IBM Research Report

Designing Remail: Reinventing the Email Client Through Innovation and Integration

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Designing Remail: Reinventing the Email Client Through Innovation and Integration

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Abstract

The Remail design team defined a specification for an innovative and integrated email client. This design-lead effort tackled three key problems that email researchers have discovered: lack of context, co-opting of email, and keeping track of too many things. Based on earlier design and research explorations, we conceived of a client from the ground up that attacked these problems in an integrated fashion. Our solutions were based on three constructs: showing message context, marking email, and selective display. A small team of programmers implemented much of the design in a functional prototype. This experimental client continues to allow researchers to expand and explore these concepts.

ACM Keywords

H.5.2 [Information Interfaces and Presentation]: User Interfaces — Graphical user interfaces (GUI), prototyping, screen design, user-centered design; D.2.2 [Software Engineering]: Design Tools and Techniques — user interfaces; H.1.2 [Models and Principles]: User/ Machine Systems — human factors, human information processing; H.4.3 [Information Systems Applications]: Communications Applications — electronic mail; H.5.1 [Information Interfaces and Presentation]: Multimedia Information Systems — evaluation/methodology; General Terms: Design, Experimentation; Keywords: Concept Design, Experience Design, Experience Strategy, Information Architecture, Integration.

Industry/Category
Enterprise Software, Design Research, Software Development, Collaborative Applications

Project/Problem Statement
Email has been shown to be one of the most effective and widely used platforms for business communication [10]. It has become a necessary and embedded channel in modern organizations [9].

Although the widespread use of email has evolved significantly since the early days of the ARPANET, the underlying user experience has changed very little. Today the conventional email client is still basically an inbox, some folders, and an address book.

Many studies have investigated the problems and frustrations that people have with email [2, 3, 5, 8, 16]. To guide our design, we distilled these into three core, interconnected problems:

- Lack of Context
- Co-Opting Email
- Keeping Track of Too Many Things

Lack of Context
At first glance, every new message is a solitary drop in the flood of email. But, often, new messages are related to older ones. For example, two messages may be sent by the same author, may have the same topic, or may be part of a conversational thread. This interconnectedness is not fully exploited in conventional email clients. For quick or concentrated exchanges, maintaining continuity is usually not a problem. However, for longer, more complex interactions, email provides very limited context for new messages. Early messages in a thread can quickly get lost or filed away.

Linking messages together by dimensions other than the reply-to chain is often a manual exercise and is limited in scope. People need more dynamic and interactive ways to connect related messages and to increase context.

Co-Opting Email
Although email was originally designed as an asynchronous communication tool, it is now being used for other tasks, including information management, task management, contact management, record keeping and file transfer. Whittaker called this phenomenon "overloading" email [16]; Ducheneaut and Bellotti called it "co-opting" email [1, 3]. The design of email clients has not changed to meet the pressure placed on it by these new uses.

Keeping Track of Too Many Things
The growing popularity of email has increased the steady flow of messages and has made it more difficult to keep them organized. People are skeptical about automatic filing schemes intended to help bring order to the chaos. They fear losing important messages and they want to monitor important topics, conversational threads and people. And, they want to do this without interrupting their workflow or their existing email practices [3].

Goals
There were multiple, sometimes conflicting, goals at the outset of the Remail project. The primary design goal of the project was an email client that solved the three problems described above. Point solutions to each problem area would not be sufficient. To really change the email experience, the solution would have to provide people with multiple, integrated ways to organize and act on their email.

A second goal was to keep the design specification within the constraints of the developers' technology choices. The design had to be feasible for a small team of developers to build quickly.

Business goals were set by product teams. This focused the design on features and capabilities relevant to near-term product plans. At the same time, some of the product teams were redesigning their infrastructure, which allowed our design perspective and solutions to influence their decisions.

Finally, in order to validate both the integrated design and the individual concepts, we believed that it was important that the prototype have a level of completeness that would allow sustained use on potential test subjects' own email.

Background/Project Participants

IBM Research's Collaborative User Experience group has been investigating the use of email for a number of years. Prior to Remail, the research had been small point experiments designed and evaluated in isolation, rather than as an encompassing email experience. For example, research had been done on email threads and thread visualization [4]. In the summer of 2001, a team of four interns set out to implement a design for a fully functional prototype in ten weeks. This "IBM Extreme Blue" project was our first attempt at incorporating a handful of our design concepts into a system that worked with people's existing email (see figure 1).

During this summer, we developed a number of novel concepts, but, with a small team and limited time, we were unable to implement all these ideas. Instead, we documented these concepts in an interactive demo called "Dremail" which was built with Macromedia Director® (see figure 2). This detailed design exploration defined a number of constructs that would later become the foundation for the Remail design.

