The Liverpool Internet Exchange

IX Liverpool (IXL) Board Meeting Minutes 13th Dec 2018 @ 6:30pm at the Queens Dock Business Centre

Present:

Prof. Matt Wilson, Chairman (MW)
Sacha Keating, Finance Director & Company Secretary (SLK)
Mark Fisher, Technical Director (MF)
Alex Mitton (AM), Director of Infrastructure (AM)

Several members of the public as observers.

Apologies :

Dr. Simon Holgate, Member Nominated Director (Sea Level Research) (SH)
Norman Booth, Stack Computers
Tim Porter, Zycomm Electronics
Warren Davies, Wirral Telecom
Mark Russell,
Liam Givens,

Start

MW welcomed everyone to the meeting and thanked the Queens Dock Business centre for the use of the board room while reminding those present that all meetings are open

to members of the public should they wish to attend and later contribute to a Q&A towards the end.

MW clarified the main aim of IX Liverpool is to create a world class infrastructure in Liverpool & new members are encouraged to join the exchange.

Baltic Broadband have sponsored the costs of this meeting including food and beverages.

Review of previous meeting minutes & matters arising

The board reviewed the minutes from the last session.

Members present agreed the minutes from the previous meeting as an accurate reflection of discussions held & recapped the matters arising.

MW welcomed Alex Mitton from RefineGroup, a new member of IXL to the meeting, and proposed Alex Mitton as Director of Infrastructure of IXL, asking members present to vote on this nomination. MW explained that Alex would head up IXL's Infrastructure with a special focus on expanding IXL's coverage into the Sefton area in order to create a dedicated node of the exchange within Sefton.

MW announced that Finance Director & Company Secretary David Parr had resigned from his post and would now be replaced by Sacha Keating. MW thanked David Parr for his tireless contribution to IXL and the many gains made by him both on the finance side and projects such as the work and negotiations done with the Cathedral and that he would be missed by the IXL team.

MW gave an update as to the new members who have recently joined the Exchange, welcoming MICT Limited (AS423093), Refine Group Limited (AS209827), Broadway Partners (AS423089), Stack Computers Limited (AS423087), National Telecoms UK (AS423096) and doES Liverpool Limited (AS423098)

The board agreed on the signature of the lease for DC01 and agreed on the conditions of 4 years to run with a 12 month notice period. MW confirmed that he was due to meet with solicitors to conclude the signing shortly.

SLK confirmed that the registered office had been moved to Basecamp.

SLK gave a brief update as to IXL's finances and that the accounts had been agreed by members and filled with Companies house.

SLK thanked Jonathan Ford and Co, IXL's accountant, for preparing the accounts for IXL free of charge as a donation to IXL.

The board discussed the success of DC01 and the need to find a more permanent home for it given the lease restrictions currently now faced and the landlord needing the land back in the medium term future for a car park space. Members discussed the recent meetings held with MICT and that IXL could help with building their new DC, eventually moving the exchange into it at some point in 2019. Talks are still ongoing.

MW proposed a change of strategy with the search for sites to convert to DC's. instead proposing the naming of network nodes or connection points at key locations so that the exchange fabric is closer to members throughout the Liverpool Community Region. MW confirmed that the planned collective capacity so far for all of the fibre loops was 100Gbps.

The board also debated the redesign and use of the many fibre loops and radio circuits that are now in use and it was decided to rename much of the fibre parts with area related branding and with the main brand of "Liverpool Fibre Loop" in order to make it more clearer for the public and business.

The board agreed that the Tapestry will become a network node instead of DC02, especially given that IXL wants to continue down the path of a non-centralized network for redundancy and resilience.

MF confirmed that the 10GB Lime Street connection was completed as planned and went live early August, with TPM training taking the first 1GB, which is much valued for the apprentices. The 10GB Lime Street connection will now be known as the "Lime Street Loop".

MW explained that IXL are currently in talks with the new owners of the Former Lewis's building to extend the Lime Street Loop into it, which will be home to a new development called "Circus" including bars, restaurants & a hotel/shops complex.

MW updated on the recent O2 outage across the country affecting millions of mobile customers. It was noted that during this time, Baltic Broadband extended it's 4 hour

usage to all day to help customers continue with accessing their data etc through free wifi which had been a great success.

MF discussed the recently help from Liverpool City Council and thanked them for their support and cooperation and the use of key assets to help extend the Lime Street Loop further into Bold St, Renshaw Street which is planned for a switch on date in early 2019 once meetings with city planners have been concluded.

