DOCUMENT TITLE

Euronext Multicast Feed Specification

STATUS

Version 1.2

Preface

This document details the Specifications of the Euronext Multicast Feed (EMF).

This document details the technical information for customers and other users (referred to in the document as the clients) to interface with EMF.

The document details:

- How clients establish a connection to EMF
- How clients process data from EMF
- How clients recover data from EMF

The Network Connection section describes how the clients are connected to EMF.

The Message Structure section describes the message processing basics, which is essential for information exchange between the clients and EMF.

The Data Processing section describes data processing logic on the various kinds of data produced by EMF. It also describes how clients can recover missing data from EMF.

A separate document contains appendices which provide other essential information necessary for processing the data.

Disclaimer

These specifications are subject to change on a regular basis. The user is responsible for ensuring this information is kept up to date.

Although this information has been compiled with great care, Euronext accepts no responsibility for errors, omissions, or other inaccuracies in this information or the consequences thereof.

Associated Documents

The following lists the associated documents, which either should be read in conjunction with this document or which provide other relevant information for the user:

Appendix to the Euronext Multicast Feed Specification for Cash Markets

Glossary

ABBREVIATION	DESCRIPTION
BDY	Field Body
CON	Message Content
EIID	EMF Instrument Identity
FID	Field Identifier
LEN	Message Length (for TCP – retransmission)
MID	Message Identity
MIS	Message Information Section
MPH	Multicast Packet Header
MSB	Most Significant Bit
MSC	Message Segment Content
MSH	Message Segment Header
SID	Segment Identification
SLEN	Message Segment Length
PLEN	Packet Length
PTYPE	Packet Type
SEQ	Packet Sequence Number
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UCNT	User Count
UOK	Unique Output Key
UTC	Universal Time Clock. This equates to GMT without the change for British Summer Time (BST).
VAP	Value Added Processing

Document History

VERSION	RELEASE DATE	SECTION	CONTENT DESCRIPTION

VERSION	RELEASE DATE	SECTION	CONTENT DESCRIPTION
1.0	30/05/2007		Initial specifications
1.1	15/01/2008		Clarifications and comments added.
1.2	**01 JUNE 2008**		Derivatives links, references and comments removed. Generic Appendices v1.1 integrated.

Table of Contents

1. Introduction

The EMF feed is a binary feed with an XML-compatible structure. The feed consists of messages each of which has a number of fields.

There is a predefined set of message IDs. However, the type and number of information fields within a message can vary depending on the circumstances in which that message is sent. Furthermore, there is no fixed length for a field. As a result, there is no fixed length for a specific message-type.

The general format of an EMF message is described later in this document.

1.1 Data available in the Euronext Multicast Feed

EMF supplies extensive information from the Euronext Cash trading markets.

The information available on the EMF feed is organised into sub-sets of data called products. A product could be defined as an individual marketplace. On an operational level, the commercial subscription of a feed client consists of one or more of these products.

EMF provides multiple Multicast Groups for clients to obtain different sets of market data. A client can join a particular Production Data Multicast Group to receive a particular set of market data. Secondary Production Data Multicast Groups are available for backup purposes.

PRIMARY PRODUCTION DATA MULTICAST GROUP	SECONDARY PRODUCTION DATA MULTICAST GROUP	DESCRIPTION
TBD by Euronext	TBD by Euronext	Cash Warrants
TBD by Euronext	TBD by Euronext	Cash Equities

1.2 Overviews and Retransmissions

Apart from real-time data, EMF supports several methods of providing overviews and/or previously disseminated information.

- Price Data/Static Data Full Image Refresh

  Overviews are broadcast of a full image of the instruments (all data fields are disseminated giving the client a complete overview on the instruments. The overviews are disseminated as continuous stream through the Refresh Multicast Groups. Same as real-time data dissemination, multiple Refresh Multicast Groups are available for different products. Refresh messages are disseminated upon the client joining the Refresh Multicast Group.

REFRESH MULTICAST GROUP	DESCRIPTION
TBD by Euronext	Cash Warrant
TBD by Euronext	Cash Equities

- Retransmission

  This is a broadcast-on-request of previously sent messages. Clients are required to connect to the Recovery Request Gateway and request for retransmissions. All retransmission messages are delivery through TCP connection from EMF system. Before receiving retransmission messages, Clients must be authenticated by supplying login credential to EMF system for permission control.

2. Network Connection

The basic networking protocol between clients and EMF is User Datagram Protocol (UDP) Multicast and Transmission Control Protocol (TCP). UDP Multicast enables clients to obtain real-time and overviews data from EMF. Multiple UPD multicast groups are available for clients to obtain different contents of data.

For historical data retransmission, clients need to establish a TCP connection to the Recovery Request Gateway before they can request retransmission of data. Each client is assigned with TCP communication parameters. Clients must connect to EMF with their assigned parameters.

The Recovery Request Gateway connection requires a LOGON. Clients must provide a valid and unique account identity and password to establish a successful connection; otherwise the connection will be terminated.

After a TCP connection is established, interaction with EMF is done through the exchange of a series of messages. Details of the message protocol are described later in this document.

2.1 Connectivity

The EMF disseminates data to the customers' site through a dedicated 100 Mbps data line from each of the Euronext Data Centres respectively located in France (FR) and in United Kingdom (UK).

3. Message Structure

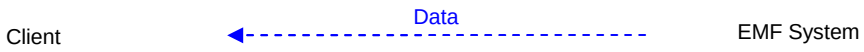
3.1 Introduction

All messages from and to EMF have to conform to a general structure, which is described in this section.

Every message carries a message identity, which denotes its purpose and implies its format. The message identity is known as the MESSAGE IDENTIFIER. For an explanation of message formats and their purpose, see section 4 Data Processing for details.

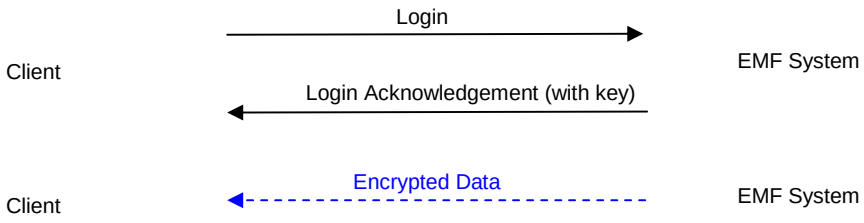
For retransmission, messages to EMF (so sent by clients) will mainly be login/logout messages or recovery requests, where the messages sent by EMF concern notifications and acknowledgements of those clients-requests, and of course the actual data itself.

EMF sends all update and refresh messages through the Multicast Group mentioned in previous section. Clients can join the corresponding Multicast Groups to receive all real-time update data and refresh data. In the following diagram the dotted line represents multicast delivery.



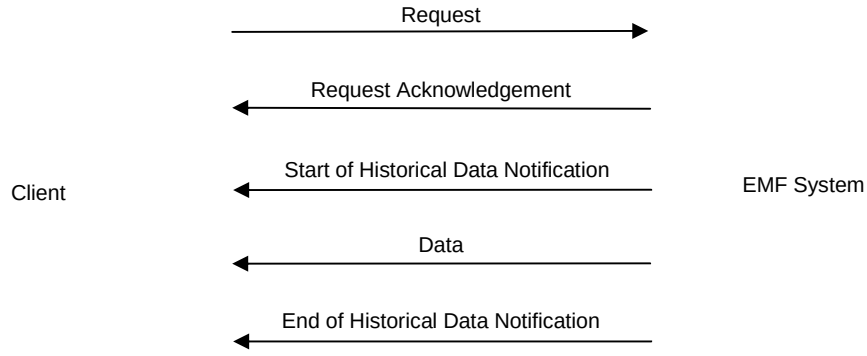
Update and refresh messages through multicast delivery may be encrypted. The encryption key could be obtained in Login Acknowledgement message from a TCP connection.

Solid lines represent TCP connections and the dotted line represents multicast delivery.



EMF replies to every recovery request from the client with an Acknowledgement message. The Acknowledgement message contains one or more data fields to indicate whether the request was successful or not. If the request was successful, EMF starts sending data according to the request. The resulting data always starts with a Start of Historical Data Notification message and ends with an End of Historical Data Notification message.