We demonstrated the Extreme Blue prototype to executives and product groups within IBM as well as to select customers. Based on their positive feedback and interest we decided to devote a significant effort on this project to build a new prototype for 2002. This "group-wide" effort was uncommon in our history. Design researchers and developers would work together to create a unified email client prototype. We adopted the standard software development process of "design - develop - test" to facilitate communication and workflow throughout the team.
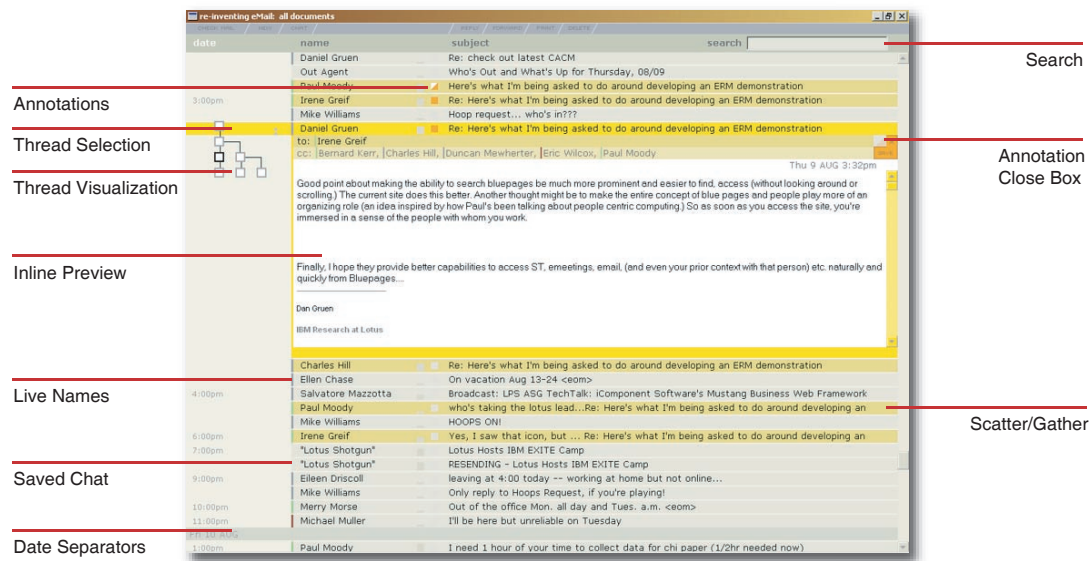

figure 1. Extreme Blue Prototype, summer 2001.

3

Search

Calendar

Annotations

Date Separators

Thread Selection

Live Names

To-Do's and Reminders

Saved Chat

Collections

In-Sight or Out-Of-Sight

Make Search a Collection

Scatter/Gather

Buddy List

Contextual Buddies

Collections

Sources

figure 2. Dremail Demo, October 2001.

Our initial goal was for our designers to deliver a design specification document in three months. The key interface elements and user interaction needed to be described adequately in order to set a foundation for the development phase of the project.

The following people contributed to the specification and resulting prototype design:

Design Team
Bernard Kerr, Eric Wilcox and Paul Moody did the interaction design, visual design, conceptual modeling, design prototyping, documentation, communication and project planning.

Research Development Team
Steve Rohall and a research development team of five architected and implemented the Remail prototype, provided design critique and scoping, and enforced technical and resource constraints relevant to design. John Patterson provided guidance on the high-level system architecture [12].

Extended research team
Dan Gruen and our extended reseach team provided past knowledge, experience, user research and tangential development.

Project Dates and Duration
The design of the Remail prototype took place from January through September, 2002. From January to April, the design team produced a design specification that described key interaction and interface elements. This 100-page, illustrated document was a schematic that articulated the design functionality and behavior to the research development team. From May to September, while the development team was building the technical foundations of the client, the design team defined the aesthetic and further refined the integration of concepts across the user interface. Our primary deliverables included interface layout guides and images, a prototype design document, and a design demo (also built in Macromedia Director®) that demonstrated key user interaction elements.

Challenge
The primary challenge of this design research was to conceive of an integrated email client which we could test on people, with their own email, over a sustained period of time. One of the problems with traditional email studies is that they only look at point solutions
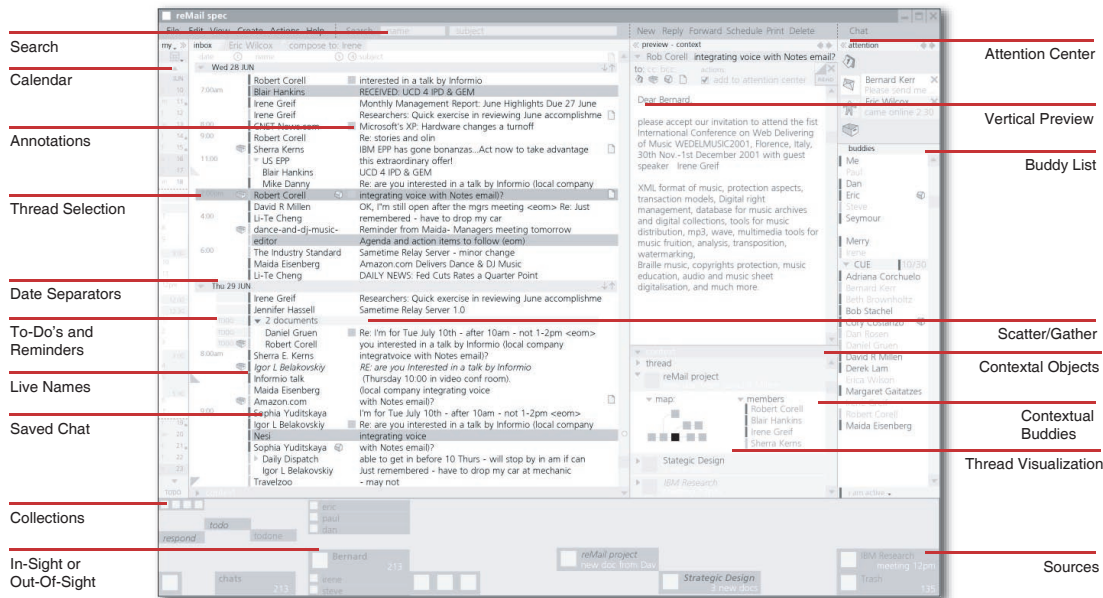
4

Labels (left side): Search, Calendar, Annotations, Thread Selection, Date Separators, To-Do's and Reminders, Live Names, Saved Chat, Collections, In-Sight or Out-Of-Sight

Labels (right side): Attention Center, Vertical Preview, Buddy List, Scatter/Gather, Contextal Objects, Contextual Buddies, Thread Visualization, Sources

figure 3. Remail Spec, initial grey spec, April 2002.

