Email: A look at the past, present and future

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Introduction

Email has become synonymous with one's identity in today's digital knowledge economy. The original intent of email is very different from the way we use email today. Email has become the kitchen sink of all digital notification needs; almost every digital service that a user can sign up to uses email or requires the user's email address.

Many modern mobile and desktop apps started because users had frustrations conducting the main function of these apps using email. For example, people used to share their favorite bookmarks with their friends or colleagues using email until dedicated social bookmarking products allowed for a better way to do this (del.ici.ous started this in 2003 [O1]). Now, users can share a bookmark they like on the web using Facebook, Google+, and other social network applications.

Email is commonly used to communicate social updates, product promotions, e-commerce confirmations, marketing campaigns, travel plans, website links, files, requests for help, phone numbers, and even identity recovery and authentication.

In the midst of all this, people developed ways to deal with their inboxes to stay sane. Companies like Google provide training for their employees how to stay on top of their email. Several startups tried to push for 'Inbox Zero' behaviors as the Holy Grail of our digital life style.

It has become apparent that the way we use email today to manage our personal and professional lives is causing more stress. People are wasting more time managing their inbox than actually getting things done [B4, F5]. Should email remain a messaging protocol or should it become a to-do list solution? Should it be replaced by collaboration platforms like Slack or project management tools like Asana [29]?

In this paper, we will start with highlighting the technical limitations of the underlying technology that made email what it is today. Then we identify the main problems faced by email users. Then we will explore what some of the leading startups and mail providers are doing to improve our email experience.

Finally we will conclude with our educated estimate of what email will or should look like in the future. Throughout the paper, we will keep track of pure consumer focused use cases vs enterprise focused use cases.

Background and Analysis

Overview of how email works

The origin of email traces back to the early 1960s when the United States Department of Defense developed the Automatic Digital Network (AUTODIN). AUTODIN provided a messaging service between its terminals which allowed users to send written communication to other users on the same network. It was essentially a text file that another user can leave in the recipient's network drive [H1].

This simple text based terminal message service evolved to support multiple networks when Ray Tomlinson used the @ symbol to separate the user's name from the user's machine name on ARPANET. Outside of ARPANET, many protocols and address formats existed but eventually, all digital mail providers standardized on using Simple Mail Transfer Protocol (SMTP) in 1982 which was very similar to the File Transfer Protocol (FTP) [H3].

SMTP is built on top of TCP (Transmission Control Protocol) connections that ensure reliable ordered data delivery between the senders and receivers. SMTP is a text based protocol where the sender issues certain command strings with a data payload. The operation of SMTP is summarized in the following diagram:
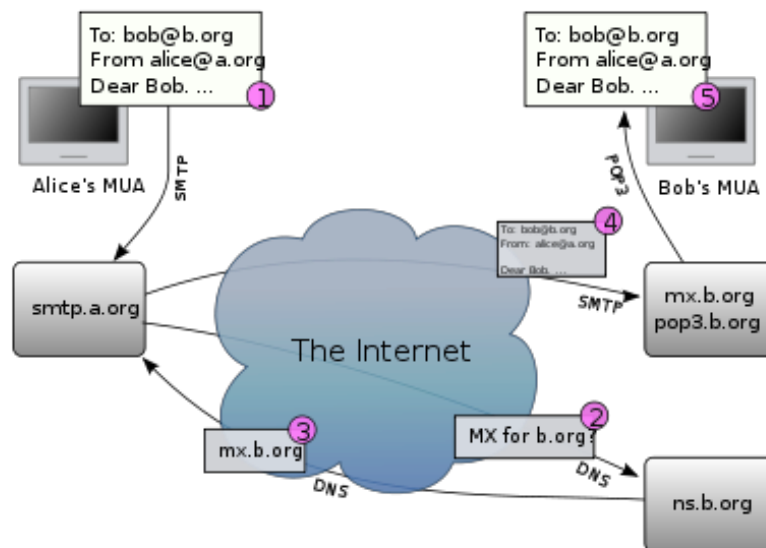

Figure 1. SMTP operation overview [H2]

In the diagram, Alice is the initiating host in the "a.org" domain is trying to send an email to Bob who is a user in the "b.org" domain. Alice's system is called the mail user agent (MUA). The MUA formats the message in the correct SMTP format and sends it to the mail submission agent (MSA) which is smtp.a.org in the diagram. The MSA resolves the domain name by using a Domain Name System (DNS) lookup. The recipient's DNS server responds to the lookup call with the mail exchanger (MX) records for mail servers in that domain (this is the mx.b.org server in the diagram). The MX server on the recipient is

called the message transfer agent (MTA). At this point, the initiating host (smtp.a.org sends the message to mx.b.org using SMTP. If there are intermediary servers between the MUA and MTA, those are called message delivery agents (MDAs). On the client side, the user retrieves their emails using a mail delivery protocol like Post Office Protocol (POP3) or the Internet Message Access Protocol (IMAP).

Implications of current email technology

The underlying protocols and technology that enable email communication have limitations that have forced users to face several problems. All of these problems did not exist when email was still a nascent technology used by a limited number of individuals for the its original use case.

In this section, we analyze email's communication protocol and its content format which will help us better understand the problems users have with email today.

Email systems rely on an asynchronous communication model called **store and forward** which holds the sent information at an intermediate station before delivering it to its final destination. This model was ideal for networks with intermittent connectivity, high error rates, or variable transmission delays. Email utilizes a **push sending model**; that means the sender decides who receives the message. The recipient has no control over who can or can't send them an email once the sender knows their email address.

All email servers today use push and store-and-forward models or a proprietary variant of it. Within this model the server only allows a limited number of operations, namely accept, forward, deliver, and store email messages. These operations translate to the following common email actions:

- Sending an email to a valid email address with multiple variants:
    - Send a brand new email message
    - Reply to an existing email that was sent to the recipient (sending an email back to a message with the same topic as before)
    - Forward an existing email message to a person that was not on the recipient list of the original email

- Categorization: the inbox supports different buckets where emails can be grouped together by topic, sender, company ... etc. This is commonly known as 'Labels' in Gmail or 'Folders' in Microsoft Outlook. Gmail supports multiple labels on the same message while Outlook requires one folder/tag for each email.

- Archival (saving an email): allows a user to keep a message saved in their inbox. Clients like Gmail allow the user to archive a message without saving it in the main inbox folder but leaves it in the All Mail folder.

- Delete a message from the user's inbox completely (also known as 'Trash'). Deleted emails are no longer indexed and are not retrievable.

- Marking messages as read or unread. All email products support differentiating between read and unread emails. Users can filter their email by the 'Read' or 'Unread' status. Few social terms are associated with the unread count of email messages in one's inbox. 'Inbox Zero' is a common email usage paradigm where the user tries to maintain zero unread count in their inbox.

As detailed above, the number of actions is limited and all of them can be done at a low cost for the sender. Any email user can send millions of emails to lists and large numbers of email accounts at little or no cost. The next section will dive deeper into problems arising from this limitation. Now that we have covered email actions, lets take a look at the email data payload format (the underlying message carried by the email protocol).

The Internet email message format is defined by several RFCs (Requests For Comments) grouped as the Multipurpose Internet Mail Extensions (MIME). Each email message has a header and a body. The message header is required to include the following fields:

- "From" - contains the email address of the sender
- "Date" - local date and time when the email was sent
- "Message ID" - a unique identifier that distinguishes each sent message or an "In-reply-to: Message ID" field that is used for grouping replies and associating them with the original sent message.