The following diagram depicts the message exchange between EMF and a client showing the request and reply with an example of a retransmission request, subsequent acknowledgment, data and notifications transmitted from EMF. Solid lines represent TCP connections.



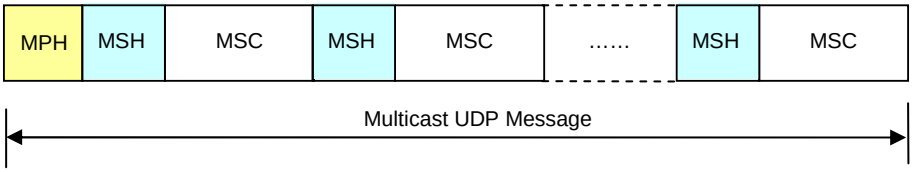
3.2 Basic UDP Multicast Packet Structure

A packet from UDP multicast stream is in binary format. Each message has a leading MESSAGE PACKET HEADER field (MPH), followed by MESSAGE SEGMENT HEADER (MSH) and MESSAGE SEGMENT CONTENT (MSC)

The MESSAGE PACKET HEADER (MPH) field is 5 bytes long and it includes the PACKET TYPE (PTYPE) and PACKET SEQUENCE NUMBER (SEQ).

The MESSAGE SEGMENT HEADER (MSH) field is 3 bytes long and it includes the definition and length of the message segment.

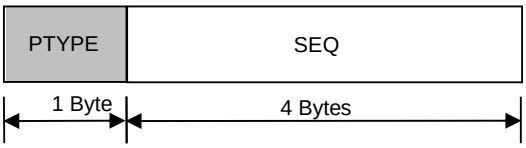
The MESSAGE SEGMENT CONTENT (MSC) may contain a complete message or a fragment of a message. Moreover, one Multicast UDP Message may contain more than one packet. User should be able to determine if multiple packets are embedded in one Multicast UDP Message by the corresponding length information



The Multicast UDP Message is not longer than 1400 bytes.

3.2.1 Message Packet Header Structure

This segment contains 5 bytes. The first byte indicates Packet Type (PTYPE) and the remaining 4 bytes indicate the Packet Sequence Number (SEQ).



Packet Type

PACKET TYPE (PTYPE) indicates whether compressed data is stored in MESSAGE SEGMENT HEADER (MSH) and MESSAGE SEGMENT CONTENT (MSC). The following table describes the current allowed values for the Packet Type field. The first bit is used and the remaining 7 bits are reserved for future usage.

PACKET TYPE	DESCRIPTION
Bit 1 and 2	0: Packet Content (data after SEQ) is not compressed 1: Packet Content (data after SEQ) is compressed by zlib 2: Packet Content (data after SEQ) is compressed by FAST The complete FAST specification can be found at : http://www.fixprotocol.org/ 3: unused **Remark:** message compression may not be enabled in the initial implementation of EMF.
Bit 3 to 8	Reserved for future usage.

When compression mode is enabled, all data after the MESSAGE PACKET HEADER is compressed.

Packet Sequence Number

Packet Sequence Number (SEQ) is a 32-bit integer in the PACKET SEQUENCE NUMBER field. It is a mandatory field for users to determine packet loss during transmission. It ranges from 0 to 2147483647. It starts from 0 and increments by 1 each time. It restarts from 1 after reaching 2147483647.

	PRODUCTION DATA MULTICAST GROUP	REFRESH MULTICAST GROUP
NUMBER OF SEQ	1 SEQ for the whole group.	1 SEQ for the whole group.
WHEN SEQ BE RESET TO 0	When EMF Multicast distribution server restart.	When EMF Multicast distribution server restart.

3.2.2 Message Segment Header Structure

A message segment header consists of two parts: SEGMENT IDENTIFICATION (SID) field and SEGMENT LENGTH (SLEN).

Segment Identification

Segment Identification is always the first field of a message segment. It is stored as a character in the SEGMENT IDENTIFICATION field.

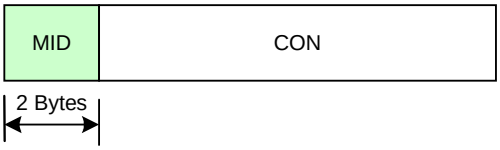
SEGMENT ID	DESCRIPTION
SID_SYSTEM_STATUS (0x00)	Available in Production Data Stream to acknowledge user the system healthiness.
SID_PROD_MSG_CONT (0x01)	Available in Update Data Stream. It indicates the associated Message Fragment is not yet the ending fragment of the message being transmitted.
SID_PROD_MSG_END (0x02)	Available in Update Data Stream. It indicates the associated Message Fragment is the ending fragment of the message being transmitted.
SID_ST_REFRESH_MSG_CONT (0x03)	Available in Recovery Data Stream. It indicates the associated Message Fragment is not yet the ending fragment of the Static Data message being refreshed.
SID_ST_REFRESH_MSG_END (0x04)	Available in Recovery Data Stream. It indicates the associated Message Fragment is the ending fragment of the Static Data message being refreshed.
SID_PR_REFRESH_MSG_CONT (0x05)	Available in Recovery Data Stream. It indicates the associated Message Fragment is not yet the ending fragment of the Price Data message being refreshed.
SID_PR_REFRESH_MSG_END (0x06)	Available in Recovery Data Stream. It indicates the associated Message Fragment is the ending fragment of the Price Data message being refreshed.

Segment Length

SEGMENT LENGTH (SLEN) is a 2-bytes integer storing the size of this message fragment

3.2.3 Message Segment Content Structure

The message segment content contains a single message. A message is in binary format. Each message has a leading MESSAGE IDENTIFICATION field (MID), followed by a CONTENT field (CON).



The MESSAGE IDENTIFICATION field carries the unique identity of the message.

The CONTENT field contains actual message content. It contains one or more data fields packed together.

3.2.3.1 Message Content

Different messages, depending on their nature, carry different data fields in the CONTENT field and therefore their size can vary markedly. The CONTENT section will always contain a MESSAGE INFORMATION section, followed by either a PARAMETER section (which provides details relating to a request) or a DATA section The DATA section may be preceded by a DATA IDENTIFICATION section where the message applies to a specific instrument or a news item.

- The MESSAGE INFORMATION section provides further information about the message itself. For example, it contains the session sequence number, which includes an ever-increasing number for unique identification of every message throughout a connection session.

- The DATA IDENTIFICATION section carries instrument information, which describes what instrument the message is for. For example, it can carry the source and the identity of the instrument.

- The DATA section carries trade information. The exact scope of these fields is source specific.

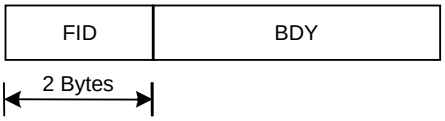
- The PARAMETER section carries Parameter information.

Details of which data fields are in different messages are described in section 4 Data Processing.

3.2.3.2 Data Field

A data field consists of two parts:

- FIELD IDENTIFIER (FID)
- FIELD BODY (BDY)



The FIELD IDENTIFIER is two bytes long. It carries the field's unique identity. Refer to the Appendices for a complete list of possible data fields and their identities.

The FIELD BODY contains one or two leading length bytes, and then followed by the actual data. Its size varies and depends on data type.

There are two kinds of data fields:

- Source Data Fields: carry information directly from the source e.g. prices and static data generated by EMF.
- System Data Fields: carry non-source specific data mostly generated by EMF for communication or for message and instrument identification purposes.

In the Appendices, Appendix D lists all the System Data Fields used by EMF. Other source specific appendices (e.g. Appendix to the Euronext Multicast Feed Specification for Cash Markets) list all the source data fields available for each source.

The data type can be determined by referring to data field directory in the appendix. The directory lists all the possible data fields and their respective data types.

Field Length

The length of the FIELD BODY (BDY) is encoded in its first one or two bytes. If the most significant bit (bit 7) of the first byte is not set, the length of the BDY is equal to the value of bits 6-0 of the first byte. If bit 7 of the first byte is set, the length of the BDY is stored in the first two bytes, with bits 6-0 of the first byte containing the higher order bits.

The field length is the length of FIELD BODY excluding the length byte(s).

