

Encoding FIX using Google Protocol Buffers

Release Candidate 3 – User Guide

RELEASE CANDIDATE 3, Document Revision 1.8 : Dec.12, 2018

THIS DOCUMENT IS A RELEASE CANDIDATE FOR A PROPOSED FIX TECHNICAL STANDARD. A RELEASE CANDIDATE HAS BEEN APPROVED BY THE GLOBAL TECHNICAL COMMITTEE AS AN INITIAL STEP IN CREATING A NEW FIX TECHNICAL STANDARD. POTENTIAL ADOPTERS ARE STRONGLY ENCOURAGED TO BEGIN WORKING WITH THE RELEASE CANDIDATE AND TO PROVIDE FEEDBACK TO THE GLOBAL TECHNICAL COMMITTEE AND THE WORKING GROUP THAT SUBMITTED THE PROPOSAL. THE FEEDBACK TO THE RELEASE CANDIDATE WILL DETERMINE IF ANOTHER REVISION AND RELEASE CANDIDATE IS NECESSARY OR IF THE RELEASE CANDIDATE CAN BE PROMOTED TO BECOME A FIX TECHNICAL STANDARD DRAFT.

© Copyright 2018 FIX Trading Community™

DISCLAIMER

THE INFORMATION CONTAINED HEREIN AND THE FINANCIAL INFORMATION EXCHANGE PROTOCOL (COLLECTIVELY, THE "FIX PROTOCOL") ARE PROVIDED "AS IS" AND NO PERSON OR ENTITY ASSOCIATED WITH THE FIX PROTOCOL MAKES ANY REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, AS TO THE FIX PROTOCOL (OR THE RESULTS TO BE OBTAINED BY THE USE THEREOF) OR ANY OTHER MATTER AND EACH SUCH PERSON AND ENTITY SPECIFICALLY DISCLAIMS ANY WARRANTY OF ORIGINALITY, ACCURACY, COMPLETENESS, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. SUCH PERSONS AND ENTITIES DO NOT WARRANT THAT THE FIX PROTOCOL WILL CONFORM TO ANY DESCRIPTION THEREOF OR BE FREE OF ERRORS. THE ENTIRE RISK OF ANY USE OF THE FIX PROTOCOL IS ASSUMED BY THE USER.

NO PERSON OR ENTITY ASSOCIATED WITH THE FIX PROTOCOL SHALL HAVE ANY LIABILITY FOR DAMAGES OF ANY KIND ARISING IN ANY MANNER OUT OF OR IN CONNECTION WITH ANY USER'S USE OF (OR ANY INABILITY TO USE) THE FIX PROTOCOL, WHETHER DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL (INCLUDING, WITHOUT LIMITATION, LOSS OF DATA, LOSS OF USE, CLAIMS OF THIRD PARTIES OR LOST PROFITS OR REVENUES OR OTHER ECONOMIC LOSS), WHETHER IN TORT (INCLUDING NEGLIGENCE AND STRICT LIABILITY), CONTRACT OR OTHERWISE, WHETHER OR NOT ANY SUCH PERSON OR ENTITY HAS BEEN ADVISED OF, OR OTHERWISE MIGHT HAVE ANTICIPATED THE POSSIBILITY OF, SUCH DAMAGES.

DRAFT OR NOT RATIFIED PROPOSALS (REFER TO PROPOSAL STATUS AND/OR SUBMISSION STATUS ON COVER PAGE) ARE PROVIDED "AS IS" TO INTERESTED PARTIES FOR DISCUSSION ONLY. PARTIES THAT CHOOSE TO IMPLEMENT THIS DRAFT PROPOSAL DO SO AT THEIR OWN RISK. IT IS A DRAFT DOCUMENT AND MAY BE UPDATED, REPLACED, OR MADE OBSOLETE BY OTHER DOCUMENTS AT ANY TIME. THE FPL GLOBAL TECHNICAL COMMITTEE WILL NOT ALLOW EARLY IMPLEMENTATION TO CONSTRAIN ITS ABILITY TO MAKE CHANGES TO THIS SPECIFICATION PRIOR TO FINAL RELEASE. IT IS INAPPROPRIATE TO USE FPL WORKING DRAFTS AS REFERENCE MATERIAL OR TO CITE THEM AS OTHER THAN "WORKS IN PROGRESS". THE FPL GLOBAL TECHNICAL COMMITTEE WILL ISSUE, UPON COMPLETION OF REVIEW AND RATIFICATION, AN OFFICIAL STATUS ("APPROVED") OF/FOR THE PROPOSAL AND A RELEASE NUMBER.

No proprietary or ownership interest of any kind is granted with respect to the FIX Protocol (or any rights therein).

Copyright 2003-2018 FIX Trading Community™, all rights reserved.

Document History

Revision	Date	Author	Revision Comments
0.1	2013-04-10	Greg Malatestinic, Jordan & Jordan Sara Rosen, CME Alessandro Triglia, OSS Nokalva	Initial draft.
0.2	2013-04-16	Greg Malatestinic, Jordan & Jordan Sara Rosen, CME Alessandro Triglia, OSS Nokalva	Changes due to feedback from HPWG review.
0.3	2013-08-15	Greg Malatestinic, Jordan & Jordan Sara Rosen, CME Joe Wood, Credit Suisse	Updated with conclusions from Community Review.
0.4	2013-11-05	Greg Malatestinic, Jordan & Jordan Sara Rosen, CME Joe Wood, Credit Suisse	Release Candidate 2 initial draft
0.15	2013-11-22	Greg Malatestinic, Jordan & Jordan Sara Rosen, CME Joe Wood, Credit Suisse	Submitted to GTC.
0.16	2014-1-27	Greg Malatestinic, Jordan & Jordan Sara Rosen, CME	Changes based on feedback from GTC.
0.22	2014-3-27	Greg Malatestinic, Jordan & Jordan Sara Rosen, CME Joe Wood, Credit Suisse	Changes based on introduction of simple open framing header and message encoding headers.
RC3, v 1.0	2018-09-21	Greg Malatestinic, Jordan & Jordan Sara Rosen, CME	Changes for Release Candidate 3: <ul style="list-style-type: none"> • Decimal64 & Decimal32 message types. • Timestamp message types • Enum handling for unspecified values • Proto3 recommendations
RC3, v 1.8	2018-12-12	Greg Malatestinic, Jordan & Jordan Sara Rosen, CME	LocalMarketTime Updated sample code listing.

Table of Contents

- 1 Introduction.....7
 - 1.1 Google Protocol Buffers for FIX.....7
 - 1.2 References.....8
- 2 Google Protocol Buffers Overview9
 - 2.1 Templates9
 - 2.2 Field Properties - Names and Tags9
 - 2.3 Message Encoding 10
 - 2.4 Optional Fields..... 10
 - 2.5 Repeating groups..... 11
 - 2.6 Protobuf Options 11
 - 2.7 Custom Options 12
 - 2.8 Embedded Comments 13
 - 2.9 Utilities..... 13
- 3 FIX Mapping..... 14
 - 3.1 Naming conventions..... 14
 - 3.2 Automated Mapping from FIX Repository 15
 - 3.3 FIX Metadata 17
 - 3.4 Proto File Organization..... 19
 - 3.5 Field Ordering..... 20
- 4 FIX Data Types 21
 - 4.1 Timestamps 21
 - 4.2 TimeOnly..... 21
 - 4.3 Time-zone Time 22
 - 4.4 Local Market Time 23
 - 4.5 Dates..... 23
 - 4.6 Decimal Values 24
 - 4.7 Fractional Values 24
 - 4.8 MultipleCharValue..... 25
 - 4.9 Encoding Attributes 25

- 5 Usage Guidelines 26
 - 5.1 Optional/Required Fields..... 26
 - 5.2 Versioning..... 26
 - 5.3 Message Evolution..... 27
 - 5.4 Direct Access..... 27
 - 5.5 Routing 28
 - 5.6 Self-describing Messages 28
- 6 Message Headers 29
 - 6.1 Framing for Message Streams..... 29
 - 6.2 GPB Encoding Header..... 29
 - 6.3 Alternate Framing Mechanisms 31
- 7 Performance Considerations 33
 - 7.1 Binary Data Representation 33
 - 7.2 VarInts vs. Fixed Length Fields..... 33
- 8 Proto3 Considerations 35
 - 8.1 Default Handling and Field Presence..... 36
 - 8.2 Enum Handling 36
 - 8.3 Removal of Optional/Required Keywords..... 37
 - 8.4 Pre-defined datatypes 37
 - 8.5 Preservation of Unknown Fields..... 37
 - 8.6 Additional Language Support 37
 - 8.7 JSON Mapping 37
 - 8.8 Backward Compatibility..... 37
- 9 Appendix A - Sample Proto2 Messages 39
 - 9.1 Meta.Proto 39
 - 9.2 Fix.proto 40
 - 9.3 Session.proto 43
 - 9.4 SingleGeneralOrderHandling.proto..... 54
- 10 Appendix B - Sample Proto3 Messages 57
 - 10.1 Meta.proto 57
 - 10.2 Fix.proto 58

- 10.3 Session.proto 62
- 10.4 SingleGeneralOrderHandling.proto 68
- 11 Appendix C – FIX Messages by Category 72

1 Introduction

The High Performance working group (HPWG) was created by the FIX Trading Community™ Global Steering Committee in July 2012. Originally chaired by Fred Malabre and Mark Reece, the HPWG is currently co-chaired by Hanno Klein and Jim Northey. The charter of the working group is to identify opportunities to enrich high performance financial messaging and propose specific enhancements to FIX to address these identified opportunities at the application, session, and encoding layers.

Several encoding subcommittees were formed. Among them is The Google Protocol Buffers encoding subgroup, led by Greg Malatestinic and Sara Rosen.

The mandate of the Google Protocol Buffer encoding subgroup is to define a mechanism for mapping FIX to Protocol Buffers which can support the rich semantics of the FIX language while meeting the performance goals of the High Performance trading community.

The Google Protocol Buffer encoding utilizes existing industry standard encodings and applies them to the FIX domain. Google Protocol Buffers is a mature binary encoding which can be applied “out of the box” to support FIX language semantics. However, the richness of this technology supports multiple solutions to mapping the existent FIX data types to a binary protocol. In the interest of standardization, this document will specify a normative encoding of the FIX data types in protocol buffers for interoperable exchange of financial data over FIX. Additionally, this document will spell out best practice guidelines for maximizing the efficiency of protocol buffer encodings.

1.1 Google Protocol Buffers for FIX

Protocol buffers are Google's language-neutral, platform-neutral, extensible mechanism for serializing structured data.

Protocol buffers are an attractive encoding technology for FIX messages for a number of reasons:

- **Open** – The complete GPB specification has been published and Google has clearly stated that GPB is available for use by anyone. Protobuf is language and platform independent, supporting C++, Java, Python and other languages on most common operating systems. Clients do not need to write their own encoders/decoders, but can rather incorporate the Google provided API's within their software.
- **Flexible** - Like FIX, protobuf messages are tagged. This supports optional fields, which can be leveraged to support multiple use cases via a single message definition.
- **Versioning** - Protobuf messages support backward compatibility across older versions of message specifications. Messages can be modified without breaking applications that utilize prior message definitions, thus reducing deployment dependencies between message producers and consumers.
- **Performance** - Protobuf produces compact binary messages to maximize network bandwidth and reduce serialization delays. Protobuf serialization is CPU efficient, with a low encoding and decoding overhead and a minimal footprint.
- **Ease of Use** - Protobuf is well documented and easy to learn. Encoders and decoders can be embedded directly in the target applications, for “do it yourself” FIX implementations.

- Structured - Protobuf supports repeating fields and nested messages, similar to FIX repeating groups. Unlike FIX, nested messages can have the same field names at any level of nesting, so there is no need for artificial constructs like Parties, NestedParties, NestedParties2, etc.
- Templates - Similar to FASTSM (<http://www.fixprotocol.org/fast>), protobuf message structures are defined in message templates, which are used by message recipients to decode the data. Default values can be populated based on template definitions, further reducing messaging bandwidth for the most commonly used values.
- Adoption - Protobuf has a large and active user community. It is also a mature technology, in use since 2001. It also serves as the underlying messaging technology for a number of open source frameworks.

1.2 References

[1] <https://developers.google.com/protocol-buffers/docs/overview>

GPB project home – Language Guide and Encoding Specification.

[2] [Encoding FIX using GPB, RC3 Specification](#)

[3] <http://www.fixprotocol.org/fastspec>

FIX Adapted for StreamingSM (FASTSM) specifications.

2 Google Protocol Buffers Overview

2.1 Templates

GPB data structures are defined as “messages” in a “.proto” template file. The template provides a machine-readable interface definition which is input to language-specific code generators to produce message encoders and decoders. These expose getters and setters for each field as well as methods to serialize/parse the whole structure to/from raw bytes. Senders and receivers must each have a copy of the proto file to encode or parse the message. These are typically exchanged out-of-band. Dynamic transmission is also possible, though less performant.

The template defines the structure and properties of the message and its fields. Messages may be nested or contain repeating groups of messages. Fields may be specified as required or optional, and may contain default values. Templates may also contain human-readable comments and namespace identifiers to prevent message collisions between packages. A single proto file may define multiple message types, and can also reference messages defined in external proto files, via the “import” command.

Here is a sample template for a FIX Logout message:

```
message Logout { // FIX MSG_ID = 5
  optional Header header = 1;
  optional int32 session_status = 2 [default = 4]; //Session status at time of logout
  optional string text = 3;
  optional bytes encoded_text = 4;
  optional Trailer trailer = 5;
};
```

2.2 Field Properties - Names and Tags

The general structure of a protobuf field is

```
<rule> <type> <name> = <tag> [{<options>}];
```

Every protobuf field has an ASCII field name and an integer field tag. The field name is the data structure’s human-readable symbolic name. Field names are not present in the binary payload of the message. Rather, the field name is mapped to the field’s accessor methods to encode/decode the binary message from/to the data structures specified in the message’s proto template. For FIX encoding, the protobuf field names are based on the FIX field and component names.

The field tag is the machine-readable integer which is embedded in the binary message, and which enables the GPB decoder to map the value from the wire-stream value to its associated data structure.

Tags with a value of 1-15 occupy one byte. Tags in the range 16-2047 take two bytes, and larger values take more. A highly optimized schema will determine the most frequently occurring message elements and assign these to the lower-value tags.

For this reason, and also to support mapping a single FIX field to multiple protobuf fields, the GPB Encoding Subgroup has decided not to utilize the FIX tags for the protobuf tag ids. Rather, tag numbers were sequentially auto-generated based on field order in the FIX repository. Clients who wish to optimize bandwidth utilization may re-sequence the fields based on the relative field utilization in their context. Unlike FIX tag numbers, protobuf field tags need not be globally unique, but must only be unique per message. The standard convention is to utilize the lowest tag numbers as possible so as to minimize the size of an encoded message.

Field rules are “required”, “optional”, and “repeated”. Required fields must appear exactly once. Optional fields may appear zero or once, and repeated fields may appear zero to any number of times.

2.3 Message Encoding

A top level message has no envelope structure. The message is just a sequence of its member key-value fields. Embedded messages are encoded similar to strings, e.g. they contain a length-delimited sequence of bytes. Like all fields, this embedded message is preceded by its field tag, which associates it with its message type. This allows the protobuf decoder to recursively invoke the appropriate parser for the byte string containing the embedded message.

Example of a simplified Market Data Snapshot message:

```
Message Instrument {
    string symbol = 1;
    fixed32 security_id = 2;
}

Message MDFullGrp {
    ...
}

Message MarketDataSnapshotFullRefresh {
    fixed32 md_request_id = 1;
    Instrument instrument =2;
    repeated MDFullGrp md_full_grp =3;
}
```

When parsing the MarketDataSnapshotFullRefresh message, presence of tag=2 causes the parser to extract the length-delimited sequence of bytes representing the instrument field. It then invokes the parser of the Instrument class to decode the nested message.

2.4 Optional Fields

Protobuf is a tagged-value encoding. This means that the presence or absence of a field can be detected by the presence of the field tag in the output stream. As a result, Protobuf is especially efficient for encoding /decoding messages with sparse optional fields, i.e. messages with many empty fields. Optional fields which are not set by the encoder carry no bandwidth overhead.

There are no “null” values in protobuf. When a message is parsed, if an optional field is not present in the message, the GPB decoder sets the value of the associated field to its default value. Default values may be specified explicitly in the proto template. Otherwise, a default value is determined implicitly, based on field type.

It is occasionally useful to determine whether the value of a decoded field was explicitly set by the message producer or whether it was set to a default value by the decoder. For each optional field, XXX, the GPB pre-compiler generates a Boolean accessor method, HasXXX(), which can be utilized to determine whether or not the field was present on the wire.

Note: See [Proto3 Considerations](#) (Chapter 8) regarding changes to default handling in proto3.

2.5 Repeating groups

The GPB encoding supports repeating groups. Repeating groups may appear any number of times in the message, including zero times. The order of the repeated group will be preserved in the protocol buffer. A repeating group with a recurrence of zero does not consume message bandwidth.

GPB also supports a packed encoding of repeating groups. Only repeating groups which contain only primitive numeric types can be declared packed. Rather than having the tag and type appear for each element of the repeating group, the entire list is encoded as a single length-delimited key-value pair containing the concatenated values of all the data elements.

Source: <https://developers.google.com/protocol-buffers/docs/encoding#optional>

2.6 Protobuf Options

GPB encoding makes use of additional metadata in the form of GPB Options. Options are annotations used to add information about the message schema over and above the standard schema constructs offered by the proto schema file. This metadata can be used to decorate fields, messages, packages, enumerated types and enumerated values. Conceptually, GPB Options are similar to Java’s decorators or .NET’s attributes.

Protocol Buffers provide a set of predefined Options that can be used in any proto file. As illustrated below, the predefined set includes a file option to specify the generated Java package name, and field options to specify a default value or to indicate that a field is deprecated. These options are added in-line to the proto file, with field options appended after the field declaration in square parenthesis:

```
package sample;
option java_package = "com.fix.sample";
message SampleMessage
{
  ...
  optional int32 old_field = 6           [deprecated=true];
  optional int32 new_field=7           [default=1000];
}
```

2.7 Custom Options

In addition to the predefined set of options supplied by Google, custom options can be defined to expose additional metadata via the schema. Metadata can be used to annotate the .proto file with user interface bindings, expected field ranges, or custom validations. For FIX encoding via GPB, metadata is used to annotate the proto schema with the FIX tag numbers, FIX version added/deprecated, and FIX enumerated values from the FIX Repository. Rather than embedding this information in comments or rules of engagement documents, custom options provide programmatic access to this rich metadata.

Custom options are typically defined in their own proto file as extensions to the core GPB metadata types. For example, the following file defines a file and a field custom option. Note that the Google-supplied file **descriptor.proto** needs to be imported into this file as it supplies the definitions of the core GPB metadata types:

```
import "google/protobuf/descriptor.proto";
package my_options;
extend google.protobuf.FieldOptions {
    optional sfixed32 max_value = 51234;
}
extend google.protobuf.MessageOptions {
    optional string message_type = 51236;
}
```

These custom options can then be used in proto files by importing their definitions and using them to annotate files, messages and fields. The custom option's name is required to be placed inside parentheses to differentiate it from the predefined standard options:

```
import "my_options.proto";
package sample;
option java_package = "com.fix.sample";
message TradeCaptureReport
{
    option (my_options.message_type) = "AE";
    optional string trade_id = 1;
    optional fixed64 last_qty = 2[(my_options.max_value) = 999999999];
}
```

Metadata defined by GPB Options and Custom Options can be accessed using the protobuf library **Descriptor** class. Options provide an efficient way to supply encoding information with no overhead to the message payload.

The FIX to GPB mapping process makes use of GPB Options to provide:

- Information tying proto file entries back to the FIX repository.

- FIX version information, tying fields and enums to the FIX Repository version when they were introduced or deprecated.
- Decimal precision of fixed and floating point numbers
- TimeUnit and epoch of dates and timestamps
- Validation information, such as string length and valid ranges

Just like GPB messages, custom option definitions may be organized into multiple .proto files, each with its own namespace. The FIX to GPB mapping specification defines two custom option .proto files:

- meta.proto – general metadata describing field usage
- fix.proto - FIX-specific metadata, based on the information in the FIX Repository

For more information about GPB Custom Options refer to <https://developers.google.com/protocol-buffers/docs/proto#options>, or the complete Protocol Buffers Documentation [1].

2.8 Embedded Comments

Comments embedded within a .proto schema are propagated into the generated source code. This is a convenient method to supply message documentation to the IDE of the protobuf-generated classes.

For FIX encoding, comments from the FIX repository as well as custom usage comments can be embedded within the proto files to make this documentation available to message consumers.

