

# Lotus Notes Case Study

## 1. Executive Overview

### **1.1 “Team Connect” - a “Killer” R&D Groupware Strategy**

“Kill the Project - before it kills our budget!” This clarion call is commonly heard in pharmaceutical R&D, which depends on quickly finding and sifting through as many potential drug molecules as possible. Once a promising drug candidate is found, hundreds or thousands of people can spend millions of dollars generating enormous amounts of data about it. Bad news can kill a project faster than good news initiates one. Putting a bad molecule through all development stages can cost millions of dollars a day, so it is imperative to stop development work on ineffective, harmful or unsafe molecules promptly. Efficient communication and reporting is a key ingredient in successful project control.

This case study is about Lotus Notes, which is being used in SmithKline Beecham, a large UK-based company, where Notes was initially chosen to facilitate communication throughout the R&D Division. At the start, communications problems existed because more than 1000 scientists did not even have effective electronic mail. They did have electronic mail (VAXmail). However, they were unable to send attachments or documents between PC's. Shared areas could be used if all parties communicating were on the same local server, but there was no way to send documents back and forth between the US and UK sites. The impact on the business was that imple innovations and findings could not be distributed as quickly as needed. Projects could not be managed and controlled as well as needed. They needed an infrastructure for group work—to handle document workflow better, to do dossier compilation, and to speed the flow and consumption of information. They also needed a more consistent set of business applications, tools for building new applications, and utilities for maintaining the environment.

### **1.2 What They Did and How They Did It**

Lotus Notes was piloted and deployed in the Executive Offices first, with a strong commitment to make it successful there before rolling it out to the R&D community. Although this high-visibility strategy was risky, it paid off well. Within three months, the executives were more successful and productive with this new tool than they thought they would be going into it. At the end of the pilot stage, they were “chomping at the bit” - asking for many more features than the support staff had anticipated. The executives then said “GO and deploy it everywhere.” With their enthusiastic support, sufficient funding was procured to plan a massive, two-year roll-out throughout the entire R&D Division - a total of over 4800 scientists and other associates.

Team Connect is SmithKline Beecham's successful groupware deployment program. Team Connect was more of a military-style “deployment” than a simple rollout, and much more of an illustration of excellent strategic and tactical planning than the success of any particular technology. As we shall see, Team Connect is successful because of the program and project managers, despite the limitations of Lotus Notes and the many workarounds required for this mostly adequate technology.

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The pilot project in the Executive Suite at SmithKline Beecham was never intended to be a “pilot” in the traditional sense, i.e., designed to be a “throw-away” if it didn’t meet expectations. The commitment of resources required to make it successful even then was enormous. Very few computer or network infrastructure improvements other than those required for Team Connect were done at SmithKline Beecham during the two years of deployment, because nearly all computer network support staff were tied up with the project in one way or another. One full-time support person was assigned to each executive to be a personal tutor for about a week after they had training. This rollout strategy has essentially been used throughout the deployment *for each person* in R&D, although over time the organization has learned ways to reduce some support and training requirements using seminars, and Lotus Notes as a support system itself.

### **1.3 Business Results Obtained**

Lotus Notes is now used with good success for most communications and project management activities, from e-mail, trip reports and expense vouchers, to meeting plans and minutes, distribution lists, job postings, and Standards Operating Procedures (SOPs), to project planning, tracking and control, to New Drug Application (NDA) dossiers.

One of the strongest attributes of Lotus Notes as a new communication infrastructure is that it allows many work processes to be standardized and optimized faster than before. Standardization is managed and driven by process optimization experts, who are highly trained in Lotus Notes and workflow and project management optimization techniques. Standardization can be initiated by knowledgeable end users who develop their own Notes applications and then ask that they be deployed more widely. After passing rigorous “qualification criteria” for potential standardization, the end user’s Notes application are re-engineered from a custom to a standardized application. This involves “abstracting and templating” the application so it will be usable by many other teams.

Besides a much higher level of standardization in project management methodologies, teams have more cultural consistency and more consistent work products. Teams generate better plans and deliverables; have shorter meetings and better “team memory.” New team members ramp up faster on new projects. Team members and team leaders have more accurate expectations of each other. The results and value of team members’ contribution have higher visibility and can be appreciated more. Still other project coordination benefits are achieved as a result of this new infrastructure.

Lotus Notes has an acknowledged contribution to the business bottom line. The basic financial justification continues to be savings in time to market. SmithKline Beecham measures the time between milestones as each drug moves through the regulatory approval process. Technologies that can significantly reduce that time to market can have a tremendous impact on the bottom line. As the average new drug can produce \$250 million in sales per year, a savings of 1 day on the time of approval can garner an extra \$1million in sales for the company.

### **1.4 Issues Remaining**

On the down side, Lotus Notes continues to be a difficult and non-trivial computing environment to manage and maintain. Large-scale rollout requires an on-going commitment of 19 people in order to deploy 50 seats per week and train their users.

SmithKline Beecham still has many questions about Lotus Notes as a major piece of its infrastructure backbone. The project started near year-end 1992 with an early version of Notes running on OS/2 servers. SmithKline Beecham has had to push Lotus significantly to improve performance and fix system management problems. They currently have over 150 Lotus Notes servers, working in conjunction with 24 Pathworks file and print servers. They have over 200 Notes client applications running across the network. Notes performance problems, system management and system development nightmares have not diminished much since the initial introduction of Notes at SmithKline Beecham. Network topology rearrangements and smart LAN segmentation appear to be the best ways to improve performance, rather than adding bigger servers or faster networks. Poor development tools still plague professional developers and knowledgeable end users who develop their own applications.

Notes remains a very poor document management system - it is not a well controllable or reliable environment for document management. Because it is so easy to make and distribute modifications, validation of the overall system for regulatory applications is a scary nightmare. It should be avoided in its current incarnation (Notes V3.3) for qualified GLP/GMP environments, where full FDA-required system validations are required.

Replication, while one of its most powerful features, causes major problems in a large network of replicating Notes servers, because errors replicate quickly. To service 4000+ end users scattered across the world, many servers and a fast replication rate is needed. SmithKline Beecham achieves end-to-end replication *in one hour maximum worldwide*. It is IMPOSSIBLE to prevent database corruptions from replicating. In the event of a corrupted database, a backup copy is recovered from either a backup server, or from a tape. An attempt is made to reconstruct transactions made since the backup from whatever can be salvaged from the corrupted database. As they are recovered locally, the backup databases will resynchronize and all copies will be brought to the most up-to-date backups. However, there is a significant risk of lost transactions. The usual recommendation to users is to NOT delete local copies of information posted to Notes for 24 hours in order to ensure that the data have been backed up. The faster that support personnel notice errors and corrupted databases, the more time they have to prevent accidental use of the corrupted data. The trick is to find a faulty server database, shutdown it down, locate and restore an uncorrupted database copy. It may be necessary to manually fix the database in some cases, and then start the repaired database replicating.

Replication of corrupted databases is sticky business problem. After all, anyone with a laptop is essentially making a backup copy of the database when they replicate to their laptop. If the database is corrupted and rolled back, a traveling user may not even realize there was a problem... and their copies of data might be used to restore parts of the database, thus replicating the errors again! There can also be replication conflicts introduced by this process... where different machines have different versions of a document, but cannot resolve which one should take precedence over another (i.e., variants exist).

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These replication conflicts can be resolved by the database custodian, but it is not a process that can be automated easily if at all, because it requires human intervention. The ability to intelligently compare and merge variants would be really nice, but this is still more of a wish than a reality.

To date, the impact on operations of replicating corrupted databases has not been too bad. We are not using Notes for transaction processing, and work can be quickly recovered. The number of transactions in a database over any 24 hour period is rather small, and reconstructing does not take much work. However, such lost transactions would be a very big deal for most TP applications (e.g., LIMS) and an even bigger deal for GLP data. Lotus does not yet provide system management tools to automate this process.

Application "owners" (database custodians) are distributed throughout the R&D groups. Database custodians have a critical need for better and safer tools for database rollback, to handle corrupted databases and replication conflicts, and for permanent archival. Access control lists, distribution lists, and address books are still difficult to manage; better tools are needed soon.

