DEUTSCHE BÖRSE GROUP

T7 Disaster Recovery Concept Interface Configuration Details

Version 3.1.1

Gruppe Deutsche Börse

T7 Disaster Recovery Concept Interface Configuration Details Deutsche Börse AG

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1 Disaster recovery scenario

The following description is relevant for installations connecting via redundant line WAN connection (Ethernet, E1/T1) outside of the Equinix data centre¹. Customer installations inside Equinix are considered defunct in a disaster recovery (DR) scenario which results in a complete outage of the Equinix data centre.

A total of three types of customer installations have to be considered for the T7 DR scenario:

- Customer installations inside the Equinix data centre (CoLocation / Proximity)
- Customer installations connecting to the Frankfurt Access Point (customers in Germany)
- Customer installations connecting to remote Access Points (London, Paris, Amsterdam, Zurich, Chicago, etc.)

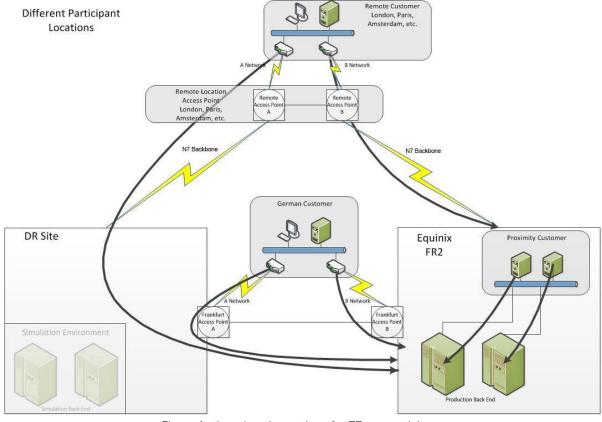


Figure 1, three location options for T7 connectivity

Figure 1 depicts all three types of customer installations and their redundant connectivity to the T7 production back ends.

¹ Combined/iAccess is available in Hausen1 and Equinix, so it depends where the participant's tunnel is terminated as to whether he will still have connection. Tunnels in Equinix do not automatically move to Hau1.

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Figure 2 displays the result of a DR scenario that renders the whole facility of Equinix data centre (FR2) inaccessible.

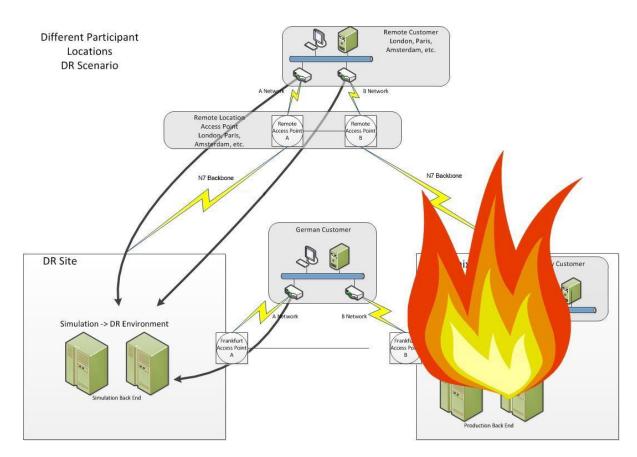


Figure 2, Disaster recovery scenario

In such a scenario customer installations, connecting to remote access points (i.e. London, Paris, Amsterdam, Chicago, etc.) will continue to use both leased lines connecting them to the local access point. The local access point continues to use backbone lines to Frankfurt, which are terminating in the DR data centre.

Customer installations connecting to the Frankfurt access point will be able to continue to use a single leased line connecting to the access point half located in the DR data centre.

Customer installations within the Equinix data centre (FR2) are considered to be non-functional in this DR scenario.

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2 General considerations

In a disaster recovery scenario the T7 infrastructure regularly used for T7 simulation will be re-used to serve as disaster recovery production infrastructure.

The switch of the back ends and the transfer of reference data will not be instantaneous, but is expected to take up to four hours.

While most T7 interfaces will be available in the disaster recovery scenario a number of conceptual differences to regular production exist and have to be accounted for.

