ORBCOMM Messaging Services Description

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PREFACE

1. This publication describes the Messaging Services provided by the ORBCOMM communications system.
2. To obtain information relative to this or other ORBCOMM documents, send an email to: DOCUMENT_CONTROL@ORBCOMM.COM.

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CHANGE SUMMARY			
Revision	Date	CHANGE DESCRIPTION	Page(s)
B	2/16/1999	• Appendix B Editing – Section B.2 Service Enhancement: Acknowledgement, SMTP clarification – Table B.2, updated information – Section B.2.1.1, Text changes – Figure B.1, enhancement – Section B.3.1 New SMTP Application Acknowledgement, text update and figure addition.	All
C	3/23/00	• General Revision of document to incorporate enhancements in the ORBCOMM system.	All
D	12/19/01	• Revision D updates the ORBCOMM Messaging Services Description to reflect new ownership by ORBCOMM LLC	i-xi
E	2/14/05	• Extensive revision to all sections of document	All
F	3/13/07	• Corrected typographical errors • Corrected description of priority as not used • Added note about automatic disabling of unprovisioned SCs • Modified delivery plan details to reflect recent changes • Added note about possibility of duplicate USER COMMANDS • Added note about automatic disabling of unprovisioned SCs • Added description of O/R inclusion in Message-ID • Added description of originator of ATA message • Corrected tables to reflect acknowledgment behavior	Various 3-3 4-1 4-3 5-7 6-1 7-2 7-4 B-2, B-4

Chapter 1 Introduction

This section provides an overview of the structure and objectives of this document, the conventions used within it, and related documentation.

1.1 Document Structure

This document describes the system services provided to ORBCOMM system subscribers and the methods available to customers to access the ORBCOMM system. It is intended to be used both as a manual and a reference. A brief description of document content and order follow:

Chapter 1 describes the document structure and format of the document itself.

Chapter 2 gives a brief description of the ORBCOMM System.

Chapter 3 provides a description of the methods available to customers to access the ORBCOMM system, both the available physical interconnection options and the available access protocols.

Chapter 4 provides a guide to the aspects of the satellite modem provisioning process that affect messaging.

Chapter 5 describes each of the Basic Service Elements (BSEs), the foundation for all ORBCOMM system services.

Chapter 6 provides an overview of the message transmission process, detailing SC-originated and SC-terminated transmissions.

Chapter 7 describes the individual messaging features available to ORBCOMM system subscribers.

Appendix A defines the message transfer diagnostic codes and status codes used with the ORBCOMM System.

Appendix B defines internet acknowledgement feature.

Appendix C defines the Group Broadcast feature.

Appendix D provides details on the mapping between Simple Mail Transfer Protocol (SMTP) and X.400 Mail addressing.

Appendix E describes the special uses ORBCOMM makes of message headers in SMTP messages.

Appendix F lists the acronyms used in this document and their meanings.

1.2 Objectives

The intent of this document is to promote a consistent understanding among ORBCOMM staff, Licensees and Value Added Resellers (VARS) of the basic services and features that the ORBCOMM system delivers to system subscribers. Ideally, with this document, the *System Overview*, and the *ORBCOMM Serial Interface Specification*, as well as documentation supplied by the manufacturer of a satellite modem, it should be possible to efficiently design a successful application using the ORBCOMM system.

1.3 Conventions

Following the ORBCOMM tradition the word "message" in lower case refers generically to any of the ORBCOMM Basic Service Elements. The specific Basic Service Element MESSAGE (see Section 5.7) follows the small capitals convention described below.

This document uses the following text conventions:

TEXT APPEARING IN SMALL CAPITALS indicates an ORBCOMM Basic Service Element.

`Text appearing in a fixed-width font` indicates specific text to be used by the customer.

1.4 Related Documents

The following is a list of related documents that may be useful for understanding some elements of the Messaging Services Description. Taken together with SC manufacturer documentation, these documents are intended to provide a starting point from which a customer can quickly develop an application for the ORBCOMM system.

- *ORBCOMM System Overview*

  (document no. A89TD008)

  This document provides a basic description of the purpose and functionality of the ORBCOMM system.

- *ORBCOMM Serial Interface Specification*

  (document no. E80050015)

  This document describes the protocol for the serial link between the subscriber communicator (SC) and devices that connect to the SC.

- *Developer API Specification for the IP Gateway*

  (document no. G65050710)

  This document specifies the interface used to communicate with the ORBCOMM IP Gateway.

Chapter 2 ORBCOMM System Overview

The ORBCOMM System is designed to enable short communications between remote, often unmanned, locations and customer information hubs. Utilizing a constellation of low-Earth orbit (LEO) satellites and an extensive terrestrial infrastructure, ORBCOMM provides eight Basic Service Elements (BSEs) that are the foundation for the market-oriented services offered by ORBCOMM's Value Added Resellers. These elements offer a cost-effective method for sending and receiving short messages, and are particularly well-suited to serving remote areas that lack traditional communications options, and to widely distributed applications.

Table 2-1 lists the BSEs provided by the ORBCOMM system.

Table 2-1 -- ORBCOMM Basic Service Elements

Basic Service Element	General Characteristics
• DATA REPORTS	Short, SC-originated messages
• POSITION REPORTS	
• MESSAGE ENQUIRIES	
• POLLS	Short, SC-terminated messages
• USER COMMANDS	
• MESSAGES	Longer, bi-directional messages
• GLOBALGRAMS	
• BROADCAST MESSAGES	Longer, SC-terminated messages

The ORBCOMM System hardware and software components comprise a global, packet-switched, two-way data communication service optimized for short messages and small file transfers. As shown in Figure 2-1, the ORBCOMM system consists of three operational segments:

- A space segment with 35 LEO satellites.
- A ground segment consisting of Gateway Earth Stations (GESs) and Gateway Control Centers (GCCs,) located throughout the world. Each GCC provides the interface between the satellite communications equipment and the terrestrial equipment (e.g., Private Data Networks, the internet). A combination of a GCC and one or more GESs is often referred to as a Gateway.
- A subscriber segment consisting of the Subscriber Communicators (SCs) used by ORBCOMM system subscribers to transmit and receive data.

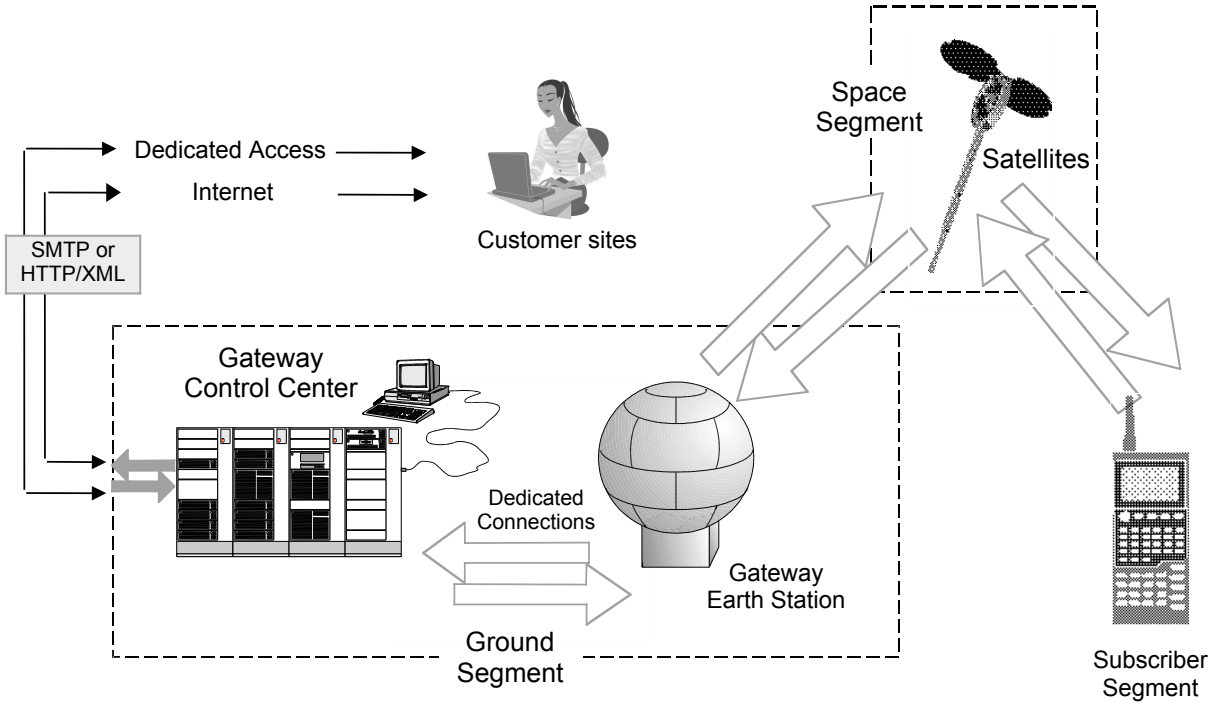

Figure 2-1 – ORBCOMM System

The ORBCOMM system allows an SC user to send (SC-originated) and receive (SC-terminated) short data packet messages to and from other parties, including other SCs, pagers, cellular phones, and networked computers. An SC communicates with an ORBCOMM satellite, which in turn communicates with the ORBCOMM Gateway. The Gateway then routes the message appropriately.

Communications between the SCs and the satellites occur within the VHF spectrum between 137 and 150 MHz. Uplink packets from are sent on a dynamically selected channel between 148 and 150.05 MHz, at 2.4 kbps. Downlink packets are sent on one of 15 downlink channels between 137 and 138 MHz, at 4.8 kbps.

Uplink communications between GESs and satellites occur within the 148.0 – 150.05 MHz range, at 57.6 kbps. Downlinks from satellites to GESs take place within the 137.0 – 138.0 MHz range, at 57.6 kbps.

Data transmission within the ORBCOMM System uses proprietary protocols. Data destined for users outside the ORBCOMM system is converted into Simple Mail Transfer Protocol (SMTP) format or into Extensible Markup Language (XML) by the GCC before being passed to a terrestrial interface for delivery.

Chapter 3 Customer Access Options

ORBCOMM provides a number of ways of sending and receiving data between customer hosts and an ORBCOMM Gateway. These can generally be divided into two categories, the type of network connection to the ORBCOMM system, and the application protocol used to communicate over those connections. The former category includes internet, leased line, and virtual private network connections. The available application protocols are Simple Mail Transfer Protocol (SMTP) electronic mail and the ORBCOMM IP Gateway.

3.1 Network Connections

ORBCOMM offers customers several options for interconnecting with the ORBCOMM system: public internet, virtual private network, or leased line. Customers can choose the best option for a particular application based on reliability, security, and cost requirements for the application in question.

Whatever the nature of the physical and network connections, customers must use a protocol stack of TCP/IP and SMTP/ESMTP for SMTP email. For XML access, TCP/IP, HTTP, and XML are used.

3.1.1 Internet

Most customers connect to ORBCOMM Gateways via the internet. Requiring minimal resources and almost no set-up, the internet is an attractive low-cost option. Measures to ensure the security of customer data over the public internet can still be implemented at the application layer according to the requirements of a particular application.

3.1.2 Virtual Private Networks

Customers desiring additional security may choose to implement a virtual private network (VPN) between their hosts and an ORBCOMM Gateway. A private network that uses the internet to connect distant locations at reasonable costs. Providing reliability, scalability, and security, TCP/IP over VPN is an increasingly popular choice for business-to-business communications. ORBCOMM offers the IPSec protocol for data encryption via VPN.

3.1.3 Leased Line Access

A user or reseller can use dedicated links, typically leased line or frame relay, to gain access to an ORBCOMM Gateway. ORBCOMM will support one of the following dedicated access technologies:

1. TCP/IP; or
2. OSI connectivity through leased lines.

Providing maximum security and availability, leased lines are customer-owned-and-maintained and customers are required to provide any necessary equipment.

3.2 Interface Options

ORBCOMM offers several different application protocol interfaces for customer use. Customers select the best option for a particular application based on cost, ease of use, and other requirements for their applications.

Within the ORBCOMM system, customer traffic is handled in a proprietary format that shares many of the features of electronic mail. Therefore, no matter what interface to the ORBCOMM system is used, an ORBCOMM Basic Service Element can still be referred to as having originating and destination addresses, a subject, and a message body.

3.2.1 SMTP Electronic Mail

SMTP is the most common choice for accessing the ORBCOMM system.

3.2.1.1 What is the Simple Mail Transfer Protocol?

SMTP is the standard for electronic mail transport across the internet. When you send an email message, SMTP packages your message in a kind of envelope and relays it to its destination. Multiple servers are often involved in the transport of the message, and as it passes through them, each one timestamps and tags it. Thus, when the message arrives, the recipient can get an idea of where it's been, and when it was sent. SMTP also handles error messages, sending notifications to senders when there is difficulty delivering their mail.

SMTP was introduced in a series of Request for Comment (RFC) documents, notably 772, 780, 788, and 821with the current base specification appearing in 2001's RFC 2821. For more information, go to:

http://www.rfc-editor.org/rfc/rfc2821.txt

ORBCOMM actually supports extended SMTP (ESMTP) as described in RFCs 1869 and 1891, allowing for acknowledgment of SC-originated messages. ORBCOMM SMTP service also provides a fully-featured acknowledgment service that is not typically available with internet email, allowing customers to be certain of the disposition of SC-terminated messages.

3.2.1.2 ORBCOMM SMTP Features

The ORBCOMM Gateway is connected to the internet to enable addressing of SCs using common internet protocol. The customer facility must have an agent capable of sending and receiving SMTP messages via TCP/IP.

ORBCOMM accepts both US-ASCII text and binary messages. For binary, the Gateway supports Multi-purpose Internet Mail Extension (MIME) encoding and decoding of internet mail messages, as specified in RFC-1521. It converts binary messages originating from an SC to the MIME format before sending them to the internet. The ORBCOMM Gateway also converts MIME-encoded internet-originated messages to binary data before transmitting the message to an SC.