Lotus still has problems servicing immediate design and implementation problems. SmithKline Beecham is still "putting up with" problems and going around to Lotus' customer service groups to find the software engineers who can fix the problems in the current version. This takes Lotus' valuable time from development of the next version of the product. This is seen by Lotus as a distraction from its highest priority, new revenue and upgrade revenue, which come primarily from getting the next Notes version out the door. This is a contradistinction to SmithKline Beecham's business priorities, whose revenues depend upon the current version of the product working well. SmithKline Beecham really needs a robust and flexible infrastructure with an easy-to-use applications deployment environment. This customer service attitude problem is not unique to Lotus.

Lotus is planning to solve this customer service problem by assigning highly qualified software development engineers as Notes Services Engineers, to the tune of approximately 1/3 engineer/year per large customer. The results of this new customer service strategy have yet to be measured.

### **1.5 Conclusion**

Lotus' Notes application development system has allowed SmithKline Beecham to establish strong communication and project management standards, and improve the efficiencies and effectiveness of their R&D professionals manifold. Notes has driven the improvements and become part of the infrastructure and the new networked culture at SmithKline Beecham. Notes requires an enormous commitment of people who are well-coordinated, efficient, highly skilled and highly intentional to deploy it on the large scale of 4000+ end users. For such a large deployment, network performance, tuning, and topology are critical factors in achieving a workable system.

The weaknesses in the technology are systemic, requiring some fundamental redesign of the Lotus Notes architecture, a few of which are coming in Notes V4.0. SmithKline Beecham does not plan to rollout Notes V4.0 until at least 6-12 months after its release, in order to let bugs get identified and fixed by Lotus/IBM. This has been SmithKline Beecham's strategy for every major release of Notes. In a

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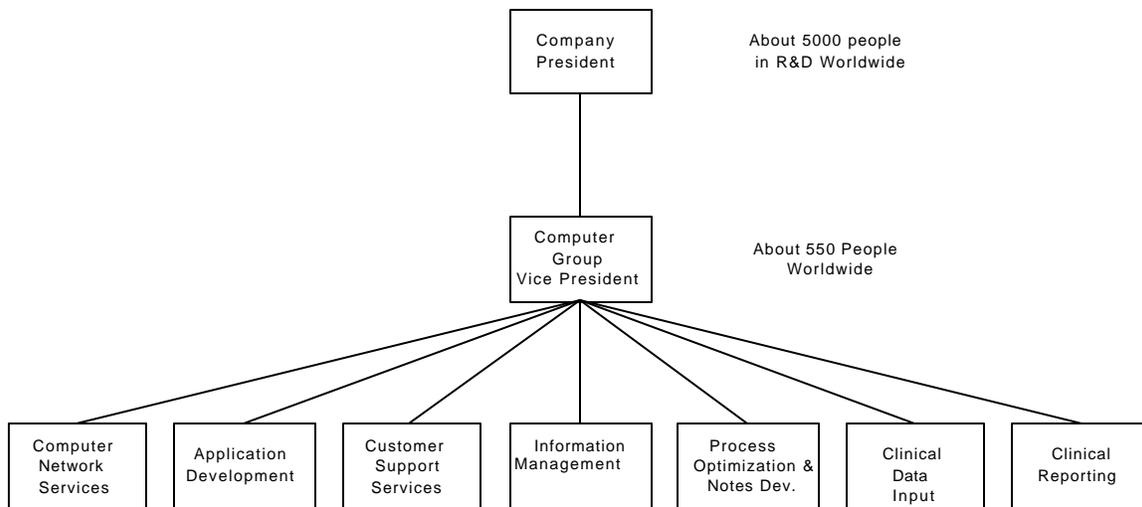
highly regulated and validated computing environment such as pharmaceuticals, Notes needs much better tools for version control and system management.

The increased communication, improved workflow, process optimization, and standardization greatly improve operations, though the very heavy dependence on Notes is a growing risk and operations are problematic at times. The benefits to SmithKline Beecham's business operations definitely outweigh the drawbacks of logistics and system management. The company is betting that the technology and Lotus technical support will improve. Many signs point to improvements on the horizon. Overall, SmithKline Beecham is happy with the ongoing return on its investment.

## 2. Introduction

### 2.1 Background on R&D Organization

SmithKline Beecham is a large UK-based pharmaceutical R&D organization with about 5000 people, covering scientific research through clinical systems. Of these 5000, about 11% (550) are technical and computer support with the following organizational structure at the time the Lotus Notes system was deployed.



Four of these groups participated in the Team Connect project, which was comprised of 42 people, including 15 contractors to do physical deployment of PCs and networks. The four groups used throughout most of the deployment were Computer Network Systems (CNS), Process Optimization, Application Development, and Customer Support Services. Other groups fed into the process at appropriate points along the way.

### 2.2 Conditions Before

The primary "point of pain" that the company wanted to remedy with Lotus Notes was electronic mail communications, because they had about 1000 PC desktops with only VAXmail connectivity through terminal emulators that could send text messages only. However, they were unable to send attachments or documents between PC's. Shared network drive areas could be used if all parties communicating were on the same local server, but there was no way to send documents back and forth between the US and UK. They also needed a way to improve Help Desk Support, which was swamped and sinking fast. Very early in their deployment they recognized that groupware would drastically change the way people worked. They called in a reputable organizational consultant to help "manage the revolution without having a revolt."

### 2.3 Key Business Problems Targeted

- Communication through electronic mail
- Static electronic conferencing (discussion databases, bulletin board services, etc.)

- Project management document template management
- Project management deliverables documentation
- Establish standardized hardware configurations

### **3. Team Connect Strategy Development**

SmithKline Beecham made a very conscious move to transform R&D and its culture to support high performance teams as its primary mode of operation. The technology was used as a facilitator of that change. The Computer Network Services (CNS) Group knew they would need to get buy-in from the Executive Team, because a major organizational transformation was ultimately desired. High-level management was enrolled to prepare the organization for the changes in store. As with any change in work, it must include at least some self-serving elements for everyone to heartily embrace it. The R&D Executive Team needed better ways to communicate, and manage and control their own projects.

The Team Connect V1.0 project started with the R&D Executive Team. CNS used as many resources as necessary so that they would not fail. The introduction of Notes to the executives was done with great care, and included much group and personalized training. The personalized training was done by a group of highly skilled technology trainers from Customer Support Services, called Deskside Support. While all of the systems were built from the same basic components, no two software systems for the 30 executives were identical, all were custom. Another key feature of Team Connect Version 1.0 is that it did not contain any automated upgrade “hooks.” All version 1.0 systems had to be upgraded manually later to either Version 1.1, 1.2, 1.2a, or 1.3. Version 1.0 was retired within 6 weeks of the 3000 level release of 1.3.

Starting with the Executive Offices was a fairly high-risk strategy, but it was not without precedent. They took their lead from a group of high-level advisors from inside the various R&D groups, called the Science Consultants. They participated in researching the strategy and approved the decision before the deployment proposal was presented to the R&D Executive Team. The only major precedent outside of SmithKline Beecham that showed them that they could take this risk and likely succeed was Price Waterhouse, Lotus' first major corporate commitment and their largest reference site. When SmithKline Beecham started their assessment, Price Waterhouse had succeeded in deploying between 3000-4000 seats of Notes V2.0. (Now Price Waterhouse is using over 30,000 seats.) SmithKline Beecham's bigger worry than the technology was whether they would succeed with the organizational transformation to a team-based R&D culture.

The next step in the strategy was to do a new drug dossier compilation. The dossier compilation process was piloted at the beginning of the rollout process (in late 1992) and tried for the first time, with a successful result. One month was saved on the trial dossier compilation, which represents potentially \$15M [ $£1 = \$1.55$ ].

With this data in hand, the investment justification was complete. The company president accepted CNS' proposal to allocate £15M British Pounds for large-scale deployment of the technology.

