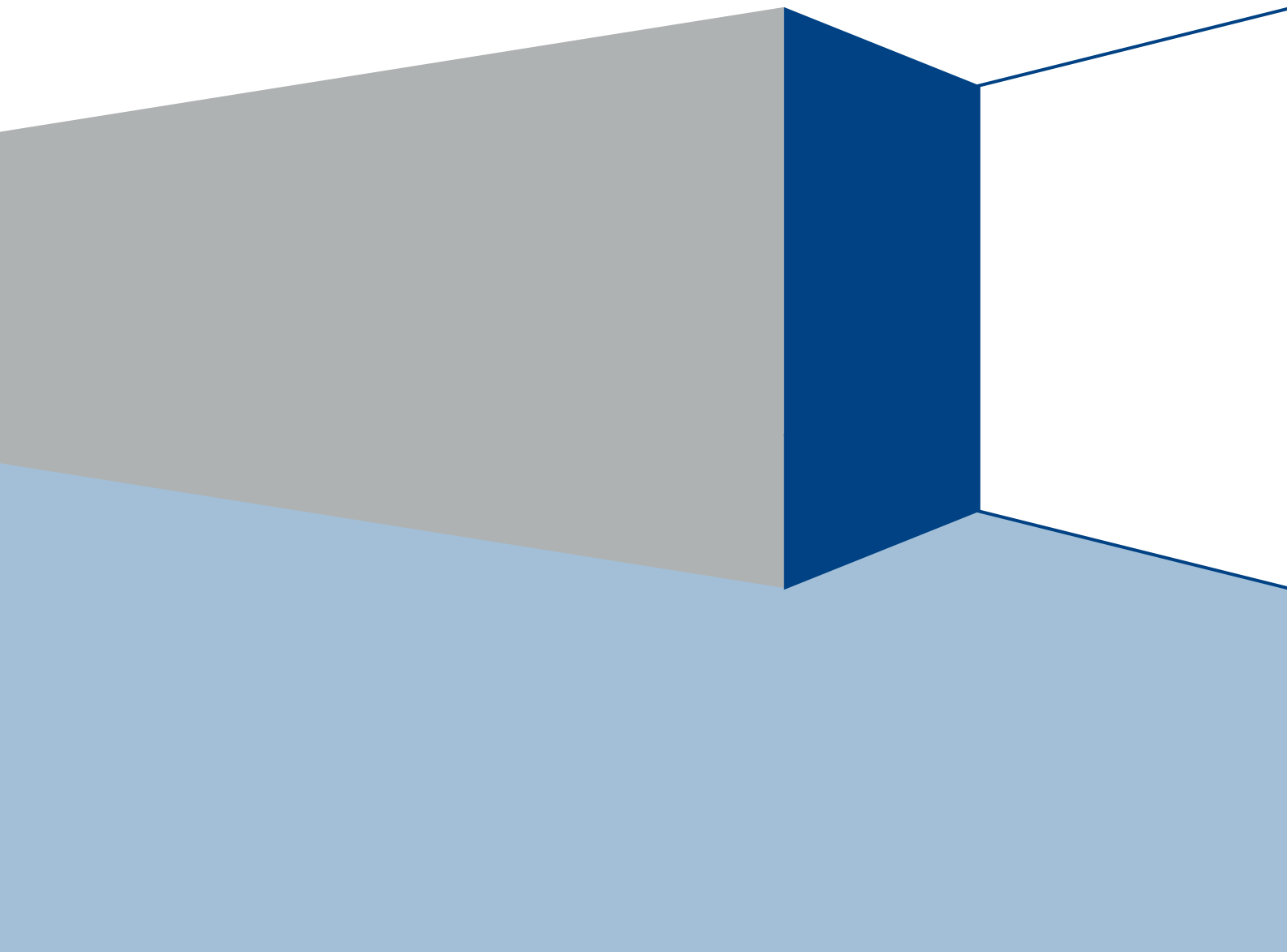




London
Stock Exchange

Service and Technical Description
Extranex 1Gb Service

Issue 3 · March 2011



Contents

Contents	2
Document Version	3
1. Introduction	4
1.1. Purpose of this document	4
1.2. Associated Documentation	5
1.3. Other services available on Extranex 1Gb.....	5
2. Technical Configuration	6
2.1. Physical Connection	6
2.2. Physical Cabling and Connectivity	7
2.3. Customer IP Addressing	9
2.4. Source IP address changes	10
2.5. Millennium Exchange Services	10
2.6. TradElect/Infolect Services	11
2.7. Traffic Flow Diagram.....	11
3. Timescales and Pricing.....	12
4. Customer Support.....	12
4.1. Client Technology Group	12
5. Frequently Asked Questions (FAQ)	12
Appendix – Equipment Installation Process	14

