 **NETWORK CONNECTIVITY
OPTIONS GUIDE
1.5 – September 2011**

Table of Contents

	Revision History	3
1	INTRODUCTION	4
	Document Purpose	4
	Intended Audience	4
2	CONNECTION POLICY	5
	Bandwidth Requirements	5
	Datacentre	5
	Resilient Communication Links.....	5
	Firewall Policy	5
	Monitoring	6
	Testing	6
3	CONNECTION TYPES	7
	Consolidated Providers.....	7
	Internet.....	8
	VPN	8
	FTP & sFTP	8
	Fixed Link	8
	Local Connect.....	9
	Network Address Translation (Fixed Links)	9
4	GATEWAY OPERATION.....	10
	Market Data	10
	Trading.....	11
5	APPENDIX.....	13
	Typical Leased line Connectivity Topology	13
	Typical Consolidated Provider Connectivity Topology	14
	Fix Connectivity Information	15
	VPN Connectivity Options.....	16
	Gateway address information	17

REVISION HISTORY

Version	Date Issued	Author	Comment
v1.0	March 2008	Equiduct Systems	
v1.1	March 2009	Equiduct Systems	
v1.2	September 2009	Equiduct Systems	
v1.3	November 2010	Equiduct Systems	
v1.4	November 2010	Equiduct Systems	
V1.5	September 2011	Oliver Jeyes	Bandwidth Requirement revision

1 INTRODUCTION

DOCUMENT PURPOSE

This document describes the network communication types recommended for connection to Equiducts suite of financial services.

Equiduct Systems will support customers in selecting the best method for a connection, taking into account the requirements and restrictions of each customer. Only in the event that a service is severely impacted by the chosen connectivity method will Equiduct prescribe an alternative connection type.

In the offered connectivity options, Equiduct has always sought best of breed on suppliers, shortest link in network distance and carriers able to offer diverse routes to ensure an uninterrupted service.

The Connection Policy outlines general assumptions and design considerations common to all connection options and describes the methods of communication supported by Equiduct.

The connection options have been divided into three communication types:

- Internet
- Direct connection
- Consolidated suppliers

Not all communication options listed are appropriate for all Equiduct services.

Equiduct will always endeavour to support any suggested connectivity option so long as the option will perform appropriately, is reliable and cost effective.

Equiduct offers trading and market data services from both production and from a functionally identical User Acceptance Test (UAT) environment.

INTENDED AUDIENCE

This document is aimed at all Equiduct market participants and distributors of market information.

This document seeks to provide all alternatives for connectivity, should another connectivity option be required, please contact Equiduct directly at onboarding@equiduct.com

2 CONNECTION POLICY

BANDWIDTH REQUIREMENTS

Bandwidth requirement is dependent upon the number and type of services required by an individual firm.

See the table below for a guide of the bandwidth requirements for each logical connection for Order Entry and the various Market Data Product offerings.

Equiduct Services	Recommended Bandwidth
Order Entry	256Kb (largely dependent on the flow sent to Equiduct).
FIX HybridBook	20 Mb
FIX VBBO	20 Mb
FIX Market by Limit	20 Mb
ITCH HybridBook	10 Mb
ITCH VBBO	20 Mb
ITCH Market by Limit	20 Mb

For Market Data connections the recommended bandwidth is sufficient for a single logical connection consuming all streams (e.g. Level I, Full Price Depth and Time & Sales where applicable) for all stocks in the Equiduct universe. Multiple logical connections, e.g. for redundancy/resiliency, will require a multiple of the recommended bandwidth.

As a growing market, Equiduct monitors activity levels and bandwidth consumed and may review and adjust the bandwidth recommendations from time to time in line with increasing market activity.

DATA CENTRE

Equiduct has selected capacity within Interxion's datacentre at:

Interxion
11 Hanbury Street
London
E1 6QL

The datacentre meets the standard expected of the technology infrastructure of a Regulated Market. The selected datacentre currently provides capacity for other execution venues and the wider financial services community; enabling excellent local connectivity and access to exceptionally low latency, high quality market data information.

RESILIENT COMMUNICATION LINKS

Equiduct has a policy of using multiple carriers for network connectivity to its clients. In selecting a communication partner, both legs of a resilient circuit are mapped to ensure they do not share any common infrastructure. Where appropriate, we recommend separate carriers are selected to prevent systemic failures affecting service delivery.

