



SwiftBroadband and IP data connections

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1 Introduction

1.1 About this guide

This document explains how IP data connections operate on the Inmarsat Network, and explains how each terminal manages IP data connections.

It is intended for distribution partners, service providers and anyone who wants to use a SwiftBroadband terminal to connect to the Inmarsat Network and use network services. A previous knowledge of satellite communications and avionics is useful, but not essential.

This document covers the following topics:

- SwiftBroadband and IP data connections – introduces Standard IP and Streaming IP connections, designed to meet all your IP data requirements.
- SwiftBroadband and PDP contexts – provides an overview of PDP contexts. A PDP context provides essential information about your data connections to the Inmarsat Network.
- Using TCP/IP and UDP/IP – gives recommendations on the use of applications based on TCP/IP and UDP/IP and provides tips on how to maximise performance.

1.2 Terminology

The following terms are used in this document. A brief explanation of each is given.

- QoS – Quality of Service (QoS) specifies a guaranteed throughput rate for data. On the SwiftBroadband terminal, you have the choice of transferring data at rates up to 128kbps, depending on the terminal specifications.
- PDP context – A Packet Data Protocol (PDP) context transfers information about your data connections between the SwiftBroadband terminal and the Inmarsat Network. The PDP context defines connection aspects such as routing, QoS and security. The SwiftBroadband terminal opens a primary PDP context or a secondary PDP context, depending on the IP data connection type. Refer to SwiftBroadband and PDP contexts for details.

1.3 Other sources of information

- This is one of a series of PDF documents that make up the SwiftBroadband Solutions Guide. The Solutions Guide is designed to help you make the most of your SwiftBroadband terminal. Other documents in the series are available for download from www.inmarsat.com/support. Click on *SwiftBroadband* to view a list of the available user guides.

2 SwiftBroadband and IP data connections

SwiftBroadband supports two types of IP data connection, designed to meet the full range of your IP data requirements. They are:

- Standard IP
- Streaming IP

NOTE: Refer to the guide for the specific SwiftBroadband terminal for information on opening and closing an IP data connection.

2.1 Standard IP

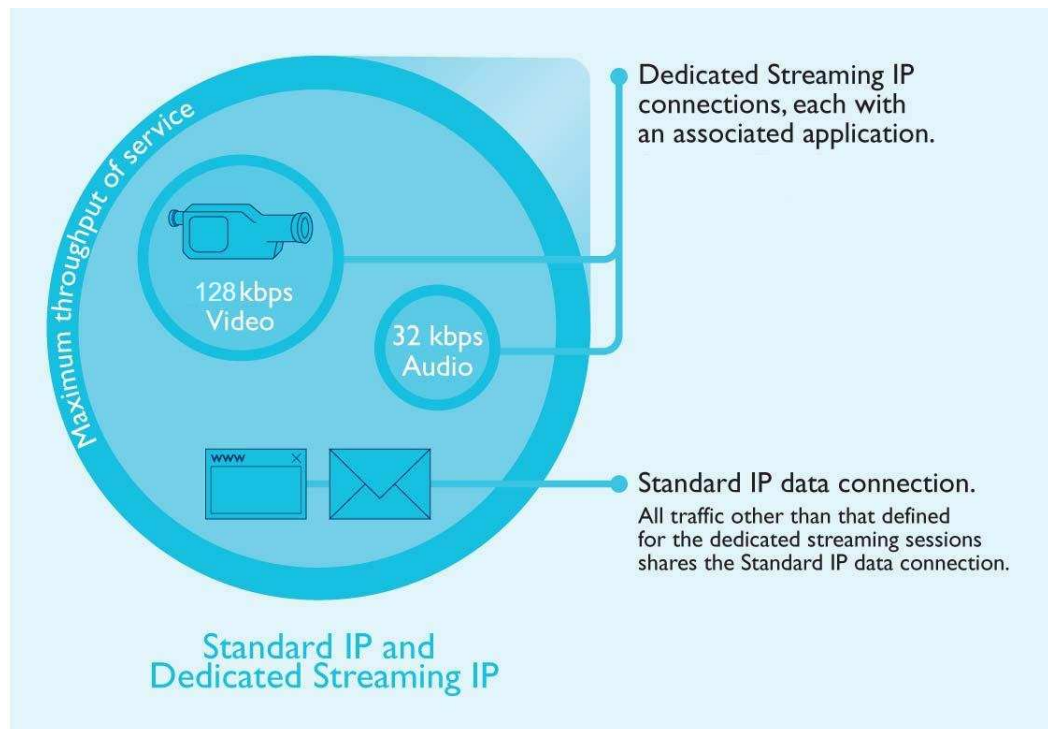


A Standard IP data connection is pre-configured on the SwiftBroadband terminal.

