

Consolidated Audit Trail

Error Correction Overview

CAT Data Processing

- ▶ The CAT Plan Processor ingests and validates data to ensure it is submitted in accordance with the *CAT Reporting Technical Specifications for Industry Members*
- ▶ The CAT Plan Processor provides specific feedback to CAT Reporters to assist them with Compliance obligations
- ▶ The CAT Plan Processor provides tools and resources to assist firms in correcting erroneous data

CAT Data Processing Stages

- ▶ **File Acknowledgment**- a receipt of acknowledgement for every data file and metadata file; file names are validated
- ▶ **File Integrity**- elements of File names and Metadata file contents are validated to ensure they are readable, formatted as expected and represent the information contained in the associated Data file submission
- ▶ **Data Ingestion**- data file and events within the data file are validated. Validations to ensure correct syntax and semantics associated with record length, field length, data type, non-null and reference data checks are performed
- ▶ **Linkage Discovery** - events are compared with other events to perform duplicate checks, out of sequence checks and to perform linkages among events having the same linkage keys

Processing Stages Error Feedback

Processing Stage	Validations	Meta File Validation	Data File Validation	Record Validation	Error Feedback
File Acknowledgement	Validate file name construct	✓	✓		Meta File and Data File with error are rejected
File Integrity	Duplicate file name	✓	✓		Feedback Meta is returned indicating the <u>file</u> for which the filename is duplicated is rejected
	Filename elements validations including submitter relationship	✓			Feedback Meta is returned indicating the <u>Meta File</u> is rejected
	Unreadable Meta file	✓			
	Meta File without a Data file	✓			
	Data File without a Meta file			✓	Feedback Meta is returned indicating the <u>Data File</u> is rejected
Data file and Meta file paired but Hash not matching; file format not matching	✓	✓			
Data Ingestion	Unreadable data file		✓		Feedback Meta is returned indicating the <u>Data File</u> is rejected
	Record count mismatch		✓		
	Validate Events correct syntax and semantics associated with record length, field length, data type, non-null and reference data checks				✓
Linkage Discovery	Validate Events, Event Keys and Linkage Keys are not duplicated			✓	Feedback Meta is returned indicating Linkage Discovery Errors have been detected; Feedback Error Data file is returned with errors
	Perform Linkage and Out of Sequence checks			✓	

Linkage Discovery Steps

Seq	Linkage Discovery Step	Feedback
1.	Full Duplicate Checks	When duplicates are found, one record is kept and all others are rejected
2.	Key Duplicate Checks	When an Event key is duplicated, all events having the same key are rejected
3.	Linkage Key Duplicate Checks	When a linkage key is duplicated, all events having the same linkage key are rejected
4.	Intrafirm Linkage and Out of Sequence	Events within a firm that do not match or are found to be out of sequence result in an unlinked event
5.	Interfirm Linkage	Events routed/received between firms that do not match result in an unlinked event
6.	Exchange Linkage	Events routed to an Exchange that do not match result in an unlinked event
7.	Trade Linkage	Trade events which name a TRF/ORF/ADF record that do not match result in an unlinked event

Important Definitions

Term	Definition	Usage
CAT Trading Day	Event Timestamps beginning after 4:15PM ET on Trade Date T-1 and <= 4:15PM ET on Trade Date	<p>Submission Due Date: CAT Trading Day + 1 8:00AM ET</p> <p>Correction Due Date: CAT Trading Day + 3 8:00AM ET</p>
Trade Date	Event Timestamps beginning > 23:59:59 ET on Trade Date T - 1 and < 00:00:00 ET on Trade Date T	<p>Due Date for Data and Associated Lifecycle Assignment delivery to Regulatory Users: Trade Date + 5 8:00AM ET</p> <p>Used to calculate summaries and present feedback by trade date on the CAT Reporter Portal</p>
CAT Processing Date	Events reported to CAT beginning after 8:00AM ET on Trade Date and <= 8:00AM ET on Trade Date + 1	Used to calculate summaries and present feedback by processing date on the CAT Reporter Portal
Action Type Code	Indicates if the event is an original submission, or if the event is a correction or deletion for a previously reported event.	Used to distinguish events reported to correct or delete reporting errors
FirmROEID	<p>The unique identifier of a record as assigned by the reporting firm</p> <p>Must be formatted as: <Event Date>_<firm assigned identifier></p>	<p>Uniquely identify CAT Submission records for a CAT Reporter IMID for the Event Date</p> <p>Used to support firm initiated Corrections and Repairs for CAT identified errors using the 'COR' Action Type Code</p>
errorROEID	CAT assigned unique identifier for the error record.	Used to support Repairs for CAT identified errors using the 'RPR' Action Type Code

