Phase 2d Requirement: Unique Order ID on Order Modified Events

Problem we are trying to solve:

- the CAT NMS Plan requires that the Plan Processor be able to accurately sequence events.

  - See Appendix C-21
    - "In furtherance thereof, data related to a particular order will be reported accurately and sequenced from receipt or origination, to routing, modification, cancellation and/or execution."
  - See also Appendix C-25
    - "As an initial matter, because of the drift between clocks, an accurately-sequenced record of orders cannot be based solely on the time stamps provided by CAT Reporters."
    - "For this reason, the Participants plan to require that the Plan Processor develop a way to accurately track the sequence of order events without relying entirely on timestamps."

Sequencing Challenge

- FINRA CAT currently must rely on parent/child relationships and timestamps to properly sequence events within an order lifecycle for non-ATS Industry Member CAT Reporters. If no parent/child relationship can be determined, and timestamps are not unique, FINRA CAT cannot ensure proper sequencing within the lifecycle.

- Issue was spotlighted by scenarios with numerous modifications and routes occurring very close together in time, as well as the complexity introduced in 2d with request for modifications in addition to confirmation of modifications
- Issue can also exist with other subsequent events sharing the same event type and timestamp (e.g., execution)
- Use of attributes such as price and quantity to determine sequencing can be imperfect

Example: Order Modification

- Lifecycle Data would show the following:

Phase 2a				
IMID	Event Type	Order ID	Event Time	Symbol
IM1	MENO	IM11234	06/22/2020 09:29:02.581365	XYZ
IM1	MEOR	IM11234	06/22/2020 09:29:02.581365	XYZ
IM2	MEOA	IM29876	06/22/2020 09:29:02.592476	XYZ
IM1	MEOM	IM11234	06/22/2020 09:29:02.593693	XYZ
IM1	MEOM	IM11234	06/22/2020 09:29:02.593693	XYZ
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ

Phase 2d				
IMID	Event Type	Order ID	Event Time	Symbol
IM1	MENO	IM11234	06/22/2020 09:29:02.581365	XYZ
IM1	MEOR	IM11234	06/22/2020 09:29:02.581365	XYZ
IM2	MEOA	IM29876	06/22/2020 09:29:02.592476	XYZ
IM1	MEOMR	IM11234	06/22/2020 09:29:02.493693	XYZ
IM1	MEOMR	IM11234	06/22/2020 09:29:02.493693	XYZ
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ
IM2	MEOMR	IM29876	06/22/2020 09:29:02.594582	XYZ
IM2	MEOMR	IM29876	06/22/2020 09:29:02.594582	XYZ
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ
IM1	MEOM	IM11234	06/22/2020 09:29:02.694582	XYZ
IM1	MEOM	IM11234	06/22/2020 09:29:02.694582	XYZ

- Since both of IM1's MEOMs have the same *orderID* and *eventTimestamp*, how does the Plan Processor know which MEOM came first?
- Since the highlighted MEORs both have the same *orderID* and *eventTimestamp*, how does the Plan Processor know which MEOMs the MEORs belong to?

Example: Order Modification

- Lifecycle Data would show the following:

Phase 2a

IMID	Event Type	Order ID	Event Time	Symbol	Quantity
IM1	MENO	IM11234	06/22/2020 09:29:02.581365	XYZ	500
IM1	MEOR	IM11234	06/22/2020 09:29:02.581365	XYZ	500
IM2	MEOA	IM29876	06/22/2020 09:29:02.592476	XYZ	500
IM1	MEOM	IM11234	06/22/2020 09:29:02.593693	XYZ	300
IM1	MEOM	IM11234	06/22/2020 09:29:02.593693	XYZ	400
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ	400
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ	300
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ	300
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ	400

Phase 2d

IMID	Event Type	Order ID	Event Time	Symbol	Quantity
IM1	MENO	IM11234	06/22/2020 09:29:02.581365	XYZ	500
IM1	MEOR	IM11234	06/22/2020 09:29:02.581365	XYZ	500
IM2	MEOA	IM29876	06/22/2020 09:29:02.592476	XYZ	500
IM1	MEOMR	IM11234	06/22/2020 09:29:02.593693	XYZ	300
IM1	MEOMR	IM11234	06/22/2020 09:29:02.593693	XYZ	400
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ	400
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ	300
IM2	MEOMR	IM29876	06/22/2020 09:29:02.594582	XYZ	300
IM2	MEOMR	IM29876	06/22/2020 09:29:02.594582	XYZ	400
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ	300
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ	400
IM1	MEOM	IM11234	06/22/2020 09:29:02.694582	XYZ	300
IM1	MEOM	IM11234	06/22/2020 09:29:02.694582	XYZ	400

- If the Plan Processor relies on Quantity, it can only match modify events to routes if the quantity changes. However, it still cannot properly sequence the events. Was the quantity reduced to 300 shares first and then increased 400 shares? Or vice versa?