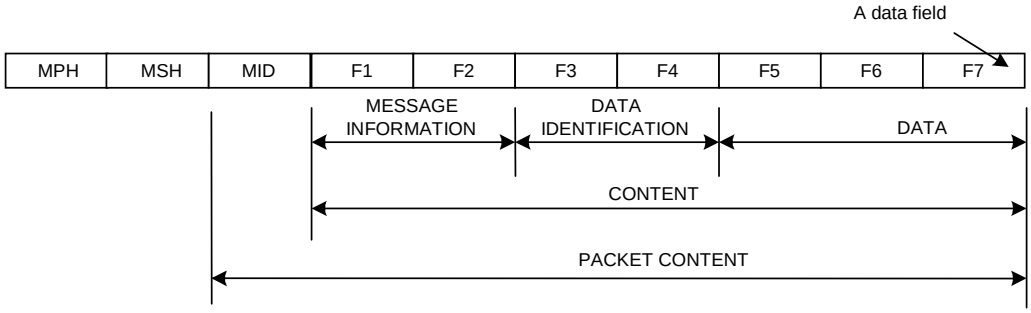
Unknown Data Fields

Clients should make provision in their interface system to handle data fields that are unknown to them. This will allow for applications to survive upgrades to the protocol (i.e. new fields added to existing messages). The recommended procedure is to ignore the unknown fields and continue processing the message.

To skip an unknown data field, clients need to determine its size from the FIELD BODY, see Field length for information on determining the field length.

3.2.4 A Sample Packet

The following diagram illustrates a sample data message sent by EMF. It carries trading information of an instrument.



The CONTENT portion of a message is made up logical sections, each of which contains one or more fields. In the example above, the sections are MESSAGE INFORMATION, DATA IDENTIFICATION and DATA. The sections included in the CONTENT portion of the message depend on the MESSAGE IDENTITY.

The following diagram illustrates the message layout for a sample packet showing the content of the message:

Messages carrying generic information, such as acknowledgements (login acknowledgement, broadcast request acknowledgement, etc) would have the following layout:

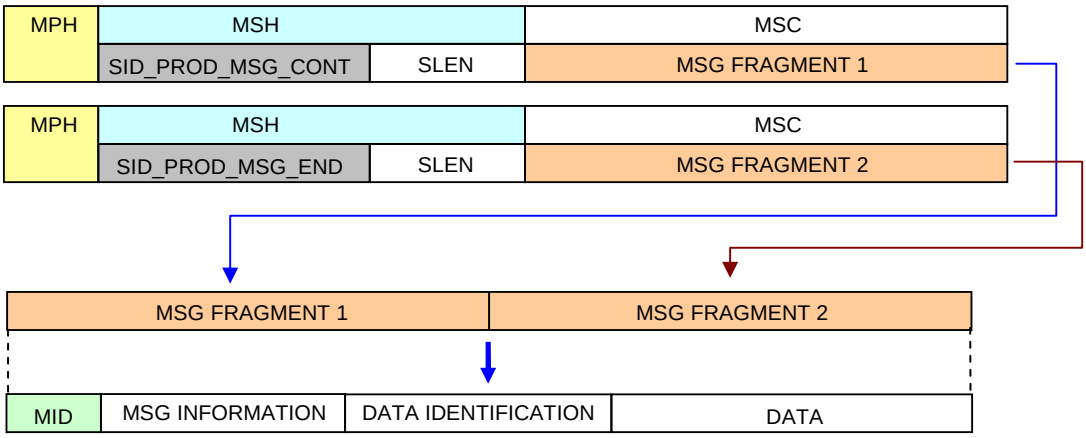
Similarly, messages carrying parameter information (messages sent by clients) would have the following layout:

3.2.5 Message Fragmentation

A long message may need to be separated into multiple fragments for multicast delivery. Examples of “long messages” are static data refresh / updates etc where no aggregation is possible.

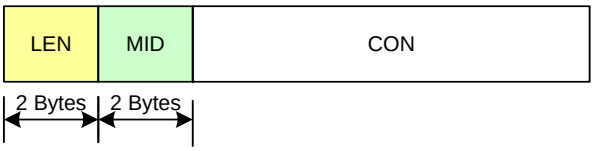
Note that trade, price and market depth update messages will not be fragmented. A Multicast UDP Message containing multiple packets will not contain a fragment of incomplete message.

Clients are required to reconstruct a message carried by multiple packets before processing the contents of the message. The following example shows how to reconstruct a message with multiple packets.



3.3 Basic TCP Message Structure

A message from TCP stream (only applicable for historical retransmission) is in binary format. Each message has a leading LENGTH field (LEN), followed by a MESSAGE IDENTIFICATION field (MID), and then a CONTENT field (CON).



The LENGTH field is two bytes long and its value determines the sum of the size of the MESSAGE IDENTIFICATION (MID) and CONTENT (CON).

The MESSAGE IDENTIFICATION field carries the unique identity of the message. The CONTENT field contains actual message content. It contains one or more data fields packed together. Their full descriptions are described in 3.2.3 Message Segment Content Structure (MSC).

3.4 EMF Instrument ID (EIID)

EIID is the instrument identifier for all market data messages. It is a variable size string situated in the DATA IDENTIFICATION section of every message containing data (as opposed to requests, acknowledgements, etc).

For Cash markets, the EIID carries the Euronext Trading Code of the instrument. The EIID can also carry other information when the message is not tied to a specific tradable instrument.

Once the EIID has been assigned to an instrument it will stay with that instrument for its lifetime.

The following table summarises all possible values for the EIID in various messages within this document:

INSTRUMENT	DESCRIPTION
Cash Market Tradable Instrument	EURONEXT TRADING CODE
Cash Market Instrument Group (Trading Group)	STOCK GROUP CODE

3.5 Broadcast Timestamp

There is a timestamp in the Identification section of each message. This timestamp is a 64-bit integer storing the number of microseconds elapsed since mid night the previous day. The time-zone of this timestamp is summarized in the following table.

MARKET	TIMEZONE
Cash	CET

3.6 Summary

An EMF message starts with a a 2-byte message-ID. This is followed by the contents of the message which consists of a number of sections. The first section (Message Information Section) is mandatory, the others are optional. Each section contains one or more fields.

3.6.1 General Message Format

MID	CONTENTS	
2 bytes	n bytes	1 or more **sections,** each containing one or more data fields
		Unique message-identity

MID	CONTENTS											
	Message Information Section		Data Identification Section		Parameter Section		Data Section					
	Data Field	Data Field	Data Field	Data Field	Data Field	Data Field	Data Field	Data Field	Data Field	Data Field	Data Field	
	F I D	Body	F I D	Body	F I D	Body	F I D	Body	F I D	Body	F I D	Body	F I D	Body	F I D	Body	F I D	Body

3.6.2 Message Contents

Message Information Section	Parameter Section	Data Identification Section	Data Section
One or more Fields	One or more Fields	One or more Fields	One or more Fields
MANDATORY	OPTIONAL		

		Sections optional, no. of fields for each section depending on MID
		Section mandatory, no. of fields depending on MID

Possible combinations in the message contents can be as follows:

- MIS + Parameter (client messages)
- MIS + Data-ID + Data (trade data messages, static data messages, etc)
- MIS + Data (Generic messages, acknowledgements, etc)

3.6.3 Data Field

FID	Body	
2 bytes	n bytes	**1 or 2 Length-bytes** + x bytes of data
		Field's unique identity

Format of Field Length byte(s):

- Value of field-length excludes the field-length byte(s) themselves.
- If MSB (bit 7) of 1st byte is not set: Length in 1 byte, Body-length presented in bit 0-6 (Max. value for 1-byte length = Binary 0111 1111, in Hex 7F, in decimals 127).
- If MSB of 1st byte is set: Length in 2 bytes, bit 0-6 of 1st byte contain high-order bits.

4. Data Processing

This section describes the data processing tasks performed on a normal trading day.

4.1 Communication Interface

4.1.1 IP Multicast

Euronext Multicast Feed (EMF) utilizes IP network supporting Internet Group Management Protocol (IGMP) to provide a subscription-based / selective delivery of market data. All market data and heartbeat messages are disseminated in the form of multicast addressed IP datagrams.

4.1.1.1 Subscription

User application systems are responsible for issuing IGMP requests to subscribe to the data they need.

