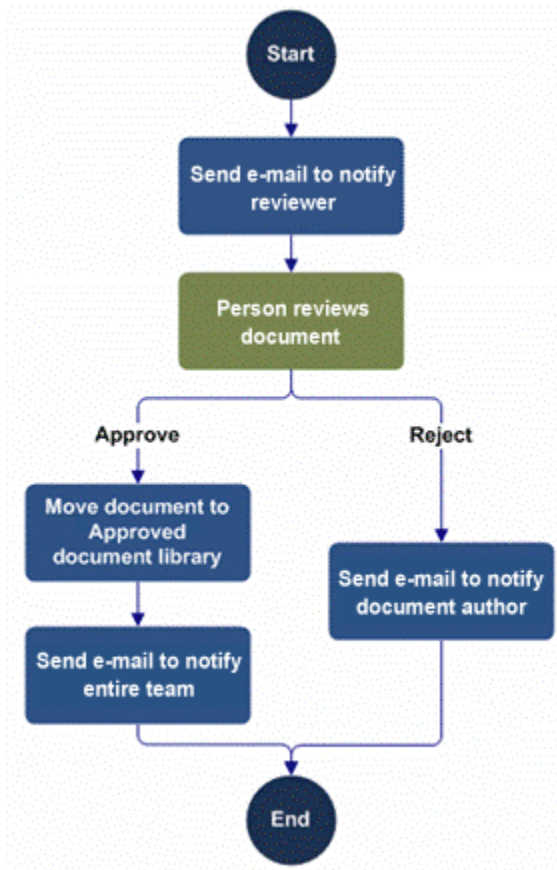
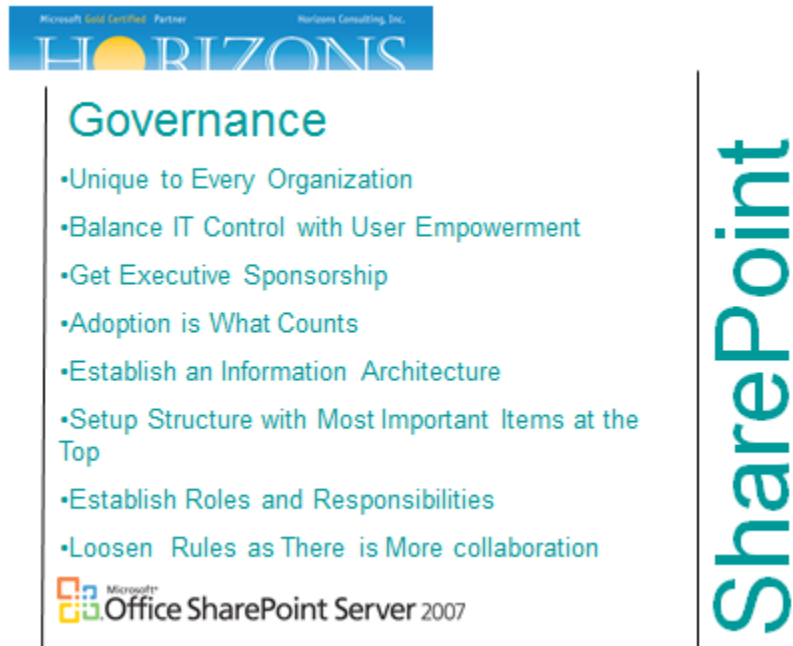