The header commonly includes the following fields as well (which are not required):

- "To" - contains the email address(es) of the recipient(s)
- "CC" and "BCC" - contains the email address(es) of secondary recipients
    - CC is used for carbon copying some recipients without labeling them in the "To" field
    - BCC is for blind carbon copying with BCC'd recipients remaining hidden from others on the email thread in most email clients. Users can still see the BCC field content if they look at the original message text.
- "Subject" - summary or title of the message
- Many other fields to help optimize the display settings, precedence of delivery, referencing other messages, and others as detailed in RFC 5322 [O2].

Its interesting to note that the "To" and "From" fields don't necessarily relate to the real addresses of the recipient and sender respectively. Email authentication is only enforced in some email server environments. SMTP also defines some tracking information that is stored in the header to show when a message is received at each point in the delivery path of the message.
The message body contains the content encoding scheme which, up to this date, is not yet standard across all servers. Mainly emails are sent as HTML text or plain text. HTML has a

lot more features and allows for embedding rich content while being less secure and much bigger in size.

Problems with Email today

Through studying many articles and power users of email in consumer and enterprise use cases, we have classified problems with email technology to nine main categories:

1) User expectations and behavior

Users can be classified on how they use email. These classifications or differences manifest themselves in several aspects of the email experience:

- Timing expectations

    Email users are split in their time expectations around email into two main groups.

    The first group of users have a heightened sense of urgency associated with their emails. They expect almost immediate replies from their email recipients as if they were making a phone call or sending a WhatsApp or an Instant Messenger chat. These users are often disappointed when replies to their emails are not received within a few hours of sending them.

    The second group of users don't associate emails with timely communication. These users are OK with leaving unopened emails in their inboxes for hours, days, or even weeks before they get to them.

    This variation arises from treating email as a synchronous (group 1) or asynchronous messaging protocol (group 2).

- Utility and Semantics

    Many knowledge workers use email as a list of tasks and things that need to be accomplished. Traditionally, email started to allow users to place files on the recipients' hard drive to deliver a message without caring much about the semantics of the message content itself. Email today does not differentiate between a super urgent email from the user's spouse and a silly cat video comment reply on YouTube or Facebook.

    Since the message content and communication protocol does not focus on the importance and urgency aspects of the message, it forces the recipient to do mail triage on all incoming emails.

2) Sender control and lack of user status

The sender has all the control on setting critical parameters of the email. The recipient has no say on when a message is delivered or how a message is classified before it gets into their inbox. This is related to the push technology model that email employs. Email is just a messaging protocol. It has no concept of a user being busy, traveling, sick or unavailable for any other reason.

3) Standards are not evolving to support more user-friendly features and many providers offer a fragmented email experience

Email protocols contain fields that could be utilized to deliver a level of urgency/importance indicators, however all clients and servers need to standardize on those fields to convey more information. The standard is not keeping up with the modern problems associated with the significant increase of email volume. Email servers and clients are not consistent in using a unified email content representation standard so requiring standardization around more advanced features is unlikely to happen anytime soon.

4) Email Volume

Many knowledge workers and consumers are struggling with the sheer volume of email they get everyday. In a 2010 article, GigaOM highlighted that 57% of knowledge workers were overwhelmed by the volume of email they received [TODO]. A few terms became popular due to the wide spread of this problems. For example, a user can reach *email bankruptcy* when they get way too many emails and they are no longer able to respond to them. Here is an email bankruptcy auto-reply message from one professor at Stanford:

> *Unfortunately, I only see about half of the 300-400 emails I get every day. If I have not replied to you within 48 hours, chances are that your email is lost in my inbox. The best way to reach me is to call or SMS my cell: +1 XXX XXX XXXX. If you have sent an email with attachments, to be sure I see it, SMS my cell your name and the date you sent the email. Ex: John Doe.11.11.11.*
>
> *Thanks!*

The information overload problem is a time suck for users where the user spends more time triaging messages than doing actual productive work.

5) Outdated and duplicate content

Since email is an asynchronous communication protocol, files or messages sent by email can quickly go out of date. The most typical scenario is file attachments; where collaborators on the same file keep sending newer versions of the same file back and forth. The files shared can quickly go out of sync.

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File sharing and collaboration systems like DropBox, Box and Google Drive help reduce the file attachment and file size limitations. However, the primary notification tool for file sharing and collaboration is still email. For instance, comments and suggested edits on collaborative files as still being communicated by email. Given the dynamic nature of these files and the frequent changes that it goes through, one change or comment that is sent now may not be valid five minutes later.

Another common example is social status updates by email, where the information communicated by email is only important or valid for a few minutes yet it still clutters the user inbox. This same information is stored in the various tools that keep notifying the user with these updates. Making it very redundant for the user to see the same duplicate information in multiple locations. Since these other applications don't necessarily have access to information about the user's inbox, they can't be smart about what and when to notify the user. The user does not want to see the same notification about a certain activity in their inbox, on their mobile device and within the application servicing that activity.

6) Tracking

SMTP provides minimal tracking mechanisms that does not include delivery and marking an email as read. Some mail servers and clients implemented message delivery and return receipt notifications that are not standard. Spammers have taken advantages of these implementations to verify whether a certain email address exists or not. For services that provide more granular control over read confirmations, the tracking is still not clear. Just because the recipient read the sender's email, that does not tell the sender if the recipient agrees, accepts, or rejects the sender's ask or request in the email. This is especially frustrating for users that consider their inbox as a task list of to-dos.

7) No support for business workflows

Businesses rely heavily on email for most of their communication but the actual work is not done within the email client itself. Lawyers work on contracts, software engineers work on integrated development environments (IDEs) and code files, marketers work on advertising, web campaigns and conferences to promote their products, support staff communicate with customers through ticketing systems, and sales uses customer relationship management (CRM) software to track and accomplish their work. All of these tools involve working with email but are outside of the mail client experience causing a lot of context switching.

8) Security and Privacy issues

A number of security and malicious behaviors that significantly degrade the user experience and trust of their email provider plague email today. The most common problem is spam. Spam is unsolicited commercial email that clutters the user's inbox. Sometimes spam may contain worms which are like computer viruses that take advantage

of vulnerable computers to cause damages. SMTP does not integrate security out of the box and therefore, there is a huge industry around security and identity authentication of emails. This includes anti-malware, anti-spam, and anti-phishing products. Phishing is the process of getting sensitive information about the user through fraudulent identities that look trustworthy and legitimate. Manipulating message headers in SMTP is incredibly easy for spammers and phishing attackers.

Another common malicious behavior is called "email bombing", where a malicious attacker sends large volumes of messages to a target address causing the inbox to become unusable and may even crash the mail server of the provider.

Privacy of emails has become a big issue for many users. Email messages are not required to be encrypted in SMTP and the message has to go through many intermediate systems before it reaches its final destination. This makes it easy for others to intercept and read messages at a very low cost. Even with encrypted and secure emails, email providers are required to present user data to government entities if asked.

9- Mobile email experience is still lacking
Despite the tremendous increase in mobile email access (as shown in Figure 2 below), the current email experience on mobile devices is suboptimal. Firing off a one-line email is not a problem for mobile users, whether they are Consumers or Enterprises [B1]. However, writing a long or a well-researched email with the proper links and pointers for more information almost always requires a laptop, desktop or a webmail client. Many articles argue that real work can't yet be done on mobile devices and we tend to agree [B5].