- It offers data rates of up to 432kbps (depending on the terminal) over a best effort, shared connection.
- Standard IP is best suited to typical office applications, such as internet browsing, email and FTP.
- Refer to your SwiftBroadband service provider for details on how you are charged for a Standard IP connection.

TIP: There may be a minimum charge when an IP data connection is open, and data may be transferred across the connection even if you are not actively using an application (for example, your computer may be receiving automatic updates).

2.2 Streaming IP



Streaming IP is optimised for use with audio and video applications, such as Streambox, Win Media and QuickTime. It is possible to configure Streaming IP data connections on the SwiftBroadband, and open two or more Streaming IP connections in addition to the Standard IP connection.

In the diagram above, a Standard IP connection is open, and is being shared by terminal users for IP data applications such as internet and email services. In addition, two dedicated Streaming IP sessions are open. The first, at 32kbps, is being used exclusively for an audio streaming application. The second, at 128kbps, is being used exclusively for a video streaming application.

- Streaming connections are available at one of the following data rates:
 - 32kbps streaming
 - 64kbps streaming
 - 128kbps streaming
- Streaming IP is optimised for use with UDP applications, such as video and audio.
- The QoS is consistent and guaranteed. However, observed throughput may be slower than the rate you select because of overheads, such as the packet header size of the application you are using. In addition, any interconnect with terrestrial networks may impact throughput.

SwiftBroadband and QoS

- To guarantee the Quality of Service (QoS), Inmarsat provides QoS on the satellite interfaces and supports QoS in the Inmarsat Network. The QoS is negotiated between the terminal and the Inmarsat Network when you open a data connection.
- To ensure a consistent data rate across the connection, you must ensure that end-to-end QoS is supported for the desired data rate. To ensure end-to-end QoS, a dedicated streaming connection must be in place between your SwiftBroadband service provider and your corporate headquarters, including any terrestrial interconnect.

- You must assign a dedicated Streaming IP connection to a specific application, such as Win Media.
- The Standard IP connection must be open before you can open a dedicated Streaming IP connection. This is because a dedicated Streaming IP connection uses the routing information of the Standard IP connection. (Note that you can open one of the pre-configured Streaming IP connections as an alternative to the Standard IP connection.)
- One or more dedicated Streaming IP connections can be open in addition to the Standard IP connection. The maximum number depends on the terminal.
- Refer to your SwiftBroadband service provider for details on how you are charged for a streaming IP connection.

3 SwiftBroadband and PDP contexts

3.1 About PDP contexts

The Inmarsat Network manages resources using Packet Data Protocol (PDP) contexts.

When you open an IP data connection, a PDP context is opened automatically. This PDP context must be established in the SwiftBroadband terminal and Inmarsat network for you to be able to transfer data across the network. A PDP context defines connection aspects such as routing, QoS, security and billing between the terminal and network.

When you first open a PDP context, the terminal requests sufficient radio resources (that is, power and bandwidth) to support the context activation procedure. Once the resources are allocated, the terminal sends the activate PDP context request to the Inmarsat network. This request includes key information about the SwiftBroadband terminal, for example:

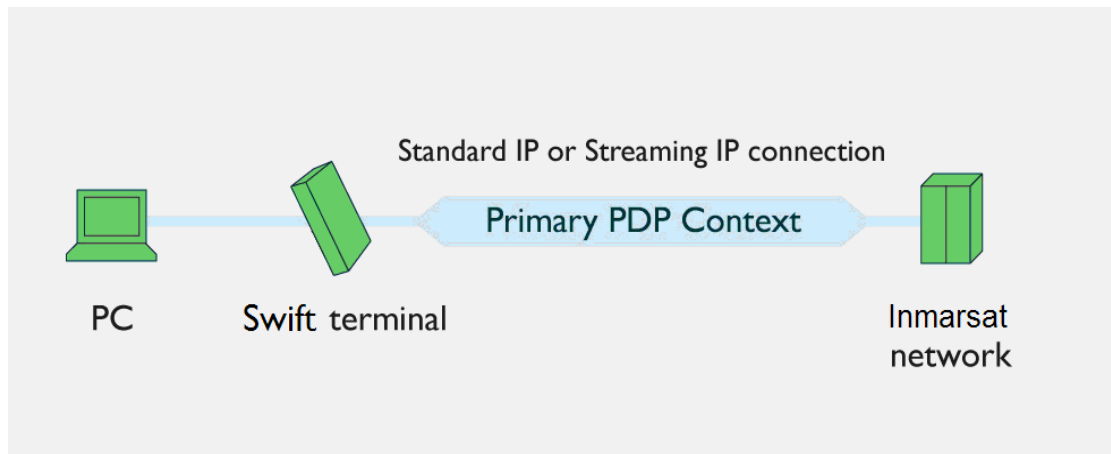
- the PDP address (which may be, for example, an IP address).
- the PDP type (that is, static or dynamic address).
- the QoS requested for this context – Standard or Streaming at the selected data rate.
- the Access Point Name (APN) of the external network to which connectivity is requested.
- your SIM card's identity number.
- any necessary IP configuration parameters (for example, security settings).

