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FIX TRADING COMMUNITY
Frankfurt Regional Meeting 2025

Using the FIX Protocol and Orchestra for the EU Consolidated Tape

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Agenda

- Interoperability of FIX and ISO 20022
  - Background
  - Use Case: EU Consolidated Tape
- Understanding Orchestra
  - Objectives
  - Orchestra in a nutshell
- FIX Recommended Practices for EU CT
  - Regulatory Data (Instrument and Trading System Status)
  - Post-Trade Market Data
  - Pre-Trade Market Data

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Interoperability of FIX and ISO 20022

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Interoperability of FIX and ISO 20022

- Background
  - Industry wants interoperability between the FIX Protocol and ISO 20022.
  - ISO 20022 RMG Practice Design working group (included FIX and Swift) analyzed interoperability.
  - EU Consolidated Tape as ideal use case for interoperability on the logical layer.
  - FIX Protocol has logical message types visualized by the FIXimate tool.
  - ISO 20022 has a conceptual and a logical layer to define message types.

- Use of the Orchestra Standard
  - Developed by FIX as a language with standardized keywords to express meta-data for electronic interfaces (FIX and non-FIX).
  - Able to define logical messages with datatype mappings for multiple encodings.
  - Machine-readable representation to generate software code and documentation.
  - Orchestra also applies to payload definitions, e.g. for REST APIs, Websockets.

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Interoperability of FIX and ISO 20022

- ESMA regulatory reporting
  - ESMA published Regulatory Technical Standards (RTS) for regulatory reporting (PDF).
  - ESMA previously submitted ISO 20022 Message Definitions to standardize regulatory reporting.
  - ESMA has submitted a Business Justification to ISO 20022 for new messages.
  - ESMA plans to submit ISO 20022 Message Definitions for the EU Consolidated Tape (CT).

- Logical versus physical layer
  - The ISO 20022 Message Definitions for the CT will become available as a PDF document and as ISO 20022 XML schemas, its main syntax for the wire format.
  - Transformation rules from logical messages to a schema for a wire format are defined by the ISO 20022 standard (Part 4 for XML and Part 8 for ASN.1).
  - Upcoming revision of ISO 20022 will add Part 9 to allow submission of addtitional syntaxes for schemas, e.g. JSON and Orchestra.
  - The advantage of using Orchestra is that it is a single, machine-readable representation that covers both the logical layer and multiple wire formats, i.e. Orchestra is protocol-agnostic.
  - The Orchestra representation abstracts from a single wire format and can then be converted to schemas for any wire format, including JSON.

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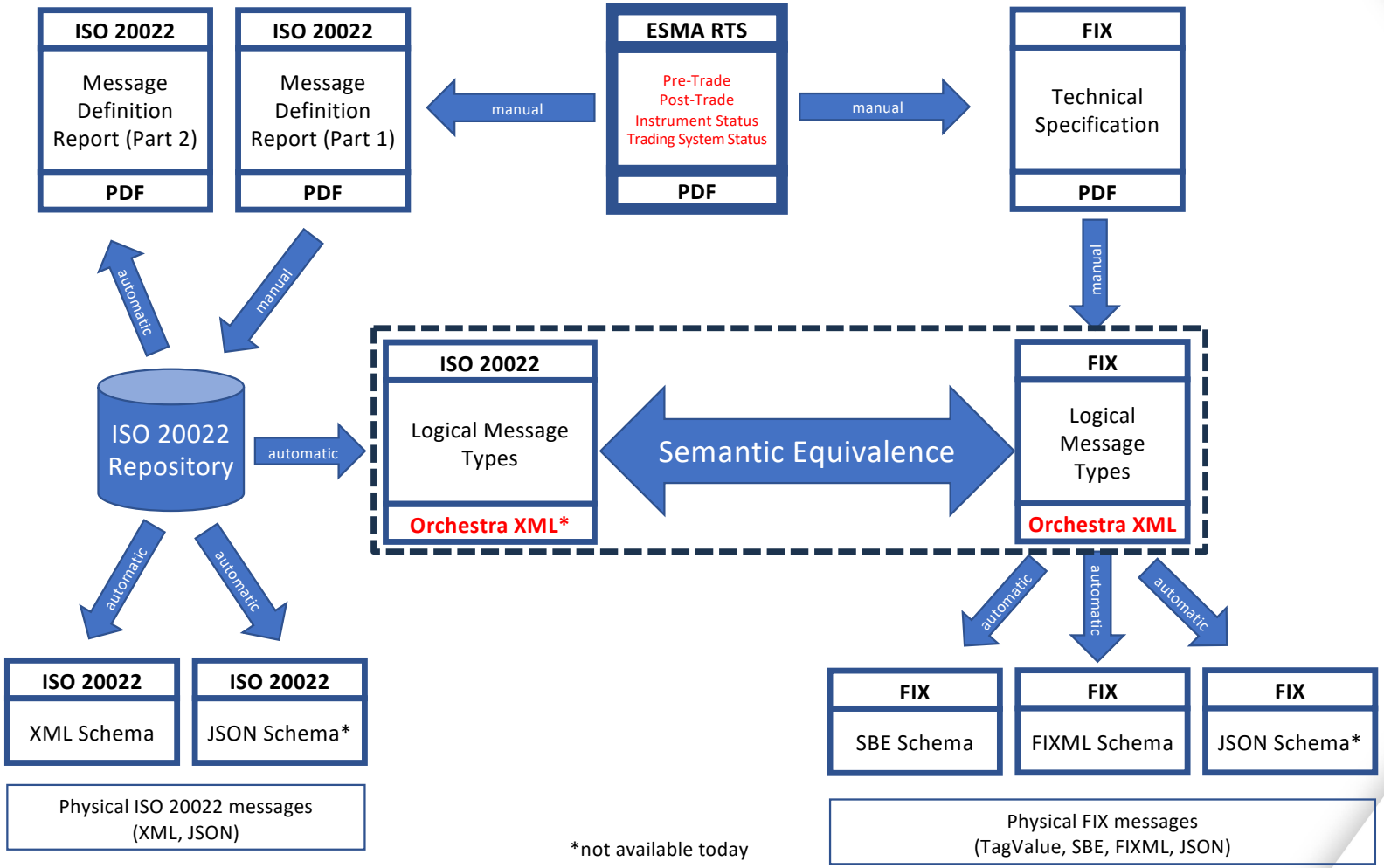
Interoperability of FIX and ISO 20022