2.1 Functional

- Order books will be empty after switch to the DR environment.
- All keys and sequence numbers are reset and starting from "1" again.
- Trades of the current business day will not be transferred to T7 DR System but can still be inquired from the Clearing systems (Eurex: C7, Xetra: CCP).
- Limited number of partitions are running in the DR scenario
- A new RDF will be produced during DR start up and will be published by the DR back end (as well as further intraday updates) onto the Common Report Engine into the directory for environment 90 (prod).

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2.2 Network

2.2.1 Same as Production

- User IDs, ETI and FIX sessions will be used from production.
- All TCP and UDP Ports will be the same as for normal production.
- FIX Gateway A Side Subnet will be the same as for normal production.
- All A-Stream multicast groups will be the same as for normal production for the T7 broadcast interfaces:
 - Market Data Interface (MDI)
 - Enhanced Market Data Interface (EMDI)
 - Extended Market Data Service (EMDS)
 - Market Signals (MS) derivatives market only
 - Reference Data Interface (RDI)
- EMDI A-Stream Rendezvous Point (RP) will be the same as for normal production.
- CRE A-Side Subnet will be the same as for normal production.

2.2.2 Differ from Production

- ETI Trading Gateway and Connection Gateway Subnets will differ from regular production!
- GUI Landing Pages will differ from regular production!
- Source IP addresses will differ from regular production for the T7 broadcast interfaces!
 - Market Data Interface (MDI)
 - Enhanced Market Data Interface (EMDI)
 - Extended Market Data Service (EMDS)
 - o Market Signals (MS) derivatives market only
 - Reference Data Interface (RDI)

See chapter 3 for full network details.

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3 Disaster recovery network details

Due to the nature of the distributed T7 architecture, different interfaces will be configured in varying ways.

T7 interfaces whose production infrastructure is solely located in the Equinix data centre FR2 will switch to the simulation infrastructure and need to be accessed via simulation network addresses.

Other T7 interfaces whose production infrastructure is distributed across both data centres will be able to continue to use the existing production infrastructure in the DR data centre.

In some cases further changes need to be done by Deutsche Börse Group for example, to re-balance the number of ETI HF gateways with the number of ETI LF gateways, according to different requirements by a DR scenario compared to regular simulation.

3.1 T7 network details derivatives markets

3.1.1 Eurex T7

The following tables summarize all available interface connection details in a disaster recovery scenario for the T7 derivatives market Eurex (XEUR).

Interface	Connection option	URL / IP addresses		Ports	Protocol
age	Internet	http://webgui.eurexchange.com/emer	http://webgui.eurexchange.com/emergency/index.html		TCP/IP
GUI Landingpage		http://193.29.93.173/emergency/index.html			
	Leased line <u>http://webgui.vpn.eurexchange.com/emergency/fqdn.html</u>		80 / 8089	TCP/IP	
Java ebStart	Internet	193.29.90.190	-	80 / (443)	TCP/IP
Java WebStart	Leased line	193.29.93.173	193.29.93.160/28	80 / (443)	TCP/IP
xies		193.29.90.235	193.29.90.224/27		
io)Pro	Internet	192.29.90.236		80	TCP/IP
GUI (Crypto)Proxies	Leased line - side A	193.29.89.225	193.29.89.224/28		
GUI	Leased line - side B	193.29.95.225	193.29.95.224/28	80 / 8089	TCP/IP
	Gateway type	IP subnets Side A	IP subnets Side B	Ports	Protocol
F	HF trading gateways	193.29.89.129 192.29.89.130	193.29.89.161 193.29.89.162		
Eurex ETI	LF trading gateways	193.29.89.65 193.29.89.66 193.29.89.67 193.29.89.68	193.29.89.97 193.29.89.98 193.29.89.99 193.29.89.100	19006	TCP/IP
	Connection gateways	193.29.89.65	193.29.89.97	19008	TCP/IP