Example:

```
optional bool working_indicator = 21  [(fix.tag)=636, (fix.type)=BOOLEAN,  
                                       (fix.added)=FIX_4_3];  
  
// Indicates if the order is currently being worked.  
Applicable only for OrdStatus = "New". For electronic  
markets, indicates that the order has transitioned from  
a contingent order to a market order.
```

2.9 Utilities

Google provides GPB parsers for Java, C++, and Python. Also provided are utilities for printing and displaying GPB messages in a human-readable, text-based format. See for example the C++ text formatting methods at: https://developers.google.com/protocol-buffers/docs/reference/cpp/google.protobuf.text_format

Many other language encoders/decoders have been developed by the open-source community. These include ActionScript, C#, Javascript, Lua, Perl, PHP, R, Android, and Ruby.

Other open-source GPB utilities include tools for converting GPB messages to XML, JSON, or HTML.

A full list of Third Party GPB Add-Ons is provided at: <http://code.google.com/p/protobuf/wiki/ThirdPartyAddOns>

3 FIX Mapping

The following is a brief discussion of a few of the salient points of the mapping. A full description of the procedure to map the full contents of the FIX Unified Repository to GPB can be found in the “[Encoding FIX using GPB, RC3](#)” Specification.

3.1 Naming conventions

Field names in the proto file are recommended to conform to the GPB field naming conventions. This will allow the GPB language-specific compilers to generate variable names which conform to the naming conventions of each target language.

GPB field names are lower case underscore-separated.

FIX field name	proto field name	generated Java variable	generated .NET variable	C++
OnBehalfOfCompID	on_behalf_of_comp_id	onBehalfOfCompId	OnBehalfOfCompId	on_behalf_of_comp_id
IOINaturalFlag	ioi_natural_flag	ioiNaturalFlag	ioiNaturalFlag	ioi_natural_flag
MDEntryPx	md_entry_px	mdEntryPx	MdEntryPx	md_entry_px

GPB message names are in Pascal Case, which capitalizes the first character of each composite word, including acronyms. This applies to both stand-alone FIX messages and FIX components embedded within GPB messages.

FIX message or component name	proto message name	generated Java class	generated .NET class	C++
NewOrderSingle	NewOrderSingle	NewOrderSingle	NewOrderSingle	NewOrderSingle
MDIncGrp	MdIncGrp	MdIncGrp	MdIncGrp	MdIncGrp
IOIQualGrp	ioiQualGrp	ioiQualGrp	ioiQualGrp	ioiQualGrp

Instances of the embedded messages are themselves GPB fields, and follow the lower-case underscore-separated convention.

Example: The FIX component “PtysSubGrp” is mapped to a GPB message type of the same name.

```

message PtysSubGrp {
    optional string party_sub_id = 1;
    optional PartySubIdTypeUnion party_sub_id_type = 2;
}
    
```

Instances of this message type are embedded in other GPB messages as “ptys_sub_grp”.

```
message Parties {
  optional string party_id = 1;
  optional PartyIdSourceEnum party_id_source = 2;
  optional PartyRoleEnum party_role = 3;
  repeated PtysSubGrp ptys_sub_grp = 4;
}
```

FIX enumeration types are mapped to GPB enums. These follow the same convention as other GPB message types (PascalCase), concatenated with the string “Enum”, e.g. PartyRoleEnum.

Enumerated-value names are fully upper case, underscore-separated names. The name of the GPB enumerated type (minus the “Enum”) is pre-pended to the name of the GPB enumerated value, separated by yet another underscore.

```
enum HandlInstEnum {
  HANDL_INST_AUTOMATED_EXECUTION_UNSPECIFIED = 0;
  HANDL_INST_AUTOMATED_EXECUTION_NO_INTERVENTION = 1;
  HANDL_INST_AUTOMATED_EXECUTION_INTERVENTION_OK = 2;
  HANDL_INST_MANUAL_ORDER = 3;
}
```

Enumerated values are prepended with the name of the enumeration due to the GPB restriction that all enumerated values in a single proto be unique. For example, both the ExecType and OrdStatus enumerations have an enumerated value of “CANCELED”. Following the convention above, the two enumerated values are EXEC_TYPE_CANCELED, and ORD_STATUS_CANCELED, which preserves their uniqueness.

It is recommended that the first value of each enumeration include a placeholder for unspecified values. This will be the default value for messages which do not contain the enumeration field.

3.2 Automated Mapping from FIX Repository

The FIX to GPB Mapping Specification [2] describes how to take as input an XML element, whose syntax and semantics comply with those of the <fix> element of the FIX Unified Repository, and generate a Google Protocol Buffers schema, consisting of a set of GPB message and enumeration types.

This specification provides rules for mapping FIX messages and component blocks to GPB messages, FIX fields to GPB field definitions, and enumerated field values to GPB enum definitions. It shows that for each FIX message or component, the mapping of its field items will depend on their effective types which include but are not limited to the following:

- Component block
- Repeating block
- Datatype restricted by the enumeration specified in <enum> child elements
- Datatype with no restricted values
- Multiple-value type with values restricted by the enumeration specified in <enum> child elements

- Multiple-value type with no restricted values

The mapping utilizes various encoding attributes to annotate repository elements such as <datatype>, <field> and <fieldRef>. These attributes are used to determine the most favorable encoding when there are several options. They include:

- minValue - minimum permitted value of the integer datatype
- maxValue - maximum permitted value of the integer datatype
- minLength - minimum permitted length of the string datatype
- maxLength - maximum permitted length of the string datatype
- numBits - maximum size in bits of the data element
- isNumeric – indicates that a FIX string will take only numeric values
- isFloat – indicates that a numeric value should be encoded as a binary float rather than as an integral mantissa and exponent
- isFixedPoint – indicates that a consistent exponent should be applied to the integral mantissa
- exponent - the fixed exponent of a fixed-point decimal number or the default exponent for a floating-point decimal number

To illustrate how the effective datatype influences the mapping, let's consider the FIX field "Side". Since it is a char type, one may think it should be mapped to the GPB bytes type which is used to encode char values. But since "Side" is restricted by enumerated values "Buy", "Sell", "Sell Short", etc., its effective datatype causes the following GPB enum type to be generated:

```
enum SideEnum {
    SIDE_UNSPECIFIED = 0;
    SIDE_BUY = 1;
    SIDE_SELL = 2;
    SIDE_BUY_MINUS = 3;
    SIDE_SELL_PLUS = 4;
    SIDE_SELL_SHORT = 5;
    SIDE_SELL_SHORT_EXEMPT = 6;
    // etc.
}
```

Any FIX message or component containing the Side field will generate a GPB message containing a field definition of field type "SideEnum". For example, the FIX message NewOrderSingle will map to the following proto snippet:

```
message NewOrderSingle {
    // ...
    optional SideEnum side = n;
    // ...
}
```


To illustrate how encoding attributes may influence the mapping, let's consider the FIX integer field, `LiquidityNumSecurities`, with the encoding attributes `minValue` equal to 0 and `maxValue` equal to 10,000. We can conclude that all values of this field are positive and only four bytes are needed to store its value. This is mapped to the GPB type `fixed32`. Had `maxValue` been a number larger than 2^{32} this would map to the GPB type `fixed64`.

Please refer to the specification, [2], for complete details of the mapping.

3.3 FIX Metadata

Attributes derived from the FIX repository and encoding attributes may be used to embellish the proto schema with metadata in the form of custom options. This metadata helps define message usage and tie the GPB proto files back to the FIX repository.

As an example, the following FIX repository excerpt is shown below. A fragment of the Repository's `fields.xml` shows the definition of two FIX fields, with some information removed for simplicity:

```
<field id="99" name="StopPx" type="Price" textId="FIELD_99" added="FIX.2.7"
  notReqXML="1"
</ field>
<field id="120" name="SettlCurrency" type="Currency" textId="FIELD_120" added="FIX.4.0"
  notReqXML="1"
  <EncodingInfo minLength="3" maxLength="3"/>
</field>
```

The above two fields appear in the `ListOrdGrp` component block, which maps into a GPB message fragment as follows:

program-trading.proto:

```
message ListOrdGrp {
  ...
  optional Decimal64 stop_px = 27  [(fix.tag)=99, (fix.type)=DATATYPE_PRICE,
    (fix.field_added)=FIX_2_7];
  optional string settl_currency = 28 [(fix.tag)=120, (fix.type)=DATATYPE_CURRENCY,
    (meta.min_len)=3, (meta.max_len)=3, (fix.field_added)=FIX_4];
  ...
}
```

As can be seen from the above example:

- The FIX tag is indicated using the `fix.tag` field option.
- The FIX datatype is indicated using the `fix.type` field option.
- The price field is split is encoded as a `Decimal64` message type containing two scalars - one representing a mantissa, and the second representing its exponent.

- The Currency string has a constant length of 3. This is exposed through the **min_len** and **max_len** field options.

The mapping process uses the FIX repository and optional encoding attributes to generate GPB schemas decorated with these custom options. The complete set of encoding attributes and corresponding custom options can be found in the GPB Mapping Specification [2].

The custom options used by the FIX GPB encoding are split into two file separate files, meta.proto and fix.proto:

- **meta.proto** metadata is related to general binary message encoding (e.g. minSize, timeUnit)
- **fix.proto** metadata is specific to the FIX repository (e.g. FIX msgType, FIX tag, FIX version added)

The table below describes each custom option and its usage:

Option	Applied To	Defined In	Description
time_unit	A date or date/time field	meta.proto	Defines the unit of time of the applied scalar field. e.g. TIME_UNIT_DAYS, TIME_UNIT_MILLISECONDS.
epoch	A date or date/time field	meta.proto	The starting reference point used to calculate the date or date/time offset.
exponent	A fixed-point scalar field	meta.proto	Defines the exponent value (base 10) of the fixed or point decimal field. Used when a constant exponent will be applied to an integer mantissa.
minValue, maxValue	GPB scalar field	meta.proto	The minimum and maximum value of the field.
minLength, maxLength	GPB string field	meta.proto	The minimum and maximum length of a string. When minLength = maxLength, the string is fixed length.
msg_type	Top-level GPB message	fix.meta	Indicates the FIX message type from which the GPB message has been generated.
tag	Any GPB field	fix.meta	Indicates the FIX tag of the field.
type	Any GPB field	fix.meta	Indicates the FIX Repository data type of the field

field_added	Any GPB field	fix.meta	Indicates the version of FIX in which the field was first added to the component or message
field_added_ep	Any GPB field	fix.meta	Indicates the extension pack (if any) in which the field was first added to the component or message
field_deprecated	Any GPB field	fix.meta	If a field has been deprecated for a given component or message, this field option indicates in which version of FIX it was first deprecated.
enum_value	GPB enumerated value	fix.meta	Indicates the corresponding enumerated value in the FIX repository.
enum_added	GPB enumerated value	fix.meta	Indicates the version of FIX when the enumerated value was added to the component or message.
enum_added_ep	GPB enumerated value	fix.meta	Indicates the extension pack (if any) of FIX when the enumerated value was added to the component or message.

3.4 Proto File Organization

Rather than mapping the entire FIX repository to a single unwieldy proto file, recommendation is to partition the set of FIX messages into namespaces paralleling the 26 FIX categories. This allows each FIX category to be implemented and versioned independently.

In the auto-mapped proto files generated from the FIX repository, the set of FIX GPB schema files are comprised of a set of static files for custom options and supporting data-types, and the files generated from the FIX repository. The generated files are organized into files named after the containing FIX category. All fields, messages, and data-types belonging to a single FIX category are contained in a single proto file. The name of the proto file is taken from the category name, but converted to lower-case with hyphen separators (e.g. single-general-order-handling.proto). In addition to the category name, proto files should be identified with their version numbers, e.g. singlegeneralorderhandling.v3.proto. Version numbers will be used in the GPB fixed-length message framing header, and should therefore be integer numbers.

Dependencies between .proto files are managed by declared imports. When a GPB field declared in one .proto file is referenced from within another .proto file, the name of the field must be qualified by its originating namespace.

The core set of static GPB schema files are as follows:

- **meta.proto** – general custom options used to annotate the schema

- **fix.proto** – FIX specific custom options derived from the FIX repository
- **google/protobuf/descriptor.proto** – required Google metadata for field options (available from protobuf download site)

The following two proto files are imported as a dependency into each generated GPB schema file:

- **common.proto** – contains common data types and components used by multiple categories
- **session.proto** – contains the definition of the FIX standard header and trailer

For a full list of FIX categories and their associated proto file names, see Appendix A.

3.5 Field Ordering

For backwards compatibility, it is important that as new fields are added to the FIX Repository, the newly generated GPB field numbers do not collide with the existing field numbers of previous generations of proto files. Generated GPB schema files must therefore ensure that newer fields are appended at the end of GPB data structures so that the existing sequence of field numbers is not disrupted.

The ordering logic utilized by the FIX Repository Automated Mapping Specification [2] makes use of the FIX repository's "added" and "ep_added" attributes to sequence fields based on the FIX version when they were added to the repository. Fields and enumerated values which were added within the same FIX repository revision (indicated by the version, service pack and extension pack) are added in alphabetical order.

Just as it is important that new fields are added to the repository with an explicit FIX version, it is also important that defunct fields be marked as deprecated, rather than deleted. Fields should never be removed from the repository, as this would disrupt the field ordering and break backwards compatibility.

Organizations which generate proto files from Custom Repositories should implement a similar methodology to ensure that new fields are added at the end of previously defined GPB messages. Rather than using the FIX version when the field was introduced, ordering can be based on a custom encoding attribute indicating the proprietary version when the field was added.

4 FIX Data Types

4.1 Timestamps

ASCII timestamps are particularly inefficient. For example, a millisecond timestamp in the format YYYYMMDD-HH:MM:SS.sss consumes 21 bytes, and must be converted to a numeric values for date comparisons or calculations.

Proto3 adds support for a native GPB Timestamp object. This can be back-ported to Proto2 by adding the Timestamp message definition. The two fields of the Timestamp object represent the number of seconds since Unix epoch, and a non-negative nanosecond offset to that value.

See: <https://github.com/google/protobuf/blob/master/src/google/protobuf/timestamp.proto>

```
message Timestamp
{
    // Supports timestamps from 0001-01-01T00:00:00Z to 9999-12-31T23:59:59Z inclusive.

    // Represents seconds of UTC time since Unix epoch
    optional int64 seconds = 1;

    // Non-negative fractions of a second at nanosecond resolution. Negative
    // second values with fractions must still have non-negative nanos values
    // that count forward in time.
    // Must be from 0 to 999,999,999 inclusive.
    optional int32 nanos = 2;
}
```

For example, the FIX field SendingTime, tag 52, when represented as a millisecond timestamp, would be defined in a proto as:

```
optional Timestamp sendingTime = gpb_field_number;
```

and would be encoded with values:

```
sendingTime.seconds = {seconds offset to Unix epoch}
sendingTime.nanos = {positive nanosecond offset to above field}
```

4.2 TimeOnly

Fix fields which are of message time UTCTimeOnly are represented as an offset to the previous midnight. This is encoded using a custom TimeOnly message type using a seconds offset to midnight plus an optional additional positive nanosecond offset.

```
message TimeOnly
{
```

```

        optional int64 seconds = 1;
        optional int32 nanos = 2;
    }

```

Note: For performance reasons, HPWG GPB recommends that FIX integers map to the GPB fixed-length integer datatypes, such as `fixed32` & `fixed64`, rather than variable-length integers such as `uint32` & `uint64`. However, the timestamp message definitions utilize the `int32/64` & `sint32/64` data types for consistency with the Google-defined timestamp message definitions of Proto3.

4.3 Time-zone Time

FIX supports time-zoned times using the `TZTimeOnly` and `TZTimestamp` data methods. These contain a string representation of the time/timestamp together with a constant signed offset from UTC.

The binary encoding of this data type utilizes the UTC Timestamp/TimeOnly representation, with the addition of two signed integer fields for the hourly & minute offset from UTC time zone.

`TzTimeOnly` represents the FIX `TZTimeOnly` datatype of format `HH:MM[:SS][Z | [+ | - hh[:mm]]]`.

The UTC portion of the timestamp is represented using the same fields as the GPB `TimeOnly` message type.

message `TzTimeOnly`

```

{
    optional int64 seconds = 1; // number of seconds since midnight
    optional int32 nanos = 2; // positive nanosecond offset to seconds
    optional sint32 hour_offset = 3; // signed hourly offset to UTC
    optional sint32 minute_offset = 4; // signed minute offset to UTC
}

```

`TzTimestamp` represents a date-time. In this case, the seconds field represents the number of seconds since Unix epoch, with the addition of the signed offsets from UTC time.

message `TzTimestamp`

```

{
    optional int64 seconds = 1; // number of seconds since Unix epoch
    optional int32 nanos = 2; // positive nanosecond offset to seconds
    optional sint32 hour_offset = 3; // signed hourly offset to UTC
    optional sint32 minute_offset = 4; // signed minute offset to UTC
}

```

Note that when a negative timezone offset to UTC contains both hours and minutes, both the `hourOffset` and `minuteOffset` fields must be set to negative values.

4.4 Local Market Time

The FIX LocalMktTime datatype (EP 161) is used to represent a time local to a specific market center. This is used where offset to UTC varies throughout the year. Format is HH:MM:SS. The defining market center is identified in a corresponding field.

For example, the following two FIX fields are part of the PaymentScheduleGrp component:

0859	PaymentScheduleFixingTime	LocalMktTime The fixing time associated with the step schedule.
40860	PaymentScheduleFixingTimeBusinessCenter	String Business center for determining fixing time. See http://www.fpml.org/coding-scheme/business-center for standard 4-character code values.

Local timestamps cannot be easily mapped to a second/nanosecond offset to a midnight or Unix epoch, due to gaps when the local time moves ahead/back for daylight savings time.

GPB representation of a local time will include the hours, minutes, seconds, and nanosecond offset.

message LocalMarketTime

```

{
    optional int32 hours = 1;    // hours in local time zone, using 24 hour clock
    optional int32 minutes = 2; // minutes in local time zone
    optional int64 seconds = 3; // seconds in local time zone
    optional int32 nanos = 4;  // positive nanosecond offset to seconds
}
    
```

4.5 Dates

Dates are represented as an sint32 offset to Unix epoch, January 01. 1970.

Dates before Unix epoch have negative offsets.

To differentiate between Local Dates and UTC dates, the fix datatype field option can be queried.

Example:

```

optional sint32 issue_date = 5 [(fix.tag)=225, (fix.type)=DATATYPE_LOCAL_MKT_DATE];
optional sint32 md_entry_date = 6 [(fix.tag)=272, (fix.type)=DATATYPE_UTC_TIMESTAMP];
    
```

4.6 Decimal Values

A special challenge exists for mapping FIX decimal values to binary data. Although all binary encodings support floating point binary numbers, the general convention in the financial industry is avoid floating point representation of decimal values due to rounding issues. The existing FIX tag/value encoding handles this by recording decimal values as ASCII strings. However, this carries a heavy performance penalty, both in terms of bandwidth utilization and processing overhead to compare or sort ASCII strings.

The solution implemented for FIX over GPB is to represent decimal values by a pair of integers – a mantissa and an exponent, where the exponent determines placement of the decimal point.

$$\text{Decimal value} = \text{Mantissa} \times 10^{\text{exponent}}$$

For example, to represent the decimal value of 12.3456, mantissa = 123456 & exponent = -4 (negative 4)

These two fields, mantissa and exponent, together comprise the definition of a Decimal64 or Decimal32 GPB message class.

```
message Decimal32 {
    optional sfixed32 mantissa = 1;
    optional sfixed32 exponent = 2;
}
```

```
message Decimal64 {
    optional sfixed64 mantissa = 1;
    optional sfixed32 exponent = 2;
}
```

Note that by GPB convention, all integers have an implicit default value of zero. In the case of the exponent field, this would indicate an integral number without any decimal places.

When the field's exponent value is a constant value, the exponent can alternately be communicated to users via the rules of engagement or as a custom option on the proto field:

```
optional sfixed32 last_px = 1 [meta.exponent=-2] ; // two decimal digits
```

However, this practice is not recommended. While the performance advantage of an implicit exponent may seem attractive, experience has shown that decimal precision will often need to change over time. By explicitly setting an exponent value, protocol authors are future-proofing their specifications, making them flexible to changes in field precision.

4.7 Fractional Values

Occasionally, fractional values may best suit the domain model, for example when quoting in thirds, e.g. $123 \frac{2}{3}$. Then the price should be declared as a binary type float:

```
optional float last_px =1;
```


4.8 MultipleCharValue

FIX fields of type MultipleCharValue (or MultipleStringValue) are mapped to a sequence of enumerated values, using a GPB “repeated group.” Inclusion of each element of the repeating group indicates selection of its associated optional value.