that tackle a small part of the larger email problem. In many cases, a prototype is made and tested, but the studies are small in scope and use sample or fake email data. As a result, the tests rarely reflect the way people use email in their day-to-day lives or how well these new solutions work with their own email. To test our concepts rigorously, we needed to build a fully functional email client [14]. One of the difficulties in achieving this was balancing the degree to which we focused on innovation versus the time spent incorporating features to which people were accustomed.
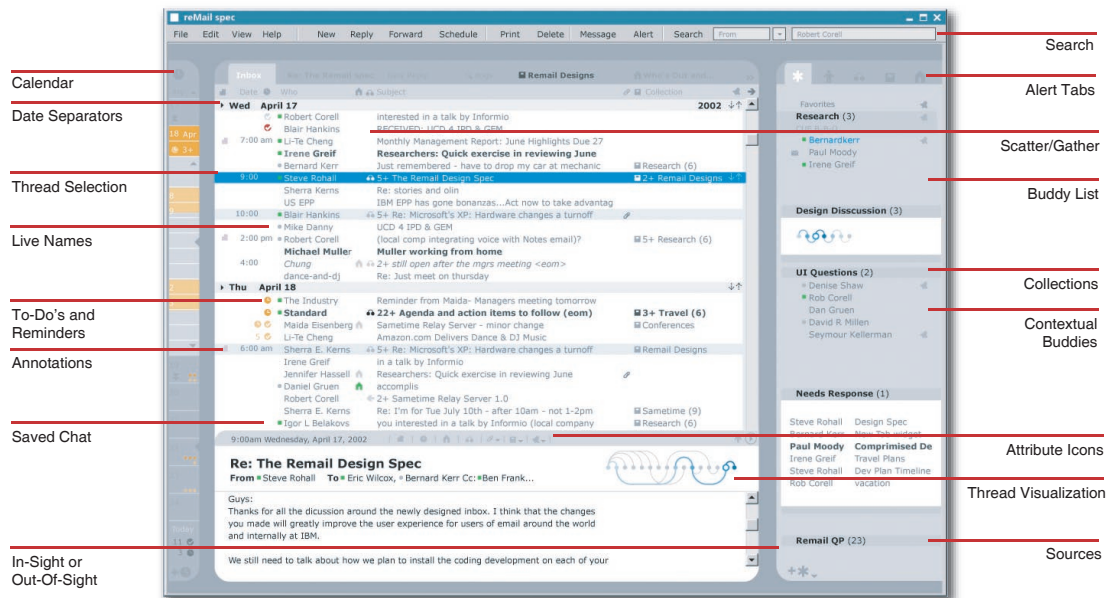
The second challenge was to find an efficient way to communicate the design to all of the different stakeholders. The design team focused on a very detailed documentation for the developers. Meanwhile, other audiences, including product teams and research management, were looking for the design to communicate strategic direction and innovation. It was uncharacteristic for research to produce a specification to this level of detail.

Limited resources and evolving constraints made it challenging to communicate the design concepts and direction at all points in the process. For example, some of the design illustrations we produced during development were very technical and stressed boundary conditions by showing extreme use cases (see figure 3). In the initial stages of the spec development we also the design tactic of drawing the design in a visually neutral grey scale. We did this to encourage critiques to focus on the concepts and functionality rather than on the look and feel. This combination worked well for the designers but was confusing for some less technical audiences who misread them. Artifacts such as storyboards would have helped more clearly communicate some of the concepts behind the intended user experience, but the tight deadlines made this impossible.

Solution Summary
A team of three designers divided the high-level design tasks. One designer led the interface design, another the documentation effort, and the third had control over communicating the design to external audiences. All three designers contributed to each aspect of the design, but the owner was responsible for collecting and unifying the work for his design task.

Calendar

Date Separators

Thread Selection

Live Names

To-Do's and Reminders

Annotations

Saved Chat

In-Sight or Out-Of-Sight

Search

Alert Tabs

Scatter/Gather

Buddy List

Collections

Contextual Buddies

Attribute Icons

Thread Visualization

Sources

figure 4. Remail Spec, final design, September 2002.

One member of the design team worked primarily remotely. Frequent email, instant messaging and phone conversations facilitated work. We sent and received digital interface sketches via email. We handled documentation writing in a similar fashion. The owner of the interface design kept a large, multi-layered Abobe Illustrator® file of the project, which was used to manage integration of interaction design elements. It also served to illustrate all parts of the design documentation, and was used to create assets in the development phase of the project. The documentation was organized in a series of Microsoft Word® documents that used built-in editing tools to track changes and commentary between authors.

Iteration was critical to the design process. As design ideas passed from sketches to documentation and communication, frequent critiques refined the direction. The designers held daily reviews, often using white boards to sketch and clarify ideas quickly. We also had periodic formal reviews with the development team.

After the design specification was completed (see figure 4) the design team created an internal website that described the design solution. This site contained high-level motivation and concept descriptions, as well as links to documentation and mockups of the final design solution.

Constructs

Constructs are defined here as a set of high-level principles that are used to guide design solutions. Our challenge as research designers was to create a set of constructs that were simple yet powerful enough to allow people to use them in a variety of ways to meet their needs.

As mentioned before, studies have shown that email is being "co-opted" or "overloaded" in ways that were never anticipated. For example, people currently use email for file sharing, to-do lists, calendars, and reminders. We saw this overloading as an opportunity to think about larger constructs that would help people use their email for these purposes.

The three constructs that we designed to address the problems with existing email clients are:

1. Showing Context
2. Marking Email
3. Selective Display

6

Solution Details

The main elements of the design are shown diagrammatically in figure 5. The interface consists of a Calendar and two major tabbed areas. The first tabbed area consists of tabs for lists of messages and the preview. There is always a tab for the Inbox List, and other List Tabs can be opened to show all of the messages in a collection, thread, or search. The second tabbed area consists of the Favorites, Buddies, Threads, Collections, and Sources Tabs.

figure 5. Main Tabs Elements in Remail.

The message was the fundamental unit in Remail. Documents from any source, including Chat and RSS, were considered messages. We applied the same organizing principles and functionality to all messages, for example putting a chat message into a Collection, or placing an annotation on a chat.