Document Version

November 2010	First Issue
December 2010	Second Issue
March 2011	Third Issue

1. Introduction

Extranex is the fully-managed private network used by the London Stock Exchange to provide access to our trading and information systems.

With the addition of new markets and continuing organic growth, there is a clear requirement for increased bandwidth to support access to all London Stock Exchange platforms and services.

1.1. Purpose of this document

The purpose of this document is to provide customers with an overview of the new 1Gb Extranex service (the “Service”).

This document provides details on the service and its introduction, including the delivery timescales, service deployment model and types of equipment used including appropriate power, space and cooling requirements

This document constitutes a supplement to, and forms part of, the Technical Specification set of documents published by London Stock Exchange plc.

1.2. Associated Documentation

Further information on each of these services can be found in a range of documents from the Exchange's website:

Millennium Exchange

<http://www.londonstockexchange.com/traders-and-brokers/products-services/millennium-exchange/millennium-exchange-migration/millennium-exchange-migration.htm>

Access to Millennium exchange production and test services will be available via the 1Gb service.

TradElect™ and Infolect®

This document serves as an addition to Network Specification document TIS103 which can be found on the Exchange's website:

<http://www.londonstockexchange.com/information-providers/technical-library/technical-specifications/technical-specifications.htm>

1.3. Other services available on Extranex 1Gb

Borsa Italiana

- Borsa Italiana TradElect/Infolect
- DDM+
- IDEM SOLA
- Blt Clearing Station (BCS)
- Blt Trading Station (BTS)

EDX London

- EDX Derivatives Exchange SOLA

Johannesburg Stock Exchange

- Johannesburg Stock Exchange TradElect/Infolect

FIX Gateway

- London Stock Exchange FIX Gateway hub

Oslo Børs

- Oslo Børs derivatives SOLA
- Oslo Børs TradElect/Infolect

Turquoise

- Turquoise Millennium Exchange

To request enablement for these services, queries should be directed to your account manager.

2. Technical Configuration

2.1. Physical Connection

The new service will be delivered by fibre optical cable directly to customer sites. The fibre optic path is optimized for high throughput through the use of DWDM / CWDM coloured optics.

This approach allows higher bandwidth services to be delivered over the same fibre optic pair. The DWDM / CWDM equipment is provided by Cube Optics and is electrically passive.

The network service access point at the Network Layer will typically be a pair of Cisco 3560's Layer 3 Switches.

The Cisco devices provide the option to have the delivery of the site hand-off as:

- Copper 1Gb/s
- Single Mode Fibre 1Gb/s
- Multi Mode Fibre 1 Gb/s

Customers can select which hand-off interface they require at the point of ordering the service.

The Physical SAP service connection is delivered;

- over copper, using the standard RJ45 physical socket, auto MDI/MDI-X or;
- over single mode fibre, using the standard LC(PC) duplex interface, or;
- over multimode fibre, using the standard LC(PC) duplex interface.

The Logical SAP service logical interface is;

- over copper, at 1Gb/s only¹ – IEEE standard 802.3ab / 1000baseT or;
- over single mode fibre, at 1Gb/s only – IEEE standard 802.3z / 1000baseLX/LH, or;
- over multi mode fibre, at 1Gb/s only – IEEE standard 802.3z / 1000baseSX.

AND

- over all of the above interfaces, 802.1Q tagged frames to distinguish VLANs.

¹ Note – even though the copper interface only supports the 1Gb/s speed, in accordance with the standard Section 28D.5 Extensions required for Clause40 (1000BASE-T), the interface must be permitted to auto-negotiate rather than being fixed configuration.