For example, the FIX field, ExecInst, is a MultipleCharValue field where the choice of values is selected from a pool of enumerated values. This maps to the GPB field definition:

```
repeated ExecInstEnum exec_inst = 21 [packed = true];
```

where the enumerated values are defined in the following GPB enum:

```
enum ExecInstEnum {  
    EXEC_INST_UNSPECIFIED = 0;  
    EXEC_INST_STAY_ON_OFFER_SIDE = 1;  
    EXEC_INST_NOT_HELD = 2;  
    EXEC_INST_WORK = 3;  
    EXEC_INST_GO_ALONG = 4;  
    // ...  
}
```

Note that repeating groups of enumerations can take advantage of the optimized “packed” encoding option for repeating groups, since they contain no complex data structures.

4.9 Encoding Attributes

To migrate a FIX tag-value protocol specification to a protobuf encoding, it is desirable to automate the mapping of a FIX Repository to a GPB proto specification. To accomplish this, the repository may be annotated with custom encoding attributes to drive the automated mapping of FIX fields to the appropriate GPB data-type. The relevant encoding attributes are: “isBinaryFloat”, “isFixedPoint”, “exponent”, “numBits”, “minValue”, “maxValue”. See [section 3.2](#) above for more information on the usage of encoding attributes to auto-generate GPB proto files from a FIX Repository.

5 Usage Guidelines

5.1 Optional/Required Fields

Google recommends that all fields be marked as optional. This is especially important to support message evolution.

“Required Is Forever -You should be very careful about marking fields as required. If at some point you wish to stop writing or sending a required field, it will be problematic to change the field to an optional field – old readers will consider messages without this field to be incomplete and may reject or drop them unintentionally. You should consider writing application-specific custom validation routines for your buffers instead. Some engineers at Google have come to the conclusion that using required does more harm than good; they prefer to use only optional and repeated. However, this view is not universal.” <https://developers.google.com/protocol-buffers/docs/proto>

Consequently, the GPB Encoding subgroup recommends that all FIX fields in the protobuf message definition be marked as optional. Semantically, fields can still be required, but enforcement of required message fields should be done on the application level, rather than by the GPB parser. Rules of engagement documents should be used to specify which fields are required in each context. When such a “required” field is missing, the message should be rejected with an application or session level rejection message.

One exception to the above guideline is when a set of fixed-length fields at the beginning of a message are designated as “Direct Access” fields, often used for high-performance routing. Since the Direct Access mechanism depends on all such fields being present in every message, these fields may be tagged as “required” to guarantee their presence in every message.

5.2 Versioning

Protobuf supports both forward and backward compatibility of message specifications, so that message senders and receivers do not have to utilize the same version of the encoding template. This is accomplished as follows:

- Backward compatibility – In this case, the message recipient has an older version of the template which contains fewer messages and fields than a newer version used by the sender. The recipient GPB decoder will drop the unknown fields.
- Forward compatibility – The message recipient has a newer version of the template which contains more messages and fields than an older version used by the sender. The recipient GPB decoder will set the values of the missing fields to their default values.

Protobuf has strong support for message evolution. Fields may be added. Optional fields may be upgraded to repeating fields. Fields may also be deleted, as long as their tags are not reused. Enumerations may be extended; when the value of the enumeration is unknown to the decoder, it will drop the enumeration as an unknown field. For a full description of the do’s and don’ts of protobuf message evolution, see [“Updating A Message Type”](#) in the Protobuf Language Guide.

One important consideration relates to default values. Since default values are applied by the decoder based on its version of the proto file, changes to default values by the message sender will not be known to recipients

with an earlier version of the proto file. When such a change is necessary, the actual [new] value should be explicitly set by the sender in all cases, thus overriding the recipient's [old] default setting.

Note: Proto3 removes support for specifying default values within the proto. Rather, missing fields always default to their type-specific defaults. To support evolution to proto3, it is not recommended to use the proto2 default feature.

5.3 Message Evolution

In designing for message reuse, it is desirable to minimize the breaking changes which would require redistribution of proto files. This can be done by anticipating the evolving needs to which the protocol may need to adapt. For example:

- Metrics may need to be calculated with additional digits of precision.
- Timestamp may need to be reported with more fine-grained precision (e.g. microseconds instead of milliseconds).
- Formerly unsigned price fields may need to support trading of negative points.
- Dollar (whole number) prices may need to support trading to the penny or fractional penny.
- USD may be replaced with other currencies with different orders of magnitude.

With small tradeoffs in message size (electing signed rather than unsigned, fixed64 rather than fixed32, dynamic exponents rather than static exponents), many of these breaking changes can be avoided.

When it is not possible to avoid a protobuf breaking change, a new .proto version must be issued. The version number will be specified in the GPB Encoding Header.

5.4 Direct Access

High-performance applications may wish to implement “direct access” to selective fields in a GPB message, without incurring the processing overhead of message parsing.

This can be implemented with the following restrictions:

1. Direct access fields must be present in all messages.
2. All “direct access” fields should appear at the front of the GPB message, before any optional fields. Field numbers of direct access fields should be in incremental order and should be lower in value than the field numbers of any non-direct-access fields.
3. Direct access fields should utilize the fixed-length GPB data types, such as fixed32 and fixed64, rather than the variable length encoding data types such as uint32 and uint64.
4. Repeating groups with a variable number of repetitions may not be direct access fields.
5. Variable length strings may not be direct access fields.

This approach supports a hybrid approach to the tradeoffs between message flexibility and performance optimization. A single message definition may contain both critical high-performance fields which support direct-access, while less frequently occurring fields can utilize the full flexibility afforded by GPB.

Note that while the Google-provided protobuf implementations serialize fields in tag number order, this is not a requirement of the specification. Users of non-Google provided implementations who depend on consistent field ordering should verify that their implementations honor with this ordering policy.

5.5 Routing

Protobuf messages can be routed through middlemen who are aware of only a subset of the template with no loss of information. Intermediate servers that don't need to inspect all the data can pass the data through without knowing about all the specific fields.

For example, a simplified proto definition can be created containing only the FIX header, or only select routing fields such as MarketID or SecurityType. An intermediary application using this proto file would parse only a subset of the message, extracting only the fields necessary for routing, but could still forward the entire message payload to the appropriate target application with no loss of data.

This mechanism contributes to the speed of the routing application, and also makes the intermediary system resilient to changes in application-level features in which it has no interest.

5.6 Self-describing Messages

See <https://developers.google.com/protocol-buffers/docs/techniques#self-description>

6 Message Headers

6.1 Framing for Message Streams

When multiple messages are serialized in a stream, it is necessary to detect where one message ends and the next begins. The Protocol Buffer wire format is not self-delimiting, so the protocol buffer parsers cannot themselves determine where a message ends. This is a common need of all the FPL binary encodings, and as such, it has been addressed by the FIX Protocol Simple Open Framing Header standard. This standard defines a normative fixed-length message prefix which identifies the message length and encoding type.

Inclusion of the encoding type in the message frame satisfies three purposes:

1. Supports interleaving of messages of different encodings in a single FIX session.
2. Allows third-party tools such as network protocol analyzers and heterogeneous communication gateways to decode the message without prior knowledge of the message encoding.
3. Provides a version-aware mechanism for evolution of the binary encoding standards. Current GPB identifier reflects version 1.0 of FIX over GPB. New releases of GPB encoding, or new versions of the GPB encoding header would be supported by additional encoding identifier values.

The Simple Open Framing Header is encoded using unsigned binary integer values in Network Byte Order.

Fields:

1. Message length - 32 bit integer containing the total number of bytes of the message, inclusive of the length of the Simple Open Framing Header.
2. Encoding type – 16-bit enumerated value, used to identify the payload encoding type. For the current version of FIX GPB, the encoding type has been set to

FIX GPB v1.0	0x4700
--------------	--------

Note that the message length field represents the total message size, including all headers. Since both the Open Framing Header (48 bits) and the GPB Encoding Header (64 bits) are fixed-length, the length of the GPB payload can be easily deduced.

[Add ref to Simple Framing Header (TBD)].

6.2 GPB Encoding Header

The GPB Encoding Header immediately follows the Simple Open Framing Header. Its purpose is to provide the GPB-specific values which are necessary to parse the GPB payload. The three field of the GPB Encoding Header are the proto identifier, proto version and message type.

The GPB Encoding Header is not encoded using Google Protocol Buffers, but rather as a sequence of fixed-length big-endian (network byte order) unsigned binary integers.

The fields of the FIX Protobuf message header are:

- **Proto Id** – a 16-bit integer used to identify the GPB schema.

- **Proto Version Number** – a 16-bit integer used to identify the schema version. The 16-bit number may be further subdivided to reflect the major and minor revisions to the schema.
- **MsgType**—a 32-bit integer or 4-character ASCII code that specifies the GPB message type.

6.2.1 GPB Encoding Header schema

The header fields precede the message body of each GPB message in a fixed layout. Each of these fields shall be encoded as an unsigned integer. The message header is encoded in big-endian byte order. All fields are required.

Header Field	Byte Size	Position Offset
Proto Id	2	0
Proto Version Number	2	2
GPB Message Type	4	4

The total size of the GPB Encoding header is fixed at 64 bits.

6.2.2 Proto Id

This integer identifier identifies the GPB schema (proto file) to be used to decode the message. The proto identifier shall be disseminated with the proto file. The Proto Id may represent any top level GPB schema file or grouping of schema files. If the proto file has been auto-generated from a FIX repository, then the Proto Id will typically represent the subset of the FIX repository reflected by this schema.

6.2.3 Proto Version Number

The Proto Version Number represents the version of the proto schema with which the message was encoded. This version number can be split into major and minor version parts. A minor revision represents a non-breaking change (such as field additions) which may be optionally adopted message decoders, while a major revision represents a breaking change which can only be decoded with the corresponding proto update.

6.2.4 Message Type

This field represents the GPB message. This 32 bit field may reflect a 4 character ASCII identifier, or any integer up to the value of 2^{32} . When the GPB message is derived from a FIX message, the message type field may be the ASCII code of the FIX message, as defined in the FIX repository, for example “AE” for TradeCaptureReport. Alternatively, the message type may reflect the integer enumerated values of the **msg_type** enumeration, as defined in the Session.proto GPB schema.

6.3 Alternate Framing Mechanisms

6.3.1 Alternate Transport Mechanisms

Higher-level transport protocols, which are layered over TCP, often provide their own framing mechanism for delimiting messages and exposing message metadata. In these cases, these mechanisms may be used in place of the FPL Framing Header and GPB fixed-length encoding header to expose GPB meta-data.

Users of these alternate transport protocols, such as message buses, should consider which of the five metadata elements exposed by the FPL Framing Header and GPB Encoder Header need be exposed to their consumers, and should define custom message properties/headers to support these:

- a. Message length
- b. Encoding Type
- c. Proto identifier
- d. Proto version
- e. Message Type

Examples would be Custom JMS Properties or HTTP Custom Header Properties.

6.3.2 JMS Properties

GPB messages which are transported over a JMS compliant messaging system need not expose the message length to message consumers. Other header fields may be populated in a JMS standard or custom message Properties. Suggested JMS Properties are as follows:

Metadata	JMS Property
Encoding Type	ContentType
Proto Id	GpbProtoID
Proto Version Number	GpbProtoVersion
Message Type	GpbMsgType

When these JMS Properties are utilized, the message body need only contain the GBP message payload.

6.3.3 Message Container

As an alternative to the fixed size Encoding Header, a generated GPB **Message Container** can be used to describe and identify messages. The **Message Container** is a generated GPB message that includes the fields from the GPB encoding header, plus an optional field for each of the top-level messages in the repository. When sending a message, the user would populate the GPB encoding header fields in the GPB generated object, and

then go on to set the selected optional message field with its message data. Optional fields that are not set are ignored by the serializer.

The advantage of the Message Container is that it simplifies message processing, avoiding the need to process a separate fixed size header to identify the message. Serialization or deserialization can be performed in a single pass. Processing to identify the message is performed on the message container data by identifying the relevant field in the container that corresponds to the message type.

However, as message metadata is contained within the message, the ability to inspect the proto id or version number prior to message parsing is lost. Message containers are thus appropriate for quick prototype or temporal efforts. However, for industrial-strength version-aware parsing, utilization of the FPL message frame and GPB encoding headers is recommended.

A sample Message Container is shown below:

```
import "session-enums.proto";
import "business-message-reject.proto";
import "dont-know-trade.proto";
import "execution-report.proto";
import "heartbeat.proto";
:: ::
import "reject.proto";
import "rfq-request.proto";
import "security-list-request.proto";
import "security-list.proto";
import "test-request.proto";

message MessageContainer {
  // message frame fields
  required uint16 proto_version_no = 3;
  required uint32 msg_type = 4;

  // one optional field for each defined message
  // only one nested message will be populated corresponding to the above msg_type
  optional BusinessReject.BusinessMessageReject business_message_reject = 114;
  optional SingleGeneralOrderHandling.DontKnowTrade dont_know_trade = 115;
  optional SingleGeneralOrderHandling.ExecutionReport execution_report = 116;
  optional Session.Heartbeat heartbeat = 117;
  optional Session.Logon logon = 118;
  optional Session.Logout logout = 119;
}
```


7 Performance Considerations

7.1 Binary Data Representation

The most significant performance advantage of GPB encoding over the existing FIX Tag-Value or XML encodings is due to the inherent efficiency of binary data when compared to string-based data representations.

These efficiencies can be compounded when applications utilize these binary representations not only for the wire encoding associated with serialization, but also for their internal data representation. For example, a timestamp representation as an integral number of milliseconds since 1970 is faster to encode than its associated `UtcDateTime` string. Moreover, a timestamp which is referenced as a binary integer throughout the application can utilize the system's native integer operators to compare timestamps or calculate the difference between them. Furthermore, such an application will also avoid the transformation overhead of mapping between the integer and string representations for data exchange between components.

Greatest performance optimization will be attained when the internal representation of data is aligned with its wire representation.

Data Representation Recommendations:

1. Opt for numeric identifiers for fields such as `Account`, `PartyId`, `OrderID`, `ExecID`, `MDReqID`, `SecurityID`, etc. Set the FIX Repository's `isNumeric` encoding attribute to `TRUE`, to instruct the GPB mapping application to generate an integer GPB field.
2. For fields which have a pre-determined set of values, chose GPB enumerations over integers or strings.
3. In places where an ASCII identifier is required, consider mapping the ASCII string to an internal numeric identifier for intra-application use. Map the integer back to the ASCII string for public consumption. For example, map an instrument's `SYMBOL` to an integral `SecurityID` for internal communication.
4. Represent dates as the integer number of days since an epoch of choice, for example `01/01/1970` for Maturity Dates and `01/01/1900` for Date of Birth. Provide the epoch as metadata on the proto file via a custom field option. Consuming applications can reference the epoch metadata to repopulate the date as a familiar date string for human-facing interfaces.
5. Represent UTC timestamps as a time offset since a time epoch using two integers – the whole number of seconds since the epoch and a nanosecond offset to the seconds.
6. Represent decimalized prices as a set of integers representing the exponent and mantissa using the `Decimal64` or `Decimal32` protobuf object types.

7.2 VarInts vs. Fixed Length Fields

GPB provides two alternate integer encoding mechanisms – varints and fixed-length integers. Varints are “variable length integers”, where the length of the field's wire representation is dynamically determined by its value, rather than by its data definition. Varint types are `int32`, `int64`, `uint32`, `uint64`, `sint32`, and `sint64`. Varints result in more compressed serializations, as unused bytes are not populated. Varints are especially useful when

the size of a field varies widely, as there is no loss of bandwidth in defining a data field as a 64 bit varint rather than as a 32 bit integer.

However, empirical testing has shown that serialization of varints is more time-consuming than serialization of the corresponding fixed length integers – fixed32, fixed 64, sfixed32, and sfixed64. It is therefore up to each installation to determine the more significant benefit:

- For optimized compression – elect GPB varints
- For optimized speed – elect GPB fixed length integers

As the stated goal of the HPWG is to optimize for speed, the FIX Repository Auto-Mapping Specification [2] maps FIX integers into GPB fixed-length data types.

8 Proto3 Considerations

In July 2017, Google released version 3.0.0 of the Protocol Buffers Language, commonly known as proto3. Proto3 introduces several important changes with the primary goal of simplifying the implementation and extending protobuf support to new programming languages.

The specification for Language Guide (proto3) can be found at

<https://developers.google.com/protocol-buffers/docs/proto3>

The complete list of the changes between Proto2 and Proto3 can be found in the Proto3 [Release Notes](#).

Primary differences between proto2 and proto3 are discussed below:

1. Default handling and presence detection
2. Enum handling
3. Removal of optional & required keywords
4. New keywords - oneof, reserved
5. Pre-defined objects: Timestamp, Duration and FieldMask
6. Additional language support
7. Canonical JSON encoding
8. Preservation of unknown fields

8.1 Default Handling and Field Presence

The most impactful change between proto2 and proto3 has been the change to default handling.

Proto3 removes support for explicitly specifying a scalar field's default value within the proto definition. Rather, scalar fields always default to their type-specific values: zero for integers, FALSE for booleans, and "" for strings.

Furthermore, whenever the value of a scalar field is equal to its default value, the field is not populated on the wire. When the message is decoded, all fields not present on the wire have their parsed value set to the default value for that field.

Language implications of the above are removal of the optional & required keywords. All proto3 fields are, by definition, optional. The new default-handling mechanism results in reduced message size and more efficient decoding. However, it removes the ability for message decoders to distinguish between unset fields and fields which have been explicitly set to the field's default value. It is no longer possible to use the HasXXX() accessor method to determine whether a scalar field has been set. HasXXX() continues to be supported for message objects, but not for scalar values.

Message designers are advised to keep this restriction in mind when defining their message specifications. For example, to differentiate between an un-priced order and order whose price is explicitly set to zero, message designers can add an explicit "isUnpricedOrder" Boolean field.

Alternately, the new "oneof" feature of proto3 can be used to wrap those fields which require support for detection of wire presence. When multiple values are defined in a single "oneof" field, the proto3 decoding library includes methods to detect which one of the optional fields has been set. This also includes the ability to detect that none of the "oneof" values has been set - using either a case() statement or WhichOneof() method, depending on the language implementation, to return a value indicating NOT_SET.

Finally, note that detection of presence of message objects remains unchanged. Clients can use a custom message type or one of the proto3 pre-defined type wrappers such as google.protobuf.Int32Value. For example, message recipients can detect whether an Int32Value or user-defined Decimal64 price object is present via a HasPrice() accessor method.

Google wrapper types are defined at:

<https://github.com/google/protobuf/blob/master/src/google/protobuf/wrappers.proto>

Using the wrapper types will increase message size and slow down decoding. Decision whether to use this mechanism for default detection of scalar values should therefore be made based on the relative tradeoffs between efficiency and convenience, and the significance of detection of field presence.

8.2 Enum Handling

In proto3, the default value of every enumeration is the first defined enumerated value, which must be 0. This will be the default value when the enumerated field is not present.

As noted in section 3.1, it is recommended that the first value of each defined enumeration include an "UNSPECIFIED" value. This will then be the default value for messages which do not contain the enumeration field.

8.3 Removal of Optional/Required Keywords

As noted above, all fields in proto3 are optional. The optional and required keywords have been removed. Rather than relying on the protocol layer, enforcement of field presence should be moved to the semantic layer using one of the mechanisms described above to detect field presence.

8.4 Pre-defined datatypes

Proto3 adds support for several predefined datatypes, including support for Timestamps and Time Durations.

The full list of pre-defined datatypes can be found at:

<http://googlecloudplatform.github.io/google-cloud-dotnet/docs/Google.Cloud.Language.V1.Experimental/api/Google.Protobuf.WellKnownTypes.html>

8.5 Preservation of Unknown Fields

In proto2, fields which are not known to the decoder are still available for message forwarding to other recipients who have a more updated protobuf schema. This capability is no longer guaranteed for all proto3 implementations. For most proto3 implementations, fields which do not appear in the decoder's proto are dropped upon deserialization, and are no longer available for message forwarding.

8.6 Additional Language Support

Proto2 native Google implementation supports Java, Python, Objective-C, and C++, Go, and JavaScript. Proto3 adds standards-based support for Ruby, PHP, and C#.

Additional languages are supported using various third-party add-ons. See

https://github.com/google/protobuf/blob/master/docs/third_party.md

8.7 JSON Mapping

Proto3 supports a canonical encoding in JSON.

The JSON mapping of each protobuf type is described at <https://developers.google.com/protocol-buffers/docs/proto3#json>.