- Approach for interoperability
  - RTS for CT has tables in the PDF for pre- and post-trade market data and instrument/ trading system status. Tables have names and descriptions of data elements.
  - The submission to ISO 20022 requires a mapping from RTS tables to the logical layer of ISO 20022 using the ISO 20022 methodology (work in progress).
  - FIX has mapped the RTS for CT to the logical layer of the FIX Protocol, i.e. defining messages, fields, and values from FIX Latest and closing gaps through extensions.
  - Orchestra standard can be used in both cases to capture the semantic mapping as defined by the RTS, resulting in sematically equivalent Orchestra XML files.
  - Implementations can be validated against Orchestra XML files to verify compliance with ISO 20022 and FIX respectively.
  - The Orchestra XML file for FIX can be enhanced with meta-data for the desired wire format, e.g. TagValue (ISO 3531-1) or Simple Binary Encoding (SBE, ISO/IEC 25390).

- Semantic mapping between Orchestra XML files
  - Orchestra standard does not yet include a “language” for mappings between logical representations (planned for 2026).
  - Orchestra is a bridge technology between different logical models like ISO 20022 and FIX. Physical messages from one logical model and syntax can be converted into physical messages of another logical model and syntax, e.g. from ISO 20022 encoded in XML to FIX Protocol encoded in SBE.

Use Case: ESMA Consolidated Tape



*not available today

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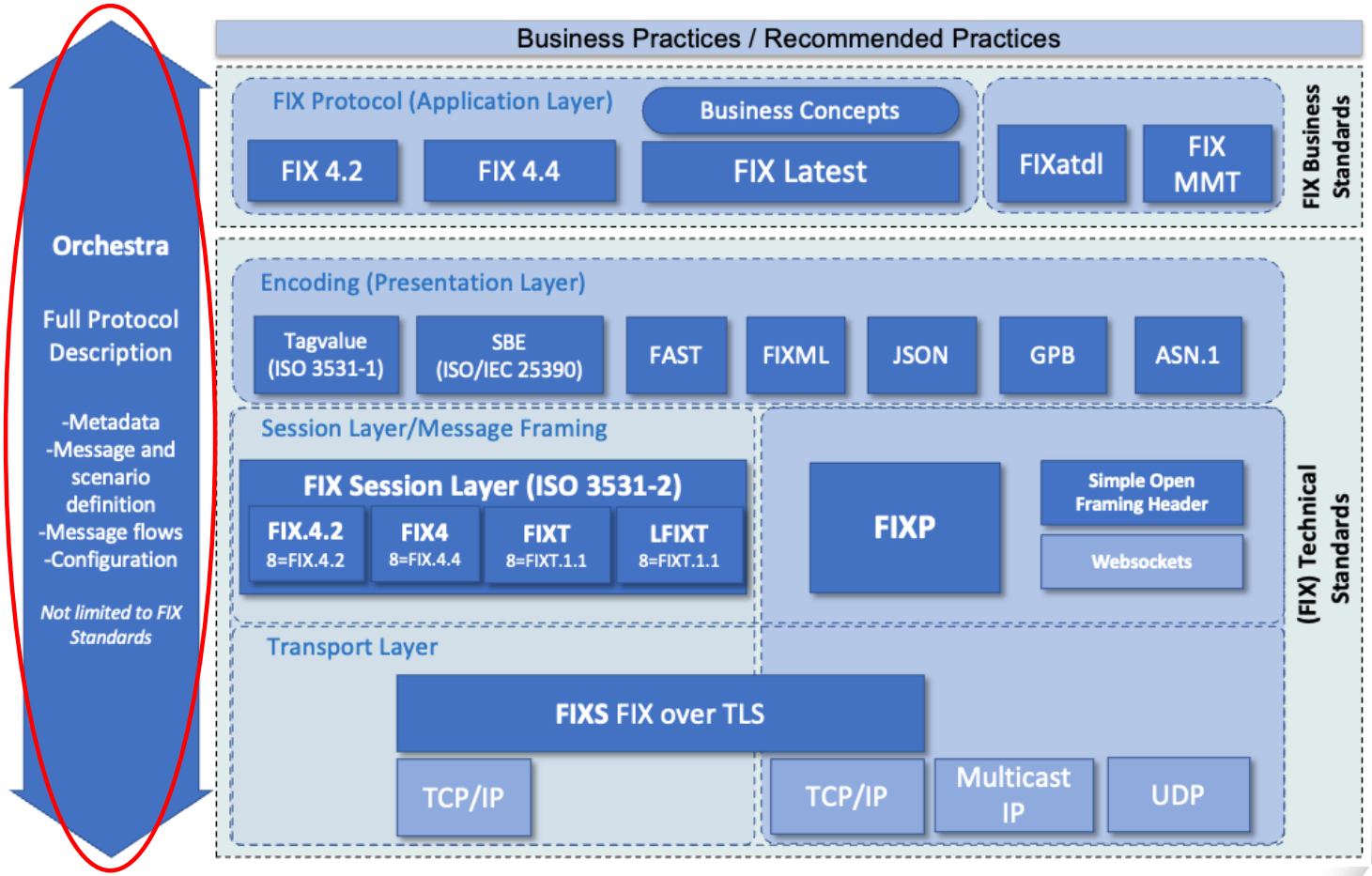
Orchestra Technical Standard

FIX Standards



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Orchestra Technical Standard

- Machine-readable standard for meta-data describing the content and behavior of an electronic messaging interface.
- Protocol agnostic to be applicable to FIX and non-FIX interfaces.
  - FIX Protocol (across all versions and flavors, including user-defined elements)
  - Regulatory protocols (e.g. US: SEC-CAT, Europe: ESMA/FCA, Asia: SFC-DS-OL)
  - Industry standard protocols (e.g. ISO 20022, FpML)
  - Proprietary protocols developed and maintained by trading venues, clearinghouses, buy/sell-side, and vendors
- Encoding agnostic to separate the business semantics from the wire format (standard/proprietary, ASCII/binary, with/without meta-data in the wire format).
- Metadata for technical connectivity (counterparties, connections, sessions, versions, encodings, security,...)

