

# ***BVCC General Meeting***

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**"Understanding Email"**

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# Understanding Email

- **Origins**
- **How it works**
- **How to access an email account**
  - Web mail vs Email app/client
- **Some specific examples**
  - BVComputerClub.org & Gmail web mail
  - Thunderbird email client

## Email Origins

- **Created in 1971 for ARPANET**
  - **One of the earliest computer network applications**
  - **ARPANET evolved into Internet** (*High Performance Computing and Communication Act of 1991*)
  - **Need for fast communication, but with tolerance for temporarily inaccessible target nodes.**

Email is asynchronous – store, then forward when possible

# Email Origins

- Originally designed to support only lines of text
  - Initially limited to only 128 chars (95 displayable)
  - sp !"#\$%&'()\*+,-./ 0-9 :;<=>?@ A-Z[^\\_` a-z {}~
  - has evolved to support 8-bit (256 value) char codes and different codesets, most common char code is now UTF-8 (8-bit representation of unicode, potentially supports > 1M characters)
  - Email consists of
    - Header lines – contains routing and processing information
    - Body lines – contains user content
  - Email structure has evolved to now support attachments, representations for binary data, control lines to divide email body into parts and describe how parts should be processed (as html, jpg image, etc.)

Max length of email line ended by CR LF: Must be <=998 (for transmission), should be <=78 (for display)

UTF-8 represents 128 chars in 1 byte , another 16384 chars in 2 bytes, many more with 3 or 4 bytes

Binary data uses Base64 encoding using 64 different characters (A-Z, a-z, 0-9,+/ ) with every 4 characters representing 3 bytes of binary data, 76 chars per line (followed by CR LF), except for possibly shorter last line, terminated by 1 or 2 "=" padding chars if binary data is one or two bytes short of a multiple of 3 bytes. Every 57 bytes takes 78 bytes to send, almost 37% overhead – inefficient for large files.

## Email Requirements

- **To send or receive email requires an email account and a device capable of connecting to that email account**
  - **Email address of form username@domainname, where domainname identifies provider of email service**
  - **Email service providers**
    - Your ISP (cox.net, sbcglobal.net, etc.)
    - Free email services (gmail, outlook.com, etc.)
    - Paid hosting services (hover.com, r4l.com, etc.)
    - Corporate servers

Supported devices include computers, smart phones and smart pads.

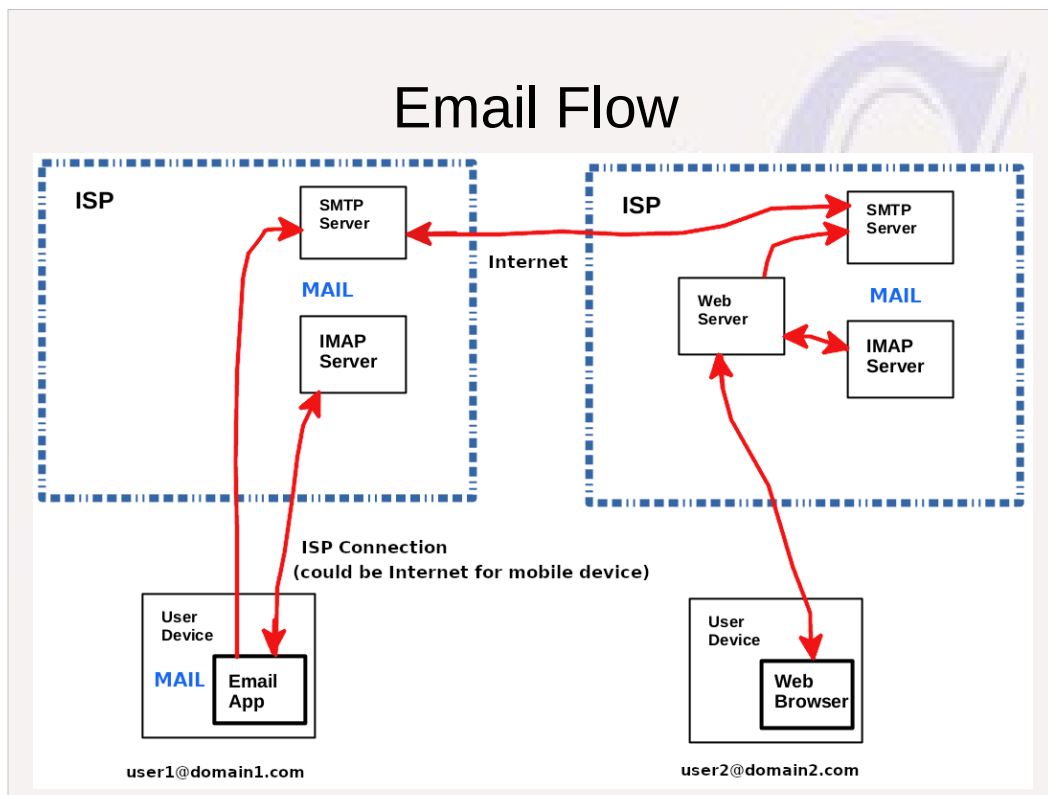
Some ISPs and hosting services better at email support than others – combating SPAM without also blocking useful email is not easy.