OPENS BY ENVIRONMENT PER QUARTER: Q1'11 - Q1'14
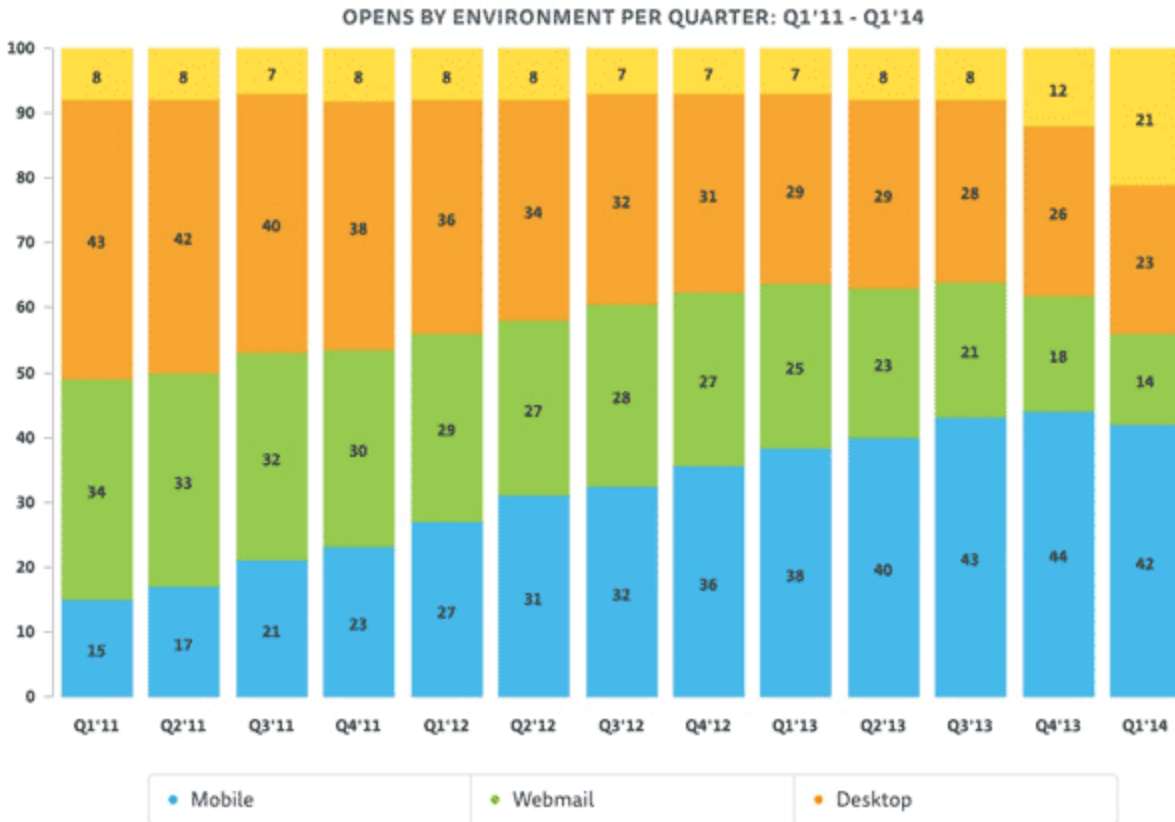
*Data based on 4 billion opens across 5 million campaigns during 2011 - March 2014. The yellow bar at the top represents opens in an undetectable environment. Undetected increased in 2013 Q4 due to introduction of Gmail image caching on proxy servers.

Figure 2. Email access statistics [O3]

Current state of the art

There are hundreds of players in the email industry, offering a wide array of features and functions. Below we will analyze some of the more established players and a few new-comers who bring a few innovative solutions to traditional email.

Apple Mail [16]

Apple Mail is the standard email client that has been with the OS X since the early days. It is complete with all the basic features that one would find in any email client. That is, Apple Mail allows users to flag important messages, do a search across emails and attachments, and organize emails through rules and spam control. Apple Mail can be used to access Gmail or AOL Mail, and one can also take advantage of the iCal app to keep track of appointments and tasks.

Drawbacks: Users have reported problems with Apple Mail being unable to properly handle Gmail accounts via IMAP, as some emails disappear and others tend to get duplicated. Also, the Smart Mailboxes feature in Apple Mail that is supposed to automatically filter messages ends up making the program load very slowly, much to the annoyance of its

users. While Apple Mail is a pretty solid email client, its features are the most basic that a client can offer and there is nothing innovative in its offering.

Microsoft Outlook.com [2]
Outlook.com is a free email service that looks a lot like the Outlook program itself, and it is another email client like Apple Mail that offers very basic features. The differentiating features that Outlook.com is focusing more heavily on is its social integration, as it allows you to use Skype and keep track of what is going on in your LinkedIn, Facebook and other circles right from your inbox.

A recent upgrade to Outlook.com has removed all display ads from the inbox, which means that Microsoft does not scan emails the way that Google does in Gmail, which is a relief for users with privacy concerns. An added bonus is the ability to share your calendar with your contacts, making the scheduling of appointments easier. A final feature of Outlook.com is the preview functionality which allows you to continue viewing your inbox in one panel, while opening messages in a separate panel, which is useful to those who want to keep an eye on everything at once.

Drawbacks: Currently the only cloud integration that Outlook.com provides is with OneDrive. But the bigger drawback is that Outlook.com does not support the IMAP protocol, meaning if you want to combine your inboxes from different providers, for instance Gmail, you would have to switch to the POP protocol which sends and receives emails in 15 minute intervals, so it is less immediate.

Yahoo! Mail [11]
Yahoo! Mail is another commonly used email service that has all the basic features of regular email available on the web and on mobile devices. Its main offerings include 1TB of storage space, instant messaging, social networking and SMS text messaging.

Drawbacks: Like Outlook.com, Yahoo! Mail does not support the IMAP protocol and so it has the same issues of having POP only access. Also, one old feature that Yahoo! Mail used to have until recently was that it would automatically separate incoming emails into different tabs for social updates and newsletters, much like Gmail does today with its 'Social' and 'Promotions' tabs. Removing this feature seems to be a mistake judging by criticisms online from users who liked having that feature to keep their inboxes organized.

Boomerang for Gmail [15]
Boomerang for Gmail is a powerful browser plug-in that adds some unique features to your Gmail inbox, and it is available for download as a mobile app for Androids as well.