CAT Feedback & Interface Methods

Feedback Types	SFTP	CAT Reporter Portal
File Status Validation outcomes for each processing stage of a file	✓	✓
Reporting Statistics Summary counts of events and related errors, aggregated by Processing Date and Trade Date		✓
Rejection Errors Events which fail validations for syntax, semantic, reference data and duplication	✓	✓
Unlinked Errors <ul style="list-style-type: none"> • Events including a linkage key for which a linkage was not made • For IM to IM and IM to Exchange matching, an Error record is presented to CAT Reporter and the Industry Member named on the event 	✓	✓
Out of Sequence Errors Events within a CAT Reporter which appear to be out of sequence	✓	✓
Corrections Feedback <ul style="list-style-type: none"> • Corrections made for repairable errors will be reflected as Repaired • Unlinked events reconciled through the correction of another event will be reflected as Repaired • Unrepaired statistics will represent the number of Repairable Errors which remain unrepaired 		✓

Feedback Format & Availability

Feedback delivered via SFTP

- The format will match the format of the original submission
- Feedback files will be accessible in the Submitter's feedback directories
- Feedback for data submitted by a CAT Reporting Agent on behalf of a CAT Reporter will be accessible under the CAT Reporter's feedback directories if the CAT Reporter has an SFTP account
- Feedback will remain available for 10 calendar days

Feedback available on the Reporter Portal

- Feedback will be accessible by the CAT Reporter, Submitter and Third-Party Reporting agent (if applicable)
- Feedback will remain available for 90 days
- *Reporter Portal infrastructure is being built using APIs for future use by CAT Reporters; timing of exposing APIs to CAT Reporters has not been determined*

Feedback and Error Correction Availability

Seq	Processing Stage	Feedback	Anticipated Delivery	Delivery No Later Than
1	File Acknowledgement	File Errors	Within 10 minutes of File Submission	1 hour of File Submission
2	File Integrity	File Errors	Within 30 minutes of Metadata File Submission	2 hours of Metadata File Submission
3	Data Ingestion	File and Data Errors	Within an 1 hour of File Integrity Feedback	4 hours of File Integrity Feedback
		Corrections	Within 1 hour of File Integrity Feedback	4 hours of File Integrity Feedback
4	Linkage Discovery	Data Errors	T+1 at Noon	T+1 at Noon
		Corrections and Linkage Reconciliation	Processing Date of Correction Submission + 1 at Noon	Processing Date of Correction Submission + 1 at Noon

Error Codes

- ▶ Error Codes identify the reason why a File or Record did not pass a validation
- ▶ Codes may be deemed an Error or a Warning:
 - All Errors must be corrected
 - Warnings are not repairable
- ▶ Error codes are organized by processing stages:

Error Type	Assigned Series
Warnings	< 1000 (<i>change to IM Specs to allow for filtering</i>)
File Integrity Errors	1000
Ingestion Errors	2000
Intrafirm Linkage Errors	3000
Trade Linkage Errors	4000 and 5000
Exchange Linkage Errors	6000 and 7000
Inter-firm Linkage Errors	8000 and 9000

Reporting Corrections

Error Feedback

- ▶ Error feedback returned to CAT Reporters will include the associated Error Code(s) and the Error Record Identifier - *errorROEID*
- ▶ Assigned an initial repair status of Unrepaired ('U')

Reporting Corrections

- ▶ Distinguished using the Action Type Code
 - **'RPR'** – must include *errorROEID* of the CAT identified error being corrected
 - **'COR'** – must include *firmROEID* of the CAT identified error or CAT Reporter reporting error being corrected
 - **'DEL'** – may include the *errorROEID* or the *firmROEID*
- ▶ The use of a 'DEL' event can be used to remove an erroneous event which resulted in an error

FAQ P16

Q. What is the T+3 error correction timeframe based on (e.g., submission date, original error date, etc.)? Example: if an order event is submitted on T and is rejected on that day, then corrected on T+1 but the correction on T+1 fails, is the event on T considered "corrected" or does the T+1 rejection need to be addressed and, if so, when? added 03/12/19

A. Pursuant to the Participants' CAT compliance rules and the CAT NMS Plan, all error corrections must be made by 8 am on T+3, where T is the CAT Trading Day of the Reportable Event, otherwise they will be marked as late. In the example, all rejections, including the second rejection on T+1 and any subsequent rejections, must be corrected and submitted by 8 am on T+3. Industry Members must correct all errors regardless of when they occur.