Individuals can purchase domain names to associate with a paid email service. Individuals can even run their own email servers, but the TCP/IP ports to do this are typically blocked by your ISP unless you pay for a more expensive business Internet account.

Large corporations may either run their own email service or pay others for hosting email services.

# How it Works

- **Your email service provides: SMTP server to send email, IMAP server to receive/view mail, and typically a web server that connects to the IMAP server to provide web mail access to your account**
  - **When you send email, you send it to your account's SMTP server, which stores it, locates the recipient's domain SMTP server and attempts to forward and store the email to the recipient's account. If that succeeds, the recipient can then download and view the email using his IMAP server.**
  - **Login credentials are required to access your SMTP and IMAP servers. Email in-transit to/from SMTP & IMAP servers is (if properly configured) encrypted, but emails stored on your and your recipient's devices and domain servers are by default not encrypted.**



If you have multiple email accounts at different domain names, each domain has its own set of email servers. If you are communicating with domain servers that are not owned by your active Internet access, then your connection is routed through your current Internet access over the Internet to reach those servers.

When email is sent, a list of all recipients (merger of To, Cc, and Bcc lists) is separately sent to the SMTP server and used to route that one email to all target accounts. The To and Cc headers that travel with the email are never directly used for routing the email and could contain misleading information.

Note that when web mail is used, there is no copy of the email on the user's device