PROBLEM: Lack of Context
CONSTRUCT: Showing Message Context

Email messages are single items in an ever-expanding list that give few clues about their relationship with other messages that have been stored and organized previously. In Remail, we give more context about each message. For example, we provide visual separators in the Inbox List and let users see each message within its context using "pivoting" and threads.

Separators

As a new message arrives in a conventional email client, it gives one limited information: author, subject, date, size, and attachment indication. To make matters worse, the date is often in a complex format (e.g. "10:25PM 11/10/2003 -0800"). Remail, by contrast, chunks the date information into days with date separators that make it easier to see messages from a given day as a group (see figure 6).

Remail also shows seven extra pieces of contextual information: annotations, reminders/to-dos, on-line status of the author (live names), message source, thread size, collection categorization, and alerts. These attributes also appear in the header information of the message, as shown in the preview pane (see figure 6). How these attributes are set is discussed in more detail in the section on "Marking Email".
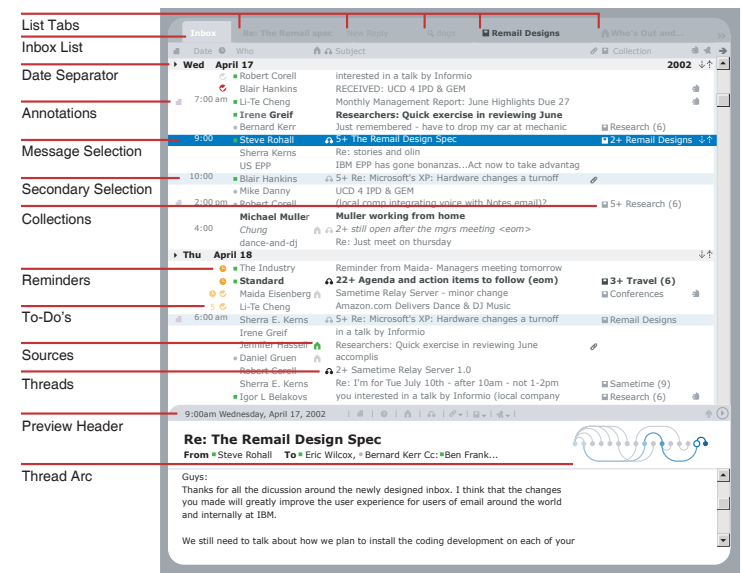

figure 6. Inbox List and Preview elements including Message Attributes and Thread Arc visualization.

figure 8. Thread Tab, showing detailed thread information.

Pivoting

Changing the sort order while the selected message remains the focus is called "pivoting". Ducheneaut and Bellotti's study [3] found that this type of re-sorting in conventional email clients was more popular than using the search function "because it can be used to more quickly specify a search criteria (such as date or sender name)." In Remail, one can "pivot" a list by clicking on the column header for that attribute. The separators then change to that attribute, showing for example, date or author name (see figure 7). Remail also allows one to pivot into a List Tab by clicking on any of a message's attribute icons. For example, clicking on a thread icon opens a List Tab of all the messages in that thread with the original message still selected. One can shift context and focus on related messages, then continue to pivot into other contexts. For example, one can pivot into a Thread List Tab, then pivot again to a Collection List Tab from one of the messages in that thread. One switches back to previous contexts via the List Tabs shown above the lists.

figure 7. Pivoting around a message by resorting the Inbox List or pivoting into a List Tab via a message attribute.
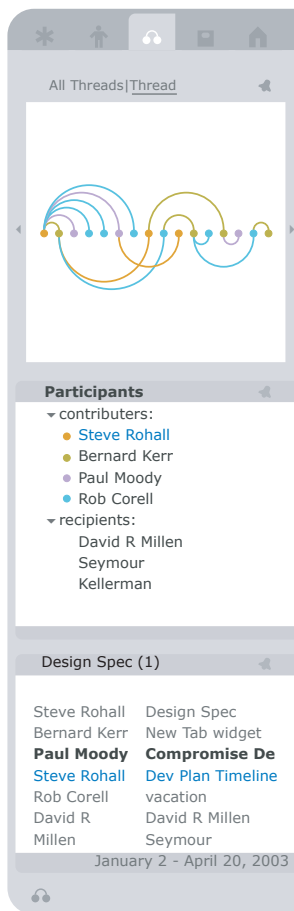
Threads

A thread is a group of messages related to each other by the email reply function. If one replies to a message, then the original message and the reply are linked as a thread. This relationship continues as more replies are added to the original and subsequent messages. When a message is selected in Remail, all the messages in the current list that are part of its thread are highlighted in the Inbox List with a secondary selection color (see Secondary Selection in figure 6).

Additionally, the Thread Arcs visualization [7] shown in figure 9 is part of the message Preview (see figure 6).

figure 9. Thread Arcs visualization showing the chronology and relationship between email messsages in a thread.

This is a compact overview of the other messages in the thread and their relationships to each other. One can navigate to these other messages via the visualization without having to go back to the Inbox List. It was important to keep this thread visualization small because it had to be an integral and visible part of the client, providing convenient context without taking up unnecessary screen space. The Thread Tab to the right of the Inbox List (see figure 8) contains more detailed information, such as the time span of the thread, or participants in the thread.

Chat

Chat is emerging as another essential communication tool in the workplace [11], so we integrated it into the Remail design. The first and most fundamental step in

8

integrating chat was to treat people as first class objects in the interface. For example, any name field in the Inbox List or Preview shows that person's on-line status (e.g. "active", "away from desk", "do not disturb"). The name can be used to initiate chats or dragged ont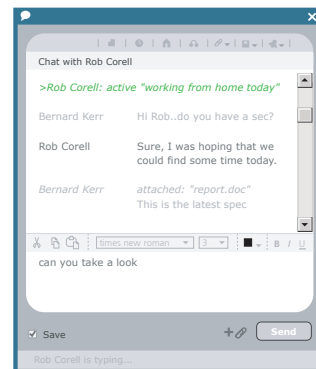o the Buddy List for future use. More importantly, Remail allows one to save chats as new messages in one's Inbox, and to organize and mark them like any other message (see figure 10). A chat initiated from an existing email message can be saved as a reply to that message and then can be viewed as part of that message's thread.

figure 10. Chat dialog box which allows one to save chats.