These IGMP requests are then processed by the intermediate network equipments (e.g. routers/switches). In response, a multicast capable IP network delivers only the multicast data to those parts of the network in the path between the data source and the subscribing systems.

Subscriptions are based on the target multicast group ID (which is synonymous with multicast address and multicast host group).

4.1.2 Multicast Group

Typically, the EMF IP multicast distribution network utilizes multiple Multicast Groups for delivering market data products. For each data product, two groups are set up for real-time market data dissemination and one is for refresh data.

4.1.2.1 Market Data

For each market data product, a copy of the update data stream is produced by each operation site. Therefore there should be at least 2 groups for update data streams for each product.

4.1.2.2 Refresh Data

The refresh data is disseminated continuously to provide a full image of the instruments. This service is designed to be supported by all operation sites, but the refresh data stream will not be delivered in a redundant manner. Therefore, there is only 1 multicast group for refresh.

4.1.3 Message Reception

Data subscribers can receive different data products from different multicast groups. Update data and refresh data are pushed to the data subscribers. Recovery data is disseminated to data subscribers through TCP connection on an on-demand basis.

4.1.3.1 Update Data

Different groups of production data are delivered through different multicast groups. Data subscribers who are entitled to receive the data can join the appropriate groups.

4.1.3.2 Refresh Data

Different groups of refresh data are delivered through different multicast groups. Data subscribers who are entitled to receive the refresh data can join the appropriate groups.

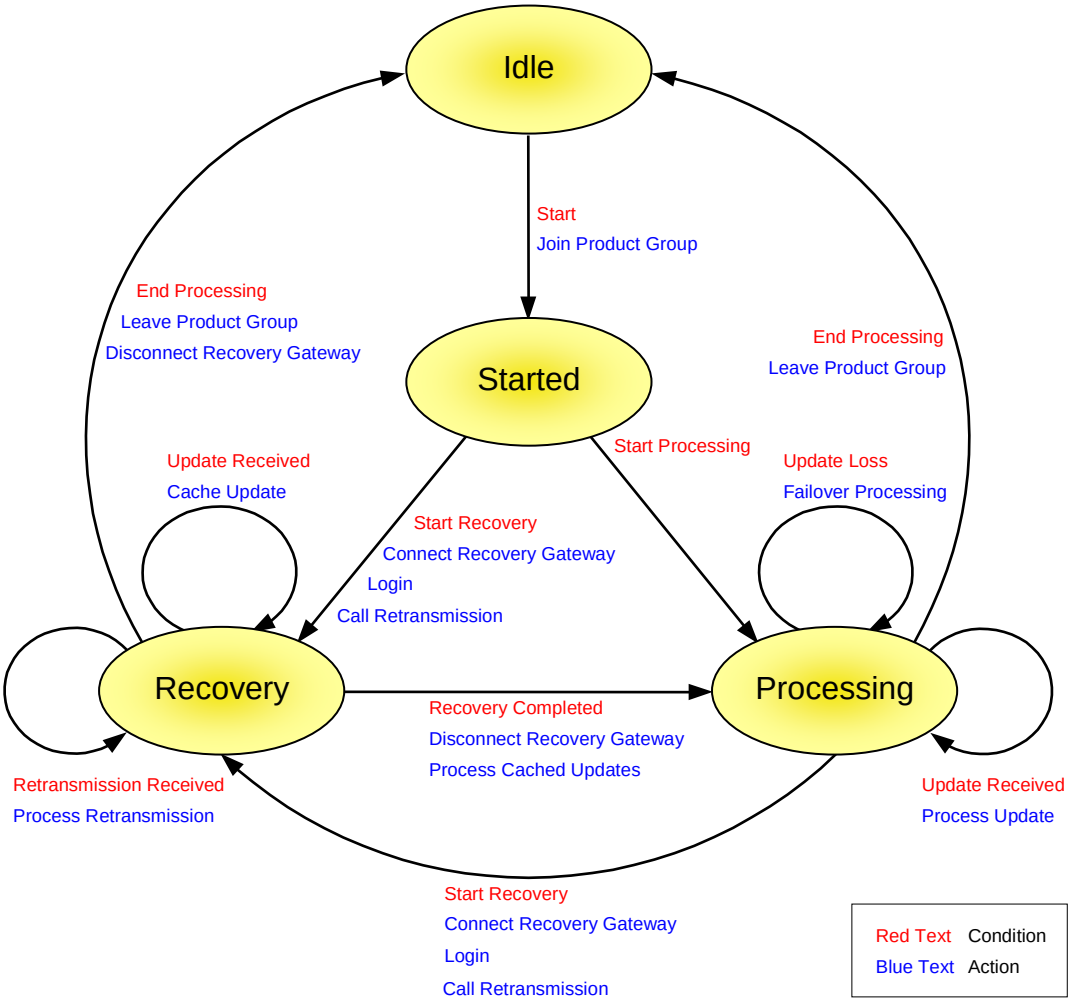
4.1.3.3 Recovery Data

Recovery (Historical Retransmission) data is delivered on demand. Data subscribers are required to connect to the Recovery Request Gateway using TCP. Since reliable TCP connection is used, the data subscriber can send the request in EMF message format directly to the agent. EMF packet coating is not required. After the connection is setup, the data subscriber is required to logon to the agent before making the appropriate recovery request. Upon receipt of the request the gateway invokes EMF to deliver the recovery data through the same TCP connection. All recovery data delivered through TCP connection is a continuous stream of MESSAGE SEGMENT CONTENT (MSC), and without MESSAGE PACKET HEADER (MPH) and MESSAGE SEGMENT HEADER (MSH).

4.2 Processing Logic

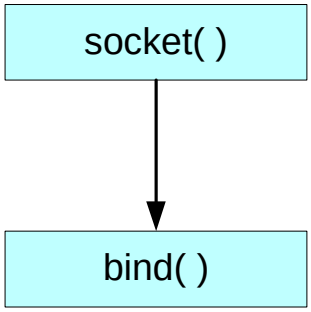
4.2.1 Client States

The following state diagram shows the recommended processing logic for EMF users:



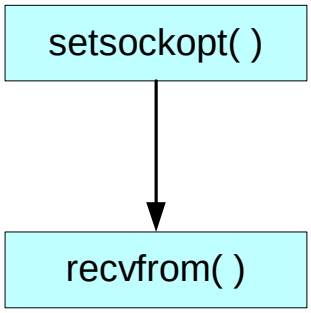
4.2.2 Socket Creation

Since the EMF messages are delivered through multicast UDP socket, connectionless socket is created for receiving messages. The following diagram illustrates the socket creation process.



4.2.3 Data Set Subscription

Each data set will be disseminated through one Multicast Group. For clients who want to receive the data set, they are required to join the particular multicast group. After joining the multicast group, EMF messages for that product will be received automatically.



4.2.4 Error Detection

There is a Packet Sequence Number (SEQ) assigned to each EMF message. For each production data multicast group, this sequence number is increased by one following each message. Note that the sequence number is not unique across channels and that maximum sequence numbers are configurable. When the maximum sequence number is reached, the next sequence number will be one. A value of zero is used for informing clients that sequence numbering has been reset. With the exception of zero values, a client application can determine message loss when a message with an unexpected sequence number is received.

Moreover, clients can receive periodic System Status messages from the each multicast group and Recovery Request Gateway. A recommended system status timeout value will be suggested so that clients can determine a channel source failure.

4.2.5 Failover

For each set of subscription, there are two multicast groups available. Both channels deliver the same data content. Clients are advised to arbitrate between the two feeds.

