



Using email over BGAN

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1 Introduction

1.1 About this guide

This document describes the use of email applications over the BGAN network, and includes advice on how to improve network performance and optimize email clients.

It is intended for first time end-users, Distribution Partners, Service Providers and anyone who wants to use a BGAN terminal to connect to the BGAN network and use network services. A previous knowledge of email client software is required. A previous knowledge of satellite communications is useful, but not essential.

The sections include:

- Introduction to email – in particular, the common email protocols.
- Improving email performance – explains how to optimize email on satellite networks, and list some of the specialized solutions available.
- Optimizing email clients – gives hints and tips on how to maximize the performance of some of the most commonly used clients, including Outlook Express, Eudora and Mozilla Thunderbird.
- BGAN testing and analysis – gives the results of extensive testing of email protocols carried out over the BGAN network, and lists some of the factors than can affect network performance, including latency, jitter and packet size.
- Email scenarios – shows a typical remote office scenario.

1.2 Other sources of information

- This is one of a series of PDF documents that make up the BGAN Solutions Guide. The Solutions Guide is designed to help you make the most of your BGAN terminal. Other documents in the series are available for download from www.inmarsat.com/bgan. Click on **Support**, then click on **User guides**.

This Web site also gives further information on the BGAN service, including Industry solutions.

- Refer to “Using BGAN LaunchPad” for details on using BGAN LaunchPad. This document is available for download from www.inmarsat.com/bgan
- Refer to the documentation supplied with your email client software for details on changing configuration and settings.

2 Introduction to email

The BGAN service enables remote offices or users to maintain email communications with company headquarters or business partners anywhere in the world. You can connect the BGAN terminal to the Internet, and use the email services provided by your Internet Service Provider (ISP), including text-based email, and the transfer of data attachments, such as Word documents, Excel spreadsheets or PowerPoint presentations.

Email is usually accessed using one of the following four protocols, all supported on the BGAN network:

- SMTP
- POP3
- IMAP4
- HTTP

There are also a number of proprietary protocols commonly in use, including:

- MSRPC (Microsoft Remote Procedure Call) for Microsoft Exchange Server.
- NotesRPC (Remote Procedure Call) for Lotus Notes.

These protocols use the following ports:

Protocol	Source Port	Destination port
SMTP	Dynamic	25 (TCP)
POP3	Dynamic	110 (TCP)
IMAP4	Dynamic	143 (TCP)
HTTP	Dynamic	80
Microsoft Exchange (MSRPC)	Dynamic	Dynamic
Lotus Notes (Notes RPC)	Dynamic	1352

SMTP, POP3 and IMAP4 are used by all Internet email clients, for example Outlook Express, (but not Exchange Server), Mozilla Thunderbird and Eudora. See section 4.0 "Optimizing email clients", for details on how to maximize the performance of these clients.

Each of these protocols is described below.

2.1 SMTP

SMTP (Simple Mail Transfer Protocol) is used to upload (send) emails from a client to the ISP's mail server for delivery. If you are using Enhanced SMTP (ESMTP), it also defines the basic mechanism for transferring mail between one server and another.

SMTP operates as follows:

- a. The client sends information to the server.
- b. The server responds with an acceptance or rejection message.

If the server is using Enhanced SMTP (ESMTP) the sending server (or client) can authenticate with the receiving server, as described below:

- a. The sending server sends the originator address and recipient addresses to the receiving server.
- b. If the receiving server agrees to transfer the message from the originator to the named recipient(s), the sending server is asked to send the message data.

The message data consists of the message header and message body. The message body can be either plain text, or can be more complex and contain, for example, HTML attachments. More complex messages are encoded into a MIME (Multipurpose Internet Mail Extensions) stream.

Note MIME encoding can increase the size of a message by up to 50%

Tip Some ISPs do not support SMTP from other networks. A symptom of this is the ability to receive email but not send email. A "server not found" or "timeout" error may be reported. One possible solution to this is to subscribe to a dedicated email service from your Distribution Partner (DP). You can also use the default SMTP server provided by Inmarsat which is:

SMTP.bgan.inmarsat.com

2.2 POP3

POP3 (Post Office Protocol v3) is the most common email download method used by ISPs. It defines how an email client interacts with a server in order to download messages, determines how many messages are waiting and defines a method to retrieve the messages.