Application of Corrections

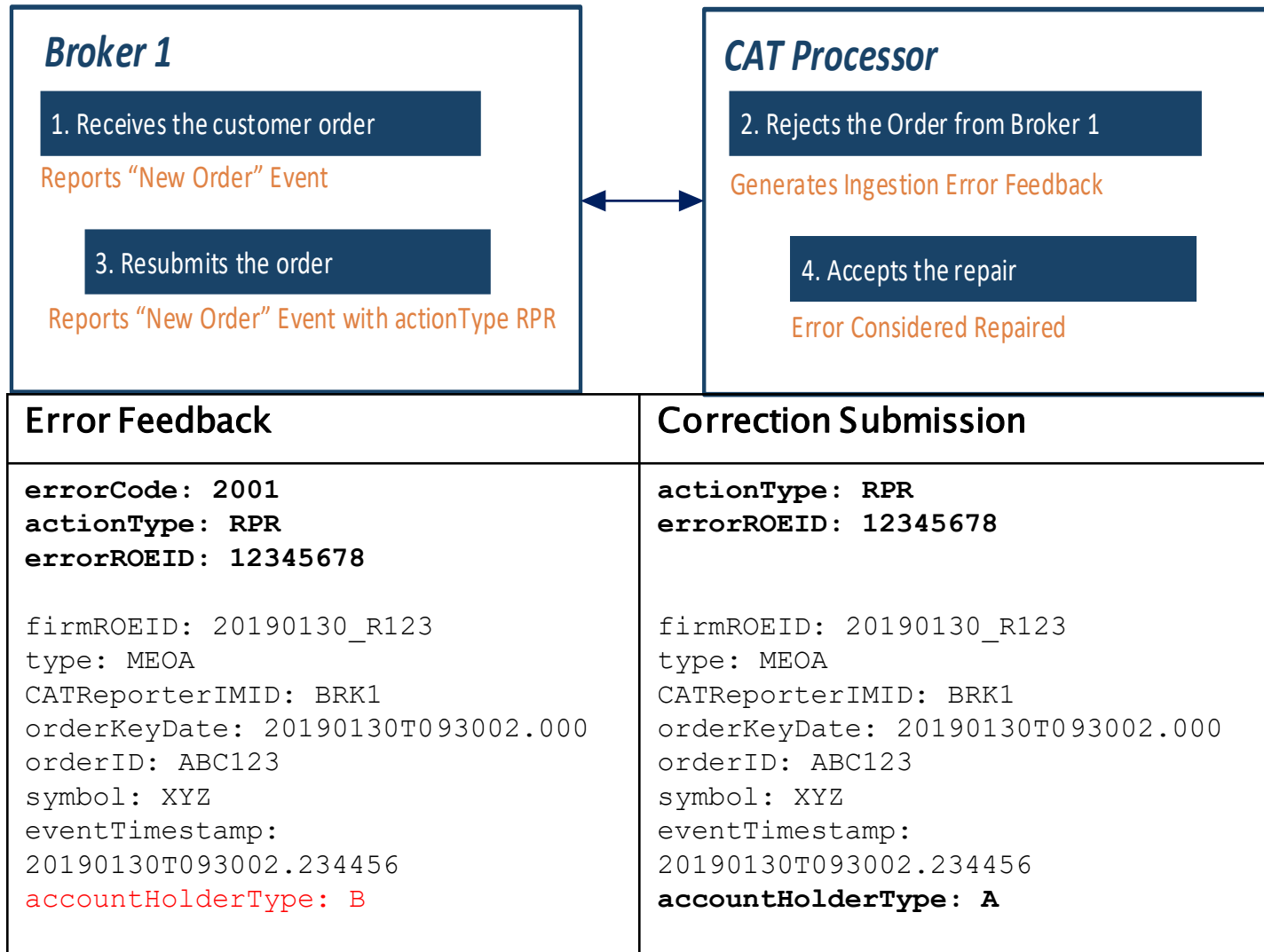
▶ Individual Records

- Correction records for which the Error Record Locator (*errorROEID* or *firmROEID*) is found will be considered Repaired
- Corrections plus late reported events will be used to reconcile unlinked errors
- Corrected record will replace the original record from all further processing
- Corrections reported after T+3 8AM will be flagged as a late repair

▶ File Deletions

- Files may be deleted individually
- Events in the original submission must all have an action type code = 'NEW' and represent a CAT Trading Day that is prior to CAT Trading Day + 4
- All events included in the original file will be removed from further processing

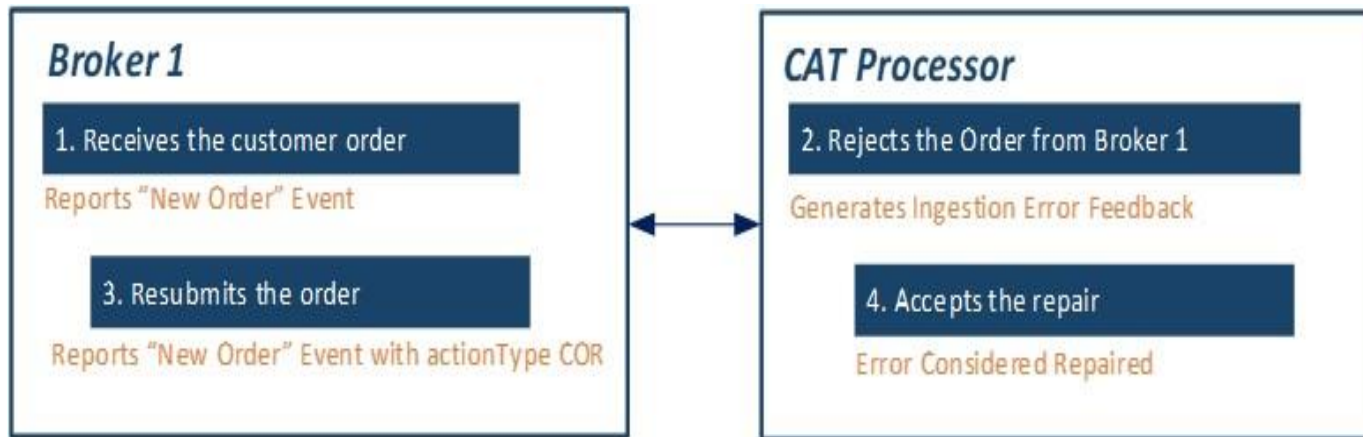
Scenario#1 – Correcting an error using *actionType* of RPR