### **3.1 Capital Investment Strategy**

To deploy 200 workstations per month for 24 months required a rather large capital investment. Approximately 15M British Pounds would be required for the entire project; about 5M British Pounds was allocated by the President directly, and the rest was reallocated from departmental budgets. Of the 15M pounds, 5.6M pounds were spent on workstations, servers and network infrastructure; 2M pounds were spent on software licenses, consultants and contractors. Most office productivity software had already been purchased, and included mostly the MS-Office Suite. As you will see, hardware and software purchases for particular deployments were done ad-hoc.

## **4. The Deployment Process**

Deployment of 4000+ seats over 24 month took considerable and masterful planning. It took careful engineering of the desktops, network infrastructure, and servers. It also required a detailed deployment plan, extensive training of many IT “soldiers” (IT associates) who would carry out the plan, plus trained Notes experts who would sit desk-side to support each SmithKline Beecham employee. Notes and its e-mail were used constantly for communication throughout the deployment.

The order of deployment was:

1. Executive Offices
2. Clinical Groups
3. Development Groups
4. Discovery Groups
5. Administration Groups

The Team Connect Project started in late 1992. By March 1993 approximately 200 seats/month were being deployed; 100 seats/month each in the US and the UK. This translates into 25 people being set up and initiating their training per week. Each R&D group required installation of servers, applications, and then training. Twenty-five people per week receiving training was deemed the maximal use of resources to be able to guarantee quality. Trying to deploy systems to any more people per week may have resulted in either poor installations of hardware or software, or end users not getting adequate training and getting frustrated. The deployment cycle was actually 1 week long. They reported statistics on a monthly basis, but the deployment team managed its resources and schedule its activities around a week-by-week plan.

### **4.1 Desktop and Server Deployment**

Desktop engineering was done using a team of computer support staff from a workstation background. They were charged with designing a standard desktop for all R&D. This included the concept of “Desktop Anywhere”.

There are 2 parts of “Desktop Anywhere”:

1. a portable laptop client system that allows people with laptops to use any docking station anywhere in the world to connect to the network and access their environment,
2. a standard desktop system that allows any user (including laptop users) to log into any desktop system and get access to their environment.

Desktop Engineering was responsible for integrating applications into Notes, and creating hooks to make future upgrades easier.

Server engineering was done by a new team of people from varied backgrounds. They designed the standard server configurations, and the server software distributions. They had to solve the operational

issues that they knew would crop up with any technology installation this large, such as capacity testing, backup, disaster planning, and access control.

Deskside Support Specialists (DSS) from Customer Support Services were all contractors. They were considered part of the Deployment Team. They took about one month to get up to speed after being trained on Lotus Notes. Each DSS person maintained their own database of questions during their training. There were many outlandish requests for client support, like scanners, special instrumentation hardware, and data transfer interfaces to favorite software packages. Individual automation tools and non-standard software packages were done ad-hoc. Such requests were prioritized and handled as exceptions to the normal deployment processes. Simple requests were handled immediately. Longer requests were put into a queue. The main job of DeskSide Support was to answer questions during the first week of deployment and training at a client's desk.

Lotus Notes itself was used to support DSS people during deployment. One and only one DSS Support Database was created in Lotus Notes. Special Notes Views were created that allowed views by DSS Specialist, by Status of Request, by Request Date, etc. This made it easy to find, track and fulfill problem requests.

Macintoshes presented particular difficulties. For the first year, the Lotus Notes client for the Macintosh was not used; PCs were added instead. Macintosh users were told that PCs would be their principal communication and working environment, like it or not. Most Macintoshes were in Discovery anyway, which was at the end of the deployment cycle, at which time the Macintosh client was expected to be really ready as a product with most of its bugs worked out.

#### **4.2 Overview of The Pilot and Final Deployment Process**

The pilot projects were delivered in the following numbers. In the beginning 3 people were chosen to pilot the technology on each side of the Atlantic. After these people learned how to use the technology and were confident of the product's stability, the next step was the set of custom systems for the Executive Team (the 30 Custom seats on each side of the pond identified below). Finally, after success with those 30, a group of 600 was targeted and deployed successfully, again on a transatlantic basis. Within three months, a sustainable rate of deployment of 100 seats per month per side was achieved. Then over the next 21 months, the deployment rolled through the rest of the organization.

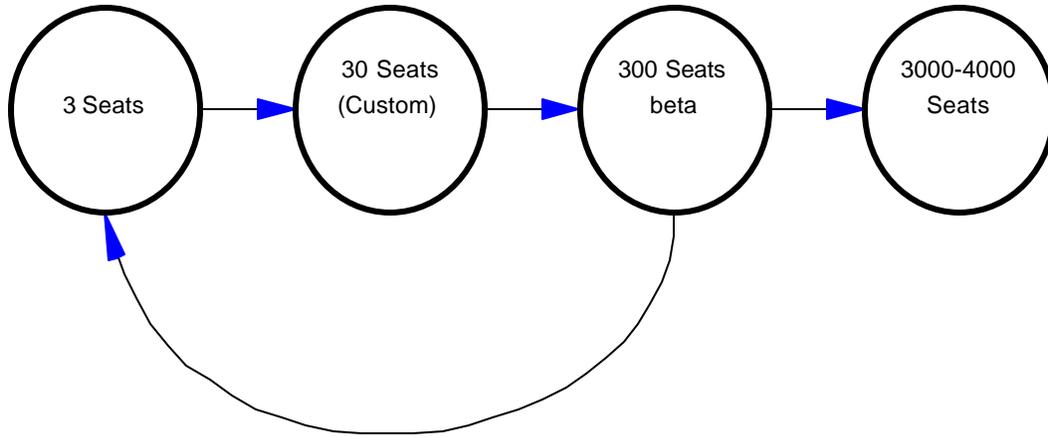
#### **4.3 Pilot Rollout**

Pilot rollout was done with three, then 30, then 300 seats, then the entire organization in groups of 300. The 3 seats were the developers of the first release. They "ate their own dog food" to make sure the release was stable.

The next 30 seats were the Team Connect Project team itself, plus key support people from the Help Desk and Operations. They provided the first real product testing for "proof of value." They also provided the first test of the deployment process.

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The 300 level release is the test of the deployment process. This deployment used one Pathworks server on each side of the Atlantic, with all clients on that server getting the upgrade. This split focus of the testing was to make sure that they delivered the right product with the right process when they released at the 3000 level.



#### 4.4 Details of Deployment Cycle

The following Task Map outlines required steps to deploy 4000 SmithKline Beecham seats.

<i>Timing</i>	<i>Task</i>	<i>Notes</i>
Before start of Project	Get a list of everyone in R&D and prioritize their deployment.	This was made very difficult by the fluid nature of the R&D workforce. They had to count consultants, temps, post docs, and people working with development groups from development partner organizations. They couldn't just get a list from payroll.
	Set up additional training facilities	Space was a problem. They rented trailers in the UK in order to set this up.
6 weeks before a system deployment	Contact people receiving to schedule a deployment during a given week	
	Survey the individuals about their requirements for AC wattage (power), PC and network hardware upgrades, software upgrades, training, applications needed, etc.	
	Create and send Purchase Orders for new HW & SW, training DeskSide Support.	
	Install Network connections and run cables as needed.	
Week of System Deployment	M, T, W - get trained T, W, Th - deploy in their office W, Th, F - Desk Side Support in their area	Deskside Support was usually in the same general area for several weeks at a time.
At the Training	~ 10 users per class from 2-3 close and related R&D groups	this establishes better peer help teams  ~ 5 slots were kept open for stragglers & "contingencies" (usually new hires)
	Show users relevant applications that they could possibly use in their daily work	
	Suggest possible re-engineering of work processes with the end users there	
After Training,	Desk Side Support give special "kick-start" help	Bicycle flags were used to

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But During Deployment Week	on document conversion (from VAX-to-PC based word processing); Use of FAX gateways, Internet, and Pathworks.	indicate where in the group the DSS specialist was working
1 Week After the start of DSS Support	Individual support were turned over to the Help Desk at Computer Support Services	

#### 4.5 Timeline and Versions for Rollout

Scheduling deployment of these multi-user systems can be tricky, especially for new versions of software. It is wise not to deploy the “freshest” version of software, but rather let other companies find the bugs and get them fixed. The trend in the software industry has been to release beta versions as “final” and let customers find the remaining bugs. This annoying reality means SmithKline Beecham end users must wait sometimes as long as a year to get the features on their desktop that they read about in the press.