FIREWALL POLICY

All connections to Equiduct are firewalled providing mutual protection as well as segregating traffic from other Equiduct users. Connectivity is regulated by use of source & destination addresses and TCP ports.

MONITORING

All of Equiduct Systems external links are monitored continuously.

TESTING

Equiduct will offer differing levels of test connection

- Basic connectivity testing to test integrity of the links
- Functionality testing is available in the UAT system using a basic VPN connection
- Failover testing can be undertaken when the full production network solution is installed

3 CONNECTION TYPES

CONSOLIDATED PROVIDERS

Equiduct supports connectivity from consolidated providers such as BTRadianz, Atrium, Savvis, VFn and TNS as well as serial and Ethernet connectivity from carriers such as Colt, BT, Verizon, Abovenet, Level 3, Geo Net, Hibernia, EUNetworks, Edge Telecom and Interroute.

In addition we have 3rd party demarcation areas at the datacentre set aside for the hosting of client equipment.

Consolidated providers provide a single point of contact for multiple financial services. Equiduct have aligned themselves with several of these providers ensuring that their point of presence is close (in network terms) to the hubs of their networks. Each of the consolidated providers has a highly resilient connection at the Interxion datacentre.

The consolidated provider networks are resilient and well managed with connectivity to most domestic European Stock Exchanges and leading Investment Firms.

Equiduct have connections to BTRadianz, Savvis, Atrium and VFN and support for additional providers is in the pipeline.

The consolidated providers will NAT network addresses to maintain IP addressing structure across their network.

BTRadianz	Atrium Networks	Verizon Financial Network (VFn)
BT GFS Kinsfield House 66 Prescott Street London E1 8HG	5th Floor 39 Houndsditch London EC3A 7DB	Reading International Business Park Basingstoke Road Reading Berkshire RG2 6DA
Contact: James Barratt Phone: +44(0)207 778 4089 email: james.barratt@bt.com	Contact: Des Peck Phone : +44 (0) 203 194 2510 email: des.peck@atriumnetwork.com	Contact : Ola Westman Phone Number: +46856617606 email: ola.westman@se.verizonbusiness.com
Transact Network Services (TNS)	IPC	MarketPrizm
99 Charterhouse Street London EC1M 6HR	Tower House 67-73 Worship Street London EC2A 2DZ	Beaufort House 15 St Botolph Street London EC3A 7QN
Contact: John Owens Phone: +44 207 336 1526 email: JOwens@tnsi.com	Contact: Maajid Khan Phone : +44 (0) 207 979 7226 email: Maajid.Khan@ipc.com	Contact: info@marketprizm.com Phone: +44 (0) 203 480 8100 Web: www.marketprizm.com

INTERNET

The Internet is an alternative and convenient method of delivering information. It is not, however, under the control of Equiduct or their clients/vendors. Failures within the Internet can result in traffic being redirected over less than optimum routes. Congestion within the Internet is not uncommon and this can also impact the transfer of critical financial data.

Whilst unable to prevent failures or congestion within the Internet, Equiduct has access to multiple Internet Service Providers (ISP). In the event of a problem within the network of one ISP, Equiduct can manually alter the links to another ISP in order to improve response times. In selecting an ISP network, Equiduct will ensure that the optimum route is selected on response time (round trip delay) basis not on number of hops.

VPN

VPNs are easy to set up and provide a secure method of information delivery. Equiduct will support both point-to-point (for more secure access) and remote access (primarily for testing) type of VPN.

Supported VPN Point-to-Point protocols:

- IPSEC VPN (with Internet key subscription) using pre-shared keys which are exchanged on the phone after the VPN connectivity form has been returned.

Equiduct would prefer not to use VPN for trading services but would consider VPN tunneling as a potential DR solution. VPN connectivity is most commonly used as a quick enabler of connectivity to our User Acceptance Test (UAT) system.

[See Appendix: VPN connection options](#)

FTP & sFTP

Equiduct have ftp and sftp servers for the delivery of end of day reports and reference data files. The servers can be accessed from all provided connectivity types: Internet based VPN, direct or via consolidated providers.