One of Boomerang's features is temporarily archiving incoming emails that you don't have time to read now, and scheduling them to be re-open at a different time when you are free.
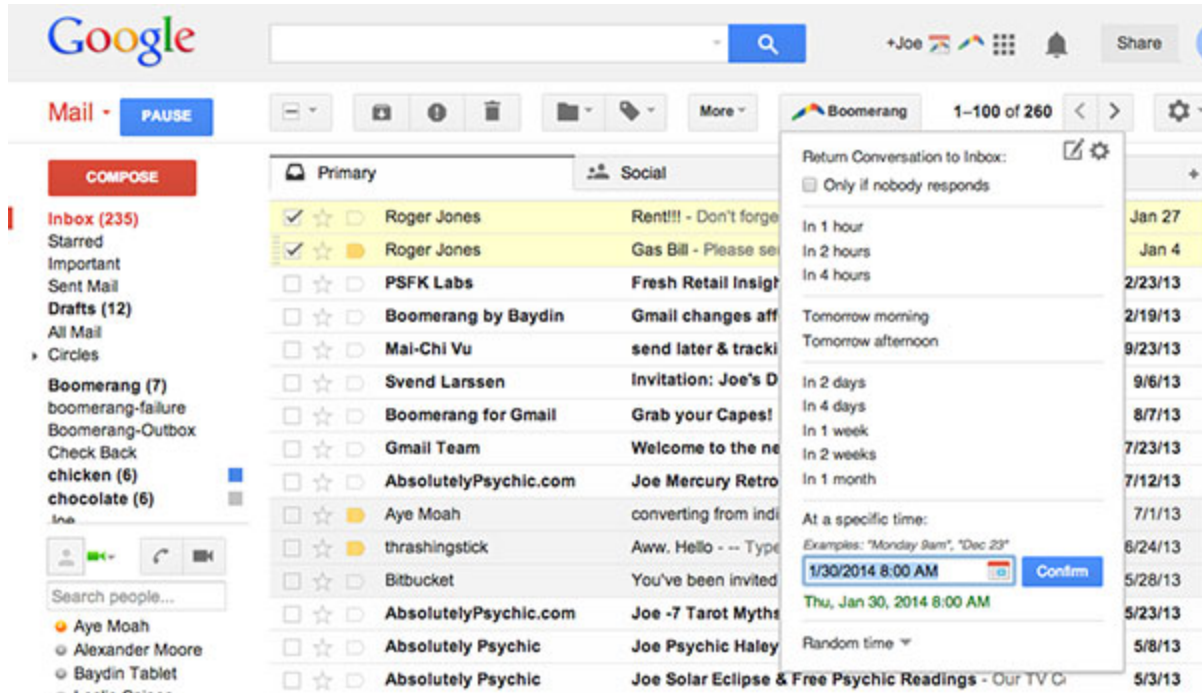
Figure 3: Snapshot of Boomerang for Gmail: Archiving incoming mail feature

Another feature that is very useful is to be able to compose an email now and schedule it to be automatically sent at a later date. Boomerang also informs you if you haven't received a response to your email, which is a great feature when you need to follow up with one or several people about tasks or other issues.
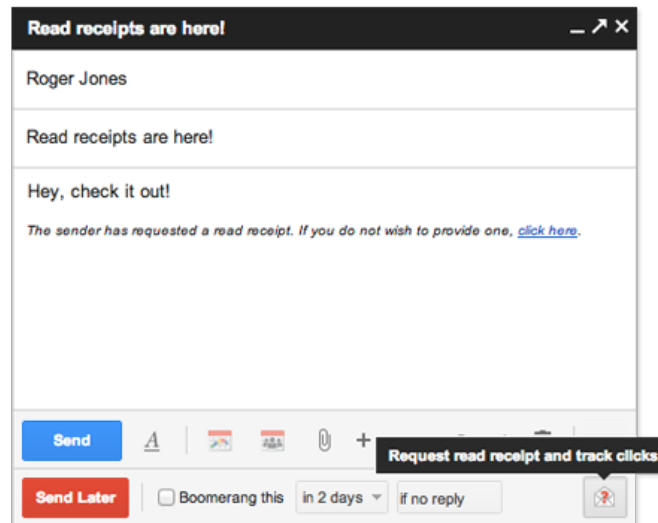

Figure 4: Snapshot of Boomerang for Gmail: Mail tracking feature

These are the key features that are offered in the free version of the extension/app, but for different fees you can add on several other features as well, including tracking emails, sending recurring messages and CRM integration.

Drawbacks: Boomerang works only for Gmail, and it only works in the Google Chrome and Mozilla Firefox browsers at the moment. Additionally, given that it is a third-party plug-in (created by Baydin), users must authorize and grant access to Baydin to access their Gmail accounts, which can be a privacy concern and security risk for some users.

Boxer [4]
Boxer is a mobile app currently available only on the iOS that claims to be the first "gesture-based interface for mobile email triage". They invented the swipe action that archives messages leaving your inbox looking clean.

The Boxer app allows you to combine inboxes and to-do lists from different email clients, and it allows you to add emails to a task list right away. An added bonus for those who care: similar to the "Like" button on Facebook, Boxer allows you to "Like" an email you receive to let the sender know you saw their message.

More importantly it offers cloud storage integration by connecting to Dropbox, Box and Evernote. Boxer also offers Salesforce integration and the Sanebox feature is Boxer's approach to smarter email filtering which learns from your past actions to messages in your inbox.

Drawbacks: The Boxer app is only available for the iPhone, and the free version of the app adds a signature to sent emails stating "Sent from Boxer" with Boxer's web address, which is annoying to most users. The signature-free version costs $5.99 which is relatively pricey for a mobile mail app.

Mailbox [3]
Mailbox is another mobile app for the iOS and Android that supports Gmail. Like Boomerang, Mailbox lets you schedule emails you have already received to be re-opened at a later date when you are free to read them, and like Box it learns from your swiping actions to become a smarter email filter in the future. These two main features mean Mailbox makes your inbox look very light and mobile-friendly.

Drawbacks: Mailbox can only be used with Gmail at the moment, and even then, the Gmail labels you would've created on your desktop will not show up in the mobile app. A basic feature that Mailbox seems to be lacking is the ability to select multiple messages at a time, which may be annoying if users are trying to clean out more than a few emails.

Acompli [5]
Acompli is an iOS app that targets professionals dealing with work email on the go. The app allows for contacts and calendar integration for easy appointment scheduling through email. The app's main selling point is its cloud integration with Google Drive and Dropbox which allows users to attach files very quickly to emails on their mobile when they're out and about.

Acompli also provides full support to Gmail labels, meaning that unlike Mailbox, it can display all your labels within the mobile app. Some users have shown appreciation for how the app has three main hubs for contacts, calendars and files, and they like how easy it is to switch between the hubs.

Drawbacks: Acompli is limited to the iOS platform, and only supports Exchange, Google Apps and Gmail. Additionally, some users who are label addicts have complained about how the labels display in the app. Since Acompli does not indent nested labels, all the labels will be display in one very long list, which can be annoying for power users to sort through to find the one they're looking for.

Hop [8]
Hop is the instant messaging approach to email. A mobile app available on both the iOS and Android, Hop supports real-time messaging, document and photo sharing, voice and video calls. Anyone with an email address can use Hop to send individual or group messages, and Hop's focus on creativity means the messages look aesthetically pleasing and fun to use.
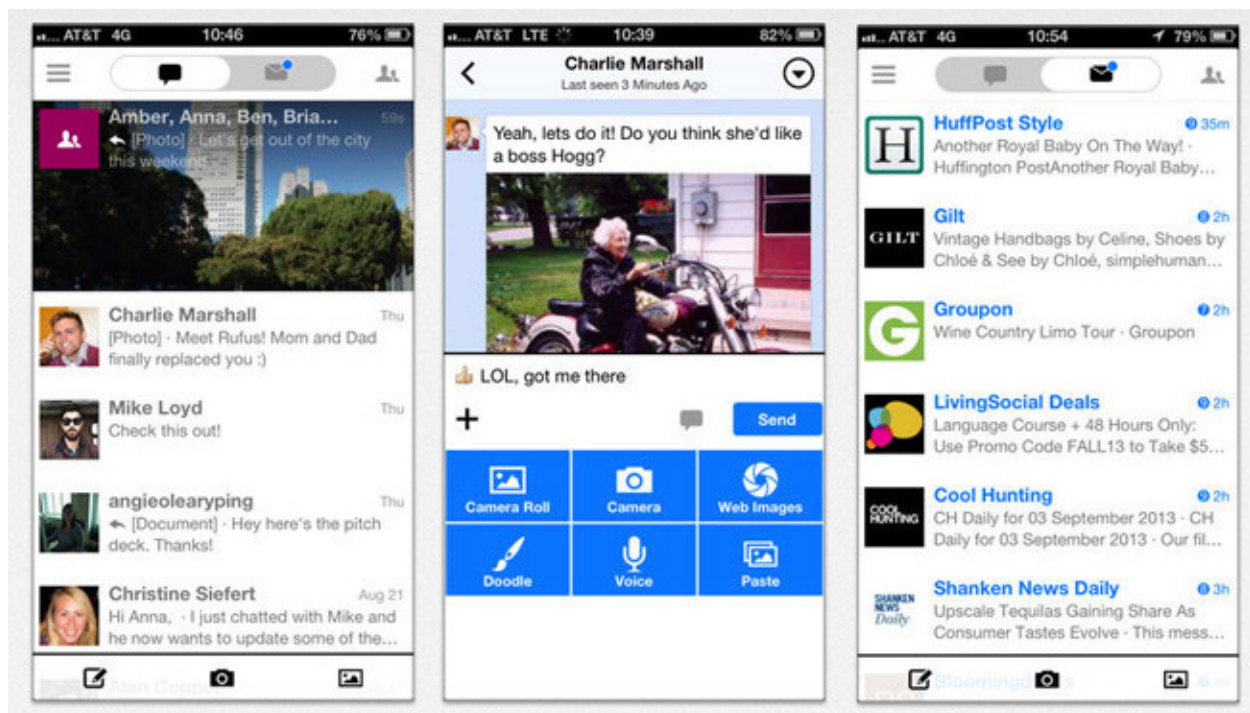