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Orchestra Technical Standard

- Basic features
  - Messages, groups, components, fields, code sets, codes, generic datatypes.
  - Nesting of groups/components inside messages, groups, components.
  - Simple presence rules (e.g. required, optional, ignored) for elements.
  - Unique identification and versioning (a.k.a. pedigree) of all elements.

- Advanced features
  - Conditional rules defined with expressions (Score DSL).
  - Scenarios for message, components etc. to distinguish use cases.
  - Workflows to support request/response models or complex negotiations.
  - Actors and state machines to define transitions.

Orchestra XML sample

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<fixr:repository xmlns:dc="http://purl.org/dc/elements/1.1/"
    xmlns:dcterms="http://purl.org/dc/terms/"
    xmlns:fixr="http://fixprotocol.io/2020/orchestra/repository"
    name="Orchestra RoE Example Version 1.0" version="1.0">
    <fixr:metadata>
        <dcterms:title>My Rules of Engagement</dcterms:title>
        <dcterms:publisher>FIX Trading Community</dcterms:publisher>
        <dcterms:rights>Copyright © FIX Protocol Ltd.</dcterms:rights>
        <dcterms:date>2024-10-16</dcterms:date>
    </fixr:metadata>
    <fixr:datatypes>…
    <fixr:codeSets>…
    <fixr:fields>…
    <fixr:components>…
    <fixr:groups/>
    <fixr:messages>…
</fixr:repository>
```

The complete Orchestra XML file for FIX Latest has 164,528 lines as of EP299!

- Orchestra XML uses English keywords to identify logical elements.
- Logical elements have attributes and some have nested logical elements.
- Rules may be attached to elements to express conditional requirements across logical elements.
- All elements may have annotations that can be used to automatically generate documentation.
- Datatypes are logical and can be mapped to physical datatypes of multiple encodings.
- Meta-data uses DC Terms (ISO 15836) as standard.