POP3 is a simple protocol, and usually downloads all messages in your Inbox as text streams; normally, it does not allow you to specify which messages to download. However, some clients enable you to configure your email application so that only the first few kilobytes of each message are downloaded. In this way, you can choose to download complete messages only when required.

Most ISPs encourage the use of POP3 clients because customer mailboxes are cleared on each connection, and so do not take up resources at the ISP.

2.3 IMAP4

IMAP4 (Interim Mail Access Protocol v4) offers greater functionality than POP3, and is available on some ISP servers. Instead of simply downloading all email, IMAP4 gives you the option of using the client to manage the emails held on a server; for example, you can maintain a structure of folders on the server, and you can also move headers between folders without downloading the messages.

In addition, you can view message headers, and select which messages you want to download immediately, select which can be deleted, and select which can be saved until you are back in the office.

In addition, if the mailbox is susceptible to junk mail and Spam mail, these messages can be deleted without downloading.

A typical IMAP session involves the following steps on the client:

- a. Authenticate with the server.
- b. Check the capabilities of the server.
- c. Check the number of messages in the Inbox
- d. Request a list of headers for all messages in the Inbox. This list populates the client's Inbox view.
- e. When you request a message, the client sends a request to the server to download that message only.

Note IMAP4 can be configured to download all messages, if required.

2.4 HTTP (WebMail)

HTTP (Hypertext Transport Protocol) is commonly available as an alternative to POP3 services. It allows you to access your mailbox through a web browser, not an email client. In addition, you can view your Inbox before downloading messages, and so you can choose the messages you want to download.

2.5 Microsoft Exchange

Microsoft Outlook clients can use the Microsoft-Remote Procedure Call (MS-RPC) to communicate with the Microsoft Exchange Server. If you use standard Exchange mode, MS-RPC must be used. In all other cases, Outlook clients can use the SMTP, POP3 and IMAP4 protocols.

Note The use of the term RPC does not imply a similarity with any other RPC protocol. MS-RPC is a proprietary protocol, and has no public specification.

Note the following when using MS-RPC:

- MS-RPC is best used over a LAN, as the connection between the client and server requires a significant amount of bandwidth. It is not well suited to BGAN.

- MS-RPC has a number of security flaws, and is best used over a VPN, where possible.
- Server, client and firewall must be correctly configured, as the clients and servers allocate dynamic ports for connections.
- Microsoft Outlook should be used in remote mode, using an OST file (early versions) or cached mode (later versions).

TIP To use Microsoft Outlook over BGAN:

- Use a VPN connection, wherever possible.
- Ensure that your client is set to cached mode.
- Consider using SMTP/IMAP when away from the office.

By default, Microsoft Outlook clients are optimized for use over a high speed, low latency network. You may need to change the configuration of your client, depending on the connection type used.

2.6 Lotus Notes

Lotus Notes clients use the NotesRPC (Remote Procedure Call) to communicate with the Notes server.

Note The use of the term RPC does not imply a similarity with any other RPC protocol. NotesRPC is a proprietary protocol, and has no public specification.

Note the following when using NotesRPC:

- Notes RPC is best used over a LAN, as the connection between the client and server requires a significant amount of bandwidth. It is not well suited to BGAN.
- Notes can be used in Island mode, only replicating data from the server when required.

Tip: To use Lotus Notes over BGAN:

- Use a VPN connection, wherever possible.
- Ensure that your client is set to island mode.
- Consider using SMTP/IMAP when away from the office.

3 Improving email performance

Some Distribution Partners (DPs) provide dedicated email facilities, which are configured to work more effectively over a satellite link, and therefore improve on those provided by an ISP. Also, as the DP hosts the service, the traffic does not pass over the Internet. This provides extra resilience and performance improvements.

3.1 General principles

Inmarsat recommends that you use a standard TCP/IP data connection for email. The standard IP data connection opens by default when you register with the network, and is sufficient for most email requirements.

3.2 Compression

The most cost-effective way to send large attachments over a packet network that is billed by volume or time is to compress the file with a standard utility such as:

- WINZIPTM, available from <http://www.winzip.com/> or
- WinRAR, available from <http://www.rarlab.com/>.