The Buddy List is integrated into the client as another tab to the right of the Inbox List. When an email message is selected in the Inbox List, a temporary contextual buddy list group ("Recipients" in figure 11) is created from the To, CC and BCC fields of that message and put at the bottom of the Buddy List Tab. People on the Buddy List can be organized spatially (rather than alphabetically ordered). One can also use buddy names to start or forward email messages.

The construct of "Showing Context" led to a design that surfaces many of a message's attributes and its relationship to other messages and people. Pivoting on these attributes and relationships is a powerful, flexible way to navigate and switch context.
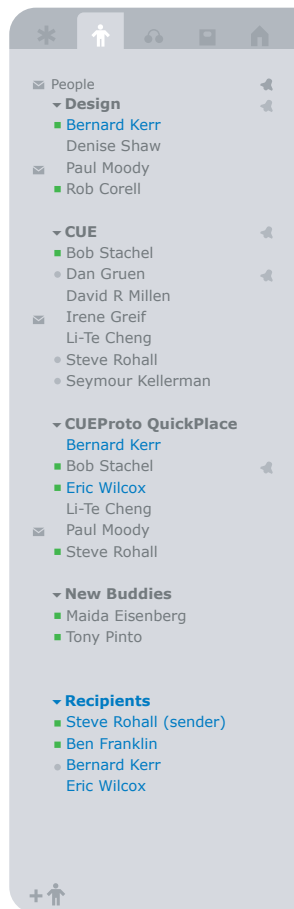
figure 11. Buddies Tab, with contextual "Recipients" buddy group based on the currently selected message.

PROBLEM: Co-Opting Email
CONSTRUCT: Marking Email

Email is used for more than simple message writing and delivery, so an updated and integrated email client must support a variety of other activities. We looked for better ways to quickly and easily mark one's messages for these purposes, and then we came up with a number of solutions, including annotations and calendar marks. Figure 12 shows the marks that can be applied to messages in Remail. Some are added automatically, while others are personal marks set by the user. We eliminated unnecessary icons ruthlessly, retaining only those that were absolutely essential. All of the personal marks can be set directly from their cells in the Inbox List, or via their icons in the message's header (see figure 6). This makes marking one's mail in Remail a quick and lightweight activity.
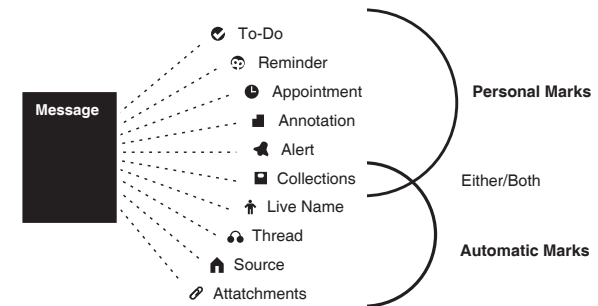
figure 12. Personal and automatic "marks" one can make on messages in Remail.

Email arrives in one's inbox in a homogeneous format. In conventional email clients, one can only put mail into a folder, delete it, or mark it as read. This is very limiting if one intends to co-opt email for other purposes. For example, people mark messages they have read to "unread" with the hope that it will catch their attention
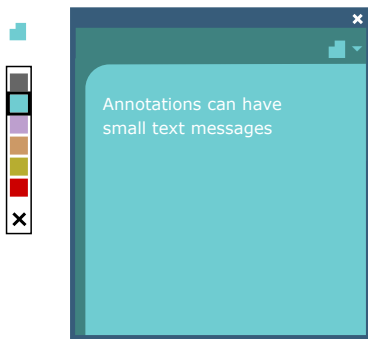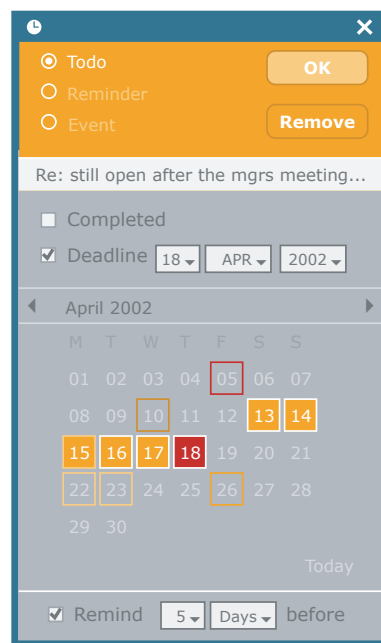
figure 13. Annotations are like digital "post-it" notes for one's email. They allows one to mark individual messages with a color icon and text.

figure 15. Calendar dialog box for To-Dos.

later and serve as a reminder. Clearly, if people are to co-opt email for other purposes, they need richer ways to mark it.

As a design thought experiment, we considered the following scenario: what would *we* want to be able to do with email if it were delivered on paper? If we received fifty pieces of mail a day, after ten days we would have an unmanageable pile of paper two inches thick. Some of the messages would contain calendar events and to-do items, others would need to be collated around topics or are part of conversational threads. So, in the physical world, we would probably want to mark and sort most of the messages in some way, putting some into calendars, and others into file folders or to-do lists. In some cases, we would do both. For example, a meeting about a project would be put into our *calendar* and into the project *folder*. The challenge for Remail was to enable people to do these kinds of operations quickly and easily with their email.

