

# MARKET DATA HIGH AVAILABILITY

## TECHNICAL NOTE



**Scope and audience:** This document provides additional information related to session management, order management, MDG high availability and Exchange business continuity.



### ASSOCIATED DOCUMENTS

The following associated documents should either be read in conjunction with this document, or provide other relevant information for the user (including the description of the fields and messages named in this document), they could be found on our [website](#) :

- Euronext Cash and Derivatives Markets – Optiq MDG Client Specifications
  - Euronext Cash and Derivatives Markets – Optiq File Specification
  - Euronext OPTIQ Market Data (MDG) Conformance Test Scripts
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# 1. INTRODUCTION

The market data high availability is a Euronext mechanisms which aims to reduce the impact on client trading in case of system failures. The scope of system failures includes UTP matching engines and market data publishers.

In the context of the Optiq migration , the current note provides guidance for clients to manage market data high availability scenarios during the migration period for step 1. As such, this note should be used along with the Euronext Optiq Market Data (MDG) Conformance Test Scripts document to prepare the high availability conformance tests on the pEUA platform and production environment during dress rehearsals. High availability conformance test scripts will be made available in the Euronext Optiq Market Data (MDG) Conformance Test Scripts at the end of April.

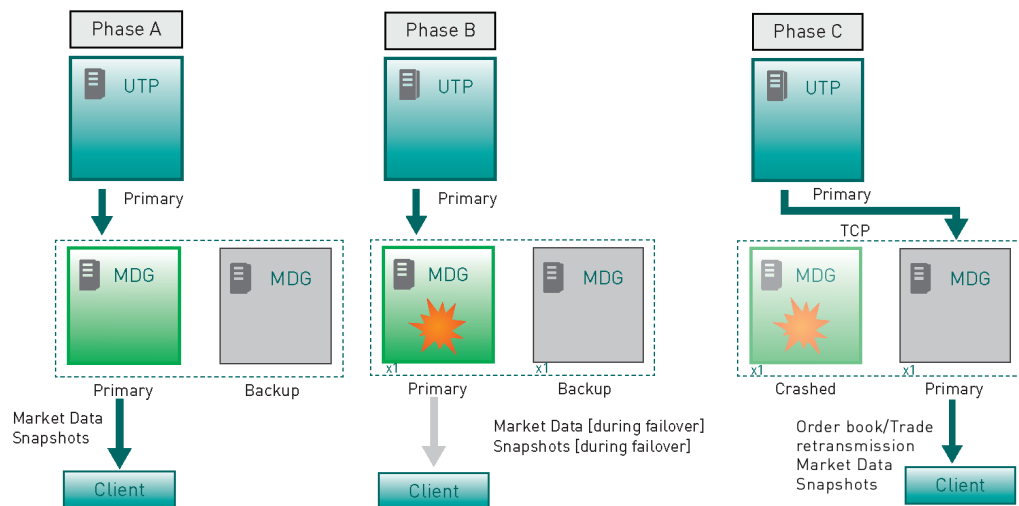
# 2. MARKET DATA HIGH AVAILABILITY OVERVIEW

In the event of UTP Matching Engine or Market Data Publisher connectivity or hardware failure, the Market Data Publisher will allow customers' connections to run a smooth and 100 % safe recovery as follows:

- Customers will be able to reconnect as transparently as possible and multicast groups and ports will not change.
- Market data will ensure that customers receive a retransmission of the order book and trades.

The diagram below provides a high level illustration of a typical market data failover scenario.

## Example of market data failover scenario ( Step 1 target phase)



**Phase A :** Client is receiving real time market data from MDG primary

**Phase B :** MDG primary fails as a result client is experiencing an interruption of real time market data and snapshot.