Scenario#1 Example

Error Feedback																	
ErrorCode	actionType	errorROEID	firmROEID	type	CATReporterIMID	orderKeyDate	orderID	symbol	eventTimestamp	routedOrderID	accountHolderType	CATProcessingDate	filename	CATROEID	CATSubmitterIMID	RprdStatus	
2001	RPR	12345678	20190130_R123	MEOA	BRKR1	1/30/2019 0:00:00.000	ABC123	XYZ	1/30/2019 9:30:02.000	RT555	B	1/30/2019	SUB1_BRKR1_20190130	12345678	SUB1	U	
Correction Submission																	
ErrorCode	actionType	errorROEID	firmROEID	type	CATReporterIMID	orderKeyDate	orderID	symbol	eventTimestamp	routedOrderID	accountHolderType	CATProcessingDate	filename	CATROEID	CATSubmitterIMID	RprdStatus	
	RPR	12345678	20190130_R123	MEOA	BRKR1	1/30/2019 0:00:00.000	XYZ123	XYZ	1/30/2019 9:30:02.000	RT555	A	1/31/2019	SUB2_BRKR1_20190131	16789012	SUB2		
Repair Status Update																	
ErrorCode	actionTypeCode	errorROEID	FirmROEID	type	CAT Reporter IMID	orderKeyDate	OrderID	symbol	eventTimestamp	routedOrderID	accountHolderType	CAT Processing Date	File Name	CAT ROE ID	Submitter	RprdStatus	Repaired Processing Date
	NEW	12345678	20190130_R123	MEOA	BRKR1	1/30/2019 0:00:00.000	ABC123	XYZ	1/30/2019 9:30:02.000	RT555	A	1/30/2019	SUB1_BRKR1_20190130	12345678	SUB1	R	1/31/2019

Scenario#2 – Correcting an error using *actionType* of COR

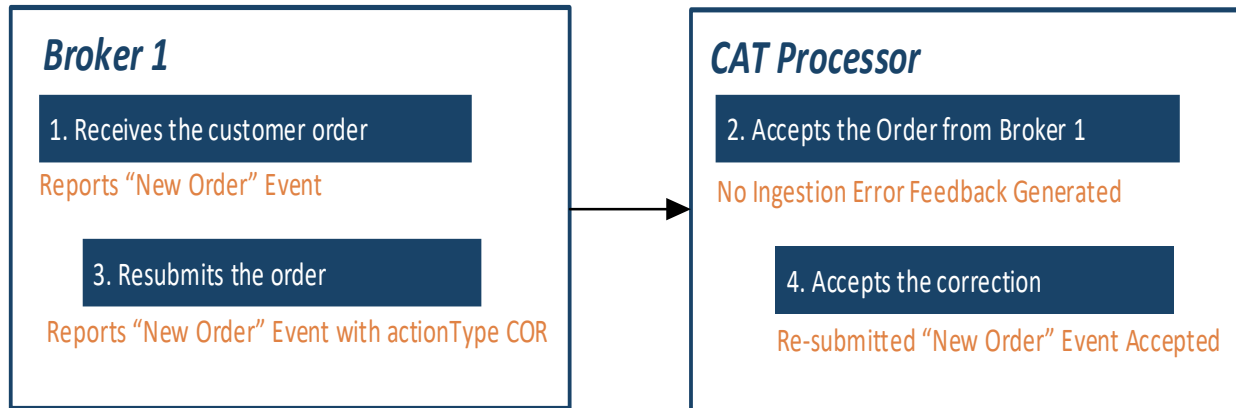


Error Feedback	Correction Submission
<pre> errorCode: 2001 actionType: RPR errorROEID: 12345678 firmROEID: 20190130_R123 type: MEOA CATReporterIMID: BRK1 orderKeyDate: 20190130T093002.000 orderID: ABC123 symbol: XYZ eventTimestamp: 20190130T093002.234456 accountHolderType: B </pre>	<pre> actionType: COR firmROEID: 20190130_R123 type: MEOA CATReporterIMID: BRK1 orderKeyDate: 20190130T093002.000 orderID: ABC123 symbol: XYZ eventTimestamp: 20190130T093002.234456 accountHolderType: A </pre>