```
<fixr:field type="String" baseCategory="SingleGeneralOrderHandling" baseCategoryAbbrName="ID"
    id="11" name="ClOrdID" abbrName="ClOrdID" added="FIX.2.7" updated="FIX.Latest" updatedEP="282">
    <fixr:annotation>
        <fixr:documentation purpose="SYNOPSIS">
            Unique identifier for Order as assigned by the buy-side (institution, broker, intermediary etc.)
            (identified by SenderCompID(49) or OnBehalfOfCompID(115) as appropriate). Uniqueness must be
            guaranteed within a single trading day. Firms, particularly those which electronically submit
            multi-day orders, trade globally or throughout market close periods, should ensure uniqueness
            across days, for example by embedding a date within the ClOrdID(11) field.</fixr:documentation>
    </fixr:annotation>
</fixr:field>
```

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FIX Recommended Practices for EU Consolidated Tape (Bonds and Equities)

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EU CT – Regulatory Data

- Business Requirements
  - The Consolidated Tape Provider (CTP) has to be able to take in and disseminate status information regarding individual instruments and entire trading systems (sessions).
  - The status is focussed on the availability of an instrument or trading system for trading and trade reporting. Outage information is only very high-level.
  - The status of an instrument includes the venue, the type of trading (e.g. CLOB), its current phase (e.g. auction or continuous), and a number of timestamps (e.g. effective time).
  - The status of a trading system is similar but does not include a trading phase.

- Logical FIX messages
  - Instrument Status: SecurityStatus(35=f)
    - Key elements: Instrument, MarketID(1301), VenueType(1430), TradingSessionSubID(625), SecurityTradingStatus(326), EffectiveTime(168), TransactTime(60)
  - Trading System Status: TradingSessionStatus(35=h)
    - Key elements: Instrument, MarketID(1301), VenueType(1430), TradSesStatus(340), EffectiveTime(168), TransactTime(60)

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FIX mapping for RTS Annex II Table 4 (equities)

SecurityStatus(35=f)

#	RTS Field Identifier	FIX Field(s)	Input/Output
1	Instrument identification code	SecurityID(48), SecurityIDSource(22)=4 (ISIN)	Both
2	Instrument status start date and time	EffectiveTime(168)	Both
3	Currency	Currency(15)	Both
4	Dissemination date and time	TransactTime(60)	Output
5	Instrument status	SecurityStatus(965), SecurityTradingStatus(326)	Both
6	Trading venue	MarketID(1301)	Both
7	Trading system	VenueType(1430)	Both
8	Trading system phase	TradingSessionID(336)=1 (Day), TradingSessionSubID(625)	Both
9	Most Relevant Market in terms of liquidity	MostLiquidMarketIndicator(3103)	Output

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FIX mapping for RTS Annex II Table 5 (equities)

TradingSessionStatus(35=h)

#	RTS Field Identifier	FIX Field(s)	Input/Output
1	Trading venue	MarketID(1301)	Both
2	Trading system	VenueType(1430)	Both
3	System status start date and time	EffectiveTime(168)	Both
4	System status dissemination date and time	TransactTime(60)	Output
5	Trading system status	TradSesStatus(340)	Both

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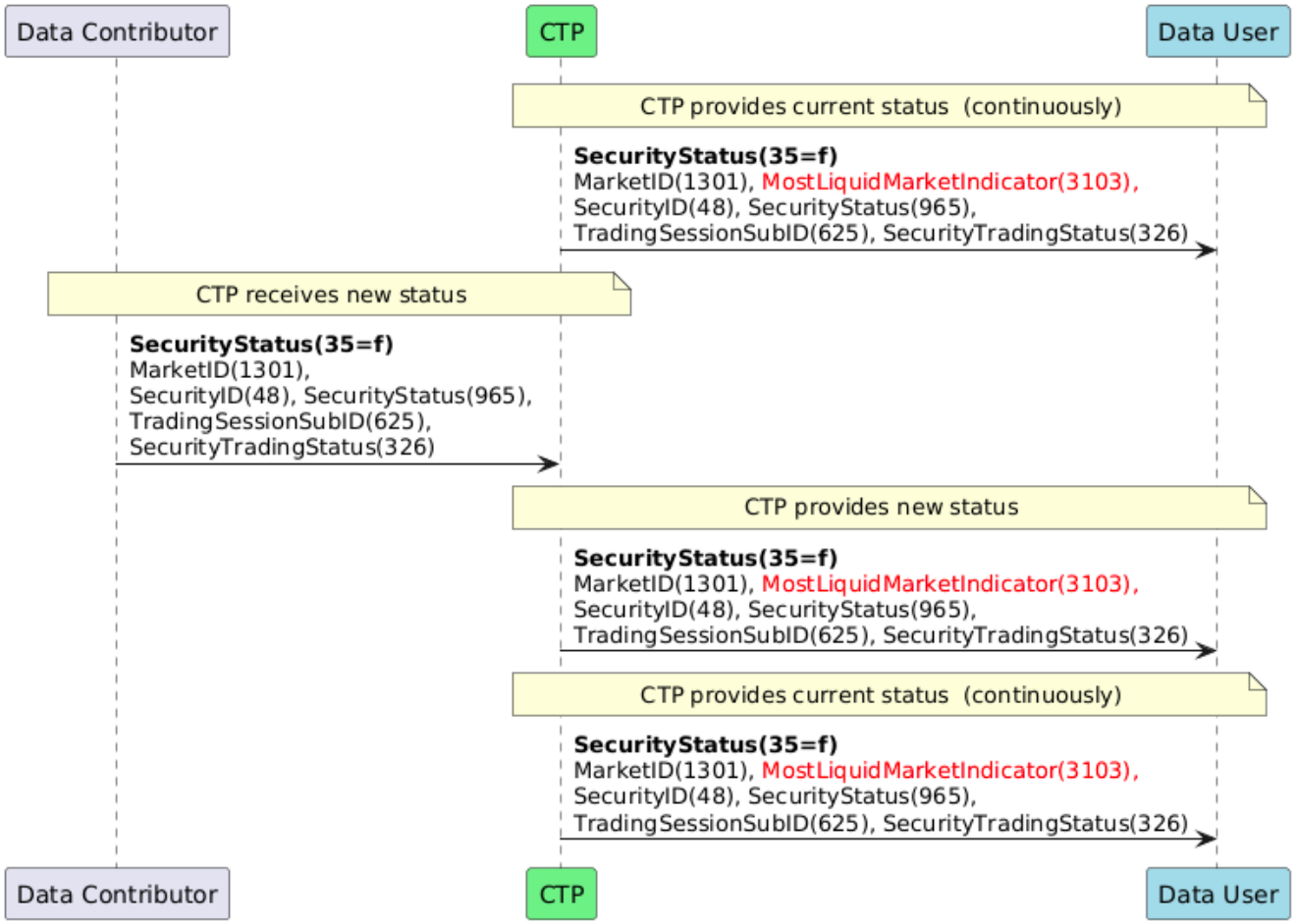
Workflow for Regulatory Data

(Instrument Status)



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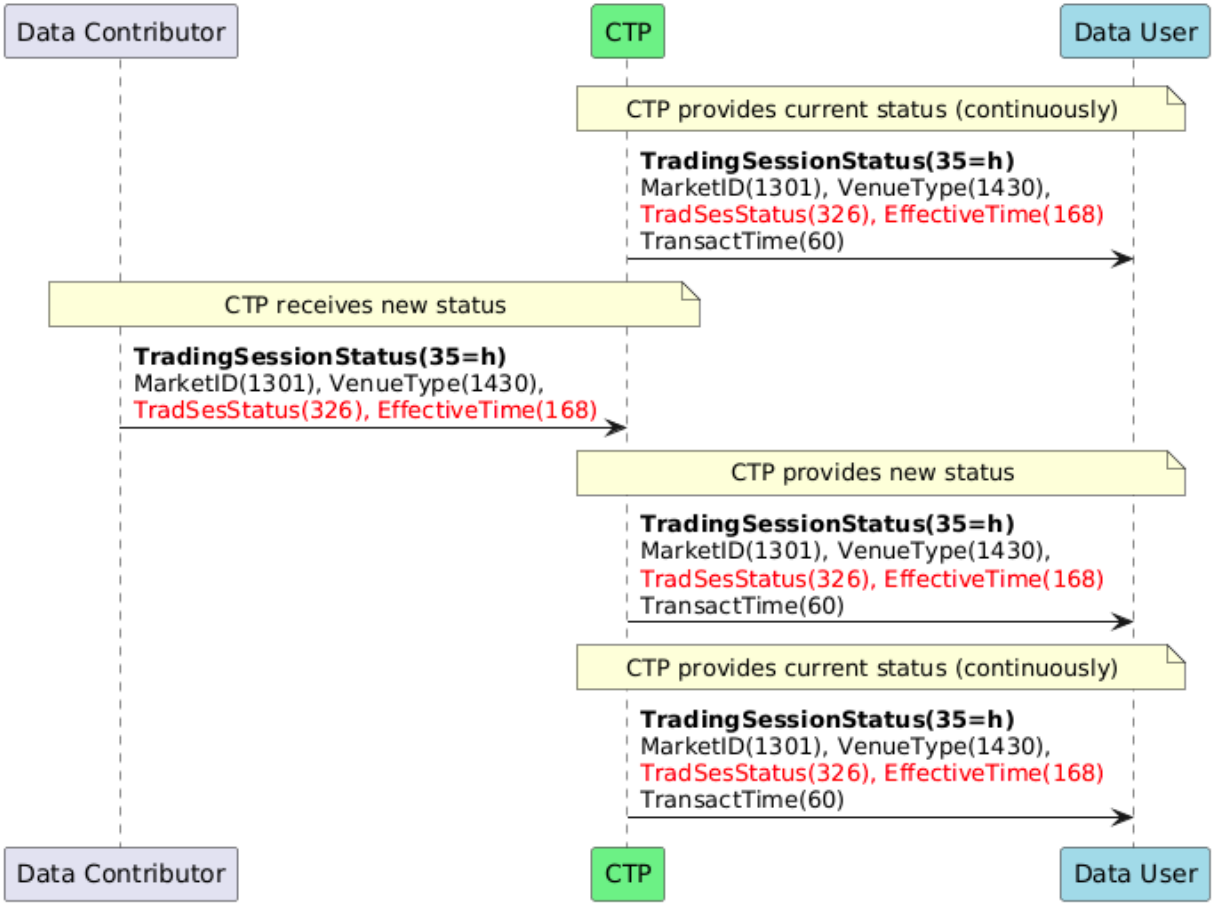
Workflow for Regulatory Data

(Trading System Status)



Example: Instrument State Change

SecurityStatus(35=f)

Event	SecurityStatus(965)	SecurityTradingStatus(326)
No information received from contributor		20=Unknown
Start of day 1, instrument available	1=Active	
Instrument is halted	1=Active	2=Trading halt
Instrument is suspended	9=Suspended	
Instrument resumes trading	1=Active	3=Resume
Start of day 2, instrument delisted	5=Delisted	
Start of day 3, instrument listed again	1=Active	
Instrument is suspended	9=Suspended	
Instrument resumes trading	1=Active	3=Resume

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EU CT – Post-Trade Market Data

- Business Requirements
  - The Consolidated Tape Provider (CTP) has to be able to take in and disseminate information about completed trades.