The ORBCOMM Gateway is not sensitive to letter case for recipient and originator addresses and therefore the customer network must also be respectively case insensitive.

Due to the varying implementations within the internet for notifying message originators of undeliverable mail, the ORBCOMM Gateway does not transmit to the SC any failed delivered reports originating within the internet (i.e. delivery reports concerning failed SC-originated

messages). ORBCOMM's implementation of ESMTP does enable the use of Delivery Status Notifications as specified in RFC 1891, enabling delivery notification information to be returned to an SC for an SC-originated message.

The ORBCOMM Gateway does support, however, non-delivery reports over the internet for SC- terminated messages. Non-delivery reports for SC-terminated messages are generated when an error is detected in the message or when the message has expired in the OMS queue. The ORBCOMM Gateway converts the non-delivery report to an SMTP message before sending it to the internet-based message originator.

Priority messaging is supported by the SMTP protocol. The ORBCOMM System is capable of supporting priority levels and may use them to manage traffic flow during periods of high demand. ORBCOMM may require users to restrict use of certain priority levels based on traffic types or other criteria; additionally, messages with different priorities may be subject to different billing terms. Contact your ORBCOMM account executive for details.

3.2.2 IP Gateway

The IP Gateway is an ORBCOMM product first introduced in 1999 to meet the increasingly sophisticated needs of internet-aware businesses.

3.2.2.1 What is the ORBCOMM IP Gateway?

The ORBCOMM IP Gateway uses two internet technologies, HTTP and XML, to transfer messages between customer hosts and the ORBCOMM system, in much the same way as web pages are transferred between web servers and browsers.

HTTP is the language that clients and hosts on the World Wide Web use to communicate with each other. It uses a request/response protocol to transfer data back and forth. When you open a web page in a web browser, the browser uses HTTP to request the web page contents described by the Universal Resource Locator, or internet address, you enter. The contents of the web page are delivered to the browser using HTTP to carry the response. The specification for HTTP 1.1, the current standard, can be viewed (using HTTP) at:

http://www.w3.org/Protocols/rfc2616/rfc2616.html

XML is a system for encoding information that allows it to be transported across the internet. Pages on the World Wide Web are coded in Hypertext Markup Language, a cousin of XML. XML documents contain both data and information about how the data should be processed, allowing processing to be done by a client application rather than by a central server. XML also has the advantage of being, as its name implies, extensible, so it can be used as a general-purpose standard to transfer data of any kind. The current specification for XML 1.0, adopted in 2004, is available at:

http://www.w3.org/TR/2004/REC-xml-20040204/

The IP Gateway also provides the capability to check the status of ORBCOMM SCs and messages, and to delete SC-terminated messages that have not yet been delivered.

3.2.2.2 ORBCOMM IP Gateway Features

The ORBCOMM IP Gateway is connected to the internet to allow access using standard internet protocol. The customer facility must have an agent capable of using HTTP over TCP/IP, and capable of processing XML.

The IP Gateway supports both US-ASCII text and binary messages. Binary data is encoded in MIME format; in the SC-terminated direction, it must also be URL-encoded for posting via HTTP.

The IP Gateway provides built-in acknowledgment service for delivery and delivery failure. It also offers pre-scheduled transmission of SC-terminated messages.

Several special features are available using the IP Gateway that are not available via other interfaces. The IP Gateway provides direct access to the Gateway to retrieve information regarding the status of an SC or of an SC-terminated message, and the capability to delete an SC-terminated message that has been sent to the Gateway but not yet delivered to the destination SC.

3.2.3 SMTP Versus IP Gateway

Customers choosing between using SMTP email and the IP Gateway to interact with the ORBCOMM system should carefully consider the needs of their businesses. A few advantages of each method are outlined in Table 3-1.

Table 3-1 -- Advantages offered by ORBCOMM access methods

SMTP	IP Gateway
Simplicity	Flexibility
Wide acceptance	E-business standard technologies
Public domain implementations	Enhanced feature set

Chapter 4 Provisioning

To use the services of an ORBCOMM Gateway, an SC must be provisioned on the Gateway. At provisioning the SC is added to a customer account and activated for messaging. This section describes the elements of provisioning that can affect ORBCOMM messaging. Full provisioning instructions are available from ORBCOMM Customer Service (service.customer@orbcomm.com).

SCs attempting to transmit to an ORBCOMM Gateway on which they have not been provisioned risk having their transmitters automatically disabled by the Gateway, normally for a minimum period of 24 hours. During that period, the SC transmitter will not operate even if the unit is provisioned in the interim.

4.1 Roaming

An SC must be provisioned on every ORBCOMM Gateway that it will use. If the SC will need to send messages over multiple Gateways, it will need to be provisioned on each of those Gateways. In most cases, provisioning on multiple Gateways can be accomplished at the time the SC is provisioned on its primary Gateway. An ORBCOMM account executive can provide additional information regarding roaming services offered and the Gateway coverage areas.

4.2 SC Location

The physical address at which an SC is provisioned can affect the success of SC-terminated message delivery, if the SC is provisioned with a Location Type of fixed, or mobile regional (see Section 5.4). For these units, a reasonably accurate physical address for the SC installation—within a few hundred miles—is essential. See Section 6.2.2 for more details on SC-terminated message delivery.

4.3 Addressing

An internet email address is assigned to each SC provisioned on the ORBCOMM Gateway. The internet address is derived from an address created for the SC according to the X.400 mail standard, used for historical purposes. (Appendix D provides additional information on X.400 protocol and converting between X.400 and SMTP addresses.) Please note that while both types of address may be specified in correspondence from ORBCOMM, only the internet address can be used to reach an SC from outside the ORBCOMM system.

The basis of the address is the email domain associated with the ORBCOMM Gateway (e.g., orbcomm.net in the western hemisphere). Customers normally select a surname that, with an appended numeric suffix, becomes the left-hand part of the SC's email address. For example, if the surname SYSTEST is requested on the North American gateway, and 18 other SCs with that surname exist, the SC will be assigned the address SYSTEST19@orbcomm.net. If the requested surname ends in a number, the appended suffix will begin with the letter "X". Thus, if SYSTEST19 is requested, SYSTEST19X1@orbcomm.net will be assigned.

For SCs that will be accessed via the IP Gateway rather than via email, the SC surname is the same as the device alias used to identify the SC. Note that SCs that use the IP Gateway will also be assigned a valid SMTP email address.

While every SC must have a surname, ORBCOMM customers may also select a given name, which is appended to the left hand side of the SC email address. Additionally, customers may opt to assign organization and organizational unit (division, sub-division, section, and/or sub-section) names, each of which would become part of the right hand side of the SC email address (see Section D.3 for details.) Most customers use only a surname, or a surname and organization name.

4.4 Location Type

The location type of an SC determines how the ORBCOMM Gateway makes delivery attempts of SC-terminated messages to an SC. For fixed installations, or mobile installations with range limited to the equivalent of a metropolitan area, a location type of "Fixed" will maximize the efficiency of SC-terminated message delivery. For SCs that range over a wider, but still limited area—like the Southeastern United States, or the Iberian Peninsula—a location type of "Regional Mobile" would be appropriate. Finally, for SCs that are liable to be found almost anywhere across a continent, a location type of "Mobile" will provide the best delivery formula. For additional information on SC-terminated message delivery, see Section 6.2.2.

Also associated with location type is the choice between ASCII text and binary data in GLOBALGRAMS. If an application is designed to send binary data and will use GLOBALGRAMS, it must be provisioned to do so, or customer data can be lost.

4.5 Personal Identification Number (PIN)

SCs can optionally be programmed to use a PIN code when communicating with the ORBCOMM Gateway, as an added level of security. If a PIN code is used, that PIN code value must be recorded when the SC is provisioned. The PIN code is also programmed into the SC and is verified during most communications between the Gateway and the SC.

4.6 Message Blocking

Message blocking is an optional feature that allows customers to restrict the addresses to which their SCs can send messages, and those addresses that are allowed to send to the SCs. The Speed Dial addresses are used as permitted addresses. For additional information, see Sections 7.1.2 and 7.2.3.

4.7 Alternate Terminating Address (Message Forwarding)

Message forwarding allows copies of all SC-terminated messages to be sent to an alternate terminating address (ATA). Any valid SMTP address can be set as the ATA, and any of three forwarding rules can be applied: carbon copy, conditional or unconditional. (See Section 7.2.2 for detailed descriptions of the rules.) The appropriate address and rule should be specified when the SC is provisioned.

4.8 Delivery Plan

An SC's delivery plan is the scheme the ORBCOMM Gateway uses to attempt delivery of SC-terminated messages. Delivery plans are distinguished by four characteristics:

- *Automatic delivery attempts*: the number of times, immediately upon receipt and at one-minute intervals, that the ORBCOMM Gateway will attempt to deliver an SC-terminated message.
- *Time to hold*: the maximum time the ORBCOMM Gateway will hold the message before returning it as undeliverable.
- *Deletion after final attempt*: whether the message should be deleted after the automatic delivery attempts are exhausted, or held until the time to hold has been reached.
- *Use of piggybacking*: whether a message delivery attempt should be triggered by successful delivery of another message in either direction.

There are four standard delivery plans, specified by number. For more information about SC-terminated message delivery, see Section 6.2.2.

4.8.1 Delivery Plan 0

Delivery Plan 0 is the default delivery plan and is appropriate for most applications.

Automatic delivery attempts:	10
Time to hold:	5 days
Delete after final attempt?	No
Use piggybacking:	Yes

4.8.2 Delivery Plan 9

Delivery plan 9 is designed for applications for which SC-terminated messages might be problematic if preserved too long. Messages are returned after the automatic delivery attempts are completed or after two hours, whichever comes first.

Automatic delivery attempts:	10
Time to hold:	2 hours
Delete after final attempt?	Yes
Use piggybacking:	Yes

4.8.3 Delivery Plan 30

Delivery plan 30 is designed for applications that use SC-terminated messages to deliver data that changes on an almost minute-to-minute basis.

Automatic delivery attempts:	1
Time to hold:	15 minutes
Delete after final attempt?	Yes
Use piggybacking:	Yes

4.8.4 Delivery Plan -1

Delivery plan –1 is used for applications that have intermittent availability (e.g. applications that sleep most of the time). The only way for the SC to trigger message delivery is by issuing a Message Inquiry to the ORBCOMM Gateway.

Automatic delivery attempts:	0

Time to hold:	5 days
Delete after final attempt?	N/A
Use piggybacking:	No

4.9 IP Gateway

For an SC that will be used via the IP Gateway, it is necessary to indicate that fact at the time the SC is provisioned. The customer must also specify the IP Gateway User ID with which the SC will be associated. For new accounts, the customer must provide a password, the number of days messages will be retained in the IP Gateway database (3, 7 15, or 20), and whether SC-terminated message bodies should be stored after the message is sent. For additional information about the ORBCOMM IP Gateway, see Section 3.2.2.

4.10 Speed Dials

The ORBCOMM Gateway maintains a list of up to eight speed dials, or originator/recipient (O/R) addresses for each SC. Typically, these speed dials contain the addresses of frequent recipients or originators of messages to and from the SC. The use of speed dials results in a reduced number of bytes in a message. The speed dials can also be used in conjunction with message blocking to restrict the addresses that can send to the SC and those to which the SC can send. For more details about speed dials, see Sections 7.1.1 and 7.2.1. For more information on message blocking, see Sections 7.1.2 and 7.2.3.

The speed dials can be set to any valid SMTP address, or to the SMTP or X.400 email address of another SC. Speed dial #1 for SCs accessed via the IP Gateway will be set to IPGWY@IPGWY by default. Many IP Gateway users also set a speed dial to IPGWY@IPGWY.ORBCOMM.NET because that is the originating address on messages from the IP Gateway, and will reduce the number of bytes in an SC-terminated message.

An SC user can obtain a copy of the O/R addresses by commanding the SC to send a specific type of MESSAGE ENQUIRY to the Gateway (see Section 5.3). The Gateway then copies the O/R addresses into the body of an SC-terminated MESSAGE and sends it to the SC.

4.11 Broadcast Messaging

SCs that will be addressed using broadcast groups must be added to those groups via provisioning. The broadcast protocol is described in Appendix C. For information on establishing one or more broadcast groups, contact your account executive.

Chapter 5 Basic Service Element Descriptions

The ORBCOMM System combines space-based and terrestrial segments, radio frequency (RF) resources, and multiple access protocols to support Basic Service Elements (BSEs) that provide the foundation for market-oriented services. There are currently eight BSEs that provide the basic messaging service platform upon which the value-added features for specific subscriber markets are built.

This chapter provides additional detail about each BSE, including a description of benefits and suitability for specific markets or applications, and a table listing the BSE's properties. Table 5.1 provides a synopsis of each BSE's characteristics. Refer to Appendix A for a description of the message transfer status and diagnostic codes used with the BSEs within the ORBCOMM System.

Table 5-1 -- BSE General Characteristics

ORBCOMM BSE	General Characteristics	User Data Size	Benefits
DATA REPORT	Short, SC-originated binary messages	≤6 bytes*	The DATA REPORT is the most cost-effective service for sending very short messages from an SC to a host application.
POSITION REPORT	Short, SC-originated binary messages	6 bytes	The POSITION REPORT is the most cost-effective way to send geographic location (latitude and longitude) information from an SC , and allows the Gateway to record the SC position to optimize delivery of SC-terminated traffic.
MESSAGE ENQUIRY	Short, SC-originated messages	N/A**	The MESSAGE ENQUIRY permits use of queued SC-terminated delivery. Retrieves information about SC-originated message status and SC-terminated messages in queues.
POLL	Short, SC-terminated messages	N/A**	The POLL is an ORBCOMM-provided utility designed to facilitate polling of key SC data by host applications.
USER COMMAND	Short, SC-terminated messages	≤5 bytes*	The USER COMMAND is the most cost-effective service for host applications to use for controlling the operation of field applications.
BROADCAST MESSAGE	Longer SC-terminated messages	≤174 bytes	The BROADCAST MESSAGE is the most cost-effective way to reach large numbers of SCs. A single unacknowledged message can be received by a large number of SCs associated with a broadcast group.
MESSAGE	Longer, bi-directional ASCII or binary messages	>6 bytes*** <8000 bytes	MESSAGES are fully-featured data units that allow bi-directional communications and larger customer data fields.