You can then FTP the file to a designated FTP server, and alert the recipient by email to retrieve the file locally. Many email clients when sending such attachments via SMTP will add greatly to the attachment's original size, sometimes by as much as 50%. Compressing attachments is only of benefit if the content is not already compressed, and the recipient has a utility to de-compress the attachments.

Contact your Distribution Partner for advice.

3.3 Using specialized software solutions

The performance of an email service can be further improved by employing specialized software, such as SkyFile and Rydex. This software offers some of the following potential benefits:

Extra resilience

If a data link is broken during the transmission of messages, standard software will re-start the transmission from the beginning. Specialised software is able to continue this transmission from the point it stopped.

Message filtering

Specialized software enables you screen email before it is downloaded. You can use this simply to prevent large messages from being downloaded, or you may be able to check who is sending messages and only allow messages through from known sources.

Least-cost access

It may be possible to save on costs by choosing a different class of connection, based on the volume and frequency of email transactions. For example, a connection charged by time may be cheaper than a connection charged by volume for larger volume email transactions. In addition, specialized software can provide the ability to automatically select the cheapest network.

Batching and compression

Specialized services can provide automated batching and compression matched to the tariff structure, ensuring that messages are transmitted in the most cost effective way.

Specialised email message hubs

There are several companies that provide email services specifically for wireless networks. The features and benefits of these solutions match those of DP value-added services. It is also possible to purchase hubs that can be sited at corporate headquarters in order to provide access for remote users directly into corporate systems, rather than routing through a third party.

Email middleware

Middleware is a term used for software that provides a link, or bridge between two applications or environments. Rather than develop complete messaging hub solutions for satellite systems, some specialist companies have developed components that integrate with the popular corporate systems. These solutions allow closer integration with existing corporate messaging systems, whilst still providing features that benefit the remote user.

4 Optimizing email clients

In general, the SMTP, POP and IMAP protocols do not offer compression, although IMAP4 allows retrieval of headers only (see section 2.0 "Introduction to email" for details).

The most effective method of optimizing email clients over these protocols is to reduce the amount of data that is sent and received. This also applies to proprietary protocols. The following hints and tips are generic and apply to all protocols and clients. The rest of this section concentrates on optimizing some of the most commonly used clients:

- Use IMAP servers rather than POP3 servers, and enable the viewing of message headers rather than downloading all messages.
- Disable regular automated checks for new mail, to reduce traffic.
- Disable the download of messages whilst they are being previewed, to reduce traffic.
- Ensure that messages are sent as text, rather than as HTML, to reduce message size. An HTML message can be up to twice the size of a text message.
- Disable signatures to reduce message size.
- Disable read receipts, to reduce traffic.
- Compress attachments, to reduce message size. (Also, consider converting attachments to text files, to reduce message size.)
- Enable connection selection on start up, that is you are asked if you are online or not.
- Enable offline use, so that message delivery is controlled rather than happens in the background.

4.1 Optimizing Outlook Express

Outlook Express supports both POP3 and IMAP4 protocols. Neither of these protocols provides any compression of data over a communications link. You can optimize the performance of these protocols, as follows:

- Switch off Check for mail every x minutes option, or set the value to several hours. Checking for mail when there isn't any generates up to 6KB of traffic. By checking for email only when necessary, you can reduce costs.
- Switch off Send and Receive messages at startup. This allows queuing or sending of batches of mail.
- Disable Automatic download of messages when in the viewing pane. This stops messages being downloaded as you browse the headers.
- Send plain text messages only. If you use bold, underline and non-standard fonts more data is used than plain text.
- De-select the Send messages immediately option. You can queue messages enabling them to be sent all at once rather than initiate a connection for each message.
- Do not include the original message in your reply. This reduces the amount of data sent.
- Do not include read receipts. Read receipts are designed to allow the sender of the message to be notified when the recipient has opened the message. As this generates extra traffic, Inmarsat recommends that you switch them off.

Tip IMAP4 transmits email twice. The email is first sent to the SMTP server and then to the IMAP server, to be placed in the "Sent Items" folder. You can turn this feature off by unchecking the "Save copy of sent messages in the 'Sent Items' folder" check box.