8.8 Backward Compatibility

Messages created using proto2 are byte-stream compatible with proto3. However, due to semantic differences such as the unavailability of default values in proto3, there are likely to be incompatibilities in message interpretation across proto versions. To avoid these issues, clients writing to the proto2 specification are advised to adhere to the following restrictions:

1. All fields should be optional.

2. Do not use custom default values.
3. All enumerations should have their first element with value = 0.
4. Do not use extension for anything except custom options.
5. Do not rely on intermediate routing applications preserving unknown fields

9 Appendix A - Sample Proto2 Messages

The following listing shows a proto2 GPB message definition for a FIX OrderCancelReuest message from the SingleGeneralOrderHandling caregory, its nested components and enumeration types. For simplicity, many of the optional FIX fields and GPB custom options have been omitted.

Excerpts of 4 proto files are provided:

- meta.proto – custom options for encoding attributes
- fix.proto – custom options for FIX Repository metadata and FIX supporting types
- session.proto – mapped from FIX Session Category
- singlegeneralorderhandling.proto – mapped from FIX SingleGeneralOrderHandling Category
-

9.1 Meta.Proto

```
//  
//      FIX Unified Repository mapping to Google Protocol Buffers  
//  
//      Copyright (c) FIX Trading Community. All Rights Reserved.  
//  
//      Category: meta  
//  
//      File: meta.proto  
//  
syntax = "proto2";  
import "google/protobuf/descriptor.proto";  
  
option java_package = "org.fixprotocol.components";  
option java_outer_classname = "Meta";  
  
package meta;  
  
extend google.protobuf.FieldOptions {  
    optional TimeUnitEnum time_unit = 51001;  
    optional Epoch epoch = 51002;  
    optional sfixed32 exponent = 51003;  
    optional fixed32 min_len = 51004;  
    optional fixed32 max_len = 51005;  
    optional sfixed64 min_value = 51006;  
    optional sfixed64 max_value = 51007;  
}  
  
enum TimeUnitEnum {  
    TIME_UNIT_UNSPECIFIED = 0;  
    TIME_UNIT_DAYS = 1;  
    TIME_UNIT_SECONDS = 2;  
    TIME_UNIT_MILLISECONDS = 3;
```

```
TIME_UNIT_MICROSECONDS = 4;
TIME_UNIT_NANOSECONDS = 5;
TIME_UNIT_PICOSECONDS = 6;
}
```

```
enum Epoch {
  EPOCH_UNSPECIFIED = 0;
  EPOCH_MIDNIGHT = 1;
  EPOCH_UNIX = 2;
  EPOCH_1900 = 3;
  EPOCH_2000 = 4;
}
```

9.2 Fix.proto

```
//
//     FIX Unified Repository mapping to Google Protocol Buffers
//
//     Copyright (c) FIX Trading Community. All Rights Reserved.
//
//     Category: fix
//
//     File: fix.proto
//
syntax = "proto2";
import "google/protobuf/descriptor.proto";

option java_package = "org.fixprotocol.components";
option java_outer_classname = "Fix";

package fix;

extend google.protobuf.FileOptions {
  optional string category = 53002;
}

extend google.protobuf.MessageOptions {
  optional string msg_type_value = 55001;
}

extend google.protobuf.FieldOptions {
  optional fixed32 tag = 56003;
  optional DatatypeEnum type = 56004;
  optional VersionEnum field_added = 56005;
  optional sfixed32 field_added_ep = 56006;
  optional VersionEnum field_deprecated = 56007;
  optional fixed32 group_tag = 56008;
}
```



```
extend google.protobuf.EnumValueOptions {
    optional string enum_value = 72004;
    optional VersionEnum enum_added = 72005;
    optional sfixed32 enum_added_ep = 72006;
    optional VersionEnum enum_deprecated = 72007;
}

enum VersionEnum {
    VERSION_UNSPECIFIED = 0;
    VERSION_FIX_2_7 = 1;
    VERSION_FIX_3_0 = 2;
    VERSION_FIX_4_0 = 3;
    VERSION_FIX_4_1 = 4;
    VERSION_FIX_4_2 = 5;
    VERSION_FIX_4_3 = 6;
    VERSION_FIX_4_4 = 7;
    VERSION_FIX_5_0 = 8;
    VERSION_FIXT_1_1 = 9;
    VERSION_FIX_5_OSP1 = 10;
    VERSION_FIX_5_OSP2 = 11;
}

enum DatatypeEnum {
    DATATYPE_UNSPECIFIED = 0;
    DATATYPE_CHAR = 1          [(enum_added)=VERSION_FIX_2_7];
    DATATYPE_DATA = 2         [(enum_added)=VERSION_FIX_2_7];
    DATATYPE_FLOAT = 3        [(enum_added)=VERSION_FIX_2_7];
    DATATYPE_INT = 4          [(enum_added)=VERSION_FIX_2_7];
    DATATYPE_DAY_OF_MONTH = 5 [(enum_added)=VERSION_FIX_4_1];
    DATATYPE_MONTH_YEAR = 6   [(enum_added)=VERSION_FIX_4_1];
    DATATYPE_AMT = 7          [(enum_added)=VERSION_FIX_4_2];
    DATATYPE_BOOLEAN = 8     [(enum_added)=VERSION_FIX_4_2];
    DATATYPE_CURRENCY = 9    [(enum_added)=VERSION_FIX_4_2];
    DATATYPE_EXCHANGE = 10   [(enum_added)=VERSION_FIX_4_2];
    DATATYPE_LOCAL_MKT_DATE = 11 [(enum_added)=VERSION_FIX_4_2];
    DATATYPE_MULTIPLE_STRING_VALUE = 12 [(enum_added)=VERSION_FIX_4_2];
    DATATYPE_PRICE = 13      [(enum_added)=VERSION_FIX_4_2];
    DATATYPE_PRICE_OFFSET = 14 [(enum_added)=VERSION_FIX_4_2];
    DATATYPE_QTY = 15        [(enum_added)=VERSION_FIX_4_2];
    DATATYPE_STRING = 16     [(enum_added)=VERSION_FIX_4_2];
    DATATYPE_UTC_TIMESTAMP = 17 [(enum_added)=VERSION_FIX_4_2];
    DATATYPE_UTC_TIME_ONLY = 18 [(enum_added)=VERSION_FIX_4_2];
    DATATYPE_LENGTH = 19     [(enum_added)=VERSION_FIX_4_3];
    DATATYPE_NUM_IN_GROUP = 20 [(enum_added)=VERSION_FIX_4_3];
    DATATYPE_PERCENTAGE = 21 [(enum_added)=VERSION_FIX_4_3];
    DATATYPE_SEQ_NUM = 22    [(enum_added)=VERSION_FIX_4_3];
    DATATYPE_TAG_NUM = 23    [(enum_added)=VERSION_FIX_4_3];
}
```

```
DATATYPE_COUNTRY = 24      [(enum_added)=VERSION_FIX_4_4];
DATATYPE_MULTIPLE_CHAR_VALUE = 25 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_PATTERN = 26      [(enum_added)=VERSION_FIX_4_4];
DATATYPE_RESERVED1000PLUS = 27 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_RESERVED100PLUS = 28 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_RESERVED4000PLUS = 29 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_TENOR = 30        [(enum_added)=VERSION_FIX_4_4];
DATATYPE_TZ_TIMESTAMP = 31 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_TZ_TIME_ONLY = 32 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_UTC_DATE_ONLY = 33 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_XML_DATA = 34     [(enum_added)=VERSION_FIX_5_0];
DATATYPE_LANGUAGE = 35    [(enum_added)=VERSION_FIX_5_OSP1];
}

message Tenor {
  oneof tenor_union {
    uint32 days = 1;
    uint32 weeks = 2;
    uint32 months = 3;
    uint32 years = 4;
  }
}

message Decimal32 {
  optional sfixed32 mantissa = 1;
  optional sfixed32 exponent = 2;
}

message Decimal64 {
  optional sfixed64 mantissa = 1;
  optional sfixed32 exponent = 2;
}

message Timestamp {
  optional int64 seconds = 1;
  optional int32 nanos = 2;
}

message TimeOnly {
  optional int64 seconds = 1;
  optional int32 nanos = 2;
}

message TZTimestamp {
  optional int64 seconds = 1;
  optional int32 nanos = 2;
  optional sint32 hour_offset = 3;
  optional sint32 minute_offset = 4;
}
```

```
}  
  
message TZTimeOnly {  
    optional int64 seconds = 1;  
    optional int32 nanos = 2;  
    optional sint32 hour_offset = 3;  
    optional sint32 minute_offset = 4;  
}  
  
message LocalMarketTime {  
    optional int32 hours = 1;  
    optional int32 minutes = 2;  
    optional int64 seconds = 3;  
    optional int32 nanos = 4;  
}
```

9.3 Session.proto

```
//  
//     FIX Unified Repository mapping to Google Protocol Buffers  
//  
//     Copyright (c) FIX Trading Community. All Rights Reserved.  
//  
//     Category: Session  
//  
//     File: session.proto  
//  
syntax = "proto2";  
import "meta.proto";  
import "fix.proto";  
import "common.proto";  
  
option java_package = "org.fixprotocol.components";  
option java_outer_classname = "Session";  
  
package Session;  
  
enum MsgTypeEnum {  
    MSG_TYPE_ADJUSTED_POSITION_REPORT = 0      [(fix.enum_value)="BL"];  
    MSG_TYPE_ADVERTISEMENT = 1      [(fix.enum_value)="7"];  
    MSG_TYPE_ALLOCATION_INSTRUCTION = 2 [(fix.enum_value)="J"];  
    MSG_TYPE_ALLOCATION_INSTRUCTION_ACK = 3      [(fix.enum_value)="P"];  
    MSG_TYPE_ALLOCATION_INSTRUCTION_ALERT = 4      [(fix.enum_value)="BM"];  
    MSG_TYPE_ALLOCATION_REPORT = 5      [(fix.enum_value)="AS"];  
    MSG_TYPE_ALLOCATION_REPORT_ACK = 6 [(fix.enum_value)="AT"];  
    MSG_TYPE_APPLICATION_MESSAGE_REPORT = 7      [(fix.enum_value)="BY"];  
    MSG_TYPE_APPLICATION_MESSAGE_REQUEST = 8      [(fix.enum_value)="BW"];  
    MSG_TYPE_APPLICATION_MESSAGE_REQUEST_ACK = 9      [(fix.enum_value)="BX"];  
    MSG_TYPE_ASSIGNMENT_REPORT = 10 [(fix.enum_value)="AW"];
```

```
MSG_TYPE_BID_REQUEST = 11      [(fix.enum_value)="k"];
MSG_TYPE_BID_RESPONSE = 12    [(fix.enum_value)="l"];
MSG_TYPE_BUSINESS_MESSAGE_REJECT = 13      [(fix.enum_value)="j"];
MSG_TYPE_COLLATERAL_ASSIGNMENT = 14 [(fix.enum_value)="AY"];
MSG_TYPE_COLLATERAL_INQUIRY = 15  [(fix.enum_value)="BB"];
MSG_TYPE_COLLATERAL_INQUIRY_ACK = 16      [(fix.enum_value)="BG"];
MSG_TYPE_COLLATERAL_REPORT = 17  [(fix.enum_value)="BA"];
MSG_TYPE_COLLATERAL_REQUEST = 18 [(fix.enum_value)="AX"];
MSG_TYPE_COLLATERAL_RESPONSE = 19 [(fix.enum_value)="AZ"];
MSG_TYPE_CONFIRMATION = 20      [(fix.enum_value)="AK"];
MSG_TYPE_CONFIRMATION_ACK = 21  [(fix.enum_value)="AU"];
MSG_TYPE_CONFIRMATION_REQUEST = 22 [(fix.enum_value)="BH"];
MSG_TYPE_CONTRARY_INTENTION_REPORT = 23    [(fix.enum_value)="BO"];
MSG_TYPE_CROSS_ORDER_CANCEL_REPLACE_REQUEST = 24 [(fix.enum_value)="t"];
MSG_TYPE_CROSS_ORDER_CANCEL_REQUEST = 25    [(fix.enum_value)="u"];
MSG_TYPE_DERIVATIVE_SECURITY_LIST = 26      [(fix.enum_value)="AA"];
MSG_TYPE_DERIVATIVE_SECURITY_LIST_REQUEST = 27 [(fix.enum_value)="z"];
MSG_TYPE_DERIVATIVE_SECURITY_LIST_UPDATE_REPORT = 28 [(fix.enum_value)="BR"];
MSG_TYPE_DONT_KNOW_TRADE = 29  [(fix.enum_value)="Q"];
MSG_TYPE_EMAIL = 30            [(fix.enum_value)="C"];
MSG_TYPE_EXECUTION_ACKNOWLEDGEMENT = 31      [(fix.enum_value)="BN"];
MSG_TYPE_EXECUTION_REPORT = 32  [(fix.enum_value)="8"];
MSG_TYPE_HEARTBEAT = 33        [(fix.enum_value)="0"];
MSG_TYPE_IOI = 34              [(fix.enum_value)="6"];
MSG_TYPE_LIST_CANCEL_REQUEST = 35 [(fix.enum_value)="K"];
MSG_TYPE_LIST_EXECUTE = 36      [(fix.enum_value)="L"];
MSG_TYPE_LIST_STATUS = 37      [(fix.enum_value)="N"];
MSG_TYPE_LIST_STATUS_REQUEST = 38 [(fix.enum_value)="M"];
MSG_TYPE_LIST_STRIKE_PRICE = 39  [(fix.enum_value)="m"];
MSG_TYPE_LOGON = 40            [(fix.enum_value)="A"];
MSG_TYPE_LOGOUT = 41          [(fix.enum_value)="5"];
MSG_TYPE_MARKET_DATA_INCREMENTAL_REFRESH = 42 [(fix.enum_value)="X"];
MSG_TYPE_MARKET_DATA_REQUEST = 43 [(fix.enum_value)="V"];
MSG_TYPE_MARKET_DATA_REQUEST_REJECT = 44      [(fix.enum_value)="Y"];
MSG_TYPE_MARKET_DATA_SNAPSHOT_FULL_REFRESH = 45 [(fix.enum_value)="W"];
MSG_TYPE_MARKET_DEFINITION = 46 [(fix.enum_value)="BU"];
MSG_TYPE_MARKET_DEFINITION_REQUEST = 47      [(fix.enum_value)="BT"];
MSG_TYPE_MARKET_DEFINITION_UPDATE_REPORT = 48 [(fix.enum_value)="BV"];
MSG_TYPE_MASS_QUOTE = 49       [(fix.enum_value)="i"];
MSG_TYPE_MASS_QUOTE_ACKNOWLEDGEMENT = 50      [(fix.enum_value)="b"];
MSG_TYPE_MULTILEG_ORDER_CANCEL_REPLACE = 51    [(fix.enum_value)="AC"];
MSG_TYPE_NETWORK_COUNTERPARTY_SYSTEM_STATUS_REQUEST = 52      [(fix.enum_value)="BC"];
MSG_TYPE_NETWORK_COUNTERPARTY_SYSTEM_STATUS_RESPONSE = 53     [(fix.enum_value)="BD"];
MSG_TYPE_NEWS = 54            [(fix.enum_value)="B"];
MSG_TYPE_NEW_ORDER_CROSS = 55  [(fix.enum_value)="s"];
MSG_TYPE_NEW_ORDER_LIST = 56  [(fix.enum_value)="E"];
MSG_TYPE_NEW_ORDER_MULTILEG = 57 [(fix.enum_value)="AB"];
MSG_TYPE_NEW_ORDER_SINGLE = 58  [(fix.enum_value)="D"];
```

```
MSG_TYPE_ORDER_CANCEL_REJECT = 59 [(fix.enum_value)="9"];
MSG_TYPE_ORDER_CANCEL_REPLACE_REQUEST = 60 [(fix.enum_value)="G"];
MSG_TYPE_ORDER_CANCEL_REQUEST = 61 [(fix.enum_value)="F"];
MSG_TYPE_ORDER_MASS_ACTION_REPORT = 62 [(fix.enum_value)="BZ"];
MSG_TYPE_ORDER_MASS_ACTION_REQUEST = 63 [(fix.enum_value)="CA"];
MSG_TYPE_ORDER_MASS_CANCEL_REPORT = 64 [(fix.enum_value)="r"];
MSG_TYPE_ORDER_MASS_CANCEL_REQUEST = 65 [(fix.enum_value)="q"];
MSG_TYPE_ORDER_MASS_STATUS_REQUEST = 66 [(fix.enum_value)="AF"];
MSG_TYPE_ORDER_STATUS_REQUEST = 67 [(fix.enum_value)="H"];
MSG_TYPE_POSITION_MAINTENANCE_REPORT = 68 [(fix.enum_value)="AM"];
MSG_TYPE_POSITION_MAINTENANCE_REQUEST = 69 [(fix.enum_value)="AL"];
MSG_TYPE_POSITION_REPORT = 70 [(fix.enum_value)="AP"];
MSG_TYPE_QUOTE = 71 [(fix.enum_value)="S"];
MSG_TYPE_QUOTE_CANCEL = 72 [(fix.enum_value)="Z"];
MSG_TYPE_QUOTE_REQUEST = 73 [(fix.enum_value)="R"];
MSG_TYPE_QUOTE_REQUEST_REJECT = 74 [(fix.enum_value)="AG"];
MSG_TYPE_QUOTE_RESPONSE = 75 [(fix.enum_value)="AJ"];
MSG_TYPE_QUOTE_STATUS_REPORT = 76 [(fix.enum_value)="Al"];
MSG_TYPE_QUOTE_STATUS_REQUEST = 77 [(fix.enum_value)="a"];
MSG_TYPE_REGISTRATION_INSTRUCTIONS = 78 [(fix.enum_value)="o"];
MSG_TYPE_REGISTRATION_INSTRUCTIONS_RESPONSE = 79 [(fix.enum_value)="p"];
MSG_TYPE_REJECT = 80 [(fix.enum_value)="3"];
MSG_TYPE_REQUEST_FOR_POSITIONS = 81 [(fix.enum_value)="AN"];
MSG_TYPE_REQUEST_FOR_POSITIONS_ACK = 82 [(fix.enum_value)="AO"];
MSG_TYPE_RESEND_REQUEST = 83 [(fix.enum_value)="2"];
MSG_TYPE_RFQ_REQUEST = 84 [(fix.enum_value)="AH"];
MSG_TYPE_SECURITY_DEFINITION = 85 [(fix.enum_value)="d"];
MSG_TYPE_SECURITY_DEFINITION_REQUEST = 86 [(fix.enum_value)="c"];
MSG_TYPE_SECURITY_DEFINITION_UPDATE_REPORT = 87 [(fix.enum_value)="BP"];
MSG_TYPE_SECURITY_LIST = 88 [(fix.enum_value)="y"];
MSG_TYPE_SECURITY_LIST_REQUEST = 89 [(fix.enum_value)="x"];
MSG_TYPE_SECURITY_LIST_UPDATE_REPORT = 90 [(fix.enum_value)="BK"];
MSG_TYPE_SECURITY_STATUS = 91 [(fix.enum_value)="f"];
MSG_TYPE_SECURITY_STATUS_REQUEST = 92 [(fix.enum_value)="e"];
MSG_TYPE_SECURITY_TYPES = 93 [(fix.enum_value)="w"];
MSG_TYPE_SECURITY_TYPE_REQUEST = 94 [(fix.enum_value)="v"];
MSG_TYPE_SEQUENCE_RESET = 95 [(fix.enum_value)="4"];
MSG_TYPE_SETTLEMENT_INSTRUCTIONS = 96 [(fix.enum_value)="T"];
MSG_TYPE_SETTLEMENT_INSTRUCTION_REQUEST = 97 [(fix.enum_value)="AV"];
MSG_TYPE_SETTLEMENT_OBLIGATION_REPORT = 98 [(fix.enum_value)="BQ"];
MSG_TYPE_STREAM_ASSIGNMENT_REPORT = 99 [(fix.enum_value)="CD"];
MSG_TYPE_STREAM_ASSIGNMENT_REPORT_ACK = 100 [(fix.enum_value)="CE"];
MSG_TYPE_STREAM_ASSIGNMENT_REQUEST = 101 [(fix.enum_value)="CC"];
MSG_TYPE_TEST_REQUEST = 102 [(fix.enum_value)="1"];
MSG_TYPE_TRADE_CAPTURE_REPORT = 103 [(fix.enum_value)="AE"];
MSG_TYPE_TRADE_CAPTURE_REPORT_ACK = 104 [(fix.enum_value)="AR"];
MSG_TYPE_TRADE_CAPTURE_REPORT_REQUEST = 105 [(fix.enum_value)="AD"];
MSG_TYPE_TRADE_CAPTURE_REPORT_REQUEST_ACK = 106 [(fix.enum_value)="AQ"];
```

```

MSG_TYPE_TRADING_SESSION_LIST = 107 [(fix.enum_value)="BJ"];
MSG_TYPE_TRADING_SESSION_LIST_REQUEST = 108 [(fix.enum_value)="BI"];
MSG_TYPE_TRADING_SESSION_LIST_UPDATE_REPORT = 109 [(fix.enum_value)="BS"];
MSG_TYPE_TRADING_SESSION_STATUS = 110 [(fix.enum_value)="h"];
MSG_TYPE_TRADING_SESSION_STATUS_REQUEST = 111 [(fix.enum_value)="g"];
MSG_TYPE_UNSPECIFIED = 112;
MSG_TYPE_USER_NOTIFICATION = 113 [(fix.enum_value)="CB"];
MSG_TYPE_USER_REQUEST = 114 [(fix.enum_value)="BE"];
MSG_TYPE_USER_RESPONSE = 115 [(fix.enum_value)="BF"];
MSG_TYPE_XMLNON_FIX = 116 [(fix.enum_value)="n"];
}

enum ApplVerIDEnum {
  APPL_VER_ID_UNSPECIFIED = 0;
  APPL_VER_ID_FIX27 = 1 [(fix.enum_value)="0", (fix.enum_added)=VERSION_FIX_4_4];
  APPL_VER_ID_FIX30 = 2 [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_4_4];
  APPL_VER_ID_FIX40 = 3 [(fix.enum_value)="2", (fix.enum_added)=VERSION_FIX_4_4];
  APPL_VER_ID_FIX41 = 4 [(fix.enum_value)="3", (fix.enum_added)=VERSION_FIX_4_4];
  APPL_VER_ID_FIX42 = 5 [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_4_4];
  APPL_VER_ID_FIX43 = 6 [(fix.enum_value)="5", (fix.enum_added)=VERSION_FIX_4_4];
  APPL_VER_ID_FIX44 = 7 [(fix.enum_value)="6", (fix.enum_added)=VERSION_FIX_4_4];
  APPL_VER_ID_FIX50 = 8 [(fix.enum_value)="7", (fix.enum_added)=VERSION_FIX_4_4];
  APPL_VER_ID_FIX50SP1 = 9 [(fix.enum_value)="8", (fix.enum_added)=VERSION_FIX_5_0];
  APPL_VER_ID_FIX50SP2 = 10 [(fix.enum_value)="9", (fix.enum_added)=VERSION_FIX_5_0SP1, (fix.enum_added_ep)=97];
}

enum RefMsgTypeEnum {
  REF_MSG_TYPE_ADJUSTED_POSITION_REPORT = 0 [(fix.enum_value)="BL"];
  REF_MSG_TYPE_ADVERTISEMENT = 1 [(fix.enum_value)="7"];
  REF_MSG_TYPE_ALLOCATION_INSTRUCTION = 2 [(fix.enum_value)="J"];
  REF_MSG_TYPE_ALLOCATION_INSTRUCTION_ACK = 3 [(fix.enum_value)="P"];
  REF_MSG_TYPE_ALLOCATION_INSTRUCTION_ALERT = 4 [(fix.enum_value)="BM"];
  REF_MSG_TYPE_ALLOCATION_REPORT = 5 [(fix.enum_value)="AS"];
  REF_MSG_TYPE_ALLOCATION_REPORT_ACK = 6 [(fix.enum_value)="AT"];
  REF_MSG_TYPE_APPLICATION_MESSAGE_REPORT = 7 [(fix.enum_value)="BY"];
  REF_MSG_TYPE_APPLICATION_MESSAGE_REQUEST = 8 [(fix.enum_value)="BW"];
  REF_MSG_TYPE_APPLICATION_MESSAGE_REQUEST_ACK = 9 [(fix.enum_value)="BX"];
  REF_MSG_TYPE_ASSIGNMENT_REPORT = 10 [(fix.enum_value)="AW"];
  REF_MSG_TYPE_BID_REQUEST = 11 [(fix.enum_value)="k"];
  REF_MSG_TYPE_BID_RESPONSE = 12 [(fix.enum_value)="l"];
  REF_MSG_TYPE_BUSINESS_MESSAGE_REJECT = 13 [(fix.enum_value)="j"];
  REF_MSG_TYPE_COLLATERAL_ASSIGNMENT = 14 [(fix.enum_value)="AY"];
  REF_MSG_TYPE_COLLATERAL_INQUIRY = 15 [(fix.enum_value)="BB"];
  REF_MSG_TYPE_COLLATERAL_INQUIRY_ACK = 16 [(fix.enum_value)="BG"];
  REF_MSG_TYPE_COLLATERAL_REPORT = 17 [(fix.enum_value)="BA"];
  REF_MSG_TYPE_COLLATERAL_REQUEST = 18 [(fix.enum_value)="AX"];
  REF_MSG_TYPE_COLLATERAL_RESPONSE = 19 [(fix.enum_value)="AZ"];
  REF_MSG_TYPE_CONFIRMATION = 20 [(fix.enum_value)="AK"];
}