Figure 5: Snapshot of Hop: Instant message feature

Drawbacks: Because of its non-email approach to email, Hop has done away with labels and folders, making it less categorized for users who depend on that level of organization. Users have also taken note of how some of the touch gestures on the app are very sensitive and require accurate direction.

Slack [26]

Slack is an email collaboration tool available across all web and mobile platforms. Its features are similar to the ones offered by some of the newer apps, but Slack does them rather well. Slack combines all your emails and messages from countless providers in one place, but their filtering and sorting system ensures that your inbox looks clean and organized. Slack refers to group conversations as "open channels", and the layout of these channels allows collaborators to easily see message histories and to take advantage of the search settings as well.
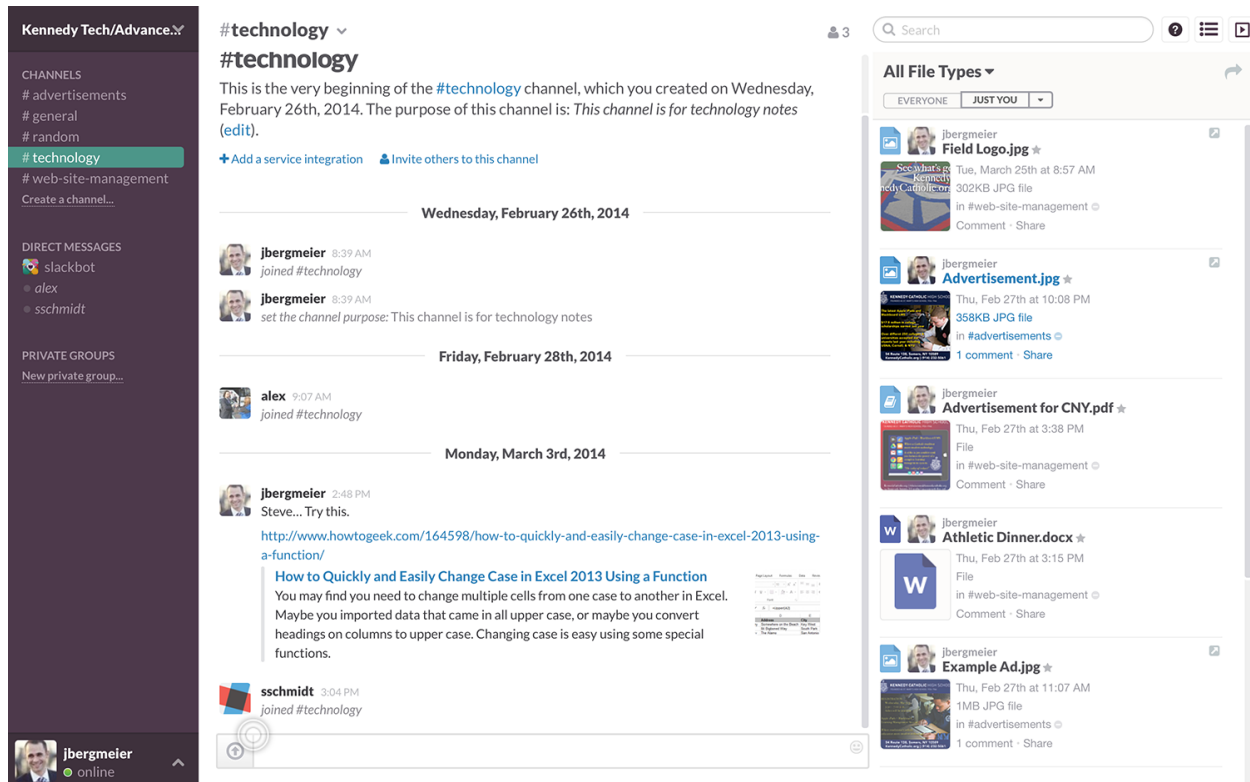

Figure 6: Snapshot of Slack: Open Channel feature

Additionally, Slack has an advanced search feature that reads entire conversations within the context of what you're looking for, and given its cloud integration with Google Docs and Dropbox, it is also able to search inside documents and attachments at the same time. Because of Slack's availability across all devices, users love the ease of access to their emails and the notifications they receive.

Drawbacks: Apart from crashes that were reported in the beta version of the program, it's difficult to find any major criticisms about Slack. The most common feature that users have expressed a desire for is the ability to control the notification vibration and sound settings on a micro-level for each channel or conversation.

Zimbra [17]

Zimbra is an enterprise-level email solution available on the web and on the Android platform aimed at making your life clutter-free and collaboration easier. The user interface allows multiple tabs to be open at the same time and it's easy to switch between different tasks. The ability to add numerous tags to messages makes search easier and the instant filtering of unimportant emails makes your inbox cleaner.

Some extra features offered in Zimbra include un-sending an email within 20 seconds of being sent, and scheduling composed emails to be sent at a future time much like the Boomerang and Mailbox applications.

The most important aspect that allows for easier email collaboration is the ability to not just share a single email with a colleague, but to share an entire sub-folder, folder or even the whole inbox, and adjusting administration rights for each user, which is an incredibly powerful tool needed by many enterprises.

Drawbacks: One major criticism about Zimbra is their lack of helpful support when users face issues with the program or app. Additionally, users have complained online about how heavy the desktop application is as it drains the machine's resources. Some users have also experienced bugs with the social integration tool.

Evomail+ [18]
Evomail+ focuses on the problems of mobile email and delivers a beautiful, frictionless and simple user interface for the user. Evomail+ supports all IMAP email providers including Yahoo! Mail, iCloud, Outlook, Rackspace, FastMail.FM, GoDaddy. Support for Exchange and POP3 clients were not available at the time of this report. Evomail+ is available on both iOS and Android platforms.

The Evomail+ email client has unified inbox, intuitive gestures, push notifications, folders and labels to deliver a seamless experience between mobile and web. Integration of cloud and social platforms such as Facebook and Twitter allows emails to be shared across different platforms, Finally smart inbox features such as Snooze Inbox, allows the mails to be delivered at a time when the user has time to act on them.