In the case of SmithKline Beecham, deploying to 4000+ users required careful staging of new versions and features. Initially, they wanted only simple features that used the most stable and available software version. The table below approximately reflects the version deployment schedule.

<i>Approx. Date</i>	<i>Team Connect</i>	<i>Purpose of Version</i>	<i>Comments</i>
March 1993	Team Connect V1.1	“Shrink-wrapped” <sup>1</sup> Version	Shrink-wrapped refers to not having to individually configure workstations.
June 1993	Team Connect V1.2	Mobile Laptop Version	
Aug. 1993	Team Connect V1.2a	Mobile Laptop Version with docking station in end users office	Allowed loading and replication anywhere in the world
Nov. 1993	Team Connect V1.3	First Automated Update & Unified Release	Single release for Laptops and Desktops
Mar. 1994	Team Connect V2.0	Rolling Upgrades to Lotus Notes V3.0b on PC, V3.15 on Macintosh	Rolling Upgrades Started
June 1994			Rolling Upgrades Finished
Dec. 1994		Upgrade to separate naming domain for infrastructure servers	
March 1995	Team Connect V2.1	Upgrade to MS-Office V4.3 and Lotus Notes 3.2	New application features
Early 1996	Team Connect V2.x	Migrate OS/2 Servers to Sun UNIX or Windows NT	OS/2 has poor system management tools (for gathering information and statistics and remote management)
Mid 1996	Team Connect V3.x	New Desktop O/S (Win95 or NTWS)	Improve remote management of workstations and increase overall security of the environment
Late 1996	Team Connect V3.x	Upgrade to Lotus Notes 4.0	New features and improved management of the Notes

<sup>1</sup> “Shrinkwrapping” refers to the practice of having a single standard set of files (i.e. a KIT) and a standard installation procedure that will install the product on a given range of computer models with sufficient resources in a reliable and repeatable manner. The key feature of the shrinkwrapped version is that the deployment team needs to know nothing more about the software they are installing than what is printed on the instructions, and they can use the same kit on all TeamBridge compatible computers.

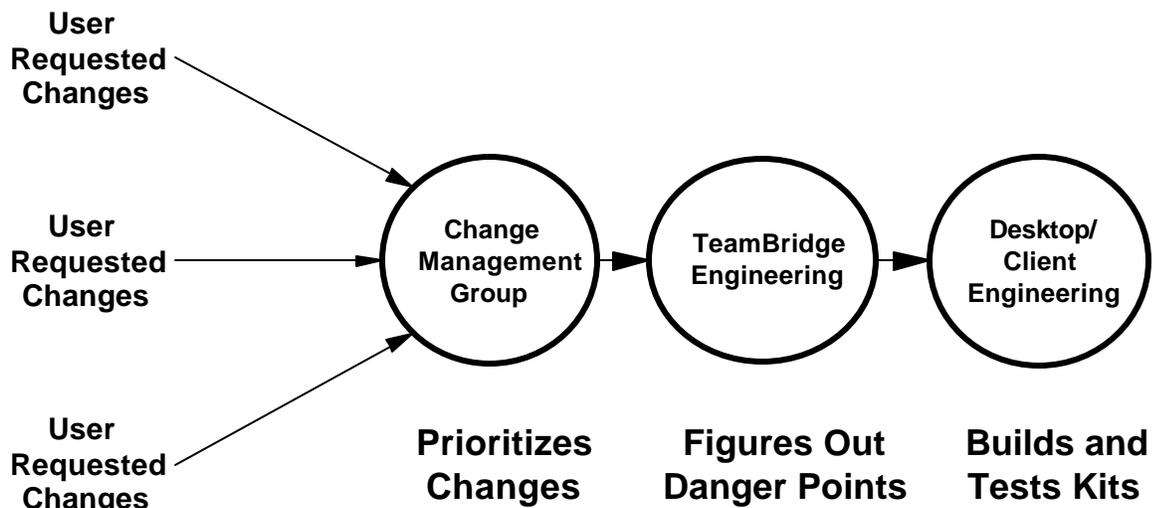
			environment.
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It is important to note that they must keep up with new releases of software. There is a pressure from users not to wait more than about 6 months after release of a new version. Otherwise, they begin to find “bootleg” copies of new versions brought in by people to improve their individual productivity. Unfortunately, this detracts from the benefits that groups derive from a homogeneous environment.

The table above makes it seem as though version deployment proceeded serially, when in fact there were multiple versions being deployed in parallel. The reality is that they designated the custom systems as Version 1.0, and the first sustainable, “one-size-fits-all” release was Version 1.1. The initial rollout of Version 1.2 went in parallel to the Version 1.1 rollout, with laptop users coming up. Version 1.2a did the same thing with the docking stations, trying to evenly split the allocation of deployment slots 3 ways between upgrades from 1.2 to 1.2a (people with laptops who got docking stations,) upgrades from 1.1 to 1.2a (people with desktops upgrading to laptops with docking stations) and “virgin installations” from 1.0 or non-Team Connect desktops. Version 1.3 finally migrated all the Version 1.0, 1.1, 1.2, and 1.2a installations to a single consistent installation kit, driver set, etc. It was executed using the 3-30-300-3000 principle, again allocating slots. The prioritization of upgrade slots for 1.3 is worthy of its own paper on trading off testing the new product versus taking time from deployment teams (who had quotas to meet) and even trying to eliminate some of the previous versions to reduce the complexity of the environment.

#### 4.6 Upgrades and Process Optimization

It takes about two months to create an “upgrade kit.” This requires gathering all requested changes and modifications since the previous upgrade, and then prioritizing them using a Change Management Team. Then a Team Connect Engineering team examines the priorities and figures out any “danger points” that the changes could cause. Then a group called Client Engineering builds a kit and tests it. Deployments of new upgrade kits go through the same iterative process, first three users, then 30 users, then 300 users, then all users in groups of 300 per month.



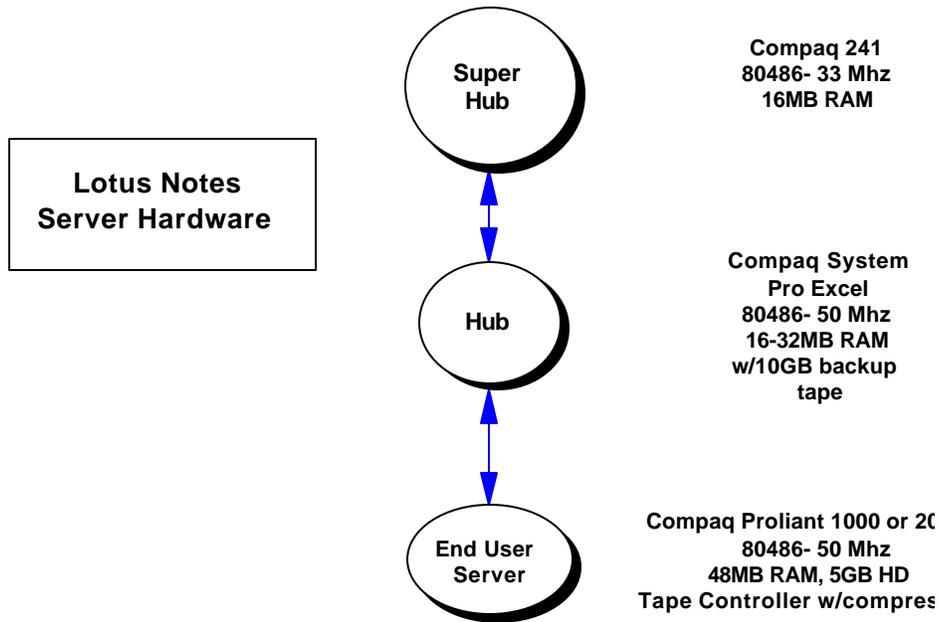
## 5. Technical Implementation and Operational Results

### 5.1 Invest The Time To Do A Good Network Design

With such a large installation, designers must pay close attention to network design, or suffer the consequences of poor performance and constant maintenance.

