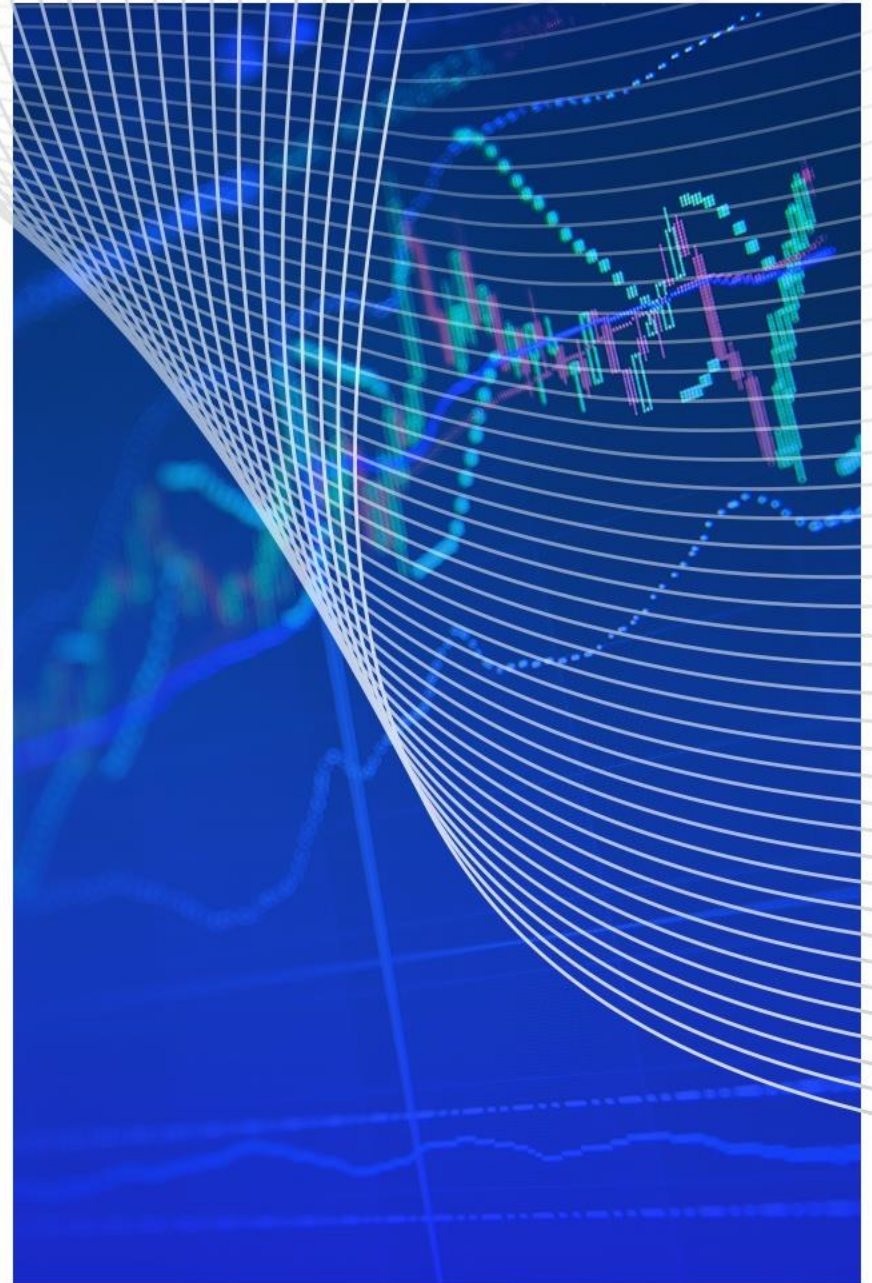


PILLAR OPRA MIGRATION TEST PLAN

Revised: Jul 6, 2021



KEY TIMELINE

Certification (Cert) System Functional Testing

- From: Monday, February 22, 2021
- Through: Friday, July 9, 2021

Industry Functional Testing

- Saturday, March 27, 2021
- Saturday, April 10, 2021
- Saturday, April 24, 2021

Industry Non-Functional Testing

- Saturday, May 8, 2021
- Saturday, May 22, 2021
- Saturday, June 5, 2021
- Saturday, June 12, 2021
- Saturday, June 26, 2021

Parallel Production Testing

- From: Monday, April 26, 2021
- Through: Friday, July 23, 2021

Production Final Software Test

- Saturday, July 10, 2021

Production Confidence Test

- Saturday, July 24, 2021

Activation Date

- Monday, July 26, 2021

TESTING PLAN

- Certification Testing is available everyday during production hours
- All input Participants must certify in Certification Environment by April 23, to be able to participate in the Production Parallel Period. Until certified, Participants can get access to Production IP/Ports for connectivity testing but would not be allowed to participate during the Parallel Period
 - Pillar OPRA Input and Retransmission lines Request forms need to be submitted by each Participant
 - Contact information and Respective forms can be found at <https://www.opraplan.com/pillar>
- Participants can verify connectivity to Pillar OPRA Production lines starting March 15, prior to first weekend test.
- Conference Call will be scheduled on each weekend test and Test Scripts will be provided to the Participants

WEEKEND PRODUCTION TESTS

WEEKEND TEST

March 27, 2021 - Functional Test

- Test Plan
 - Regular and Extended Session Message Flow can be verified
 - Input Participants and Data Subscribers will run through their respective tests scripts, as applicable.
 - Participants may run any additional functional test as needed for their system functionality
 - Participants will confirm test results by sending the completed test scripts
- Input Participants will also connect to their legacy OPRA input lines and simultaneously send data to both systems