Since its launch Evomail is working on improving its interface though users have found the application to crash and not responsive at times. Evomail+, thus provides a great interface though it is dysfunctional at times and needs to improve on its service-ability.

myMail [19]
myMail is a mobile only private, secure, spam-free email client that allows users to send and receive messages without compromising security. myMail is a free service and offers a email address with @my.com which comes with unlimited storage and does away with a password based log-in. myMail offers a single inbox that helps to manage messages from both IMAP and POP3-enabled mailboxes, though it does not provide a unified inbox view. myMail is built for the mobile interface and is designed for iOS and Android.

myMail offers push notifications and allows users to turn these off between certain hours of the day to keep the space between personal and work life. Since it is designed for the mobile user, the search looks for contacts on the phone and on the email servers. Messages on myMail are encrypted and comes with with built in attachment browser to view attached files and pictures. myMail supports Lotus notes and Microsoft Exchange in addition to Gmail, Microsoft Outlook, Hotmail, MSN, Office 365 and Live,Yahoo! Mail), AOL mail, GMX, Mail.com, Apple (iCloud, Me.com and Mac.com) and myMail (@My.com).

Drawbacks: Attachments allow the user to add only locally stored files (iOS allows only photos as attachments). myMail does not integrate with cloud services and does not allow additional files to be attached. The lack of a unified inbox does not allow users to view all the emails at a glance. The mobile-only feature of myMail limits users to compose and manage emails from tablets and smartphones.

Mail Pilot [20]
Mail Pilot serves as a Mac email client and simplifies email with a task-oriented approach. MailPilot uses the "Getting Things Done' approach and allows the emails to be categorized as complete and archived and others can be postponed for delivery, added to a list of similar messages for review or simply set aside for later time. Mail Pilot supports IMAP accounts including Gmail, iCloud, Yahoo!, AOL, Rackspace, Outlook.com, and Google Apps at the time of this review. Mail Pilot offers a unified inbox and a clean, appealing design with email threads with a heading. At the time of this report, Mail Pilot had a version 1.1 that supports Mac and iphone and iPad. Mail Pilot offers the exchanges to happen between mail servers and the connecting devices and allows secure exchange. The universal Mail Pilot for iPhone + iPad is priced for $9.99. Mail Pilot for Mac is priced at $19.99.

Key features of the Mail Pilot include, staying notified with system notifications on iOS7 and Mac, nested threading, adaptable unified inbox, gesture and alias support. A soon-to-appear feature is the Push to Mobile/Desktop feature allows appropriate notifications to appear on the device of choice.

Drawbacks: Mail Pilot does not store emails locally and it takes time to download every time from the server. Mail Pilot is not integrated to iCal, calendar for the Macs.

SeedMail [21]
Seedmail is an email client that allows users to manage email, calendar and contacts. Seedmail supports IMAP and Exchange accounts including Gmail, Outlook, Yahoo, iCloud, AOL and other imap, exchange server. Further the integration to Evernote and Dropbox allows it to add and archive attachments. Seedmail is available for iOS and Android devices. Seedmail allows to search through email, calendar and contacts across different emails. It further allows to create calendar events and sync contacts.

Seedmail shows a chat-like summary including all the emails and helps to turn tiresome email thread back into a conversation between people. This will further allow the user to reply via a quick reply feature.
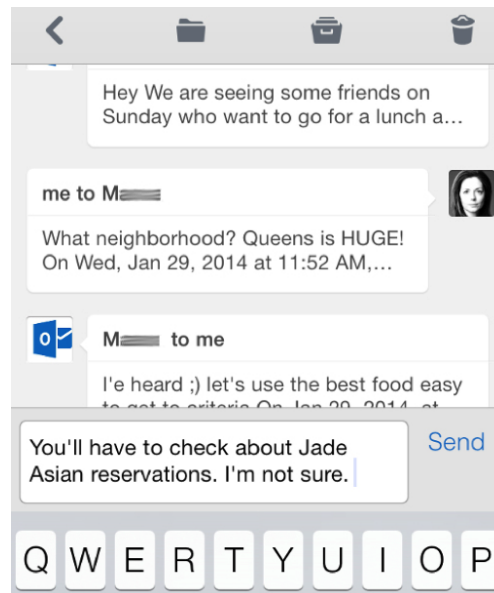

Figure 7: Snapshot of Seedmail: Chat-like summary feature

Gusto [10]

Gusto is an email app that envisions providing that one unified view of all files, photos and emails across all online accounts. Currently the product is free but it will go the freemium route. The app manages users' digital life, supporting Gmail, Yahoo, Outlook, AOL, IMAP, Facebook and Instagram accounts and a powerful search feature that looks into all the attachments and messages across all accounts. The app mimics Apple Mail app's look and feel and allows user to attach photos or files to new messages as well. Gusto provides a unified inbox with an image feature that can cluster the email threads together or use a list-view to list all emails.
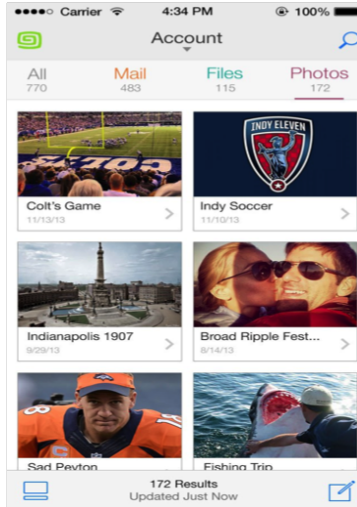
Figure 8: Snapshot of Gusto: Unified inbox with image association

SquadMail [22]

Squadmail is a web plugin tool that turns the Gmail Labels into sharable work folders to assist team work. SquadMail creates a new folder at IMAP server level and a new email address for the projects with the project name label that can be shared and synced with all email accounts across the team members. The plug-in works with email clients such as Apple Mail, Gmail and Outlook and is available for Chrome clients only. SquadMail is a freemium software and allows Dropbox integration that allows the email attachments to be sent directly to the Dropbox folder.

Key features of Squadmail includes ability to add and drop group members, use a common label folder, send emails and email digests directly to the folder.
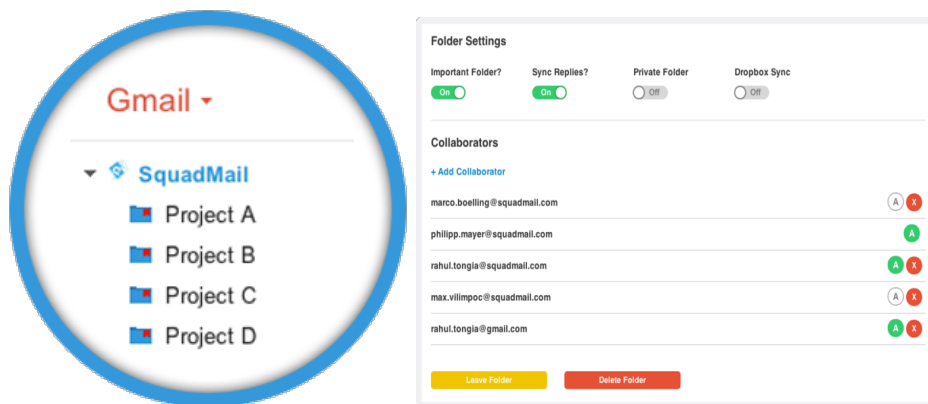

Figure 9: Snapshot of Squadmail: Unique Project label and folder settings feature

eM Client [23]

eM Client is a enterprise grade email client for Windows that comes with full features and supports Gmail, Exchange, iCloud and Outlook.com. The service allows users to quickly import data from their old email client and allows them to search through email, attachments or contacts. The client supports email POP3, SMTP, IMAP, EWS, Airsync technologies and supports message encryption using S/MIME. The service is available for $49.95 and it supports multiple users.