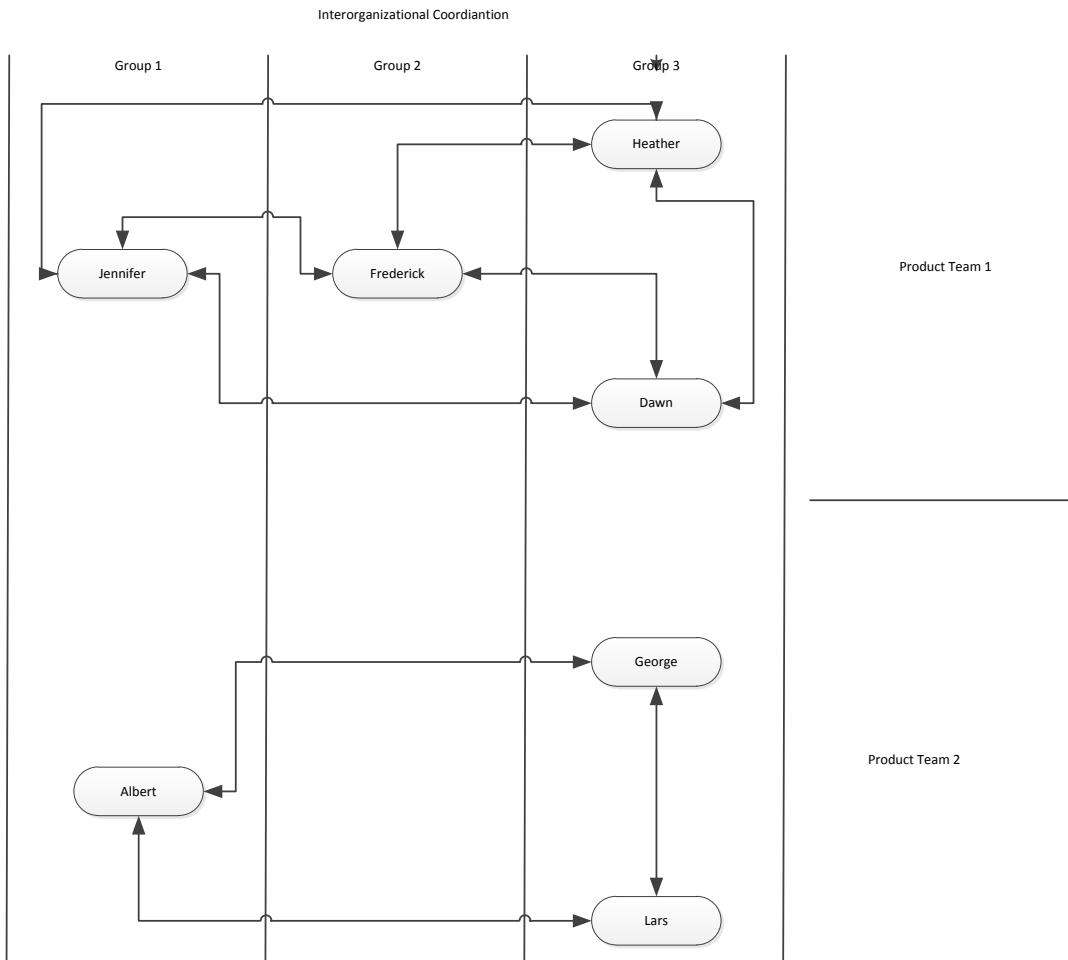
Figure 16 - Examples of rules in SharePoint



#### 8.1.12 SharePoint Tool – Coordination – Interorganizational

Interorganizational projects require interesting collaboration support. An example would be where two companies contributing to the manufacture of a laptop. The memory comes from Taiwan, the hard drives come from Thailand and the remaining technology comes from Japan. Key members of each company in each country would have to collaborate schedules and status to ensure product delivery. SharePoint is easily configured to connect team members in various countries and ensure work execution. Figure , the Interorganizational chart outlines the connectivity. It should be noted that SharePoint as the beginnings of a multilingual tool interface.

Figure 17 – Example of Interorganizational coordination



### 8.1.13 SharePoint Tool – Coordination - Thought Swapping

SharePoint has developed a feature for project teams called “Colleague Suggestions”. This is an automated service that suggests contacting colleagues based data

traffic. The tools allows for; a desired reporting structure, your communities membership, e-mail distribution lists, and contact lists. Each member may have a topics of interest list that will contribute to the search recommender. All members will be able to generate idea blogs that will be merged into one data repository for all suggestions and these can be reviewed by team members. This would put these data thoughts into a central location rather than e-mailing each idea to each person.

#### 8.1.14 SharePoint Tool – Coordination – Handoffs

SharePoint can support hand off and handovers. The server is a central repository. When one task is completed by one team member, then the next team members is notified and accesses the artifact while logs are updated. In this way the handoff is monitored and recorded in the workflow shows the status of the handoff and artifact movement to next team member.

#### 8.1.15 SharePoint Tool – Coordination – Routines

Routines are a byproduct of the workflow design. As team members are instructed to execute the tasks and upon completion the next team member will carry out their instructions with the artifact as well. So the workflow will determine the availability of resources and team members and then assign them in the workflow. A general routine would be to enter the workspace see what has happened. The team member would check the blogs and current task assignments and then proceed to complete them. These routines would change if the workflow imposed a meeting where approvals were needed.

#### 8.1.16 SharePoint Tool –Context Persistence – Temporal

The major goal for SharePoint is that all data is searchable. When a search is conducted all data artifacts are examined including; workflows, blogs, e-mails, documents, project history, etc.. Activity logs can be arranged in such a way that the date, performer, and project info can be stored as a log or tag. Then we can move back and forth in time and select what project we want to examine and who were the contributors what artifacts were changed.

#### 8.1.17 SharePoint Tool –Context Persistence – Storage and Retrieval

The SharePoint tool has a feature for tagging information. Tags can be used to classify and organize large amounts of information for projects. Members may use standardized taxonomy tags defined by the organization and informal social tags defined by employees. Tags can be designed in such a way that they link to a key event, with certain team members, who made various contributions. This would maintain the context of an event for future examination.