Annotations
An annotation is the digital equivalent of a Post-It® note. It allows one to mark a message with a small colored icon of one's choice that can also have associated text. This annotation (see figure 13) can be used in many different ways. For example, one can use a blue annotation to mark messages that are requests for information. One can also include a snippet of text that describes exactly what is being requested or how it should be handled. One can then sort or pivot on the Inbox List to see all the messages annotated in blue, and then work through the requests by reading the annotation text without re-opening any of the messages.
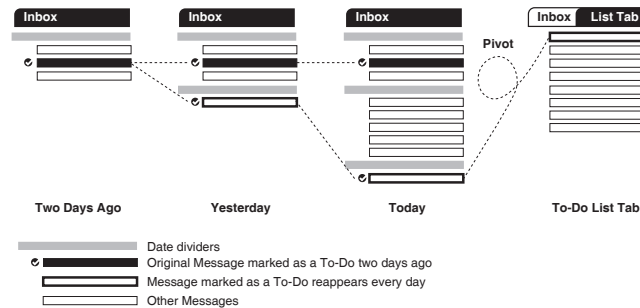
Calendar
In the business environment, a great deal of work is received and delegated in email. [16]. One way to handle these messages is to mark them as to-do or calendar items. Remail lets one assign three calendar markings to email:

    ✔   To-Do
    ☺   Reminder
    🕐   Appointment
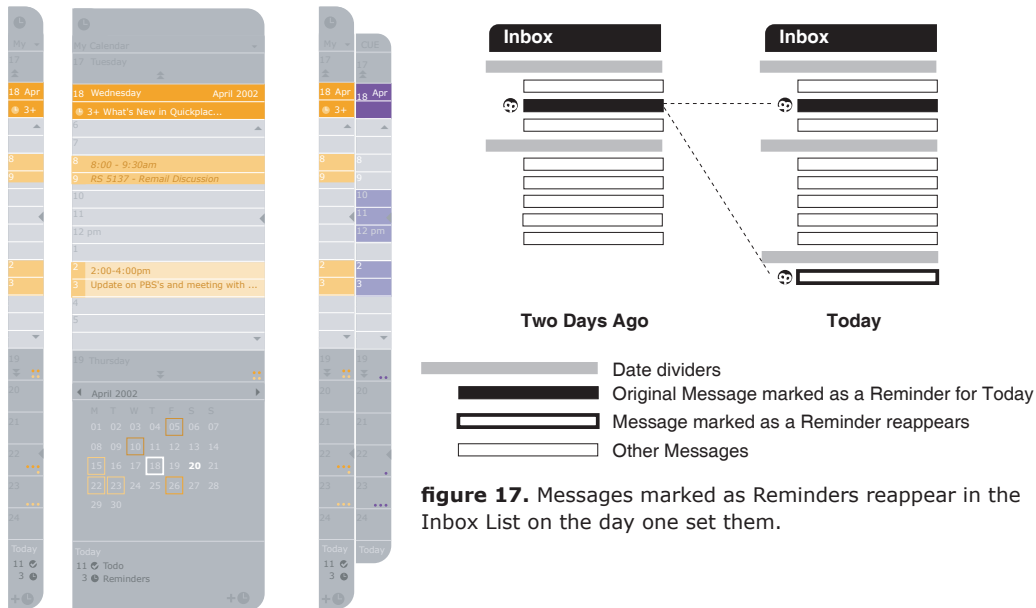
figure 14. Calendar markings.

These markings can be applied simply by dragging a message onto a day on the Calendar Tab. A dialog box (see figure 15, left) fills in that day's information and provides additional options. We subsequently worked out a technique to identify this date information directly from the body of messages automatically, for example, determining the relevant date for an email about a meeting "next wednesday" [15].

Marking a message as a "To-Do" stores it in one's To-Do List. Once one is done with a To-Do item, it can be marked as a "Completed To-Do" and archived with other completed tasks. One accesses the To-Do List via the To-Do icon in the Calendar Tab, or by pivoting from any To-Do item in the Inbox List, (see figure 6). The top message in the To-Do List is a special message that shows up as the first message of the day, every day in the Inbox List. This resurfacing, illustrated in figure 16, keeps one's To-Dos in sight as a reminder about ongoing tasks and resurfaces them daily so they won't scroll out of sight for long.

10

figure 16. Messages marked as To-Dos reappear in the Inbox List, which allows one to pivot into the To-Do List Tab.

One can drag-and-drop a message on the calendar to mark it as a "Reminder". A message marked as a Reminder resurfaces as a new message in the Inbox on the day that is set (see figure 17) and is also added as a calendar entry on the specified day.

figure 17. Messages marked as Reminders reappear in the Inbox List on the day one set them.

An "Appointment" is similar to a Reminder, except that it has a time associated with the day, for example, "meeting on the 18th from 5:00-6:00". Appointments appear on the Calendar Tab for that day.

The calendar is a thin (expandable) strip along the left side of the screen (see figure 18). In addition to containing calendar information the Calendar Tab scolls the Inbox List. Conventional scrolling offers few clues to where one is in the Inbox List as one moves backward or forward in time. Clicking on a day in the Remail calendar scrolls the Inbox List directly to the messages for that day. In addition, one can view other people's or teams' calendars side-by-side with one's own.

All of Remail's marks (including Sources and Collections described in the next section) give people multiple ways to co-opt their email.

PROBLEM: Keeping Track of Too Many Things
CONSTRUCT: Selective Display

As the saying goes "out of sight, out of mind", so keeping things that are important in view is crucial. Messages left in a conventional inbox as reminders can scroll off the screen as newer messages flood in. We looked for ways to reduce the clutter of the Inbox List without hiding messages that have been designated as important. We also searched for ways to monitor key information without taking up too much screen space.

Sources
Many applications use email as a notification mechanism. For example, changes in a collaborative web site (such as a wiki) or transaction confirmations (such as Amazon.com book purchases) trigger automatic email messages. Remail aggregates messages from multiple

figure 18. Calendar Tab in three states, collapsed , expanded, and collapsed while comparing schedules with another person's calendar.