  - Trades may be amended or canceled after being disseminated by the CTP.
  - The CTP must analyze the received trade for suspicious data and communicate findings back to the data contributor and flag trades as suspicious when disseminating.
  - Trades may contain multiple flags for the purpose of post-trade transparency. The ESMA flags are also part of the upcoming FIX MMT 5.0 standard.
  - Trades must contain various timestamps ranging from execution time to the time of dissemination by the CTP to the data user.

- Logical FIX message
  - MarketDataIncrementalRefresh(35=X) with MDEntryType(269)=2 (Trade)
  - MDUpdateAction(279) to distinguish new, modified, cancelled trades
  - Components TrdRegPublicationGrp, TradePriceConditionGrp, TradeTypeGrp, and field RegulatoryReportType(1934) for most of the flags
  - Component TrdRegTimestamps for timestamps

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FIX mapping for RTS Annex II Table 6 (bonds)

MarketDataIncrementalRefresh(35=X)

#	RTS Field Identifier	FIX Field(s)	Input/ Output
1	Trading date and time	TrdRegTimestamp(769), TrdRegTimestampType(770)=1 (Execution time), TrdRegTimestampOrigin(771)=C (Contributor)	Both
2	Instrument identification code	SecurityID(48), SecurityIDSource(22)=4 (ISIN)	Both
3	Price	MDEntryPx(270)	Both
4	Missing Price	TradePriceCondition(1839)	Both
5	Price currency	Currency(15)	Both
6	Price notation	PriceType(423)	Both
7	Notional amount	MDEntrySize(271)	Both
8	Notional currency	Currency(15)	Both
9	Venue of execution	LastMkt(30)	Both
10	Third-country venue of execution	PartyID(448), PartyIDSource(447)=G (MIC) PartyIDRole(452)=73 (Execution Venue)	Both
11	Date and Time when the data contributor received the data	TrdRegTimestamp(769), TrdRegTimestampType(770)=2 (Time in), TrdRegTimestampOrigin(771)=C (Contributor)	Input
12	Date and Time when the data contributor published the transaction	TrdRegTimestamp(769), TrdRegTimestampType(770)=11 (Publicly reported), TrdRegTimestampOrigin(771)=C (Contributor)	Both
13	Venue of publication	PartyID(448), PartyIDSource(447)=G (MIC) PartyIDRole(452)=62 (Report originator)	Both
14	Transaction Identification Code	RegulatoryTradeID(1903), RegulatoryTradeIDType(1906)= 5 (TVTIC)	Both

#	RTS Field Identifier	FIX Field(s)	Input/ Output
15	Date and Time of reception by the CTP	TrdRegTimestamp(769), TrdRegTimestampType(770)=2 (Time in), TrdRegTimestampOrigin(771)=P (Publisher)	Output
16	Date and Time of publication by the CTP	TrdRegTimestamp(769), TrdRegTimestampType(770)=11 (Publicly reported), TrdRegTimestampOrigin(771)=P (Publisher)	Output
17	Flags for post-trade transparency	DealingCapacity(1048), TradeType(3006), TradePriceCondition(1839)	Both
17	Flags for post-trade deferrals	TrdRegPublicationType(2669)=1 (Post-trade deferral), TrdRegPublicationReason(2670)	Both
17	Flags for post-trade supplementary deferrals	RegulaturyReportType(1934)	Both
17	Flags for amendments and cancellations	MDUpdateAction(279)	Both
18	Suspicious Data Flag	MDQualityIndicator(3105)	Output
19	Trading System Type	MDOriginType(1024)	Both
20	Number of Transactions	NumberOfTrades(3104)	Both

Workflow for Post-Trade Core Market Data with FIX

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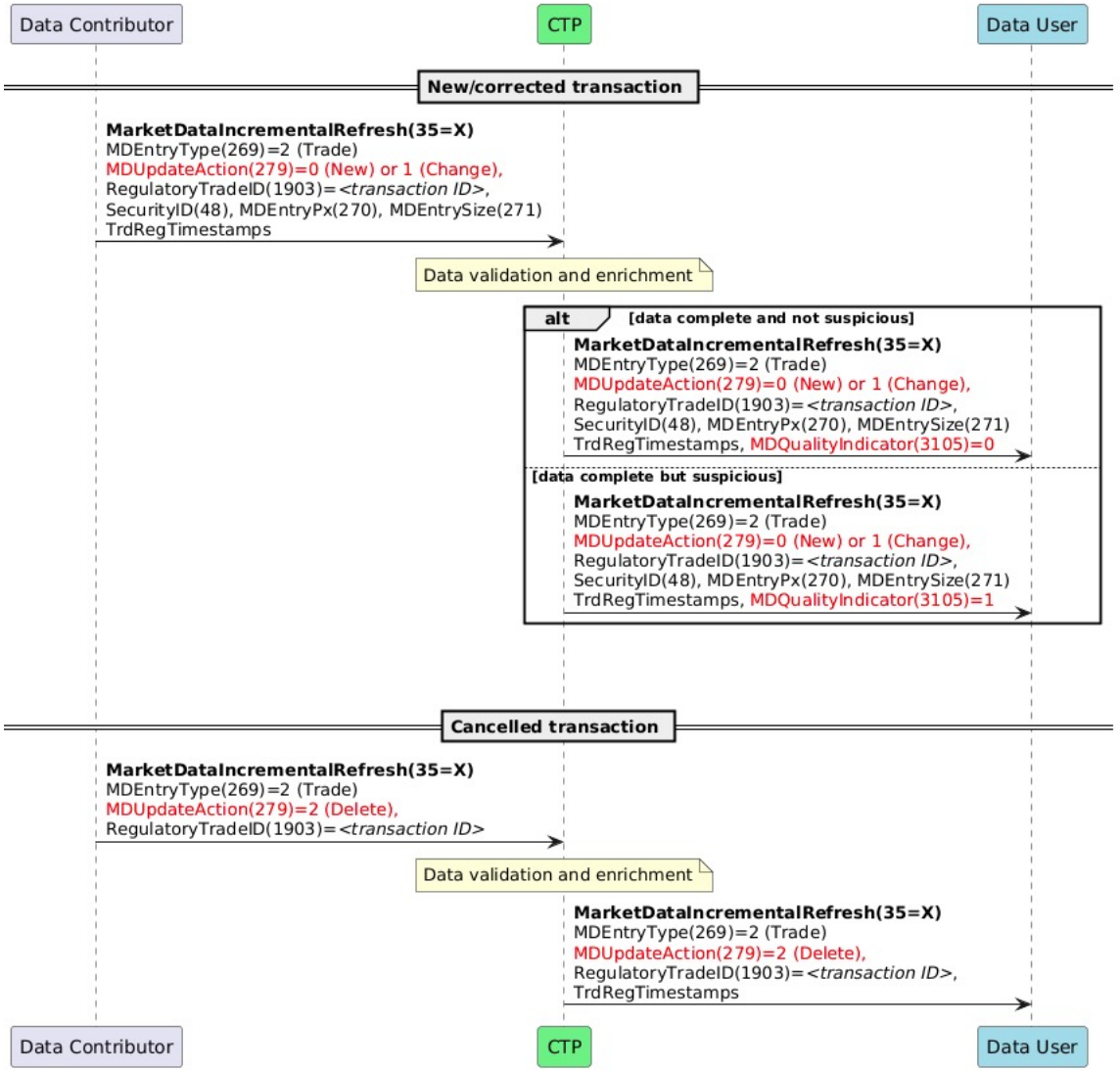

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EU CT – Pre-Trade Market Data (equities only)

- Business Requirements
  - The Consolidated Tape Provider (CTP) has to be able to take in and disseminate information about bids, offers, and indicative auction prices and volumes.
  - The CTP has to consolidate the bids and offers (only top of book) from continuous trading at the submitting venues and disseminate a best bid and offer (EBBO) across all of them.
  - The CTP has to consolidate the indicative information from auctions at the submitting venues and disseminate low/high/VWAP prices and total volume across all of them.
  - The CTP has to provide the MRMTL (Most Relevant Market in Terms of Liquidity) as defined by ESMA (only changes annually).

- Logical FIX message
  - MarketDataSnapshotFullRefresh(35=W) with MDEntryType(269)=0 (Bid), 1 (Offer), Q (Auction), J (Empty book)
  - Continuous Trading: MDEntryPx(270) and MDEntrySize(271) for bid/offer price and volume
  - Auctions: LowPx(333)/HighPx(332)/MDEntryPx(270) for lowest/highest/VWAP auction price and MDEntrySize(271) for total auction volume