#### 8.1.18 SharePoint Tool –Context Persistence – Activity Diagrams

Tags can be designed for different events to have a chronological order. Then the tags could be arranged in such a way that they represent different periods of time and could be used as a search to see what events happened at different time periods based on the tag. An employee coming back to work after a few weeks off could review the activity and its context and get caught up to speed to continue work on the effort. A visualization could be developed in SharePoint to indicate what activities have occurred in a project or data artifact.

#### 8.1.19 SharePoint Tool –Context Persistence – Chat Records

SharePoint has the ability to post blogs, merge thoughts or new ideas of many members. In addition users can perform surveys and participate in voting. Tags can be applied to these blogs, thoughts, and chat records to see who participated in what events where. As before if the tags are arranged in chronological order then the user can proceed tag to tag over time we can obtain the context persistence chat records over time.

#### 8.1.20 SharePoint Tool –Context Persistence – Context Sharing

In the SharePoint tool, task activity over time also includes the context of activities. Each context is included and the more times a particular context appears, the more prominent the particular context is indicated. If members review the tags in chronological order it is possible to obtain the total context of what the team performed doing during a certain period of time.

#### 8.1.21 SharePoint tool – Visualization – Dependencies

SharePoint has the ability to perform workflows. When the work of one team member depends on completion of work by another team member the status of the workflow can be reviewed and what progress has been made. The next team can review the work that needs to be completed. This is also true of resources, The workflow will indicate what resources are to be provided and if they are on schedule.

#### 8.1.22 SharePoint Tool – Visualization - Artifact Activity

Examples of SharePoint dashboards and organizational browsers have been indicated. These can be configured in such a way as to track the progress of an artifact, what the annotations are and the current state of the artifact. This is another area that is extremely useful for an team member returning to work after a long duration or supporting the orientation of new team member.

#### 8.1.23 SharePoint Tool – Visualization - Expert Finder

SharePoint has the ability to learn more about your colleagues with Profile pages. The My Profile page contains information about employees, including biographies, job titles, location, contact information, interests and skills, and previous projects. SharePoint has a “Help People Connect “capability. The more quickly and easily they can find each other, the more they can share ideas and expertise to solve problems, improve processes, and foster innovation.

#### 8.1.24 SharePoint Tool – Visualization - Stuck Work

SharePoint has the ability to provide workflows with visualizations. these workflow tasks can have set durations applied to them by the calendar assist. If these

times are significantly exceeded and alerts and alarms can be set off from owning conversations between employees to find out if work is actually talk for stopped. Then the appropriate people can work on a problem that needs to be resolved .

## 8.2 The Daisyphone Tool

<http://gouda.dcs.qmul.ac.uk/>

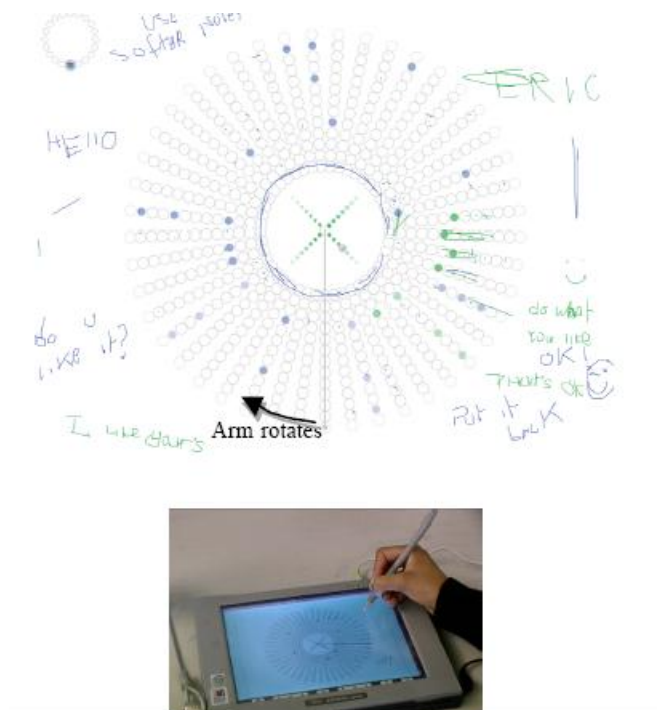


Figure 18 – Daisyphone Interface

Members use the Daisyphone to co-create short loops of music with other members in real-time simply by pressing on little dots to create and remove notes. Multi User real-time co-creation of loops with other people. Each person has a different color, and messages can be written around the edge. Once the annotation is finished the shared composition can be saved. This occurs in a single user screen. There are four kinds of



sound represented by which you choose from the center of the Daisy. This this collaboration works well for groups of 10 or less.

#### 8.2.1 Daisyphone Tool - Awareness - Temporal Social Activity

The tool cannot support this sub element.