**Phase C :** MDG backup is promoted as primary as a result client receives order book retransmission then resume receiving real time data and snapshots

### 3. MIGRATION PERIOD OVERVIEW

In the context of the Optiq migration, the step 1 consists in migrating XDP to MDG (market data gateway) as the new market data protocol. This step is broken down into three phases:

1. **Preproduction**
2. **Dual run / Parallel run**
3. **Target phase**

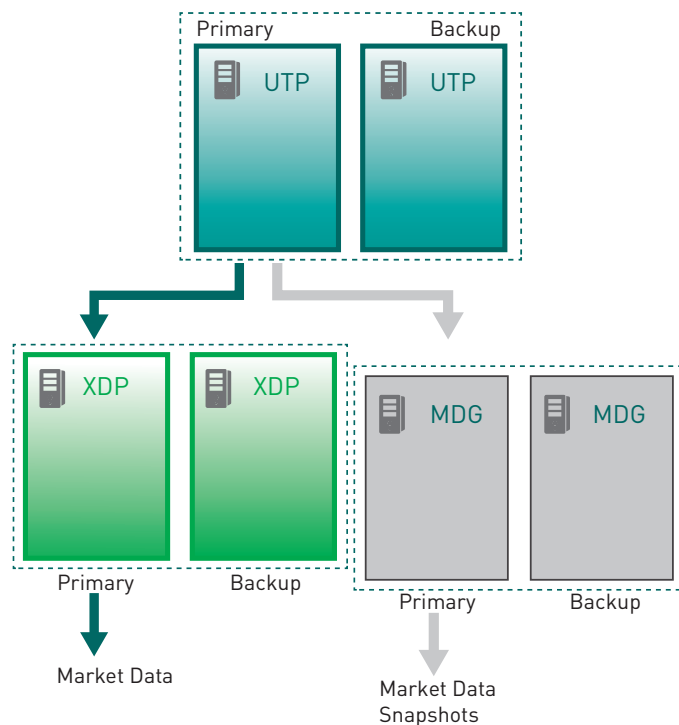
During the external preproduction and dual run period, both XDP and MDG are broadcasting market data.

#### 3.1 PREPRODUCTION PHASE

During the preproduction phase:

1. XDP remains the production market data protocol.
2. In case of a failure that involves XDP, Market Surveillance might decide to halt the market in the specific case where the failover process requires manual intervention.
3. Alternatively, in case of a failure that involves MDG, the market will not be halted.

It is to be noted that, in case of a failure that involves MDG, XDP client applications will receive the order book retransmission as a side effect of MDG recovery.

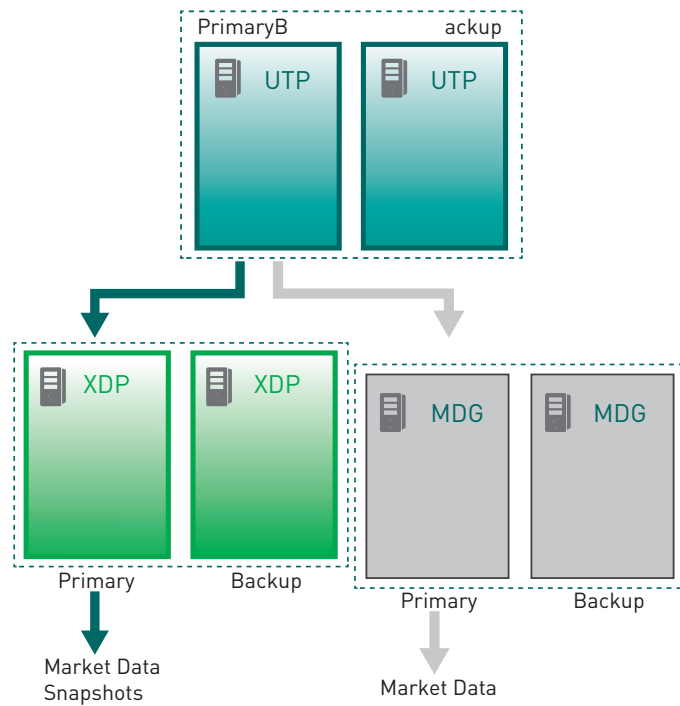


### 3.2 DUAL RUN PHASE

During the dual run phase:

1. MDG becomes the primary production market data protocol.
2. In case of a failure that involves MDG, Market Surveillance might decide to halt the market in the specific case where the failover process requires manual intervention.
3. Alternatively, in case of a failure that involves XDP, the market will not be halted.

In case of a failure that involves MDG, XDP client applications will receive the order book retransmission as a side effect of MDG recovery.



### 3.3 TARGET PHASE

#### Step 1 Target mode:

MDG will be the only market data protocol generating data. XDP Cash will no longer be broadcasted.