2.2. Physical Cabling and Connectivity

The equipment that is installed within the client site includes transmission and IP (Internet Protocol) equipment. As mentioned elsewhere in the document, the actual location of the equipment may vary depending on what is already installed at a customer site and what accommodation is available at the site; however the actual connectivity between the IP devices doesn't really change.

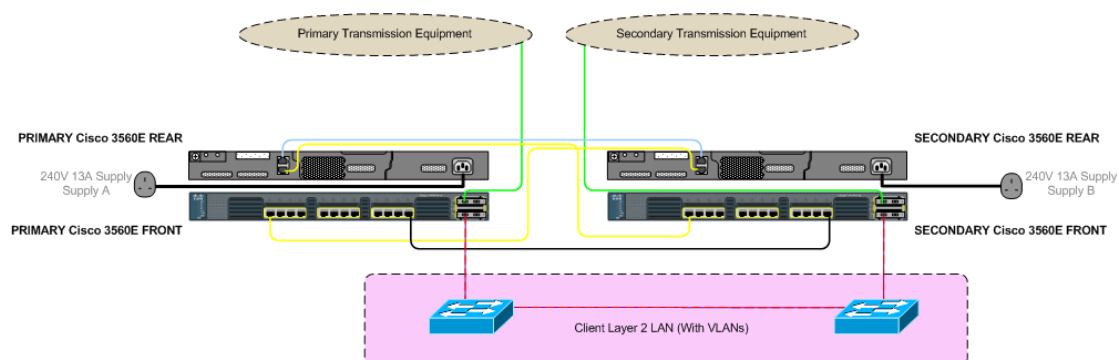
Production Connectivity

- Multimode Fibre from the transmission equipment connects to each Cisco 3560-E on port GigabitEthernet 0/25 using an SFP connector (this is shown as light Green on the diagram).
- The two 3560-Es connect together using UTP (CAT6) cable up to a maximum of 100m total length from GigabitEthernet 0/24 to GigabitEthernet 0/24, this is effectively the resilient path which is used in case of the failure of one WAN link (this is shown as black on the diagram below).
- The client LAN interconnect is connected to GigabitEthernet 0/27 on both Cisco 3560-Es. Depending on what type of interfaces has been requested by a customer (Single Mode Fibre, Multimode Fibre or Copper) an appropriate SFP adapter is installed (this is shown as Red & Purple on the diagram). If copper is selected it is highly recommended that only CAT6 or CAT6A cabling is used. This connection provides VLAN tagged frames to the LAN.

Management Connectivity

In order to provide the highest levels of reliability and supportability, a management connection to the device is used outside the normal production path to the device, as follows:

- UTP (CAT6) up to a maximum of 100m total length is connected between port GigabitEthernet 0/1 of one 3560-E to the management interface of the other 3560-E, (this is shown as yellow on the diagram below).
- An asynchronous roll-over (not crossover) cable is placed between the Console ports of the devices, (this is shown as light blue on the diagram below). Where this cable length is over a specified length, line drivers may be required.



Customer Premises Equipment

The following table shows the customer premises equipment (CPE) to be used for a typical installation:

Qty (Resilient)	Description	Power Type	Typical Power	Max Power	Typical Device Cooling Req'd	Type of power plug per unit	19" Rackmount
2	Cube Optics Wavelength Splitter (with one or two modules)	not applicable - passive	zero	zero	zero	not applicable	yes
2	Flashwave 7120 Wavelength Services Access Platform	DC from PSU	150W	275W	938 BTU/Hr	DC	yes
2	Emerson 240vAC to 48vDC Power Supply, STS16 & Battery	240v AC	200W	1000W	1000 BTU/Hr	2x 16A IEC 60309 "Commando"	yes
2	Cisco 3560E-24TD-E Switch	240v AC	90W	150W	300 BTU/Hr	1x 13A BS1363A	yes
Qty (Resilient)	Description	Dimensions per unit	Frontal Protrusion (in front of 19" rails)	Cable Space Required	Operating Temperature	Relative Humidity	Weight per unit
2	Cube Optics Wavelength Splitter (with one or two modules)	height = 44mm (1RU) width = 438mm (19") depth = 215mm	34mm		0°C to +70°C	TBC	approx 2Kg
2	Flashwave 7120 Wavelength Services Access Platform	height = 90mm (2RU) width = 440mm (19") depth = 279mm			-20°C to +65°C	5-90% Non Condensing	7.5Kg
2	Emerson 240vAC to 48vDC Power Supply, STS16 & Battery	height = 358 (8RU) width = 440mm (19") max depth = 345		25mm	-40°C to +80°C	0-95% Non Condensing	13Kg
2	Cisco 3560E-24TD-E Switch	height = 44.5mm (1RU) width = 445mm (19") depth = 440mm			0°C to +40°C	0-95% Non Condensing	8.1Kg