MF explained that the fibre network that circles the Baltic Triangle will now be known as the Baltic Loop and is now planned to connect up new buildings that go live in February 2019, confirmed as The Old Oil Factory (large office space across 5 floors for digital businesses), the new MICT Data Centre on Norfolk Street and Blundell Street

MF explained that since the 10GB connection was installed into the Queens Dock Business Centre, it has had some interest from businesses wanting connections into Cloud.

MF updated the board as to progress with the 10GB Vauxhall/Everton link and that progress is good and IXL should be able to go live before the end of 2018 and that it will be known as the Vauxhall Everton Loop. MW explained that IXL is currently in talks with a number of businesses in the Great Homer Street area around connecting them into the fibre so members of IXL can provide services to this new development with the League of Welldoers building being the first to go live, planned for 2019.

MF gave an update with the 10GB for the Wirral service and that connections are installed but currently under testing and that he is currently in talks with member Wirral Telecom to begin trials of the service around Birkenhead in early 2019.

MF gave an update on the Liverpool Community Grid project and that the project still needed volunteers, more donations of computers and more space from local businesses in order to build more nodes (www.liverpoolcommunitygrid.org)

MW confirmed that the 5G trials on the dedicated LAN in DC01 have performed well and the mix of the LoRAWAN IOT network and the 5G LAN have been successful research and development opportunities for members and non members of IXL.

MW explained that he had been in talks with Broadway Partners to use DC01 to host a node of the TV White Space Broadband service that IXL wants to trial around the city

and that Broadway Partners will be installing a number of transmission points throughout the city shortly.

AM explained that talks with a landowner in Sefton are progressing with a view to establishing a node of IXL at said location. AM explained that the land in question is owned by a charity with similar principles to IXL while also being central to key infrastructure assets with the Sefton area. AM confirmed that he would continue talks while also beginning planning routes for fibre for what will be the “Sefton Fibre Loop”.

Action: AM to design network map of fibre loop & connecting areas to provide visual aid for members.

MW stated there are no more talks planned for IXL & these are needed to keep promoting the work of the membership….plea to members to forward this area.

AM updated on land within Sefton & Wirral area for the container & potential for rack space available. Members discussed & agreed that a meeting with Sefton Council to discuss the use of land in Sefton area would be beneficial & the use of free WIFI around Sefton area. Funding from Dong Energy is also being explored.

Action: MW, MF & AM to meet with Sefton Council to further discussions regarding use of land in Sefton area. AM to update progression on Sefton land issues late January/early February & head up donations & equipment for recycling for IXL. (Contacts at Sefton Council - Mike Mullen & Gavin Quinn)

MW suggested it would be beneficial to invite Sefton Council & local Sefton businesses to where the container is presently situated to see how it works.

Action: Members agreed it would also be useful to host a future IXL Board meeting in the Sefton area (Goddard Hall) & for AM to present findings at this meeting regarding land use.

AM briefed site on Knowsley Road by Citizens Advice Bureau - land situated at rear to building to be further investigated as to acquisition - near to Bootle & exchange - possible move for container. Look to have a 5 year agreement for the lease similar to Baltic lease. Separate meters available for power & reimburse charity for any costs.

MF stated the container is useful material for a roadshow type promotion to hi-light the work of the internet exchange. Members agreed & to also use high profile events such as the Liverpool Giants to promote the use of free WIFI.

MW updated on free WIFI around Lime Street, Baltic Triangle & soon to be Vauxhall & Everton area with Lime Street & London Road being most frequently used. Liverpool Fibre Loop to be designed for the public to see how it is being connected.

MW updated on talks with Liverpool City Council re supplying free piece of land for IXL - space at Cunard Building offered but not suitable - ongoing discussions at present.

MW updated on IX Manchester & LINX meet up meetings - invite to any member who would like to attend Linx meeting - AM volunteered to attend next LINX meeting with MW with opportunity to present expansion of IXL into Sefton & MICT build for container.

MW stated location of Liverpool & economic issues results in city being overlooked as so near to Manchester with their own internet exchange.

Future Talks

MW has two talks planned for 2019 as opportunity to discuss progress of container with view to touring as part of this.

Action: CF to look at some dates of availability to present IXL talks - provide information on Slack to members.

JF stated he has developer contacts who may be interested in giving talks for IXL.