Scenario#2 Example

Error Feedback																	
ErrorCode	actionType	errorROEID	firmROEID	type	CATReporterIMID	orderKeyDate	orderID	symbol	eventTimestamp	routedOrderID	accountHolderType	CATProcessingDate	filename	CATROEID	CATSubmitterIMID	RprStatus	
2001	RPR	12345678	20190130_R123	MEOA	BRKR1	1/30/2019 0:00:00.000	ABC123	XYZ	1/30/2019 9:30:02.000	RT555	B	1/30/2019	SUB1_BRKR1_20190130	12345678	SUB1	U	
Correction Submission																	
	actionType	errorROEID	firmROEID	type	CATReporterIMID	orderKeyDate	orderID	symbol	eventTimestamp	routedOrderID	accountHolderType	CATProcessingDate	filename	CATROEID	CATSubmitterIMID		
	COR		20190130_R123	MEOA	BRKR1	1/30/2019 0:00:00.000	XYZ123	XYZ	1/30/2019 9:30:02.000	RT555	A	1/31/2019	SUB2_BRKR1_20190131	16789012	SUB2		
Repair Status Update																	
ErrorCode	actionTypeCode	errorROEID	FirmROEID	type	CAT Reporter IMID	orderKeyDate	OrderID	symbol	eventTimestamp	routedOrderID	accountHolderType	CAT Processing Date	File Name	CAT ROE ID	Submitter	RprStatus	Repaired Processing Date
	NEW	12345678	20190130_R123	MEOA	BRKR1	1/30/2019 0:00:00.000	ABC123	XYZ	1/30/2019 9:30:02.000	RT555	A	1/30/2019	SUB1_BRKR1_20190130	12345678	SUB1	R	1/31/2019