Table 1, Eurex T7 market network details in DR scenario, part 1/3

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л. Х	Connection option	IP addresses	IP subnets	Ports Protocol
Eurex FIX Gateway	Leased line - side A	90.150.253.31	90.150.253.0 / 24	Individually TCP/IP
0		50.100.200.01	50.100.200.07.24	assigned
	Description	Multicast groups Service A	Ports US-allowed products	US-restricted products
ō	Multicast groups	224.0.50.64 - 74	59000	59032
Eurex MDI	Source networks	193.29.89.192/28	-	-
Eu	Rendezvous point Service A only	193.29.91.252/32	-	-
	Technical heartbeat Service A only	-	59086	-
			Ports	
	Description	Multicast groups Service A	US-allowed products	US-restricted products
Eurex EMDI	Multicast groups	224.0.50.0 - 63 224.0.29.0 - 55	Snapshot: 59000 Incremental: 59001	Snapshot: 59032 Incremental: 59033
ш	Source networks	193.29.89.0/27	-	
(0	Description		Ports	
	Description	Multicast groups Service A	US-allowed products	US-restricted products
ignals	Reference Data	224.0.114.1	59000	-
Eurex Market Signals	Eurex IOC liquidity Indicator for Options	224.0.114.128	59001	59033
ex Ma	Intraday Volatility Forecast	224.0.114.132	59001	59033
Eur	Risk Alerts	224.0.114.134	59001	59033
	Source networks	193.29.89.0/27	-	
Ð	Description	Multicast groups Service A	Ports	
at Data Service)	Multicast group: Ticker Feed	224.0.50.75	US-allowed products	US-restricted products
irkat Dat SS)	Multicast group: Settlement prices	224.0.50.77	59000 Replay: 59001	59032 Babley, 50022
nded Ma (EMI	Multicast group: Intraday open interest data	224.0.50.78	Replay: 55001	Replay: 59033
Eurex Extended Mark (EMDS)	Multicast group: Eurex T7 trades	224.0.50.79	Replay only: 59001	Replay only: 59033
Ш	Source networks	193.29.89.192/28	-	
-	Description Multicast groups	Mutlicast groups service A	Ports	
Eurex RDI	Snapshot data	224.0.50.0	59098	3
Eur	Multicast groups Incremental data	224.0.50.1	59099	
	Source networks	193.29.89.192/28	-	

Table 2, Eurex T7 market network details in DR scenario, part 2/3

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Report 1e	Opennestion antion			Ports	
	Connection option	Gateway IP address	IP subnets	Public	Particip.
Common Re Engine	Internet	193.29.90.129	-	2221	2222
	Leased line - side A	193.29.90.65	193.29.90.64/27		
Eurex EOBI	Description				
	currently not available	-	-		

Table 3, Eurex T7 market network details in DR scenario, part 3/3

3.1.2 EEX T7

The European Energy Exchange, EEX, market running on T7 shares infrastructure with Eurex T7. Therefore IP addresses for GUI servers, ETI and FIX gateways will be the same as for Eurex T7.

EEX multicast addresses from Eurex T7, but follow the same logic (only A-side, source network from simulation)

Interface	Connection option	URL / IP addresses		Ports	Protocol
GUI Landingpage	Internet	http://webgui.eurexchange.com/eme	http://webgui.eurexchange.com/emergency/eex/index.html		TCP/IP
	Leased line	http://193.29.93.173/emergency/eex/index.html http://webgui.vpn.eurexchange.com/emergency/eex/fqdn.html		80 / 8089	TCP/IP
Java WebStart	Internet	193.29.90.190	-	80 / (443)	TCP/IP
Ja Web	Leased line	193.29.93.173	193.29.93.160/28	80 / (443)	TCP/IP
xies		193.29.90.235	100.00.00.004/07	00	TODUD
to)Pro	Internet	192.29.90.236	193.29.90.224/27	80	TCP/IP
GUI (Crypto)Proxies	Leased line - side A	193.29.89.225	193.29.89.224/28	00 / 0000	TODUD
GUI	Leased line - side B	193.29.95.225	193.29.95.224/28	80 / 8089	TCP/IP
	Gateway type	IP subnets Side A	IP subnets Side B	Ports	Protocol
EEX ETI	HF trading gateways LF trading gateways	193.29.89.129 192.29.89.130 193.29.89.65 193.29.89.66 193.29.89.67 193.29.89.68	193.29.89.161 193.29.89.162 193.29.89.97 193.29.89.98 193.29.89.99 193.29.89.100	19006	TCP/IP
	Connection gateways	193.29.89.65	193.29.89.97	19008	TCP/IP
~					
EEX FIX Gateway	Connection option	IP addresses	IP subnets	Ports	Protocol
EEX FIX Gateway	Leased line - side A	90.150.253.31	90.150.253.0 / 24	Individually assigned	TCP/IP