```

```
REF_MSG_TYPE_CONFIRMATION_ACK = 21 [(fix.enum_value)="AU"];
REF_MSG_TYPE_CONFIRMATION_REQUEST = 22 [(fix.enum_value)="BH"];
REF_MSG_TYPE_CONTRARY_INTENTION_REPORT = 23 [(fix.enum_value)="BO"];
REF_MSG_TYPE_CROSS_ORDER_CANCEL_REPLACE_REQUEST = 24 [(fix.enum_value)="t"];
REF_MSG_TYPE_CROSS_ORDER_CANCEL_REQUEST = 25 [(fix.enum_value)="u"];
REF_MSG_TYPE_DERIVATIVE_SECURITY_LIST = 26 [(fix.enum_value)="AA"];
REF_MSG_TYPE_DERIVATIVE_SECURITY_LIST_REQUEST = 27 [(fix.enum_value)="z"];
REF_MSG_TYPE_DERIVATIVE_SECURITY_LIST_UPDATE_REPORT = 28 [(fix.enum_value)="BR"];
REF_MSG_TYPE_DONT_KNOW_TRADE = 29 [(fix.enum_value)="Q"];
REF_MSG_TYPE_EMAIL = 30 [(fix.enum_value)="C"];
REF_MSG_TYPE_EXECUTION_ACKNOWLEDGEMENT = 31 [(fix.enum_value)="BN"];
REF_MSG_TYPE_EXECUTION_REPORT = 32 [(fix.enum_value)="8"];
REF_MSG_TYPE_HEARTBEAT = 33 [(fix.enum_value)="0"];
REF_MSG_TYPE_IOI = 34 [(fix.enum_value)="6"];
REF_MSG_TYPE_LIST_CANCEL_REQUEST = 35 [(fix.enum_value)="K"];
REF_MSG_TYPE_LIST_EXECUTE = 36 [(fix.enum_value)="L"];
REF_MSG_TYPE_LIST_STATUS = 37 [(fix.enum_value)="N"];
REF_MSG_TYPE_LIST_STATUS_REQUEST = 38 [(fix.enum_value)="M"];
REF_MSG_TYPE_LIST_STRIKE_PRICE = 39 [(fix.enum_value)="m"];
REF_MSG_TYPE_LOGON = 40 [(fix.enum_value)="A"];
REF_MSG_TYPE_LOGOUT = 41 [(fix.enum_value)="5"];
REF_MSG_TYPE_MARKET_DATA_INCREMENTAL_REFRESH = 42 [(fix.enum_value)="X"];
REF_MSG_TYPE_MARKET_DATA_REQUEST = 43 [(fix.enum_value)="V"];
REF_MSG_TYPE_MARKET_DATA_REQUEST_REJECT = 44 [(fix.enum_value)="Y"];
REF_MSG_TYPE_MARKET_DATA_SNAPSHOT_FULL_REFRESH = 45 [(fix.enum_value)="W"];
REF_MSG_TYPE_MARKET_DEFINITION = 46 [(fix.enum_value)="BU"];
REF_MSG_TYPE_MARKET_DEFINITION_REQUEST = 47 [(fix.enum_value)="BT"];
REF_MSG_TYPE_MARKET_DEFINITION_UPDATE_REPORT = 48 [(fix.enum_value)="BV"];
REF_MSG_TYPE_MASS_QUOTE = 49 [(fix.enum_value)="i"];
REF_MSG_TYPE_MASS_QUOTE_ACKNOWLEDGEMENT = 50 [(fix.enum_value)="b"];
REF_MSG_TYPE_MULTILEG_ORDER_CANCEL_REPLACE = 51 [(fix.enum_value)="AC"];
REF_MSG_TYPE_NETWORK_COUNTERPARTY_SYSTEM_STATUS_REQUEST = 52 [(fix.enum_value)="BC"];
REF_MSG_TYPE_NETWORK_COUNTERPARTY_SYSTEM_STATUS_RESPONSE = 53 [(fix.enum_value)="BD"];
REF_MSG_TYPE_NEWS = 54 [(fix.enum_value)="B"];
REF_MSG_TYPE_NEW_ORDER_CROSS = 55 [(fix.enum_value)="s"];
REF_MSG_TYPE_NEW_ORDER_LIST = 56 [(fix.enum_value)="E"];
REF_MSG_TYPE_NEW_ORDER_MULTILEG = 57 [(fix.enum_value)="AB"];
REF_MSG_TYPE_NEW_ORDER_SINGLE = 58 [(fix.enum_value)="D"];
REF_MSG_TYPE_ORDER_CANCEL_REJECT = 59 [(fix.enum_value)="9"];
REF_MSG_TYPE_ORDER_CANCEL_REPLACE_REQUEST = 60 [(fix.enum_value)="G"];
REF_MSG_TYPE_ORDER_CANCEL_REQUEST = 61 [(fix.enum_value)="F"];
REF_MSG_TYPE_ORDER_MASS_ACTION_REPORT = 62 [(fix.enum_value)="BZ"];
REF_MSG_TYPE_ORDER_MASS_ACTION_REQUEST = 63 [(fix.enum_value)="CA"];
REF_MSG_TYPE_ORDER_MASS_CANCEL_REPORT = 64 [(fix.enum_value)="r"];
REF_MSG_TYPE_ORDER_MASS_CANCEL_REQUEST = 65 [(fix.enum_value)="q"];
REF_MSG_TYPE_ORDER_MASS_STATUS_REQUEST = 66 [(fix.enum_value)="AF"];
REF_MSG_TYPE_ORDER_STATUS_REQUEST = 67 [(fix.enum_value)="H"];
REF_MSG_TYPE_POSITION_MAINTENANCE_REPORT = 68 [(fix.enum_value)="AM"];
```

```
REF_MSG_TYPE_POSITION_MAINTENANCE_REQUEST = 69    [(fix.enum_value)="AL"];
REF_MSG_TYPE_POSITION_REPORT = 70 [(fix.enum_value)="AP"];
REF_MSG_TYPE_QUOTE = 71    [(fix.enum_value)="S"];
REF_MSG_TYPE_QUOTE_CANCEL = 72 [(fix.enum_value)="Z"];
REF_MSG_TYPE_QUOTE_REQUEST = 73 [(fix.enum_value)="R"];
REF_MSG_TYPE_QUOTE_REQUEST_REJECT = 74    [(fix.enum_value)="AG"];
REF_MSG_TYPE_QUOTE_RESPONSE = 75 [(fix.enum_value)="AJ"];
REF_MSG_TYPE_QUOTE_STATUS_REPORT = 76    [(fix.enum_value)="AI"];
REF_MSG_TYPE_QUOTE_STATUS_REQUEST = 77    [(fix.enum_value)="a"];
REF_MSG_TYPE_REGISTRATION_INSTRUCTIONS = 78    [(fix.enum_value)="o"];
REF_MSG_TYPE_REGISTRATION_INSTRUCTIONS_RESPONSE = 79 [(fix.enum_value)="p"];
REF_MSG_TYPE_REJECT = 80    [(fix.enum_value)="3"];
REF_MSG_TYPE_REQUEST_FOR_POSITIONS = 81    [(fix.enum_value)="AN"];
REF_MSG_TYPE_REQUEST_FOR_POSITIONS_ACK = 82    [(fix.enum_value)="AO"];
REF_MSG_TYPE_RESEND_REQUEST = 83 [(fix.enum_value)="2"];
REF_MSG_TYPE_RFQ_REQUEST = 84 [(fix.enum_value)="AH"];
REF_MSG_TYPE_SECURITY_DEFINITION = 85    [(fix.enum_value)="d"];
REF_MSG_TYPE_SECURITY_DEFINITION_REQUEST = 86    [(fix.enum_value)="c"];
REF_MSG_TYPE_SECURITY_DEFINITION_UPDATE_REPORT = 87 [(fix.enum_value)="BP"];
REF_MSG_TYPE_SECURITY_LIST = 88 [(fix.enum_value)="y"];
REF_MSG_TYPE_SECURITY_LIST_REQUEST = 89    [(fix.enum_value)="x"];
REF_MSG_TYPE_SECURITY_LIST_UPDATE_REPORT = 90    [(fix.enum_value)="BK"];
REF_MSG_TYPE_SECURITY_STATUS = 91 [(fix.enum_value)="f"];
REF_MSG_TYPE_SECURITY_STATUS_REQUEST = 92    [(fix.enum_value)="e"];
REF_MSG_TYPE_SECURITY_TYPES = 93 [(fix.enum_value)="w"];
REF_MSG_TYPE_SECURITY_TYPE_REQUEST = 94    [(fix.enum_value)="v"];
REF_MSG_TYPE_SEQUENCE_RESET = 95 [(fix.enum_value)="4"];
REF_MSG_TYPE_SETTLEMENT_INSTRUCTIONS = 96    [(fix.enum_value)="T"];
REF_MSG_TYPE_SETTLEMENT_INSTRUCTION_REQUEST = 97 [(fix.enum_value)="AV"];
REF_MSG_TYPE_SETTLEMENT_OBLIGATION_REPORT = 98    [(fix.enum_value)="BQ"];
REF_MSG_TYPE_STREAM_ASSIGNMENT_REPORT = 99    [(fix.enum_value)="CD"];
REF_MSG_TYPE_STREAM_ASSIGNMENT_REPORT_ACK = 100 [(fix.enum_value)="CE"];
REF_MSG_TYPE_STREAM_ASSIGNMENT_REQUEST = 101 [(fix.enum_value)="CC"];
REF_MSG_TYPE_TEST_REQUEST = 102 [(fix.enum_value)="1"];
REF_MSG_TYPE_TRADE_CAPTURE_REPORT = 103    [(fix.enum_value)="AE"];
REF_MSG_TYPE_TRADE_CAPTURE_REPORT_ACK = 104    [(fix.enum_value)="AR"];
REF_MSG_TYPE_TRADE_CAPTURE_REPORT_REQUEST = 105 [(fix.enum_value)="AD"];
REF_MSG_TYPE_TRADE_CAPTURE_REPORT_REQUEST_ACK = 106 [(fix.enum_value)="AQ"];
REF_MSG_TYPE_TRADING_SESSION_LIST = 107    [(fix.enum_value)="BJ"];
REF_MSG_TYPE_TRADING_SESSION_LIST_REQUEST = 108 [(fix.enum_value)="BI"];
REF_MSG_TYPE_TRADING_SESSION_LIST_UPDATE_REPORT = 109 [(fix.enum_value)="BS"];
REF_MSG_TYPE_TRADING_SESSION_STATUS = 110    [(fix.enum_value)="h"];
REF_MSG_TYPE_TRADING_SESSION_STATUS_REQUEST = 111 [(fix.enum_value)="g"];
REF_MSG_TYPE_UNSPECIFIED = 112;
REF_MSG_TYPE_USER_NOTIFICATION = 113    [(fix.enum_value)="CB"];
REF_MSG_TYPE_USER_REQUEST = 114 [(fix.enum_value)="BE"];
REF_MSG_TYPE_USER_RESPONSE = 115 [(fix.enum_value)="BF"];
REF_MSG_TYPE_XMLNON_FIX = 116 [(fix.enum_value)="n"];
```



```

}

enum RefApplVerIDEnum {
  REF_APPL_VER_ID_UNSPECIFIED = 0;
  REF_APPL_VER_ID_FIX27 = 1    [(fix.enum_value)="0", (fix.enum_added)=VERSION_FIX_4_4];
  REF_APPL_VER_ID_FIX30 = 2    [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_4_4];
  REF_APPL_VER_ID_FIX40 = 3    [(fix.enum_value)="2", (fix.enum_added)=VERSION_FIX_4_4];
  REF_APPL_VER_ID_FIX41 = 4    [(fix.enum_value)="3", (fix.enum_added)=VERSION_FIX_4_4];
  REF_APPL_VER_ID_FIX42 = 5    [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_4_4];
  REF_APPL_VER_ID_FIX43 = 6    [(fix.enum_value)="5", (fix.enum_added)=VERSION_FIX_4_4];
  REF_APPL_VER_ID_FIX44 = 7    [(fix.enum_value)="6", (fix.enum_added)=VERSION_FIX_4_4];
  REF_APPL_VER_ID_FIX50 = 8    [(fix.enum_value)="7", (fix.enum_added)=VERSION_FIX_4_4];
  REF_APPL_VER_ID_FIX50SP1 = 9  [(fix.enum_value)="8", (fix.enum_added)=VERSION_FIX_5_0];
  REF_APPL_VER_ID_FIX50SP2 = 10 [(fix.enum_value)="9", (fix.enum_added)=VERSION_FIX_5_0SP1, (fix.enum_added_ep)=97];
}

enum SessionRejectReasonEnum {
  SESSION_REJECT_REASON_UNSPECIFIED = 0;
  SESSION_REJECT_REASON_COMP_ID_PROBLEM = 1    [(fix.enum_value)="9", (fix.enum_added)=VERSION_FIX_4_2];
  SESSION_REJECT_REASON_DECRYPTION_PROBLEM = 2  [(fix.enum_value)="7", (fix.enum_added)=VERSION_FIX_4_2];
  SESSION_REJECT_REASON_INCORRECT_DATA_FORMAT_FOR_VALUE = 3    [(fix.enum_value)="6",
(fix.enum_added)=VERSION_FIX_4_2];
  SESSION_REJECT_REASON_INVALID_MSG_TYPE = 4    [(fix.enum_value)="11", (fix.enum_added)=VERSION_FIX_4_2];
  SESSION_REJECT_REASON_INVALID_TAG_NUMBER = 5  [(fix.enum_value)="0", (fix.enum_added)=VERSION_FIX_4_2];
  SESSION_REJECT_REASON_REQUIRED_TAG_MISSING = 6 [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_4_2];
  SESSION_REJECT_REASON_SENDING_TIME_ACCURACY_PROBLEM = 7 [(fix.enum_value)="10", (fix.enum_added)=VERSION_FIX_4_2];
  SESSION_REJECT_REASON_SIGNATURE_PROBLEM = 8   [(fix.enum_value)="8", (fix.enum_added)=VERSION_FIX_4_2];
  SESSION_REJECT_REASON_TAG_NOT_DEFINED_FOR_THIS_MESSAGE_TYPE = 9 [(fix.enum_value)="2",
(fix.enum_added)=VERSION_FIX_4_2];
  SESSION_REJECT_REASON_TAG_SPECIFIED_WITHOUT_AVALUE = 10 [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_4_2];
  SESSION_REJECT_REASON_UNDEFINED_TAG = 11     [(fix.enum_value)="3", (fix.enum_added)=VERSION_FIX_4_2];
  SESSION_REJECT_REASON_VALUE_IS_INCORRECT = 12 [(fix.enum_value)="5", (fix.enum_added)=VERSION_FIX_4_2];
  SESSION_REJECT_REASON_INCORRECT_NUM_IN_GROUP_COUNT_FOR_REPEATING_GROUP = 13 [(fix.enum_value)="16",
(fix.enum_added)=VERSION_FIX_4_3];
  SESSION_REJECT_REASON_NON = 14 [(fix.enum_value)="17", (fix.enum_added)=VERSION_FIX_4_3];
  SESSION_REJECT_REASON_REPEATING_GROUP_FIELDS_OUT_OF_ORDER = 15 [(fix.enum_value)="15",
(fix.enum_added)=VERSION_FIX_4_3];
  SESSION_REJECT_REASON_TAG_APPEARS_MORE_THAN_ONCE = 16 [(fix.enum_value)="13", (fix.enum_added)=VERSION_FIX_4_3];
  SESSION_REJECT_REASON_TAG_SPECIFIED_OUT_OF_REQUIRED_ORDER = 17 [(fix.enum_value)="14",
(fix.enum_added)=VERSION_FIX_4_3];
  SESSION_REJECT_REASON_XML_VALIDATION_ERROR = 18 [(fix.enum_value)="12", (fix.enum_added)=VERSION_FIX_4_3];
  SESSION_REJECT_REASON_OTHER = 19 [(fix.enum_value)="99", (fix.enum_added)=VERSION_FIX_4_4];
  SESSION_REJECT_REASON_INVALID = 20 [(fix.enum_value)="18", (fix.enum_added)=VERSION_FIX_5_0, (fix.enum_added_ep)=56];
}

enum SessionStatusEnum {
  SESSION_STATUS_UNSPECIFIED = 0;
  SESSION_STATUS_ACCOUNT_LOCKED = 1 [(fix.enum_value)="6", (fix.enum_added)=VERSION_FIX_5_0, (fix.enum_added_ep)=56];
}

