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# A Collaborative B2E based on a P2P platform

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## Abstract

Companies, large and small, are rapidly adopting Business-to-Employee (B2E) applications hoping to improve productivity of their work force. However, most B2E applications do not provide a good sense of community and lack of collaboration and interaction among its users. Consequently, employees are not motivated to fully utilize the contents and information provided by these applications. Peer-to-peer (P2P) computing is proven to be a good platform that provides and supports community by empowering users to collaborate and interact with one another. In this paper, we propose an approach to provide collaboration in B2E applications based on a P2P platform.

## 1. Introduction

Business-to-Employee (B2E) applications are believed to be the next wave of the "B" technology. It is estimated that over 75% of global 2000 companies will have adopted B2E applications by 2004. Not only are large corporations adopting B2E as a means to improve communication and increase productivity of its work force, but more small and medium companies are also expected to embrace the technology [6]. In another survey conducted recently by Venkatesh Shankar, et al [8], rapid adoption of B2E applications is further confirmed: more than two-thirds of the 473 firms who participated in the survey claimed that they are using the wireless Internet primarily for B2E applications. The survey results also make an interesting revelation in addition to the finding that B2E applications are going mobile: companies adopting B2E applications are not only confined to a few industries. Instead, the surveyed sectors are quite diversified; they include banking, insurance, manufacturing, telecommunications, transportation, media, utilities, retail, health care, and government. It is apparent that B2E is gaining acceptance across the board of industries.

In this paper, we will first discuss what B2E is, the desirable features of B2E, and the deficiencies of existing B2E applications. To overcome these deficiencies, we

propose a new approach to develop B2E applications based on a peer-to-peer (P2P) platform. We will briefly describe what a P2P platform is and how B2E can be built on it. Finally, we present a collaborative B2E system that is implemented by a global IT company based on Groove Network, a commercial P2P platform.

## 2. What B2E is

B2E is said to have evolved from the Executive Information System (EIS) of the 1980s [5]. In an EIS, senior management of an organization can access the news, financial data, company performance, information of products, competitors and vendors etc, with a single entry point. This is supplemented by emails, customized built applications, ad hoc query tools, quick and easy report writers, etc. Others believe that B2E actually began with telephone automatic systems (e.g. integrated voice response (IVR) systems) that provided simple human resources administrative functions and evolved into fully personalized portals. While it is debatable that B2E evolved from EIS projects, lessons were definitely learned from developing these EIS. For example, developers gained understanding and experience on integrating diversified data sources of an enterprise with new IT technologies and infrastructure. In addition, developers also realized the significance of politics, company culture, commitment and support from the top management in order to secure the acceptance of EIS. These experiences influence and propel the development of B2E.

B2E is to improve the effectiveness, efficiency and productivity for both individuals and teams by simplifying administrative processes, building competitive advantages through simplified workflow, collaborating and sharing knowledge with one another. Many functions and applications such as company information, R&D programs, project teams, marketing campaigns, HR functions etc, were mostly invisible to employees before, but the advent of Internet technologies made it possible for companies to create portals that integrated all these functions within one single entry point. A company can provide the most up-to-date information to its employees.

Employees can now invoke applications within the same portal without leaving the browser. Through the portal, archives of presentations made by marketing department, status reports on new products and information regarding competitors and vendors, are all accessible through the portal. The accessibility not only makes sharing work easier, but it also makes the entire company more transparent.

## 2.1 Desirable B2E Features

A typical B2E scenario can be described as follows: A Sales staff logs onto his personalized portal (i.e. MyPortal) in the morning. The portal contains information on the company, updated departmental information, the latest news on products, market analysis (including news on competitors, customers and vendors) done by the Marketing dept, pricing schedule, customer info, sales order status, emails, discussion forums on topics related to sales, file repository that includes sales order forms, customer PO history, new sales training materials on product specifications, and a To-Do list which includes pending sales calls, replies and responses to customers, call list for potential future customers. He will then carry out his daily task assignments and obtain supporting information using the portal.

