equiduct
The trading venue of tomorrow, today

Network connectivity options guide

September 2019

Revision History

Version	Date issued	Author	Comments
v1.0	March 2008	Equiduct Systems	
v1.1	March 2009	Equiduct Systems	
v1.2	September 2009	Equiduct Systems	
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v1.4	November 2010	Equiduct Systems	
v1.5	September 2011	Oliver Jeyes	Bandwidth Requirement revision
v1.6	December 2013	Oliver Jeyes	Updated Server IP details.
v1.7	April 2016	Equiduct Systems	Updated Server IP details
v1.8	January 2019	George Cox	Removal of FIX MD
v1.9	September 2019	Kader Thiam	VPN topology addition. Updated leased-line and consolidated providers topologies. Removal of FIX/ITCH form (BTR). Removal of TMX Atrium.

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1 Introduction

1.1 Document purpose

This document describes the network communication types recommended for connection to Equiduct's 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.

1.2 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

2.1 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
FIX Order Entry	256Kb (largely dependent on the flow sent to Equiduct).
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.

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.

2.2 Datacentre

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.

2.3 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.

2.4 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.

2.5 Monitoring

All of Equiduct Systems external links are monitored continuously.

2.6 Testing

Equiduct will offer differing levels of test connection:

- Basic connectivity testing to test integrity of the links
- Functionality testing is the 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

3.1 Consolidated providers

Equiduct supports connectivity from consolidated providers such as BTRadianz, Colt PrizmNet, ICE Data Services, 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, ICE Data Services, VFn, TNS, IPC, Colt PrizmNet & Pico Global and support for additional providers is in the pipeline.

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

Pico Global	**ICE Global Network**	**Verizon Financial Network (VFn)**
122 Leadenhall Street, 30th Floor London EC3V 4AB	5th Floor Milton Gate 60 Chiswell Street London EC1Y 4SA	Reading International Business Park Basingstoke Road Reading Berkshire RG2 6DA
Shamir Parmar +44 (0)207 550 0888 shamir.parmar@pico.global	IGN Sales Team +44 (0) 207 429 4610 ICEglobalnetwork-info@theice.com	Akdag Sezen sezen.akdag@uk.verizon.com
Transact Network Services (TNS)	**IPC**	**Colt PrizmNet**
99 Charterhouse Street London EC1M 6HR	Tower House 67-73 Worship Street London EC2A 2DZ	Colt House 20 Great Eastern Street London EC2A 3EH
John Owens +44 (0)207 336 1526 JOwens@tnsi.com	Maajid Khan +44 (0)207 979 7226 Maajid.Khan@ipc.com	Andrew Young +44 (0)7966 967731 Andrew.Young@colt.net
BT Radianz		
BT GFS Kinsfield House 66 Prescot Street London E1 8HG		
James Barratt +44(0)207 778 4089 james.barratt@bt.com		

3.2 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.

3.3 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 tunnelling as a potential DR solution. VPN connectivity is most commonly used as a quick enabler of connectivity to our User Acceptance Test (UAT) system.

3.4 SFTP

Equiduct have 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.

3.5 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.

3.6 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) fibre

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.

3.7 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. As standard, these are 1 Gigabit links.

3.8 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

4.1 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 the ITCH protocol.

4.1.1 Normal operation

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

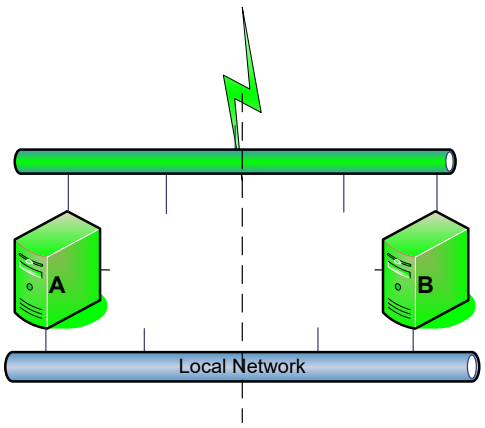


Figure a: live-live scenario for the MD gateways.