ORBCOMM BSE	General Characteristics	User Data Size	Benefits
GLOBALGRAM	Longer, bi-directional ASCII or binary messages	≤182 SC-terminated bytes ≤229 SC-originated bytes	GLOBALGRAMS permit access to the ORBCOMM system in a store-and-forward mode when available satellites are not in view of an ORBCOMM Gateway.
*Unused bytes in REPORTS and USER COMMANDS are filled with null characters so their lengths as transmitted are always six and five bytes respectively. **ORBCOMM-defined codes used in place of user data bytes. For billing purposes, MESSAGE ENQUIRIES are counted as six bytes, and POLL COMMANDS are counted as five bytes. ***Typical: There is no lower limit on MESSAGE size, but DATA REPORTS represent a more efficient option for smaller data sizes			

5.1 DATA REPORT

DATA REPORTS use an abbreviated communications protocol compared to MESSAGES, making them a more cost-effective and faster way to send very short messages from an SC to a host application. DATA REPORTS are particularly well-suited for relaying monitored data from remote sites, such as tank capacity, product temperature, or intruder alerts. Table 5-2 lists the properties associated with the DATA REPORTS service.

Table 5-2 -- DATA REPORT Properties

Property	Description
Direction	SC-originated
Size & Data Properties	≤ 6 Bytes of binary data, MIME-encoded by ORBCOMM for delivery to customer host; unused bytes are padded with null characters
Intended/Typical Use	Highly condensed, pre-formatted data
Transmission Attempts	Retransmission is optional, dependent on selected service type
Addressing	Limited to speed dials 0-3 only; not counted as user data
Acknowledgement to Originator	Optional, dependent on selected service type
Polled or SC Initiated	SC can issue report autonomously or in response to poll
Priority	Two available priorities: Normal or Special Delivery, dependent on selected service type
Status and Diagnostic Codes	Standard; see Appendix A
Formatting	The ORBCOMM Gateway inserts `[REPORT]` into the subject field of the DATA REPORT for delivery
Notes: All 6 user bytes are contained in the message body—the subject and addressees are not counted for billing purposes.	

5.2 POSITION REPORT

The POSITION REPORT is ORBCOMM's standard format for sending geographic location (latitude and longitude) from an SC to a host application and the GCC. Typical mobile applications include tracking ships at sea and tracking trucking fleets as they move around a country. Another advantage of using a POSITION REPORT is that the ORBCOMM Gateway is able to maintain a more accurate location for the SC. This allows the optimization of delivery of SC-terminated traffic (see Section 6.2.2.3). For highly mobile applications, ORBCOMM recommends that regular POSITION REPORTS be a part of the application design. Table 5-3 lists the properties associated with the POSITION REPORT service.

Table 5-3 – POSITION REPORT Properties

Property	Description
Direction	SC-originated
Size & Data Properties	6 bytes of binary data, formatted according to ORBCOMM protocol
Intended/ Typical Use	Report SC location
Transmission Attempts	Retransmission is optional, dependent on selected service type
Addressing	Limited to speed dials 0-3 only; not counted as user data
Acknowledgement to Originator	Optional, dependent on selected service type
Polled or SC Initiated	SC-initiated or polled; for polled POSITION REPORT, SC receives POLL, calculates position, and sends the POSITION REPORT to the specified speed dial
Priority	Support two priorities: Normal or Special Delivery, dependent on selected service type
Status and Diagnostic Codes	Standard; see Appendix A
Formatting	The geodetic position is encoded and sent by the SC. The ORBCOMM Gateway converts the transmitted latitude and longitude into human-readable format and inserts the information into subject field for delivery, in the following format: `[POSITION REPORT:LAT=XXXXXXX,LON=XXXXXXXX].` Latitude and longitude values may be positive or negative and include up to 6 decimal places.
Note: The length of the message subject and any addressees are not counted for billing purposes, only the six bytes of the encoded position set in the original Report are considered user data.	

5.3 MESSAGE ENQUIRY

The MESSAGE ENQUIRY, also sometimes referred to as a Communications Command Message Enquiry or as a Subscriber Message Enquiry, uses a 4-bit code sent by an SC to retrieve a message or to request information about any messages held for the SC in the SC-terminated queue at the ORBCOMM Gateway. The 4-bit code is set by the Communications Command

issued by the user application to the SC (please refer to the *Serial Interface Specification* for more information.)

The MESSAGE ENQUIRY allows applications to maximize power efficiency. Instead of being required to stay powered on or in receive-ready mode, an SC can be turned-off or placed in sleep mode. When appropriate for the application, it wakes and issues a MESSAGE ENQUIRY to retrieve any SC-terminated messages sent since the last check, thus saving battery power. Table 5-4 lists the properties associated with the MESSAGE ENQUIRY service.

Table 5-4 – MESSAGE ENQUIRY Properties

Property	Description
Direction	SC-originated
Size & Data Properties	4-bit ORBCOMM-defined code specifies the desired action; length is considered to be six bytes for billing purposes
Intended/ Typical Use	Used for requesting a message or information about messages held in Gateway queue, such as the number, subject line, and message length
Transmission Attempts	Retransmission will be attempted until the SC default retries limit is reached or the transaction is successfully completed. Robust retransmission must be implemented at the application layer
Addressing	Not applicable; destination is available gateway or satellite only
Acknowledgement to Originator	Not available
Status and Diagnostic Codes	Standard; see Appendix A
Polled or SC Initiated	SC-initiated only
Additional Information	Type Code Options 0 - Request all SC-terminated MESSAGES and USER COMMANDS in Gateway queue. MESSAGES AND USER COMMANDS are sent or Gateway sends status information indicating no messages are available 1 - Request all SC-terminated MESSAGES and USER COMMANDS in Gateway queue smaller than 150 bytes. MESSAGES AND USER COMMANDS are sent or Gateway sends status indicating no messages smaller than 150 bytes are available 2 - Request all GLOBALGRAMS in Satellite queue. One GLOBALGRAM is sent for each MESSAGE ENQUIRY; or satellite sends status indicating no GLOBALGRAMS are available 3 - Request Speed Dial addresses. Gateway sends SC's registered Speed Dial addresses or a status indicating no information is available 4 - Unused 5 - Request delivery status of SC-originated message identified by gateway reference number. Gateway responds with status, indicating success or failure in reaching each recipient (Not currently supported)

Property	Description
	6 - Request list of subjects of messages in Gateway queue. Gateway replies with an SC-terminated MESSAGE that includes message size, subject, submission time, and originator for up to 256 messages, or sends a status indicating no information is available 7 - Request a single SC-terminated message identified by message subject index number. Message subject index numbers starts at 1, and are inferred from position relative to other message subjects in the response to a MESSAGE ENQUIRY with Type Code = 6. Gateway responds by sending specified message or sends a status indicating no information is available 8 - Request deletion of a single SC-terminated message identified by message subject index number. Message subject index numbers start at 1, and are inferred from position relative to other message subjects in the response to a MESSAGE ENQUIRY with Type Code = 6. Gateway responds by deleting specified message or sends a status indicating no information is available (Not currently supported)
Note: Gateway responses to MESSAGE ENQUIRIES are in the form of SC-terminated messages or System Responses. (See *ORBCOMM Serial Interface Specification* for more information.)	

5.4 POLLS

A POLL is a special type of SC-terminated message created by ORBCOMM to simplify the retrieval of certain data from an SC. The response from the SC to a POLL depends upon the command code included in the subject field of the POLL. The benefits of this service are cost, efficiency and ease of implementation. POLLS are very short messages that will generate desired information without extensive SC application development. They can also be used to prompt delivery of queued SC-terminated traffic for applications where the host may be only intermittently available. Typical user applications include tracking vehicle locations. Table 5-5 lists the properties associated with the POLL service.

Table 5-5 – POLL Properties

Property	Description
Direction	SC-terminated
Size & Data Properties	ORBCOMM-defined codes within the subject field: POLL type and speed dial destination for response. The length of user data is considered to be five bytes for billing purposes
Intended/ Typical Use	Highly condensed pre-formatted data for requesting information from the SC
Transmission Attempts	Twenty delivery attempts, regardless of delivery plan; desired response constitutes acknowledgment of receipt
Addressing	Any valid SC or broadcast group address; responses limited to speed dials 0-3 only (see note below)
Acknowledgement to Originator	Optional: see Section B.2
Priority	Supports normal priority only
Status and Diagnostic Codes	Standard; see Appendix A
Polled or SC Initiated	Not applicable
Formatting	The message subject must include the token `[POLL:ACK:TYPE=X;DEST=Y]` where X is the type code (see Additional Information below) and Y is the destination speed dial for the response (see Notes below)
Additional Information	Type codes: 0 = Calculate position estimate then send POSITION REPORT 1 = Send first SC-originated REPORT in SC queue 2 = Unused 3 = Unused 4 = Send one SC-originated MESSAGE 5 = Send one SC-originated MESSAGE or one SC-originated REPORT
Notes: Destination (Y), where Y is not 0, will replace the existing speed dial of DATA and POSITION REPORTS if the report already exists in the SC queue. Where Y=0, the SC will send to the speed dial specified in the existing REPORT. Destination (Y) has no effect upon queued SC-originated MESSAGES.	

5.5 USER COMMANDS

A USER COMMAND is the most efficient and cost-effective method for a host application to send data to an SC, and is often used to control the operation of remotely located equipment. A subscriber's host application sends a USER COMMAND to an SC, to which the SC application can then respond according to the information sent. Typical uses include turning a pump on or off at an unmanned site, thereby saving the costs and time associated with physically dispatching service personnel, or changing the thermostat setting on a refrigerated trailer. Table 5-6 lists the properties associated with the USER COMMAND service.

Table 5-6 – USER COMMAND Properties

Property	Description
Direction	SC-terminated
Size & Data Properties	≤ 5 Bytes of binary characters; unused bytes are filled with null characters
Intended/ Typical Use	Highly condensed data for delivering information to the SC application
Transmission Attempts	Retransmission according to SC Delivery Plan. Unlike SC-terminated MESSAGES, USER COMMANDS may be delivered to an SC more than once. Applications using USER COMMANDS should be tolerant of duplicate traffic.
Addressing	Any valid SC or broadcast group address
Acknowledgement to Originator	Optional: see Section B.2
Priority	Supports normal priority only
Status and Diagnostic Codes	Standard; see Appendix A
Polled or SC Initiated	Not applicable
Formatting	The message subject must include the token [COMMAND:ACK]

5.6 BROADCAST MESSAGES

The BROADCAST MESSAGING service allows data to be sent to a single address and delivered to a large number of SCs, all associated with a broadcast group. BROADCAST MESSAGES are single-packet transmissions of up to 174 data bytes that are transmitted once, without any acknowledgment protocol. If desired, a specific satellite can be targeted, allowing customers to tailor BROADCAST MESSAGES for the region served by that satellite at that particular time. For additional security, broadcast messages can only be sent by one of up to four senders authorized when the broadcast group is established.

SCs may be assigned to as many as five broadcast groups via the provisioning process (see Section C.3). When a BROADCAST MESSAGE is received that matches one of the SC's stored groups, the SC verifies the integrity of the message (if the message is identified as corrupted,

that information is specified in the subject line of the message). The BROADCAST MESSAGE is then passed to the SC application.

The BROADCAST MESSAGE protocol was designed to allow customers the maximum flexibility in application design. For instance, customers can design and manage a transmission and retransmission scheme that matches the needs of the specific application. An application providing metropolitan area-wide traffic information might have a substantially different implementation than a trailer tracking service, and the BROADCAST MESSAGE service can be tailored to the needs of both. See Appendix C for more details on BROADCAST MESSAGES. Table 5-7 lists the properties associated with the BROADCAST MESSAGE service.

Table 5-7 – BROADCAST MESSAGE Properties

Property	Description
Direction	SC-terminated
Size & Data Properties	Maximum length of user data is 174 bytes
Intended/Typical Use	One-to-many broadcast
Transmission Attempts	Each BROADCAST MESSAGE is attempted once. Retransmission, if desired, is managed at the application layer
Addressing	Any valid broadcast group. The sender must be one of up to four authorized senders for the broadcast group, and the index value of that sender is sent to the SC
Acknowledgement to Originator	Optional: see Section B-2. Positive acknowledgment of delivery to user (level 4) indicates only that the message was successfully transmitted over the listed satellites, not that it was delivered to any members of the broadcast group
Priority	Supports normal priority only
Status and Diagnostic Codes	Standard; see Appendix A
Polled or SC Initiated	Not applicable
Formatting	The message subject must include either `[BROADCAST]` or `[BROADCAST:SAT=XX]` where XX is the two-digit numeric identifier of the desired satellite. When passed to the application, the subject line will carry information about any identified corruption (see Section C-1)
Additional Information	The SMTP message address is in the format ALL@group_name.domain_name.tld where group_name is the assigned organizational name for the targeted broadcast group, and domain_name.tld is the normal domain for the ORBCOMM Gateway
Notes: Unlike in the case of an individual SC, the IP Gateway alias for a broadcast group does not correspond to the email address. The IP Gateway alias can be whatever the customer chooses. Broadcast service using broadcast groups is also available for POLLS and USER COMMANDS.	