For example a client application could cache messages from the secondary subscription channel for emergency recovery purposes and this could produce the following scenario:

1. Cache all update messages from both real-time Multicast Group channels during Market Data processing

Following a detected message loss on the primary product channel:

2. Get the Packet Sequence Number (SEQ) of the last good message from the primary product channel

3. Scan the cache in the secondary product channel and get the expected missing message(s) by comparing SEQs

4. After all missing messages are located and processed, process the cached primary product channel messages

5. After all cached update messages have been processed, the client can continue to process normal update messages received from the primary product channel

A channel source failure could produce the following scenario:

1. Cache all updates message in secondary product channel

Application detects a source failure:

2. Get the SEQ of the last good message from the primary product channel

3. Locate the last good message in the cache of the secondary product channel by comparing the SEQs

4. Process all the cached messages after the last good message

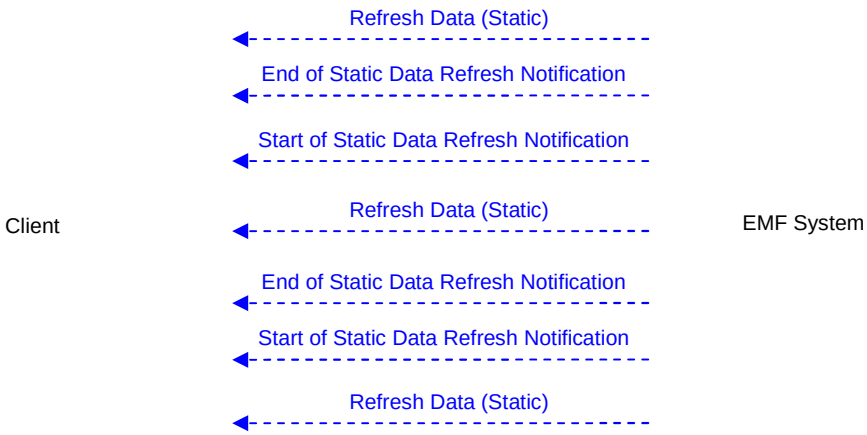
5. After all cached update messages is processed, the client can continue to process normal update message received from the secondary product channel

4.2.6 Refresh

Client applications are able to receive latest Static Data through Refresh Multicast Groups. EMF system sends refresh images continuously to the multicast groups. Before each refresh cycle starts, a Start of Refresh Notification message is sent. When the refresh cycle is completed, an End of Refresh Notification message is sent. All corresponding refresh messages received between this Start of Refresh Notification and End of Refresh Notification messages represents a complete refresh cycle. Therefore, the client application may use these two messages to determine when to process the refresh messages received from the Refresh Multicast Groups.

A Refresh Multicast Group only contain both Static Data.

The following diagram indicates this process flow of Static Data Refresh:



4.2.7 Retransmission

Client may call for retransmission of historical messages under the following 2 situations.

4.2.7.1 Message Loss

Message is considered lost when there is a missing SEQ detected when processing EMF messages from Production Data Multicast Group and the lost messages cannot be found from the caches for the Secondary Production Data Multicast Group. Clients are required to login to the system (through a TCP/IP connection) to request for a retransmission. There is Unique Outbound Key (UOK) in each data message. Clients must provide the starting UOK and ending UOK for the system as a starting and ending points, respectively, for the retransmission. The most suitable selection of starting and ending UOKs are the UOK of the last message before the message loss occurred and UOK of the first message after the loss is detected. Upon a retransmission request the system will send out messages through the same TCP connection.

A potential message recovery procedure is as follows:

1. Cache all update messages from Production Data Multicast Group during the recovery.

2. Process the retransmission messages and mark down the UOK of all retransmission messages.

3. After retransmission is completed, process the cached updates. The Client application is responsible for handling duplicate message filtering by comparing the UOK of the cached update messages with the UOK marked in the previous step.

4. After all cached update messages have been processed, the recovery handling is finished and the client can continue to process normal update messages received through the product channel.

4.2.7.2 Site Failover

When site failover happens, clients cannot use the UOK to request for retransmission from the secondary site. Under this situation, clients have to request for retransmission by

time. If Source Sequence Number is available in the Price Data Update message, client applications can filter out duplicate messages using this Source Sequence Number. When requesting recovery by time, the starting time should be set to 1 minute before the outage is detected.

Clients can rely on the Hub Sequence Number field, an unique Trading source sequence number, in order to synchronize the different source feeds in case of site failure.

4.2.8 Leaving Multicast Group

Clients can simply close the socket or leave the corresponding multicast group to end processing the Production Data updates.

4.3 Connection Establishing

4.3.1 Connecting to EMF Multicast

Before a Client can receive any data, it first needs to join one or more EMF Multicast Group channels.

Following the channel joining, the client starts receiving data from EMF. The client can join the Refresh Multicast Group for receiving static data refresh messages from EMF, as described in sections **Erreur ! Source du renvoi introuvable.** and 4.7.2. Following diagrams show the general approach for each one:

Option 1: Receiving Normal Broadcast Data

1. Join Production Data Multicast Group
2. Start processing the updates.

The following diagram shows the simplest case where the client simply receives the production data sent by EMF.

Option 2: Receiving Refresh Data

1. Join Production Data Multicast Group and cache all message updates
2. Join Refresh Multicast Group to process price data refresh messages
3. Leave the Refresh Multicast Group and start processing the cached updates.

4.3.2 Connecting to EMF TCP

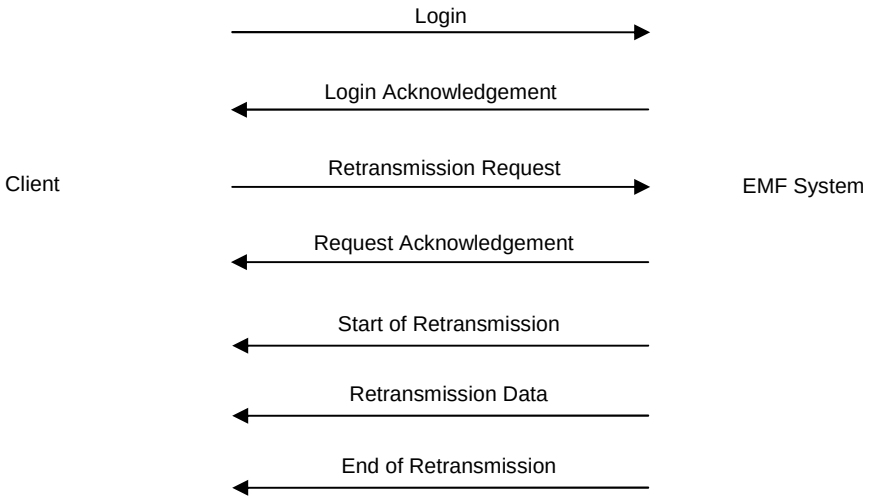
TCP connection is available for retransmission requests only.

1. Make a TCP connection to Recovery Request Gateway
2. Login

3. Request a data retransmission by UOK or by time

4. Receive retransmitted messages

The following diagram shows the case where a client application connects to the Recovery Request Gateway, makes a recovery request and receives historical messages from EMF.



The login procedure is described as follows.

4.3.2.1 Login for Recovery Request

The Client application submits the login message to EMF Recovery Request Gateway.

The Login message has the following structure:

The MESSAGE INFORMATION section carries information about the message itself. The Client needs to provide account identity and password values in the PARAMETER section.

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	0	Login from the Client
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
REQUEST IDENTITY	Any number between 1 and 32767	Submitted by the Customer to identify a login request.
PARAMETER SECTION		
Data Field	**Value**	**Remark**
USER IDENTITY	e.g. “EC”	Allocated by EMF for a particular Customer
PASSWORD	e.g. “PASSWORD”	Allocated by EMF for a particular Customer

4.3.2.2 Login Acknowledgement

EMF always acknowledges the request with a Login Acknowledgement message. The Client must check this message to verify if the recent login request is accepted or not.

The Login Acknowledgement message has the following structure:

The MESSAGE INFORMATION section carries information about the message itself. The login result is stored in DATA section.

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	50	Login Acknowledgement
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
REQUEST IDENTITY	Any number between 1 and 32767	Same as the identity submitted by the client at login.
SESSION SEQUENCE NUMBER	Any number between 1 and 2147483647	Optional and applicable only for EMF through TCP. An ever-increasing number, used to detect lost message, is attached to every message throughout a connection session.

DATA SECTION		
Data Field	**Value**	**Remark**
RETURN CODE	“1”	Successful login
	“100”	System error
	“101”	System not available
	“103”	Incorrect password
	“112”	Unknown user
	“113”	User already logged in
ENCRYPTION KEY		Key for decoding encrypted data message. Mandatory if encryption is enabled.

If a login request fails, the client can attempt to connect again. By default EMF will automatically terminate the connection after three failed attempts. EMF will also terminate a connection if a client does not submit a login request within one minute.