Scenario#3 – Firm initiated Corrections

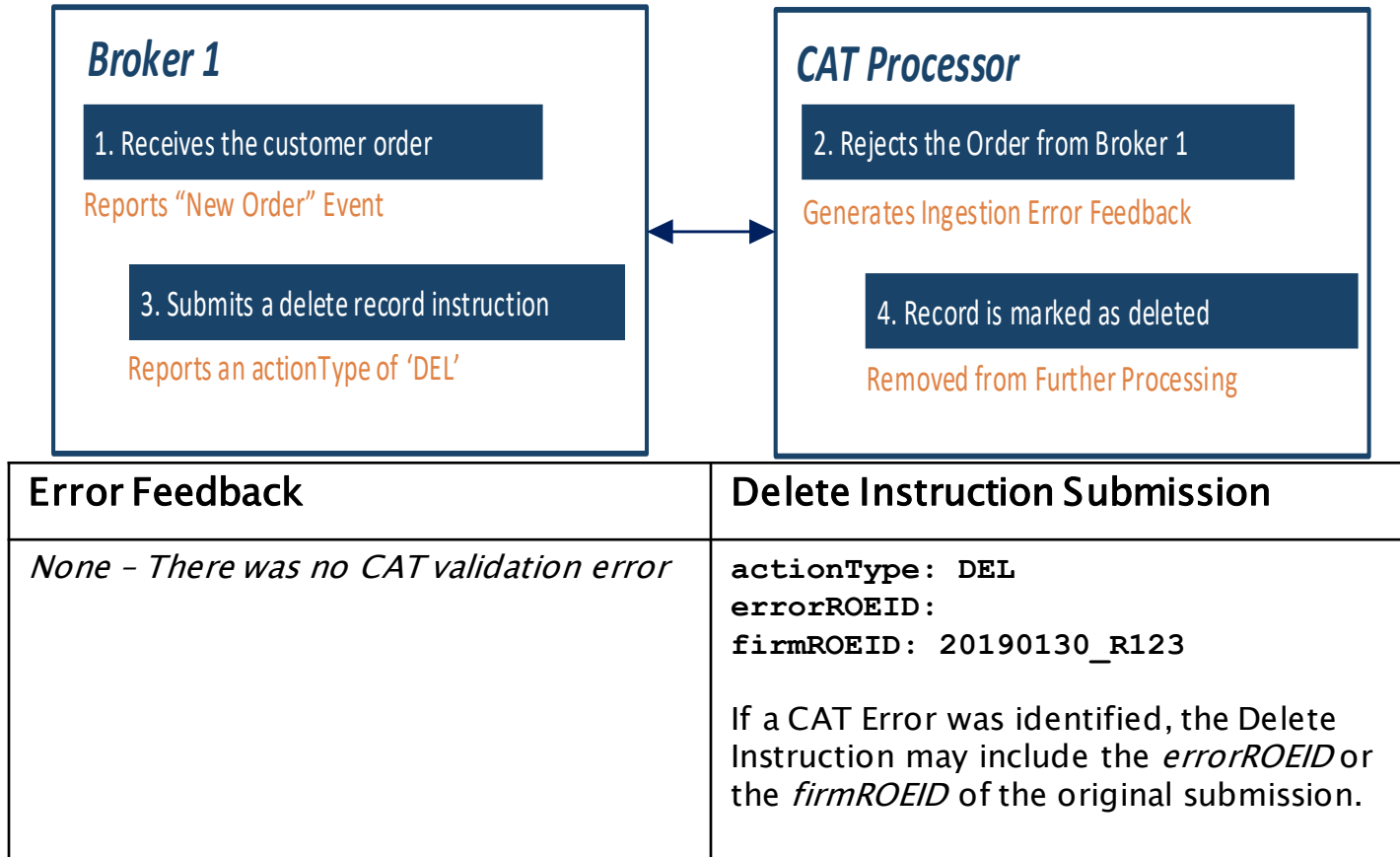


Error Feedback	Correction Submission
<i>None - There was no CAT validation error</i>	actionType: COR firmROEID: 20190130_R123 type: MEOA CATReporterIMID: BRK1 orderKeyDate: 20190130T093002.000 orderID: ABC123 symbol: XYZ eventTimestamp: 20190130T093002.234456

Scenario#3 Example

Accepted Data														
actionType	errorROEID	firmROEID	type	CATReporterIMID	orderKeyDate	orderId	symbol	eventTimestamp	routedOrderID	CATProcessingDate	filename	CATROEID	CATSubmitterIMID	
NEW		20190130_R123	MEOA	BRKR1	1/30/2019 0:00:00.000	ABC123	XYZ	1/30/2019 9:30:02.000	RT555	1/30/2019	SUB1_BRKR1_20190130	12345678	SUB1	
Correction Submission														
actionType	errorROEID	firmROEID	type	CATReporterIMID	orderKeyDate	orderId	symbol	eventTimestamp	routedOrderID	CATProcessingDate	filename	CATROEID	CATSubmitterIMID	
COR		20190130_R123	MEOA	BRKR1	1/30/2019 0:00:00.000	XYZ123	XYZ	1/30/2019 9:30:02.000	RT555	1/31/2019	SUB2_BRKR1_20190131	16789012	SUB2	
Accepted Data														
actionType	errorROEID	firmROEID	type	CATReporterIMID	orderKeyDate	orderId	symbol	eventTimestamp	routedOrderID	CATProcessingDate	filename	CATROEID	CATSubmitterIMID	
NEW		20190130_R123	MEOA	BRKR1	1/30/2019 0:00:00.000	ABC123	XYZ	1/30/2019 9:30:02.000	RT555	1/30/2019	SUB1_BRKR1_20190130	12345678	SUB1	removed from further processing
COR		20190130_R123	MEOA	BRKR1	1/30/2019 0:00:00.000	XYZ123	XYZ	1/30/2019 9:30:02.000	RT555	1/31/2019	SUB2_BRKR1_20190131	16789012	SUB2	