The servers' address and TCP port numbers are provided as part of the onboarding documents.

FIXED LINK

Fixed link is a layer 2 circuit directly between Equiduct and client/vendor. The two types considered here are the leased line and local direct connection.

LEASED LINE (LAYER 2)

A leased line link is a Point-to-Point layer 2 connection between Equiduct and client/Vendor. This link could be a serial connection but Ethernet is the preferred protocol.

- Ethernet
- Dark(or fractals) fiber

Links should be provided as a resilient pair.

This can be provided by Colt, Verizon, Abovenet, Level 3, Geo net, Hibernia, EUnetworks, Edge Telecom and Interroute. The client is responsible for the carrier choice but we typically recommend that the customer go with a carrier that is on-net at Interxion as this will reduce the lead time of the circuit.

LOCAL CONNECT

Equiduct's policy of placing systems within datacentres hosting other execution venues, market data providers and clients means that many of Equiduct's client and vendor equipment will be adjacent to Equiduct's. This allows for layer 2 connections with ultra low latency, maximum security and the lowest cost. Where possible, local connects are the first choice method of connection.

Please note that there is an associated cross connect charge for the local connection. This is limited to a one-off cost and no monthly charges.

Equiduct uses BGP as the routing protocol over this connection.

NETWORK ADDRESS TRANSLATION (FIXED LINKS)

Where Equiduct provides CPE devices on a customer's site Equiduct will take care of all NAT and will present in line with the customers addressing. Where a customer provides CPE equipment they will be responsible for the NAT boundary. We require the use of a globally unique address space that is allocated to them or, that they NAT to an Equiduct address range which will be provided. Where this is not acceptable to them they will be required to perform NAT on their own devices.

4 GATEWAY OPERATION

MARKET DATA

There are two services within this product:

- “conflated” a time sliced presentation of the market data
- “tick by tick” all market information.

All market data “MD” gateways support both services differentiated by TCP port. The Port number will be the same across all gateways however each gateway has an individual address. This address will depend on the type of connectivity and whether NAT is employed or not. Equiduct will always provide a primary and secondary gateway. A connection to a single Gateway will be sufficient to deliver all market data requirements.

Market Data is available over two protocols:ITCH and FIX.

NORMAL OPERATION

There are two gateways assigned to each client. (ie Gateways A and B). Both gateways are live ready to service the client market data requests and will deliver identical streams of data.

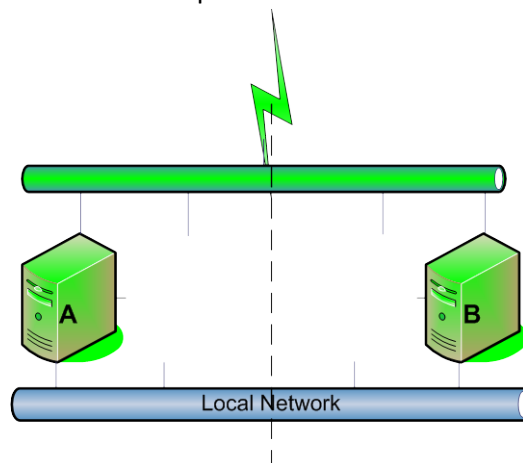
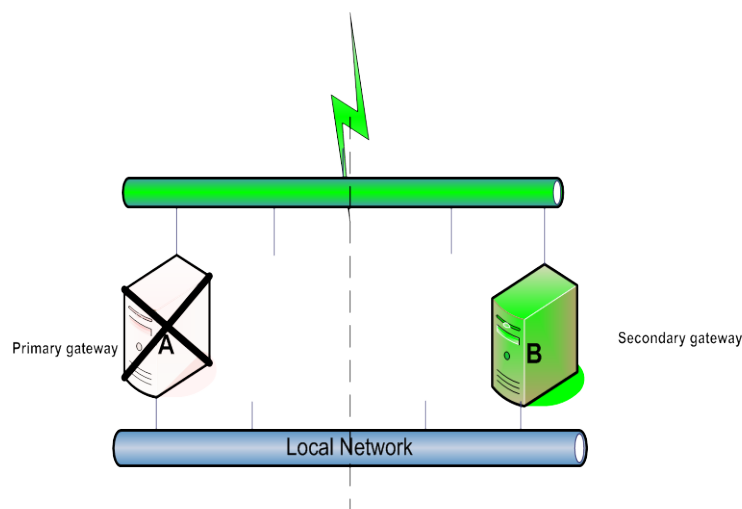


Fig b: live-live scenario for the MD gateways

GATEWAY FAILURE

Should any of the gateways fail then the other gateway will still be available for client connectivity.