11

Sources into a single Inbox List. One can see messages from multiple email accounts, team rooms, RSS feeds and NNTP in the same client and in the same single Inbox List view. To distinguish these messages from regular email, we marked them with Source Icons in the Inbox List (see Sources in figure 6).

Collections
A "Collection" is a container of pointers to email. The use of folders in conventional email clients have a number of limitations [13]. A key problem is that they remove messages from the Inbox List, rendering them "out of sight" and "out of mind". Another problem is that each message can only exist in one folder at a time. For example, a message about one's dog it must either be put into the folder "dogs" or the "my pets" folder, but not both [6]. Remail "Collections" overcomes both of these problems.

In Sight and Out of Sight
In Remail a Collection can be set as either "out of sight" (like conventional folders) or "in sight," where the message is marked as part of a Collection but still appears in the Inbox List. Messages in a Collection are marked with an icon and label for that Collection in the Inbox List (see figure 6). This shows the name and number of the collections that a message belongs to. These Collections are also highlighted on the Collections Tab when the message is selected (see figure 19). The Collections Tab lists all of one's Collections, which can be ordered spatially rather than in the flawed alphabetical order imposed by conventional email clients [3]. One can also pivot into any Collection by clicking on the Collection icon in the Inbox List.
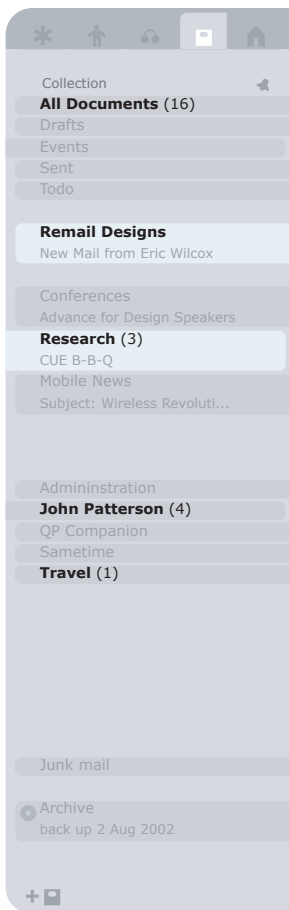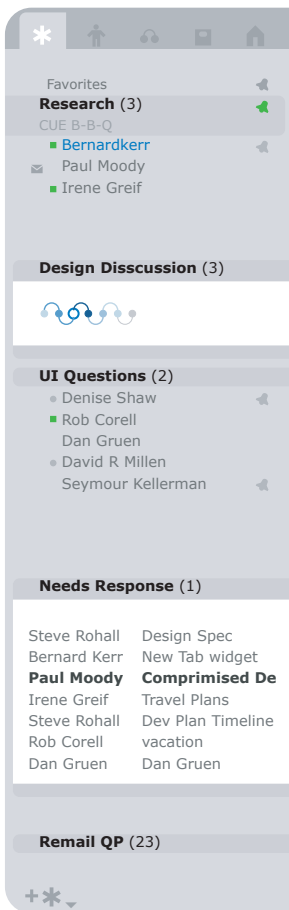
Automatic and Manual
Collections are analogous to MP3 jukebox "play lists." The email messages represent the entire music library, and one can make multiple "play lists" with any combination of messages for each Collection. One can even generate "play lists" automatically via filter criteria (for example, all messages from the boss). Conventional email clients do this with filters or search folders. When new messages match filter criteria, they are automatically sent to one of these folders. But because all folders in conventional clients are "out of sight," important messages can be removed from the Inbox list before one sees them. Without checking all of one's folders regularly, an important message can be missed easily. The advantage of Collections is that one can set them to be "in sight," so while the message is marked as part of a Collection for later retrieval, it remains in the Inbox List.

Users often mistrust filters because they sometimes move messages into the wrong folder or fail to filter a message that should be moved. For example, a filter that puts all messages with "dog" in the subject line into "my pets" folder would inadvertently grab a message with the subject "hot dogs." Part of the problem is that defining the filter criteria accurately is difficult, and even the best written rule rarely catches all of the messages that should be collected. Remail allows the user to add or remove messages manually from Collections, regardless of the filter. For example, if a "hot dog" message were found incorrectly in the "pets" collection, the user could remove it manually, and Remail would never automatically place it there again.

More refined filter rules can be made in Remail based on any of a message's marks. For example, all blue

figure 19. Collections Tab. Light blue coloring highlights all Collections to which the selected messages belongs.

annotations or all messages from an RSS Source that contain the word "Research" can be grouped together. This feature becomes more powerful when combined with the ability to have the same messages in multiple Collections; setting up one filter does not preclude organizing a message into other Collections. In addition, if a Collection is set to "in sight," then the Collection labels in the Inbox List (see figure 6) tells one that a filter is working.

Scatter and Gather
Conventional email clients "scatter" the messages of a thread throughout the inbox, so although these messages are closely related in content and context, they are separated by other, unrelated messages. In Remail, one can quickly "gather" them. Gathering removes from the Inbox List all but the latest message in the thread, which is left to represent the entire thread, as illustrated in figure 20.
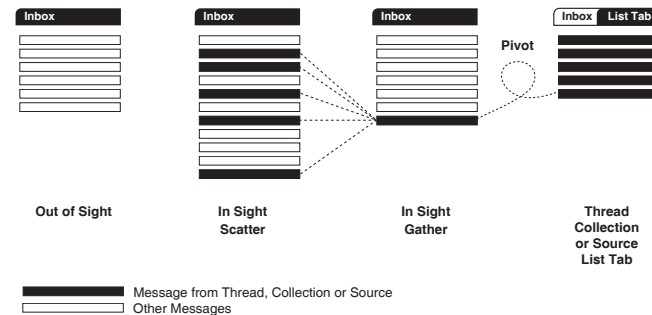
figure 20. Threads, Collections and Sources can all be set to Scatter or Gather. If they are set to "out of sight" they will not appear in the Inbox list.