4.1.2 Gateway failure

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

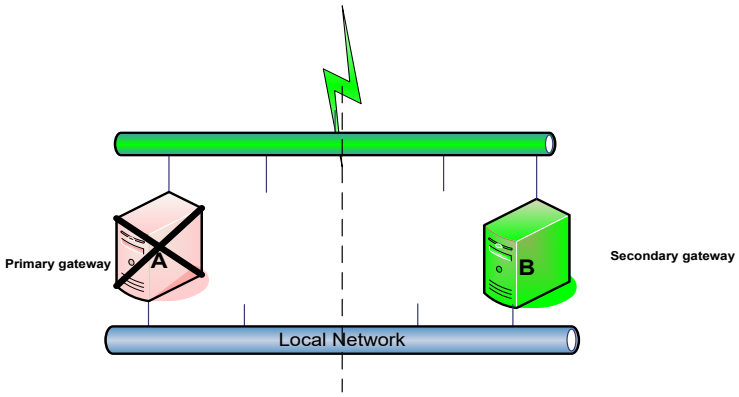


Figure b: failure scenario for the MD gateways.

4.2 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.

4.2.1 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.

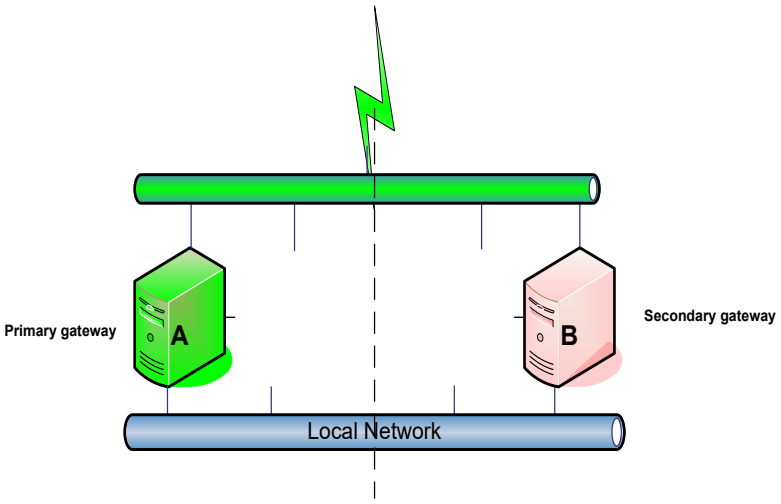


Figure c: hot-standby scenario for the TX gateways.

4.2.2 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.