2.3. Customer IP Addressing

Customers will have the choice of using their own registered addressing, or alternatively the Exchange will assign blocks of registered addressing for use.

If a customer is using their own registered IP addressing, the following rules apply:

- The customer provided IP address subnets have to be a public range and registered to their company e.g. on RIPE database
- The registered subnet for production has to be a minimum of a /26
- The registered subnet for Customer Testing has to be a minimum of a /27
- A contiguous subnet has to be provided for each services i.e. Production and Customer Testing
- The subnets should support growth within the customer network to avoid running out of host addresses.
- The subnet is dedicated to a Single customer SAP and cannot be used elsewhere on the LSE network or via another customer SAP.

The following VLAN's and subnets will be made available to customers and will be assigned for different services as shown below:

VLAN 950

Subnet: Public /26

Unicast: Legacy Production & MIT Product

Multicast: Legacy Production

VLAN 951

Subnet: Public /27

Unicast: Legacy Test & MIT Test (All traversing B-Leg)

Multicast: Legacy & MIT Test (All traversing B-Leg)

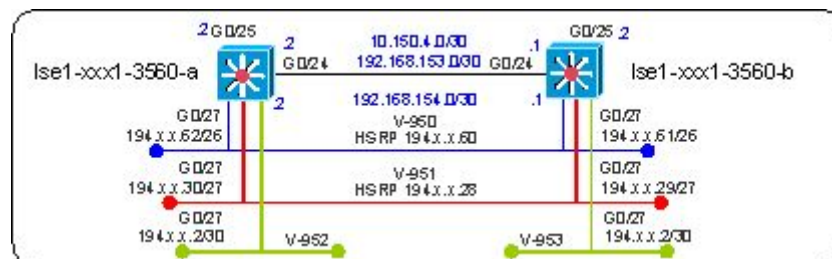
VLAN 952 / 953

Subnet: Public /30

Unicast: None

Multicast: MIT Production & HVS

The diagram below illustrates this further:



Please note that the production registered IP addressing can only be configured for production services, and likewise the testing registered IP addressing can only be configured for testing services.

2.4. Source IP address changes

The following services will have their source IP address changed for use on 1gb:

Market	Environment	Trading/Information?	Description	Source Address	Port
Johannesburg Stock Exchange	Production	Information	Multicast Performance Channels	194.169.14.85	60500
Johannesburg Stock Exchange	Production	Information	Multicast Performance Channels PTW	194.168.14.90	60500
London Stock Exchange	Production	Information	Multicast Performance Channels	194.169.14.70	60000
London Stock Exchange	Production	Information	Multicast Performance Channels PTW	194.169.14.75	60000
London Stock Exchange	Testing	Information	CDS Multicast Performance Channels	194.169.14.115	61500
London Stock Exchange	Testing	Information	CONF Multicast Performance Channels	194.169.14.120	62500
London Stock Exchange	Testing	Information	HVS Multicast Performance Channels	194.169.14.125	63500
London Stock Exchange	Testing	Information	CDS Multicast Service Channels	194.169.14.100	61000
London Stock Exchange	Testing	Information	CONF Multicast Service Channels	194.169.14.105	62000
London Stock Exchange	Testing	Information	HVS Multicast Service Channels	194.169.14.110	63000
London Stock Exchange	Production	Trading	TradElect Production Interactive SII	194.169.14.10	61100
London Stock Exchange	Production	Information	Infolect Production Interactive IRI	194.169.14.20	62200
London Stock Exchange	Testing	Trading	CDS Tradelect Testing Interactive SII	194.169.14.34	51100
London Stock Exchange	Testing	Trading	CONF Tradelect Testing Interactive SII	194.169.14.42	51800
London Stock Exchange	Testing	Information	CDS Infolect Testing Interactive IRI	194.169.14.36	52200
London Stock Exchange	Testing	Information	CONF Infolect Testing Interactive IRI	194.169.14.44	52800
London Stock Exchange	Testing	Information	HVS Infolect Testing Interactive IRI	194.168.14.50	52900
Fix Gateway	Production	N/A	London Fix Gateway	194.169.14.193	2001
Fix Gateway	Production	N/A	Australian FIX Gateway	194.169.14.194	2001
Fix Gateway	Testing	N/A	London Fix Gateway	194.169.14.225	2001