The following section provides details on the high availability mechanisms, their impact on the market data reception and describes the course of events in place to resume the service.

## 4. DETAILED FAILURE SCENARIOS AND RECOVERY STEPS

### 4.1 MARKET DATA FAILURE SCENARIOS

Several scenarios of market data failure are identified depending on the failing component:

Scenarios	Detailed description and sequence of events
<b>FAILOVER UTP Cash</b>	<ul style="list-style-type: none"> <li>• Technical interruption of the matching engine.</li> <li>• The primary UTP engine fails, the backup UTP matching engine node takes over after a short period of time in seconds.</li> <li>• Once the backup is fully up, the MDG and XDP connections to UTP matching engine are re-established.</li> <li>• The UTP matching engine application starts with all the instruments in active mode (unhalted) (in case of standard failover)</li> <li>• The MDG sends the recovery sequence (see next section)</li> <li>• The XDP sends the recovery sequence (see next section)</li> </ul>
<b>FAILOVER UTP Derivatives</b>	<ul style="list-style-type: none"> <li>• Technical interruption of the matching engine.</li> <li>• The primary UTP engine fails, the backup UTP matching engine node takes over after some time in seconds.</li> <li>• Once the backup is fully up, the MDG and XDP connections to UTP matching engine are re-established.</li> <li>• The UTP matching engine application starts with all the instruments in the halted state.</li> <li>• The MDG sends the recovery sequence (see next section)</li> <li>• The XDP sends the recovery sequence (see next section)</li> <li>• Market surveillance will schedule a reopening of the market.</li> </ul>
<b>FAILOVER MDG</b>	<ul style="list-style-type: none"> <li>• Technical interruption of the Market Data Gateway.</li> <li>• The primary MDG node fails, the backup MDG node takes over after a short period of time in seconds.</li> <li>• Once the backup MDG is fully up, the MDG connections to UTP matching engine are re-established.</li> <li>• The MDG sends the recovery sequence (see next section)</li> <li>• The XDP sends the recovery sequence (see next section)</li> </ul>
<b>FAILOVER XDP</b>	<ul style="list-style-type: none"> <li>• Technical interruption of the Market Data Gateway.</li> <li>• The primary XDP node fails, the backup XDP node takes over after a short period of time in seconds.</li> <li>• Once the backup XDP is fully up, the XDP connections to UTP matching engine are re-established.</li> <li>• No impact on MDG.</li> </ul>
<b>LOSS OF CONNECTION BETWEEN UTP and MDG</b>	<ul style="list-style-type: none"> <li>• Technical interruption of connectivity between UTP and MDG.</li> <li>• The MDG connections to UTP matching engine is re-established.</li> <li>• The MDG sends the recovery sequence (see next section).</li> <li>• The XDP sends the recovery sequence (see next section).</li> </ul>
<b>LOSS OF CONNECTION BETWEEN UTP and XDP</b>	<ul style="list-style-type: none"> <li>• Technical interruption of connectivity between UTP and XDP.</li> <li>• The XDP connections to UTP matching engine is re-established.</li> <li>• No impact on MDG.</li> </ul>

In summary, during the preproduction and dual run periods, the following behaviours will be observed in the event of a failure.

	Impact on MDG flows	Impact on XDP flows
UTP Issue (or loss of transmission)	<ul style="list-style-type: none"><li>• MDG sends the synchronisation sequence</li></ul>	<ul style="list-style-type: none"><li>• XDP sends the synchronisation sequence</li></ul>
XDP Issue	<ul style="list-style-type: none"><li>• No impact</li></ul>	<ul style="list-style-type: none"><li>• Switch to XDP spare</li></ul>
MDG Issue	<ul style="list-style-type: none"><li>• Switch to MDG spare which sends the synchronisation sequence</li></ul>	<ul style="list-style-type: none"><li>• XDP will also send out the synchronisation sequence</li></ul>