TRADING

For trading “TX” gateways (Order Entry and Execution flow), there is a primary and secondary gateway for each client connection. A point to point connection is made to a primary Trading Gateway and in the event of a gateway failure the secondary gateway will be available for servicing the client requests.

NORMAL OPERATION

Client connects to the primary gateway A and gateway B is configured as a hot standby to take over in the event of gateway A failing.

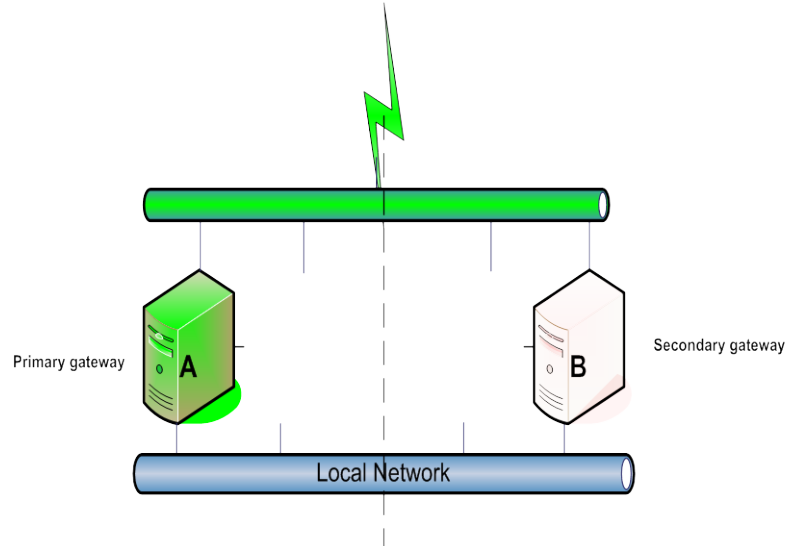
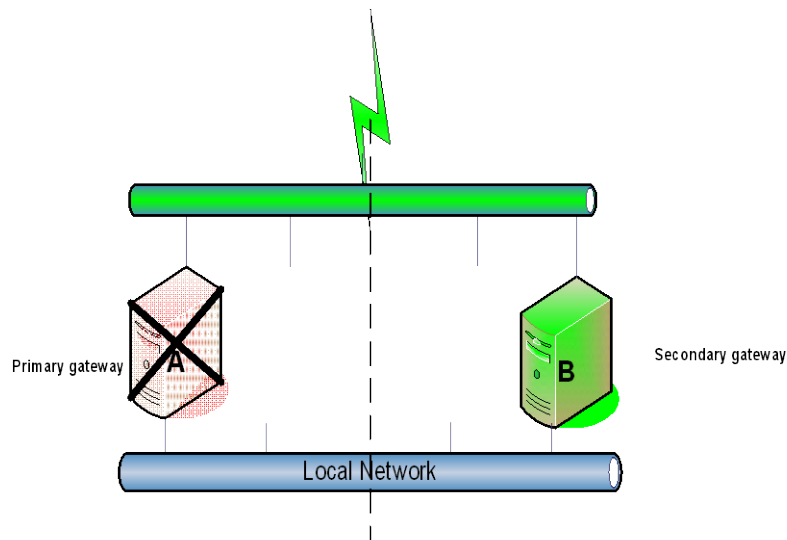


fig.c : host-standby scenario for the TX gateways

GATEWAY FAILURE

In the event of a failure of primary gateway A connection is made to gateway B. Note that gateway A and B are synchronised so there is no loss of data after the FIX session resynchronisation.