Tip Outlook over IMAP4 allows the client to synchronize selected folders to the local machine. This feature is controlled on the window shown when the IMAP account is selected from the left hand panel. Turn synchronisation off for all folders to avoid unnecessary downloads.

4.2 Optimising Eudora 5.1

Eudora 5.1 supports both POP3 and IMAP4 protocols. Neither of these protocols provide any compression of data over the communications link. You can optimize the performance of these protocols, as follows:

- Download part of a message (over POP3). This has the benefit of appearing to download only the header (if set correctly), and of giving you the option of deleting a message that may contain a virus without downloading it. You are prompted to skip messages over a certain size; Inmarsat recommends that you skip messages over 3K.

Note Although this setting suggests that you are skipping messages over a specified size, in fact the program skips the remainder of the message after the first 3K has been downloaded.

- Leave email on the server. This has the advantage of enabling you to retrieve the message later, or downloading a duplicate copy if you lose the original. The disadvantage is that you could download a duplicate copy of an existing message. Inmarsat recommends that you download what is required, and delete what is not from the server.
- Send plain text messages only. If you use bold, underline and non-standard fonts more data is used than plain text.
- Do not include signatures. Signatures impose an extra overhead.
- Send messages together. This allows email to queue, which reduces the number of SMTP connections needed to send messages.
- Check for mail manually (or set the automatic check function to check every few hours). Checking for email only when necessary can reduce costs.
- Do not enable read receipts. Read receipts are designed to allow the sender of the message to be notified when the recipient has opened the message. This generates extra traffic. Read receipts are disabled in Eudora by default.

4.3 Optimizing Mozilla Thunderbird

The Thunderbird client is an open source equivalent to Outlook Express. Exactly the same modifications can be carried out to ensure that this client works optimally over BGAN.

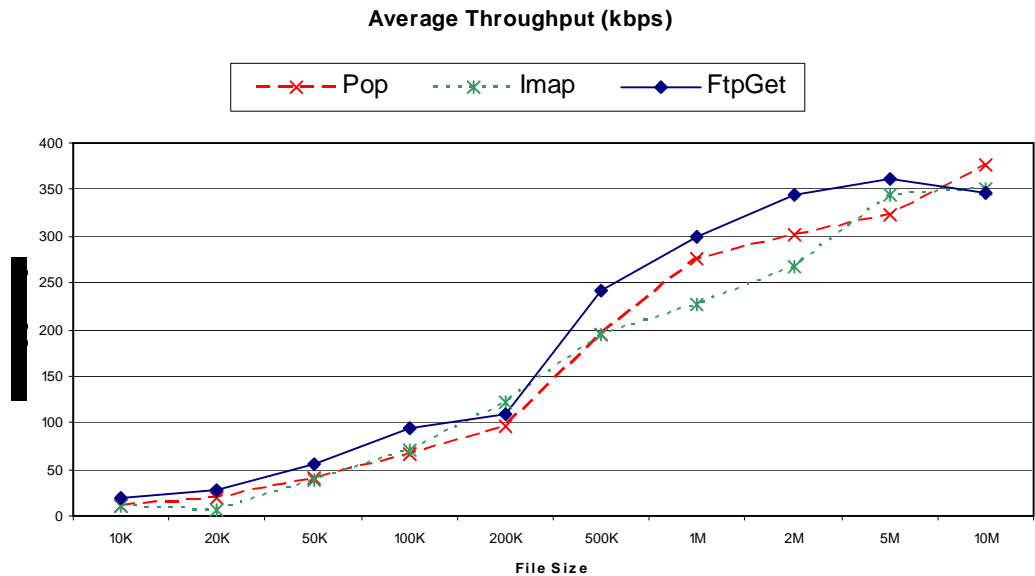
- Switch off Check for mail every x minutes option, or set the value to several hours. Checking for mail when there isn't any generates around 6KB of traffic. By checking for email only when necessary, you can reduce costs.
- Switch off Send and Receive messages at startup. This allows queuing or sending of batches of mail.

Tip IMAP4 transmits email twice. The email is first sent to the SMTP server and then to the IMAP server, to be placed in the "Sent Items" folder. You can turn this feature off by unchecking the "Save copy of sent messages in the 'Sent Items' folder" check box.