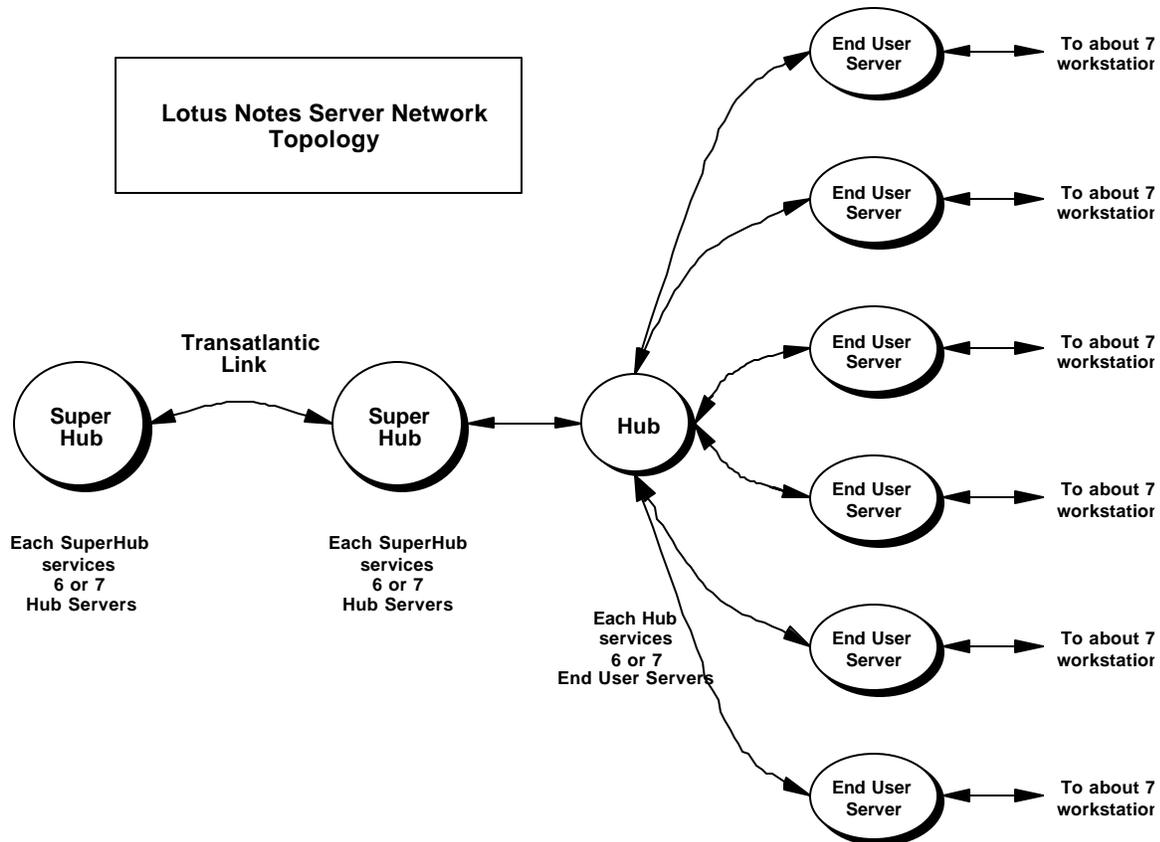
Three types of servers are used:

<i>Type of Server</i>	<i>Purpose</i>
End User Servers	handle end user accounts and databases
Hub Servers	handle mail routing and database replication
SuperHub Servers	handle transatlantic mail routing & database replication



## 5.2 Global Network Topology

SmithKline Beecham's network topology evolved over time to the hierarchical design described below.



NetBios is used for end-user connections and TCP/IP for InterHub communication. Macintoshes use Appletalk protocol to their servers currently. They are gradually migrating to all TCP/IP, including to the desktop, but that change is expected to take many months to switchover completely. For 4800+ users about 150 servers are used, approximately 115 are End User Servers; the other 35 are infrastructure servers and contain no user accounts. The transatlantic links shown in the diagram are actually multiplexed channels within a T3 cable (6.5Mbits/sec), with a T1 backup.

## 5.3 Design the Notes Network for Good Replication Performance and Robustness

Database replication is the capability for automatically duplicating information held in Notes databases to other place in the network, so that data are available for use in remote sites with good performance. Database replication can be a very bandwidth-intensive operation, because potentially every field in every database record must be compared for the replication process to decide whether to replicate a record. Replication can consume a network's bandwidth if careful network design is not done, and very negatively effect on the performance that users see. (It is rumored that Lotus' internal network bandwidth is 70% consumed by replication every night throughout its worldwide sites.) However, with

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proper planning, this traffic can be greatly reduced by segmenting the network and running parallel segments.

SmithKline Beecham is using Lotus Notes for a general purpose communications infrastructure as well as many corporate database applications. SmithKline Beecham has a goal of Just-In-Time (JIT) information to all of its R&D personnel. This is a difficult task, because the company is distributed over so many sites around the world. To service its 4000+ (now > 4800) end users scattered around the world, many servers and a fast replication rate are needed. With its distributed network architecture of Lotus Notes servers, SmithKline Beecham achieves end-to-end replication **in one hour maximum worldwide.**

Since worldwide end-to-end replication is achieved so quickly, local replication by End-User Servers must be fast. End-User Servers start replicating every 15 minutes, staggered by three minutes between each of the 6 servers. Because replication happens so frequently, many Lotus Notes document and record changes do not get a chance to accumulate, so replication is completed quickly. Also, in virtually all cases, server 6 is some type of gateway or backup server that does not replicate with high priority. Gateways include connections to information services (e.g. Hoover, Dow Jones), certain business partners (e.g. Compaq, Lotus), Internet gateways, and gateways to other internal mail systems (e.g., Softswitch, cc:Mail). Backup servers only replicate copies from the hub on off-hours, when replication traffic is lower.

<i>End User Server Number</i>	<i>Replication Time</i>
1	0 minutes
2	3 minutes
3	6 minutes
4	9 minutes
5	12 minutes
6	15 minutes

Hub servers replicate at the same rate as the End-User Servers. SuperHubs replicate less frequently, starting every 15 minutes, taking about five minutes. This permits between two and three round trip communications between the US and UK corporate headquarters during normal business hours each day. This is sufficient to support transatlantic collaboration using Lotus Notes.

Electronic mail goes through a separate, parallel routing mechanism that is provided by Notes; it does not use the Notes replication scheme. Mail delivery can be five minutes or less. It is interesting to note that Notes Mail is used at in the R&D Center. Corporate uses cc:Mail, but do so outside of Notes; they have not incorporated it into Notes

SmithKline Beecham is running parallel network segments between End-User Servers to improve performance. One segment is for replication, the other is for end user usage. Every End-User Server has two Ethernet adapters, one for replication, one for normal usage by end users. There is also a parallel network between hubs and the superhubs. The Hubs also use two Ethernet controllers, one to

the superhub and the other to their end user servers. Superhubs have two controllers, one to the transatlantic link, and the other to their local hubs.

Another way to enhance performance is to partition the network into domains and segments. The structure of domains can affect performance greatly. At SmithKline Beecham, domains are segmented by the infrastructure and performance required, rather than by geography. All infrastructure servers are in one domain, and all End User Servers are in another.

#### **5.4 *Thou Shalt Hassle With Replication Errors***

Replication, while one of its most powerful features, causes major problems in a large network of replicating Notes servers, because errors replicate quickly. With a one hour end-to-end replication time, by the time an error in a database is noticed, that error has been promulgated to several servers worldwide. The recovery procedure is to restore the database from a recent backup, usually on a backup server. However, if a single copy of the damaged database is left out on the network to replicate, it will again replicate the error to all the “good” copies of the database, because the error still appears as an “update” to the restored databases. This is a particular problem when the database is used by remote or laptop users that have “unregistered” instances of the database. Because transactions on the database can occur at multiple sites, reconstructing all the transactions between state of the database at the time of the backup and the time of the corruption is virtually impossible. While it is possible to recover most of the documents from the damaged database, the process of database recovery cannot be validated. Lotus does not yet provide system management tools to automate this process.