#### 8.2.2 Daisyphone Tool - Awareness - Actions

The team members can review their actions if they are creating annotations or reviewing the music composition.

#### 8.2.3 Daisyphone Tool - Awareness – Avatars

The tool cannot support this sub element.

#### 8.2.4 Daisyphone Tool - Awareness – Maps

The tool cannot support this sub element.

#### 8.2.5 Daisyphone Tool - Awareness - Activity Logs

The tool cannot support this sub element.

#### 8.2.6 Daisyphone Tool - Calendar Assistance - Restoration

The tool cannot support this sub element.

#### 8.2.7 Daisyphone Tool - Calendar Assistance - Large Scale Events

The tool cannot support this sub element.

#### 8.2.8 Daisyphone Tool - Calendar Assistance - Managing Privacy

The tool cannot support this sub element.

#### 8.2.9 Daisyphone Tool - Calendar Assistance - Task Flow

The tool cannot support this sub element.

#### 8.2.10 Daisyphone Tool - Calendar Assistance - Policy Decisions

The tool cannot support this sub element.

#### 8.2.11 Daisyphone Tool – Coordination – Rules

The tool cannot support this sub element.

#### 8.2.12 Daisyphone Tool – Coordination – Interorganizational

The tool cannot support this sub element.

#### 8.2.13 Daisyphone Tool – Coordination - Thought Swapping

Team members are able to share written thoughts as well as musical composition thoughts to all the other composers.

#### 8.2.14 Daisyphone Tool – Coordination – Handoffs

The tool cannot support this sub element.

#### 8.2.15 Daisyphone Tool – Coordination - Routines

The tool cannot support this sub element.

#### 8.2.16 Daisyphone Tool –Context Persistence – Temporal

The tool cannot support this sub element.

#### 8.2.17 Daisyphone Tool –Context Persistence – Storage and Retrieval

The tool cannot support this sub element.

#### 8.2.18 Daisyphone Tool –Context Persistence – Activity Diagrams

The tool cannot support this sub element.

#### 8.2.19 Daisyphone Tool-Context- Chat Records

Members can add handwritten text all around the workspace and their identity is determined by the color of their ink. However the current display version is the only one accessible.

#### 8.2.20 Daisyphone Tool –Context Persistence – Context Sharing

The composition in the multiuser space is the total sum of context of the multiuser experience.

#### 8.2.21 Daisyphone Tool – Visualization - Public + Private

Team members can choose to compose by themselves or make another selection that is multiuser. This provides the private and public workspaces.

#### 8.2.22 Daisyphone Tool – Visualization - Dependencies

The tool cannot support this sub element.

#### 8.2.23 Daisyphone Tool – Visualization - Artifact Activity

When members use the Daisy phone and make alterations and changes notice you can see artifact activity for the composition

#### 8.2.24 Daisyphone Tool – Visualization - Expert Finder

The tool cannot support this sub element.

#### 8.2.25 Daisyphone Tool – Visualization – Stuck Work

When members use the Daisy phone and there are no changes notice this is an indication of stuck work.

## **9 Summary**

Characteristics of collaboration tools were examined. A number of individual beneficial characteristics for collaboration tools have discovered in the literature review. An evaluation framework composed of these characteristics has been proposed and examined. This will ensure reuse of beneficial effects for team members. This framework of methods is comprised of techniques, and software support tools. A framework has been proposed that uses the proven methods of awareness, context persistence, multi user calendar, rules, and visualizations. But more precision was needed to distinguish between and rate their level of usefulness. An additional set of sub-elements was developed has been presented and supported that better define the tools in terms of use. The team was determined to be a set of team types and not just a common group of workers. A notional flow of asynchronous team processes has been indicated A set of teams commonly found in asynchronous collaboration team have been presented and discussed. The needs of these teams have been highlighted in detail. Then the sub-elements of the framework are based on their usefulness to each of the team type need. Then a composite list of team types, frameworks needed and sub-element needed was presented. Then team type varying requirements were discussed. The result was that different teams needed different sub-elements because of the nature of the work and processes that the team performed.

## 10 Future Work

The asynchronous collaboration tool evaluation framework with sub-elements has been established and the foundation for the framework has been shown. This provides a basis for future work. Innovations in technology, products and services will require new types of teams with new skills. The effect of which will be that asynchronous tools will require new characteristics and sub elements for performance. This would suggest that every 3-4 Moores law segments the framework should be re-evaluated because of the significant increase in processing power.

This effort can continue the literature review with developments from several conference proceedings including CHI, CSCW and Group. Collaboration tools can be sorted into different types for specialized teams. New sub-elements will appear as computing power grows. This can be refined into characteristic elements dedicated to teams. The benefits of such collaboration tool evaluation work would be better tools for highly specialized teams

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