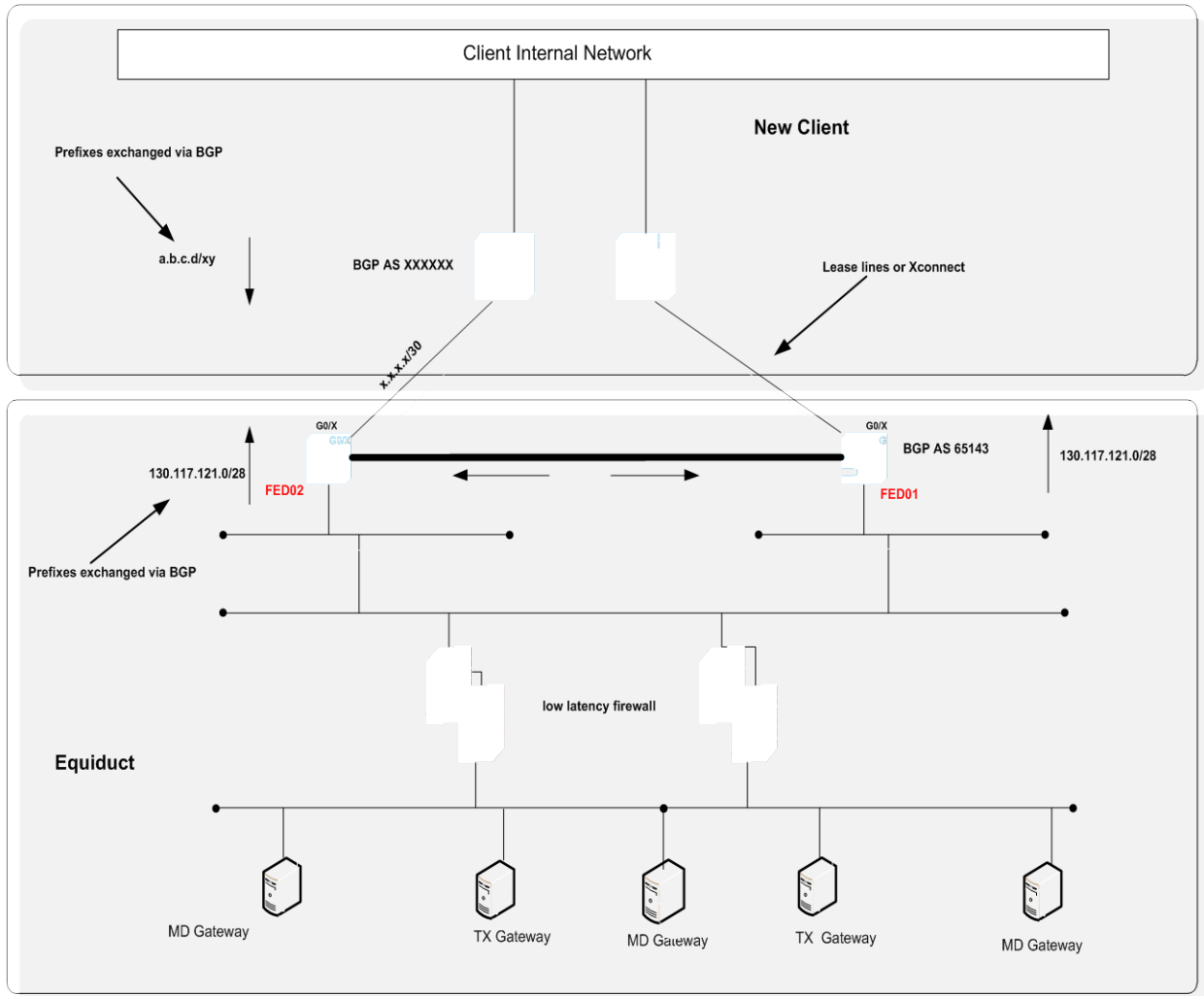


UAT

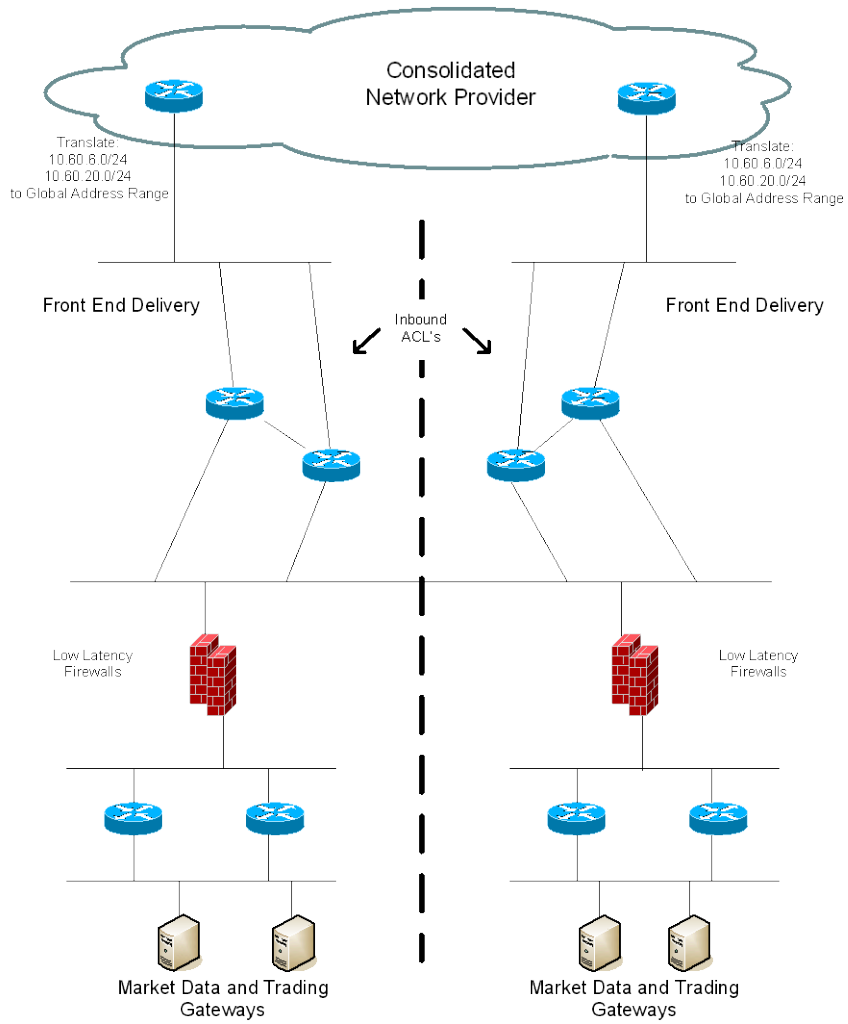
Equiduct offer a single Virtual IP address which provides connectivity two both Market Data and Transactional UAT gateways. Client will be allocated a specific port username and password. Equiduct can offer VPN connectivity to provide fast commissioning of a UAT connection. Client host address information will be required for firewall access.

5 APPENDIX

TYPICAL LEASE LINE CONNECTIVITY TOPOLOGY



TYPICAL CONSOLIDATED PROVIDER CONNECTIVITY TOPOLOGY



FIX CONNECTIVITY INFORMATION

EQUIDUCT		Company Name	
		Service type Trading Market Data	
Fix Connectivity information			
FIX version	4.4		
Heartbeat Interval	30 sec		
Gateway Session	Start (CET)	06:00	End 18:30
Market	Open (CET)	09:00	Close 17:35
Gateway	Primary	Gateway	Secondary
Service	Production Trading	Service	Production Trading
Host IP	75.124.145.230	Host IP	75.124.145.231
Port	10001	Port	10001
Sender CompID(tag 49)	TEST	Sender CompID(tag 49)	TEST
Target CompID(tag 56)	SERV	Target CompID(tag 56)	SERV