#### **5.5 *Take Advantage of Parallel Network for File and Print Services***

A parallel Digital VAX network running Pathworks is used for basic print and file services. The VAX servers provide Pathworks services only. Printing from within Lotus Notes is done using Pathworks Print Services. Pathworks File Services are used for keeping versions of system and application software synchronized on all workstations. Windows is always installed locally. Laptops have all applications installed locally as well. The Pathworks File Servers also serve MS-Office, Lotus Notes, and other end user applications to the End-User client desktop machine. These applications are loaded in real-time to end user servers, as users need them, to whatever client machine the user happens to login from. All user-dependent files are kept on the server. All machine-dependent files are kept on the local machine. This file server approach is also used for easier installation and upgrade management.

#### **5.6 *Desktop Engineering Results and Problems***

The Desktop Engineering Group succeeded fairly well in creating a “Desktop Anywhere” that can be used from any login point on the worldwide network. Users’ desktops and applications are loaded from their servers, and then they can run their applications and access their documents. There are a few glitches, especially during upgrades. SmithKline Beecham has managed to automate “2.5” of their upgrades; the latest upgrade kit requires a special procedure, because the latest version of Microsoft Office (V4.3) is so large (over 50MB). They set up specially-equipped laptop docking stations at convenient sites around R&D so laptops can be upgraded automatically, using a “bloodmobile” model.

Laptop users came to specific locations set up around the sites during the upgrade. They served coffee and donuts and did the upgrade from the docking station hard drives, rather than over the network..

Desktop Engineering still has trouble with large applications, which can sink the automated distribution strategy, because it takes so much time and network bandwidth to do the distribution. SmithKline Beecham did experiment during the latest desktop upgrades using "tokens." Each Pathworks server had 5 tokens. Each client requesting an upgrade checked out a token. If there were no tokens left, the upgrade request would be denied with a pleasant request to try again later. This kept the network traffic on the desktop upgrades in check. In the future, a tool such as Microsoft SMS could be employed. SMS can detect when network throughput falls below a predefined level, and will not process any but high-priority software installations while the network is busy. The two characteristics of Notes that cause the most problems are: 1) the software is never hardware-independent enough, and 2) within the Notes environment "everything is related." In other words, to get one feature, you have to take many changes. These characteristics of Notes may be improved as its internal design and development approach become more object-oriented, however for now it remains a source of aggravation.

### **5.7 Infrastructure Engineering Results and Problems**

SmithKline Beecham has constant problems with network bandwidth and segmenting servers to increase available bandwidth to particular servers. Teams are located in different buildings, so they are put on different network segments. Infrastructure Operations carefully manages load balancing, and allocates manpower just to do diagnostics on an ongoing basis. Engineering reviews operations' records periodically to redesign network segmentation. With 150 servers in place it is difficult to manage them all. There are just too many. The complexity of the overall configuration causes ripple effects through all operations, including backup, restore, and disaster recovery operations. Newer technology from Lotus and elsewhere will solve some of these problems.

The Infrastructure Engineering team had some problems with migration to newer versions of Notes. Notes 3.0 and 3.0a were not stable in the environment, but 3.0b was. Version 3.0c was not stable in their environment. Version 3.1.5 worked well on the Macintosh, but not the PC. Version 3.2 was good on the PC.

Other general / chronic desktop engineering problem areas are:

- Video drivers
- Network drivers / NOS compatibility
- COM port driver
- Size of the Name & Address Book

A tradeoff was made to invest in local disk space versus higher speed networks, so that R&D staff get good local performance. Currently Infrastructure Servers cannot have more than 10 GB of disk space, because they cannot be backed up using the Compaq hardware. This is just one of several limitations of the OS/2 servers. SmithKline Beecham will be migrating to Windows NT servers as soon as those servers are stable and dependable, estimated to be sometime in late 1995.

Pathworks was described as “too flaky” for dialup access. Pathworks cannot handle remote network dialup reliably, so that users must make several phone calls to replication all their common databases. Eventually they will replace all the Pathworks servers with Windows NT Advanced Server.

Lotus Notes V3.2 still has limitations that show up periodically. The master Name & Address Book can only accommodate about 25,000 entries. SmithKline Beecham routinely does business with more people than that, especially with its large number of collaborators in universities and biotechnology companies. To get around this problem, they have separate databases for Notes e-mail and Internet e-mail addresses.

The migration to X.400 E-mail and X.500 Directory Services poses special problems for SmithKline Beecham. R&D forms and disbands “virtual teams” frequently. Administering this constantly changing team makeup in Lotus Notes (or any other system) requires constant diligence. The overhead is too much to maintain right now, so SmithKline Beecham is reluctant to migrate until Lotus delivers some improvements in this area.

Full text indexing, although a key selling feature of Lotus Notes, has not been implemented yet. It can require 2-3 times the amount disk space as the regular databases themselves. It also puts a great load on the CPUs and causes reliability problems. This was true for the Intel 80486 CPUs that were being used. Faster CPUs may alleviate the magnitude of the problem, but will not eliminate it.

### **5.8 Rigorous Logistics On The Deployment Teams**

SmithKline Beecham outsourced their entire deployment team. Surveys and installation were done by contractors, as were wiring and network installations and Deskside Support. In the US, the manager of the deployment team was a contractor. In the UK, the manager was an employee.

Outsourcing was chosen for the following reasons:

- The number of people needed would vary depending on the group being deployed to, so the number of people would need to vary month to month.
- The people doing deployment would not be needed following the project, and there was no career path within the organization for them.
- No headcount was available.

First the team surveyed existing client desktops to find out what PC and network hardware and software existed and, then ordered all the necessary missing pieces long enough ahead of time to be ready for the days of deployment and training. Scheduling and logistics were key aspects of this rollout.

Installation proceeded smoothly. The Deployment Team actually received the most praise throughout the deployment. They had to work around some people who were either difficult to work with or plan for because of other project exigencies. There were quote a number of VP and VIP setups required, which took extra time to prepare. DeskSide Support makes the biggest difference at this stage.

### **5.9 Training Tactics and Logistics**

A regular Training Team was instituted; contractors played a very large part. A training program was developed that both fit the computing environment and the culture of SmithKline Beecham. A decision was made to provide “integrated training” that included an integrated program of classroom training, desk-side support, automated (on-line) support, and training documentation that provided consistent messages. They wanted to present a consistent technical voice to the client community. Design of this program was non-trivial. Content of the training was managed by an employee—the manager of computer training. The look of the training and communication materials was coordinated by a contractor.

The results were that all associates were trained. The training materials are still in use today. The training was distributed by Department. Their conclusions now are that training might have been more effective if done by experience level, based on the computer literacy and application expertise of clients. They are also wondering just how much they can really afford to outsource and still maintain a solid curriculum that is focused on SmithKline Beecham's business applications.

### **5.10 DeskSide Support Was the Best Investment**

DSS specialists were all contractors, however, they turned out to be an excellent investment. They kept HelpDesk calls down to a minimum, kept satisfaction high, and compliance high. Keeping compliance high was a key element in keeping HelpDesk calls low.

DSS had some problems because departmental needs varied widely in some cases, necessitating better focused preparation for each department in the future. DSS also needed to provide more and better feedback to Process Optimization as individual departments did their own customizing.

### **5.11 Employ Sufficient Support Staff & Prepare for Continuous Rollout**

Supporting a Lotus Notes network for 4000+ users is a non-trivial task. Between 60 and 70 people in the Computer Network Systems (CNS) Group are employed doing Lotus Notes and Pathworks support. This may seem like an excessive number of people, however, not when you consider all the ongoing work. The teams were able to track deployment very, very well.

Rollout of new systems is an ongoing activity. Personal computers have about a 4-year lifecycle, which means that about 1000 new PCs are purchased per year. During a PC's lifetime it is usually used by two users. With both new and recycled systems, this means that 2000 machines are deployed per year. This means that on the average (4) four machines are deployed per day, forever. This is in addition to emergencies, system changes, and training. Three people are used for administering Lotus Notes, account changes, access control lists, VAXmail, and Pathworks file and print services.