MW briefed areas where contacts needed - Sefton Loop,Knowsley & Kirby Loop, St Helens Loop & Speke/Halton/Halewood Loop.

MW also updated on “Janet” (School & University learning provider) linking students & ability to work from home linking to university network - met with contact at recent LINX meet up - they are keen to connect to IXL & enquired lease sign up - would not commit until lease signed as too risky to sign up to.

MW stated looking at putting a switch in locations such as Halton, Knowsley & Halewood to connect & looking at Clock Tower as potential Fazakerley site.

AM suggested looking into Lord Mayors fund & charity donations, grants & community projects to assist with IXL location work.

MW briefed Everton & Vauxhall with 10Gbps currently going into these areas - switch inside church at Everton & network now set up.

MW stated that member Telecoms Cloud is leaving the exchange soon & consolidating to Internet of Things for noting of IXL membership. All members noted work must continue to increase IXL membership.

MW updated on Queens Dock work which is now complete - other areas to now be progressed with extension to Everton & Vauxhall loop.

Members of Public Questions

No questions from public members.

MW stated that 5G is up & running with a trial currently operating in DC01 & an opportunity with new members Broadway partners to put equipment in container for white TV space to broadcast around Liverpool area.

AM queried of there was any roof space at MICT - it was established that there wasn't any available space as not suitable for wireless providers at present. Members agreed to keep talks open with Liverpool Council regarding roof space at Cunard Building.

MF updated on Liverpool Community Grid - sponsored by IBM - slow progress on this area as old machines are needed for donation & people to install nodes so more volunteers & storage space needed.

AM suggested looking for solar powered buildings to help with meter costs.

MW stated member needed to promote & find storage space.

Accounts

Jonathan Ford & CO have filled latest IXL accounts which have been approved.

No members present raised any objections to the latest set of accounts.

AM queried the expenses for IXL - it was noted there is a £60 per month electricity bill for the container.

MW added that MICT would provide power as part of a deal of putting equipment into building.

Any Other Business

None

Next meeting date confirmed as 13th June 2019 – 6:30 pm at venue in Sefton to be confirmed..

End.

Glossary of Terms Used

24x7
A service that has permanent availability – ‘always on’ (i.e., 24 hours a day, every day of the week); such as for a technical support service at an IXP or network operator.

A

AF-IX
African Internet Exchange Point Operators’ Association - A community of practice set up in 2013 to “provide a collaborative environment for Internet Exchange Point Operators in the African region to be able to share knowledge, experiences, and to provide support for each other.

AFRINIC
Africa Network Information Centre - One of the 5 regional Internet registries (RIRs) that provides IPv4 and IPv6 address allocation services for the African. AFRINIC, like most of the other RIRs, it has an active IXP support programme.

Anycast
Anycast is a networking strategy where the same IP address prefix is advertised from multiple locations. Users of an anycast service (such as DNS) will always connect to the closest server available.

AP-IX
Asia-Pacific Internet Exchange Point Association - Serves as a forum for Internet Exchange Points to exchange experiences. APIX members meet twice a year at the APNIC Conference and Members meeting.

APNIC
Asia Pacific Network Information Centre - One of the 5 regional Internet registries (RIRs) that provides IPv4 and IPv6 address allocation services; APNIC serves the Asia-Pacific region except for China, India, Japan, Korea, and Taiwan, Vietnam, which

each have their own National Internet Registry (NIR) to handle address allocation and assignment.

ARIN

American Registry for Internet Numbers - One of the 5 regional Internet registries (RIRs) that provides IPv4 and IPv6 address allocation services. The ARIN service region includes Canada, many Caribbean and North Atlantic islands, and the United States.

ASN

Autonomous System Number - An identifying number allocated to an Autonomous System on the Internet. ASNs are a basic requirement to run a network with more than one link to the Internet and are almost always required when joining an IXP. ASNs are used in conjunction with the Border Gateway Protocol (BGP) to determine the path along which to route traffic. RIRs assign ASNs.

AUP

Acceptable Use Policy - A policy adopted up by a network operator describing the rules for using the service – most often limiting the volume of data that may be transferred over certain time period or in defining types of network abuse, such as accessing undesirable types of websites, downloading pirated media, or using the network for sending unsolicited bulk email (spam). Some IXPs provide services to support the enforcement of their member's AUPs, such as anti-spam measures.

B

Backbone

The main route of a network used as the path for transporting traffic. Also used to refer to long-distance fibre optic links, such as in 'national backbone'.