A B2E portal can provide abundant information for a user. However, the real issue is not all on the B2E portal contents. People can become so overwhelmed by the vast amount of information in a portal that they feel alienated by them. This presents a real problem because, above all, a B2E portal should be the platform where people can relate to their company and to one another and to build the sense of community. Furthermore, any B2E portal has to be compelling to the people who use it. Based on these perspectives, we identify the following list of desirable features of a B2E portal:

- (1) Basic Features
  - a. Single point of entry. A B2E has one URL that will be the entry point of all employees.
  - b. Tools and applications that support daily operations such as news, events, calendar, file repository, etc.
  - c. Personalization. The functional aspect of personalization is to allow an employee to select what information should be presented in what order. Psychologically, personalization gives an illusion that the portal is designed to serve just one employee. The more personalization an employee does to his portal, the higher chance that he will use the portal.
- (2) Advanced Features
  - a. Communication  
Communication should include many modes, synchronous and asynchronous such as one-to-one (email), one-to-many (broadcast message, listserver, mass mailing list), and many-to-many (discussion groups and forums), including chat room and instant

messaging. A B2E must provide channels for employees to communicate to the management and to each other.

- b. Collaboration
  - i. Real time collaboration.  
Employees will need to collaborate and interact with each other in order to improve their efficiency, productivity, often to provide better customer services. Real time collaboration includes co-browsing, co-editing, co-annotating, whiteboard drawing, chatting, and instant messaging.
  - ii. Offline collaboration and synchronization.  
Offline collaboration is also necessary to support team work. There will be times when team members are not connected to the Internet or the collaboration does not require real time support. A B2E should support offline collaboration mode such as discussion forums. Updates done by other team members should be synchronized with members who have been offline so that they can catch up with the activities and events at a later time.
  - iii. Ad Hoc Collaboration.  
Collaboration mode is mostly pre-defined, i.e. establishing a virtual workspace for a specific project or purpose. However, there are often times when people need to set up ad hoc collaboration workspaces to facilitate their work. For instance, a sales staff may need to collaborate with an engineering team for a short period of time. They should be able to form an ad hoc collaboration workspace to support their work.
- c. Knowledge Sharing.  
A B2E should support both structured and unstructured knowledge, e.g. file repository, training materials, handbook, guidelines, company procedures and policy, chat room archives, history of document annotation and editing.
- d. Multiple Channel Delivery System.  
A B2E should be able to deliver to multiple devices and platforms, ranging from desktop browsers, to notebook computers connected through cell phones and Wi-Fi, to PDAs and cell phones.
- e. Workflow and Processes Support,  
A B2E should support workflow and processes that are tailored to the company's culture and best business practices.
- f. The B2E should not be restricted to single domain or application. It should be able to

span across the boundaries within and outside of a company. It should cross departments and be exposed to external entities such as clients, vendors and suppliers.

## 2.2 Existing B2E applications and their deficiencies

Basic B2E solutions have been around for quite some time [2]. In the 1980s, companies used phone system automation (e.g. the integrated voice response (IVR) system) to support their employees. Most notably, it was at this time that many human resource functions, such as benefit administration, could be accessed via an IVR system. In the 1990s, client/server employee self-service applications were developed. Employees could submit benefit application forms, modify their personal information, view the status of their benefit packages, apply for vacation, etc through a client/server application within the LAN. In the late 1990s and early 2000s, the advent of technologies and the availability of the Internet, in addition to the valuable experiences in building EIA systems, B2E applications were transformed into web-based Intranet or Internet applications that allowed an employee to access information anytime from anywhere. These web-based applications were then further integrated to form a fully customizable company portal. As can be seen, the B2E portal has evolved from a traditional simple IVR to a client/server application, from a limited amount of services to a full spectrum of employee services that range from accessing information on the company, product specifications, business/market intelligence on its competitors, customers and vendors, product pricing information to employee handbook, company policies and procedures, HR benefits and to online training. It is irrefutable that these solutions do improve the productivity, efficiency and effectiveness of employees. However, there are several areas that these solutions fail to address:

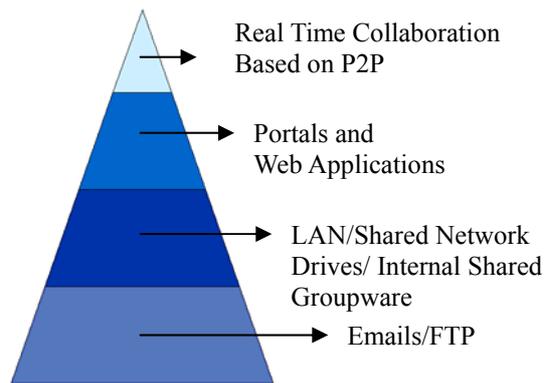
- (1) Lack of communication. Communication is mostly one-sided. The company disseminates information to employees and collects specific information from employees through applications. It would be difficult for employees to pass information upward. In an efficient and ideal organization, with more people in the decision making process, people who have relevant information or ideas have a better chance than ever to influence the outcome of those decisions. Existing B2E is weak to support m-way communication among employees and management.
- (2) Lack of Collaboration and Interaction. B2E applications hardly support collaboration and with very limited interaction. However, collaboration is key to improve effectiveness, efficiency and productivity. Collaboration creates good sense of community which can be the major attraction to draw employees to use B2E.
- (3) Lack of Sense of Community. Most B2E applications do not support communities. Users of such systems will hardly get the chance to interact with other users. A good sense of community support is essential to attract and retain users.
- (4) Difficulty in crossing boundaries. Most B2E applications are separated from each other. It is difficult to traverse or integrate a specific B2E application to other B2Es or to other non B2E applications.
- (5) Lack of flexibility to support ad hoc collaboration. Collaborations in most B2E are pre-defined and do not allow users to create ad hoc collaboration when needed.

## 3. Peer-to-Peer Platform

In the past few years, P2P has attracted enormous media attention and gained popularity by supporting two main classes of applications: file sharing, in which peers share files with each other (for example, Napster, Gnutella, Morpheus and Kazaa), highly parallel computing, in which an (inherently) parallel application runs on available nodes (for example, SETI@home and FightAIDS@home) [9].

A Peer-to-Peer (P2P) is a set of protocols on which an IT architecture is built upon to provide a distributed computing environment (DCE) [7]. Hosts are interconnected via Internet. Each host maintains its autonomy. Every host is "equal" without the distinction between Client and Server. An individual host can have its unique abilities and can benefit from services provided by its peers. The enabling technologies of P2P are due to the ubiquitous network connectivity with available high bandwidth, combined with increased process and memory capacity. In addition to file sharing and highly parallel computing, other services such as virtual communities, real time collaboration emerge.

The major deficiency of existing B2E is the missing of collaboration and hence the sense of community. Analogous to the Maslow's Hierarchy of Needs, a Collaboration Hierarchy is depicted in Figure 1. At the lowest level, collaboration can be based on emails and supplemented with FTP. The next level of collaboration is the groupware and shared network drives. A more elaborated collaboration can be provided with web applications and portals so that employees can share and collaborate anywhere anytime. The highest level of collaboration will be the real-time collaboration based on a P2P architecture. Peer-to-Peer (P2P) is proven to be an excellent computing environment to create and support collaboration and sense of community [3, 4, 7, 9]. It is this level of collaboration we are proposing in this paper.



**Figure 1: If Maslow was a collaborator**

#### 4. A Collaborative B2E based on P2P

A collaborative B2E can be built on top of a peer-to-peer (P2P) platform. Figure 2 depicts a high level architecture of such system.

The foundation of this architecture is based on a peer-to-peer platform. Its major services include communications, security, data synchronization, and providing components/APIs to integrate applications. For example, Groove Network is one of several commercial available P2P platforms [10].