Double-clicking the thread icon for that message pivots to a List Tab that contains only the messages from that thread. Gathering reduces clutter in the Inbox List by

reducing the number of messages seen. To prevent any messages from being removed before one has a chance to read them, Remail can gather only the messages that have already been read; unread messages from a thread are left scattered. In addition, a bold thread icon indicates if there are any unread messages (see Threads in figure 6). The size of the thread is also shown in the Inbox List.

Scattering and Gathering can also be applied to Collections and Sources. For example, all the messages for one's newsletter Collection can be gathered and represented as one message. The latest message can still be seen, allowing one to monitor these items in the Inbox List. From there, one can simply pivot into a List Tab to see the rest of the Collection.

Tabs
Remail has five main tabs, which contain contextual and organizational information about one's email (see figure 21). Tabs like these are often used as part of an interface to organize information that cannot fit on a single screen. An inherent weakness is that activity or changes to information can be missed easily if a tab is not actively selected. Remail addresses this problem with two innovative approaches to tabs.

figure 21. The five main tabs, with two alerts indicated on the Collections tab.

Favorites Tab
The "Favorites Tab" allows one to bring together objects from the other tabs and combine them in any order on a single tab (see figure 22, left). For example, a Collection

figure 22. Favorites Tab can contain objects from each of the other Tabs for active monitoring.

13

for a project with some buddies from that project team, a thread that one is monitoring, and another project Collection one is keeping an eye on can all be displayed on the same tab.

Alerting Tabs
The tabs in Remail also signal alerts. Alerts can be placed on any item in the favorites, buddies, threads, collections and sources tabs. One is then notified when a new message comes into a Collection, an important conversation thread grows, or a particular person comes on line. If an alert is triggered, then its tab turns green, as shown by the Collections Tab in figure 21. If the tab is selected a green bell icon appears next to the item triggering the alert (see the "Research" Collection in figure 22). Clicking this alert icon displays the item in the preview pane and dismisses the alert. If more than one alert is triggered, a number is also shown on the tab.

The ability to hide items in an out-of-sight Collection or gather items in an Inbox List allows one to monitor messages actively without feeling overwhelmed by the large volume of email that is commonplace today. The Favorites tab and alerts help one monitor specific collections, people, and sources actively.

Results
Producing the large comprehensive design specification required for the Remail project was uncharacteristic for our group. Meeting the goals of generating and integrating innovative design concepts demanded significant time and resources. The internal success of this project, however, validated by research and product audiences, has demonstrated the value of our concentrated design research effort.

Overall, we designed a successful solution that met the goals and the constraints we were given. Developing three main constructs led to solutions that were deeply connected across the email experience and allowed people to act on their mail in a number of novel ways.

The short time frame and limited resources kept us focused on realistic design solutions that were of high value to end users. However, design ideas that were not technically feasible to build under the constraints we faced were not lost; we documented them in the specification and through interactive design mockups for future research.

Our work also influenced the emerging designs and technologies of product groups. For example, after completing the specification, one of the research design team members worked full time for six months with several product groups as a lead product designer. In this role he communicated and transfered our design solutions as well as other lessons learned from email research.

The design of Thread Arcs proved to be a powerful visualization [7]. Its development was carried through to a series of formal tests in usability labs with users' own mail. Results of these and smaller tests on the prototype have provided valuable insights about its usefulness.

The Remail prototype also turned out to be an excellent test-bed for innovation. Other research groups in our organization have extended their ideas to work on top of our design, taking advantage of the foundation we built.

We gained key insights in design strategy. Our success hinged on our ability to be flexible and to communicate the design to various audiences throughout the design

and development phases. Balancing the needs and mechanics of designing for a research development team while communicating a clear vision to product teams was challenging. The two goals were sometimes at odds. In fact, some audiences misinterpreted early views of the schematic designs as the final aesthetic solution. Based on our experience, we see the need to communicate our design progress along with the design vision. We also recognize the value of a concentrated design research effort at strategic moments for the company.

The development phase was recently completed, and we have a deployable prototype that is currently being distributed for user testing and evaluation. We continue to enhance the prototype along with other internal research groups.

Figure 23 summarizes the innovations we describe in this paper that address many of the shortcomings of conventional email clients. Although some email clients have some of the features that we described, none of
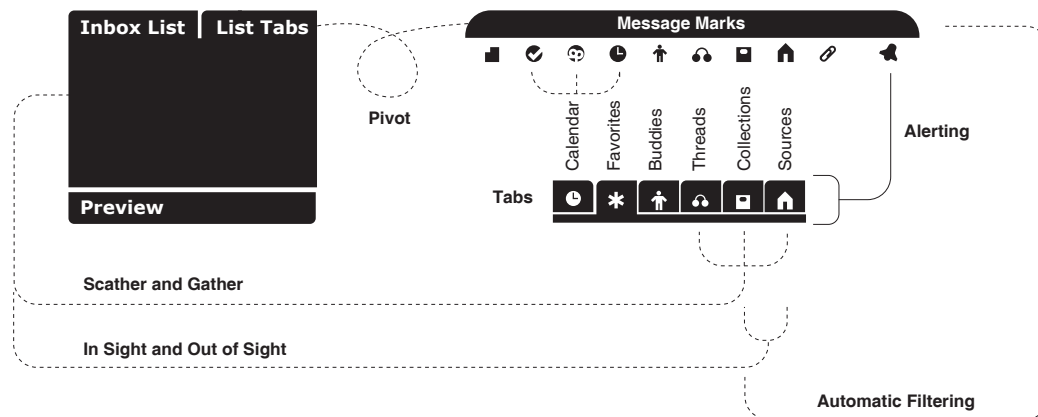
these clients integrate them as extensively as our design specification does. The combination of innovation and integration was the key to our success. Bringing these innovations together into a single client will allow people to tackle their email in new and powerful ways.

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figure 23. Integration of the constructs provides mutiple ways to use and organize email.

15

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