On receiving the *Activate PDP Context* message, the Inmarsat Network checks your subscription record to establish whether the request is valid. If the request is valid, a virtual connection is established between the terminal and the Inmarsat network and data transfer can then take place between the terminal and the external data network.

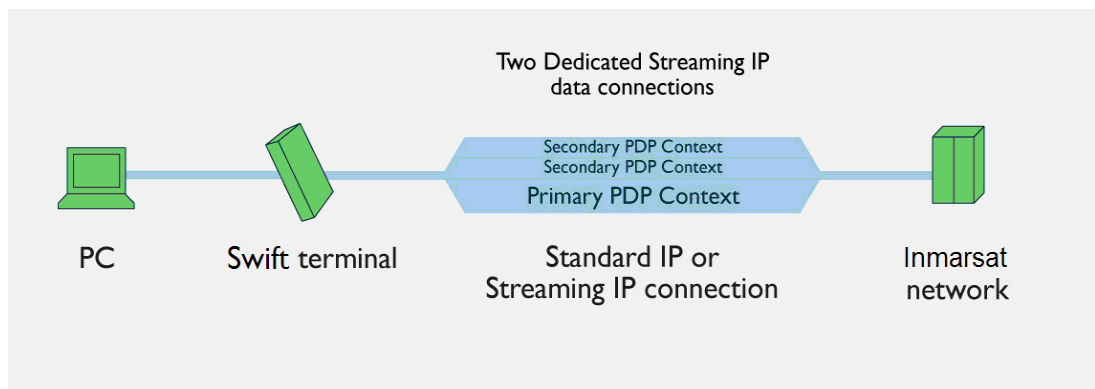
3.2 SwiftBroadband and PDP contexts

The SwiftBroadband terminal creates a PDP context for each IP data connection that you open to send or receive traffic over the Inmarsat Network. These contexts can either be primary or secondary.

If you open the Standard IP data connection or one of the pre-configured Streaming IP data connections in SwiftBroadband, the SwiftBroadband terminal opens a primary PDP context, as shown below. Primary contexts can each connect to a different APN and each get a public IP address.



If you open a dedicated streaming IP data connection, allocated to a particular application, the SwiftBroadband terminal opens a secondary PDP context, specifically for this connection, as shown below:



A secondary context is always associated with the primary PDP context open on the interface and shares the APN and IP address with the primary context. However, the secondary PDP context can have a different QoS from that of the primary PDP context.

Each terminal has a different method of managing PDP contexts and supports different combinations of primary and secondary PDP contexts.

4 SwiftBroadband and IP addressing

The SwiftBroadband terminal obtains a public IP address when it connects to the Inmarsat Network. Each of the computers connected to the terminal obtains a private IP address, either direct from the terminal's Network Address Translation (NAT) functionality or from a router connected to the terminal.

4.1 Address allocation

A Dynamic Host Configuration Protocol (DHCP) server dynamically allocates an IP address to each user connected to the Ethernet or WLAN interface, up to the maximum number of users allowed by the terminal specification. The DHCP server then maps the IP address to a network address for full NAT and Port Address Translation (PAT). Each user can therefore open a separate data connection from the terminal.

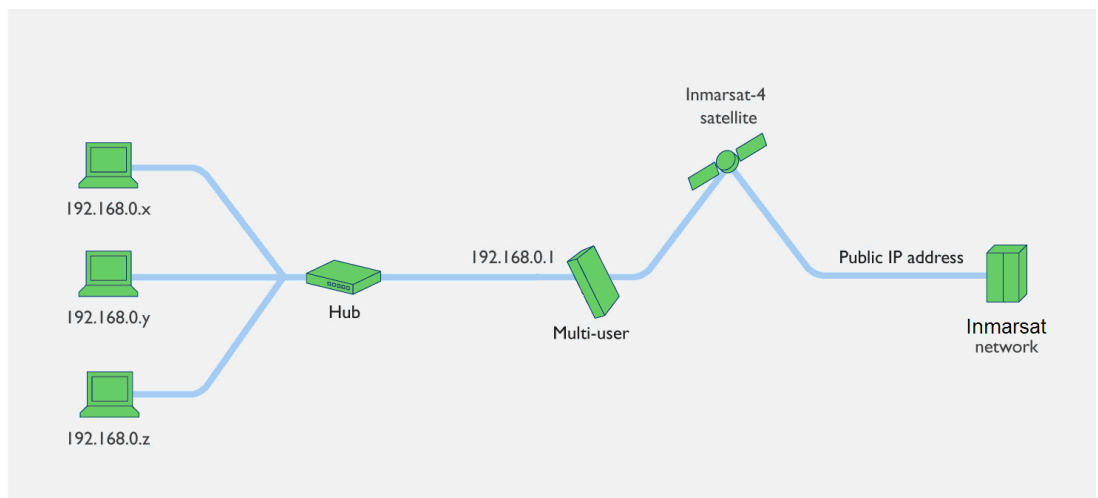
The public IP address of the terminal is allocated by your SwiftBroadband service provider and can be either static or dynamic. Dynamic configuration is carried out automatically.