2.5. Millennium Exchange Services

Unlike the current LSE multicast streams, the new service will feature active/active primary (A Stream) and secondary (B Stream) of market data being delivered at the same time.

Both streams will contain identical market data however the source and group IP Multicast addresses will be different.

The two streams of data will be sourced from the Primary and Secondary LSE data centres and therefore there will be a generally consistent time differential between receiving the A and B stream.

The A stream is optimized using the shortest path through the fibre network and the minimum number of devices to pass through, which means that the A Stream will normally be delivering the market data faster than the B Stream. Under certain circumstances, the location of the site and other factors may determine the B stream to be faster, particularly when the network is operating on the resilient leg of a transmission or IP Network path. It is therefore not recommended to assume that the A Stream is always delivering the most recent data.

Each feed will have its own source IP address with different multicast destination addresses; all of these addresses will be registered.

2.6. TradElect/Infolect Services

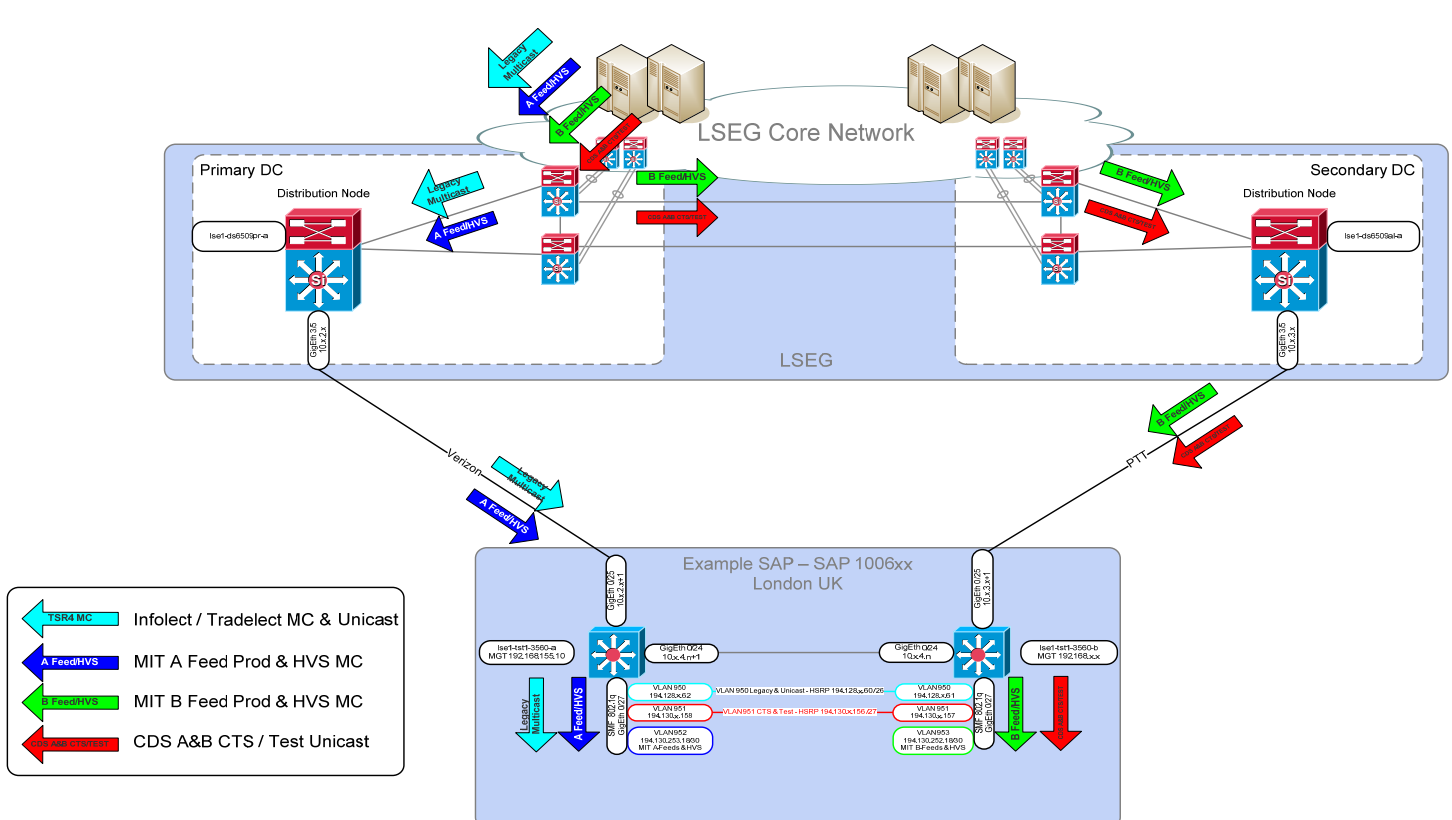
The existing Infolect multicast services will be delivered using the current approach and addressing.