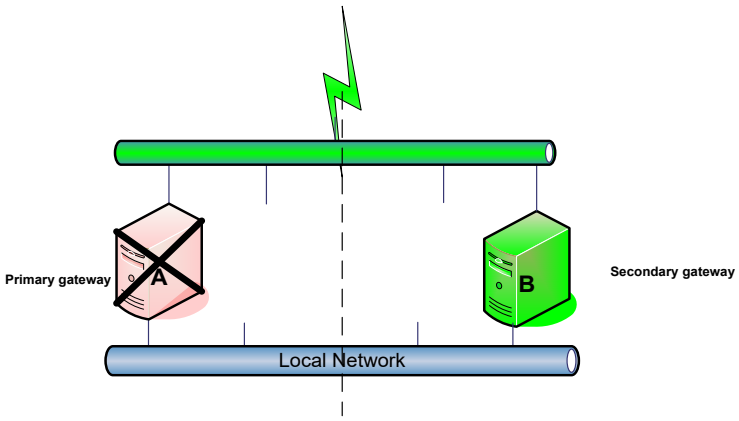


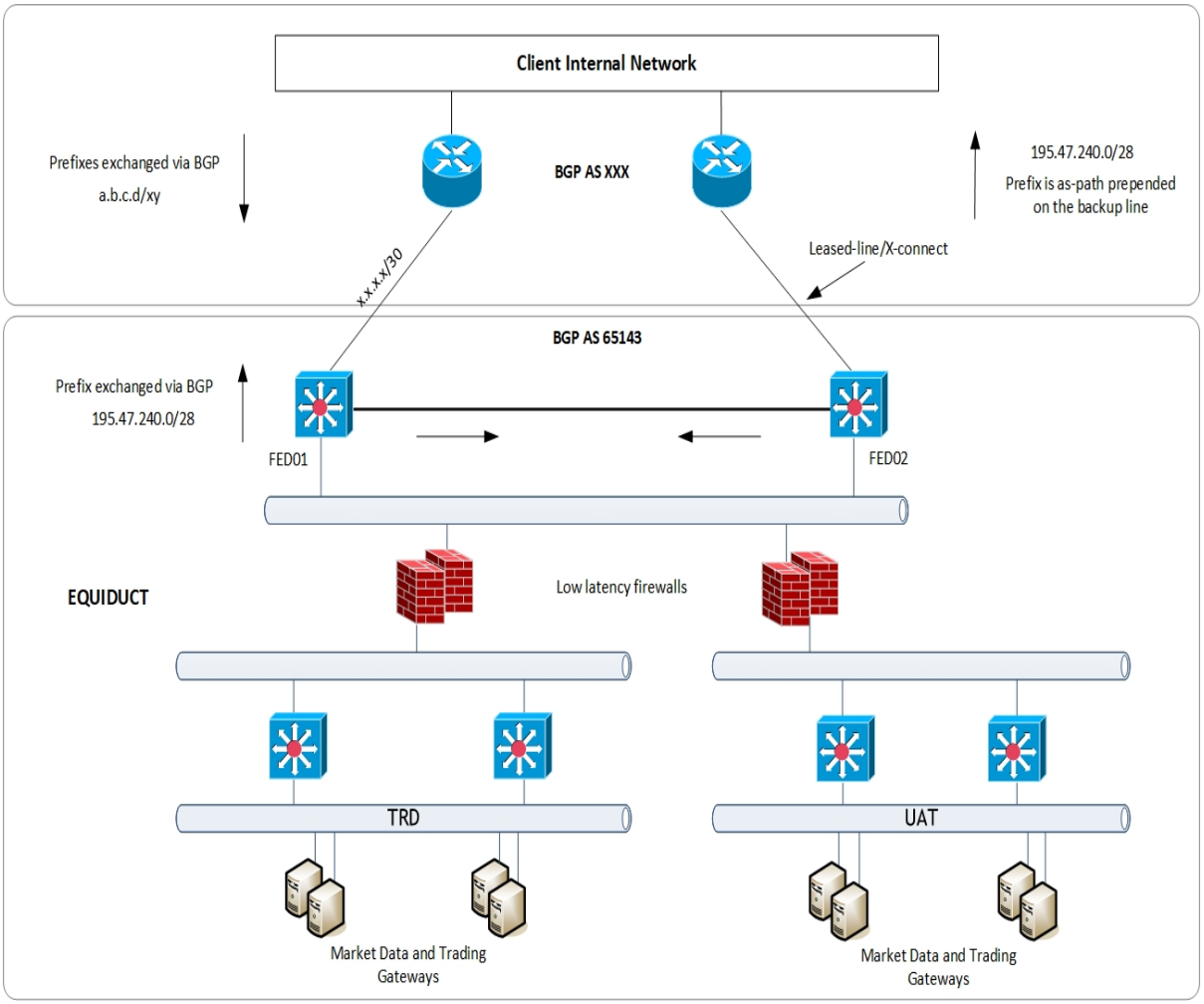
Figure d: failure scenario for hot-standby TX gateways.