Bandwidth

A measure of the capacity of a communications channel to transfer a certain amount of data in a specific time, usually defined in bits per second (bps), as in Kbps, Mbps, Gbps.

BGP

Border Gateway Protocol - An IETF routing protocol defining the way in which Autonomous Systems exchange information to determine the path to use in order to send data. Participants at an IXP normally must be able to configure and maintain routers that run BGP. See below for information about the IETF.

Bilateral Peering
This is peering negotiated between any two providers, through an IXP switch or privately. Also, see Peer/peering

Bit
Binary digit, i.e., 0 or 1; it is the basic unit used in computing and data transmission. 8 bits usually define a single character that is called a 'Byte' (see below).

Blackholing
A configuration technique used to deal with DDoS attacks or routing configuration errors on other networks in which packets to or from selected destinations are ‘blackholed’ or dropped.

Bps
Bits Per Second - The number of bits passing a given point every second. This is the transmission rate for digital information, i.e., a measure of how fast data can be sent or received. Often expressed as Mbps, for Megabits per second for broadband links. See Bandwidth.

Broadband
A high-speed (multi-megabit) data-connection, normally provided to the end-user. The International Telecommunication Union (ITU) currently defines broadband as greater than 256Kbps; however in practice, a broadband connection is usually expected to be at least 1Mbps. In many countries, 10Mbps is now a commonly seen domestic broadband connection (on the download link), 50+Mbps is also becoming increasingly available, and some residential service providers are even providing 1Gbps broadband connections, where fibre to the premises is available.

Byte
8 bits of data, sometimes called a "word" or an "octet". While data streams are usually measured in bits, file sizes and units of data storage are normally measured in Bytes; e.g., a one terabyte hard drive.

C

Cache
A copy of a set of data that is stored closer to the end-user than the original source of the data in order to improve performance, reduce bandwidth requirements, or limit real-time access to the original content. Caches are filled when a piece of content is downloaded the first time, and usually refreshed at regular intervals or when a later version of the content becomes available. Web browsers often include a cache and so do IXPs – see Content Distribution Networks.

Cat5
Category 5 Cable - A specification of twisted-pair copper cable able to provide a performance of up to 100Mhz that is suitable for up to 1000Mbps (1Gbps). It has been superseded by the CAT5e (enhanced) specification.

cc
Country code - A two-letter code uniquely identifying a country, used in top-level national domains, such as .ca (Canada) or .fr (France). Standardised by ISO3166-1. See ccTLD .

ccTLD
Country code Top Level Domain - The last part of a domain name using a country code allocated to a specific nation. This normally signifies the country in which the domain is registered and usually, but not always, indicates where the holder of the domain name is based. Some ccTLDs have also been used for denoting certain types of content services or websites, such as .tv (Tuvalu). The database of sub-domains registered under a specific ccTLD are called name servers and are often hosted at IXPs to improve performance and reliability for end-users.

CDN
Content Distribution Network - A network whose primary aim is to deliver content to end-users and is often hosted at an IXP to improve performance by bringing the content closer to the end user. These can be content redistribution networks that act as intermediaries, such as Akamai, or content generators themselves, such as Google and Netflix.

Cloud Service
A service provided via the Internet that gives its users access to applications and data-storage facilities that are hosted remotely on a ‘cloud’ service provider's network consisting of distributed storage and application servers, which may be spread around the world. Cloud services provide a business model that allows entrepreneurs the ability to more easily scale up and offer service(s) without provisioning their own infrastructure. Typical examples of cloud-based applications are DropBox, Gmail, and Hotmail. Increasing use of cloud services means end-users are ever more dependent on fast and reliable Internet connectivity, adding to the incentive for networks to peer at an IXP.

colo
Co-location - The renting of space for housing computer equipment, usually in buildings specially designed to support a high density of computers and network connections, often called data centres, but also called telehouses or carrier hotels. Co-location is not normally an IXP service as it usually competes with exchange participants, however many IXPs are hosted at colo/data centres.

Connection Redundancy
Two or more connections, ideally via physically different paths to different networks, linked to the Internet. Redundancy ensures continued availability of the Internet in the event of a service interruption on one of the connections. IXPs can help to improve a network's reliability by making it easy to access more than one connection to the rest of the Internet. Of course, this may also require two physically independent connections to the IXP unless the network is also using a direct connection to a peer or transit provider.