4.3.3 Monitor Connection

Once a connection is established, EMF broadcasts status messages to the client at regular intervals of 1 per minute (this is subject to change after a notification period).

4.3.3.1 System Status

This message is for client applications to verify that the connection is operating correctly.

The System Status message has the following structure:

The DATA section carries the system time at which the status message was generated.

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	104	System Status
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
SESSION SEQUENCE NUMBER	Any number between 1 and 2147483647	Optional and applicable only for EMF through TCP. An ever-increasing number, used to detect lost message, is attached to every message throughout a connection session.

DATA SECTION		
Data Field	**Value**	**Remark**
SYSTEM TIME		Time the heartbeat message was generated.

4.4 Refresh Data Processing

4.4.1 Process Static Data Refresh

Client applications automatically receive Static Data from the Multicast Group for both Derivatives and Cash instruments before trading hour.

Client applications are also able to request for a Static Data refresh anytime during the day. The term Refresh is used throughout this document to describe a broadcast of the complete image for each instrument. This should not be confused with the concept of historical data retransmission, in which messages previously sent to the user are resent as part of a recovery process.

4.4.1.1 Static Data Refresh Message

The Static Data Refresh message has the following structure:

The DATA IDENTIFICATION section carries data fields that uniquely identify the tradable instrument(s).

The DATA fields convey source specific static data content.

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	151	Static Data Refresh
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
UNIQUE OUTPUT KEY	Any possible value for long integer type	Lifetime unique message identifier attached to broadcast output messages for data recovery.
BROADCAST TIMESTAMP		
DATA IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
EIID		
INSTRUMENT TYPE		
DATA SECTION		

Data Field	Value	Remark
<source specific static data fields>		Refer to the associated Market Appendix for the particular values

4.5 Update Data Processing

The message carries quote, trade data or other information linked to the associated trading market.

The Data Update message has the following structure:

The DATA IDENTIFICATION section contains data fields that uniquely identify an instrument. The DATA section conveys source specific data included in a quote, trade, …

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	156	Price Data Update
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
UNIQUE OUTPUT KEY	Any possible value for long integer type	Lifetime unique message identifier attached to broadcast output messages for data recovery.
BROADCAST TIMESTAMP		
DATA IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
EIID		
INSTRUMENT TYPE		
DATA SECTION		
Data Field	**Value**	**Remark**
<source specific quote fields>		Refer to the associated Market appendix documents for data fields used in different instruments.

4.6 Connection Shutdown

No data will be disseminated to the clients through the Multicast update channels after trading hours.

4.6.1 Disconnect from EMF Multicast

A Client can leave EMF Multicast Group after trading hours.

4.6.2 Disconnect from EMF TCP

4.6.2.1 Logout after Recovery Request

The Client gets logout notification in the message.

The Logout message has the following structure:

The MESSAGE INFORMATION section carries information about the message itself. The PARAMETER section informs EMF of the client identity.

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	1	Logout request from the Client
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
REQUEST IDENTITY	Any number between 1 and 32767	Supplied by the Client to identify the logout request.
PARAMETER SECTION		
Data Field	**Value**	**Remark**
USER IDENTITY		This should be the same as the identification used to login to EMF.

4.6.2.2 Logout Acknowledgement

The Client gets acknowledgement for its logout request from EMF in the message.

The Logout Acknowledgement message has the following structure:

The MESSAGE INFORMATION section carries information about the message itself. EMF acknowledges the logout result in the DATA section.

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	51	Logout Acknowledgement
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
REQUEST IDENTITY	Any number between 1 and 32767	Same as the ID supplied by the Client in its logout request.
SESSION SEQUENCE NUMBER	Any number between 1 and 2147483647	Optional and applicable only for EMF through TCP. An ever-increasing number, used to detect lost message, is attached to every message throughout a connection session.
DATA SECTION		
Data Field	**Value**	**Remark**
RETURN CODE	“3”	Successful logout
	“114”	Request denied, typically due to badly constructed request.

4.6.3 System Logout Notification

The Client gets the logout notification in the message.

The System Logout Notification message has the following structure:

The MESSAGE INFORMATION section carries information about the message itself. The DATA section gives the reason of the forced logout.

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	105	System Logout Notification
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
SESSION SEQUENCE NUMBER	Any number between 1 and 2147483647	Optional and applicable only for EMF through TCP. An ever-increasing number, used to detect lost message, is attached to every message throughout a connection session.
DATA SECTION		

Data Field	Value	Remark
LOGOUT REMARK	“1”	Connection terminated for maintenance
	“2”	Connection terminated by the system operator
	“-1”	Expired authorisation

4.7 Data Recovery

The messages in this section relate to recovery of lost messages during a period of time when the Client is not connected to EMF.

4.7.1 Historical Message Retransmission

A Client can request historical data retransmission at any moment when it is connected to EMF.

4.7.1.1 Historical Data Retransmission Request

A client can request historical data retransmission at any moment when it is connected to EMF. The client cannot receive broadcast and refresh data when it is receiving retransmitted data.

The Historical Data Retransmission Request message has the following structure:

The MESSAGE INFORMATION section carries information about the message itself. The client specifies the retransmission parameters in the PARAMETER section. There are two ways to make the request, either by Unique Output Key or by DateTime.

Method 1 – Request by Unique Output Key

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	2	Retransmission Request
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
REQUEST IDENTITY	Any number between 1 and 32767	Supplied by the Client to identify the retransmission request
PARAMETER SECTION		
Data Field	**Value**	**Remark**

UNIQUE OUTPUT KEY	Any possible value for long integer type	The Unique Output Key of the first retransmission message
END UNIQUE OUTPUT KEY	Any possible value for long integer type	The Unique Output Key of the last retransmission message
RECOVERY ADJUSTMENT	Any possible value allowed by the 'Integer' type. e.g. –100 to recover data starting from the 100th message before the one identified by UNIQUE OUTPUT KEY	Specify the position from which the recovery starts

Method 2 – Request by DateTime

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	2	Retransmission Request
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
REQUEST IDENTITY	Any number between 1 and 32767	Supplied by the Client to identify the retransmission request
PARAMETER SECTION		
RECOVER FROM DATETIME	e.g. 20031230125959123 to recover all data after 2003/12/30 12:59:59.123	Time zone used is UTC.
RECOVER TO DATETIME	e.g. 20031231125959123 to recover all data from the specific RECOVER FROM DATETIME to 2003/12/31 12:59:59.123	This is an optional field. Time zone used is UTC.
RECOVERY ADJUSTMENT	0	

4.7.1.2 Historical Data Request Acknowledgement

EMF always acknowledges with a Historical Data Request Acknowledgement message. Clients must check this message to verify whether or not the recent request has been accepted or not. This message is received from the TCP connection of the Recovery Gateway.

The Historical Data Request Acknowledgement message has the following structure:

The MESSAGE INFORMATION section carries information about the message itself. The request result is stored in DATA section.

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	52	Retransmission Request Acknowledgement
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
REQUEST IDENTITY	Any number between 1 and 32767	Same as the ID supplied by the Client in its retransmission request.
SESSION SEQUENCE NUMBER	Any number between 1 and 2147483647	Optional and applicable only for EMF through TCP. An ever-increasing number, used to detect lost message, is attached to every message throughout a connection session.
DATA SECTION		
Data Field	**Value**	**Remark**
RETURN CODE	"4"	Request accepted
	"114"	Request denied

4.7.1.3 Start of Historical Data Retransmission Notification

EMF notifies the client of the start of historical data retransmission. Clients should interpret any messages received after this message as retransmitted historical data.

Note: All messages following a Start of Historical Data Retransmission Notification will appear almost identical to the messages that would have been received when the message was first sent. The two possible differences are:

- If the client's entitlement or subscription has changed, the retransmitted data will reflect the new entitlement / subscription settings rather than those at the time when the message was first sent.

- Every data message sent as part of a retransmission request will include the REQUEST ID of the original retransmission request so that the client can avoid any confusion over which retransmission request caused the data message to be sent.

The Start of Historical Data Retransmission Notification message has the following structure:

The MESSAGE INFORMATION section carries information about the message itself.

