

Distributed Software Team

The HP 38G calculator was the first product to be developed by Hewlett-Packard's Asia Pacific Personal Computer Division after the charter for handheld products was transferred there from Corvallis, Oregon. The software team was split between Oregon and Singapore, so we learned to make good use of communication technology, including Internet tools.

We had to figure out how to overcome a separation of over 9,000 miles and eight time zones. At the end of normal working hours in Oregon, the Singapore workday has just begun. Our specific communication needs included same-time, different-place meetings and documents that could be accessed anywhere, anytime.

Same-Time, Different-Place Meetings

Two of our Oregon team members were already experienced telecommuters, working at home a few days each week. They pioneered the idea of "virtual team meetings." Our first virtual meeting experiments were practiced with everyone in the office, sitting in our individual work areas with telephone headsets and a shared window running on all of our computers, so that we could all view and edit the same document at the same time.

We were able to work out the initial kinks in the process by standing up and shouting to each other if necessary. The next step was to link our two telecommuters from their Oregon homes. When we added our two Singapore engineers, we were already familiar with the procedures and etiquette for same-time, different-place meetings.

The team used HP 9000 workstations as well as computers at home that were connected to the workstations in the office using a LAN connection over 56-kbit/s frame relay lines. The applications used for sharing documents during meetings ran on our workstations and included Collage and HP SharedX. These applications allow a group of people to view and edit the same document simultaneously. However, our more typical way of sharing documents during meetings was by individually accessing our team's WorldWide Web pages.

Anywhere, Anytime Documents

Project documents are used to keep people informed of discussions and decisions and to provide product descriptions for the extended team members. Our challenge was to create and maintain project documents that would be accessible from many different locations. Our documentation process made extensive use of Internet technologies: hypertext documents, graphical browsers, and electronic mail.

Hypertext documents contain links to other documents. They can be easily created with any text editor using a special kind of formatting called Hypertext Markup Language (abbreviated HTML). Our team members were all able to get started with simple hypertext document creation after only a few minutes of study.

It became apparent to us that HTML was the best choice for developing and maintaining our project documentation, because:

- As a text-based source file format, HTML is compatible with our source code control system. This allowed us to maintain HTML documents with the same familiar tools that we used to maintain source code.
- A variety of HTML browsers such as Mosaic and Netscape are commonly available for multiple hardware platforms, which ensured that each team member could access our documentation.
- The hypertext nature of HTML documents provided a natural and extensible means to link together our rapidly growing documentation set.

We started with an HP 38G project home page. It had links to conventional software project documentation, such as our external reference specification (ERS) documents, which were also authored in HTML. But the power of linked documents to disseminate information also led us in new directions that supported the HP 38G project development process.

In past projects, we often regretted our inability to look back at topics discussed through less formal means like email, but with our HP 38G home page and tools to support HTML document generation, we finally had the enabling technologies to overcome this limitation. We began to archive our group email discussions and link them into our HP 38G project home page, indexed by date, author, and subject. On frequent occasions (sometimes as a group during a teleconference) we would refer back to these email archives to revisit a line of reasoning about design choices.

The success of the discussion archival technique led to the side benefit of a uniform, centrally maintained mailing list for software team members. Over time we expanded this concept to include multiple discussion groups, each with associated email archives and each specialized for a different audience.

Soon we were using the HP 38G home page to collect information that was previously scattered throughout paper documents or engineers' minds. For the first time, documents detailing the setup of our software debugger systems, EPROM burners, and more were readily available around the clock.

Other departments involved with the HP 38G began to seek out the resources we made available through the HP 38G home page, and it was quite rewarding for us to be able to direct them to our pages. The frustration of trying to coordinate delivery of information by hand was becoming a distant memory. Some departments, with our encouragement and support, began making information available through linked documents. These we gladly added to our project page, making it more valuable for all parties. For example, when our colleagues

in Singapore had industrial design drawings to share, these were made available to all through the HP 38G home page, and the QA department's software test plans were added so that engineers could review and comment on them to ensure complete test coverage.

Conclusion

Our use of linked HTML documents has increased steadily since the HP 38G project. We now have more email discussion groups, our own Web server to simplify access for remote connections, a team home page with links to all of our project home pages, a dynamic team calendar of events, a "what's new" service for quickly learning what's changed, and a searching service for finding specific topics amongst our wealth of interconnected documents. We expect exciting new developments to further increase our productivity as we expand our knowledge and use of the Web.

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