  - Component TrdRegTimestamps for timestamps

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FIX mapping for RTS Annex III Table 2 (input)

MarketDataSnapshotFullRefresh(35=W)

#	RTS Field Identifier	FIX Field(s)
1	Update date and time	TrdRegTimestamp(769), TrdRegTimestampType(770)=9 (Orderbook entry time), TrdRegTimestampOrigin(771)=C (Contributor)
2	Instrument identification code	SecurityID(48), SecurityIDSource(22)=4 (ISIN)
3	Side	MDEntryType(269)
4	Price	MDEntryPx(270)
5	Price currency	Currency(15)
6	Quantity	MDEntrySize(271)
7	Venue	MarketID(1301)
8	Trading System	MDOriginType(1024)
9	Trading system phase	TradingSessionID(336)=1 (Day), TradingSessionSubID(625)
10	Publication date and time	TrdRegTimestamp(769), TrdRegTimestampType(770)=11 (Publicly reported), TrdRegTimestampOrigin(771)=C (Contributor)

FIX mapping for RTS Annex III Table 3 (output continuous)

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MarketDataSnapshotFullRefresh(35=W)

#	RTS Field Identifier	FIX Field(s)
1	Entry date and time	TrdRegTimestamp(769), TrdRegTimestampType(770)=9 (Orderbook entry time), TrdRegTimestampOrigin(771)=C (Contributor)
2	Instrument identification code	SecurityID(48), SecurityIDSource(22)=4 (ISIN)
3	Currency	Currency(15)
4	Best bid	MDEntryType(269)=0 (Bid), MDEntryPx(270)
5	Best bid volume	MDEntryType(269)=0 (Bid), MDEntrySize(271)
6	EBBO timestamp	TrdRegTimestamp(769), TrdRegTimestampType(770)=34 (Reference time for NBBO), TrdRegTimestampOrigin(771)=P (Publisher)
7	MRMTL	MostLiquidMarketID(3102)
8	Best offer	MDEntryType(269)=1 (Offer), MDEntryPx(270)
9	Best offer volume	MDEntryType(269)=1 (Offer), MDEntrySize(271)
10	Dissemination date and time	TrdRegTimestamp(769), TrdRegTimestampType(770)=11 (Publicly reported), TrdRegTimestampOrigin(771)=P (Publisher)
11	Publication date and time	TrdRegTimestamp(769), TrdRegTimestampType(770)=11 (Publicly reported), TrdRegTimestampOrigin(771)=C (Contributor)

FIX mapping for RTS Annex III Tables 4 and 5 (output auction)

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MarketDataSnapshotFullRefresh(35=W)

#	RTS Field Identifier	FIX Field(s)
1	Indicative date and time	TrdRegTimestamp(769), TrdRegTimestampType(770)=36 (Auction update time), TrdRegTimestampOrigin(771)=C (Contributor)
2	Instrument identification code	SecurityID(48), SecurityIDSource(22)=4 (ISIN)
3a	Lowest auction price	LowPx(333)
3b	Highest auction price	HighPx(332)
3c	Volume weigted auction price	MDEntryPx(270)
4	Currency	Currency(15)
5	Auction volume	MDEntrySize(271)
6	Dissemination date and time	TrdRegTimestamp(769), TrdRegTimestampType(770)=11 (Publicly reported), TrdRegTimestampOrigin(771)=P (Publisher)
7	Publication date and time	TrdRegTimestamp(769), TrdRegTimestampType(770)=11 (Publicly reported), TrdRegTimestampOrigin(771)=C (Contributor)
8	MRMTL	MostLiquidMarketID(3102)

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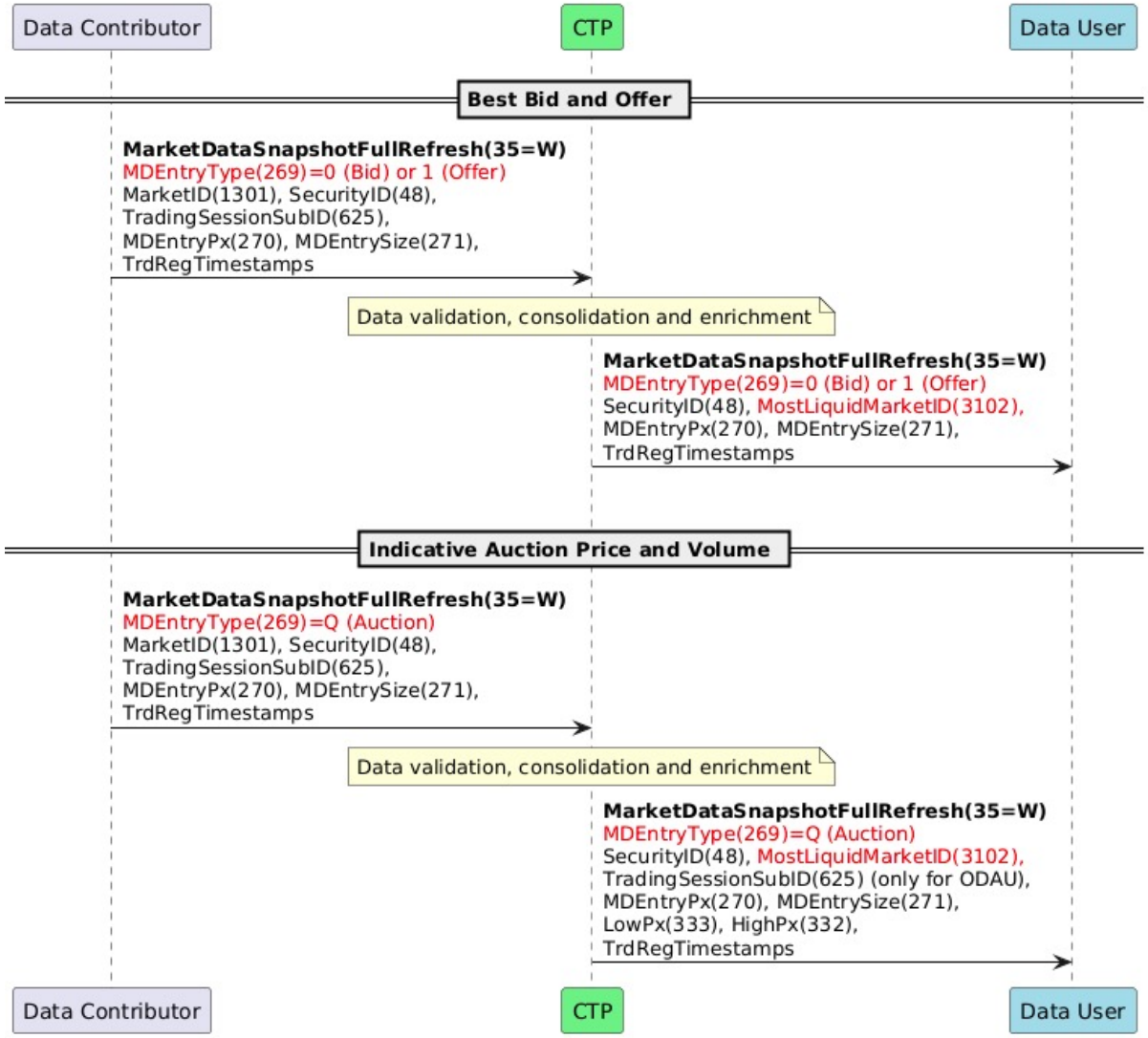
Workflow for Pre-Trade Core Market Data



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Example: Auction Price Consolidation

Time	Input to CTP Update time	Output from CTP Indicative time	MarketID (input) MRMTL (output)	MDEntryType	LowPx	HighPx	MDEntryPx	MDEntrySize	Comment
1	MDSnapshot, t1		MIC1	Q=Auction			10.75	100	Auction at MIC1 starts
2		MDSnapshot, t1	MIC3	Q=Auction	10.75	10.75	10.75	100	
3	MDSnapshot, t2		MIC2	Q=Auction			10.80	150	Auction at MIC2 starts
4		MDSnapshot, t2	MIC3	Q=Auction	10.75	10.80	10.78	250	
5	MDSnapshot, t3		MIC3	Q=Auction			10.85	50	Auction at MIC3 starts
6		MDSnapshot, t3	MIC3	Q=Auction	10.75	10.85	10.79167	300	
7	MDSnapshot, t4		MIC3	J=Empty book			0	0	Auction at MIC3 ends
8		MDSnapshot, t2	MIC3	Q=Auction	10.75	10.80	10.78	250	Latest timestamp now t2
9	MDSnapshot, t5		MIC2	J=Empty book			0	0	Auction at MIC2 ends
10		MDSnapshot, t1	MIC3	Q=Auction	10.75	10.75	10.75	100	Latest timestamp now t1
11	MDSnapshot, t6		MIC1	J=Empty book			0	0	Auction at MIC1 ends
12		MDSnapshot	MIC3	J=Empty book	0	0	0	0	Empty consolidated book

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Appendix
Examples for EU CT with FIX messages defined in Orchestra

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FIX SecurityStatus(35=f) for input (equities)