```

```

SESSION_STATUS_INVALID_USERNAME_OR_PASSWORD = 2    [(fix.enum_value)="5", (fix.enum_added)=VERSION_FIX_5_0,
(fix.enum_added_ep)=56];
SESSION_STATUS_LOGONS_ARE_NOT_ALLOWED_AT_THIS_TIME = 3 [(fix.enum_value)="7", (fix.enum_added)=VERSION_FIX_5_0,
(fix.enum_added_ep)=56];
SESSION_STATUS_NEW_SESSION_PASSWORD_DOES_NOT_COMPLY_WITH_POLICY = 4    [(fix.enum_value)="3",
(fix.enum_added)=VERSION_FIX_5_0, (fix.enum_added_ep)=56];
SESSION_STATUS_PASSWORD_EXPIRED = 5 [(fix.enum_value)="8", (fix.enum_added)=VERSION_FIX_5_0, (fix.enum_added_ep)=56];
SESSION_STATUS_SESSION_ACTIVE = 6 [(fix.enum_value)="0", (fix.enum_added)=VERSION_FIX_5_0, (fix.enum_added_ep)=56];
SESSION_STATUS_SESSION_LOGOUT_COMPLETE = 7        [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_5_0,
(fix.enum_added_ep)=56];
SESSION_STATUS_SESSION_PASSWORD_CHANGED = 8        [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_5_0,
(fix.enum_added_ep)=56];
SESSION_STATUS_SESSION_PASSWORD_DUE_TO_EXPIRE = 9 [(fix.enum_value)="2", (fix.enum_added)=VERSION_FIX_5_0,
(fix.enum_added_ep)=56];
}

```

```

enum EncryptMethodEnum {
  ENCRYPT_METHOD_UNSPECIFIED = 0;
  ENCRYPT_METHOD_DES = 1        [(fix.enum_value)="2", (fix.enum_added)=VERSION_FIX_2_7];
  ENCRYPT_METHOD_NONE = 2      [(fix.enum_value)="0", (fix.enum_added)=VERSION_FIX_2_7];
  ENCRYPT_METHOD_PKCS = 3      [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_2_7];
  ENCRYPT_METHOD_PKCSDES = 4   [(fix.enum_value)="3", (fix.enum_added)=VERSION_FIX_2_7];
  ENCRYPT_METHOD_PGPDES = 5    [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_3_0];
  ENCRYPT_METHOD_PEM = 6       [(fix.enum_value)="6", (fix.enum_added)=VERSION_FIX_4_0];
  ENCRYPT_METHOD_PGPDESMD5 = 7 [(fix.enum_value)="5", (fix.enum_added)=VERSION_FIX_4_0];
}

```

```

enum DefaultApplVerIDEnum {
  DEFAULT_APPL_VER_ID_UNSPECIFIED = 0;
  DEFAULT_APPL_VER_ID_FIX27 = 1    [(fix.enum_value)="0", (fix.enum_added)=VERSION_FIX_4_4];
  DEFAULT_APPL_VER_ID_FIX30 = 2    [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_4_4];
  DEFAULT_APPL_VER_ID_FIX40 = 3    [(fix.enum_value)="2", (fix.enum_added)=VERSION_FIX_4_4];
  DEFAULT_APPL_VER_ID_FIX41 = 4    [(fix.enum_value)="3", (fix.enum_added)=VERSION_FIX_4_4];
  DEFAULT_APPL_VER_ID_FIX42 = 5    [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_4_4];
  DEFAULT_APPL_VER_ID_FIX43 = 6    [(fix.enum_value)="5", (fix.enum_added)=VERSION_FIX_4_4];
  DEFAULT_APPL_VER_ID_FIX44 = 7    [(fix.enum_value)="6", (fix.enum_added)=VERSION_FIX_4_4];
  DEFAULT_APPL_VER_ID_FIX50 = 8    [(fix.enum_value)="7", (fix.enum_added)=VERSION_FIX_4_4];
  DEFAULT_APPL_VER_ID_FIX50SP1 = 9 [(fix.enum_value)="8", (fix.enum_added)=VERSION_FIX_5_0];
  DEFAULT_APPL_VER_ID_FIX50SP2 = 10 [(fix.enum_value)="9", (fix.enum_added)=VERSION_FIX_5_0SP1, (fix.enum_added_ep)=97];
}

```

```

message StandardHeader {
  optional string begin_string = 1 [(fix.tag)=8, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  optional sfixed64 body_length = 2 [(fix.tag)=9, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_0];
  optional string deliver_to_comp_id = 3 [(fix.tag)=128, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  optional string deliver_to_sub_id = 4 [(fix.tag)=129, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  optional sfixed64 msg_seq_num = 5 [(fix.tag)=34, (fix.type)=DATATYPE_SEQ_NUM, (fix.field_added)=VERSION_FIX_4_0];
  optional MsgTypeEnum msg_type = 6 [(fix.tag)=35, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  optional string on_behalf_of_comp_id = 7 [(fix.tag)=115, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
}

```

```

optional string on_behalf_of_sub_id = 8      [(fix.tag)=116, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
optional fix.Timestamp orig_sending_time = 9 [(fix.tag)=122, (fix.type)=DATATYPE_UTCTIME, (fix.field_added)=VERSION_FIX_4_0];
optional bool poss_dup_flag = 10 [(fix.tag)=43, (fix.type)=DATATYPE_BOOLEAN, (fix.field_added)=VERSION_FIX_4_0];
optional bool poss_resend = 11 [(fix.tag)=97, (fix.type)=DATATYPE_BOOLEAN, (fix.field_added)=VERSION_FIX_4_0];
optional string secure_data = 12 [(fix.tag)=91, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_4_0];
optional sfixed64 secure_data_len = 13 [(fix.tag)=90, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_0];
optional string sender_comp_id = 14 [(fix.tag)=49, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
optional string sender_sub_id = 15 [(fix.tag)=50, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
optional fix.Timestamp sending_time = 16 [(fix.tag)=52, (fix.type)=DATATYPE_UTCTIME, (fix.field_added)=VERSION_FIX_4_0];
optional string target_comp_id = 17 [(fix.tag)=56, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
optional string target_sub_id = 18 [(fix.tag)=57, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
optional string deliver_to_location_id = 19 [(fix.tag)=145, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_1];
optional string on_behalf_of_location_id = 20 [(fix.tag)=144, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_1];
optional string sender_location_id = 21 [(fix.tag)=142, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_1];
optional string target_location_id = 22 [(fix.tag)=143, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_1];
optional sfixed64 last_msg_seq_num_processed = 23 [(fix.tag)=369, (fix.type)=DATATYPE_SEQ_NUM, (fix.field_added)=VERSION_FIX_4_2];
optional string message_encoding = 24 [(fix.tag)=347, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_2];
optional string xml_data = 25 [(fix.tag)=213, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_4_2];
optional sfixed64 xml_data_len = 26 [(fix.tag)=212, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_2];
optional ApplVerIDEnum appl_ver_id = 27 [(fix.tag)=1128, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_4];
optional string cstm_appl_ver_id = 28 [(fix.tag)=1129, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_4];
repeated HopGrp hop_grp = 29 [(fix.field_added)=VERSION_FIX_4_4];
optional sfixed64 appl_ext_id = 30 [(fix.tag)=1156, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_5_0];
}

message StandardTrailer {
optional string check_sum = 1 [(fix.tag)=10, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
optional string signature = 2 [(fix.tag)=89, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_4_0];
optional sfixed64 signature_length = 3 [(fix.tag)=93, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_0];
}

message HopGrp {
optional string hop_comp_id = 1 [(fix.tag)=628, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_4];
optional sfixed64 hop_ref_id = 2 [(fix.tag)=630, (fix.type)=DATATYPE_SEQ_NUM, (fix.field_added)=VERSION_FIX_4_4];
optional fix.Timestamp hop_sending_time = 3 [(fix.tag)=629, (fix.type)=DATATYPE_UTCTIME, (fix.field_added)=VERSION_FIX_4_4];
}

message Heartbeat {
option (fix.msg_type_value)="0";
optional StandardHeader standard_header = 1 [(fix.field_added)=VERSION_FIX_2_7];
optional StandardTrailer standard_trailer = 2 [(fix.field_added)=VERSION_FIX_2_7];
optional string test_req_id = 3 [(fix.tag)=112, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
}

message TestRequest {

```

```
option (fix.msg_type_value)="1";
optional StandardHeader standard_header = 1      [(fix.field_added)=VERSION_FIX_2_7];
optional StandardTrailer standard_trailer = 2    [(fix.field_added)=VERSION_FIX_2_7];
optional string test_req_id = 3 [(fix.tag)=112, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
}

message ResendRequest {
option (fix.msg_type_value)="2";
optional sfixed64 begin_seq_no = 1 [(fix.tag)=7, (fix.type)=DATATYPE_SEQ_NUM, (fix.field_added)=VERSION_FIX_2_7];
optional sfixed64 end_seq_no = 2 [(fix.tag)=16, (fix.type)=DATATYPE_SEQ_NUM, (fix.field_added)=VERSION_FIX_2_7];
optional StandardHeader standard_header = 3      [(fix.field_added)=VERSION_FIX_2_7];
optional StandardTrailer standard_trailer = 4    [(fix.field_added)=VERSION_FIX_2_7];
}

message Reject {
option (fix.msg_type_value)="3";
optional sfixed64 ref_seq_num = 1 [(fix.tag)=45, (fix.type)=DATATYPE_SEQ_NUM, (fix.field_added)=VERSION_FIX_2_7];
optional StandardHeader standard_header = 2      [(fix.field_added)=VERSION_FIX_2_7];
optional StandardTrailer standard_trailer = 3    [(fix.field_added)=VERSION_FIX_2_7];
optional string text = 4 [(fix.tag)=58, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_2_7];
optional string encoded_text = 5 [(fix.tag)=355, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_4_2];
optional sfixed64 encoded_text_len = 6 [(fix.tag)=354, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_2];
optional RefMsgTypeEnum ref_msg_type = 7 [(fix.tag)=372, (fix.type)=DATATYPE_STRING,
(fix.field_added)=VERSION_FIX_4_2];
optional sfixed64 ref_tag_id = 8 [(fix.tag)=371, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_4_2];
oneof session_reject_reason_union {
  SessionRejectReasonEnum session_reject_reason = 9 [(fix.tag)=373, (fix.type)=DATATYPE_INT,
(fix.field_added)=VERSION_FIX_4_2];
  fixed32 session_reject_reason_reserved100plus = 10 [(fix.tag)=373, (fix.type)=DATATYPE_RESERVED100PLUS,
(fix.field_added)=VERSION_FIX_4_2];
}
optional sfixed64 ref_appl_ext_id = 11 [(fix.tag)=1406, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_5_0];
optional RefApplVerIDEnum ref_appl_ver_id = 12 [(fix.tag)=1130, (fix.type)=DATATYPE_STRING,
(fix.field_added)=VERSION_FIX_5_0];
optional string ref_cstm_appl_ver_id = 13 [(fix.tag)=1131, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_5_0];
}

message SequenceReset {
option (fix.msg_type_value)="4";
optional sfixed64 new_seq_no = 1 [(fix.tag)=36, (fix.type)=DATATYPE_SEQ_NUM, (fix.field_added)=VERSION_FIX_2_7];
optional StandardHeader standard_header = 2      [(fix.field_added)=VERSION_FIX_2_7];
optional StandardTrailer standard_trailer = 3    [(fix.field_added)=VERSION_FIX_2_7];
optional bool gap_fill_flag = 4 [(fix.tag)=123, (fix.type)=DATATYPE_BOOLEAN, (fix.field_added)=VERSION_FIX_4_0];
}

message Logout {
option (fix.msg_type_value)="5";
optional StandardHeader standard_header = 1      [(fix.field_added)=VERSION_FIX_2_7];
optional StandardTrailer standard_trailer = 2    [(fix.field_added)=VERSION_FIX_2_7];
```

```

optional string text = 3      [(fix.tag)=58, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_2_7];
optional string encoded_text = 4 [(fix.tag)=355, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_4_2];
optional sfixed64 encoded_text_len = 5      [(fix.tag)=354, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_2];
oneof session_status_union {
  SessionStatusEnum session_status = 6      [(fix.tag)=1409, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_5_0];
  fixed32 session_status_reserved100plus = 7      [(fix.tag)=1409, (fix.type)=DATATYPE_RESERVED100PLUS,
(fix.field_added)=VERSION_FIX_5_0];
}
}

message Logon {
  option (fix.msg_type_value)="A";
  optional EncryptMethodEnum encrypt_method = 1      [(fix.tag)=98, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_2_7];
  optional string raw_data = 2      [(fix.tag)=96, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_2_7];
  optional sfixed64 raw_data_length = 3      [(fix.tag)=95, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_2_7];
  optional StandardHeader standard_header = 4      [(fix.field_added)=VERSION_FIX_2_7];
  optional StandardTrailer standard_trailer = 5      [(fix.field_added)=VERSION_FIX_2_7];
  optional sfixed64 heart_bt_int = 6 [(fix.tag)=108, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_3_0];
  optional bool reset_seq_num_flag = 7      [(fix.tag)=141, (fix.type)=DATATYPE_BOOLEAN, (fix.field_added)=VERSION_FIX_4_1];
  optional sfixed64 max_message_size = 8      [(fix.tag)=383, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_2];
  optional string password = 9      [(fix.tag)=554, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_3];
  optional bool test_message_indicator = 10      [(fix.tag)=464, (fix.type)=DATATYPE_BOOLEAN, (fix.field_added)=VERSION_FIX_4_3];
  optional string username = 11      [(fix.tag)=553, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_3];
  optional DefaultApplVerIDEnum default_appl_ver_id = 12 [(fix.tag)=1137, (fix.type)=DATATYPE_STRING,
(fix.field_added)=VERSION_FIX_4_4];
  repeated Common.MsgTypeGrp msg_type_grp = 13      [(fix.field_added)=VERSION_FIX_4_4];
  optional sfixed64 next_expected_msg_seq_num = 14      [(fix.tag)=789, (fix.type)=DATATYPE_SEQ_NUM,
(fix.field_added)=VERSION_FIX_4_4];
  optional sfixed64 default_appl_ext_id = 15      [(fix.tag)=1407, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_5_0];
  optional string default_custm_appl_ver_id = 16      [(fix.tag)=1408, (fix.type)=DATATYPE_STRING,
(fix.field_added)=VERSION_FIX_5_0];
  optional string encoded_text = 17 [(fix.tag)=355, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_5_0];
  optional sfixed64 encoded_text_len = 18      [(fix.tag)=354, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_5_0];
  optional string encrypted_new_password = 19      [(fix.tag)=1404, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_5_0];
  optional sfixed64 encrypted_new_password_len = 20      [(fix.tag)=1403, (fix.type)=DATATYPE_LENGTH,
(fix.field_added)=VERSION_FIX_5_0];
  optional string encrypted_password = 21      [(fix.tag)=1402, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_5_0];
  optional sfixed64 encrypted_password_len = 22      [(fix.tag)=1401, (fix.type)=DATATYPE_LENGTH,
(fix.field_added)=VERSION_FIX_5_0];
  oneof encrypted_password_method_union {
    sfixed64 encrypted_password_method = 23      [(fix.tag)=1400, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_5_0];
    fixed32 encrypted_password_method_reserved100plus = 24 [(fix.tag)=1400, (fix.type)=DATATYPE_RESERVED100PLUS,
(fix.field_added)=VERSION_FIX_5_0];
  }
  optional string new_password = 25 [(fix.tag)=925, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_5_0];
  oneof session_status_union {
    SessionStatusEnum session_status = 26      [(fix.tag)=1409, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_5_0];
    fixed32 session_status_reserved100plus = 27      [(fix.tag)=1409, (fix.type)=DATATYPE_RESERVED100PLUS,
(fix.field_added)=VERSION_FIX_5_0];
}
}

```

```
}
  optional string text = 28      [(fix.tag)=58, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_5_0];
}

message XMLnonFIX {
  option (fix.msg_type_value)="n";
  optional StandardHeader standard_header = 1      [(fix.field_added)=VERSION_FIX_4_3];
  optional StandardTrailer standard_trailer = 2    [(fix.field_added)=VERSION_FIX_4_3];
}
```

9.4 SingleGeneralOrderHandling.proto

```
//
//      FIX Unified Repository mapping to Google Protocol Buffers
//
//      Copyright (c) FIX Trading Community. All Rights Reserved.
//
//      Category: SingleGeneralOrderHandling
//
//      File: singlegeneralorderhandling.proto
//
syntax = "proto2";
import "meta.proto";
import "fix.proto";
import "common.proto";
import "session.proto";

option java_package = "org.fixprotocol.components";
option java_outer_classname = "SingleGeneralOrderHandling";

package SingleGeneralOrderHandling;

enum AcctIDSourceEnum {
  ACCT_ID_SOURCE_UNSPECIFIED = 0;
  ACCT_ID_SOURCE_BIC = 1      [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_4_4];
  ACCT_ID_SOURCE_DTCCCODE = 2  [(fix.enum_value)="5", (fix.enum_added)=VERSION_FIX_4_4];
  ACCT_ID_SOURCE_OMGEO = 3     [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_4_4];
  ACCT_ID_SOURCE_OTHER = 4     [(fix.enum_value)="99", (fix.enum_added)=VERSION_FIX_4_4];
  ACCT_ID_SOURCE_SID_CODE = 5  [(fix.enum_value)="2", (fix.enum_added)=VERSION_FIX_4_4];
  ACCT_ID_SOURCE_TFM = 6      [(fix.enum_value)="3", (fix.enum_added)=VERSION_FIX_4_4];
}

enum AccountTypeEnum {
  ACCOUNT_TYPE_UNSPECIFIED = 0;
```

```

ACCOUNT_TYPE_CARRIED_CUSTOMER_SIDE = 1      [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_4_3];
ACCOUNT_TYPE_CARRIED_NON_CUSTOMER_SIDE = 2   [(fix.enum_value)="2", (fix.enum_added)=VERSION_FIX_4_3];
ACCOUNT_TYPE_CARRIED_NON_CUSTOMER_SIDE_CROSS_MARGIN = 3 [(fix.enum_value)="6",
(fix.enum_added)=VERSION_FIX_4_3];
ACCOUNT_TYPE_FLOOR_TRADER = 4 [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_4_3];
ACCOUNT_TYPE_HOUSE_TRADER = 5 [(fix.enum_value)="3", (fix.enum_added)=VERSION_FIX_4_3];
ACCOUNT_TYPE_HOUSE_TRADER_CROSS_MARGIN = 6 [(fix.enum_value)="7", (fix.enum_added)=VERSION_FIX_4_3];
ACCOUNT_TYPE_JOINT_BACK_OFFICE_ACCOUNT = 7 [(fix.enum_value)="8", (fix.enum_added)=VERSION_FIX_4_3];
}

```

```

enum SideEnum {
SIDE_UNSPECIFIED = 0;
SIDE_BUY = 1 [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_2_7];
SIDE_BUY_MINUS = 2 [(fix.enum_value)="3", (fix.enum_added)=VERSION_FIX_2_7];
SIDE_SELL = 3 [(fix.enum_value)="2", (fix.enum_added)=VERSION_FIX_2_7];
SIDE_SELL_PLUS = 4 [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_2_7];
SIDE_SELL_SHORT = 5 [(fix.enum_value)="5", (fix.enum_added)=VERSION_FIX_2_7];
SIDE_SELL_SHORT_EXEMPT = 6 [(fix.enum_value)="6", (fix.enum_added)=VERSION_FIX_2_7];
SIDE_CROSS = 7 [(fix.enum_value)="8", (fix.enum_added)=VERSION_FIX_4_1];
SIDE_UNDISCLOSED = 8 [(fix.enum_value)="7", (fix.enum_added)=VERSION_FIX_4_1];
SIDE_CROSS_SHORT = 9 [(fix.enum_value)="9", (fix.enum_added)=VERSION_FIX_4_2];
SIDE_AS_DEFINED = 10 [(fix.enum_value)="B", (fix.enum_added)=VERSION_FIX_4_3];
SIDE_CROSS_SHORT_EXEMPT = 11 [(fix.enum_value)="A", (fix.enum_added)=VERSION_FIX_4_3];
SIDE_OPPOSITE = 12 [(fix.enum_value)="C", (fix.enum_added)=VERSION_FIX_4_3];
SIDE_BORROW = 13 [(fix.enum_value)="G", (fix.enum_added)=VERSION_FIX_4_4];
SIDE_LEND = 14 [(fix.enum_value)="F", (fix.enum_added)=VERSION_FIX_4_4];
SIDE_REDEEM = 15 [(fix.enum_value)="E", (fix.enum_added)=VERSION_FIX_4_4];
SIDE_SUBSCRIBE = 16 [(fix.enum_value)="D", (fix.enum_added)=VERSION_FIX_4_4];
}