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**

MESSAGE IDENTITY	100	Start of Retransmission Notification
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
REQUEST IDENTITY	Any number between 1 and 32767	Same as the ID supplied by the user in the originating retransmission request
SESSION SEQUENCE NUMBER	Any number between 1 and 2147483647	Optional and applicable only for EMF through TCP. An ever-increasing number, used to detect lost message, is attached to every message throughout a connection session.
DATA SECTION		
Data Field	**Value**	**Remark**

4.7.1.4 End of Historical Data Retransmission Notification

EMF notifies the client of the end of historical data retransmission. The End of Historical Data Retransmission Notification message has the following structure:

The MESSAGE INFORMATION section carries information about the message itself.

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	101	End of Retransmission Notification
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
REQUEST IDENTITY	Any number between 1 and 32767	Same as the ID supplied by the user in the originating retransmission request
SESSION SEQUENCE NUMBER	Any number between 1 and 2147483647	Optional and applicable only for EMF through TCP. An ever-increasing number, used to detect lost message, is attached to every message throughout a connection session.
DATA SECTION		
Data Field	**Value**	**Remark**

4.7.2 Static Data Refresh

A client can request a full image refresh of static data at any moment after joining the Refresh Multicast Group. The client will receive broadcast data when it is receiving full image refresh.

4.7.2.1 Start of Static Data Refresh Notification

EMF notifies the client of the start of the price data full image refresh. This message is received from the Refresh Multicast Group.

The Start of Static Data Full Image Refresh Notification message has the following structure:

The MESSAGE INFORMATION section carries information about the message itself.

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	109	Start of Static Data Refresh Notification
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
DATA SECTION		
Data Field	**Value**	**Remark**

4.7.2.2 End of Static Data Refresh Notification

EMF notifies the client of the end of the static data full image refresh. This message is received from Refresh Multicast Group.

The End of Static Data Full Image Refresh Notification message has the following structure:

The MESSAGE INFORMATION section carries information about the message itself.

MESSAGE IDENTIFICATION SECTION		
Data Field	**Value**	**Remark**
MESSAGE IDENTITY	110	End of Static Data Refresh Notification
MESSAGE INFORMATION SECTION		
Data Field	**Value**	**Remark**
DATA SECTION		
Data Field	**Value**	**Remark**

4.7.3 Data Recovery Scenarios

This section details a variety of scenarios in which a Customer can recover lost data.

4.7.3.1 Scenario 1

A Customer wants to log on intra day and replay all messages. The Customer does not know the Unique Output Key (UOK) for the first messages in the morning.

1. Join Production Data Multicast Group for real-time data updates.

2. Connect to Recovery Request Gateway

1. Send Login Request (and check response)

2. Send Retransmission Request with RECOVER FROM DATETIME set (**Note:** At this time, the RECOVERY ADJUSTMENT must also be included, although the value should be 0).

3. Process the Retransmission Messages between the Start of Retransmission Notification and End of Retransmission Notification.

A Customer connects at 10:00 but EMF has been transmitting since 06:00. In this scenario, the Customer sends a retransmission request with the RECOVER FROM DATETIME set to 06:00 GMT on the current day. The RECOVER TO DATETIME would be omitted. In this case, as soon as EMF has replayed all the missed data, it will automatically send an END OF RETRANSMISISON NOTIFICATION.

However, there are chances that there is still a gap between the last retransmission messages and the last received real-time message. To recover the rest of the message, the Customer can request for retransmission again but this time specify the UOK and End UOK. The UOK could be extracted from the last message of historical retransmission while End UOK is obtained from the last received real-time message.

4.7.3.2 Scenario 2

A Customer lost connection to EMF system, then reconnects and request for a replay of missed data before processing the broadcast data.

1. Join Production Data Multicast Group and start caching real-time data updates.

2. Connect to Recovery Request Gateway

3. Send Login Request (and check response)

4. Send Retransmission Request with UOK set to the last known received message, End UOK set to last received real-time message, and RECOVERY ADJUSTMENT set to a negative number (say, -100).

5. Process the Retransmission Messages between the Start of Retransmission Notification and End of Retransmission Notification.

6. Apply the cached real-time data update and continue to process broadcast from the Production Data Multicast Group.

This is identical to the previous scenario, except that the UOK of the last successfully processed message from EMF will be known. In this scenario, instead of using the RECOVER FROM DATETIME, the UOK, End UOK and a RECOVERY ADJUSTMENT will be specified. Typically, the UOK will match the UOK from the last processed message and the RECOVERY ADJUSTMENT a small negative number (e.g. -100). This ensures that all messages immediately prior to the disconnection are received. This may be needed because the messages may be resent in a slight different order the Customer connects to a different Recovery Request Gateway (this is possible if the connection is through a load balancer). If there is no load balancer for managing connections for retransmission request, RECOVERY ADJUSTMENT could be safely set to zero.

Duplicated messages will need to be filtered by UOK as messages that have already been processed will be received. The RECOVERY ADJUSTMENT counts total messages generated by EMF, rather than ones that should have been previously received, so typically less messages will need to be filtered than the number specified in the RECOVERY ADJUSTMENT.

Note: The UOK included in the retransmission request must be a valid UOK -- i.e. it must correspond to a message that has been sent from Production Data Multicast Group in the last two days. If not, EMF will reject the request with a return code of “114” retransmission. Those UOKs obtained from the Refresh Multicast Groups are not considered as valid UOK.

4.7.3.3 Scenario 3

After scenarios 1 or 2, the customer may wish to request missed messages during the period when no data was received, but only for a subset of the data.

1. EMF is sending just heartbeats (normal day is finished)

2. Connect to Recovery Request Gateway

3. Send Login Request (and check response)

4. Send the RETRANSMISSION REQUEST message with RECOVER FROM DATETIME and RECOVER TO DATETIME set appropriately.

5. EMF sends a START OF RETRANSMISSION NOTIFICATION message through same TCP connection.

6. EMF resends the missed messages, and the vendor populates it trades database.

7. EMF sends an END OF RETRANSMISSION NOTIFICATION message.

8. Customer sends either a LOGOUT message to disconnect from Recovery Request Gateway or joins the Production Data Multicast Group channels to continue.

In this case, a Customer may wait until the normal data has been sent at the end of the day and request a retransmission with both a RECOVER FROM DATETIME and a RECOVER TO DATETIME. The data set can be refined if only a specific data set is required (e.g. news to populate the news history). The sequence will be as with previous retransmission requests.

4.7.3.4 Scenario 4

A customer connects and requests a static data refresh. Prior to receiving the end of static data full image refresh notification, the connection is lost.

In this scenario, it might seem feasible to connect and request a retransmission request however, the static / price full image refresh messages are not replayed. It is recommended that the request for refresh data is repeated rather than starting a retransmission.

Note: As previously stated, the UOK in any retransmission request must be a valid UOK. The UOKs that are provided in the Static Refresh messages that are received from Refresh Multicast Group are not designed for historical recovery and hence, they are not considered as valid UOK.

Appendix A. Sample Messages

A.1 Login Message

This example shows a Login request of 44 bytes in length for user “A TYPICAL CLIENT” with a request identity of 123 and password of PASSWORD1.

The login message is sent to the system via a TCP link. The EMF header reserved for UDP Multicast delivery is not required.

DATA	FIELD NAME	FID	VALUE
00 2A	LEN	N/A	42
00 00	MESSAGE IDENTITY	N/A	0
4B 4C 04 00 00 00 7B	REQUEST IDENTITY	0x4B4C	123
87 57 11 00 41 5F 54 59 50 49 43 41 4C 5F 43 4C 49 45 4E 54	USER IDENTITY	0x8757	“A_TYPICAL_CLIENT”
87 41 0A 00 50 41 53 53 57 4F 52 44 31	PASSWORD	0x8741	“PASSWORD1”

A.2 Login Acknowledgement

In response to a Login request, a Login Acknowledgement will be returned. This example shows a potential return, with a length of 23 bytes, to the request in A.1, request identity 123. In this case the request has been successful, return code 1, and the session sequence number has been initiated.

The login message is sent to the system via a TCP link. The EMF header reserved for UDP Multicast delivery is not required.