5.7 MESSAGES

MESSAGES are the most versatile type of communication offered by ORBCOMM. Bi-directional and allowing for larger sizes than the more efficient USER COMMAND and DATA REPORT, MESSAGES are well-suited for providing personal communications services as well as for applications requiring larger data sizes. Table 5-8 lists the properties associated with the MESSAGE service.

Table 5-8 – MESSAGE Properties

Property	Description
Direction	SC-originated and SC-terminated
Size & Data Properties	No lower limit, but typically > 6 bytes. Body supports ASCII and binary formats. 8000 byte maximum SC-terminated size*
Intended/Typical Use	Communications of larger message content
Transmission Attempts	Retransmission according to SC Delivery Plan.
Addressing	Any valid SC or internet address, or speed dial, included as part of user data. Up to seven addressees may be included. In the SC-terminated direction, the originating address and up to six additional addressees (or the corresponding Speed Dial numbers) will be sent in the message body
Acknowledgement to Originator	Optional; see Appendix B
Polled or SC Initiated	SC-originated MESSAGES may be autonomously initiated or polled by an external application
Note: *The SC manufacturer or the SC's available memory may also limit the MESSAGE size	

5.8 GLOBALGRAM

GLOBALGRAMS, sometimes referred to as store-and-forward messages, are the type of communication used within the ORBCOMM system for SCs that are not within range of an ORBCOMM Gateway. An SC-originated GLOBALGRAM is received by a satellite from an SC and carried until the intended ORBCOMM Gateway is reached, where the message is transferred to the Gateway for delivery. An SC-terminated GLOBALGRAM is received at the ORBCOMM Gateway in the same manner as other SC-terminated traffic, and then placed aboard a particular satellite where it is stored until requested by the destination SC.

A satellite can store a maximum of 1000 pending SC-originated and 1000 pending SC-terminated GLOBALGRAMS, including up to 16 in each direction for a particular SC. The satellite will reject any messages after these thresholds are reached.

An SC can only send and receive GLOBALGRAMS when communication between its satellite and an ORBCOMM Gateway is not in progress. In areas where visible satellites may occasionally connect to an ORBCOMM Gateway, GLOBALGRAM use is limited.

The ORBCOMM satellites do not automatically deliver SC-terminated GLOBALGRAMS to an SC. To receive a GLOBALGRAM, the SC must send a MESSAGE ENQUIRY (see Section 5.3) to the specific satellite carrying that GLOBALGRAM. Users sending SC-terminated GLOBALGRAMS specify in the message subject the satellite on which the GLOBALGRAM should be carried. Table 5-9 lists the properties associated with the GLOBALGRAM service.

Table 5-9 – GLOBALGRAM Properties

Property	Description
Direction	SC-originated and SC-terminated
Size & Data Properties	ASCII and binary data formats are supported. Binary GLOBALGRAMS must be specified in SC provisioning (see Section 4.4). Maximum length of user data is 229 characters for SC-originated. Maximum length of user data is 182 characters for SC-terminated.
Intended/ Typical Use	Intended for limited length messages when SC cannot connect with a Gateway
Transmission Attempts	Protocols ensure delivery of information for SC-originated GLOBALGRAMS. No automatic transmission attempts for SC-terminated GLOBALGRAMS; SC must request using MESSAGE ENQUIRY.
Addressing	• Limited to one address per GLOBALGRAM • In the SC-originated direction, limited to speed dials 1-8 only • In the SC-terminated direction, any valid SC address. The speed dial number is contained in the Globalgram if the originating address is a speed dial for the SC • Address not part of user data
Priority	Supports normal priority only
Acknowledgement to Originator	Automatically supported between satellite and SC. Only confirmation level 2 is available for SC-terminated GLOBALGRAMS (see Appendix B)
Polled or SC Initiated	SC-initiated
Formatting	For SC-terminated GLOBALGRAMS, the message subject must include [GLOBALGRAM:SAT=XX] where XX is the two-digit numeric identifier of the desired satellite
Note: GLOBALGRAMS cannot be sent while the target satellite is connected to any ORBCOMM Gateway.	

Chapter 6 Message Transmission Process

When an SC sends a message to a satellite, the satellite sends the packet to a GES, which in turn passes the packet to the Gateway Control Center, or GCC. All messages must go through a GCC, as the GCC provides the interface between the GESs and customer access methods. If the intended recipient is another SC, then the message is sent from the GCC to the appropriate satellite and on to the receiving SC. If the recipient is not another SC, the message is converted into SMTP-formatted data or inserted into the IP Gateway database (as appropriate) and made available to the recipient via a terrestrial interface.

When a message is originated by a user outside the ORBCOMM system and sent to an SC, the path to the SC is essentially the reverse. An SMTP-formatted message traverses the terrestrial interface to the GCC, or a message is inserted in the IP Gateway database by the sender. The GCC then translates the message into the ORBCOMM proprietary protocol and sends it to the GES for transmission to the satellite. The satellite transmits the message to the recipient SC, completing the message path.

The protocol is robust and capable of recovering from errors at all stages without necessarily having to restart the session. A session can be maintained even when the satellite being used for communication passes out of view of the SC, if another satellite is available to continue the session.

Typically, messaging functions are managed by an application that controls the satellite modem at the core of the SC. The application may be embedded in the SC or reside in an external data terminal equipment (DTE) device. The following sections describe what occurs during message sessions without regard to the connection between the SC and the application. The *ORBCOMM Serial Interface Specification* provides details on the interface between the DTE and the SC. Refer to Section 6.1 for a more detailed description of the communication process for an SC-originated message, and to Section 6.2.1 for a more detailed description of the SC-terminated message communication process.

6.1 SC-Originated Messaging

SC-originated messaging falls mainly in to two categories: MESSAGES and REPORTS. The protocols for those BSEs are described in the following sections.

It should be noted that SCs attempting to transmit to an ORBCOMM Gateway on which they are not provisioned are subject to having their transmitters automatically disabled for a period of up to 24 hours. The disable-transmitter command would be sent by the GCC in lieu of the SC-O assignment or the packet acknowledgment in the following examples.

6.1.1 SC-Originated MESSAGE Protocol

When a message is queued in an SC, it contacts an available satellite and requests a channel with an acquire burst. The satellite assigns a channel to the SC with a slot assignment. The SC then requests permission to transmit from the GCC. The GCC opens a session and issues a channel assignment to the satellite to relay to the SC.

Once the session is opened, the SC transmits the MESSAGE data in SC-originated MESSAGE packets that are sent to the satellite for forwarding to the GCC. The GCC periodically acknowledges receipt of the data packets via the satellite to the SC, indicating that

transmissions may continue, or that some packets must be repeated because they were lost. Upon receiving the final MESSAGE packet, the GCC ends the session by issuing a session clear signal to the SC via the satellite. Figure 6-1 is a diagram showing what occurs during an SC-originated MESSAGE session

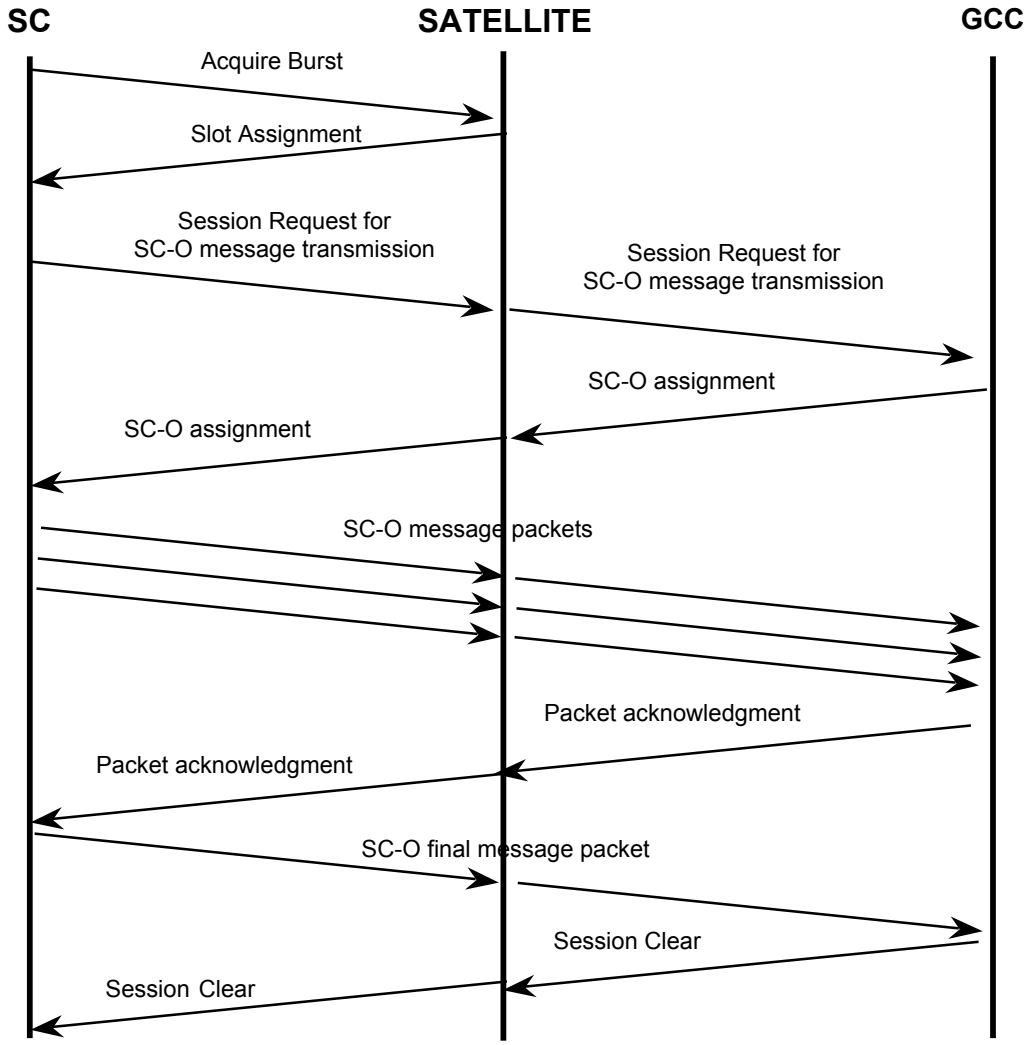

Figure 6-1 – SC-Originated MESSAGE Protocol

6.1.2 REPORT Protocol

DATA REPORTS and POSITION REPORTS are similar to messages, but simpler due to the smaller sizes. In a REPORT transmission, the slot assignment issued by the satellite in response to the SC's acquire burst is used to transmit the REPORT data. The response to the REPORT data from the GCC is an acknowledgment, the receipt of which by the SC signals the conclusion of the REPORT transmission. A REPORT transfer is detailed in Figure 6-2.

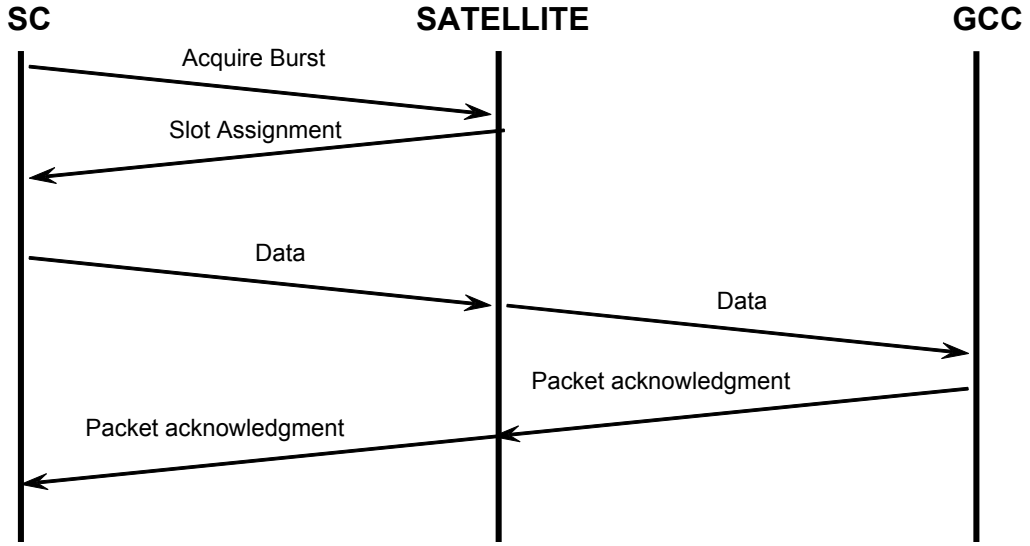

Figure 6-2 -- REPORT Protocol

6.2 SC-Terminated Messaging

Delivery of SC-terminated traffic is somewhat more complicated than delivery through other wireless short messaging systems because the architecture of the ORBCOMM network does not require mobile terminals to maintain registration with the network for delivery. Section 6.2.1 describes the basic structure of an SC-terminated MESSAGE session. Section 6.2.2 provides a discussion of the factors that determine how and when an SC-terminated message is delivered.

6.2.1 SC-Terminated Message Protocol

Figure 6-5 depicts an SC-terminated MESSAGE session. When a MESSAGE is received for an SC, the Gateway initiates a session with an SC-terminated assignment to the appropriate satellite(s). The targeted satellites issue the SC-terminated assignment over the air for delivery to the SC. When it receives an assignment, the SC sends an acquire burst to request permission to transmit from the satellite, which in turn issues a slot assignment. The SC sends the satellite a receiver ready indication, and the satellite conveys that to the Gateway.

The Gateway begins data packet transmission to the satellite, which passes the data to the SC. The SC responds with an acknowledgment indicating which packets should be transmitted next. Checksums are used to verify successful message transmission/receipt. Should one or more data packets not be correctly received during transmission, they are selectively re-transmitted.