The primary Extranet path will be used to connect to the Exchange's Primary Data centre, with the backup path connecting to the Secondary Data Centre.

Unlike Millennium Exchange services, the legacy TradElect/Infolect services do not offer dual 'A', 'B' feeds.

2.7. Traffic Flow Diagram

The diagram below depicts the topology and traffic flows for existing Infolect/TradElect services and Millennium IT:



3. Timescales and Pricing

For the standard resilient service in “ON net” locations in and around London provided with a diverse pair of Verizon circuits, Verizon will charge £22,000 per installation with an annual charge of £84,000.

Where carrier diversity is required COLT will be used, and for a resilient service in and around London provided using Verizon and COLT, Verizon will charge £23,500 per installation with an annual charge of £84,000, which is the same as the pricing for the existing 100mb service.

Service for customers located OFF net or outside the UK will continue to be priced on a site by site basis and will be confirmed individually for existing customers depending on carrier availability.

There is a minimum 1 year contract followed by a 3 months rolling notice period.

4. Customer Support

4.1. Client Technology Group

The Client Technology Group will provide technical support and advice via:

- The Technical Information Desk on +44 (0) 207 797 3939, STX 33939
- The Client Technology Group Email via CTGroup@londonstockexchange.com

Technical queries may also be raised directly through your Technical Account Manager.

5. Frequently Asked Questions (FAQ)

How do I order Extranex 1Gb?

Customers can request order forms by emailing: Extranex1gb@londonstockexchange.com or calling +44(0)20 7797 3232

Can the services be delivered using two carriers to increase resilience?

During the planning process, the route of the fibre path is considered extensively with respect to resilience and latency. The optimum path will be proposed which could be a

dual linear service from one provider or multiple protected or unprotected services from multiple providers.

We already have CAT6 / CAT6a structured cabling between the locations of the Primary and Secondary SAP switch cabinets, can this cabling be used to reduce the need to install new cables?

If the cabling meets the required specification it may be possible to be used, this will be assessed during the site survey. If you would like to use structured cabling please identify the specification of the cabling, length between cabinets and commissioning results, prior to site survey.