Table 4, EEX T7 market network details in DR scenario, part 1/2

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	Description	Multicast groups Service A	Ports		
	Multicast groups	224.0.50.66	US-allowed products 59000	US-restricted p	
EEX MDI	Source networks	193.29.89.192/28	-	-	
EE)	Rendezvous point Service A only	193.29.91.252/32		-	
	Technical heartbeat Service A only	-	59086	-	
			Ports		
Ō	Description	Multicast groups Service A	US-allowed products	US-restricted p	roducts
EEX EMDI	Multicast groups	224.0.50.10 224.0.29.11	Snapshot: 59000 Incremental: 59001	Snapshot: 59032 Incremental: 59033	
-	Source networks	193.29.89.0/27	-		
	Description	Mutlicast groups service A	Ports		
EEX RDI	Multicast groups Snapshot data	224.0.29.0	59098		
EEX	Multicast groups Incremental data	224.0.29.1	59099		
	Source networks	193.29.89.192/28	-		
ort	Connection option	Gateway IP address	IP subnets	Ports	5
Repu	Connection option	Galeway IP address	IF Subhets	Public	Particip.
Common Report Engine	Internet	193.29.90.129	-	2221	2222
Con	Leased line - side A	193.29.90.65	193.29.90.64/27		
EOBI	Description				
EEX EO	currently not available	-	-		

Table 5, EEX T7 market network details in DR scenario, part $2\!/\!2$

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3.2 T7 network details cash market

3.2.1 Xetra T7

The following tables summarize all available interface connection details in a disaster recovery scenario for Xetra T7.

Interface	Connection option	URL / IP addresses		Ports	Protocol
age	Internet	http://webgui.xetra.com/emergency/in	http://webgui.xetra.com/emergency/index.html		TCP/IP
GUI Landingpage	http://193.29.93.174/emergency/index.html Leased line		dex.html	80 / 8089	TCP/IP
Lar	Leaseu inte	http:// webgui.vpn.xetra.com/emerge	ncy/fqdn.html	8078089	I GF/IF
Java WebStart	Internet	193.29.90.189	-	80 / (443)	TCP/IP
Ja Web	Leased line	193.29.93.174	-	80 / (443)	TCP/IP
oxies	Internet	193.29.90.233	193.29.90.224/27	80	TCP/IP
GUI (Crypto)Proxies	internet	193.29.90.234	193.29.90.224/27	80	I GF/IF
(Cryp	Leased line - side A	193.29.94.225	193.29.94.224/29	90 / 9090	
GUI	Leased line - side B	193.29.94.233	193.29.94.232/29	80 / 8089	TCP/IP
_	Gateway type	IP subnets Side A	IP subnets Side B	Ports	Protocol
Xetra ETI	HF trading gateways	193.29.94.129	193.29.94.161	19006	TCP/IP
Xetr	LF trading gateways	193.29.94.65	193.29.94.97		
	Connection gateways	193.29.94.65	193.29.94.97	19008	TCP/IP
ra vay	Connection option	IP addresses	IP subnets	Ports	Protocol
Xetra FIX Gateway	Leased line - side A	90.152.253.41	90.152.253.0/24	Individually assigned	TCP/IP
	Description	Multicast groups Service A	Ports		
_	Multicast groups	224.0.161.16 - 30	59000		
Xetra MDI	Source networks	193.29.94.192/28	-		
Xet	Rendezvous point Service A only	185.102.253.252	-		
	Technical heartbeat Service A only	-	59086		
	Description	Multicast groups Service A	Ports		
Xetra EMDI	Multicast groups	224.0.160.0 - 63	Snapshot: 59000		
Xetra	municast groups	224.0.100.0 - 05	Incremental: 5	59001	
	Source networks	193.29.94.0/27	-		

Table 6, Cash market network details in DR scenario, part 1/2

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Description Multicast groups Service A Ports Xetra Extended Markat Data Service (EMDS) All Trade Prices (ATP) 224.0.161.64 59000 Replay: 59001 Ticker feed 224.0.161.31 193.29.94.192/28 Source networks Description Mutlicast groups service A Ports Multicast groups RDI 224.0.161.0 59098 Snapshot data Xetra Multicast groups 224.0.161.0 59099 Incremental data Source networks 193.29.94.192/28 Common Report Engine Ports Gateway IP address **Connection option** IP subnets Public Particip. Internet 193.29.90.129 2221 2222 Leased line - side A 193.29.90.65 193.29.90.64/27 Description Xetra EOBI currently not available _ _