Upon receiving the last packet of a group, the SC sends an acknowledgment to the satellite, using a slot assignment received by transmitting an acquire burst. The satellite passes the acknowledgment on to the Gateway. If there are more packets to be sent, or if packets must be re-sent, those are transmitted in the same manner. After the last packet is received, the SC issues a final acknowledgment in the same manner as the interim acknowledgments.

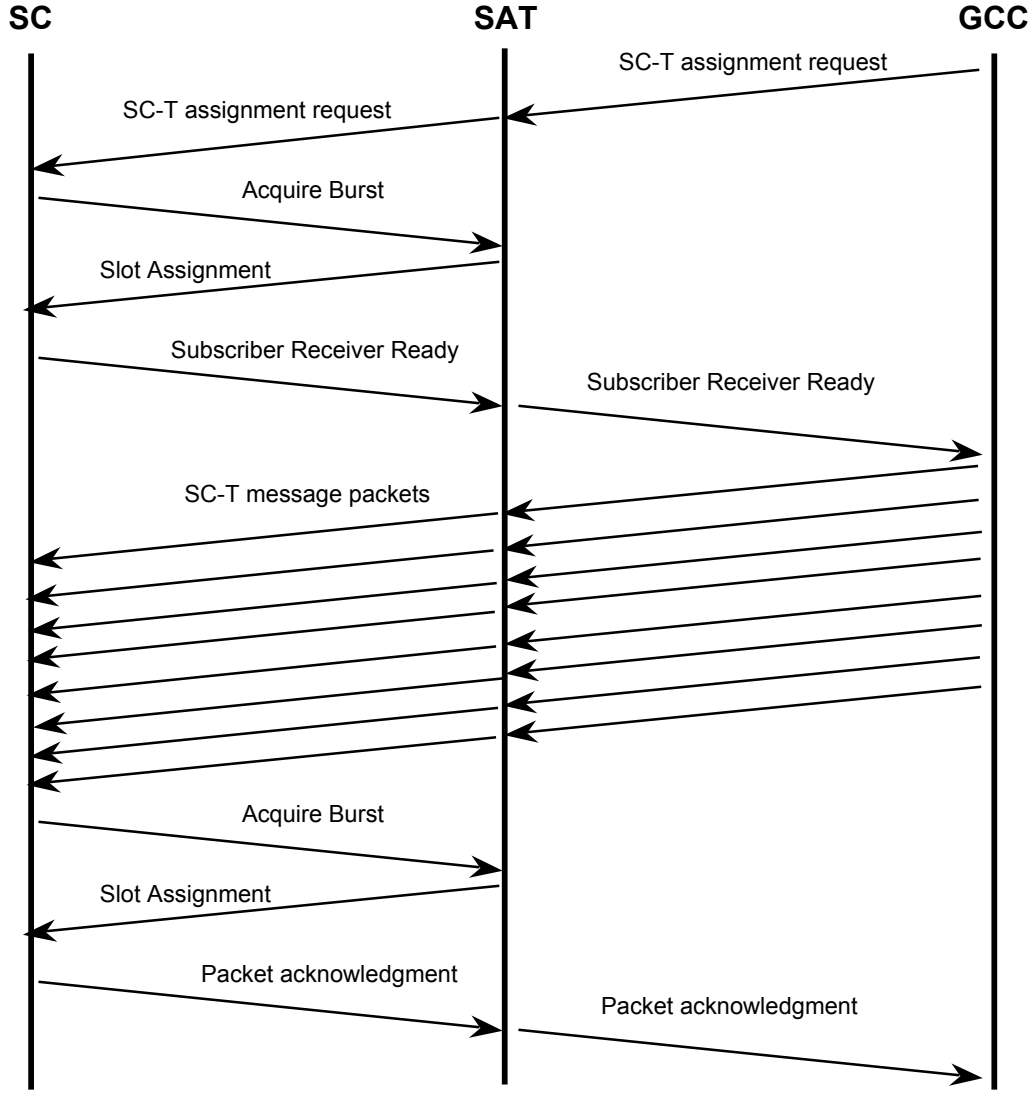

Figure 6-3 -- SC-Terminated MESSAGE Protocol

USER COMMANDS are similar, but the user data is transmitted in place of the SC-terminated assignment from the Gateway and no MESSAGE packets are required. The response to the GCC is in the form of a simple acknowledgment rather than a subscriber receiver ready indicator.

POLLS are a special case. As with USER COMMANDS, the customer data in a POLL is sent in place of an SC-terminated assignment. However, POLLS are re-transmitted less often than USER COMMANDS or SC-terminated assignments for MESSAGES, because it is anticipated that the SC may require time to process and respond to the POLL. Additionally, the response to a POLL may

be an acknowledgment, as with a USER COMMAND, or it may be a specially designated SC-originated MESSAGE, POSITION REPORT, or DATA REPORT.

BROADCAST MESSAGES are sent from the Gateway over the satellite specified in the message subject, or over all available satellites. As with USER COMMANDS, the user data is sent in place of the SC-terminated assignment. However, no retransmission is attempted and no acknowledgment is expected. Upon receipt, the SC checks for any data corruption, which is signaled in the message subject if discovered. The message is then sent to the DTE, which returns a link-level acknowledgment.

6.2.2 Factors Affecting SC-Terminated Message Delivery

When a message intended for an SC is received at an ORBCOMM Gateway, the ORBCOMM Message Switch (OMS) makes a determination about whether and in what manner to send the message based on a handful of criteria, including SC provisioning and satellite location.

6.2.2.1 Delivery Plan

The delivery plan with which the SC is provisioned determines whether there will be automatic delivery attempts, how many delivery attempts will be made, and over what time period the message will be available for delivery. Section 4.8 describes the available delivery plans.

Delivery plans provide the OMS with important information regarding how SC-terminated messages should be delivered. Formally, there are five parameters that can be set via the delivery plan, two of which can be set differently for different message priorities:

- *Delivery attempts*-the number of automatic attempts made to deliver a message, can be set differently for messages with different priorities
- *Interval between attempts*-the length of time between delivery attempts, can be sent differently for messages with different priorities
- *Time to hold*-the maximum amount of time a message is kept before being returned as undeliverable
- *Delete after final attempt*-a flag indicating whether a message should be deleted after the final automatic delivery attempt
- *Use piggybacking*-a flag indicating whether a message delivery attempt should be triggered by the successful delivery of another message in either direction

At this time, all delivery plans use the minimum interval between attempts of 60 seconds. Additionally, all current delivery plans specify the same values for the number of delivery attempts and for the interval between them, regardless of message priority.

Piggybacking is the term used to describe allowing a message to be triggered by delivery of another message: the second message “piggybacks” on the first. It is a way of maximizing the number of messages delivered when there is known to be a good connection between an ORBCOMM satellite and the destination SC. An SC-terminated message may piggyback on the delivery of another SC-terminated message, or on the successful transmission of traffic from the SC in question.

6.2.2.2 Order of Arrival

In general, messages that arrive first will be attempted first. However, the ORBCOMM system is not designed to deliver messages strictly in the order they are received. For example, once the automatic delivery attempts of the earliest message have been exhausted, the automatic delivery attempts of the next earliest message will be started, which can result in later messages being delivered before older traffic. Delivery of a USER COMMAND may be attempted before delivery of an earlier MESSAGE, and subsequent delivery attempts of the oldest MESSAGE (that has automatic delivery attempts remaining) and the USER COMMAND may be intermingled.

6.2.2.3 SC Location

SC location, and what the OMS has stored as the SC location, are the most complex factors affecting SC-terminated message delivery. The ORBCOMM Gateway stores a location for each provisioned SC. The location is set in one of three ways:

- *Provisioning*-At the time the SC is provisioned, it is associated with a physical address. That address is used as the initial SC position. A new location can also be established for an existing SC by changing the provisioning.
- *POSITION REPORTS*-Any ORBCOMM-style POSITION REPORT is considered authoritative for an SC and replaces the stored SC location. The location is valid for 96 hours or until superseded by another POSITION REPORT.
- *Sub-satellite point*-For SCs that are provisioned with a location type of mobile or regional mobile (see Section 4.4), the point on the earth directly below the last satellite through which the SC successfully communicated is used as an estimate of the SC's location. Note that the sub-satellite point is only used if no POSITION REPORT is received for 96 hours.

These methods suffice for most purposes. When it is time to make a delivery attempt on an SC-terminated message, the OMS makes a determination as to whether a satellite is likely to be in view of the SC based on the stored location. If the stored location is derived from a sub-satellite point, and therefore likely to be less accurate than other methods, satellites covering a wider area are used to attempt delivery of the message. For mobile and regional mobile SCs, the targeted delivery area is also expanded over the course of the delivery attempt, allowing substantial margin for error.

Customers concerned that poor position estimates may be interfering with timely message delivery should consider designing the SC application to send POSITION REPORTS on a regular basis. Such a strategy allows the OMS to be as accurate as possible in delivering messages

Chapter 7 Message Features

ORBCOMM offers a number of features that improve the convenience and effectiveness of the ORBCOMM Basic Service Elements (BSEs). Those features are described below.

7.1 SC-Originated Features

Speed dials, message blocking, delivery priority and acknowledgments are the features available for SC-originated traffic that enable the ORBCOMM service to be tailored to the needs of a particular application. Table 7.1 outlines the features available for SC-originated BSEs.

Table 7-1 – SC-Originated BSE Features

Feature	DATA REPORTS	POSITION REPORTS	MESSAGE INQUIRIES	MESSAGES	GLOBALGRAMS	Description Key: M = Mandatory O = Optional X = Not Applicable/ Supported F = Future support planned
Speed Dials (O/R Addresses)	M	M	X	O	M	Integers 1-8 represent user's chosen addresses registered to SC. Zero is for loopback test. Gateway substitutes full addresses for single byte to route message.
Message Blocking	O	O	X	O	O	Restricts SC from sending to addresses other than speed dials
Priority	O	O	X	O	X	Allows most important messages to be processed first by ORBCOMM system REPORTS use Service Type to specify the priority level.
Acknowledgments	O	O	X	M	X	Acknowledgments allow the SC application to receive confirmation of message delivery REPORTS use Service Type to specify the acknowledgment level.
Personal Identification Number	O	O	O	O	O	A PIN prevents the unauthorized use of a customer account.

7.1.1 Speed Dials

Also known as Originator/Recipient (O/R) Indicators, speed dials are the eight optional email addresses selected by the user for an SC that can be referred to by a single integer (1-8). When the message is received by the ORBCOMM Gateway, the single integer is expanded to the full corresponding address for proper routing. This reduces the total number of bytes sent over the ORBCOMM satellites.

Because of size restrictions, GLOBALGRAMS can only be sent to speed dials, and DATA REPORTS and POSITION REPORTS can only be sent to speed dials 1-3.

For SCs provisioned on the IP Gateway, Speed Dial 1 is typically set to "IPGWY@IPGWY," the internal address for the IP Gateway.

Speed Dial 0 is reserved for loopback test messages, messages that, when received by the ORBCOMM Gateway, are sent back to the SC that originated them. Using Speed Dial 0 in a DATA or POSITION REPORT causes the last byte to be stripped off and the other five bytes to be sent back to the SC as a USER COMMAND.

In instances where a Speed Dial is used, the first one used for a particular message is specified as the first digit of the Message-ID value in the SMTP message header. An application could use this to convey additional information when customer data is at a premium (e.g., while all Speed Dials point to address@foo.net, the use of Speed Dial 1 might indicate application report type #1, while Speed Dial 2 indicates type #2, etc.)

7.1.2 Message Blocking

An SC provisioned with SC-originated message blocking is restricted to sending to its eight speed dials. The ORBCOMM Gateway will discard messages sent to other addresses.

7.1.3 Message Priority

Message priority is a feature that allows messages to be processed in order of importance. The higher the priority, the faster the message moves through the network. However, the ORBCOMM message switch (OMS) does not terminate message sessions in progress; a new urgent message will remain queued until any active lower-priority message is completed.

ORBCOMM will only implement priority restrictions during periods of very heavy usage. If the system is lightly loaded and no queues (or only very short queues) are formed, there is little user benefit gained from the priority feature.

Functionally, within the ORBCOMM Gateway congestion control mechanisms use priority to stop SCs from sending messages not meeting a customer-designated priority threshold. The satellite broadcasts the identification number of connected Gateways and their minimum message priority thresholds in the downlink control information. All listening SCs that have messages queued for a listed Gateway must refrain from sending messages below the specified priority threshold. Only queued messages having a priority at or above the minimum priority threshold are sent. Messages below the minimum priority will remain in queue until channel utilization falls below the threshold.

The available priority levels, in ascending importance, are:

0. Non-urgent
1. Normal
2. Urgent
3. Special Delivery

Messages with different priorities may be subject to different billing terms. An ORBCOMM account executive can provide additional information.

7.1.4 Acknowledgments

Acknowledgments allow a customer to have confidence that SC-originated messages have reached the Gateway successfully. Acknowledgment levels for message delivery to the final recipient exist for historical reasons, but their use can provide unpredictable results for messages to internet mail destinations. While ORBCOMM's implementation of extended SMTP (ESMTP) allows for delivery notification information for SC-originated messages, the destination mail server and any mail servers relaying mail along the path to the destination server must also support the extended version of the protocol. In cases where the customer hosts support ESMTP, delivery notification is returned to the originating SC in a System Response (see the *ORBCOMM Serial Interface Specification*). In other cases, results described in a System Response as referring to delivery to the message recipient can be misleading.

An acknowledgment from the ORBCOMM Gateway is implicit in the delivery protocol for MESSAGES, and will be implemented regardless of the specified acknowledgment level. No acknowledgment by the Gateway is available for GLOBALGRAMS. For DATA REPORTS and POSITION REPORTS, the service type specified for the message determines the acknowledgment level. Acknowledgment levels are detailed in Appendix B.