WEEKEND TEST

April 10, 2021 - Functional Test

- Regular and Extended Session Message Flow will be verified
- Participants may repeat functional tests from March 27
- Participants will also connect to their legacy OPRA input lines and simultaneously send data to both systems

WEEKEND TEST

April 24, 2021 - Functional Test

- Participants may repeat functional tests from March 27 and April 10
- Participants will also connect to their legacy OPRA lines and simultaneously send data to both systems
- Participants will leave their parallel connectivity to Pillar OPRA in-place for Monday, April 26, 2021

Key Milestone - Parallel Production Phase

- Parallel Production Testing will commence from Monday, April 26, 2021
- Starting April 26, certified Participants can begin to send quote and trade data to both Legacy and Pillar OPRA simultaneously
- Pillar OPRA will consume input data for data comparison. Data will be disseminated in parallel from subset of multicast line as follows:
 - Regular Hours Multicast Lines 1, 2, 3, and 4
 - Extended Hours Multicast Lines 97, 98, 99, and 100
 - Line Integrity messages will NOT be disseminated over Pillar lines 5 through 48 during the parallel period.
 - Line Integrity messages WILL be disseminated over Pillar lines 49 through 96 during the parallel period.
- Legacy OPRA remains live, and will continue to publish Data for all symbols, until Pillar OPRA activation

WEEKEND TEST

May 8, 2021 - Non-Functional Test

- Input Failure Recovery Test
 - Input line disconnect/reconnect test
 - Pillar OPRA will simulate primary port failure
 - Participants will reconnect to secondary port
 - Sequence number jump on Participant input lines
 - Pillar OPRA will disconnect both primary and secondary ports and simulate a sequence number jump
 - Participants will reconnect and perform Sequence Inquiry
 - Participants will submit messages as per latest sequence number
 - Pillar OPRA to simulate hardware, network and software failure-recovery scenarios
- Output Failure Recovery Test
 - Pillar OPRA will publish Reset Block Sequence Number (Category H, Type K) message and simulate a sequence number jump on multicast lines
 - Participants will receive data and process the sequence number jump

WEEKEND TEST

May 22, 2021 - Non-Functional Test

- DR (RDC) Input Test
 - On request, Participants can connect to Pillar OPRA DR (RDC) input lines, while Pillar OPRA Primary site (LDC) will be handling message processing and dissemination
- Output Failure Recovery Test
 - Pillar OPRA will failover subset of output dissemination channels
 - Data Subscribers will continue to receive data
- Site Failover Test
 - Pillar OPRA will failover from Primary (LDC) site to the DR (RDC) site
 - Participants will reestablish connection to RDC, perform sequence handshake and submit messages as per latest block sequence number
 - Data Subscribers will continue to receive data on the multicast channels
- Pillar OPRA to simulate hardware, network and software failure-recovery scenarios on the DR (RDC) site

Key Milestone – Pillar OPRA would operate from DR (RDC) site for 1 week (May 24, 2021 - May 28, 2021)

WEEKEND TEST

June 5, 2021 – Non-Functional Test

- Input Line Subsystem Failure
 - Pillar OPRA to simulate Input Line Subsystem Failure which impacts connections for all input Participant lines
 - Pillar OPRA to restore input connectivity for all Participants
 - Participants to reconnect to Pillar OPRA and start submitting data
- OPRA System Cold Restart
 - Pillar OPRA to perform cold restart
 - Input sequence numbers will be recovered and Participants can perform sequence handshake and submit messages as per latest block sequence number
 - Output Sequence numbers will be reset to 1 for all multicast lines

WEEKEND TEST

June 12, 2021 – Site Failover and Fallback Test

- Pillar OPRA to perform Site Failover Test
 - Pillar OPRA will failover from Primary (LDC) site to the DR (RDC) site
 - Pillar OPRA will failover back from DR (RDC) site to the Primary (LDC) site
- Fallback from Pillar OPRA to Legacy OPRA
 - Notice will be issued that OPRA is falling back to the legacy system
 - Pillar OPRA will disable data publication on all output multicast channels
 - Legacy OPRA will publish Reset Block Sequence Number (Category C Type L) message to bump up the sequence number on all multicast lines, to avoid confusion
 - Legacy OPRA will resume data publication from latest received input message
 - Data Subscribers should confirm they are processing the multicast feeds from the legacy OPRA
 - After fallback, any Retransmission request will be handled only via legacy OPRA and data will be retransmitted via legacy OPRA retransmission lines
 - Retransmission need to be requested from start of day, since Block Sequence Number are independent across both systems
- Pillar OPRA to facilitate Load Test opportunity for Data Subscribers

Key Milestone – Pillar OPRA would operate from DR (RDC) site for 1 week (June 14, 2021 - June 18, 2021)

WEEKEND TEST

June 26, 2021 - Non-Functional Test

- Repeat of various Failure Recovery Test Scenarios
 - DR Input Test - Participants can connect to Pillar OPRA DR (RDC) input lines while Pillar OPRA Primary site (LDC) will be handling message processing and dissemination
 - Pillar OPRA to perform Site Failover Test
 - Pillar OPRA will failover from Primary (LDC) site to the DR (RDC) site
 - Pillar OPRA will failover back from DR (RDC) site to the Primary (LDC) site
 - Fallback from Pillar OPRA to Legacy OPRA

PRODUCTION FINAL SOFTWARE TEST

Saturday, July 10, 2021

- Participants may repeat any functional message flow tests on the final software
- Fallback from Pillar OPRA to Legacy OPRA
- Pillar OPRA to facilitate final Load Test opportunity for Data Subscribers

PRODUCTION CONFIDENCE TEST

Saturday, July 24, 2021

- Participants will connect to their primary ports
- Participants can run through final tests to ensure readiness for go-live.