## IMAP vs POP3 Access

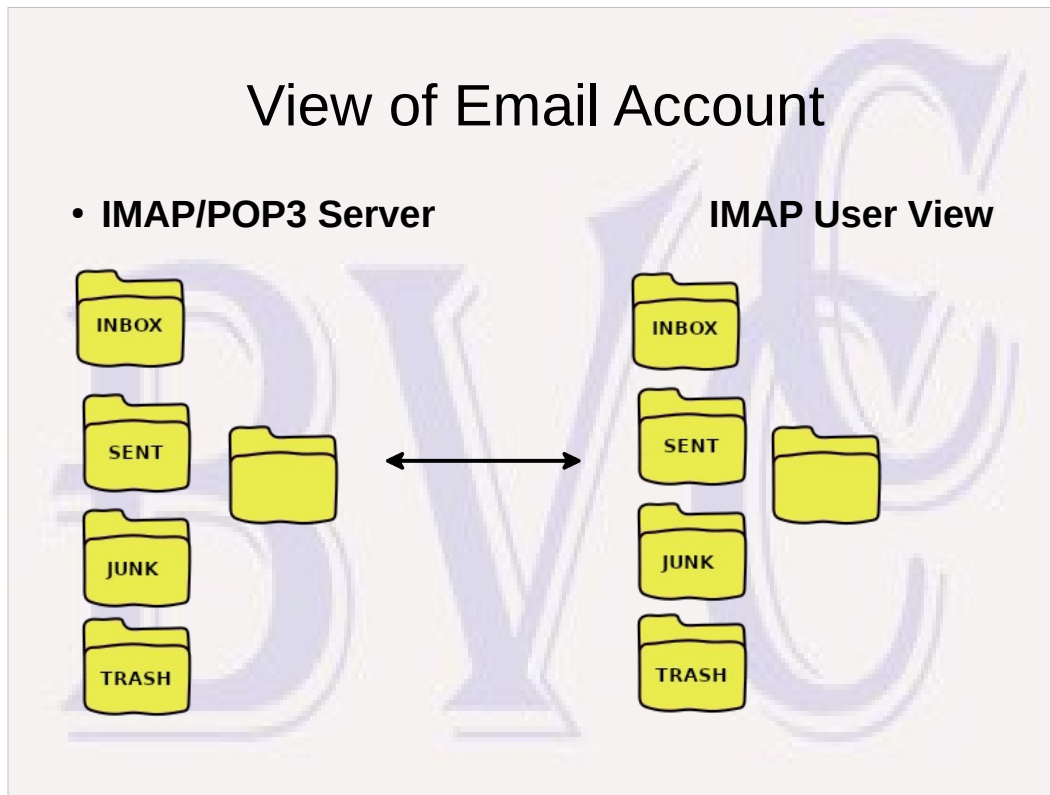
- **POP3 (Post Office Protocol) was widely used a decade ago when everyone had one computer device and one email account. It is essentially obsolete, although still supported. It works poorly when a user has multiple devices, because the first device to access an email by default pulls the email down to that device, and other devices owned by the user will never see that email.**



## IMAP vs POP3 Access

- **IMAP (Internet Message Access Protocol) is much more flexible than POP3 and should be chosen when setting up a new email account on an email app or client**
  - **Allows multiple folders on the IMAP server, and by default emails are kept on the server with copies of folders and emails on the user device kept in sync with the server.**
  - **Many different user devices can view and change the account email folders and contents**
  - **Email apps/clients will detect that a new account can support IMAP and should default to that**
  - **web mail web applications work as if using IMAP access to manage received email**