7.1.5 Personal Identification Number (PIN)

Customers can implement a PIN at the time an SC is provisioned. The PIN is then used to validate all transactions between the SC and the Gateway, adding security against unauthorized use of a customer's account. The PIN can be any value between 1 and 9999. Note that while the establishment of a PIN is optional, if it is set in the SC provisioning or in the SC itself, it must be set in both.

7.2 SC-Terminated Features

Speed dials, message blocking, delivery priority, and acknowledgments are also available in the SC-terminated direction, as well as the Alternate Terminating Address and Group Addressing features. Table 7.2 lists the features available for SC-terminated BSEs.

Table 7-2 -- SC-Terminated BSE Features

Feature	APPLICATION POLLS	COMMANDS	MESSAGES	GLOBALGRAMS	BROADCAST MESSAGES	Description Key: M = Mandatory O = Optional X = Not Applicable/ Supported
Speed Dials (O/R Addresses)	M	M	O	M	X	Integers 1-8 represent user's chosen messaging addresses registered to SC. Gateway substitutes single byte for SMTP addresses for routing messages to Satellite/SC. Originating address not included in GLOBALGRAM unless a Speed Dial.
Alternate Terminating Address (ATA, Message Forwarding)	O	O	O	O	X	Messages forwarded to additional destination according to provisioned rule for SC.
Message Blocking	O	O	O	O	M	Restricts SC from receiving traffic from addresses other than speed dials. Broadcast traffic uses authorized sender list rather than speed dials.
Group Addressing Mailing List (EACH)	O	O	O	O	X	Allows an individual message to be received by each of a group of SCs identified by Organization name.
Group Addressing Broadcast (ALL)	O	O	X	X	M	Allows a single message to be received by a group of SCs specified by Organization and provisioned to a broadcast group.
Acknowledgments	O	O	O	O	M X	Allows user to receive delivery confirmation of SC-terminated traffic. BROADCAST MESSAGES are automatically acknowledged by the ORBCOMM Gateway as either transmitted or failed; no acknowledgment of delivery to SC is possible.
Personal Identification Number	O	O	O	O	X	A PIN prevents the unauthorized use of a customer account.

7.2.1 Speed Dials

Speed dials, or Originator/Recipient (O/R) Indicators, are the eight optional email addresses set by the customer via the provisioning process. These addresses can be referred to by a single integer (1-8). When the ORBCOMM Gateway receives an SC-terminated message for an SC in which the originator or another addressee matches one of the SC's speed dials, the corresponding number is substituted for the address before the message is sent over the ORBCOMM satellites. This reduces the total number of bytes sent over the air.

Because of size restrictions, originator address information is only included in GLOBALGRAMS when the originating address is a Speed Dial and is not carried at all in POLLS or USER COMMANDS.

An SC using the IP Gateway will always have speed dial #1 set to `IPGWY@IPGWY`. IP Gateway users often also set a Speed Dial equal to `IPGWY@IPGWY.ORBCOMM.NET`, the originating address from which SC-terminated messages created on the IP Gateway are sent. This causes the address to be abbreviated in the message delivered to the SC.

7.2.2 Alternate Terminating Address

ORBCOMM offers the option of forwarding SC-terminated messages to an Alternate Terminating Address (ATA). The address can be another SC or an address outside of the ORBCOMM system. The copy of the message sent to the ATA address indicates the same originator as the original message, with no explicit indication that the message is an ATA message.

Any of three rules can be applied to SC-terminated messages for the purposes of forwarding them:

1. Carbon copy forwarding: A copy of any message sent to the SC is sent to the ATA immediately upon receipt at the Gateway. Delivery of the message to the SC is also attempted according to normal procedures.
2. Conditional forwarding: Messages are only forwarded after all attempts to deliver the message to the destination SC are exhausted.
3. Unconditional forwarding: All messages are forwarded to the ATA directly without being sent to the SC at all.

7.2.3 Message Blocking

Messages received for an SC provisioned with SC-terminated message blocking must have an originator that matches one of the eight speed dials provisioned for the SC. Messages with originating addresses that do not match will be rejected by the ORBCOMM Gateway.

Broadcast groups do not have speed dials. However, when a broadcast group is created, a list of authorized senders is established, and is used for message blocking.

7.2.4 Group Addressing

It is possible for messages to be addressed to more than one SC at a time, without listing individual SC addresses. ORBCOMM offers two types of Group Addressing, Mailing List and Broadcast. When used via the IP Gateway interface, a separate alias must be established for each addressable group for which the customer requires service.

7.2.4.1 Mailing List

When a group of two or more SCs is provisioned with an Organization name (see Appendix D), a message can be addressed to that Organization using the word "EACH" in the left hand part of the destination email address. A message so addressed will cause a separate copy of the message to be sent to each SC provisioned with that Organization name.

For example, to send a separate message to each SC in the same organization as the SC with the email address TESTSC1@SYSTEST.ORBCOMM.NET, the message would be addressed to EACH@SYSTEST.ORBCOMM.NET.

Note that each resulting copy of the message will be considered a unique message for message delivery and billing purposes.

7.2.4.2 Broadcast

It is possible to establish through provisioning a broadcast group, and to provision one or more SCs to that group. The broadcast group is associated with an Organization name, and a message can be sent to all of the SCs in the Broadcast group by using the word "ALL" in the left hand part of the destination email address in a message sent to that Organization. The message will then be sent over one or more ORBCOMM satellites and received by any members of the group available at that time.

For example, to send a User Command or Broadcast Message to all of the SCs in the SYSCAST Broadcast group on the North American ORBCOMM Gateway, a message would be addressed to ALL@SYSCAST.ORBCOMM.NET. Unlike mailing list addressing, the individual SCs in a broadcast group do not need to have the corresponding Organization name provisioned as part of their individual email addresses.

Note that broadcast addressing is mandated for BROADCAST MESSAGES, but is not supported for MESSAGES or GLOBALGRAMS. For more information on the broadcast protocol, see Appendix C.

7.2.5 Message Priority

Customers can set different priorities for different SC-terminated messages, causing the Gateway to handle the messages differently during busy periods. The higher the priority, the faster the message moves through the network. However, the ORBCOMM message switch (OMS) does not terminate message sessions in progress; a new urgent message will wait until any active lower-priority message is completed.

ORBCOMM will only implement priority restrictions during periods of very heavy usage. If the system is lightly loaded and no queues (or only very short queues) are formed, there is little user benefit gained from the priority feature.

Functionally, within the ORBCOMM Gateway, congestion control mechanisms use priority to determine whether delivery attempts should be made for a message at a given time. Messages not meeting the required priority are not attempted. The status of such messages is re-evaluated

after approximately one minute. Messages below the minimum allowed priority will remain in queue until system utilization falls to nominal levels.

SC-terminated priority levels are set in an SMTP message by specifying a priority in the message header (e.g., "Priority: Normal"), and for an IP Gateway message by setting the appropriate flag in the SendMessage command. The available priority levels, in ascending importance, are:

0. Non-urgent
1. Normal
2. Urgent

Note that, unlike for SC-originated traffic, no Special Delivery option is available.

Messages with different priorities may be subject to different billing terms. Contact your ORBCOMM account executive for additional information.

7.2.6 Acknowledgments

Acknowledgments allow ORBCOMM customers to have confidence that their SC-terminated traffic has been delivered to the ORBCOMM Gateway, and even to the destination SC. Note that for Globalgrams and broadcast traffic, no acknowledgement of delivery to a specific SC is possible. Positive level 4 acknowledgments merely indicate successful delivery to the satellite.

Full acknowledgment services are provided automatically to customers using the IP Gateway interface, through the IP Gateway API. For customers using the SMTP interface, acknowledgments must be explicitly requested.

The supported acknowledgment levels are described in Appendix B. To enable the acknowledgment functionality via the SMTP interface, the desired acknowledgement level must be specified in the message subject line in the format:

```
[confirm=X]
```

where X is the acknowledgment level.

A detailed description of the SMTP acknowledgment service is provided in Appendix B.

7.2.7 Delivery Plans

The way SC-terminated messages are delivered to an SC is defined, in part, by the Delivery Plan with which the SC is provisioned. Delivery Plans define the number of automatic delivery attempts to be made for each message and other details about the message delivery protocol. For details, see Section 6.2.2.1. The available Delivery Plans are listed in Section 4.8.

7.2.8 Personal Identification Number (PIN)

Customers can implement a PIN at the time an SC is provisioned. The PIN is then used to validate all transactions between the SC and the Gateway, adding security against unauthorized use of a customer's account. The PIN can be any value between 1 and 9999. Note that while the establishment of a PIN is optional, if it is set in the SC provisioning or in the SC itself, it must be set in both.

Appendix A Status and Diagnostic Codes

This Appendix contains the message transfer diagnostic codes and status codes used with the ORBCOMM System. Status and diagnostic codes are generated by the GMSS to help application developers determine the causes for the success or failure for each of the message transaction and are returned to SCs and customer hosts in acknowledgments.

A.1 Status Codes

Table A-1 lists the message transfer status codes used in the ORBCOMM System.

Table A-1 -- ORBCOMM System Status Codes

Status Code	Meaning
0	Transfer failure
1	Unable to transfer
2	Conversion not performed
3	Reserved for future use
4-9	Reserved for future use
10	Transfer attempt failed but message has been requeued and will be attempted again
11	Response to COMMUNICATIONS COMMAND
12	Status unknown
13	No acknowledgement from recipient at this time, please wait
14	Message aborted by user
15	Message was received by indicated acknowledgement originator

A.2 Diagnostic Codes

Table A-2 lists the message transfer diagnostic codes used in the ORBCOMM System.

Table A-2 -- ORBCOMM System Diagnostic Codes

Diagnostic Code	Meaning
0	Unrecognized originator/recipient name
1	Ambiguous originator/recipient name
2	X.400 MTA congestion
3	Loop detected
4	Recipient unavailable
5	Transfer time-out

Diagnostic Code	Meaning
6	Body type not supported
7	Content too long
8	Convert impractical
9	Convert prohibited
10	Convert not registered
11	Invalid parameter
12-99	Reserved for future use
100	Message-level checksum failed
101	SC ID not registered
102	PIN code not valid
103	Requested gateway could not be found on any satellite downlink
104	Insufficient message priority (Gateway may be congested)
105	Satellite not responding (uplink may be congested)
106	SC access restriction
107	Subscriber terminal registration has expired
108	SC-originated message already exists in Gateway
109	No active session, or SC-originated message number error
110	Error occurred in Gateway while saving Message to non-volatile memory
111	Database error occurred in Gateway
112	No additional diagnostic information indicated
113	Maximum retries attempted
114	Globalgram is not permitted at this time
115	No satellite in view at this time
116	Position Report currently not available, but starting calculation
117	No position determination capability
118	Globalgram size exceeded
119	No SC-terminated Messages/Commands queued in Gateway
120	No SC-terminated Messages/Commands queued in Gateway of size less than 150 bytes
121	No Globalgrams queued in current satellite

Diagnostic Code	Meaning
122	Requested message deleted
123	No stored Satellite orbital elements
124	Registration request received, please wait
125	Registration granted by Gateway
126	Registration rejected by Gateway
127	Maximum number of Globalgrams (16) stored in current satellite
128	Invalid range of one or more fields
129 and above	Reserved for future use

Appendix B SMTP Acknowledgment Service

ORBCOMM Acknowledgments (ACKs) are used to provide message originators with information to determine the success or failure of a message reaching its intended destination. The ORBCOMM System supports two access protocols, SMTP and IP Gateway. Acknowledgment service is built into the IP Gateway protocols; this section describes the SMTP service.

Five acknowledgment service levels, 0 to 4 are defined and supported by the ORBCOMM system. These five levels are listed in Table B-1.

Table B-1 -- Acknowledgment Levels for ORBCOMM BSEs

Service Level	Description
0	No Acknowledgment
1	Acknowledgment is generated only if message fails to reach the GCC.
2	Acknowledgment is generated when message has successfully reached (or failed to reach) the GCC.
3	Acknowledgment is generated only if message fails to reach recipient.
4	Acknowledgment is generated when message has successfully reached (or failed to reach) the recipient.
Note that service levels 0 and 1 are only used for SC-originated traffic and refer to acknowledgments between the SC and any device terminal equipment in use.	

B.1 SC-Originated Acknowledgments

SC-originated acknowledgments are always available for use among any customer device terminal equipment, the SC, and the ORBCOMM Gateway. Customers wishing to use acknowledgment levels of three or four must ensure that mail servers for which SC-originated traffic is destined and any intervening relay mail servers are compliant with the Delivery Service Notification (DSN) extension to the SMTP protocol.

When a message is sent with an acknowledgment level of three or four the Gateway will attempt to deliver the message using the DSN protocol. If the destination server is not compliant, the Gateway will determine delivery success or failure based simply on delivery to that server. If the server is compliant, the Gateway will determine success or failure according to the DSN protocol. In either case, the result will be returned to the SC in a System Response (see the *ORBCOMM Serial Interface Specification*). Note that if the first destination server is not compliant with DSN, a false positive report of delivery can be returned to the originating SC.

System Responses indicating success (a status code of 15) are only issued once by the Gateway. System responses indicating other statuses are repeated until acknowledged by the SC. An SC may request the current delivery status of an SC-originated message by issuing the appropriate Communications Command.

B.2 SC-Terminated Acknowledgments

The ORBCOMM System supports service levels 2-4 for SC-terminated messages, as described in Table B-1. Because the ORBCOMM SC does not report actual delivery of a message to the end user (Device Terminal Equipment, mailbox user, etc.) from the SC, the GCC considers message delivery to the SC satisfactory for service level 4. Failure to deliver a message to the SC will generate a negative delivery report for service levels 3 and 4.

Broadcast Messages and Globalgrams do not support service levels 3 or 4. A positive delivery acknowledgment in such cases only indicates successful transmission of the message to the satellite.

The acknowledgment or delivery failure report is returned to the originator as a normal SMTP message.