Content
The data that travels over a network, which can also be termed traffic, but from the user perspective, it is the material that the user is accessing and interacting with over the network. See Content Distribution Network. Because IXPs help to reduce local bandwidth costs and improve network performance, they help to encourage hosting of content, including local content.

D

Data Centre
Data centres primarily focus on hosting content although they often host IXPs, especially carrier-neutral ones (i.e., not those built by a specific telecom operator, but

those which have multiple carriers terminating links into the data centre). Some commercial data centres operate as IXPs and may provide good value for purchasing transit capacity, but are often less cost- effective for peering. See co-location.

DNS
Domain Name System - A distributed database that allows names to be associated with IP addresses. A query of a DNS server will match a domain name to the IP address required by the computer in order to route the traffic to its destination; e.g.,www.lemonde.fr will match to the IP number 62.116.143.15 - the IP address of the web server hosting Le Monde's online service.

Domain Name
A sequence of characters (a name) for use by Internet applications; e.g., someone wishing to access the Le Monde newspaper via a web browser would type www.lemonde.fr (to be clear the registered domain name is lemonde.fr).

Downstream
A network's paid traffic, in contrast to upstream traffic for which a network must usually pay transit fees, and peered traffic which is usually settlement free. See Peers/peering.

DWDM
Dense Wave Division Multiplexing - A technology that enables multiple data streams to be transmitted simultaneously on a single optical fibre by using different optical wavelengths (colour) for each data stream. Up to 160 (and theoretically more) wavelengths can now be transmitted on a single optical fibre. Availability of DWDM fibre is helping to meet exploding bandwidth requirements.

E

Ethernet
The communications protocol used within a switch to route data packets inside the local network. Ethernet is normally only used within a local network because the packets are broadcast to every device attached to the switch. This is computationally inexpensive but makes this protocol less suitable for long-distance, usually more expensive, lower-capacity links. Ethernet switches are normally used to interconnect the routers of participants at an IXP. Maximum Ethernet speeds have steadily increased and some

IXPs are now able to support 100Gbps Ethernet connections. GE is a common notation for one-gigabit Ethernet links, 10GE for 10Gbps links.

Euro-IX
European Internet Exchange Association - An Association of European exchange points and other members formed to exchange ideas and information on IXP and related issues. Most IXPs in Europe have joined Euro-IX to share information about best practices. The association is not restricted to European members and welcomes members from other regions. It is also helping to assist in the formation of a global federation of IXP associations.

Eyeball Networks
Networks that focus on provision of Internet access to the end-user – these networks provide the demand for content networks that operate applications or services desired by end-users.

F

Fibre optic cable
The use of specially manufactured glass fibre for the transmission of data. The signal is transmitted along the fibre using pulses of light from a laser or a light-emitting diode (LED). Current modulation technology allows fibre cables thousands of kilometres long to carry many terabits of data per second (see DWDM above). Optical fibre patch cables are used in IXPs to connect with high speed ports, such as 10 or 100Gbps.

G

Gb
Gigabit - One billion bits.

Gbps
Gigabits per second.

GE
Gigabit Ethernet - Ethernet that supports data transfer rates of 1 Gbps. See Ethernet. Most IXPs now support 1Gbps and 10Gbps ports.

Global Routing Table
Also called the global BGP table, this is a database of the different paths in the public Internet over which traffic can be routed. In mid-2013, there were about 480,000 IPv4 and 14,000 IPv6 routes visible on the Internet. This information is used by routers that run the BGP protocol to decide on the most efficient path over which to direct traffic. In practice, with the common use of route filters and rapid changes in Internet routing, no router has the complete view of all routes available. Big IXPs, which usually have routes seen by multiple large networks are among the best places to assess global Internet routing.

gTLD
generic Top Level Domain - A top-level domain of the Internet that does not carry a ccTLD identifier. In contrast to ccTLDs (see above), gTLDs are normally used to register names that are not associated with a particular country. However, due to the history of the emergence of the Internet, most US-based organisations have, in practice, also used gTLDs in place of the .us ccTLD. Currently, 7 gTLDs are commonly used -.com, .org, .net, .edu, .gov, .mil, .int, and another six have more recently come into use -.aero, .biz, .coop, .info, .museum, and .name. The management of TLDs is the responsibility of ICANN. ICANN is now in the process of greatly expanding the number of gTLDs in use. IXPs often host copies of gTLD and ccTLD databases to improve local performance in name lookups.