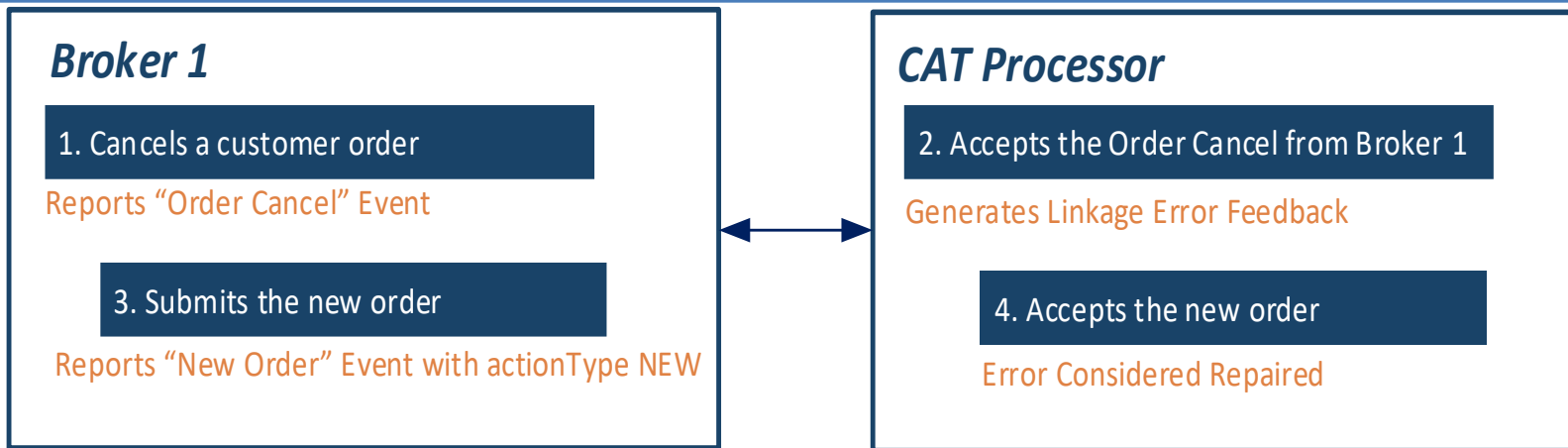
Scenario#4 – Record Deletion



Scenario#4 Example

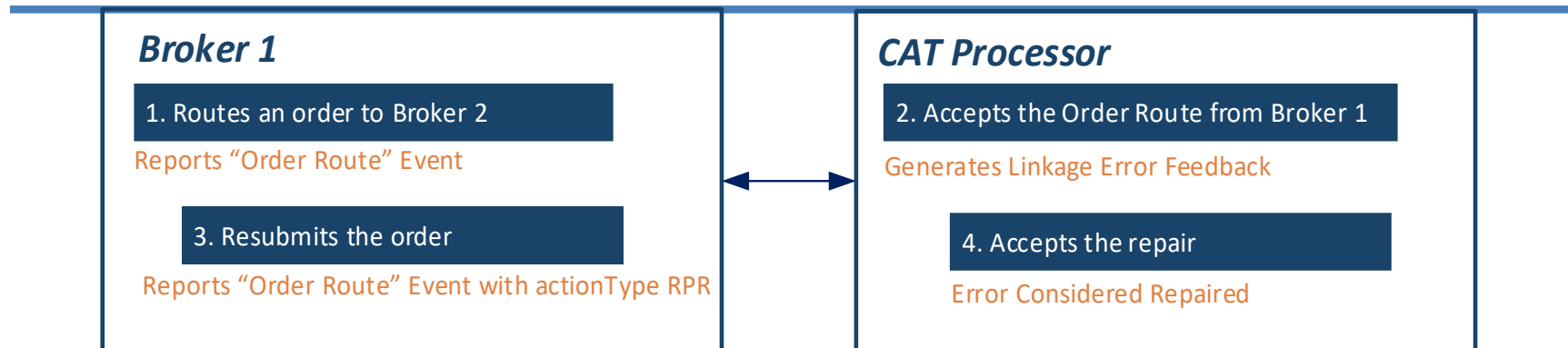
Accepted Data														
actionType	errorROEID	firmROEID	type	CATReporterIMID	orderKeyDate	orderID	symbol	eventTimestamp	routedOrderID	CATProcessingDate	filename	CATROEID	CATSubmitterIMID	
NEW		20190130_R123	MEOA	BRKR1	1/30/2019 0:00:00.000	ABC123	XYZ	1/30/2019 9:30:02.000	RT555	1/30/2019	SUB1_BRKR1_20190130	12345678	SUB1	
Deletion Instruction														
actionType	firmROEID													
DEL	20190130_R123													
Accepted Data														
actionType	errorROEID	firmROEID	type	CATReporterIMID	orderKeyDate	orderID	symbol	eventTimestamp	routedOrderID	CATProcessingDate	filename	CATROEID	CATSubmitterIMID	
NEW		20190130_R123	MEOA	BRKR1	1/30/2019 0:00:00.000	ABC123	XYZ	1/30/2019 9:30:02.000	RT555	1/30/2019	SUB1_BRKR1_20190130	12345678	SUB1	removed from further processing

Scenario#5 – Intrafirm Linkage Correction



Error Feedback – Unlinked Intrafirm Event	Late Submission
errorCode: 3501 actionType: RPR errorROEID: 923451234 firmROEID: 20180417_Q12360 type: MEOC CATReporterIMID:BRK1 orderKeyDate: 20180417T000000 orderID: Z23456 symbol: XYZ cancelQty: 1000	actionType: NEW firmROEID: 20180417_Q12378 type: MENO CATReporterIMID:BRK1 orderKeyDate: 20180417T000000 orderID: Z23456 symbol: XYZ quantity: 1000 Late reported event will Correct the unlinked event through reconciliation

Scenario#6 – Interfirm Linkage Correction



<p>Error Feedback for Broker 1 – Unlinked Route</p> <p>errorCode: 8003 actionType: RPR errorROEID: 123451234</p> <p>firmROEID: 20180417_z12360 type: MEOR orderKeyDate: 20180417T000000 eventTimestamp: 20180417T153035.234556 symbol: XYZ senderIMID: FRMA destination: FRMB orderID: O23456 routedOrderID: A0223-001 quantity: 1000</p>	<p>Additional Error Feedback for Broker 1 – Named on Unlinked Order Accept reported by Broker 2</p> <p>errorCode: 9004</p> <p>firmROEID: 20180417_567812345 eventTimestamp: 20180417T153035.234556 symbol: XYZ receiverIMID: FRMB senderIMID: FRMA routedOrderID: A0223</p> <p>Additionally, Broker 1 (FRMA) receives Named feedback including information from an MEOA event reported by Broker 2</p>
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Scenario#6 – Interfirm Linkage Correction (cont.)