## 4.2 MDG MARKET DATA RECOVERY SEQUENCE

### 4.2.1 Behaviour per type of channel

	Cash	Derivatives
Full Order Book Market Update (FBMU) channel	<ul style="list-style-type: none"><li>• Book retransmission</li></ul>	<ul style="list-style-type: none"><li>• Book retransmission</li></ul>
Full Order Book Order Update (FBOU) channel	<ul style="list-style-type: none"><li>• Book retransmission</li></ul>	<ul style="list-style-type: none"><li>• N.A.</li></ul>
Best Bid and Offer (BBBO) channel	<ul style="list-style-type: none"><li>• BBO retransmission</li></ul>	<ul style="list-style-type: none"><li>• BBO retransmission</li></ul>
Reference Data and Full Trade Information channel (REFT)	<ul style="list-style-type: none"><li>• Trade retransmission</li></ul>	<ul style="list-style-type: none"><li>• Outright Standing Data intraday</li><li>• Strategies Standing Data (all)</li><li>• Trade retransmission</li><li>• PriceUpdate per instrument</li><li>• Market Status Change</li></ul>

More details about the functionalities of the sequence of messages above can be found in the [Euronext Cash and Derivatives Markets – Optiq MDG Client Specifications](#) document.

More details about the sequence of messages above will be made available in the High availability scripts related section in the [Euronext OPTIQ Market Data \(MDG\) Conformance Test Scripts](#) document as of end of April.

Regarding Snapshot recovery, once the MDG recovery sequence is complete, the next cycle of snapshot will be provided with an up-to-date content.

### 4.3 CUSTOMER RECOVERY METHOD FOR MDG

In the event of a market data failure, customer applications will need to implement necessary recovery measures to detect the failure, manage the recovery sequence and resume real time. The following section provides the recovery steps from the customer's perspective.

#### 4.3.1 Detection of a failure

A customer will be able to detect each of the failure scenarios by identifying the related failure symptoms as follows:

Scenarios	Detailed description and sequence of events
<b>FAILOVER UTP Cash</b>	<ul style="list-style-type: none"> <li>Real time channels are not sending any application messages (only technical messages are sent) + Snapshot channels are sending only the last known state on all instruments during a short period in seconds.</li> <li>In the case MDG is connected to multiple UTP engines, Real time channels are not sending application messages on the impacted set of instruments + Snapshot channels are sending the last known state on these instruments during a short period in seconds. (please see section 4.3.3 for more detail)</li> <li>The fail over scenario is confirmed only if the above is followed by the MDG recovery sequence.</li> </ul>
<b>FAILOVER UTP Derivatives</b>	<ul style="list-style-type: none"> <li>Real time channels are not sending any application messages (only technical messages are sent) + Snapshot channels are sending only the last known state on all instruments during a short period in seconds.</li> <li>In the case MDG is connected to multiple UTP engines, Real time channels are not sending application messages on the impacted set of instruments + Snapshot channels are sending the last known state on these instruments during a short period in seconds. (please see section 4.3.3 for more detail)</li> <li>The fail over scenario is confirmed only if the above is followed by receiving multiple market status instruments halted messages.</li> </ul>
<b>FAILOVER MDG</b>	<ul style="list-style-type: none"> <li>Real time channels are not sending any application messages nor technical messages during a short period in seconds.</li> <li>The fail over scenario is confirmed only if the above is followed by receiving a message where the PSN field is reset and the round count bit field is incremented.</li> </ul>
<b>FAILOVER XDP</b>	<ul style="list-style-type: none"> <li>No impact on MDG.</li> </ul>
<b>LOSS OF CONNECTION BETWEEN UTP and MDG</b>	<ul style="list-style-type: none"> <li>Real time channels are not sending any application messages (only technical messages are sent) + Snapshot channels are sending only the last known state on all instruments during a short period in seconds.</li> <li>In the case MDG is connected to multiple UTP engines, Real time channels are not sending application message on the impacted set of instruments + Snapshot channels are sending the last known state on these instruments during a short period in seconds. (please see section 4.3.3 for more detail)</li> </ul>
<b>LOSS OF CONNECTION BETWEEN UTP and XDP</b>	<ul style="list-style-type: none"> <li>No impact on MDG.</li> </ul>
<b>BETWEEN UTP and XDP</b>	



### 4.3.2 Recovery sequence

The recovery sequence can be described as follows:

- **Orders:** 'clear book' message is sent for each impacted symbol then all orders are retransmitted for this symbol.
- **Trades:** 'start of retransmit' message is sent for a given symbol then potentially missed trades for this symbol are retransmitted then 'stop retransmit' message is sent for this symbol.