I

ICANN
Internet Corporation for Assigned Names and Numbers - The highest level coordinating body for the technical resources of the Internet, responsible for global policy and management of Internet domain names and IP numbers.

ICT
Information and Communication Technologies - The most common means of referring collectively to both computing and communications technologies, which include the Internet.

IETF

Internet Engineering Task Force - The body responsible for developing standards for the technical operation of the Internet. The IETF is an open community of network designers, operators, vendors, and researchers concerned with the technical aspects of the operation and evolution of the Internet. It is open to any interested individual.

Interface
The hardware and software that connects a computer or communications devices to each other or to the end-user.

International gateway
A telecommunications link that crosses a national bounder. It is usually a service that aggregates international traffic from many networks and end-users. It is also a construct used by some developing country governments to restrict access to international capacity to particular license holders, often the incumbent state operator, and to mobile network operators. Where there is a single entry point where Internet traffic must pass through the same point, creating a de-facto IXP, but without the benefits of building a community. This arrangement often constrains local growth of the Internet through inefficient routing or by imposing non-cost based pricing for local traffic exchange. The resulting incumbent can also often be a significant barrier to creating an IXP for the other ISPs in the country.

Internet
Interconnected networks that use the TCP/IP protocol (see below) to communicate with each other. Emerging from military and academic research in the 1960s, the Internet is continuing to double in size every year. Currently, the Internet is made up of about 44,000 independent networks that connect about 2.5bn end-users to each other and to millions of content and application providers. The Internet is also now emerging as the platform for machine-to-machine communications, known as the ‘Internet of things’, which will result in the Internet growing even faster and becoming even larger.

IP
Internet Protocol - The basic packet communications protocol used on Internet networks. See IP Packet.

IP Address
A unique numeric identifier for a device connected the Internet. Until recently, this was usually expressed as 4 sets of numbers in the range 0-255 separated by dots, e.g.,

196.6.208.1, which is known as an IPv4 IP address. Due to the unexpected growth of the Internet from the time it was first developed, this addressing model cannot provide enough addresses to uniquely identify every device that needs to be connected to the Internet – it is inherently limited to 4,294,967,296 addresses. So a new, larger standard of IP Address was developed – IPv6 which can provide 3.4 X 1038 addresses in the form of eight groups of four hexadecimal digits separated by colons (for example, 2001:0cb7:64g2:0342:1000:8a2e:0370:7334) however, methods of abbreviation of this full notation can be used. IPv6 has enough addresses to connect every device for the foreseeable future.

IP Packet

A discrete unit of data that contains the source and destination of a transmission for routing purposes, along with other management information, as well as the user's data. Because each packet contains the source and destination, each packet can be treated independently by the networks it travels through to reach its destination and different packets may take different routes before being reassembled as the data stream on the recipient device.

ISOC

Internet Society - The Internet Society is a cause-based organization that works with governments, industries, businesses, policymakers, regulators and others to ensure the technologies and policies that helped develop and evolve today's Internet will continue into the future. Our programs support and advocate for an Internet that is open and accessible to everyone, everywhere, and ensures that it will continue to be a tool for creativity, innovation, and economic growth. Working with its members and Chapters around the world, the Internet Society enables the continued evolution and growth of the Internet for everyone. www.internetsociety.org

ISP

Internet Service Provider - A company or organisation that provides individuals, organisations, and enterprises with access to the Internet. Aside from connecting users, ISPs often provide other services such as email and hosting of websites for their customers. ISPs are also known as 'eyeball networks' that essentially aggregate bandwidth in bulk and resell it to consumers and businesses in smaller chunks. This is in contrast to content networks that focus on providing content and applications for end-users. These two types of networks most often meet at IXPs.

ISPA

Internet Service Providers Association - An association of ISPs often run on a membership basis in a defined geographic region, usually in a country or a capital city of a country. Many IXPs are operated by national ISP associations.

ITU
International Telecommunication Union - The UN agency responsible for the development of infrastructure, orbital slot and coordinated spectrum allocation, and development of technical standards used in telecommunication networks, particularly traditional voice networks. The ITU has also recently become more involved in Internet public policy and other related matters.

IXP
Internet Exchange Point - A physical location that allows many Internet-based networks to exchange traffic with each other at a common meeting point, thus eliminating the need to build separate bilateral links with each local network. Most IXPs are non-commercial organisations funded by membership and/or port fees paid by the participating networks. Commercial exchanges are also common, particularly in North America, where IXPs are often called Network Access Points (NAPs). INX and IX are also common abbreviations. In Latin America, additional abbreviations are: NAP, PIC, PIT, and PTT.