## View of Email Account

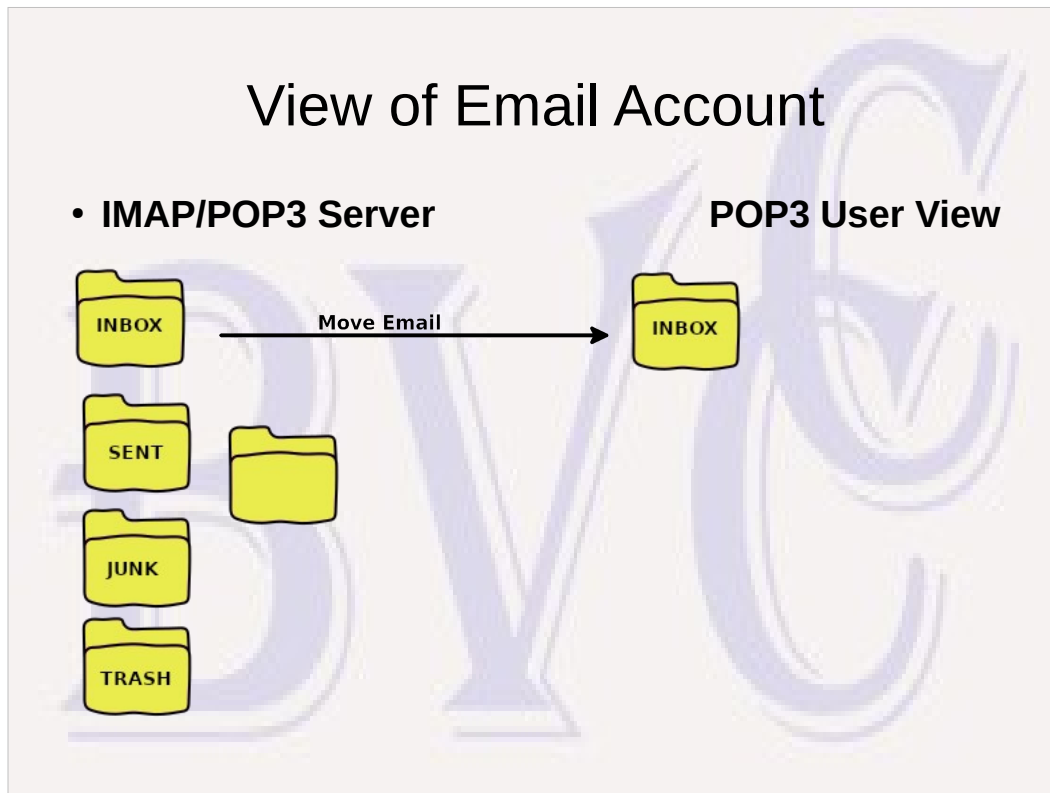


Any device using IMAP to access the account can see all folders and all emails inside folders

While connected, the INPUT folder (and possibly other folders) on the server will be kept in sync with the INPUT folder on the user's device(s).

Changes to folder content on user side will cause corresponding changes to Server side.

New folders and sub-folders can be created on user side and be propagated to server.



The same server may provide both IMAP and POP3 access, but capabilities limited when using POP3. Whenever the user app checks for new mail, any new mail found in the INBOX will by default be moved from the server to the user's device, erasing them from the server INBOX.

Any other folders on the server will be hidden when accessing the account using POP3

The user may be able to create folders on his device and move email into those folders, but those folders and their contents will only be known to that device.

# GMail Peculiarities

- **Instead of Email folders, Gmail server uses email "tags"**
  - New received email has tags of "Inbox" & "All Mail", possibly also "Important"
  - Normal email clients translate gmail tags into "folders"
    - One email with 3 tags will show up on the user's device as 3 distinct emails in 3 folders, all indicating "unread". You only need to read the email in one folder. That will change the status of the email on the server to "read", and a re-sync with the server will change its "unread" status in other folders.
    - Deleting an email from a folder only removes the associated gmail tag, so that the email will still exist in other folders associated with the remaining tags.
    - To avoid buildup of obsolete emails, you occasionally need to delete obsolete entries in the "All Mail" and "Important" folders. The one copy of an Email on the gmail server doesn't actually get deleted until all tags associated with the email have been deleted.