### **5.12 Policy Lessons Are Learned From Users**

End users must cooperate with the policies established by support groups in order to receive good service from their hardware, software, and support specialists. The democracy of desktop PCs is nice because users have the power to enhance (or really mess up) their system. Until some fairly rigid policies were established, SmithKline Beecham had many problems with user-installed applications

changing system configurations so that Notes would not work properly. Something as simple as a screen saver application can grab the CPU at just the right time to interfere with network operations. It is also easy for users to copy a Notes database, change it, and then have the changed database be confused with one of the corporate databases.

Consequently, a policy was instituted that users must get clearance from the Customer Support Services (CSS) group before adding any applications of their own, or modifying any applications developed by the Application Development Group. They get good cooperation from users, because otherwise users' systems do not work properly. If it happens repeatedly, it takes longer and longer for an errant user to get the problem corrected by CSS.

### **5.13 Communicate, Communicate, Communicate (or Wait for Problems)**

A marketing communications program was instituted at both the divisional level and departmental levels. This was part of Team Connect Project Management and Administration. The goal was to provide a single voice to the client community. This included an official "look and feel" for all communications. Team Connect had its own section in the SmithKline Beecham Information Resources Newsletter, called "SmithKline Beecham Bits." Plans for future releases were announced this way, as were survey feedback results. A Notes database was set up to handle gripes and suggestions. Promotional PR programs gave out keychains, mousepads, and trifold brochures to keep awareness high. Annual meetings also served as a forum for announcing Team Connect benefits and future plans. Through these various avenues, people continuously knew about Team Connect decisions.

## **6. R&D Business Applications Development**

### **6.1 Core Applications and Template Applications**

Other applications were developed as either "Core Applications" or as "Template Applications."

*Core Applications* are where one copy is available to all of R&D. These included the following business applications plus more:

- Newsfeeds
- Bulletin Board Systems (BBSs)
- Distribution Lists
- General Information
- Standard Operating Procedures (SOPS)
- Job Postings
- Validation Information
- Policies and Procedures
- Journal Articles

*Template Applications* are where each group within R&D makes copies of the database template but the contents of the database are different for each group. These included such databases as:

- Meetings And Action Items

- Project Deliverables (Research Reports, Papers, Summaries, etc. Based On Work Breakdown Structure)
- SOPs For Particular Groups
- Monthly Reports
- Trip Planning And Reporting
- Expense Reporting

Templates setup for new applications were partially automated through the use of Macros. Some functions could be easily automated this way, such as setting up Access Control Lists (ACLs) and instructions for usage of each template application. Other standard setup operations can be done quickly. Each template also contained the standard copyright notice.

#### **6.1.1 A Few Comments About Template Development And Usage:**

*On the positive side*, templates are a particularly easy way to deploy applications, provided they developed up front and deployed with little to no modification. This is a particularly effective way to save time and to prevent “reinventing the wheel” for similar applications.

*On the negative side*, the lack of debugging tools and doing debugging ad-hoc with the scripting tools and trial-and-error templates made it particularly frustrating. It frequently meant spending extra hours creating trial templates and debugging them. Changes had to be made manually to each instance of a template application in the early versions of Notes. SmithKline Beecham's general comment was that the integration tools from Lotus were found to be inadequate.

To get around the lack of adequate development and integration tools, SmithKline Beecham did the easy, “big-payback” applications first. With this strategy they got big wins with minimal sweat.

#### **6.1.2 Problems with Modifying Templates**

CNS was forced to issue an edict for end user application development because templates are so easy to modify, which caused some problems in the beginning. The edict issued early on was: “*Either use our templates or hire, develop, and support your own applications from your own budget.*” It was also made clear that Process Optimization would provide minimal support for “out-of-tolerance” applications. Process Optimization was the primary Lotus Notes development group. They looked at particular workflow processes within a group and re-engineered it from a custom workflow to a more standard workflow, if they deemed it necessary in order to deploy Lotus Notes. If that made sense for the laboratory or group, processes could very often be put into Notes quite effectively.

Business Process Re-engineering (BPR) was done before and while new systems were being installed. The scientists knew this. A Rapid Application Prototyping, Development, and Deployment methodology was used as part of process optimization. This also allowed the evolution of data architectures. Data architecting was done dynamically, and was focused on business process and workflow optimization, rather than on a data warehousing approach. Thus the focus was on process efficiency.

### **6.1.3 Effective Use of Contractors for Template Development and Training**

Somewhat surprising was that much of the template development was done by contractors. All Deskside Support was also done by contractors, as was most training.

### **6.2 Third-Party Tools Used to Aid in Application Development**

Virtually all development was done using the native Lotus Notes scripting language. Microsoft's Visual Basic was the only third-party development tool used. This was used primarily to connect to relational databases and pull data into Lotus Notes. PowerSoft's PowerBuilder and Lotus' VIP were tested but not used to aid in the development of business applications.

### **6.3 Integration with Other Systems**

The extent of integration with existing information systems within SmithKline Beecham was fairly minimal. Seamless integration was not expected in early versions of Lotus Notes. With the newer versions of Lotus Notes, much tighter integration has been possible.

The following applications and systems were integrated with Team Connect:

- MS-Office (MS-Excel, MS-Access, MS-Word, MS-PowerPoint)
- Reflections 4 Terminal Emulator
- Address Book and Phone Dialer
- Screen Savers
- Pathworks Shared Resources such as shared printers and files services

A special integration application was developed called SmithKline Beecham Tube, which was a database integration project to tie Oracle and Ingres in with MS-Access using ODBC links.

## **7. Systems Administration**

Notes proved itself to be an easy environment to simply administer. SmithKline Beecham has a Notes helpdesk called "Notes Central", that employs three people part-time, or 1.5 Full-Time Equivalent (FTEs). This is much less than they required for their Oracle and Ingres shared database environment.

Given all the business functions that Notes is handling for SmithKline Beecham, the company does not face serious system administration problems. The job of an administrator in a Notes environment is to handle user account creation and changes, changes to distribution lists, Access Control Lists (ACLs), address books, replication conflicts, and corrupted databases. ACL maintenance is done by the owners of each application. Thus, system administration is distributed by default to local group resources, and is a normal part of doing daily business. Distributing local administration tasks is an important part of any groupware environment, because some changes can be so trivial.

Systems Administration is distinctly different from engineering, which deals with throughput calculations, topology rearrangements, performance maintenance, severe database exceptions such as database and records corruption, and other bad system glitches.

System administration tools are badly needed to help application owners to handle corrupted databases and replication conflicts. Tools are needed to do database rollbacks, to run safety checks on databases, and to check databases before deleting replication conflicts. There are no permanent archival mechanisms, which presents problems if one were to consider using Notes for Records Management.

It is still too easy for application owners to delete top priority events and alarms for important operations. This must be changed so that such deletions cannot be done by application owners, they should first have to pass requests to Notes Central. The central administration group should be the only one that can delete such requests, especially if one is in GLP/GMP or patent generating environments.

## **8. Assessing R&D Team Applications & Their Business Benefits**

### ***8.1 Dossier Compilation Is A Big Winner***

A few projects were used as benchmarks to assess the improvements in business processes. The most striking example is that of preparation of new Dossiers that are submitted to regulatory agencies. This is the equivalent of a New Drug Application in the US. This is one of the easiest projects for which to quantify return on investment, because so many independent industry studies have accurately measured the cost of dossier compilation. Other benefits take much longer to quantify, if you can at all develop accurate and meaningful metrics for these things in the first place.

SmithKline Beecham measured ***about 30 days reduction in cycle times for dossier preparation.*** At a cost of ~\$ 1M/day for this stage in Development, this represents about \$30M saved per dossier done using Lotus Notes. Note that not all dossiers are prepared with Lotus Notes. Projects are selected based on end-user computer skills and their willingness to put up with “rough” system characteristics. Approximately four dossiers had been prepared with Lotus Notes per year for the first two years; this adds up to about \$250M saved for the first two years. An initial expense of \$22M saved them \$250M, which is an excellent good Return on Investment (ROI). Please note that these numbers are only approximate, because not all personnel expenses have been figured into these numbers. The company is actually submitting more dossiers than this per year now.