DATA	FIELD NAME	FID	VALUE
00 1C	LEN	N/A	21
00 32	MESSAGE IDENTITY	N/A	50
4B 4C 04 00 00 00 7B	REQUEST IDENTITY	0x4B4C	123
4B 64 04 00 00 00 01	SESSION SEQUENCE NUMBER	0x4B64	1
87 43 02 00 31	RETURN CODE	0x8743	“1”

Appendix B. Field Type

This appendix summarises all possible field types supported in the Euronext Multicast Feed.

Note: Network byte ordering is used to encode multi-byte data types.

B.1 Boolean

Boolean fields contains ONE byte that may have the following possible values:

VALUE	MEANING
0	False/No/Off
1	True/Yes/On

B.2 Byte Array

A Byte Array field stores data in a contiguous memory organisation. Its size is variable.

A Byte Array is considered as empty when its length is equal to 0.

B.3 Character

The Character fields are one byte in length. Its primary usage is for storage of a short integer or a single text character:

- Numeric – value from -127 to 127.
- Text Character – printable characters e.g. ‘A’ to ‘Z’, ‘a’ to ‘z’ and ‘0’ to ‘9’

No value is represented by the value of -128.

B.4 Date and Time Types

B.4.1 Date Time

This data type encodes both date and time information inside a single 64-bit binary field.

LENGTH	REPRESENTATION IN DECIMAL NUMBER
8 bytes	YYYYMMDDHHMMSSNNN

The following table shows an example of date time data type:

DATE & TIME	DECIMAL VALUE
2003/12/23 12:34:56.123	20031223123456123

No value is represented by the value of –1.

B.4.2 Time

This data type contains the value of time. The data is stored as a single 32-bit binary field.

LENGTH	REPRESENTATION IN DECIMAL NUMBER
4 bytes	HHMMSSNNN

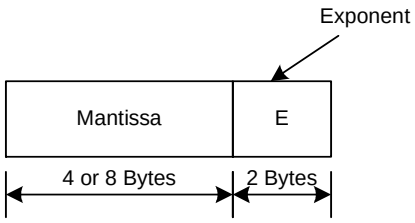
The following table shows an example of date time data type:

DATE & TIME	DECIMAL VALUE
12:34:56.123	123456123

No value is represented by the value of –1.

B.5 Decimal Number Types

The EMF representation of a Decimal Number captures the numerical value of a field with no precision loss in a fixed memory size. The diagram below shows the structure of a Decimal Number.



A Decimal value is composed of two parts:

- Mantissa
- Exponent

The exponent is a 2-byte signed integer which ranges from -32768 to 32767, defining the order of magnitude of base 10 of the number.

- Decimal Value = Mantissa * $10^{Exponent}$

B.5.1 Decimal

The mantissa part of a Decimal value is a 4-byte signed integer with the range from -2^{31} to $2^{31} - 1$. A Decimal value is therefore 6 bytes in length.

Examples of Decimal numbers are shown in the following table:

ACTUAL VALUE	REPRESENTATION	
	MANTISSA	**EXPONENT**
123.45	00 00 30 39	FF FE
-12345.67	FF ED 29 79	FF FE
-123450000	FF FF CF C7	00 04

No value is represented by the value of Mantissa = 0 and Exponent = -32768 or 0x00 00 00 00 80 00.

B.5.2 Long Decimal

A Long Decimal field is identical to a Decimal field except that the mantissa part is an 8-byte signed integer with the range from -2^{63} to $2^{63} - 1$.

Examples of Long Decimal numbers are shown in the following table:

ACTUAL VALUE	REPRESENTATION	
	MANTISSA	**EXPONENT**
123.45	00 00 00 00 00 00 30 39	FF FE
-12345.67	FF FF FF FF FF ED 29 79	FF FE
12345667890.123	00 00 01 1F 71 FB 04 CB	FF FD
-123456789012300	FF FF FE E0 8E 04 FB 35	00 02

No value is represented by the value of Mantissa = 0 and Exponent = -32768.

B.6 Integer Types

The Euronext Multicast Feed contains three different integer types which differ only in their length.

B.6.1 Short Integer

A Short Integer is a signed 2-byte integer with a value ranging from -2^{15} to $2^{15}-1$.

No value is represented by the value –32768.

B.6.2 Integer

An Integer is a signed 4-byte integer with a value ranging from -2^{31} to $2^{31}- 1$.

No value is represented by the value of –2147483648.

B.6.3 Long Integer

A Long Integer is a signed 8 byte integer with a value ranging from -2^{63} to $2^{63}- 1$.

No value is represented by the value of –9223372036854775808.

B.6.4 String

The String data type is used to store a variable size text string in a contiguous memory organisation. Zero is not allowed in the String text. The most significant bit of the first byte is used to determine the code set of contained text characters. The code set byte is mandatory and can be zero when there is no code set specified.

- If it is cleared – 7-bit ASCII string
- If it is set – reserved for future used.

No value is represented by the value of 0xFF in the first byte.

Appendix C. Message Types

MESSAGE TYPE	MESSAGE IDENTITY
Requests from Users	
Login	0
Logout	1
Historical Data Retransmission Request	2
Static Data Full Image Refresh Request	9
Request Acknowledgements	
Login Acknowledgement	50
Logout Acknowledgement	51
Historical Data Request Acknowledgement	52
Static Data Full Image Refresh Request Acknowledgement	59
Notifications and Status	
Start of Historical Data Retransmission Notification	100
End of Historical Data Retransmission Notification	101
System Status	104
System Logout Notification	105
Retransmission Interruption Notification	106
Start of Static Data Full Image Refresh Notification	109
End of Static Data Full Image Refresh Notification	110
Data Messages	
Static Data Full Image Refresh	151
Price Data Update	156
Host Failure Notification	156

Appendix D. System Fields

This appendix lists the System Data Fields that are used within the Euronext Multicast Feed. System Data Fields are included in messages regardless of the source. They are used in those sections of messages that do not change from one source to another, such as the Message Identification section.

The following table provides the System Data Fields in alphabetical order by field name.

FIELD	DATA TYPE	FID	DESCRIPTION
BROADCAST TIMESTAMP	Long Integer	0x7711	Number of microseconds elapsed since mid-night.
EIID	String	0x8751	Unique identifier for any instrument
ENCRYPTION KEY	String	0x8486	Encryption Key
INSTRUMENT TYPE	Character	0x4010	Asset class for the data in the record. See Appendix E - Instrument Types for possible values.
LOGOUT REMARK	String	0x872E	Description of the reason for being logged out.
PASSWORD	String	0x8741	Password, included in the LOGON REQUEST message.
RECOVER FROM DATETIME	Date Time	0x5330	Start time for retransmission request.
RECOVER TO DATETIME	Date Time	0x5334	End time for retransmission request
RECOVERY ADJUSTMENT	Integer	0x4B63	Number of messages to shift from the base point for recovery by message ID. If negative, then shift earlier; if positive shift later.
REQUEST IDENTITY	Integer	0x4B4C	Unique identifier for any request sent by the user. Possible values / Restrictions: The value of this field must be an integer, x, satisfying: 1 <= x <= 32767
RETURN CODE	String	0x8743	Identifier for the response to the request. Value depends on the message request. See the various sections in the Specifications for specific values for each request type.
SESSION SEQUENCE NUMBER	Integer	0x4B64	Sequence number for the session. Increases by 1 for each message received from EMF.
SYSTEM TIME	Time	0x5B54	EMF time (in UTC) included in each system status message.
UNIQUE OUTPUT KEY	Long Integer	0x7762	Unique identifier for each message

FIELD	DATA TYPE	FID	DESCRIPTION
			sent by EMF. Used in message recovery.
END UNIQUE OUTPUT KEY	Long Integer	0x7591	End unique output key of recovery request
USER IDENTITY	String	0x8757	User name included in each logon request.

Appendix E. Instrument Types

The Instrument Type field in the DATA IDENTIFICATION section determines the asset class to which the quote or trade refers.

Data Field	Value	Remark
Cash instrument types	'B'	BOND
	'E'	STOCK
	'W'	WARRANT
	'b'	TRACKER
	'D'	FUND
	'k'	REPO
	'I'	INDEX
	'/'	CURRENCY
	'0'	INSTRUMENT GROUP
	'K'	MARKET
	'N'	NEWS

Please note: The Value shown here is the ASCII value of the field value.