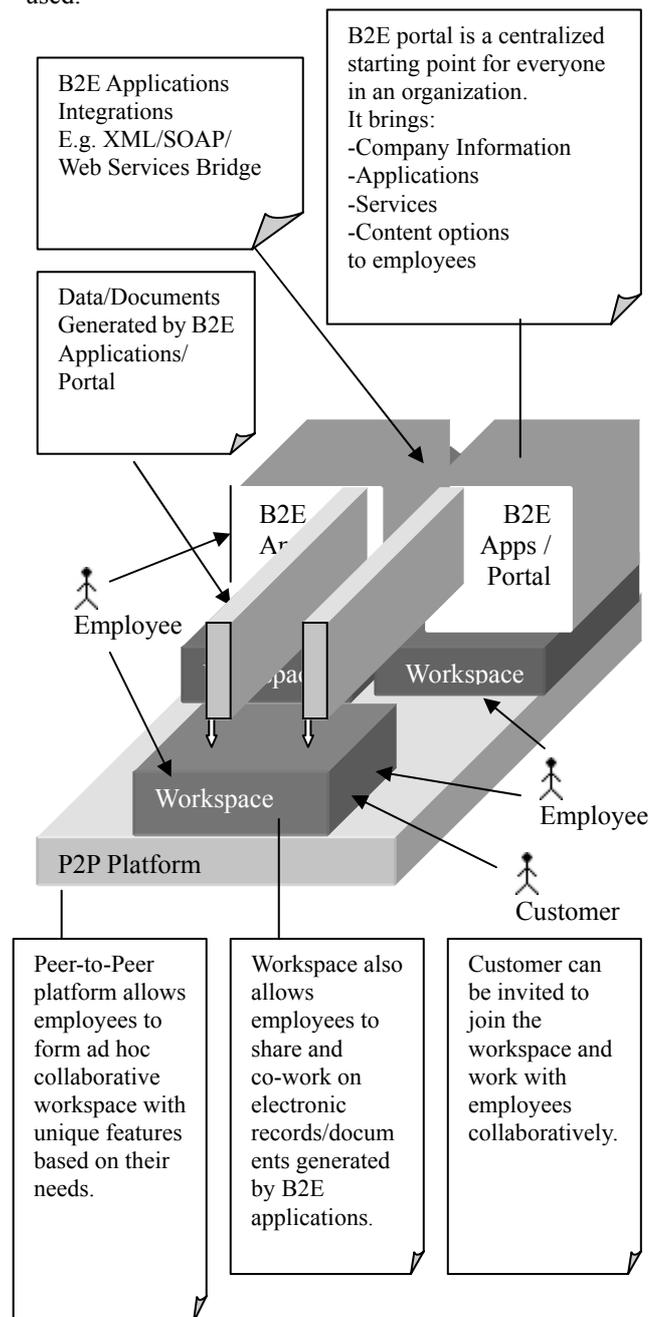
Virtual workspaces can then be built on top of the P2P platform. A workspace is a virtual environment in which a small group of people can collaborate and interact with one another across technical and organizational boundaries. The workspace becomes a community for its members. For example, a Sales Workspace can be created and shared by sales staff who need collaboration, or just to create the sense of community. For each product development, a workspace can be created to support people who need to collaborate on that product development. An employee can belong to many workspaces at one time.

B2E Application/Portal includes those contents and applications that an employee may find in a typical company portal. The portal may include corporate directory, customer support information, e-learning system, customer support management system, marketing/sales management system, knowledge management system, etc. It can also contain other personal information and links (such as stock information, web cams to the daycare center to monitor their children, etc). The intention is to increase not only work efficiency, but also employee satisfaction and a sense of community within the organization.

Another major component is the B2E Applications Data /Documents such as customer and competitor profiles, previous proposal, etc. These are electronic records generated by B2E applications.

The B2E Integration Bridge is used to integrate B2E applications. It enables electronic records transfer between B2E applications via XML, SOAP and Web Services. The Bridge can reduce the use of emails as the primary document-sharing tool. Instead, open standard

such as Web Services based on J2EE or .NET could be used.



**Figure 2: A high Level architecture for a collaborative B2E on P2P**

#### 4.1 Benefits

The architecture has many benefits:

- (1) A Peer-to-peer platform (e.g. Groove Network) does not require a company to reinvent itself on the existing network infrastructures. It offers a high degree of flexibility that allows applications to run across department boundaries, corporate boundaries, exposing themselves to other business partners and vendors.
- (2) Workspace can be formed easily; employees can

share and co-edit documents or electronic records generated by B2E applications/Portal. The sharing eliminates the time spending on swapping emails with attachments at the same time provides a centralized and organized way to manage the documents. Workspace can also be formed with employees and even customers from different locations or organizations.

- (3) The B2E Integration Bridge based on open technology serves all the enterprise applications integration requirements. It simplifies most of the routine data transfer between B2E applications. For those ad hoc non-routine data sharing between B2E applications and collaboration, employee can easily create workspace to facilitate the needs.
- (4) The B2E on P2P solution can be rapidly deployed with minimum custom programming needs.

## 5. A Case Study - B2E at KBQuest Group

KBQuest Group, Inc. is a global IT company with offices in Los Angeles, Hong Kong, and Shanghai, China. It engages in the business of software design, development, and production for its worldwide customer base.

### 5.1 Business Challenge

As business grew, more B2E applications were built to automate the software development processes. For example, the following applications were built to support software development process: Project Management System, Bug Tracking System, Knowledge Base Sharing System, and Configuration Management System. An Intranet was also created to enable interactions and some degree of collaboration among staff and sometimes even with the customers. The Intranet had applications such as the Online Project Tracking System and Requirements Changes Management System. Even though all of these applications were built as web-based solutions, they missed the real time collaboration capabilities. Moreover, because these applications were developed separately, it became increasingly difficult to manage and evolve to support real time collaboration. Software development requires real-time communication and collaboration among sales, development teams, and customers from different countries and time zones, but Faxes and emails with attachments supplemented with ftp sites were the only tools allowing staff from different departments and offices to share documents or electronic records.