## Email Structure

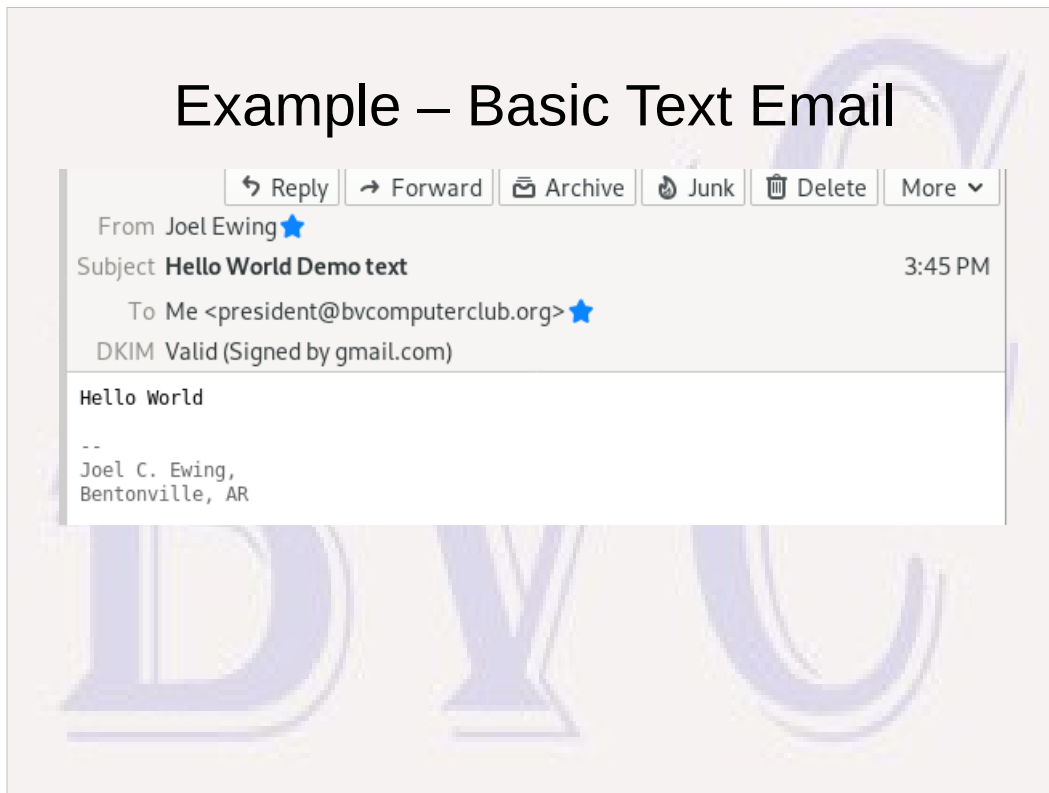
- **Header Lines**
  - Some header lines created when email is composed (To, CC, Subject, Date, From, Reply-to), others added by servers that process the email
  - Can be used to evaluate true origin of email and likelihood of it being SPAM, but otherwise passed through with minimal validation.
  - Some headers (like From) are trivial to forge.

Only a small number of the headers are directly related to data entered by the creator of the email. Most of the header lines are created to track the path the email takes on the Internet and to evaluate whether the email is Spam or of legitimate origin.

# Email Structure

- **Email Body Lines**
  - Contain the message content
  - Embedded control lines can direct division of Email Body into parts and specify type of content in each part. This enables support for attachments, Rich-Text-Format (HTML) email, and handling of base64-encoded binary data as text.

## Example – Basic Text Email



Typical default email display only shows a few of the standard header lines: Date, From, Subject, To, Reply-to, CC.

DKIM is only shown because I have an add-on to my email client to try to diagnose "spam" misclassification issues

The email above uses the UTF-8 codeset internally, but doesn't actually contain any characters requiring more than 7 bits.

## Email as Actually Received

[Click on this link to View Source for text-only Email](#)



Many email applications provide an option to "View Source" to display the raw text of the entire email message, showing all header and body text lines. highlighting is used to show who created what parts of the email. Very few of the lines are created directly or indirectly by the end user.