Username	TESTT01	Username	TESTT01
Password	TESTT01	Password	TESTT01
Gateway	DR-Primary	Gateway	DR-Secondary
Service	Production DR Trading	Service	Production DR Trading
Host IP	75.124.157.72	Host IP	75.124.157.73
Port	10000	Port	10000
Sender CompID(tag 49)	TEST	Sender CompID(tag 49)	TEST
Target CompID(tag 56)	SERV	Target CompID(tag 56)	SERV
Username	TESTT01	Username	TESTT01
Password	TESTT01	Password	TESTT01
Gateway	Primary	Gateway	Secondary
Service	Production Market Data	Service	Production Market Data
Host IP	75.124.145.228	Host IP	75.124.157.71
Port	10002	Port	10002
Sender CompID(tag 49)	TEST	Sender CompID(tag 49)	TEST
Target CompID(tag 56)	MRKD	Target CompID(tag 56)	MRKD
Username	TESTM01	Username	TESTM01
Password	TESTM01	Password	TESTM01
Gateway	Primary		
Service	Production Market Data		
Host IP	75.124.157.70		
Port	10000		
Sender CompID(tag 49)	TEST		
Target CompID(tag 56)	MRKD		
Username	TESTM01		
Password	TESTM01		
FTP site credentials	75.124.145.225		
	75.124.157.66		
Logon	ftp.abcd		
Password			