Key features of eM Client include spell checks across applications, a built-in translator using Bing translate engine, fully functional calendar, ability to share calendar and tasks, merge contacts across email accounts, ability to view communication history and chat interface inside application and support file transfer protocol. A comparison of features across popular email clients is presented in Table 1.

Drawbacks: Common issues such as long time to restart the program and sync issues have been reported.

Super fast Search	✔	✘	✘	✔	✘
Import from different email clients	✔	✔	✔	✔	✔
Full Sync with Gmail	✔	✔	✘	✘	✘
Communication History	✔	✘	✘	✘	✘
Integrated Chat (Including Facebook chat)	✔	✘	✘	✘	✘

Table 1: Comparison of key features across major email providers, eM Client [23]

TapMail [24]

TapMail is a mobile client that enhances user productivity by providing a mobile experience that enables iPhone users to manage emails efficiently. The application is available for iPhone and will be extended to Mac and iPad. TapMail supports Gmail, iCloud, AOL, Yahoo, Hotmail, MSN, Live, Outlook and any IMAP/POP personalized account. TapMail is available on iTunes for $2.99.

Key features of Tapmail includes integration with Dropbox and Google drive, allowing users to store emails and attachments in a personalized folder. Furthermore, Tap Mail provides a unified inbox, allows users to switch between accounts and use alias email addresses to keep the work and personal accounts separate. Features such as 'Thread View' - pulling down the screen to refresh and moving the messages into a folder by dragging the message to the left of the screen - helps to manage emails efficiently.

TapMail was introduced in 2012 but do not have a lot of reviews online or in the iTunes store.

Pluto Email [13]

Pluto Email is an email plugin that provides features to enable control over sent email messages to enable email privacy. The email plugin is free and can work with any of the following email clients: Gmail, iOS Mail.app, Apple Mail, Outlook, Android Mail.

Pluto allows email users to monitor if the sent emails are read, as well as unsend emails or edit emails if they have not already been opened by the recipient. Pluto also allows emails to auto-expire after a certain period so as to free up a cluttered inbox. The feature is enabled by displaying the email as an image, and destroying it after the expiry period.

Plutomail has great features but needs to improve on design and functionality to make it user friendly.
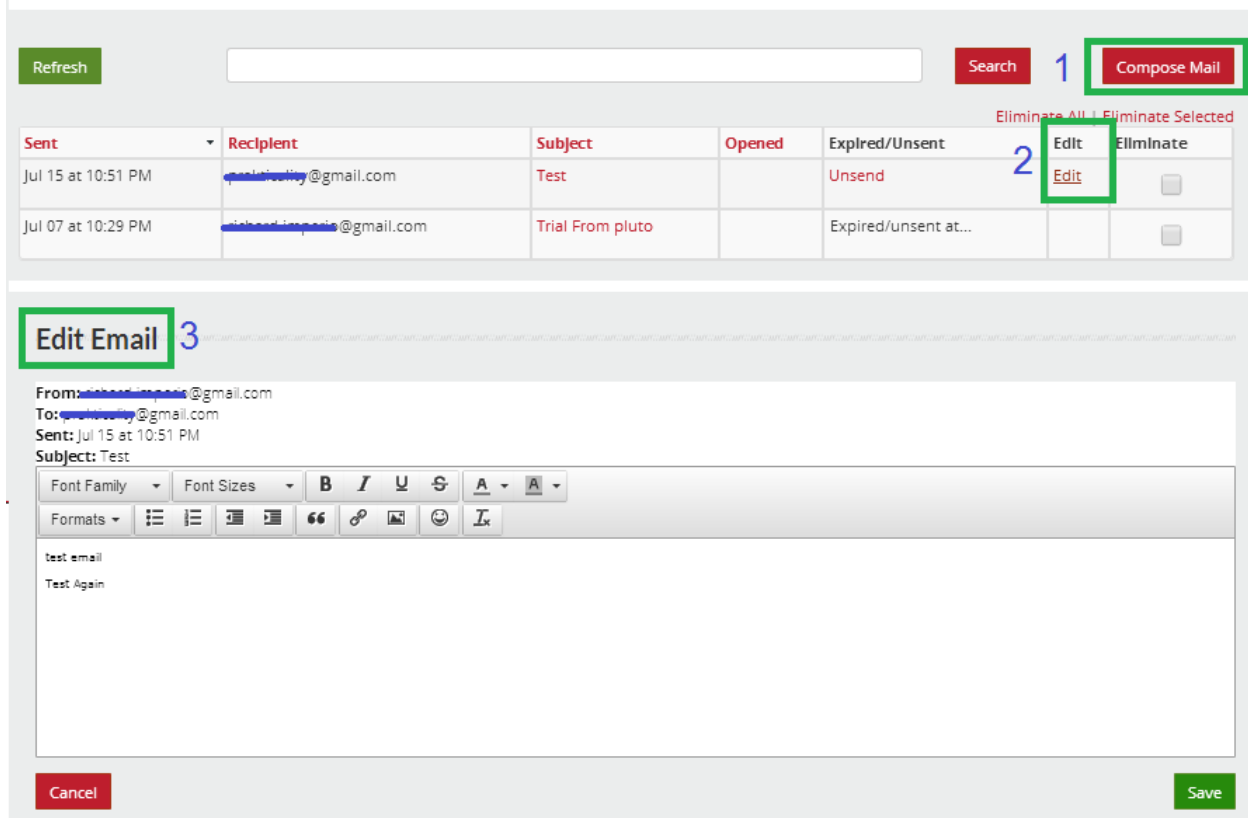
Figure 10: Snapshot of Pluto mail: Mail tracking feature

Tipbit Mail [7]

Tipbit Mail enhances productivity by combining email, calendar, contacts, file sharing, and relevant social information in a mobile experience. Tipbit finds relevant documents and enables task completion by allowing the user to view all relevant documents and persons while on email. Tipbit supports iCloud, Me, Mac, Gmail, Hotmail, Live, Exchange, Outlook, Yahoo!, MSN, and all IMAP Servers. Currently Tipbit is available for iPhone, iPad and is free.

Key features that enhances productivity include the integration of Salesforce, Dropbox, Box, Evernote and Google Drive. Additionally, Tipbit allows smart web search functionality in the inbox and allows unified inbox view that combines email, calendar and contacts. Tipbit offers integration of social media profiles on Linkedin, Twitter and Facebook. Thus TipBit gives the ability to reach out somebody from one's Linkedin contacts, send email, assign a meeting or review a document from a single place. Tipbit is in its beta stage and does not have a lot of reviews.

Sanebox [25]
Sanebox helps to prioritize emails and increase productivity. SaneBox works on your PC or Mac, desktop or mobile with Gmail, Exchange, Outlook, Yahoo! Mail or IBM Notes. Sanebox is subscription-based and is available at $7 per month. Sanebox provides this

service by accessing the mail servers and categorizes emails based on past interactions and by analyzing the email headers. The current version supports up to four email accounts.

Sanebox prioritizes important emails and summarizes the rest of the email as a digest. Additional features include the option to provide notifications in case of no response, unsubscribing with one click and snoozing emails, all of which improves the ability to work on the important emails on hand. The integration with Dropbox and Box allows attachments to be stored separately.