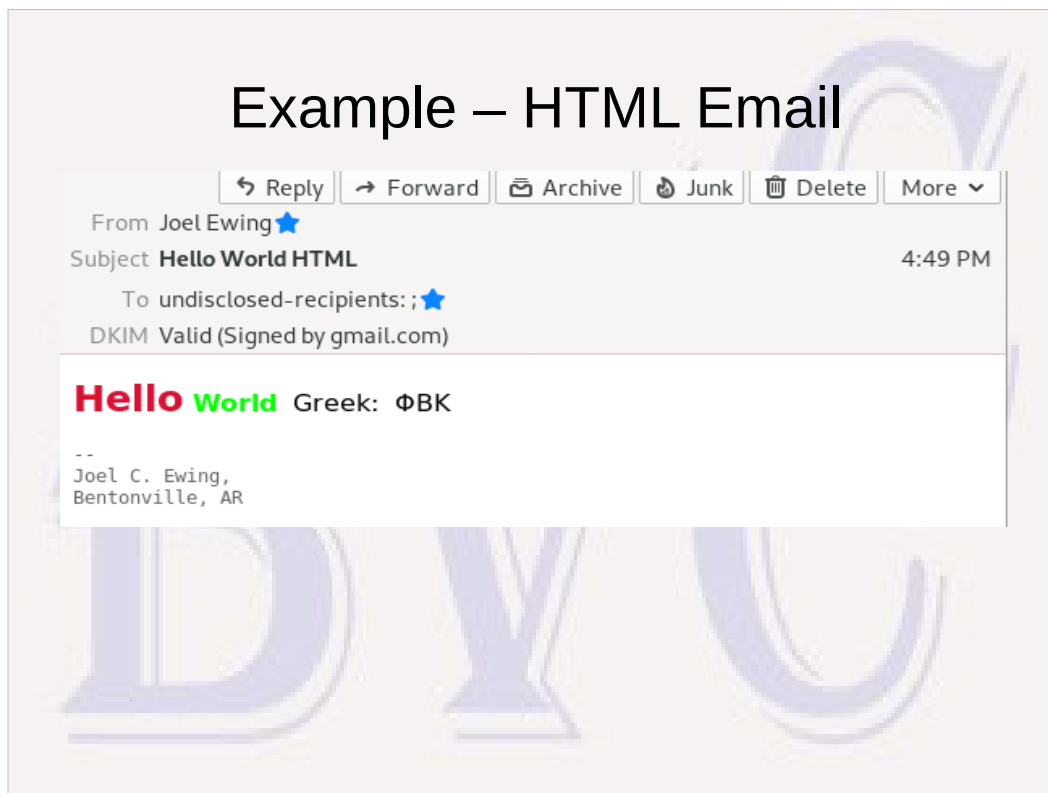
yellow – created directly or indirectly by email creator

green - added by sender's email service servers

gold – added by receivers email service servers

Very large email service providers may sometimes route the email through more than one server within their own organization, or sometime farm out part of the processing (like spam detection) to a different server,





To support different font attributes and formatting directives requires that the email be sent using Rich Text Format or HTML. This uses a subset of the same HTML formatting tags used to format web page content. All modern email display software should be able to handle HTML formatting, but straight text is still much more efficient if you don't really need fancy formatting.

This email deliberately uses some greek characters that require full 8-bit transmission and multiple bytes to represent some characters. You may still, but rarely, encounter email servers that are not configured to support 8-bit transmission. This can cause even ordinary UTF-8 text to be converted to Base64 format to transmit the text as 7-bit characters.

## Email as Actually Received

[Click on this link to View Source for HTML Email](#)



Yellow highlighting used to show the lines present in the original email.

This email was sent with "both text and HTML" alternatives, "boundary markers" divide the various parts. An email program without HTML support (no modern examples) or with HTML display suppressed will show the text version of the message, others will interpret the HTML part and display that.

HTML format contains many tags delimited by < > that describe how to format the email content. HTML is the same language used by web browsers to format web pages.

Some email composition applications can generate needlessly complex HTML emails. Don't go overboard on "fancy" appearance when simple text suffices

## Accessing an Email Account

- **Two main ways**
  - **Via an Email Client** – a special application on your device that specifically handles email (Thunderbird, Outlook, Live Mail, Evolution, Mail app, Gmail app, etc.)
  - **Via a web browser** (IE, Edge, Chrome, Firefox, Safari, etc.) that accesses a web site provided by the same company that supports your email account and allows you to view and submit email from their web server (web mail)
  - **Can use a mix**

The term "client" in this context is more specifically a "client computer application". This application connects over the Internet to a "server application", or just "server", that provides some service it needs to function. The conventional computer terminology used here is borrowed from human endeavors, where a service employs human servers to satisfy the needs of human customers or clients.