Table 7, Cash market network details in DR scenario, part 2/2

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3.2.2 Xetra Vienna T7

The following tables summarize all available interface connection details in a disaster recovery scenario for Xetra Vienna T7

Interface	Connection option	URL / IP addresses	Ports	Protocol	
age	Internet	http://webgui.xetra.com/emergency/xvie/index.html		80	TCP/IP
GUI Landingpage	Lanad Bas	http://193.29.93.174/emergency/xvie/index.html		80 / 8089	
Leased line		http://webgui.vpn.xetra.com/emerge	http://webgui.vpn.xetra.com/emergency/xvie/fqdn.html		TCP/IP
Java WebStart	Internet	193.29.90.189	-	80 / (443)	TCP/IP
Ja Web	Leased line	193.29.93.174	-	80 / (443)	TCP/IP
oxies	Internet	193.29.90.233	102 20 00 224/27	80	TCP/IP
GUI (Crypto) Proxies	Internet	193.29.90.234	193.29.90.224/27	80	ICF/IF
(Cryp	Leased line - side A	193.29.94.225	193.29.94.224/29	80 / 8089	TCP/IP
GUI	Leased line - side B	193.29.94.233	193.29.94.232/29	8078089	I GF/IF
	Gateway type	IP subnets Side A	IP subnets Side B	Ports	Protocol
ETI					
Xetra ETI	Trading gateways (LF only)	193.29.94.65	193.29.94.97	19006	TCP/IP
	Connection gateways	193.29.94.65	193.29.94.97	19008	TCP/IP
Xetra FIX Gateway	Connection option	IP addresses	IP subnets	Ports Individually	Protocol
Xe Fl Gati	Leased line - side A	90.152.253.41	90.152.253.0/24	assigned	TCP/IP
	Description Multicast groups	Multicast groups Service A 224.0.161.32 - 38	Ports		
MDI	Source networks	193.29.94.192/28		,	
Xetra MDI	Rendezvous point	185.102.253.252			
	Service A only Technical heartbeat	-	59086		
	Service A only		59060		
	Description	Multicast groups Service A	Ports		
MDI			Snapshot: 5		
Xetra EMDI	Multicast groups	224.0.160.64 - 95	Incremental:	59001	
Xe	Source networks	193.29.94.0/27	-		

Table 8, Vienna cash market network details in DR scenario, part 1/2

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ta	Description	Multicast groups Service A	Ports		
Ticker feed 224.0.161.39		224.0.161.68	59000		
		Replay: 59001			
Xetra	Source networks	193.29.94.192/28	-		
	Description	Mutlicast groups service A	Ports		
RDI	Multicast groups Snapshot data	224.0.161.1	59098		
Xetra	Multicast groups Incremental data	224.0.161.1	59099		
	Source networks	193.29.94.192/28	-		
Common Report Engine	Connection option	Gateway IP address	IP subnets	Ports Public	Particip.
Common port Engi	Internet	193.29.90.129	-		
Repo	Leased line - side A	193.29.90.65	193.29.90.64/27 2221		2222
E E	Description				
Xetra EOBI	currently not available	-	-		

Table 9, Vienna cash market network details in DR scenario, part 2/2

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3.2.3 Xetra Dublin T7

The following tables summarize all available interface connection details in a disaster recovery scenario for Xetra Dublin T7