B.2.1 Requesting SMTP Acknowledgments

The customer requests SC-terminated message acknowledgment via SMTP by specifying the desired acknowledgment level in the subject of a MESSAGE, POLL or USER COMMAND. The format for the specification is:

`[confirm=X]`

where X is one of the acknowledgment levels listed in Table B-2. This text is appended to any other content in the message subject. Table B-2 outlines the actions taken by the ORBCOMM Gateway in various scenarios for MESSAGES sent with each acknowledgment service level.

Table B-2 -- Results of Acknowledgment Level Selections for SC-Terminated MESSAGES

Specification of service level	Delivery to GCC failed	Delivery to the GCC successful	Delivery to SC sailed	Delivery to SC successful
[CONFIRM=2]	A	B	A	A
[CONFIRM=3]	A	B	B	A
[CONFIRM=4]	A	B	B	B

A. Not supported/no action taken

B. Email message is sent to originator to report delivery status. See Functional Specification for SC-terminated Confirmation for more details.

B.2.2 Acknowledgment Protocol Example

There are four parameters for this example:

a. An SMTP Host with the address `appsdeveloper@VAR.com`, is sending a USER COMMAND to an SC with the address `SC2@orbdomain.com`.

b. The message is sent Monday, 30 November 1998 at 23:39:02 UTC.

c. The GCC successfully transmits the message to the designated SC.

d. The SMTP host requests notification of the message's success or failure to reach the designated SC (acknowledgment level 4 as shown in Table B-1).

This example is outlined in a six-step sequence:

1. The SMTP host creates a message with two SC recipient addresses, SC1@orbdomain.com and SC2@orbdomain.com. Additionally, copies of the message are directed to the SC SC3@orbdomain.com and to the internet email address ceo@var.com.
2. The subject line of the message is
   `Configuration message[confirm=4]`
3. The message is sent to the GCC and processed.
4. The GCC strips out the `[confirm=4]`. It then sends the MESSAGE to the designated SCs. The SC with the surname SC2 receives the message and sends an acknowledgment to the GCC.
5. The GMSS creates an acknowledgment message to return to the originator of the MESSAGE. (The message is depicted in Figure B-1.)
6. Transaction complete

B.2.3 Acknowledgment formats

SC-terminated SMTP acknowledgments will contain the following message header fields:

- *From*-the address `gateway@orbdomain.tld` (where orbdomain.tld is the standard domain for the ORBCOMM Gateway);
- *To*-the originating address of the original message;
- *Date*-the date and time the acknowledgment was issued; and,
- *Subject*-a text description of the state of the original message.

The body of the acknowledgment message will contain the following fields:

- *Message Time*-the time the original message was received at the ORBCOMM Gateway;
- *Confirm Message Sub Type*-the type of acknowledgment being issued (see Table B-3 for a list of sub-types);
- *OMS Message ID*-the unique identifier used for the original message within the ORBCOMM Gateway;
- *Status* and *Diagnostic*-the current ORBCOMM status and diagnostic codes for the original message;
- *Subject*-the subject line of the original message;
- *Recipient*-the recipient of the original message to which the acknowledgment applies; and,
- *Addressed recipients*-the list of the addressees from the original message.

Figure B-1 illustrates an SMTP acknowledgment.

Note that separate acknowledgments can be issued for each ORBCOMM recipient of an SC-terminated message, and that the message may have different status and diagnostic codes for each addressee.

The message ID can be set by the customer in the original SC-terminated message by specifying a unique string of up to 40 characters in a SMTP header field entitled “Message-ID”. This ID will be preserved as part of the OMS Message ID returned in the confirmation. This

mechanism allows customers to determine without ambiguity the original message to which an acknowledgment refers.

```
(Message header, mail application dependent)
Date:  Fri, 30 Jul 99 11:52AM EDT
From:  gateway@orbdomain.com
To:  appsdeveloper@var.com
   Subject:  Message Delivery to ORBCOMM Gateway

(Message body)
Message Time:  Fri Jan 14 15:53:09 2000

Confirm Message Sub Type:  0

OMS Message ID:  us/telemail/orbdomain/XGW-000114154904+0000-10497.1

Status:  (15) Msg Sent OK

Diagnostic:  (112) No Additional Info

Subject:  Configuration message

   Recipient:  sc2///internet/us/telemail/orbdomain

Addressed Recipients(s):

       To:  sc1///internet/us/telemail/orbdomain,
                 Sc2///internet/us/telemail/orbdomain

       cc:  sc3///internet/us/telemail/orbdomain,
              ceo@var.com
```

Figure B-1 -- Sample SMTP Acknowledgment Message

The acknowledgment sub-type and the subject line of the acknowledgment message header are set according to the type of message for which the acknowledgment was requested and the circumstances in which it was issued. The most common scenarios are outlined in table B-3

Table B-3 -- Acknowledgment Characteristics for Common Scenarios

Scenario				
BSE Type	**Service Level**	**Event**	**Sub-type**	**Acknowledgment subject**
MESSAGE	2, 3 or 4	Arrival at Gateway	0	Message Delivery to ORBCOMM Gateway
MESSAGE	3 or 4	Exhaustion of automatic delivery attempts	1	All Attempts Exhausted – Msg Queued Waiting SC Comm
POLL	3 or 4	Final delivery failure	4	POLL:ACK:UNDELIVERED
USER COMMAND	3 or 4	Final delivery failure	7	Failed Delivery of User Command
MESSAGE	3 or 4	Final delivery failure	2	Failed Delivery of Message
MESSAGE	4	Successful delivery	3	Message Delivery to Recipient
POLL	4	Successful delivery	5	Poll Command Sent
POLL	4	Successful delivery, SC has nothing to send in response	6	Poll Command Sent – No data Available from SC
USER COMMAND	4	Successful delivery	8	User Command Sent

Appendix C Group Broadcast

The ORBCOMM Group Broadcast service permits customers to originate a single SC-terminated BROADCAST MESSAGE, USER COMMAND, or POLL for delivery to a group of subscribers. A group broadcast is delivered to one or more subscriber communicators (SCs) tuned to a single broadcast channel. Group broadcast is similar to an AM/FM car radio, in that a common station transmits a signal that is received by any radio in the area that is tuned to one of its preset radio channels.

C.1 Receiving a Group Broadcast

An SC has six broadcast radio identification numbers (IDs) that can be configured to monitor broadcast messages transmitted over the ORBCOMM System. Each of five of these IDs may be tuned to a broadcast radio channel established through provisioning. (The sixth ID is reserved for use by ORBCOMM.) A channel corresponds to a broadcast group name selected by the customer and assigned as the organization part of the SMTP mail address for the broadcast group. When an application or user originates a message to the broadcast group address, the ORBCOMM system associates the broadcast group name with the appropriate broadcast channel and sends the message over that channel. It is received by all SCs configured to listen to that channel ID that are awake and in view of the transmitting satellites at the time. Most broadcasts are transmitted over all satellites connected to a particular Gateway, although customers can target BROADCAST MESSAGES to be carried by particular satellites. The group broadcast service is capable of broadcasting a message to millions of SCs within the geographic coverage area of an ORBCOMM Gateway.

On receipt, the SC verifies the message checksums. If the checksums are correct, the BROADCAST MESSAGE is passed to the customer application with the subject line, "`Broadcast Message to Group #X`". If the checksums are incorrect, the subject contains the line "`Corrupted Broadcast Message to Group #X`". In either case, X represents the index number of the broadcast radio ID to which the BROADCAST MESSAGE was sent.

C.2 Message Addressing

The service offers a simplified method of addressing broadcast messages to SCs. Easy to remember group names replace pre-existing methods of addressing by Organization and Organizational Unit. To send a message to a group, the originator sends messages to groups using the following syntax:

```
ALL@GROUPNAME.DOMAIN.TLD
```

where `GROUPNAME` is the designated name of the broadcast group and `DOMAIN.TLD` is the standard right-hand part of the email address for the ORBCOMM Gateway (e.g., orbcomm.net.)

C.3 Provisioning

The ORBCOMM provisioning system is used for all additions, modifications, and terminations of Broadcast services including the setup of groups and the addition of members to those

groups. Each customer selects their own unique broadcast group name, adds members as appropriate, and can establish a list of authorized message originators for the broadcast group.

The size of a group is limited to 16 million SCs, and the total number of broadcast groups on a Gateway to 499,999. A single SC may be a member of up to five groups at a given time. The provisioning process for a group is as follows:

1. Customer requests a broadcast service/feature and provides the broadcast group name (up to 64 alphanumeric characters), the SCs that are to be members of the broadcast group (the SCs must themselves be provisioned individually), and the authorized originators for the group.
2. Customer Service enters the data into the provisioning system.
3. The provisioning system sends the new group information to the ORBCOMM Message Switch (OMS).
4. Each SC being added to a broadcast group must be turned on, powered up, and have an unobstructed view of the satellites.
5. The OMS sends an acknowledged command to the SC, tuning one of the five available broadcast radio channels, making it a member of the group.
6. Customer Service sends a confirmation to the customer that the new group/service has been established.

Note that SCs from different accounts could be members of the same broadcast group. If two resellers offer their customers the same third-party service, for example, SCs from both of those customer accounts might be assigned to a group provisioned by the third-party service provider. Because a broadcast group can only be associated with a single billable entity, the owner of the account with which the broadcast group is associated—the third-party service provider, in the example--would be billed by ORBCOMM for all broadcast messages to the SCs in the group.

If an SC is replaced with new equipment, the new SC must be provisioned to the desired broadcast groups, and the old SC must be removed from them. This includes tuning the new SC to the appropriate channels, and de-tuning the old ones.

C.4 Originator Authentication

All broadcast messages originating from an SMTP host application will be authenticated by the OMS before the message is sent to the broadcast group. The customer can specify up to four e-mail addresses that are authorized to send messages to the group.

Any of three matching rules can be applied to the authorized originators to authenticate them:

Exact match-The originating address must match the authorized address exactly.

Wild card match-The authorized originator must match the beginning or end (as specified) of the originating address exactly.

Contains-The authorized originator must be included in the originating address.

Table C-1 illustrates the matching rules for originator authentication.

Table C-1 -- Broadcast Originator Authentication Examples

Valid Originators (e-mail addresses)	Matching Rules	Authenticates
1Dispatcher@truckco.com **2Dispatcher@truckco.com** **3Dispatcher@truckco.com** **4Dispatcher@truckco.com**	Exact Match	Only allows **1Dispatcher@truckco.com** **2Dispatcher@truckco.com** **3Dispatcher@truckco.com** **4Dispatcher@truckco.com** and no others to originate a broadcast
*__truckco.com__	Wild card match	Allow any originator e-mail address ending with truckco.com to send a broadcast message. For example: ernie@dispatch.**truckco.com**
truckco*	Wild card match	Allow any originator e-mail address starting with truckco to send a broadcast message. For example: **truckco**_dispatch@freemail.com
truckco	Contains	Allows any originator with truckco as part of their e-mail address to originate a broadcast message. For example: 623**truckco**dispatcher@freemail.com dispatcher@**trucko.**bigcorp.com
Note: Wild card character may only be first or last character of authorized originator.		

C.5 Sending a Group Broadcast Message

A valid originator addresses a message as described in Section C.2.

The subject field is used to specify the type of broadcast service. USER COMMANDS, POLLS, and BROADCAST MESSAGES can be used in conjunction with the broadcast protocol. The appropriate format of the subject line for each type of BSE is described in Table C-2.

If a BROADCAST MESSAGE is being transmitted, the originator may specify the satellite over which it is desired that the BROADCAST MESSAGE be transmitted. That specification is made in the subject of the BROADCAST MESSAGE as described in Table C-2.

The ORBCOMM Gateway receives the message and determines if it has been originated by a valid originator address. If the originator is valid, the Gateway sends the message to the group specified in the recipient address.

Table C-2 -- Broadcast BSE Subject Formatting

BSE Type	Subject field
User Command	[COMMAND] (See Section 5.5 for additional information.)
Poll	[POLL:TYPE=X;DEST=Y] where X is the poll type and Y is the Speed Dial to which the response is to be sent (see Section 5.4).
Broadcast Message	[BROADCAST] if the Broadcast Message is to be directed to any available satellites, or [BROADCAST:SAT=XX] where XX is the number of the satellite over which the Broadcast Message is to be sent (see Section 5.6)

Broadcast traffic will be sent immediately on a best-effort basis to all satellites in view of a Gateway, except in the case of a BROADCAST MESSAGE where the destination satellite is specified, in which case the BROADCAST MESSAGE will only be sent via that satellite. If the specified satellite is not connected to the Gateway, the BROADCAST MESSAGE will be marked as undeliverable and discarded. Otherwise, any broadcast traffic will be sent once over each appropriate satellite.

BROADCAST MESSAGES are automatically acknowledged by the ORBCOMM Gateway as either transmitted or failed. The sender can request acknowledgment for broadcast POLLS and USER COMMANDS using the SMTP acknowledgment service described in Appendix B. Any positive delivery indication for any broadcast service merely indicates that the message was transmitted over at least one satellite. Broadcast messages are not automatically acknowledged by the SCs, but the application or the user can send an acknowledgement message if required for the application.

Appendix D X.400 and SMTP Addressing

For historical reasons, X.400 addresses are widely used within the ORBCOMM system. While most of the details of the X.400 mail protocol are not important to ORBCOMM customers, X.400 protocol addressing and how it relates to SMTP addressing can be important.

D.1 X.400 Addressing

An X.400 address consists of a collection of attributes known as the X.400 Originator/ Recipient (O/R) name (also referred to as X.400 O/R name or X.400 O/R address). Table D-1 lists some of the more common fields used to compose X.400 O/R names and the symbols that represent each field. For ORBCOMM SCs, the total number of characters in the X.400 address is limited to 128.

The internet address of the SC acts as an alias of the X.400 address and can take the X.400 surname and other fieldnames from the X.400 address.