### 4.3.3 Specific cases

It is to be noted that before the full migration onto Optiq, there are situations where one MDG is connected to several UTP Matching Engines. In the case of an issue on one of these UTP Matching Engines, the related MDG will send the recovery sequence only for instruments that are setup on this UTP Matching Engine.

### 4.3.4 Resuming real time

Real time channels resume sending real time application message and Snapshot channels are sending an up to date state for all instruments.

## 4.4 SCENARIOS AND CLIENT RECOVERY RECOMMENDED ACTIONS

### 4.4.1 Pre-production phase( Production = XDP)

	CASH	DERIVATIVES
<b>FAILOVER UTP</b>  <b>Or LOSS OF CONNECTION BETWEEN UTP &amp; MDG</b>	For XDP: 1. A period of time in seconds of silence RT <b>KO**</b> 2. Packet sequence from last sequence number XDP publishes resynchronization sequence generated by MDG (side effect) 3. Real time data resumption For MDG: 1. RT <b>KO**</b> (only technical messages are sent – no Application messages) SS <b>OK</b> (but at the last known state) seconds of silence 2. RT: MDG recovery sequence SS: Next cycle has an updated content 3. Resumption RT	For XDP: 1. A period of time in seconds of silence RT <b>KO**</b> 2. Contracts suspended are (only in case of fail over UTP) Packet sequence from last sequence number XDP publishes resynchronization sequence generated by MDG (side effect) 3. Real time data resumption (contracts opening by the EMS + schedule a re-opening of the market in case of fail over UTP) For MDG: 1. RT <b>KO**</b> + SS <b>OK</b> (but at the last known state) seconds of silence “Contracts suspended” 2. MDG recovery sequence 3. Resumption of RT = <b>OK</b> (EMS schedule market re-opening)
<b>FAILOVER MDG</b>	For XDP: XDP publishes resynchronization sequence generated by MDG (side effect) For MDG: 1. Silence 30 sec - No heartbeat: RT + SS = <b>KO</b> 2. Run Count incremented (rank of run) + Reset of PSN RT: MDG recovery sequence SS: Next cycle has an updated content 3. RT + SS = <b>OK</b> – resumption	For XDP: XDP publishes resynchronization sequence generated by MDG (side effect) For MDG: 1. Silence 30 sec – No heartbeat RT + SS = <b>KO</b> 2. Run Count incremented (rank of run) + Reset of PSN RT: MDG recovery sequence SS: Next cycle has an updated content 3. RT + SS = <b>OK</b> – resumption
<b>FAILOVER XDP</b>  <b>Or LOSS OF CONNECTION BETWEEN UTP &amp; XDP</b>	For XDP : 1. A period of time in seconds of silence RT <b>KO</b> 2. XDP resumes from the Last Sequence Number 3. RT = <b>OK</b> - resumption For MDG : no impact on MDG	For XDP : 1. A period of time in seconds of silence RT <b>KO</b> 2. Reset of PSN 3. RT = <b>OK</b> - resumption For MDG : no impact on MDG

RT stands for real-time // SS stands for Snapshot on MDG

**KO**: only technical messages are sent – no Application messages are sent until the failover is completed and the service is resumed

(\*\*): MDG from other connected UTP (that is not impacted) still disseminates market data