Error Feedback for Broker 2 – Unlinked Order Accept	Error Feedback for Broker 2 – Named on Unlinked Order Route reported by Broker 1
<p> errorCode: 9003 actionType: RPR errorROEID: 123451299 </p> <p> firmROEID: 20180417_567912345 type: MEOA orderKeyDate: 20180417T000000 eventTimestamp: 20180417T153035.23678 symbol: XYZ orderID: BBB222 routedOrderID: A0223 quantity: 1000 receiverIMID: FRMB senderIMID: FRMA </p>	<p> errorCode: 8004 </p> <p> actionType: RPR firmROEID: 20180417_z12360 eventTimestamp: 20180417T153035.23678 symbol: XYZ senderIMID: FRMA destination: FRMB routedOrderID: A0223-001 quantity: 1000 </p> <p> Broker 2 (FRMB) receives Named feedback including information from an MEOR event reported by Broker 1 </p>

- *Error analysis conducted with determination that Broker 1 reported the incorrect routedOrderID*

Scenario#6 – Interfirm Linkage Correction (cont.)

Correction Submission by Broker 1	Corrections Resolution
<p> actionType: RPR errorROEID: 123451234 firmROEID: 20180417_z12360 type: MEOR orderKeyDate: 20180417T000000 eventTimestamp: 20180417T153035.234556 symbol: XYZ senderIMID: FRMA destination: FRMB orderID: O23456 routedOrderID: AO223 </p>	<p> Broker 1 (FRMA): Error is Repaired <ul style="list-style-type: none"> • 8003– Unlinked MEOR event • Original submission of the MEOR event is removed from further processing and is replaced by the resubmitted MEOR event. Related Feedback is Repaired through Linkage Reconciliation: <ul style="list-style-type: none"> • 9004– Named on Unlinked Order Accept event • Broker 2 (FRMB) – 9003– Unlinked MEOA event • Broker 2 (FRMB) – 8004–Named on Unlinked Order Route event </p>

Reporter Portal Features Supporting Corrections

- ▶ Manual File Data Upload supporting JSON and CSV formats
- ▶ View and Download prior Web Submissions
- ▶ Comingle error types with enhanced search and sort features
- ▶ Support for Linkage Corrections – open events with editable linkage key fields
- ▶ Additional Bulk Repair options including linkage repairs
- ▶ Feedback Views by Trade Date or CAT Processing Date with clear distinction of Corrections Due Dates
- ▶ Enhanced Bulk Repair

Comingled Feedback Example

	errorROEID	type	actionTypeCode	IMID	IMID/sendIMID/ rtngOrigin	rcvriIMID/ destination	symbol	OrderID	routedOrderID	eventTimestamp	ErrorCode	ErrorDesc	RprdStatus	Analysis	Correction Steps & Outcome
1	12345	MENO	NEW	FRMA			XYZ	ABC123		1/30/2019 9:30:02.000	2018	Missing or Invalid deptType	U	Rejection causing unlinked Intrafirm	Rejection repair will repair both errors
	12992	MEOC	NEW	FRMA			XYZ	ABC123		1/30/2019 9:30:03.000	3501	Secondary Event - Key Not Found	U		
2	13004	MEOC	NEW	FRMA			ZZY	AB9101		1/30/2019 9:42:03.000	3501	Secondary Event - Key Not Found	U	Missing Origination Event, no rejection	Late report will repair unlinked error
3	13921	MEOA		FRMA	FRMB	FRMA	BBA	AZ333	VFA499	1/30/2019 9:45:03.000	9003	Matching routedOrderID not found	U	Unlinked because FRMB did not report or Route rejected; named error for FRMB Route not present	FRMB's rejection repair or late submission will repair unlinked error
4					FRMB	FRMA	AAA		CCD931	1/30/2019 9:58:03.000	8004	Named on Order Route event where routedOrderID cannot be found	U	FRMA or FRMB - Incorrect linkage key	Additional analysis needed
	13273	MEOA		FRMA	FRMB	FRMA	BBA	AZ333	VFA499	1/30/2019 9:45:03.000	9003	Matching routedOrderID not found	U		

Bulk Repair Functionality

- ▶ Bulk repairs will support rejection and linkage errors for events with 1 associated error
- ▶ Rejection Errors
 - All Missing or Invalid error reasons for fields of Data Type Choice and Boolean
 - All fields with symbol and IMID values
- ▶ Linkage Errors
 - Linkage errors related to senderIMID, receiverIMID, routingOrigin, and destination

How to Ask a Question during Today's Call

▶ **For participants using computer audio:**

- Click the “Participants” button at the bottom of the app window, then the “Raise Hand” button at the bottom of the participants window.
- A visual prompt will indicate that your line has been unmuted.

▶ **For participants using phone audio:**

- Enter *9 on your phone keypad.
- An audio prompt will indicate that your line has been unmuted.