4.3 UAT

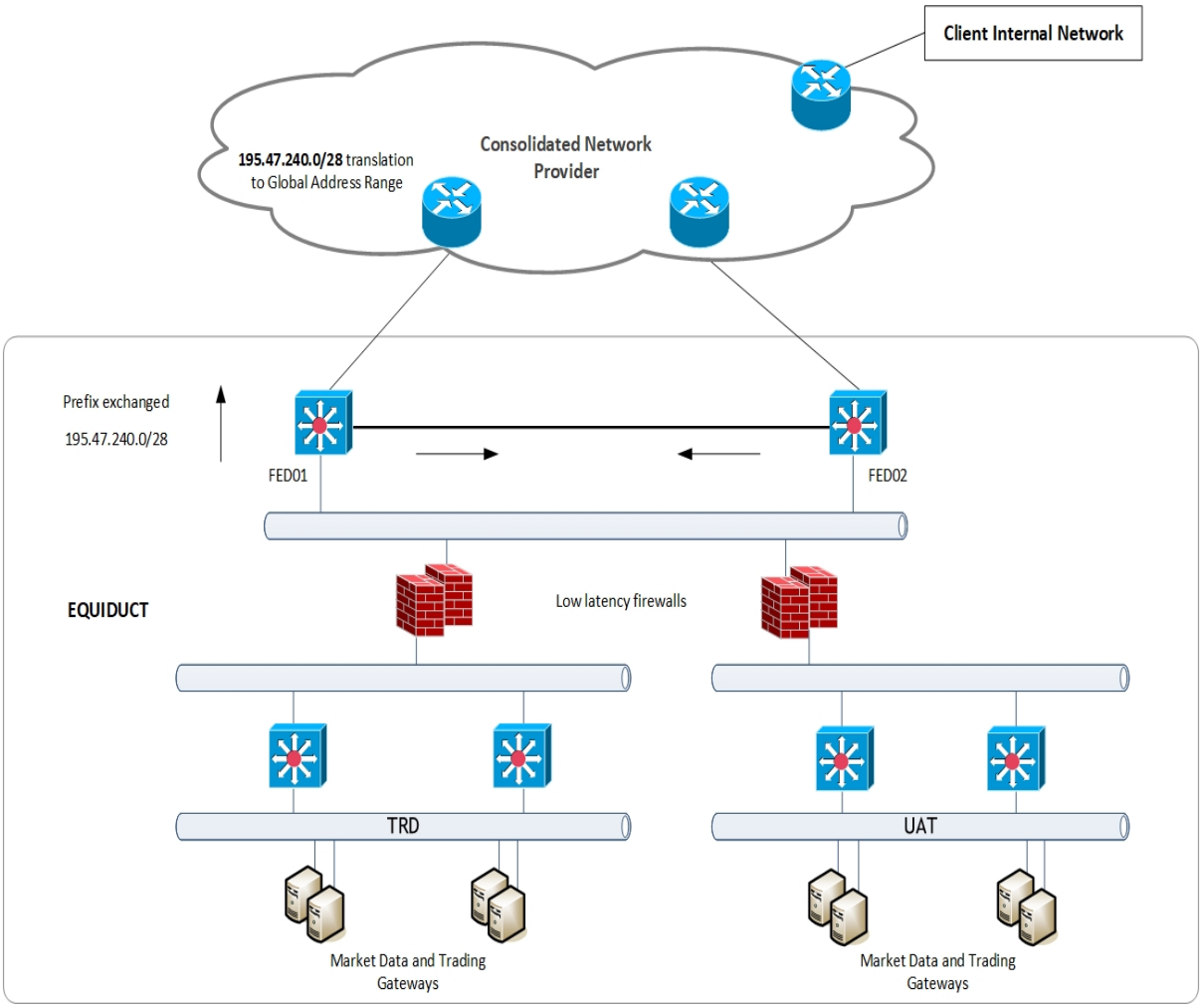
Equiduct offer a single Virtual IP address which provides connectivity two both Market Data and Transactional UAT gateways. Client will be allocated a specific port username and password. Equiduct can offer VPN connectivity to provide fast commissioning of a UAT connection. Client host address information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