```

```

message OrderCancelRequest {
option (fix.msg_type_value)="F";
optional string cl_ord_id = 1 [(fix.tag)=11, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_2_7];
optional string list_id = 2 [(fix.tag)=66, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_2_7];
optional string order_id = 3 [(fix.tag)=37, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_2_7];
optional string orig_cl_ord_id = 4 [(fix.tag)=41, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_2_7];
optional SideEnum side = 5 [(fix.tag)=54, (fix.type)=DATATYPE_CHAR, (fix.field_added)=VERSION_FIX_2_7];
optional Session.StandardHeader standard_header = 6 [(fix.field_added)=VERSION_FIX_2_7];
optional Session.StandardTrailer standard_trailer = 7 [(fix.field_added)=VERSION_FIX_2_7];
optional string text = 8 [(fix.tag)=58, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_2_7];
optional string account = 9 [(fix.tag)=1, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_2];
optional string compliance_id = 10 [(fix.tag)=376, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_2];
optional string encoded_text = 11 [(fix.tag)=355, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_4_2];
}

```

```
optional sfixed64 encoded_text_len = 12      [(fix.tag)=354, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_2];
optional fix.Timestamp transact_time = 13    [(fix.tag)=60, (fix.type)=DATATYPE_UTC_TIMESTAMP,
(fix.field_added)=VERSION_FIX_4_2];
optional AccountTypeEnum account_type = 14   [(fix.tag)=581, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_4_3];
optional string cl_ord_link_id = 15 [(fix.tag)=583, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_3];
optional Common.Instrument instrument = 16   [(fix.field_added)=VERSION_FIX_4_3];
optional Common.OrderQtyData order_qty_data = 17 [(fix.field_added)=VERSION_FIX_4_3];
optional fix.Timestamp orig_ord_mod_time = 18 [(fix.tag)=586, (fix.type)=DATATYPE_UTC_TIMESTAMP,
(fix.field_added)=VERSION_FIX_4_3];
repeated Common.Parties parties = 19        [(fix.field_added)=VERSION_FIX_4_3];
optional string secondary_cl_ord_id = 20     [(fix.tag)=526, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_3];
oneof acct_id_source_union {
  AcctIDSourceEnum acct_id_source = 21      [(fix.tag)=660, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_4_4];
  fixed32 acct_id_source_reserved100plus = 22 [(fix.tag)=660, (fix.type)=DATATYPE_RESERVED100PLUS,
(fix.field_added)=VERSION_FIX_4_4];
}
optional Common.FinancingDetails financing_details = 23 [(fix.field_added)=VERSION_FIX_4_4];
repeated Common.UndInstrmtGrp und_instrmt_grp = 24 [(fix.field_added)=VERSION_FIX_4_4];
}
```


10 Appendix B - Sample Proto3 Messages

The following listing shows a proto3 GPB message definition for a FIX OrderCancelRequest message from the SingleGeneralOrderHandling category, its nested components and enumeration types. For simplicity, many of the optional FIX fields and GPB custom options have been omitted.

Excerpts of 5 proto files are provided:

- meta.proto –GPB custom options for encoding attributes
- fix.proto – GPB custom options for FIX Repository metadata
- session.proto – mapped from FIX Session Category
- singlegeneralorderhandling.proto – mapped from FIX SingleGeneralOrderHandling Category

10.1 Meta.proto

```
//  
//     FIX Unified Repository mapping to Google Protocol Buffers  
//  
//     Copyright (c) FIX Trading Community. All Rights Reserved.  
//  
//     Category: meta  
//  
//     File: meta.proto  
//  
syntax = "proto3";  
import "google/protobuf/descriptor.proto";  
  
option java_package = "org.fixprotocol.components";  
option java_outer_classname = "Meta";  
  
package meta;  
  
extend google.protobuf.FieldOptions {  
    TimeUnitEnum time_unit = 51001;  
    Epoch epoch = 51002;  
    sfixed32 exponent = 51003;  
    fixed32 min_len = 51004;  
    fixed32 max_len = 51005;
```

```
    sfixed64 min_value = 51006;
    sfixed64 max_value = 51007;
}
```

```
enum TimeUnitEnum {
    TIME_UNIT_UNSPECIFIED = 0;
    TIME_UNIT_DAYS = 1;
    TIME_UNIT_SECONDS = 2;
    TIME_UNIT_MILLISECONDS = 3;
    TIME_UNIT_MICROSECONDS = 4;
    TIME_UNIT_NANOSECONDS = 5;
    TIME_UNIT_PICOSECONDS = 6;
}
```

```
enum Epoch {
    EPOCH_UNSPECIFIED = 0;
    EPOCH_MIDNIGHT = 1;
    EPOCH_UNIX = 2;
    EPOCH_1900 = 3;
    EPOCH_2000 = 4;
}
```

10.2 Fix.proto

```
//
//      FIX Unified Repository mapping to Google Protocol Buffers
//
//      Copyright (c) FIX Trading Community. All Rights Reserved.
//
//      Category: fix
//
//      File: fix.proto
//
syntax = "proto3";
import "google/protobuf/descriptor.proto";
```

```
option java_package = "org.fixprotocol.components";
option java_outer_classname = "Fix";
```

```
package fix;
```

```
extend google.protobuf.FileOptions {
    string category = 53002;
}
```

```
extend google.protobuf.MessageOptions {
    string msg_type_value = 55001;
}
```

```
extend google.protobuf.FieldOptions {
    fixed32 tag = 56003;
    DatatypeEnum type = 56004;
    VersionEnum field_added = 56005;
    sfixed32 field_added_ep = 56006;
    VersionEnum field_deprecated = 56007;
    fixed32 group_tag = 56008;
}
```

```
extend google.protobuf.EnumValueOptions {
    string enum_value = 72004;
    VersionEnum enum_added = 72005;
    sfixed32 enum_added_ep = 72006;
    VersionEnum enum_deprecated = 72007;
}
```

```
enum VersionEnum {
    VERSION_UNSPECIFIED = 0;
    VERSION_FIX_2_7 = 1;
    VERSION_FIX_3_0 = 2;
    VERSION_FIX_4_0 = 3;
}
```

```
VERSION_FIX_4_1 = 4;
VERSION_FIX_4_2 = 5;
VERSION_FIX_4_3 = 6;
VERSION_FIX_4_4 = 7;
VERSION_FIX_5_0 = 8;
VERSION_FIX_1_1 = 9;
VERSION_FIX_5_OSP1 = 10;
VERSION_FIX_5_OSP2 = 11;
}
```

```
enum DatatypeEnum {
  DATATYPE_UNSPECIFIED = 0;
  DATATYPE_CHAR = 1      [(enum_added)=VERSION_FIX_2_7];
  DATATYPE_DATA = 2     [(enum_added)=VERSION_FIX_2_7];
  DATATYPE_FLOAT = 3    [(enum_added)=VERSION_FIX_2_7];
  DATATYPE_INT = 4      [(enum_added)=VERSION_FIX_2_7];
  DATATYPE_DAY_OF_MONTH = 5 [(enum_added)=VERSION_FIX_4_1];
  DATATYPE_MONTH_YEAR = 6 [(enum_added)=VERSION_FIX_4_1];
  DATATYPE_AMT = 7      [(enum_added)=VERSION_FIX_4_2];
  DATATYPE_BOOLEAN = 8 [(enum_added)=VERSION_FIX_4_2];
  DATATYPE_CURRENCY = 9 [(enum_added)=VERSION_FIX_4_2];
  DATATYPE_EXCHANGE = 10 [(enum_added)=VERSION_FIX_4_2];
  DATATYPE_LOCAL_MKT_DATE = 11 [(enum_added)=VERSION_FIX_4_2];
  DATATYPE_MULTIPLE_STRING_VALUE = 12 [(enum_added)=VERSION_FIX_4_2];
  DATATYPE_PRICE = 13 [(enum_added)=VERSION_FIX_4_2];
  DATATYPE_PRICE_OFFSET = 14 [(enum_added)=VERSION_FIX_4_2];
  DATATYPE_QTY = 15 [(enum_added)=VERSION_FIX_4_2];
  DATATYPE_STRING = 16 [(enum_added)=VERSION_FIX_4_2];
  DATATYPE_UTC_TIMESTAMP = 17 [(enum_added)=VERSION_FIX_4_2];
  DATATYPE_UTC_TIME_ONLY = 18 [(enum_added)=VERSION_FIX_4_2];
  DATATYPE_LENGTH = 19 [(enum_added)=VERSION_FIX_4_3];
  DATATYPE_NUM_IN_GROUP = 20 [(enum_added)=VERSION_FIX_4_3];
  DATATYPE_PERCENTAGE = 21 [(enum_added)=VERSION_FIX_4_3];
  DATATYPE_SEQ_NUM = 22 [(enum_added)=VERSION_FIX_4_3];
}
```

```
DATATYPE_TAG_NUM = 23      [(enum_added)=VERSION_FIX_4_3];
DATATYPE_COUNTRY = 24     [(enum_added)=VERSION_FIX_4_4];
DATATYPE_MULTIPLE_CHAR_VALUE = 25 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_PATTERN = 26     [(enum_added)=VERSION_FIX_4_4];
DATATYPE_RESERVED1000PLUS = 27 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_RESERVED100PLUS = 28 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_RESERVED4000PLUS = 29 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_TENOR = 30       [(enum_added)=VERSION_FIX_4_4];
DATATYPE_TZ_TIMESTAMP = 31 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_TZ_TIME_ONLY = 32 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_UTC_DATE_ONLY = 33 [(enum_added)=VERSION_FIX_4_4];
DATATYPE_XML_DATA = 34    [(enum_added)=VERSION_FIX_5_0];
DATATYPE_LANGUAGE = 35    [(enum_added)=VERSION_FIX_5_OSP1];
}
```

```
message Tenor {
  uint32 days = 1;
  uint32 weeks = 2;
  uint32 months = 3;
  uint32 years = 4;
}
```

```
message Decimal32 {
  sfixed32 mantissa = 1;
  sfixed32 exponent = 2;
}
```

```
message Decimal64 {
  sfixed64 mantissa = 1;
  sfixed32 exponent = 2;
}
```

```
message Timestamp {
  int64 seconds = 1;
```

```
    int32 nanos = 2;
}

message TimeOnly {
    int64 seconds = 1;
    int32 nanos = 2;
}

message TZTimestamp {
    int64 seconds = 1;
    int32 nanos = 2;
    sint32 hour_offset = 3;
    sint32 minute_offset = 4;
}

message TZTimeOnly {
    int64 seconds = 1;
    int32 nanos = 2;
    sint32 hour_offset = 3;
    sint32 minute_offset = 4;
}

message LocalMarketTime {
    int32 hours = 1;
    int32 minutes = 2;
    int64 seconds = 3;
    int32 nanos = 4;
}
```

10.3 Session.proto

```
//
//     FIX Unified Repository mapping to Google Protocol Buffers
//
//     Copyright (c) FIX Trading Community. All Rights Reserved.
```

```
//
//      Category: Session
//
//      File: session.proto
//
syntax = "proto3";
import "meta.proto";
import "fix.proto";

option java_package = "org.fixprotocol.components";
option java_outer_classname = "Session";

package Session;

enum MsgTypeEnum {
    MSG_TYPE_ADJUSTED_POSITION_REPORT = 0      [(fix.enum_value)="BL"];
    MSG_TYPE_ADVERTISEMENT = 1      [(fix.enum_value)="7"];
    MSG_TYPE_ALLOCATION_INSTRUCTION = 2 [(fix.enum_value)="J"];
    MSG_TYPE_ALLOCATION_INSTRUCTION_ACK = 3      [(fix.enum_value)="P"];
    MSG_TYPE_ALLOCATION_INSTRUCTION_ALERT = 4      [(fix.enum_value)="BM"];
    MSG_TYPE_ALLOCATION_REPORT = 5      [(fix.enum_value)="AS"];
    MSG_TYPE_ALLOCATION_REPORT_ACK = 6 [(fix.enum_value)="AT"];
    MSG_TYPE_APPLICATION_MESSAGE_REPORT = 7      [(fix.enum_value)="BY"];
    MSG_TYPE_APPLICATION_MESSAGE_REQUEST = 8      [(fix.enum_value)="BW"];
    MSG_TYPE_APPLICATION_MESSAGE_REQUEST_ACK = 9      [(fix.enum_value)="BX"];
    MSG_TYPE_ASSIGNMENT_REPORT = 10 [(fix.enum_value)="AW"];
    MSG_TYPE_BID_REQUEST = 11      [(fix.enum_value)="k"];
    MSG_TYPE_BID_RESPONSE = 12      [(fix.enum_value)="l"];
    MSG_TYPE_BUSINESS_MESSAGE_REJECT = 13      [(fix.enum_value)="j"];
    MSG_TYPE_COLLATERAL_ASSIGNMENT = 14 [(fix.enum_value)="AY"];
    MSG_TYPE_COLLATERAL_INQUIRY = 15 [(fix.enum_value)="BB"];
    MSG_TYPE_COLLATERAL_INQUIRY_ACK = 16      [(fix.enum_value)="BG"];
    MSG_TYPE_COLLATERAL_REPORT = 17 [(fix.enum_value)="BA"];
    MSG_TYPE_COLLATERAL_REQUEST = 18 [(fix.enum_value)="AX"];
```

MSG_TYPE_COLLATERAL_RESPONSE = 19 [(fix.enum_value)="AZ"];
MSG_TYPE_CONFIRMATION = 20 [(fix.enum_value)="AK"];
MSG_TYPE_CONFIRMATION_ACK = 21 [(fix.enum_value)="AU"];
MSG_TYPE_CONFIRMATION_REQUEST = 22 [(fix.enum_value)="BH"];
MSG_TYPE_CONTRARY_INTENTION_REPORT = 23 [(fix.enum_value)="BO"];
MSG_TYPE_CROSS_ORDER_CANCEL_REPLACE_REQUEST = 24 [(fix.enum_value)="t"];
MSG_TYPE_CROSS_ORDER_CANCEL_REQUEST = 25 [(fix.enum_value)="u"];
MSG_TYPE_DERIVATIVE_SECURITY_LIST = 26 [(fix.enum_value)="AA"];
MSG_TYPE_DERIVATIVE_SECURITY_LIST_REQUEST = 27 [(fix.enum_value)="z"];
MSG_TYPE_DERIVATIVE_SECURITY_LIST_UPDATE_REPORT = 28 [(fix.enum_value)="BR"];
MSG_TYPE_DONT_KNOW_TRADE = 29 [(fix.enum_value)="Q"];
MSG_TYPE_EMAIL = 30 [(fix.enum_value)="C"];
MSG_TYPE_EXECUTION_ACKNOWLEDGEMENT = 31 [(fix.enum_value)="BN"];
MSG_TYPE_EXECUTION_REPORT = 32 [(fix.enum_value)="8"];
MSG_TYPE_HEARTBEAT = 33 [(fix.enum_value)="0"];
MSG_TYPE_IOI = 34 [(fix.enum_value)="6"];
MSG_TYPE_LIST_CANCEL_REQUEST = 35 [(fix.enum_value)="K"];
MSG_TYPE_LIST_EXECUTE = 36 [(fix.enum_value)="L"];
MSG_TYPE_LIST_STATUS = 37 [(fix.enum_value)="N"];
MSG_TYPE_LIST_STATUS_REQUEST = 38 [(fix.enum_value)="M"];
MSG_TYPE_LIST_STRIKE_PRICE = 39 [(fix.enum_value)="m"];
MSG_TYPE_LOGON = 40 [(fix.enum_value)="A"];
MSG_TYPE_LOGOUT = 41 [(fix.enum_value)="5"];
MSG_TYPE_MARKET_DATA_INCREMENTAL_REFRESH = 42 [(fix.enum_value)="X"];
MSG_TYPE_MARKET_DATA_REQUEST = 43 [(fix.enum_value)="V"];
MSG_TYPE_MARKET_DATA_REQUEST_REJECT = 44 [(fix.enum_value)="Y"];
MSG_TYPE_MARKET_DATA_SNAPSHOT_FULL_REFRESH = 45 [(fix.enum_value)="W"];
MSG_TYPE_MARKET_DEFINITION = 46 [(fix.enum_value)="BU"];
MSG_TYPE_MARKET_DEFINITION_REQUEST = 47 [(fix.enum_value)="BT"];
MSG_TYPE_MARKET_DEFINITION_UPDATE_REPORT = 48 [(fix.enum_value)="BV"];
MSG_TYPE_MASS_QUOTE = 49 [(fix.enum_value)="i"];
MSG_TYPE_MASS_QUOTE_ACKNOWLEDGEMENT = 50 [(fix.enum_value)="b"];
MSG_TYPE_MULTILEG_ORDER_CANCEL_REPLACE = 51 [(fix.enum_value)="AC"];
MSG_TYPE_NETWORK_COUNTERPARTY_SYSTEM_STATUS_REQUEST = 52 [(fix.enum_value)="BC"];


```
MSG_TYPE_NETWORK_COUNTERPARTY_SYSTEM_STATUS_RESPONSE = 53      [(fix.enum_value)="BD"];
MSG_TYPE_NEWS = 54      [(fix.enum_value)="B"];
MSG_TYPE_NEW_ORDER_CROSS = 55  [(fix.enum_value)="s"];
MSG_TYPE_NEW_ORDER_LIST = 56  [(fix.enum_value)="E"];
MSG_TYPE_NEW_ORDER_MULTILEG = 57 [(fix.enum_value)="AB"];
MSG_TYPE_NEW_ORDER_SINGLE = 58  [(fix.enum_value)="D"];
MSG_TYPE_ORDER_CANCEL_REJECT = 59 [(fix.enum_value)="9"];
MSG_TYPE_ORDER_CANCEL_REPLACE_REQUEST = 60      [(fix.enum_value)="G"];
MSG_TYPE_ORDER_CANCEL_REQUEST = 61 [(fix.enum_value)="F"];
MSG_TYPE_ORDER_MASS_ACTION_REPORT = 62      [(fix.enum_value)="BZ"];
MSG_TYPE_ORDER_MASS_ACTION_REQUEST = 63      [(fix.enum_value)="CA"];
MSG_TYPE_ORDER_MASS_CANCEL_REPORT = 64      [(fix.enum_value)="r"];
MSG_TYPE_ORDER_MASS_CANCEL_REQUEST = 65      [(fix.enum_value)="q"];
MSG_TYPE_ORDER_MASS_STATUS_REQUEST = 66      [(fix.enum_value)="AF"];
MSG_TYPE_ORDER_STATUS_REQUEST = 67 [(fix.enum_value)="H"];
MSG_TYPE_POSITION_MAINTENANCE_REPORT = 68      [(fix.enum_value)="AM"];
MSG_TYPE_POSITION_MAINTENANCE_REQUEST = 69      [(fix.enum_value)="AL"];
MSG_TYPE_POSITION_REPORT = 70  [(fix.enum_value)="AP"];
MSG_TYPE_QUOTE = 71      [(fix.enum_value)="S"];
MSG_TYPE_QUOTE_CANCEL = 72  [(fix.enum_value)="Z"];
MSG_TYPE_QUOTE_REQUEST = 73  [(fix.enum_value)="R"];
MSG_TYPE_QUOTE_REQUEST_REJECT = 74 [(fix.enum_value)="AG"];
MSG_TYPE_QUOTE_RESPONSE = 75  [(fix.enum_value)="AJ"];
MSG_TYPE_QUOTE_STATUS_REPORT = 76 [(fix.enum_value)="AI"];
MSG_TYPE_QUOTE_STATUS_REQUEST = 77 [(fix.enum_value)="a"];
MSG_TYPE_REGISTRATION_INSTRUCTIONS = 78      [(fix.enum_value)="o"];
MSG_TYPE_REGISTRATION_INSTRUCTIONS_RESPONSE = 79 [(fix.enum_value)="p"];
MSG_TYPE_REJECT = 80      [(fix.enum_value)="3"];
MSG_TYPE_REQUEST_FOR_POSITIONS = 81 [(fix.enum_value)="AN"];
MSG_TYPE_REQUEST_FOR_POSITIONS_ACK = 82      [(fix.enum_value)="AO"];
MSG_TYPE_RESEND_REQUEST = 83  [(fix.enum_value)="2"];
MSG_TYPE_RFQ_REQUEST = 84  [(fix.enum_value)="AH"];
MSG_TYPE_SECURITY_DEFINITION = 85 [(fix.enum_value)="d"];
MSG_TYPE_SECURITY_DEFINITION_REQUEST = 86      [(fix.enum_value)="c"];
```

```
MSG_TYPE_SECURITY_DEFINITION_UPDATE_REPORT = 87    [(fix.enum_value)="BP"];
MSG_TYPE_SECURITY_LIST = 88    [(fix.enum_value)="Y"];
MSG_TYPE_SECURITY_LIST_REQUEST = 89 [(fix.enum_value)="X"];
MSG_TYPE_SECURITY_LIST_UPDATE_REPORT = 90    [(fix.enum_value)="BK"];
MSG_TYPE_SECURITY_STATUS = 91    [(fix.enum_value)="F"];
MSG_TYPE_SECURITY_STATUS_REQUEST = 92    [(fix.enum_value)="E"];
MSG_TYPE_SECURITY_TYPES = 93    [(fix.enum_value)="W"];
MSG_TYPE_SECURITY_TYPE_REQUEST = 94 [(fix.enum_value)="V"];
MSG_TYPE_SEQUENCE_RESET = 95    [(fix.enum_value)="4"];
MSG_TYPE_SETTLEMENT_INSTRUCTIONS = 96    [(fix.enum_value)="T"];
MSG_TYPE_SETTLEMENT_INSTRUCTION_REQUEST = 97    [(fix.enum_value)="AV"];
MSG_TYPE_SETTLEMENT_OBLIGATION_REPORT = 98    [(fix.enum_value)="BQ"];
MSG_TYPE_STREAM_ASSIGNMENT_REPORT = 99    [(fix.enum_value)="CD"];
MSG_TYPE_STREAM_ASSIGNMENT_REPORT_ACK = 100    [(fix.enum_value)="CE"];
MSG_TYPE_STREAM_ASSIGNMENT_REQUEST = 101    [(fix.enum_value)="CC"];
MSG_TYPE_TEST_REQUEST = 102    [(fix.enum_value)="1"];
MSG_TYPE_TRADE_CAPTURE_REPORT = 103 [(fix.enum_value)="AE"];
MSG_TYPE_TRADE_CAPTURE_REPORT_ACK = 104    [(fix.enum_value)="AR"];
MSG_TYPE_TRADE_CAPTURE_REPORT_REQUEST = 105    [(fix.enum_value)="AD"];
MSG_TYPE_TRADE_CAPTURE_REPORT_REQUEST_ACK = 106    [(fix.enum_value)="AQ"];
MSG_TYPE_TRADING_SESSION_LIST = 107 [(fix.enum_value)="BJ"];
MSG_TYPE_TRADING_SESSION_LIST_REQUEST = 108    [(fix.enum_value)="BI"];
MSG_TYPE_TRADING_SESSION_LIST_UPDATE_REPORT = 109    [(fix.enum_value)="BS"];
MSG_TYPE_TRADING_SESSION_STATUS = 110    [(fix.enum_value)="H"];
MSG_TYPE_TRADING_SESSION_STATUS_REQUEST = 111    [(fix.enum_value)="G"];
MSG_TYPE_UNSPECIFIED = 112;
MSG_TYPE_USER_NOTIFICATION = 113 [(fix.enum_value)="CB"];
MSG_TYPE_USER_REQUEST = 114    [(fix.enum_value)="BE"];
MSG_TYPE_USER_RESPONSE = 115    [(fix.enum_value)="BF"];
MSG_TYPE_XMLNON_FIX = 116    [(fix.enum_value)="N"];
}
```

```
enum ApplVerIDEnum {
  APPL_VER_ID_UNSPECIFIED = 0;
```

```

APPL_VER_ID_FIX27 = 1      [(fix.enum_value)="0", (fix.enum_added)=VERSION_FIX_4_4];
APPL_VER_ID_FIX30 = 2      [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_4_4];
APPL_VER_ID_FIX40 = 3      [(fix.enum_value)="2", (fix.enum_added)=VERSION_FIX_4_4];
APPL_VER_ID_FIX41 = 4      [(fix.enum_value)="3", (fix.enum_added)=VERSION_FIX_4_4];
APPL_VER_ID_FIX42 = 5      [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_4_4];
APPL_VER_ID_FIX43 = 6      [(fix.enum_value)="5", (fix.enum_added)=VERSION_FIX_4_4];
APPL_VER_ID_FIX44 = 7      [(fix.enum_value)="6", (fix.enum_added)=VERSION_FIX_4_4];
APPL_VER_ID_FIX50 = 8      [(fix.enum_value)="7", (fix.enum_added)=VERSION_FIX_4_4];
APPL_VER_ID_FIX50SP1 = 9    [(fix.enum_value)="8", (fix.enum_added)=VERSION_FIX_5_0];
APPL_VER_ID_FIX50SP2 = 10  [(fix.enum_value)="9", (fix.enum_added)=VERSION_FIX_5_0SP1, (fix.enum_added_ep)=97];
}