By the same convention a web browser (like Firefox) is also a client application (but for web content, not email), and the web sites it connects to are running an application that is indeed called a "web server"

## Email Clients or Apps

- Tend to be more flexible
- More direct control over emails – copies reside on your local machine – can easily make local copies and archive copies of email
- Multiple email accounts may be managed by one client – single contacts list, emails may even be moved to a folder of another account or to an archive folder that is only on your local device.
- Each email account to be used must be defined to your email client – more complex to set up than web mail
- Some are free, others are not

Having local copies of your email means that if you take image backups of your system you also have a point-in-time backup of all your email folders. Should some disaster befall your email service provider and they lose all your saved emails, you have your own backup. The ease of recovering an email folder from an image backup depends the specific email client involved.

# Web Mail

- **Each email account has its own unique web mail URL**
  - **Simple** – only need email address, password, and URL
  - **Different accounts may have different web mail interfaces**
  - **Each account has its own contacts list**
  - **No email access when Internet not accessible**
  - **Handling of attachments is more complex** – attachments must be uploaded to web server to attach to an email and downloaded from web server if a copy wanted on local machine – different accounts may have different conventions for doing this.
  - **May have more limited options for filtering email displays or automated categorizing of emails**

## Web mail Example – R4L

- **WebM@bvcomputerclub.org**
  - <http://webmail.bvcomputerclub.org> with **WebM@bvcomputerclub.org** & password
  - Can import contacts, create folders & sub folders (gear, manage folders, +), change email account options, set up filters (from "web mail home"), etc.
    - Contacts import may not preserve everything (groups, some fields, etc)
  - Attachments, HTML vs Text message, etc

There are several free, open-source webmail applications, most notable of which are Roundcube and Horde. Many email providers may offer web mail with a choice of which of these interfaces to use. If so, choose a consistent interface across all email accounts to reduce confusion.

Other email provider, like Gmail, have special conventions and provide a completely different web mail interface.

## Web mail Example – Gmail

- **jc\*\*\*ewing@gmail.com**
  - **http://www.google.com** with **jc\*\*\*ewing@gmail.com** & password – if multiple gmail accounts, web mail will remember last used
  - **Totally different interface: create folders?, can set up filters based on a specific email, but actions much more limited. Contacts under totally different "Contacts" web app can import (slightly different results)**
  - **Attachments (opened via web site app, rather than app on local machine, pluses & minuses, also download option)**
  - **HTML vs Text message (under ...more options), but less clear what you are sending. Formatting options hidden – toggled by A to right of "Send" button. Don't appear to have option of sending Only HTML when formatting options are used.**

Gmail web mail may permit opening documents using the corresponding Google Office on-line applications.

That means you can open such attachments without downloading them to your local system.

If you want to open an attachment with a software application on your local system, the attachment will first have to be downloaded to your local system.

## Email Clients

- **A client is an application that must be installed on each user device where it is needed**
- **Must choose among the clients compatible with the particular user device and Operating System on the device**
- **Some clients have been implemented on multiple platforms and Operating Systems**

A client that is implemented on multiple platforms should look very similar to the user on all platforms, but it does not run identical code on different platforms. It is designed so that the operating-system-specific part of the application can be isolated and just that part of the application is changed.

Each client application on each device may have its own contacts list, or there may be a way to share a contacts list on the web. If a unique contacts list, there should be some way to export/import contacts to other devices.



## Windows Clients

- **Live Mail** – dropped after Win 7. Will run on Win10, but is incompatible with MSN Mail, Office365, Hotmail, or Outlook.com
- **Mail and Calendar app** in Win 10 – basic, no frills
- **Thunderbird** – free open-source client with many features. One of the best completely free clients
- **Outlook** – if you already have MS Office, this is a very capable email client. Versions prior to 2003 were security risks, but recent versions have addressed those issues.
- **Evolution** – another free open-source client – designed to appeal to those who prefer an Outlook-like user interface, but lack access to MS Office

Email services run by MS no longer support the protocol required by Live Mail, but it still works with accounts from other email providers.