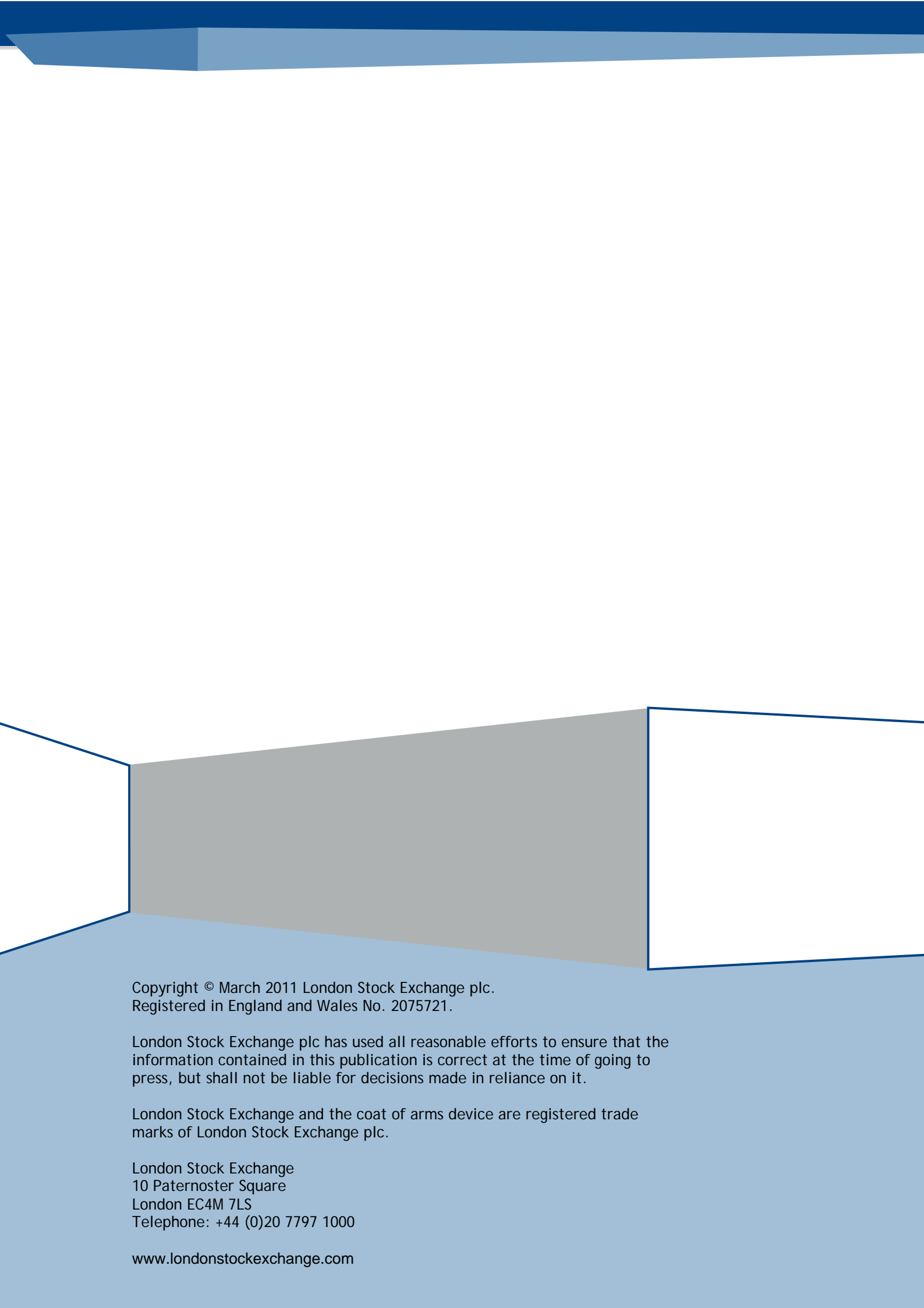
Appendix – Equipment Installation Process

Prior to the installation of the SAP equipment at a customer site, a survey will be carried out to ensure the environment is suitable. The surveying engineer will verify that the location the equipment is to be installed is suitable and has the correct facilities, such as space and electrical outlets.

In some cases all of the equipment will be located in one rack and in other cases equipment may be distributed over more than one location, depending on the current infrastructure at the site. Passive cabling is required between the Primary and Secondary LAN devices, so a cable route may have to be agreed during the site survey.

The Cube Optics device is provided as a 1U rack mountable chassis unit with modular filter units that plug into the chassis. Depending on the layout of the site either one or two filter units can be installed in each chassis, catering for one or two lines.

Flashwave Wavelength Services Access Platforms provide the overall control and management of the physical fibre path.



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