```

```

message StandardHeader {
  string begin_string = 1      [(fix.tag)=8, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  sfixed64 body_length = 2     [(fix.tag)=9, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_0];
  string deliver_to_comp_id = 3 [(fix.tag)=128, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  string deliver_to_sub_id = 4 [(fix.tag)=129, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  sfixed64 msg_seq_num = 5     [(fix.tag)=34, (fix.type)=DATATYPE_SEQ_NUM, (fix.field_added)=VERSION_FIX_4_0];
  MsgTypeEnum msg_type = 6     [(fix.tag)=35, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  string on_behalf_of_comp_id = 7 [(fix.tag)=115, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  string on_behalf_of_sub_id = 8 [(fix.tag)=116, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  fix.Timestamp orig_sending_time = 9 [(fix.tag)=122, (fix.type)=DATATYPE_UTC_TIMESTAMP, (fix.field_added)=VERSION_FIX_4_0];
  bool poss_dup_flag = 10      [(fix.tag)=43, (fix.type)=DATATYPE_BOOLEAN, (fix.field_added)=VERSION_FIX_4_0];
  bool poss_resend = 11       [(fix.tag)=97, (fix.type)=DATATYPE_BOOLEAN, (fix.field_added)=VERSION_FIX_4_0];
  string secure_data = 12      [(fix.tag)=91, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_4_0];
  sfixed64 secure_data_len = 13 [(fix.tag)=90, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_0];
  string sender_comp_id = 14    [(fix.tag)=49, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  string sender_sub_id = 15     [(fix.tag)=50, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  fix.Timestamp sending_time = 16 [(fix.tag)=52, (fix.type)=DATATYPE_UTC_TIMESTAMP, (fix.field_added)=VERSION_FIX_4_0];
  string target_comp_id = 17    [(fix.tag)=56, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  string target_sub_id = 18     [(fix.tag)=57, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
  string deliver_to_location_id = 19 [(fix.tag)=145, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_1];
  string on_behalf_of_location_id = 20 [(fix.tag)=144, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_1];
  string sender_location_id = 21 [(fix.tag)=142, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_1];
}

```

```
string target_location_id = 22    [(fix.tag)=143, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_1];
sfixed64 last_msg_seq_num_processed = 23    [(fix.tag)=369, (fix.type)=DATATYPE_SEQ_NUM,
(fix.field_added)=VERSION_FIX_4_2];
string message_encoding = 24    [(fix.tag)=347, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_2];
string xml_data = 25            [(fix.tag)=213, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_4_2];
sfixed64 xml_data_len = 26      [(fix.tag)=212, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_2];
ApplVerIDEnum appl_ver_id = 27    [(fix.tag)=1128, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_4];
string cstm_appl_ver_id = 28    [(fix.tag)=1129, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_4];
repeated HopGrp hop_grp = 29    [(fix.field_added)=VERSION_FIX_4_4];
sfixed64 appl_ext_id = 30      [(fix.tag)=1156, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_5_0];
}

message HopGrp {
    string hop_comp_id = 1        [(fix.tag)=628, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_4];
    sfixed64 hop_ref_id = 2      [(fix.tag)=630, (fix.type)=DATATYPE_SEQ_NUM, (fix.field_added)=VERSION_FIX_4_4];
    float Timestamp hop_sending_time = 3 [(fix.tag)=629, (fix.type)=DATATYPE_UTCTIME, (fix.field_added)=VERSION_FIX_4_4];
}

message StandardTrailer {
    string check_sum = 1        [(fix.tag)=10, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_0];
    string signature = 2        [(fix.tag)=89, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_4_0];
    sfixed64 signature_length = 3 [(fix.tag)=93, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_0];
}
```

10.4 SingleGeneralOrderHandling.proto

```
//
//     FIX Unified Repository mapping to Google Protocol Buffers
//
//     Copyright (c) FIX Trading Community. All Rights Reserved.
//
//     Category: SingleGeneralOrderHandling
//
//     File: singlegeneralorderhandling.proto
//
syntax = "proto3";
```

```
import "meta.proto";
import "fix.proto";
import "session.proto";
import "common.proto";

option java_package = "org.fixprotocol.components";
option java_outer_classname = "SingleGeneralOrderHandling";
package SingleGeneralOrderHandling;

enum AcctIDSourceEnum {
  ACCT_ID_SOURCE_UNSPECIFIED = 0;
  ACCT_ID_SOURCE_BIC = 1      [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_4_4];
  ACCT_ID_SOURCE_DTCCCODE = 2 [(fix.enum_value)="5", (fix.enum_added)=VERSION_FIX_4_4];
  ACCT_ID_SOURCE_OMGEO = 3   [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_4_4];
  ACCT_ID_SOURCE_OTHER = 4   [(fix.enum_value)="99", (fix.enum_added)=VERSION_FIX_4_4];
  ACCT_ID_SOURCE_SID_CODE = 5 [(fix.enum_value)="2", (fix.enum_added)=VERSION_FIX_4_4];
  ACCT_ID_SOURCE_TFM = 6     [(fix.enum_value)="3", (fix.enum_added)=VERSION_FIX_4_4];
}

enum AccountTypeEnum {
  ACCOUNT_TYPE_UNSPECIFIED = 0;
  ACCOUNT_TYPE_CARRIED_CUSTOMER_SIDE = 1      [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_4_3];
  ACCOUNT_TYPE_CARRIED_NON_CUSTOMER_SIDE = 2   [(fix.enum_value)="2", (fix.enum_added)=VERSION_FIX_4_3];
  ACCOUNT_TYPE_CARRIED_NON_CUSTOMER_SIDE_CROSS_MARGINED = 3 [(fix.enum_value)="6",
(fix.enum_added)=VERSION_FIX_4_3];
  ACCOUNT_TYPE_FLOOR_TRADER = 4 [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_4_3];
  ACCOUNT_TYPE_HOUSE_TRADER = 5 [(fix.enum_value)="3", (fix.enum_added)=VERSION_FIX_4_3];
  ACCOUNT_TYPE_HOUSE_TRADER_CROSS_MARGINED = 6 [(fix.enum_value)="7", (fix.enum_added)=VERSION_FIX_4_3];
  ACCOUNT_TYPE_JOINT_BACK_OFFICE_ACCOUNT = 7   [(fix.enum_value)="8", (fix.enum_added)=VERSION_FIX_4_3];
}

enum SideEnum {
  SIDE_UNSPECIFIED = 0;
  SIDE_BUY = 1      [(fix.enum_value)="1", (fix.enum_added)=VERSION_FIX_2_7];
  SIDE_BUY_MINUS = 2 [(fix.enum_value)="3", (fix.enum_added)=VERSION_FIX_2_7];
  SIDE_SELL = 3     [(fix.enum_value)="2", (fix.enum_added)=VERSION_FIX_2_7];
}
```

```

SIDE_SELL_PLUS = 4      [(fix.enum_value)="4", (fix.enum_added)=VERSION_FIX_2_7];
SIDE_SELL_SHORT = 5     [(fix.enum_value)="5", (fix.enum_added)=VERSION_FIX_2_7];
SIDE_SELL_SHORT_EXEMPT = 6 [(fix.enum_value)="6", (fix.enum_added)=VERSION_FIX_2_7];
SIDE_CROSS = 7         [(fix.enum_value)="8", (fix.enum_added)=VERSION_FIX_4_1];
SIDE_UNDISCLOSED = 8   [(fix.enum_value)="7", (fix.enum_added)=VERSION_FIX_4_1];
SIDE_CROSS_SHORT = 9   [(fix.enum_value)="9", (fix.enum_added)=VERSION_FIX_4_2];
SIDE_AS_DEFINED = 10   [(fix.enum_value)="B", (fix.enum_added)=VERSION_FIX_4_3];
SIDE_CROSS_SHORT_EXEMPT = 11 [(fix.enum_value)="A", (fix.enum_added)=VERSION_FIX_4_3];
SIDE_OPPOSITE = 12     [(fix.enum_value)="C", (fix.enum_added)=VERSION_FIX_4_3];
SIDE_BORROW = 13       [(fix.enum_value)="G", (fix.enum_added)=VERSION_FIX_4_4];
SIDE_LEND = 14         [(fix.enum_value)="F", (fix.enum_added)=VERSION_FIX_4_4];
SIDE_REDEEM = 15      [(fix.enum_value)="E", (fix.enum_added)=VERSION_FIX_4_4];
SIDE_SUBSCRIBE = 16   [(fix.enum_value)="D", (fix.enum_added)=VERSION_FIX_4_4];
}

```

```

message OrderCancelRequest {
  option (fix.msg_type_value)="F";
  string cl_ord_id = 1      [(fix.tag)=11, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_2_7];
  string list_id = 2       [(fix.tag)=66, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_2_7];
  string order_id = 3      [(fix.tag)=37, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_2_7];
  string orig_cl_ord_id = 4 [(fix.tag)=41, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_2_7];
  SideEnum side = 5        [(fix.tag)=54, (fix.type)=DATATYPE_CHAR, (fix.field_added)=VERSION_FIX_2_7];
  Session.StandardHeader standard_header = 6 [(fix.field_added)=VERSION_FIX_2_7];
  Session.StandardTrailer standard_trailer = 7 [(fix.field_added)=VERSION_FIX_2_7];
  string text = 8          [(fix.tag)=58, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_2_7];
  string account = 9       [(fix.tag)=1, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_2];
  string compliance_id = 10 [(fix.tag)=376, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_2];
  string encoded_text = 11 [(fix.tag)=355, (fix.type)=DATATYPE_DATA, (fix.field_added)=VERSION_FIX_4_2];
  sfixed64 encoded_text_len = 12 [(fix.tag)=354, (fix.type)=DATATYPE_LENGTH, (fix.field_added)=VERSION_FIX_4_2];
  fix.Timestamp transact_time = 13 [(fix.tag)=60, (fix.type)=DATATYPE_UTCTIMESTAMP, (fix.field_added)=VERSION_FIX_4_2];
  AccountTypeEnum account_type = 14 [(fix.tag)=581, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_4_3];
  string cl_ord_link_id = 15 [(fix.tag)=583, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_3];
  Common.Instrument instrument = 16 [(fix.field_added)=VERSION_FIX_4_3];
  Common.OrderQtyData order_qty_data = 17 [(fix.field_added)=VERSION_FIX_4_3];
}

```

```
fix.Timestamp orig_ord_mod_time = 18      [(fix.tag)=586, (fix.type)=DATATYPE_UTC_TIMESTAMP,
(fix.field_added)=VERSION_FIX_4_3];

repeated Common.Parties parties = 19      [(fix.field_added)=VERSION_FIX_4_3];

string secondary_cl_ord_id = 20    [(fix.tag)=526, (fix.type)=DATATYPE_STRING, (fix.field_added)=VERSION_FIX_4_3];

oneof acct_id_source_union {
  AcctIDSourceEnum acct_id_source = 21      [(fix.tag)=660, (fix.type)=DATATYPE_INT, (fix.field_added)=VERSION_FIX_4_4];
  fixed32 acct_id_source_reserved100plus = 22    [(fix.tag)=660, (fix.type)=DATATYPE_RESERVED100PLUS,
(fix.field_added)=VERSION_FIX_4_4];
}

Common.FinancingDetails financing_details = 23    [(fix.field_added)=VERSION_FIX_4_4];

repeated Common.UndInstrmtGrp und_instrmt_grp = 24    [(fix.field_added)=VERSION_FIX_4_4];
}
```

11 Appendix C – FIX Messages by Category

FIX Section	FIX Category	Proto file name	FIX Messages
N/A	Common	common.proto	common components
Session	Session	session.proto	Heartbeat <0> TestRequest <1> ResendRequest <2> Reject <3> SequenceReset <4> Logout <5> Logon <A> XML_non_FIX <n>
Pre Trade	Indication	indication.proto	IOI <6> Advertisement <7>
	EventCommunication	event-communication.proto	News Email <C>
	QuotationNegotiation	quotation-negotiation.proto	QuoteRequest <R> Quote <S> QuoteCancel <Z> QuoteStatusRequest <a> MassQuoteAcknowledgement MassQuote <i> QuoteRequestReject <AG> RFQRequest <AH> QuoteStatusReport <AI> QuoteResponse <AJ>
	MarketData	market-data.proto	MarketDataRequest <V> MarketDataSnapshotFullRefresh <W> MarketDataIncrementalRefresh <X> MarketDataRequestReject <Y> StreamAssignmentRequest <CC> StreamAssignmentReport <CD>

			StreamAssignmentReportACK <CE>
	SecuritiesReferenceData	securities-reference-data.proto	SecurityDefinitionRequest <c> SecurityDefinition <d> SecurityStatusRequest <e> SecurityStatus <f> SecurityTypeRequest <v> SecurityTypes <w> SecurityListRequest <x> SecurityList <y> DerivativeSecurityListRequest <z> DerivativeSecurityList <AA> SecurityDefinitionUpdateReport <BP> SecurityListUpdateReport <BK> DerivativeSecurityListUpdateReport
	MarketStructureReferenceData	market-structure-reference-data.proto	TradingSessionStatusRequest <g> TradingSessionStatus <h> TradingSessionList <BJ> TradingSessionListRequest <BI> TradingSessionListUpdateReport <BS> MarketDefinitionRequest <BT> MarketDefinition <BU> MarketDefinitionUpdateReport <BV>
	PartiesReferenceData	parties-reference-data.proto	PartyDetailsListRequest <CF> PartyDetailsListReport <CG>
Trade	SingleGeneralOrderHandling	single-general-order-handling.proto	ExecutionReport <8> OrderCancelReject <9> NewOrderSingle <D> OrderCancelRequest <F> OrderCancelReplaceRequest <G> OrderStatusRequest <H> DontKnowTradeDK <Q> ExecutionAcknowledgement <BN>

	ProgramTrading	program-trading.proto	NewOrderList <E> ListCancelRequest <K> ListExecute <L> ListStatusRequest <M> ListStatus <N> BidRequest <k> BidResponse <l> ListStrikePrice <m>
	OrderMassHandling	order-mass-handling.proto	OrderMassCancelRequest <q> OrderMassCancelReport <r> OrderMassStatusRequest <AF> OrderMassActionReport <BZ> OrderMassActionRequest <CA>
	CrossOrders	cross-orders.proto	NewOrderCross <s> CrossOrderCancelReplaceRequest <t> CrossOrderCancelRequest <u>
	MultilegOrders	multileg-orders.proto	NewOrderMultileg <AB> MultilegOrderCancelReplace <AC>
Post Trade	Allocation	allocation.proto	AllocationInstruction <J> AllocationInstructionAck <P> AllocationReport <AS> AllocationReportAck <AT> AllocationInstructionAlert <BM>
	SettlementInstruction	settlement-instruction.proto	SettlementInstructions <T> SettlementInstructionRequest <AV> SettlementObligationReport <BQ>
	RegistrationInstruction	registration-instruction.proto	RegistrationInstructions <o> RegistrationInstructionsResponse <p>
	TradeCapture	trade-capture.proto	TradeCaptureReportRequest <AD> TradeCaptureReport <AE> TradeCaptureReportRequestAck <AQ> TradeCaptureReportAck <AR>

	Confirmation	confirmation.proto	Confirmation <AK> Confirmation_Ack <AU> ConfirmationRequest <BH>
	PositionMaintenance	position-maintenance.proto	PositionMaintenanceRequest <AL> PositionMaintenanceReport <AM> RequestForPositions <AN> RequestForPositionsAck <AO> PositionReport <AP> AssignmentReport <AW> ContraryIntentionReport <BO> AdjustedPositionReport <BL>
	CollateralManagement	collateral-management.proto	CollateralRequest <AX> CollateralAssignment <AY> CollateralResponse <AZ> CollateralReport <BA> CollateralInquiry <BB> CollateralInquiryAck <BG>
Infrastructure	BusinessReject	business-reject.proto	BusinessMessageReject <j>
	Network	network.proto	NetworkCounterpartySystemStatusRequest <BC> NetworkCounterpartySystemStatusResponse <BD>
	UserManagement	user-management.proto	UserRequest <BE> UserResponse <BF> UserNotification <CB>
	Application	application.proto	ApplicationMessageRequest <BW> ApplicationMessageRequestAck <BX> ApplicationMessageReport <BY>