#### 4.4.2 Dual Run (Production = MDG)

	CASH	DERIVATIVES
<b>FAILOVER UTP</b>  <b>Or LOSS OF CONNECTION BETWEEN UTP &amp; MDG</b>	For MDG : <ol style="list-style-type: none"> <li>RT <b>KO</b>** (A period of time in seconds of silence – only heartbeat) SS <b>OK</b> (but at the last known state)</li> <li>MDG recovery sequence</li> <li>RT = <b>OK</b> – resumption</li> </ol> For XDP:  XDP publishes resynchronization sequence generated by MDG (side effect)	For MDG: <ol style="list-style-type: none"> <li>RT <b>KO</b>** (A period of time in seconds of silence – only heartbeat) SS <b>OK</b> (but at the last known state)</li> <li>Contracts are suspended in case of a fail over UTP MDG recovery sequence</li> <li>Resumption of RT = OK (contracts opening by the EMS + schedule a re-opening of the market in case of a fail over UTP)</li> </ol> For XDP:  XDP publishes resynchronization sequence generated by MDG (side effect)
<b>FAILOVER MDG</b>	For MDG : <ol style="list-style-type: none"> <li>RT + SS = <b>KO</b> (A period of time in seconds of silence – No heartbeat)</li> <li>Run Count incremented (rank of run) + Reset of PSN RT: MDG recovery sequence SS: Next cycle has an updated content</li> <li>RT + SS = <b>OK</b> – resumption</li> </ol> For XDP:  XDP publishes resynchronization sequence generated by MDG (side effect)	For MDG : <ol style="list-style-type: none"> <li>RT + SS = <b>KO</b> (A period of time in seconds of silence – No heartbeat)</li> <li>Run Count incremented (rank of run) + Reset of PSN RT: MDG recovery sequence SS: Next cycle has an updated content</li> <li>RT + SS = <b>OK</b> – resumption</li> </ol> For XDP:  XDP publishes resynchronization sequence generated by MDG (side effect)
<b>FAILOVER XDP</b>  <b>Or LOSS OF CONNECTION BETWEEN UTP &amp; XDP</b>	For MDG : no impact.  For XDP : <ol style="list-style-type: none"> <li>RT: <b>KO</b>** (A period of time in seconds of silence – no heartbeat in case of XDP failover)</li> <li>XDP resumes from the Last Sequence Number</li> <li>RT = <b>OK</b></li> </ol>	For MDG: no impact  For XDP : <ol style="list-style-type: none"> <li>RT <b>KO</b> (A period of time in seconds of silence – no heartbeat in case of XDP failover)</li> <li>Reset of PSN</li> <li>RT + SS = <b>OK</b> – resumption</li> </ol>

RT stands for real-time // SS stands for Snapshot

(\*\*) MDG from other connected UTP (that is not impacted) still disseminates market data.

#### 4.4.3 Target Step

	CASH	DERIVATIVES
<b>FAILOVER UTP</b>  <b>Or LOSS OF CONNECTION BETWEEN UTP &amp; MDG</b>	<ol style="list-style-type: none"> <li>1. RT: <b>KO</b>** (A period of time in seconds of silence – only heartbeat) SS: <b>OK</b> (but at the last known state)</li> <li>2. RT: MDG recovery sequence SS: Next cycle has an updated content</li> <li>3. Resumption RT</li> </ol>	<ol style="list-style-type: none"> <li>1. RT: <b>KO</b>** (A period of time in seconds of silence – only heartbeat) SS: <b>OK</b> (but at the last known state)</li> <li>2. Contracts are suspended in case of a fail over UTP RT: MDG recovery sequence SS: Next cycle has an updated content</li> <li>3. Resumption of RT = <b>OK</b> (contracts opening by the EMS + schedule a re-opening of the market with announcement) (only in case of a fail over UTP)</li> </ol>
<b>FAILOVER MDG</b>	<ol style="list-style-type: none"> <li>1. RT + SS = <b>KO</b> (A period of time in seconds of silence – only heartbeat)</li> <li>2. Run Count incremented (rank of run) + Reset of PSN RT: MDG recovery sequence SS: Next cycle has an updated content</li> <li>3. RT + SS = <b>OK</b> – resumption</li> </ol>	<ol style="list-style-type: none"> <li>1. RT + SS = <b>KO</b> (A period of time in seconds of silence – only heartbeat)</li> <li>2. Run Count incremented (rank of run) + Reset of PSN RT: MDG recovery sequence SS: Next cycle has an updated content</li> <li>3. RT + SS = <b>OK</b> – resumption</li> </ol>

RT stands for real-time // SS stands for Snapshot

(\*\*): MDG from other connected UTP (that is not impacted) still disseminates market data.

## Customer focus

The migration onto the new Optiq platform has been designed with customers in mind. Technical relationship managers from the Euronext Client Readiness team will be available to meet with clients to review the technical specifications, facilitate impact assessment, hold development workshops, and provide regular updates on the migration timeline and status.

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