Interface	Connection option	URL / IP addresses Prot			Protocol
age	Internet	http://webgui.xetra.com/emergency/xdub/index.html		80	TCP/IP
GUI Landingpage		http://193.29.93.174/emergency/xdub/index.html		00 / 0000	700/10
Leased line		http://webgui.vpn.xetra.com/emerger	ncy/xdub/fqdn.html	80 / 8089	TCP/IP
Java ebStart	Internet	193.29.90.189	-	80 / (443)	TCP/IP
Java WebStart	Leased line	193.29.93.174	-	80 / (443)	TCP/IP
xies		193.29.90.233			700 // 0
GUI (Crypto)Proxies	Internet	193.29.90.234	193.29.90.224/27	80	TCP/IP
(Cryp	Leased line - side A	193.29.94.225	193.29.94.224/29	00 / 0000	T00//0
GUI	Leased line - side B	193.29.94.233	193.29.94.232/29	80 / 8089	TCP/IP
ETI	Gateway type	IP subnets Side A	IP subnets Side B	Ports	Protocol
Xetra E	Trading gateways (LF only)	193.29.94.65	193.29.94.97	19006	TCP/IP
×	Connection gateways	193.29.94.65	193.29.94.97	19008	TCP/IP
~					
Xetra FIX Gateway	Connection option	IP addresses	IP subnets	Ports	Protocol
X F Gat	Leased line - side A	90.152.253.41	90.152.253.0/24	Individually assigned	TCP/IP
	Description	Multicast groups Service A	Ports		
=	Multicast groups	224.0.161.40 - 46	59000)	
Xetra MDI	Source networks	193.29.94.192/28	-		
Xet	Rendezvous point Service A only	185.102.253.252	-		
	Technical heartbeat Service A only	-	59086		
_	Description	Multicast groups Service A	Ports		
Xetra EMDI	Multicast groups	224.0.160.96 - 103	Snapshot: 59000 Incremental: 59001		
		193.29.94.0/27	-		

Table 10, Dublin cash market network details in DR scenario, part 1/2

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Data	Description Multicast groups Service A		Ports		
All Trade Prices (ATP) Service (EMDS) Ticker feed Ticker feed		224.0.161.72	59000		
Xetra Extende Service	Ticker feed	224.0.161.47	Replay: 59001		
Xe	Source networks	193.29.94.192/28	-		
	Description	Mutlicast groups service A	Ports		
Xetra RDI	Multicast groups Snapshot data	224.0.161.2	59098		
Xetra	Multicast groups Incremental data	224.0.161.2	59099		
	Source networks	193.29.94.192/28	-		
Common Report Engine	Connection option	Gateway IP address	IP subnets	Port Public	s Particip.
mon Re Engine	Internet	193.29.90.129	-		0000
Com	Leased line - side A	193.29.90.65	193.29.90.64/27	2221	2222
Xetra EOBI	Description				
Xe EC	currently not available	-	-		

Table 11, Dublin cash market network details in DR scenario, part 2/2

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4 Disaster recovery test scope

Disaster recovery test exercises will be performed once a year on a weekend (usually Saturday). DR test exercises haven been aligned with the yearly FIA business continuity test (see https://bcp.fia.org) in 2016 and 2017. Participation in the DR test exercise is optional but highly recommended for all trading and clearing participants to ensure easy transition in case of a real disaster.

During a DR test, exercise production reference data will be used, including User IDs, T7 GUI SSH keys and ETI sessions. Changes done to these reference data will not be copied back to production after the test. It is not advised to perform any changes to this data during the test exercise.

Any order book or trading information created during the DR test exercise will <u>not</u> be transferred back to production.

The scope of DR test exercises is as follows:

The following T7 interfaces will be available during the DR test exercise

- Enhanced Transaction Solution (ETI)
- T7 Market Data Service (MDI)
- T7 Enhanced Market Data Service (EMDI)
- T7 GUI
- Reference Data Interface (RDI)
- Reference Data File (RDF)
- Common Report Engine (CRE)

Customers participating in the DR test exercise can

- receive market data via MDI, EMDI and T7 GUI
- read reference data via RDI
- receive Reference Data File (RDF) provided by CTS on request
- enter orders and quotes via ETI and T7 GUI
- access CRE

The following T7 interfaces will <u>not</u> be available during the DR test <u>exercise</u>

- FIX Gateway
- Enhanced Order Book Interface (as no CoLocation installations are available in this scenario)
- Extended Market Data Service
- Market Signals (MS)

The Xetra legacy trading system and the Clearing systems C7 and CCP are not participating in the DR test exercise. No data generated during a DR test exercise is forwarded to any Clearing system.

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4 September	20	1	7
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T7 Disaster Recovery Concept Interface Configuration Details Change log

5 Change log

The change log describes on a higher level, what changed in the latest version of the document over older versions.

No	Chapter, page	Date	Change
1.0.0		27 Sept 2013	Initial version the Eurex Exchange's T7 Disaster Recovery Concept
2.0.0	All	25 July 2016	Added EOBI, EMDS and Eurex Market Signals
3.1.1	All	31 August 2017	Change to common document including T7 cash markets and EEX