NAT mode

In NAT mode, the terminal dynamically allocates IP addresses to the connected devices. Alternatively, you can manually configure the IP addresses using your operating system's administrative tools.

If multiple users are connected to the Ethernet interface, the terminal allocates a private IP address to each device connected to it from its pool of private IP addresses.

The following diagram illustrates how multiple private IP addresses allocated by the terminal correspond to one public IP address on the network. Therefore, each user must share the Standard or Streaming IP connection.



Modem mode

In Modem mode, the terminal does not allocate IP addresses to the connected devices.

The public IP address is allocated by your SwiftBroadband Service Provider to the connected device, which may be a computer if a single user is connected to the terminal, or a router if multiple users are connected to the terminal's LAN interface. Only one public IP address is allocated. If the terminal is connected to a router, the router can allocate private IP addresses to connected devices from its own pool of IP addresses.

The following diagram illustrates how multiple private IP addresses allocated by the router correspond to one public IP address. If multiple users are connected to the Ethernet interface over a router, only one user can request a Standard or IP connection.

5 Using TCP/IP and UDP/IP

This section gives recommendations for the use of applications based TCP/IP and UDP/IP, over the Inmarsat Network, provides information on the performance of each protocol on a streaming IP data connection, and recommends how to configure your data connections and applications to maximise performance.

5.1 Recommendations

- Use a Standard IP data connection for TCP applications, for example e-mail and FTP.
- Use a Streaming IP data connection for UDP applications, for example video streaming and audio streaming.

5.2 About TCP/IP

TCP traffic is better suited to a Standard IP data connection.

TCP (Transmission Control Protocol) is used for normal internet traffic and applications such as web browsers, FTP and so on, where data delivery must be guaranteed. TCP/IP requires packet retransmission, that is the re-sending of dropped or lost packets to ensure that all data is transmitted.

Packet retransmission is a standard feature on all networks running applications over TCP/IP. One result of this is the reduction in perceived IP throughput rates as the protocol waits for the re-transmission of dropped or lost packets. In addition, TCP/IP applications throttle their rate of packet transmission based on the capacity of the link. For these reasons, TCP is best suited to an IP connection optimised for packet re-transmission, and ideally with as large a capacity possible. Inmarsat recommends the Standard IP connection, with data rates of up to 432kbps, for TCP-based applications traffic over the Inmarsat Network.

The characteristics of TCP/IP traffic are not as well suited to the Streaming IP connections available on the Inmarsat Network. Each Streaming IP connection is a dedicated connection designed for a single IP packet stream at a fixed rate of throughput (up to 128kbps). The Streaming IP connection is better suited to time-critical applications, where rapid transmission of data is more important than dropped or lost packets. Such applications are better suited to the UDP protocol.

Should you decide to use TCP/IP applications over a Streaming IP data connection, you may experience the following:

- In the from-aircraft direction, a typical 10-15% reduction in throughput due to network signalling and application overheads, plus a further 10-15% reduction based on TCP packet retransmission. The achieved IP throughput could therefore be up to 30% less than the desired rate.
- In the to-aircraft direction, the effect on performance could be the same as the from-aircraft direction. In addition, there is the risk of further dropped packets should data burst at a rate higher than the capacity of the connection. In this scenario, packets are repeatedly lost and re-transmitted until the SwiftBroadband link has the capacity to forward them to their destination. This may cause a further 10% reduction in throughput.

5.3 About UDP/IP

UDP traffic is better suited to a Streaming IP data connection.

UDP (User Datagram Protocol) is used for applications such as video streaming or audio streaming, where lost packets don't need to be retransmitted and speed takes precedence. Unlike TCP/IP, any dropped or lost packets are ignored and compensated for or replaced by the application. This application intelligence optimises transmission speeds, and is particularly effective on non-contended connections, such as Streaming IP connections on the Inmarsat Network.

UDP applications throttle their transmission rate according to the capacity of the connection, but they do not retransmit packets. The achieved data rate is therefore much closer to the desired connection rate.

Inmarsat particularly recommends Streaming IP connections for live video and audio applications, which are better suited to the UDP protocol. Examples of such applications are Streambox and QuickLink.