In order to increase efficiency and to ensure the consistent quality of its creativity process, KBQuest adopted a new technology solution that would allow its teams to collaborate in real time in a virtual environment and provide a more reliable means of exchanging and working together on large programming files that were generated by B2E applications. In addition, the solution also supported mobile and offline operations with synchronization, so traveling staff could remain productive and informed.

## 5.2 The Solution

KBQuest built a scalable and flexible B2E based on Groove Network, a commercial P2P platform. When a user logs in his Groove space, he is able to see his personalized company portal as a welcome page. From his home page, he is able to access all workspaces that he belongs to. The B2E centralizes the entire software development process, incorporating all the B2E components, within a P2P workspace. The B2E is used primarily to support three major processes: Proposal Development, Project Development and Management and Customer Support. More processes are planned to be included in the future. These processes with examples will be described briefly in the following sections.

### (A) Proposal Development

When a new client brief is received, the project team immediately creates a Groove workspace. Relevant and related managers, sales and project leads are invited to the shared workspace. Throughout the brainstorming process, the Groove workspace is the sole repository for all the information, files and data imported from other B2E applications. The workspace is the default virtual meeting place for discussion sessions, research activities and general communication.

#### *Planning & Research*

The first phase of proposal development is strategic planning and research. The project management team collects previous project information from the portal and other workspaces, including previously created proposals, analysis and design documents, and case studies. These materials are loaded into the Groove workspace shared by all members. Once all materials are shared, the team can assess the opportunity and determine a conceptual direction for the proposal. Figure 3 depicts a work in progress conceptual plan that the team is developing.

#### *Solution Plan Development*

The second phase is to develop solution plans. Team members discuss ideas through virtual meetings, draft solution plans, working on possible solutions until the right idea is achieved through chatting, instant messaging, discussing issues in the topic forum, exploring internet search by co-browsing, etc. For instance, a topic forum is depicted in Figure 4. The workspace essentially allows the team to work together on the development of the proposal, without requiring as much face-to-face time, hence reducing travel.

#### *Proposal Generation*

The final phase of the process is to generate the proposal. The sales, project managers, team leads collaborate with each other to generate a cohesive proposal by co-editing the document. Very often, client's inputs are sought at this early stage. Because Groove works easily across firewalls, the team can involve its clients throughout the proposal refinement process. The client will install Groove workspace (a free download). They will be invited to a workspace where KBQuest staff can communicate and clarify issues of the project. Once

the contract is awarded, the proposal workspace becomes the project space, where the team continues working to design and implement the system while keeping constant communication with the client.

### (B) Project Development and Management

In the project space, KBQuest uses a variety of applications to manage the project and the relationship with the client. Documents and electronic records generated by B2E applications can be shared through the project space. For example, during the stage of requirements analysis, use cases can be shared and discussed by all related members (Figure 5). Design document such as domain model, data model, sequence diagrams etc can also be shared and discusses. (Figure 6). Indeed, all project-related information is now kept up-to-date automatically via the project space, including specifications document, requirements and analysis document, development documents, source code, and test cases. When a KBQuest team member makes a change, it is automatically sent to the workspace so that all other team members will see the change. Updates of workspace will be synchronized to all participants. For example, a team member can be offline or his internet connection is interrupted. Once he is back online, Groove will synchronize all missing updates, events including chat scripts that took place while the member was offline. This is especially useful in the Asia Pacific region, where Internet connections are frequently lost throughout the day.

### (C) Customer Support

Customers invited to join the workspace can monitor the development process and provide instant feedback through the Project Tracking component without delay.

## 5.3 Results

KBQuest now has a unified B2E software process management and collaborative system that spans all of their cross-countries departments and gives their worldwide customers the ability to effectively monitor the project status. With the simple yet powerful platform supplied by Groove, the previous multiple web-based systems have been replaced or integrated by the B2E workspaces. Teams from the US, Hong Kong and Shanghai offices can communicate with each other via real-time chat, co-browsing and co-editing. All project team members work with the same up-to-date information regardless of their locations and time zones. Groove's P2P platform eliminates the network barriers between departments of KBQuest and also between KBQuest with different customers. Information extracted from the B2E portal can flow more freely. Furthermore, the Groove workspace ensures that both customers and KBQuest personnel can access the project information anywhere anytime; even when there is no Internet connection (Each local Groove workspace retains a copy of the data files). Best of all, the KBQuest staff no longer needs to login onto multiple systems just to access the same project documents.