### ***8.2 Standards for Projects, Deliverables, and Infrastructure***

The Project Deliverables databases were the next most visible benefits provided by having such a unified infrastructure and applications base. The value of these Project Deliverables databases was most evident in the clinical groups doing project management. These same groups do dossier compilation. The benefits were:

- Consistent Project Management Methodology
- Common Cultural Standards
- Common Electronic Mail

### **8.3 Unexpected Benefits and Proponents**

A few other groups within SmithKline Beecham have benefited in unexpected ways and adopted Notes for a large number of key business applications, most notably the Patent Department. Notes is used to received requests from labs to start patent searches, to track patent disclosure and application status, and for general purpose communication with people throughout the company. They are using a Notes-based patent tracking database developed and marketed by a third party.

## 9. Lessons Learned

Lotus Notes can be a very effective system for communication and collaboration. SmithKline Beecham's experiences with it have been generally positive. The following table lists the benefits obtained from their deployment.

<i>Benefits</i>	<i>Comments</i>
<b><i>General Benefits to All Users (including Executives, R&amp;D, and Support Staff)</i></b>	
Improved commitment tracking	
Made invisible work processes visible	Many tasks were taken for granted. Now all project activities are tracked by system.
Expectations are set better on all sides	
Significantly improved productivity of teams	
Facilitated the move to a standard project management culture	
Everyone can see the backlog of pending IT projects.	
<b><i>Benefits to Scientists/End Users</i></b>	
More efficient, intuitive desktop	All desktop documents are searchable (except attachments.)
Files have more robust description with long files names.	
Simplification of end user and corporate computing environment	
Better fit of computing environment to varying levels of user sophistication	
Management knows better what scientists do, so value added by particular scientists is more visible	
Network support is transparent to users.	
<b><i>Benefits to R&amp;D Teams</i></b>	
Better team, project, and time planning	A result of BPR and process optimization.
Better tracking of team activities	Action items and their status are posted to the database.
Better quality deliverables	This is a result of better planning of teams, projects, and time.
Shorter meetings because activities are reviewed better	People are required to read the relevant notes database before meetings.
Better "team memory"	All major activities and deliverables are tracked through the notes databases.
Faster ramp-up for new team members	Team history is contained in the database.

<b>Benefits to R&amp;D Organization</b>	
Reduction of support costs	
Improved responsiveness of support staff to clients	
Better coordination among teams in different groups	
Better general information and announcements	
Common, more uniform ways of running projects and project workflow	
On-Line decision forums happen at lower levels in the organizations and decisions are approved faster.	Decision making still takes deliberation in meetings, but executives still get information faster.
Better focus on business applications, rather than developing many new, specialized software tools.	
<b>Benefits to Computer Support Organization</b>	
Better client responsiveness	
Customers are more satisfied, to IT people and with services delivered.	
Easier support environment, because user have a more uniform computing environment. Rules are observed better.	
A more unified infrastructure is easier to deal with than a very heterogeneous collection of networks, databases, electronic mail, and other systems.	Improved service results because more focus is on developing business applications and solving business problems.
<b>Benefits to Other SmithKline Beecham Organizations</b>	
Patent Department uses Lotus Notes <i>all the time</i> . They are heavily dependent on it.	

## 10. What's Still Missing From Lotus Notes

Address space in such large systems continues to be a major headache. SmithKline Beecham ran out of address space in Lotus Notes V2.1. The switch from flat address space in V3.0 to hierarchical address space in V4.0 is viewed as a step backward for team-based R&D organizations. This is because R&D teams form and disband so rapidly that maintaining a hierarchical address space is senseless. A hierarchical address space organized along rough lines of reporting or job code hierarchies could work, but only if local, ad-hoc objects for address books and distribution lists could be built on top of these hierarchies by users and team leaders for actual teams for the period of time they are in existence.

The Macintosh bugs were not all worked even at the end of the deployment cycle. The Macintosh client lags behind the Windows client; the two platforms have still not attained parity.

### **10.1 Replication Problems**

Replication of errors can be a big problem with Lotus Notes. More system administration tools are needed to detect and automatically shut down replication when errors have been detected.

### **10.2 Database Problems**

Databases do not compress as well as they could for SmithKline Beecham. A compression level of between 20-25% is seen. As can be expected, binary attachments do not compress well; discussion databases and other text-based document compress better than binaries. The poor file compression puts a heavier load on the network during replication because databases are larger than they could be.

### **10.3 Other Key Notes Issues**

Calendaring and Scheduling remain a major headache within Notes. Lotus Organizer is a clunky way to schedule meetings and book people's calendars. A previous calendaring package in the VAX environment has fallen into disuse in the client/server environment.

Hardware dependencies still causes serious time wastage. Notes' hardware dependencies cause each PC to require some "tweaking" to fit properly, especially when driver sets may be different on each machine.

Software deployment for large applications<sup>2</sup> is still a major problem within the Team Connect Environment. This still cannot be done automatically

Specialized workstation configurations still require much custom work to produce. Having an object-oriented, drag-and-drop administrator interface would help to create workstation "components" that could then be reused during configuration. Notes is a good distance away from such an object-oriented administrators interface.

Ways are needed to improve load measurement and balancing. The Notes NetView Administrator Interface greatly improves this.

### **10.4 FDA Notes CANDAs Acceptance Issues**

***GERRY, ANY IDEA HOW MANY, IF ANY CANDAS IN NOTES FORMAT HAVE BEEN APPROVED BY THE FDA??***

## **11. Future Plans At SmithKline Beecham**

The most important item on the SmithKline Beecham agenda is to design and implement the plan for the next three years. Incorporating other groupware tools into the infrastructure may be in the plans, though

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<sup>2</sup> Large applications, for the current configuration, is defined as applications that require more than 50 MB of data to be transferred over the network to the workstations.

these have not been solidified or announced to users yet. Establishing a new corporate standard for a Network Operating System (NOS) is essential, because today a combination of Novell, Pathworks, Windows NT, and others are being used. Rolling out a standard will be non-trivial, but will simply the environment even further. Windows NT is expected to play a large part in that, as is UNIX.

On the organizational side, the two main goals are: 1) to establish new feedback mechanisms that will help to fine tune the optimization process, 2) to re-engineer the training program to focus on client experience levels, rather than geographical or group-level training.

Finally, keeping everyone happy and enthusiastic is a major goal, from clients, to deployment and support teams, to R&D managers, to the executive.

## **12. Conclusions**

### ***12.1 Large Changes Require Enormous Commitment***

Lotus' Notes application development system has allowed SmithKline Beecham to establish strong communication and project management standards, and improve the efficiencies and effectiveness of their R&D professionals manifold. Notes has driven the improvements and become part of the infrastructure and the new networked culture at SmithKline Beecham. Notes requires an enormous commitment of resources, that are well-coordinated, highly intentional, and efficient, to deploy it on the large scale of 4000+ end users. For such a large deployment, network performance, tuning, and topology are critical factors in achieving a workable system.

### ***12.2 When You Have a Hammer, Everything Can Begin To Look Like A Nail***

Many, many processes were re-engineered to fit into Notes. This may have been a reflection that when your favorite tool is a hammer, all structural binding elements begin to look like nails. We did not have time to conduct large-scale interviews with users to ascertain if this was the case.

### ***12.3 Systemic Weaknesses Are Strong***

The weaknesses in the technology are systemic, requiring some fundamental redesign of the Lotus Notes architecture, a few of which are coming in Notes V4.0. SmithKline Beecham does not plan to rollout Notes V4.0 until at least 6-12 months after its release, in order to let bugs get identified and fixed by Lotus/IBM. This has been SmithKline Beecham's strategy for every major release of Notes. In a highly regulated and validated computing environment such as pharmaceuticals, Notes needs much better tools for system management.

### ***12.4 Bottom Line - Business Improvements Were Worth The Investment***

The increased communication, improved workflow, process optimization, and standardization greatly improve operations, though the very heavy dependence on Notes is a growing risk and operations are problematic at times. The benefits to SmithKline Beecham's business operations definitely outweigh the drawbacks of logistics and system management. The company is betting that the technology and Lotus technical support will improve. Many signs point to improvements on the horizon. Overall, SmithKline Beecham is happy with the ongoing return on its investment.