Example: Order Modification

- Lifecycle Data would show the following:

Phase 2a					
IMID	Event Type	Order ID	Event Time	Symbol	Price
IM1	MENO	IM11234	06/22/2020 09:29:02.581365	XYZ	16.11
IM1	MEOR	IM11234	06/22/2020 09:29:02.581365	XYZ	16.11
IM2	MEOA	IM29876	06/22/2020 09:29:02.592476	XYZ	16.11
IM1	MEOM	IM11234	06/22/2020 09:29:02.593693	XYZ	16.12
IM1	MEOM	IM11234	06/22/2020 09:29:02.593693	XYZ	16.12
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ	16.12
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ	16.12
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ	16.12
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ	16.12

Phase 2d					
IMID	Event Type	Order ID	Event Time	Symbol	Price
IM1	MENO	IM11234	06/22/2020 09:29:02.581365	XYZ	16.11
IM1	MEOR	IM11234	06/22/2020 09:29:02.581365	XYZ	16.11
IM2	MEOA	IM29876	06/22/2020 09:29:02.592476	XYZ	16.11
IM1	MEOMR	IM11234	06/22/2020 09:29:02.493693	XYZ	16.12
IM1	MEOMR	IM11234	06/22/2020 09:29:02.493693	XYZ	16.12
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ	16.12
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ	16.12
IM2	MEOMR	IM29876	06/22/2020 09:29:02.594582	XYZ	16.12
IM2	MEOMR	IM29876	06/22/2020 09:29:02.594582	XYZ	16.12
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ	16.12
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ	16.12
IM1	MEOM	IM11234	06/22/2020 09:29:02.694582	XYZ	16.12
IM1	MEOM	IM11234	06/22/2020 09:29:02.694582	XYZ	16.12

- If the Plan Processor relies on price, it won't be able to match modify events to routes if the price does not change. It still cannot properly sequence the events.

Example: Order Modification

- Lifecycle Data would show the following:

Phase 2a

IMID	Event Type	Order ID	Event Time	Symbol	Quantity	Price	Handling Instructions
IM1	MENO	IM11234	06/22/2020 09:29:02.581365	XYZ	500	16.11	
IM1	MEOR	IM11234	06/22/2020 09:29:02.581365	XYZ	500	16.11	
IM2	MEOA	IM29876	06/22/2020 09:29:02.592476	XYZ	500	16.11	
IM1	MEOM	IM11234	06/22/2020 09:29:02.593693	XYZ	300	16.12	SW
IM1	MEOM	IM11234	06/22/2020 09:29:02.593693	XYZ	400	16.12	
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ	400	16.12	
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ	300	16.12	
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ	300	16.12	
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ	400	16.12	

Phase 2d

IMID	Event Type	Order ID	Event Time	Symbol	Quantity	Price	Handling Instructions
IM1	MENO	IM11234	06/22/2020 09:29:02.581365	XYZ	500	16.11	
IM1	MEOR	IM11234	06/22/2020 09:29:02.581365	XYZ	500	16.11	
IM2	MEOA	IM29876	06/22/2020 09:29:02.592476	XYZ	500	16.11	
IM1	MEOMR	IM11234	06/22/2020 09:29:02.593693	XYZ	300	16.12	SW
IM1	MEOMR	IM11234	06/22/2020 09:29:02.593693	XYZ	400	16.12	
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ	400	16.12	
IM1	MEOR	IM11234	06/22/2020 09:29:02.593693	XYZ	300	16.12	SW
IM2	MEOMR	IM29876	06/22/2020 09:29:02.594582	XYZ	300	16.12	SW
IM2	MEOMR	IM29876	06/22/2020 09:29:02.594582	XYZ	400	16.12	
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ	300	16.12	SW
IM2	MEOM	IM29876	06/22/2020 09:29:02.594582	XYZ	400	16.12	
IM1	MEOM	IM11234	06/22/2020 09:29:02.694582	XYZ	300	16.12	SW
IM1	MEOM	IM11234	06/22/2020 09:29:02.694582	XYZ	400	16.12	

- Even if the Plan Processor relies on multiple fields such as quantity and price, it won't be able to properly sequence the events because the Order Key remains the same (*orderKeyDate, CATReporterIMID, symbol (*or *optionID)* and *orderID*).

Phase 2a Requirement: Order Modified vs. Cancel/Replace

- Anytime the Material Terms of an order have changed, this must be reflected in one of the following ways:
  - Order Cancelled event and New Order event (requires new *orderID*)
  - Order Modified Event (supports but does not require a new *orderID*)
  - Reduction of share quantity can be reflected using an Order Cancelled event (does not require a new *orderID*)

- FINRA CAT could support separate Order Modified and Cancel/Replace events to easily distinguish when a new order ID has been assigned
  - Is this preferred by the industry?
  - Does not solve sequencing problem for modifications where no new order ID is assigned

How to Ensure Proper Sequencing?

- Option to leverage ATS sequence number field and Industry Members provide a sequence number when it cannot guarantee unique timestamps for subsequent events within a single order ID

- Question for the Industry: Are there other ways to guarantee proper sequencing?