Mail app, free with W10, is simple compared to Live Mail. Many Live Mail users did not like the stepdown to "Mail".

My personal preference is for the Thunderbird user interface, but that may be from using TB for over a decade on both Linux and Windows.

Both Outlook and Thunderbird should be able to auto-configure for many common email accounts given the email address and password. Other email accounts may require additional configuration information to access the account properly.

## Folders in Thunderbird vs Outlook

- Outlook stores synchronized copy of all folders on an IMAP email server account in a single .OST file (used to be .PST) – implications for incremental backups
- Thunderbird only stores all emails in one folder in a single file plus an index file. Mail sub folders are stored as files under a directory named for the parent folder. Unless the emails in a folder change, the associated files remain unchanged
- Thunderbird has very obvious local folders that can be used when you want to save emails for long term on your local device and not take up space against your email account space limits.
- Outlook has the functionality of "local" folders but they are called "Personal Folders" and stored in a separate .PST file. The terminology used obscures their function until you understand their similarity to TB local folders.

Businesses with many computers may use incremental backup schemes (backup only files that have changed since the last backup) to reduce backup overhead. The Outlook design means for an email account with 1000's of saved emails, the addition or deletion of one email requires all emails in the single changed file to be backed up. With Thunderbird, only the file for a changed folder needs to be backed up.

## Linux Email Clients

- **Evolution – free – (Outlook-like) – available for all Linux distributions and may be included by default**
- **Thunderbird – looks to user the same as version for Windows. Available for all Linux distributions**
- **Others**

Thunderbird includes a calendar. There is a way to sync the Thunderbird calendar with other calendars, like your Google calendar. I have Thunderbird on my desk top and the calendar on my iPhone both synced with my Google email calendar

## Free iPhone/iPad Clients

- **Mail app**– the default client is fairly simple to set up for the 6 "known" providers (includes Gmail), but if you use it with "other" it seems to be a more complex manual setup. I've seen at least one instance where some other app that wanted to send an email insisted on using Mail, so you might be forced to configure Mail and keep it even if you normally use another app to view and send email.
- **Gmail app** – optimized for Gmail's quirks but claims to also support other email services
- **Outlook app** – free if you don't add additional features. Have tried this with multiple email accounts. Works, although switching between folders and accounts is more work than on a desktop client.

## Other Devices

- **I'm sure a Google search will turn up both free and non-free email clients for other devices (Mac, Android smart devices, Chromebooks, etc)**
  - **Free Open source clients like Thunderbird and Evolution have been ported to many different devices**

## Thunderbird Example (Windows)

- If not installed, download from
- <https://www.thunderbird.net/en-GB/download/>
- Importance of "Master Password" – otherwise account passwords not encrypted
- Adding a Gmail email account
- Adding an account that must be manually configured
- Contacts Lists, text vs HTML, use of BCC, attachments

Gmail can be enabled for multi-factor authentication. Believe it asked for confirmation of a code sent to my iPhone before I could add access to a new device.

Questions?

BVC

## Email & BCC

- **BCC – blind Carbon Copy – designates a recipient of email that will not be revealed (only TO and CC headers are sent with email). Use when emailing an announcement to a large group.**
- **Can specify multiple recipients of an email and individually select whether each address will be a TO, CC, or BCC**
- **Once was a requirement of some email programs to have at least one TO address – no longer true for Thunderbird (will indicate a TO of "Unspecified Recipients" if no TO or CC specified)**
- **Thunderbird will accept a copy & paste of multiple cells from a spreadsheet column of email addresses into a BCC field to send to a group of addresses (but different email services may place limits on max recipients for a single email)**