Table D-1 -- Fields and Symbols in X.400 O/R Names

X.400 O/R Name Field	Symbol	Field Length (Characters)	Required or Optional
Given Name	/G	16	Optional
Surname	/S	40	Required
Country Name	/C	2	Required
Administrative Management Domain	/ADMD or /A	24	Required
Private Management Domain	/PRMD or /P	24	Required
Organization	/O	64	Optional
Organization Units 1-4 (Division, Sub-division, Section, Sub-section)	/OU	32	Optional

An SC could be addressed as follows:

/G=JOE/S=SMITH3/C=US/ADMD=TELEMAIL/PRMD=ORBCOMM

where the individual's name is Joe Smith and he is located at ORBCOMM.

D.2 Internet Addressing

Each SC provisioned on an ORBCOMM Gateway is assigned a X.400 address and an SMTP conversion of that address, which is pre-pended to the Gateway internet domain to create the SMTP address. For example, an SC on the North American Gateway could be addressed as follows:

smith3@orbcomm.net

where smith3 is both the internet username and the SC's X.400 surname within the ORBCOMM Gateway.

D.3 Address Mapping

X.400 addresses can be mapped directly to internet addresses. The ORBCOMM Gateway supports RFC- 1327 address mapping tables. There are two types of address mapping tables:

- mapping SMTP address domains into X.400 addresses (RFC1327-mapping2); and
- mapping X.400 address domain details into SMTP address (RFC1327-mapping1)

The following paragraphs provide examples of both types of mapping.

An SC could be addressed as follows:

```
joe.smith3@orbcomm.net
```

This is equivalent to the following X.400 address:

```
/G=JOE/S=SMITH3/C=US/ADMD=TELEMAIL/PRMD=ORBCOMM/
```

Organizations and organizational units can also be included in the SC address. Organizational units in the SMTP address are assigned lower significance the further to the left that they appear. Thus, an SC can be addressed as follows:

```
joe.smith3@ou4.ou3.ou2.ou1.org.orbcomm.net.
```

This is equivalent to the following X.400 address:

```
/G=JOE/S=SMITH3/O=org/OU=ou1/OU=ou2/OU=ou3/OU=ou4/C=US/
ADMD=TELEMAIL/PRMD=ORBCOMM/.
```

During the address mapping, initials (/I=) and generation (/GQ=) will be omitted.

With the X.400 address:

```
/G=JOE/S=SMITH3/I=J/G=III/O=org/OU=ou1/OU=ou2/OU=ou3/
OU=ou4/C=US/ADMD=TELEMAIL/PRMD=ORBCOMM/
```

the internet address will be:

```
joe.smith3@ou4.ou3.ou2.ou1.org.orbcomm.net
```

Appendix E SMTP Message Formatting

ORBCOMM makes use of the SMTP message headers to provide additional information about and control of messages. In the SC-originated direction, different header information may be included depending on whether a message is transferred via the normal mechanism, or through redundant means. In the SC-terminated direction, the SMTP header is used to specify the message body type, the message priority and the message number, if desired.

E.1 SC-Originated SMTP Headers

For purposes of redundancy, ORBCOMM has more than one mechanism by which SC-originated SMTP messages may be sent from the Gateway. The use of the back-up mechanism results in messages carrying different SMTP message header information than when the message is transmitted via the normal path. In both cases, message headers are compliant with SMTP standards.

Some messages may be passed via the back-up path even during normal Gateway operations. This path is used for messages the addressees of which include a speed dial address that is not provisioned, and all SMTP acknowledgment messages (see Appendix B). Other messages may follow this path as needed to provide optimal system performance.

Note that some header information is dependent on the specific path messages take to their destination and can potentially vary from one message to the next. In general, customer mail servers should be prepared to accept any standards-compliant message header in messages from ORBCOMM.

While the examples below are SC-originated Messages, all SC-originated traffic passed via SMTP is subject to the same variations.

E.1.1 Messages sent via normal path

Figure E.1 illustrates a typical SC-originated message with a body in ASCII text format. Fields in bold do not have equivalents in messages sent via the back-up mechanism.

```
From TEST.SC1@TRAINING.INTL.DC.ENGINEERING.ORBCOMM.orbcomm.net Tue Jul 17 19:30:43 GMT
2003
Received: from omss (omss.orbcomm.net [xxx.xxx.xxx.xxx])
by fw1.orbcomm.net (8.9.3.1f/8.9.3.1h.fw) with ESMTP id TAA09674
for <somebody@foo.com>; Tue, 17 Jul 2003 19:30:56 GMT
From: TEST.SC1@TRAINING.INTL.DC.ENGINEERING.ORBCOMM.orbcomm.net
Date: 17 Jul 2003 19:30:42 +0000
Message-ID: <"37743799 0060 3b549262"* @MHS>
Subject: Sample 1
To: somebody@foo.com
Priority: normal
X-sat_id: 40
X-ncc_id: 101
X-ncc_mha_ref: 96
X-ack_level: 2
Mime-Version: 1.0
Content-Type: text/plain; charset=us-ascii
Content-Disposition: inline
Content-Transfer-Encoding: 7bit

Sample 1 message body
```

Figure E-1 -- SC-originated text message via normal path

Figure E-2 illustrates an SC-originated message with a binary-encoded body type.

```
From TEST.SC1@TRAINING.INTL.DC.ENGINEERING.ORBCOMM.orbcomm.net Tue Jul 17 20:09:37 GMT
2003
Received: from omss (omss.orbcomm.net [xxx.xxx.xxx.xxx])
by fw2 (8.9.3.1f/8.9.3.1h.fw) with ESMTP id UAA08637
for <somebody@foo.com>; Tue, 17 Jul 2003 20:09:54 GMT
From: TEST.SC1@TRAINING.INTL.DC.ENGINEERING.ORBCOMM.orbcomm.net
Date: 17 Jul 2003 20:09:36 +0000
Message-ID: <"37743799 0064 3b549b80"* @MHS>
Subject: Sample Message 2
To: x400@omss.orbcomm.net
Priority: normal
X-sat_id: 40
X-ncc_id: 101
X-ncc_mha_ref: 100
X-ack_level: 4
Mime-Version: 1.0
Content-Type: application/octet-stream; name="3b549b80.att"
Content-Disposition: attachment; filename="3b549b80.att"
Content-Transfer-Encoding: Base64

U2FtcGxlIGJpbmFyeSBlbmNhcHN1bGF0ZWQgbWVzc2FnZS4NCg==
```

Figure E-2 -- SC-originated binary message via normal path

E.1.2 Messages sent via back-up path

Figure E-3 represents a message with an ASCII text body sent via the back-up delivery mechanism. Fields in bold do not have equivalents in messages sent via the normal delivery path.

```
From SC4@orbcomm.net Tue Mar 7 03:51:54 GMT 2003
Received: from omss_us.orbcomm.net (omss_us.orbcomm.net [xxx.xxx.xxx.xxx])
by fw2.orbcomm.net (8.9.3p2/8.9.3p2.fw2525 (GMSS3.3E Internal)) with ESMTP id DAA06505;
for <somebody@foo.com>; Tue, 7 Mar 2003 03:51:56 GMT
From: SC4@orbcomm.net
Received: (from root@localhost)
by omss_us.orbcomm.net (8.9.3p2/8.9.3p2.isocor (GMSS3.3E)) id DAA06505;
for <somebody@foo.com>; Tue, 7 Mar 2003 03:51:54 GMT
X400-Received: by mta orb in /PRMD=orbcomm/ADMD=telemail/C=us; Relayed; 07 Mar 2003
03:51:52 +0000
Date: 07 Mar 2003 03:51:43 +0000
Delivery-Date: 07 Mar 2003 03:51:53 +0000
Message-Type: Multiple Part
X400-Originator: SC4@orbcomm.net
X400-MTS-Identifier: [/PRMD=orbcomm/ADMD=telemail/C=us;gateway 37773053 0051 38c47ccf.6]
X400-Recipients: non-disclosure
Original-Encoded-Information-Types: IA5-Text
X400-Content-Type: P2-1984
Message-ID: <"37773053 0051 38c47ccf"* @MHS>
Importance: normal
Subject: Sample Text Message sent as IA5
Autoforwarded: FALSE
To: somebody@foo.com
CC: me2@foo.com, me3@foo.com
Priority: normal
Conversion: Allowed
Conversion-With-Loss: Allowed
Alternate-Recipient: Prohibited

This is a sample text message...
Testing 1 2 3...
```

Figure E-3 -- SC-originated text message via back-up path

Figure E-4 illustrates an SC-originated message with a binary-encoded message.

```
From SC4@orbcomm.net Tue Mar 7 03:53:27 GMT 2003
Received: from omss_us.orbcomm.net (omss_us.orbcomm.net [xxx.xxx.xxx.xxx])
by fw2.orbcomm.net (8.9.3p2/8.9.3p2.fw2525 (GMSS3.3E Internal)) with ESMTP id DAA06505;
for <somebody@foo.com>; Tue, 7 Mar 2003 03:53:29 GMT
From: SC4@orbcomm.net
Received: (from root@localhost)
by omss_us.orbcomm.net (8.9.3p2/8.9.3p2.isocor (GMSS3.3E)) id DAA06505;
for <somebody@foo.com>; Tue, 7 Mar 2003 03:53:27 GMT
X400-Received: by mta orb in /PRMD=orbcomm/ADMD=telemail/C=us; Relayed; 07 Mar 2003
03:53:22 +0000
Date: 07 Mar 2003 03:53:14 +0000
Delivery-Date: 07 Mar 2003 03:53:23 +0000
Message-Type: Multiple Part
X400-Originator: SC4@orbcomm.net
X400-MTS-Identifier: [/PRMD=orbcomm/ADMD=telemail/C=us;gateway 37773053 0052 38c47d2a.7]
X400-Recipients: non-disclosure
Original-Encoded-Information-Types: Undefined
X400-Content-Type: P2-1984
Message-ID: <"37773053 0052 38c47d2a"* @MHS>
Importance: normal
Subject: Sample Test Message 2 sent as Bilateral
Autoforwarded: FALSE
To: somebody@foo.com
CC: me2@foo.com, me3@foo.com
Priority: normal
Conversion: Allowed
Conversion-With-Loss: Allowed
Alternate-Recipient: Prohibited
Mime-Version: 1.0
Content-Type: application/octet-stream
Content-Transfer-Encoding: Base64

U2FtcGxlIHRlc3QgbWVzc2FnZSBzZW50IGFzIEJpbGF0ZXJhbA0K
```

Figure E-4 -- SC-originated binary message via back-up path

E.2 SC-Terminated SMTP Headers

In the SC-terminated direction, ORBCOMM customers can use SMTP headers to take advantage of some special features for SC-terminated messages.

E.2.1 Subject

Several features are triggered via special entries the subject field in the SMTP header. The subject field is also available to IP Gateway users, and functions similarly using either protocol except as noted.

E.2.1.1 Specification of BSE type

While a normal email is assumed to be a message, other SC-terminated BSEs are designated by the inclusion in the subject line of a particular token. For these BSEs, no subject information is actually passed to the destination SC. Table E-1 outlines the appropriate format to specify a particular BSE. For more details, see Chapter 5.

Table E-1 -- BSE Subject Tokens

Basic Service Element	Subject Token
POLL	[POLL:ACK:TYPE=X;DEST=Y]
USER COMMAND	[COMMAND:ACK]
BROADCAST MESSAGE	[BROADCAST:SAT=XX]
GLOBALGRAM	[GLOBALGRAM:SAT=XX]

E.2.1.2 SMTP acknowledgments

SMTP acknowledgments, described in detail in Appendix B, are requested by adding to the subject line a token in the format:

```
[CONFIRM=X]
```

Note that this feature is not available via the IP Gateway.

E.2.2 Body type

The type of data carried in the message can be specified using the Content-type header. For text messages, the appropriate header is:

```
Content-Type: text/plain
```

Binary messages should carry the field:

```
Content-Type: application/octet-stream
```

Additionally, binary messages should be MIME-encoded and should specify that encoding in the message header:

```
Content-Transfer-Encoding: Base64
```

E.2.3 Message ID

The identification number of the message can be specified in the SMTP header. The message ID thus provided is included as part of the message ID used by the ORBCOMM system internally, and SMTP acknowledgment messages (see Appendix B) referring to that message will include the specified value in the OMS Message ID field. The message ID can be specified using the Message-ID field:

```
Message-ID: FOMOCO20030214035643_12567AB7
```

Note that the message ID will be truncated if it is longer than 40 characters. The message originator is responsible for ensuring the uniqueness of the message ID in SC-terminated messages.

E.2.4 Priority

The priority of an SC-terminated message can be set using the SMTP header of the same name. ORBCOMM recognizes values of “Non-urgent”, Normal”, and “Urgent”.

```
Priority: Non-urgent
```

Note that messages with different priorities may be subject to different billing terms. Contact your ORBCOMM account executive for additional information.

Appendix F Acronyms

Acronym	Term
BSE	Basic Service Element
DTE	Data Terminal Equipment
FCC	Federal Communications Commission
FIFO	First In, First Out
GCC	Gateway Control Center
GES	Gateway Earth Station
GMSS	Gateway Message Switching System
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
LAN	Local Area Network
IP	Internet Protocol
LEO	Low Earth Orbit
MIME	Multipurpose Internet Mail Extensions
MTA	Message Transfer Agent
OMS	ORBCOMM Message Switch
OSI	Open Systems Interconnection
PC	Personal Computer
PSTN	Public Switched Telephone Network
RF	Radio Frequency
RFC	Request for Comment
SC	Subscriber Communicator
SMTP	Simple Mail Transfer Protocol
TCP	Transfer Control Protocol
VHF	Very High Frequency
VPN	Virtual Private Network
WAN	Wide Area Network
XML	Extensible Markup Language