```
<fixr:message msgType="f" id="39" name="SecurityStatus" abbrName="SecStat" scenario="InputEquities">
  <fixr:structure>
    <fixr:componentRef id="1024">
      <fixr:annotation>…
    </fixr:componentRef>
    <fixr:componentRef presence="required" id="1003" scenario="InstrumentStatus"></fixr:componentRef>
    <fixr:fieldRef presence="required" id="15"></fixr:fieldRef>
    <fixr:fieldRef presence="required" id="1301"></fixr:fieldRef>
    <fixr:fieldRef presence="required" id="1430" scenario="Equities"></fixr:fieldRef>
    <fixr:fieldRef id="336"></fixr:fieldRef>
    <fixr:fieldRef id="625"></fixr:fieldRef>
    <fixr:fieldRef id="574"></fixr:fieldRef>
    <fixr:fieldRef id="326"></fixr:fieldRef>
    <fixr:fieldRef presence="required" id="168">
      <fixr:annotation>…
    </fixr:fieldRef>
    <fixr:componentRef id="1025">
      <fixr:annotation>…
    </fixr:componentRef>
  </fixr:structure>
  <fixr:annotation>
    <fixr:documentation purpose="SYNOPSIS">Use for regulatory data (instrument status).</fixr:documentation>
  </fixr:annotation>
</fixr:message>
```

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FIX TradingSessionStatus(35=h) for output (bonds)