- Send plain text messages only. If you use bold, underline and non-standard fonts more data is used than plain text.
- Unless you want your messages available offline, disable offline downloads. Uncheck the Make the messages... and When I create new... check boxes.
- Disable some of the advanced options for extra bandwidth savings. Uncheck Block loading of remote images, and disable the return receipts option.

5 BGAN testing and analysis

The SMTP, POP and IMAP protocols have been extensively tested over the BGAN network. The following graph shows the POP and IMAP protocols, compared with FTP GET:



The above graph indicates that POP and IMAP compare favourably with the FTP GET protocol. The overheads are greater, however, and result in more data being sent:

- POP and IMAP overheads vary between 37% and 60%, depending on the message size.
- FTP GET overheads vary between 2% and 10%, depending on the message size.

5.1 Factors affecting performance

By default, email applications are configured to operate over low latency and very high bandwidth networks. Some network characteristics impact the performance of the protocols in such a way that optimization usually becomes necessary.

You can achieve a more cost-effective email service by ensuring that your email client and server settings have been optimized for satellite networks. Most ISPs do not specifically tailor their services to wireless users. Your Distribution Partners offers a wide range of value-added services that help you maintain customized and optimized services for email and other applications.

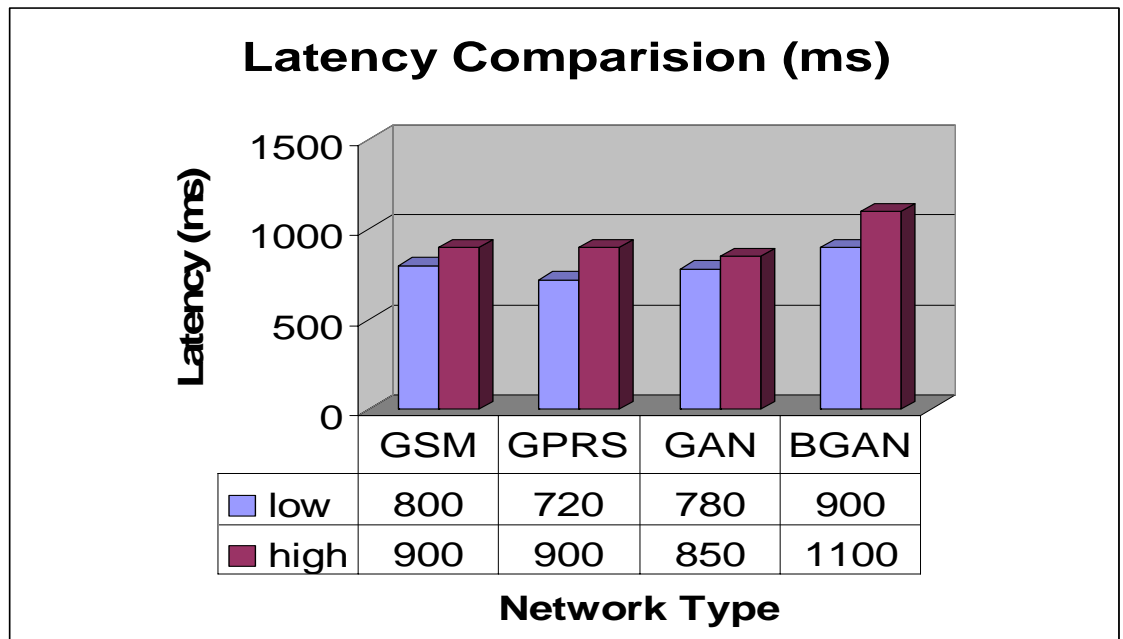
Some of the characteristics that impact email protocols include:

- Latency
- Jitter
- Overheads
- Dynamic Packet Size

Each of these is described briefly in the following sections.