VPN CONNECTIVITY OPTIONS

<h1 style="margin: 0;">EQUIDUCT</h1>	UAT VPN Connection Options
Please complete and return to Equiduct Network Services	
Name of Data Vendor	<input style="width: 100%;" type="text"/>
Technical contact	<input style="width: 100%;" type="text"/>
Name	<input style="width: 100%;" type="text"/>
Phone	<input style="width: 100%;" type="text"/>
Email	<input style="width: 100%;" type="text"/>
Business Contact	<input style="width: 100%;" type="text"/>
Name	<input style="width: 100%;" type="text"/>
Phone	<input style="width: 100%;" type="text"/>
Email	<input style="width: 100%;" type="text"/>
VPN Configuration	
Equiduct Configuration	
VPN termination Equipment Manufacturer	<input style="width: 100%;" type="text" value="Cisco ASA"/>
VPN Peer address	<input style="width: 100%;" type="text" value="149.7.45.100"/>
Subnet requiring access (For interesting traffic)	<input style="width: 100%;" type="text" value="192.168.190.200/32"/>
Customer Configuration	
VPN termination Equipment Manufacturer	<input style="width: 100%;" type="text"/>
VPN Peer address	<input style="width: 100%;" type="text"/>
Subnet requiring access (For interesting traffic)	<input style="width: 100%;" type="text" value="e.g.. 10.1.1.0/24"/>
ISAKMP Phase1 Default	
Authentication	PSK RSA RSA Nonce <input style="width: 100%;" type="text" value="PSK"/>
Encryption	3 DES 3 DES <input style="width: 100%;" type="text" value="3 DES"/>
HMAC	SHA-1 MD5 <input style="width: 100%;" type="text" value="SHA-1"/>
Diffie-Hellamn	Group 2 Group1 Group 5 <input style="width: 100%;" type="text" value="Group 2"/>
Lifetimes	86400 Sec. User definable <input style="width: 100%;" type="text" value="86400"/>
IPSEC Policy Phase2 Default	
Encryption*	3 DES 3 DES <input style="width: 100%;" type="text" value="3 DES"/>
HMAC	SHA-1 MD5 <input style="width: 100%;" type="text" value="SHA-1"/>
Diffie-Hellamn	Group 2 Group1 Group 5 <input style="width: 100%;" type="text" value="Group 2"/>
Lifetimes	3600 Sec. User definable <input style="width: 100%;" type="text" value="3600"/>
Ipssec mode *	Tunnel Mode <input style="width: 100%;" type="text" value="Tunnel"/>
<p><i>* You should ensure your firewall can support 10mbps of ipsec throughput using the chosen encryption.</i></p> <p><i>* Transport mode cannot be used.</i></p>	

GATEWAY ADDRESS INFORMATION

Equiduct Addresses for the different consolidated providers				
Gateways	BTR Address	Atrium	VFn	Leased Lines
TX Gateway 1	75.124.145.230	83.151.87.227	10.60.6.11	130.117.121.3
TX Gateway 2	75.124.145.231	83.151.87.228	10.60.6.12	130.117.121.4
MD Gateway1	75.124.145.228	83.151.87.225	10.60.6.9	130.117.121.1
MD Gateway2	75.124.145.229	83.151.87.226	10.60.6.10	130.117.121.2
FTP Server 1	75.124.145.225	83.151.88.134	10.60.20.180	130.117.121.5
FTP Server 2	75.124.157.66	83.151.79.114	10.60.20.190	130.117.121.6
Test Gateway	75.124.159.190	83.151.88.133	10.50.1.106	130.117.121.7