Sanebox is easy to set up but its pricing model is very complicated and has 'snack', 'lunch' and 'dinner' options with additional features added on at a cost.

Future of email

We have analyzed over 24 email services (listed in the references section) and noticed the following trends (summarized in the figures 11, 12, and 13 below):
- Mail apps are increasingly being used to cover both consumer and enterprise email accounts. Having a unified inbox simplifies the user's email work style.
- Integrating other cloud services (like DropBox or Salesforce) improves the user's ability to accomplish more without leaving the email context.
- Integrations with social contacts, tools and sites also increases the user's productivity and gives them more context about the people they are contacting.
- Smarter search offline and online is a requirement not a differentiator.
- Apps that support task management tend to stick more with the user since it fits with the inbox zero work style.
- Mobile improvements are on the rise but no app has perfected the mobile email experience to replace desktop clients.
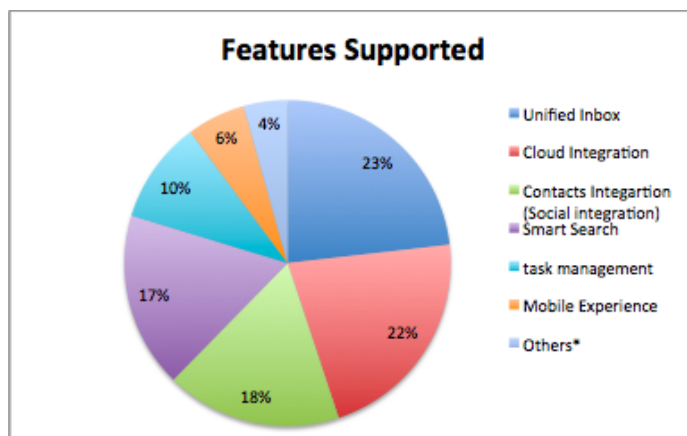- Most email clients support all major email providers and protocols (Figure 12)
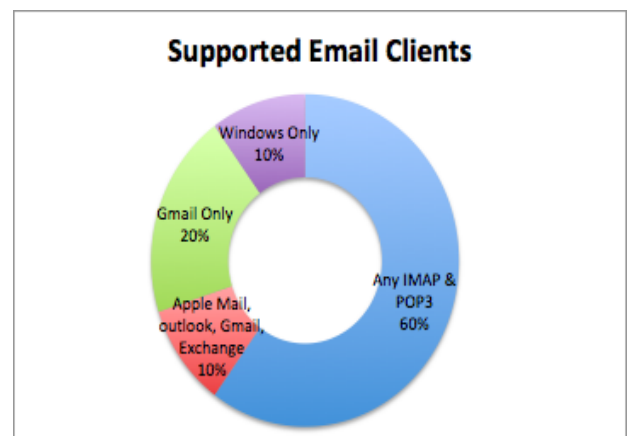

Figure 11. Feature focus

Figure 12. Supported providers

Despite Android's huge marketshare [B6], the percentage of Android only app is only 15%. We believe this is due to three factors. First, iOS apps are easier to monetize than Android

apps [B7]. Second, the number of iOS devices in Enterprise is higher due to its higher security features [B8]. Third, Android devices are fragmented with less than 20% of devices on the latest KitKat version [O4].
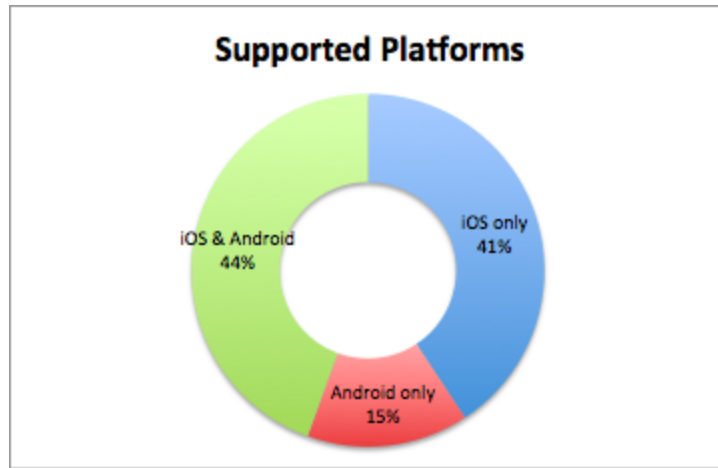

Figure 13. iOS vs Android breakdown

Based on our analysis of: 1) the history of email and the limitations of its underlying technology; 2) the major problems users are still facing today; 3) analysis of what state of the art apps are trying to accomplish [B2]; and 4) trends in the market [B3, F1, F2, and F3], we believe the future of email will be shaped in three main categories:

APIs (Email as a platform)
Email needs to evolve to address more needs than just a simple messaging protocol [F4]. The best way to allow users to be more productive in email is by allowing them to do more right from within their email client. For consumers, imagine if a user could accomplish all the things that you would do on the Twitter app right from your inbox. The use cases for Enterprises include CRM, finance, operational apps etc. Email will start to include more calendar, task/project management, search, and collaboration features to be more useful and relevant. This integration needs to happen on both desktop and mobile clients so it can span all the user devices anywhere anytime.

We strongly believe that using email as a platform for providing richer and more engaging experience will be a major booster for productivity and overall user happiness.

Smarter inboxes
In today's world with mobile devices, wearables, big data, fast internet connection, and hectic schedules, users demand a smart app that acts as a personal assistant. The email app needs to understand the context of what the user is trying to do and make that as easy and as fast as possible. The email app needs to provide controls for the user to determine who, what, when and how they are contacted by email. Sending an email and hoping for the best is something of the past. The email app needs to make the trackability of messages sent a requirement while maintaining user privacy and content preference needs. For example, a user may not be contacted while they are on vacation (by knowing their

geo-location and calendar) and upon their return, the email app will only ask the user to respond to the most urgent most important emails.

For consumers, the email app could know from the user's previous interactions that users A and B are always contacted about football while users A and C are contacted about basketball. When the user contacts A and B about basketball, the email app can suggest including C instead of B. For Enterprises, the cases are endless as well. The email app should know that when adding a new person to an existing long thread, it should just share the entire thread with that new person rather than user having to go through tons of quoted text.

Email systems will integrate information from many cloud apps especially around the user's social network and contacts providing the user a full 360-degree view of the context around their email messages.

Unified inboxes and standards (personal and work)
The lines between life and work are very thin. Users need to manage their entire digital life from one place usually from their mobile device. This requires email systems to provide enterprise-level security, manageability, and privacy controls for both consumer and enterprise users on all types of devices. The standards behind email need to require strict security and privacy practices. The minimum threshold for any email service should have a high bar of encryption, security and privacy protection. This can only happen if all players agree on a standard that meets these new requirements.

In order for users to feel more comfortable putting all their data in the cloud, they need to be assured that their privacy is protected and that their data is secure.

Collectively, the three categories above address all nine problems stated in the beginning. Our vision of the future of email can only happen if all email clients supported a unified protocol that works with all the new technologies and signals that we are able to collect today. To answer the questions we posed in the introduction of this paper, we don't believe email as a messaging service will ever go away. People will always have the need to conduct asynchronous conversations. We don't think that a simple to-do list protocol or project management and team collaboration tools like Asana will be able to replace email completely. We do believe that email needs to encompass more use cases by becoming a unified mobile, smart, secure and integrated platform for getting things done in life and at work.

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[B3] Paul Graham's article on ambitious startup projects,
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[O4] Google Android Developer Console Report http://goo.gl/1a4Q1N