

## An Architecture for Collaboration: a Case Study

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Conventional wisdom says that the most efficient and effective way to develop software is to have all members of a development team in a single location. Unfortunately, many large and complex software development projects in Lucent Technologies are unable to work as a completely co-located team. Lucent Technologies' product development projects typically involve at least 100 people in globally distributed locations and different organizations. In addition, almost every product is part of one or more integrated offer, which requires collaboration with several other organizations.

As a result project teams in Lucent Technologies have always had to find or create tools and technologies to support distributed development. For example, software configuration management and build tools, on line document repositories, email, telephone conference bridges, and remote access to servers have been part of the culture for decades. Over the past five years, most of the available tools have had web interfaces and access added. However, if two teams need to collaborate, there is no guarantee that the tools one team uses will be compatible with those of another. And although everyone generally has access to large amounts of information, it can be difficult to know what is available and what is important. Face to face meetings have remained the preferred method of transferring knowledge and making decisions.

For the past year, our group in Bell Laboratories Software Technology Center (STC) has been working to overcome obstacles to collaboration, both within our own organization and within a large software project in Lucent Technologies. STC is a center within Lucent Technologies' Advanced Technologies organization. STC consists of individual experts and teams of experts in technologies, processes, and tools in areas such as software requirements, architecture, test, software configuration management, performance, reliability, user interface, and usability. Some Center members work out of Lucent Technologies facilities in the US and Europe, others work from their homes or from hotels when on the road. All work closely with project teams throughout Lucent Technologies to help their projects to apply best-in-class, organized, and disciplined software processes and tools to their software product deliveries.

The distributed and non-co-located nature of our own work and our customer's work spurred our small team in the STC to launch a knowledge transfer initiative. This initiative has focused on defining techniques to enhance knowledge transfer and information sharing in three areas:

- between the STC experts and product teams,
- among STC experts from different functional areas, and
- across different functional groups and locations of the product teams we work with.

Our first application of our techniques started with an extended STC team. The extended STC team was contracted to work with a product development team in one of Lucent Technologies' business units. The team worked directly with a distributed product development organization to reduce their software development interval and costs while increasing their product quality.

Our customer is a part of a product organization that is developing a carrier grade application server platform that enables telcos to provide intelligent services in a converged voice/data network. The platform

is being deployed as part of an integrated offering consisting of several network elements and application products. We have been working with the development organization responsible for one major component of the platform; the organization is composed of functional teams responsible for the requirements, architecture, development, integration, test, project management, and lab environment. Members of the functional teams for this part of the platform are located in five US states and across two time zones. The functional teams must also collaborate with their partners in the integrated offering: teams that are building other platform component products, service application development organizations, and organizations responsible for other network elements in the offering. The partners are located in four additional US states and four European countries, adding more time zones to the mix.

The STC team for this effort consists of fourteen lead experts in different areas of software engineering, and additional team members who assist with specific activities. The team provides an integrated set of technology transfer activities, such as jumpstarts, specialized consulting, training courses, and review services. The team is spread over four departments and six locations in the US, only one of which overlaps with the product team.

Our challenge has been to

- Improve the skills and knowledge of members of several of the functional teams, especially the functional teams that are not co-located.
- Increase collaboration and communication among the organization's functional teams and between the organization and others in the integrated offering.
- Increase synergy between STC experts through collaboration and communication.
- Achieve all three goals with minimal overhead (e.g. minimal capital investment, very little planning and startup time, short process and tools learning curve for participants).
- Make the process adaptable, flexible and repeatable.

This paper focuses on how we promoted more communication and knowledge sharing, although the STC team also helped the project team with solutions to technical problems. We also report on our experience with technical and organizational pitfalls and key solutions to the issues relating to collaboration across multiple teams and multiple locations.

Some of the key issues include building relationships and trust, gaining agreement on goals, managing culture change, and "turf" concerns. Lesser, but still significant issues such as different skill and knowledge levels and varying software and hardware environments also had to be addressed.

Our solution to these challenges four major facets:

- We defined an architecture centered on a communication backplane and selected off the shelf collaborative tools (such as Internet-based document sharing, Lotus QuickPlace®, Microsoft NetMeeting®, and ordinary conference calls) to implement it. We helped the product organization learn to apply those collaboration tools effectively in their own work. (Figure 1)
- We partnered with the product organization to provide training and documentation that clarified the roles, responsibilities, tasks, and workflows for the functional teams.
- We worked with the product teams to employ key software artifacts (problem description, use cases and scenarios) that contain information that is used by several functional teams to capture vision and communicate priorities and requirements. (Figure 2)
- We set up an initial schedule and goals, with both STC and customers participating in the goal setting. We held mini-retrospectives to review the effectiveness of each activity throughout the process.