## 6. Concluding Remarks

In this paper, the recent trend on B2E applications is discussed. We further identify the desirable features of B2E and the deficiencies of existing B2E systems. We show that, in order to attract and retain people to use B2E, it is essential to provide a good sense of community through real time collaboration. We further propose to implement B2E based on a Peer-to-Peer (P2P) environment that supports real time collaboration. Finally, we presented a case study to illustrate how the system is implemented and used.

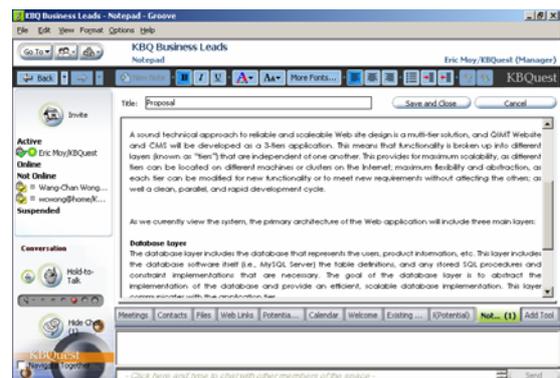


Figure 3: Proposal generation

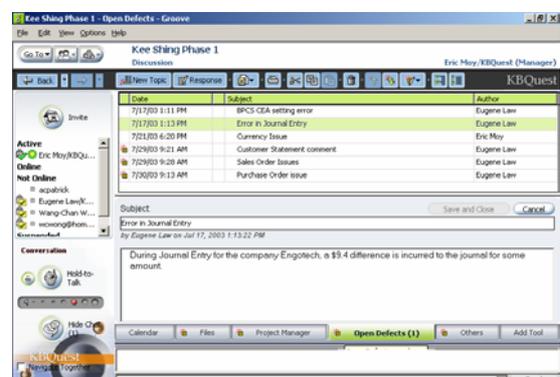


Figure 4: Discussion forum

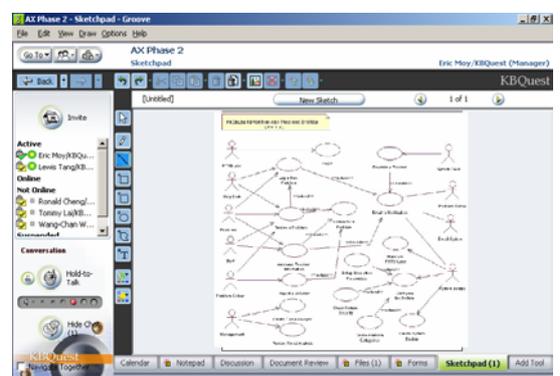


Figure 5: Use-case diagram

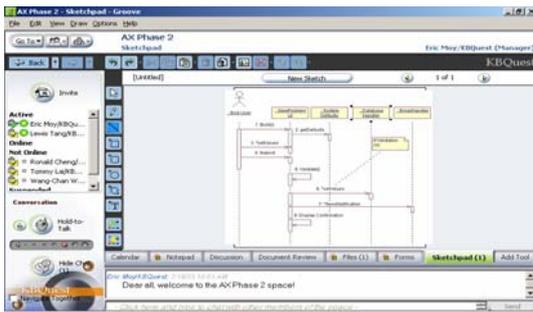


Figure 6: Sequence diagram

Task	Start	Finish	Assigned To	Priority	Status
K3HS	Mon 6/16/03	Mon 8/18/03			In Progress
Convert K3HS data to SPC3	Mon 6/16/03	Fri 6/20/03	Eugene Law/KBQuest	Normal	Complete
Develop reports necessary for data validation	Mon 6/16/03	Fri 6/20/03	Eugene Law/KBQuest	Normal	Complete
Data validation	Mon 6/23/03	Fri 6/27/03	<Unassigned>	Normal	Complete
Bug Fixing	Mon 6/23/03	Fri 6/27/03	Eugene Law/KBQuest	Normal	Complete
Test Run	Mon 6/23/03	Fri 7/25/03	<Unassigned>	Critical	In Progress

**Kee Shing Phase 1 [Project Summary]**

Project Leader: <Unassigned>      Status: In Progress  
 Start Date: Fri 6/13/03      Actual Start: Mon 6/16/03  
 Finish Date: Mon 10/20/03  
 Duration: 92 days

Figure 7: Project management

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