```
<fixr:message msgType="h" id="41" name="TradingSessionStatus" abbrName="TrdgSesStat" scenario="OutputBonds">
  <fixr:structure>
    <fixr:componentRef id="1024">
      <fixr:annotation>…
    </fixr:componentRef>
    <fixr:fieldRef presence="required" id="1301"></fixr:fieldRef>
    <fixr:fieldRef presence="required" id="1430" scenario="Bonds"></fixr:fieldRef>
    <fixr:fieldRef presence="required" id="340"></fixr:fieldRef>
    <fixr:fieldRef presence="required" id="60"></fixr:fieldRef>
    <fixr:fieldRef presence="required" id="168">
      <fixr:annotation>…
    </fixr:fieldRef>
    <fixr:componentRef id="1025">
      <fixr:annotation>…
    </fixr:componentRef>
  </fixr:structure>
  <fixr:annotation>
    <fixr:documentation purpose="SYNOPSIS">Use for regulatory data (trading system status).</fixr:documentation>
  </fixr:annotation>
</fixr:message>
```

FIX repeating group MDIncGrp for post-trade output (bonds)

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```
<fixr:group id="2032" name="MDIncGrp" scenario="OutputBonds">
  <fixr:numInGroup id="268">
    <fixr:annotation>…
  </fixr:numInGroup>
  <fixr:fieldRef presence="required" id="279"></fixr:fieldRef>
  <fixr:fieldRef presence="required" id="269" scenario="PostTrade"></fixr:fieldRef>
  <fixr:componentRef presence="required" id="1003" scenario="InstrumentIdentification"></fixr:componentRef>
  <fixr:fieldRef presence="required" id="30"></fixr:fieldRef>
  <fixr:fieldRef id="270">
    <fixr:annotation>…
  </fixr:fieldRef>
  <fixr:fieldRef presence="required" id="423"></fixr:fieldRef>
  <fixr:fieldRef presence="required" id="15">
    <fixr:annotation>…
  </fixr:fieldRef>
  <fixr:fieldRef presence="required" id="271">
    <fixr:annotation>…
  </fixr:fieldRef>
  <fixr:fieldRef id="3104">
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  </fixr:fieldRef>
  <fixr:fieldRef id="3105">
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  </fixr:fieldRef>
  <fixr:fieldRef id="1024" scenario="Bonds"></fixr:fieldRef>
  <fixr:fieldRef id="1048"></fixr:fieldRef>
  <fixr:fieldRef id="1934"></fixr:fieldRef>
  <fixr:groupRef presence="required" id="1020" scenario="PostTradeOutput"></fixr:groupRef>
  <fixr:groupRef id="2207"></fixr:groupRef>
  <fixr:groupRef presence="required" id="1012"></fixr:groupRef>
  <fixr:groupRef id="2208" scenario="Bonds"></fixr:groupRef>
  <fixr:groupRef id="2206" scenario="Bonds"></fixr:groupRef>
  <fixr:groupRef id="1072" scenario="OutputBonds"></fixr:groupRef>
</fixr:group>
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