We found that we used collaborative tools frequently for communication among the members of the STC team. Internet-based tools are good for sharing project artifacts and detailed status information. Each STC team member could post and read important project information. The existence of a shared repository of project documentation improved the efficiency of information exchanges with other team members by phone and email. We encouraged the product organization to adopt some of the same tools to help integrate and manage their own activities.

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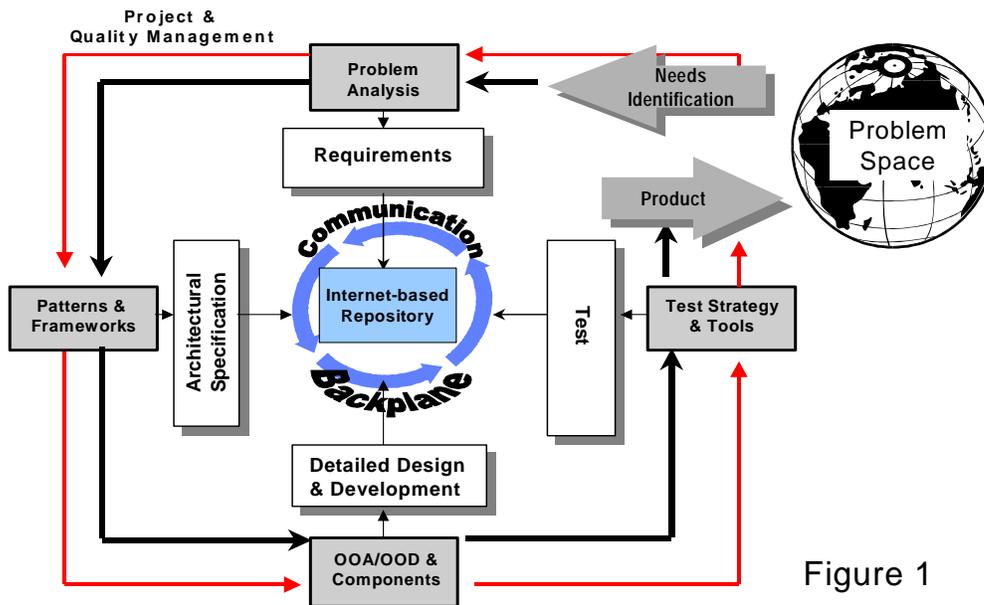


Figure 1

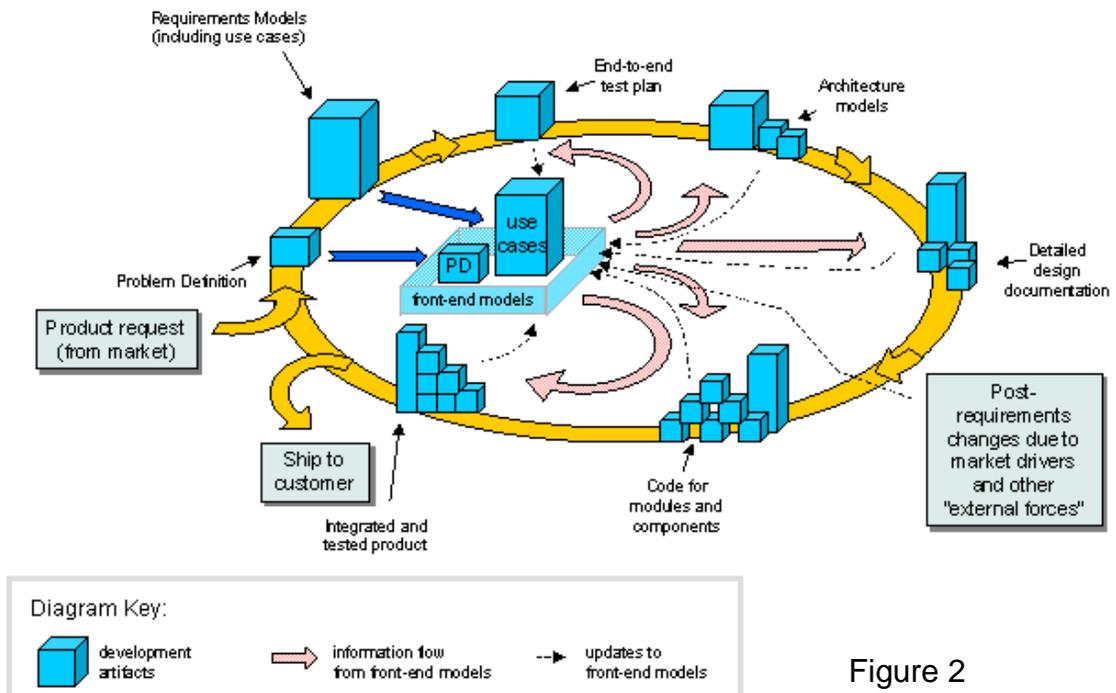


Figure 2