Appendix A Topologies

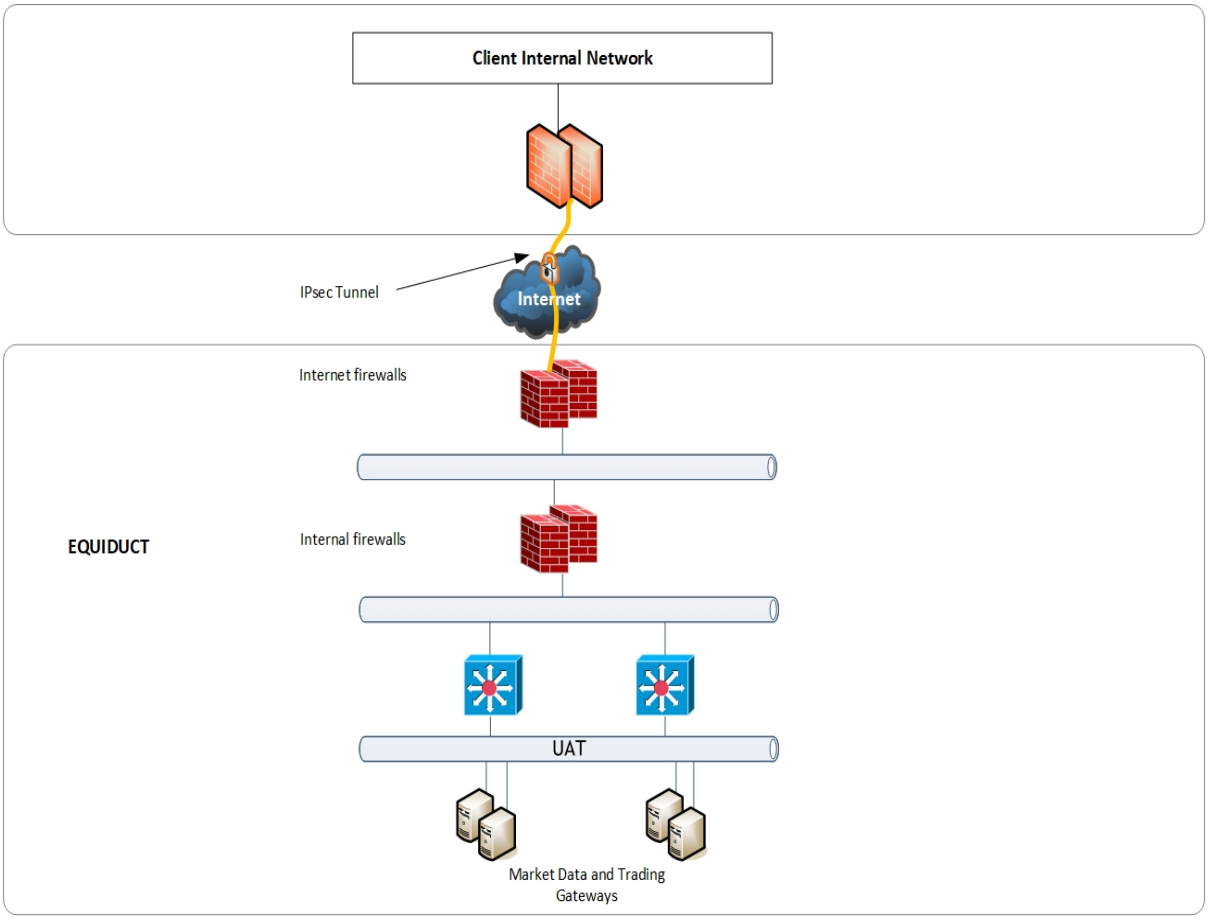
Appendix A.1 Typical leased-line connectivity topology



Appendix A.2 Typical consolidated provider connectivity topology



Appendix A.3 Typical site-to-site VPN topology



Appendix B Gateway addresses

Appendix B.1 Gateway address via consolidated provider and leased line

Gateways	Leased-line & X-Connect	BT Radianz
TX Gateway 1	195.47.240.3	75.124.145.230
TX Gateway 2	195.47.240.4	75.124.145.231
ITCH MD Gateway1	195.47.240.5	75.124.145.233
ITCH MD Gateway2	195.47.240.6	75.124.145.234
SFTP Server 1	195.47.240.7	75.124.145.225
SFTP Server 2	195.47.240.8	75.124.157.66
Test Gateway (UAT)	195.47.240.9	75.124.159.190

Appendix B.2 Gateway address via site-to-site VPN

Gateways	VPN
Test Gateway (UAT)	195.47.240.41