Latency

Latency is the delay experienced in network communications. Latency impacts the performance of acknowledgements and therefore of packet sizes. The BGAN network typically provides a Latency of between 900 – 1100 msec. This compares favourably with other networks:

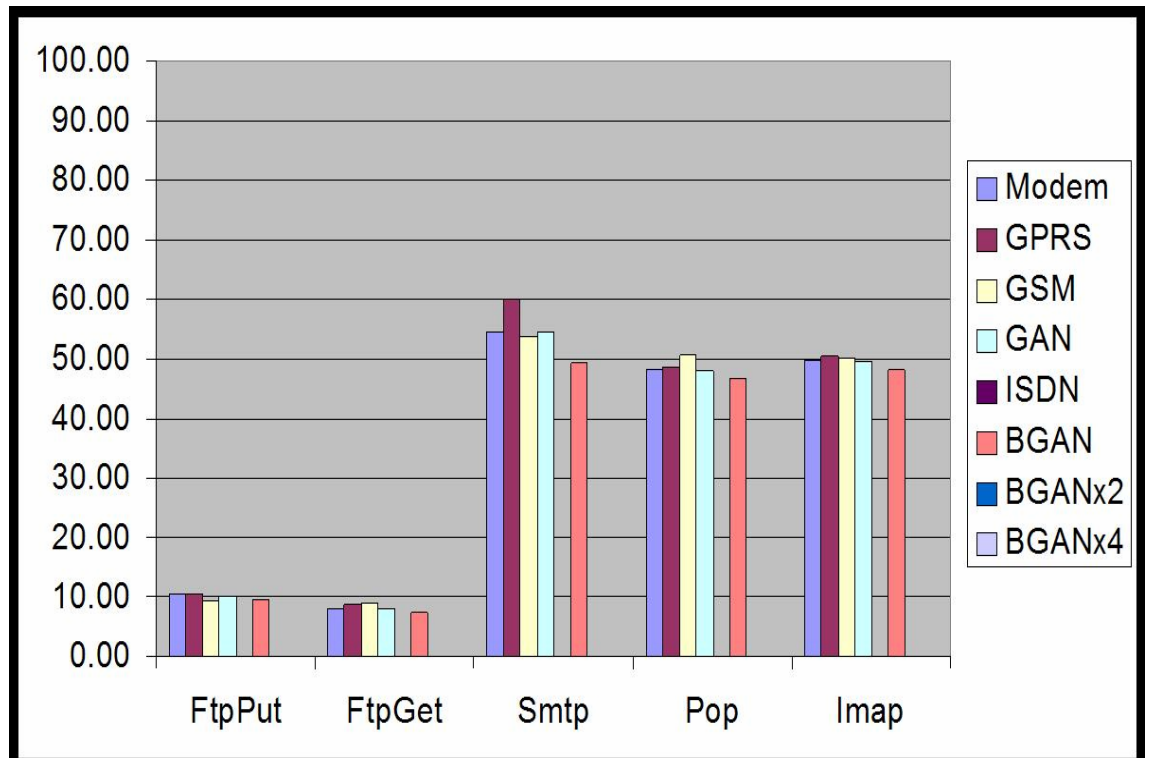


Jitter

Jitter is the range by which the latency of a network varies. The greater the variation the higher the jitter and therefore the higher the impact on the protocols used. A Standard IP data connection tends to have higher jitter than a streaming IP data connection.

Overheads

When a protocol sends email, there is overhead associated with the email, for example in the use of headers and packet acknowledgements. The percentage size of the overhead varies depending on the protocol and on the network. The following graph shows that the BGAN network compares favourably with other networks, and that the impact on cost and volume of transmissions is minimized.



An example of overheads, based on figures shown in the graph above, is given below.

- If you send a 1MB file over FTP, the overheads for FTP are approximately 10% across all network types, therefore you would be charged for 1.1MB of data.
- If you send a 1MB file over SMTP, the overheads for SMTP are approximately 55% across all network types, therefore you would be charged for 1.55MB of data.

Note that if you send data over a VPN (or another secure network) the overhead is approximately 18% - 40%. This is in addition to the percentage overhead shown in the above graph for the protocol used.

It is therefore very important to select the most efficient method of transmitting data, based on the nature of the traffic you are sending.

Dynamic Packet size

Dynamic packet size determines the volume of data that can be sent per packet in comparison to the error correction information. Dynamic packet size varies depending on the protocol, but plays a significant role in data transfer. It enables throughput to vary depending upon the quality of the service or channel.