K

Kbps
Kilobits per second - A data transfer rate of one thousand bits per second.

L

LAC-IX
Latin America and Caribbean Internet Exchange Point Association - The association's objectives are to increase Internet traffic in the region, represent the member IXPs worldwide, support governments on policies, provide statistics and advice related to Internet Exchange Traffic, simplify cooperation between the IXPs, and promote and support the establishment of new IXPs. http://lac-ix.org

LACNIC
Latin America and Caribbean Network Information Centre - One of the 5 regional Internet registries (RIRs) around the globe that provide IPv4 and IPv6 address

allocation services (for the Latin American and Caribbean region except for Brazil, Chile and Mexico, which each have a National Internet Registry (NIR) to handle address allocation). LACNIC has recently helped to launch an association of IXPs in the region called LAC-IX.

LACP
Link Aggregation Control Protocol - Link aggregation is used by some IXPs to provide higher capacity links to members.

LAN
Local Area Network - A local network of devices interconnected physically through one or more Ethernet switches or wireless links. An IXP is essentially a set of participant routers connected to a LAN. An IXP may have additional LANs for administrative purposes or for providing other shared services.

Latency
Typically measured in milliseconds (ms), latency is a measure of the delay in the round trip time (RTT) it takes for a packet of data to reach and return from its destination.

Leased Line
A telecommunications circuit leased between two or more locations from a telecom provider. Networks will normally need to lease a line or deploy their own infrastructure to connect with the IXP.

Looking Glass Server
A server hosted on a network or IXP that makes it easy to identify the routes available at that location.

M

MAN
Metropolitan Area Network - A network spread over a metropolitan area. This may refer to a physical fibre or microwave network, such as may be operated by a telecom provider to carry voice and data traffic within a large city, or it may refer to an IP network linking different locations in one city, including an IXP with several locations in the same city.

Mbps
Megabits per second - A data transfer rate of Mega (million) bits per second.

MLPA
Multilateral Peering - A type of peering policy available at many IXPs where members agree to exchange traffic with every other member present at the exchange, usually through a route-server. This contrasts with bilateral peering or 'private peering' where two networks agree to exchange traffic with each other in a private arrangement. A choice of multilateral and bilateral peering is usually available at most IXPs.

Multi-homing
An IP network with two or more physical links to other networks, to provide resilience and/or diversity. An AS number and appropriate routers are required to operate multi-homing networks connected to the Internet. Knowledge of multi-homing router configuration is a basic prerequisite for joining an IXP.

N

NAP
Network Access Point - Another name for an IXP. NAP was the name given to the first exchange points established in the United States when parts of NSFNet, the first TCP/IP-based network, were spun off from its academic roots into commercial operations. NAP is also more commonly used in Latin America

Network
Two or more interconnected computers or data communications devices. "IP network" or just "network" is now the commonly used term for a distinct group of interconnected devices linked to the Internet and operated by a specific entity.

NGO
Non-Governmental Organisation - A non-profit organisation whose shareholders or other governing body do not financially benefit from the organisation's primary activity. Noncommercial IXPs may be registered as NGOs or as non-profit companies.

NRA

National Regulatory Authority See “Regulator,”

O

OFC
Optic Fibre Cable - See Fibre Optic Cable.

P

Packet
A discrete unit of data traffic. Packet switched networks are the basis of Internet in contrast to the older circuit switched networks that were developed in the previous century for voice networks.

Peer/Peering
Peers are networks that agree to exchange routes (and therefore traffic) with each other, normally on a settlement free basis. The distinction between settlement-free peering and ‘transit,’ where one network pays another to exchange traffic (usually to reach most of the other remote networks on the Internet), is blurred by options such as ‘paid peering,’ where some routes may be settlement free while other routes carry a fee, or where there is some other form of compensation between the two networks. In all these cases, these specific business arrangements between two networks are called ‘bilateral peering’ or ‘private peering.’ Bilateral peering can either take place at an IXP or through direct physical interconnection between the two networks. The latter is normally called ‘private peering.’ The other common form of peering at an IXP is called ‘multilateral peering’

Petabit
One thousand Terabits.

PoP
Point of Presence - A physical infrastructure location where a network or end-user can access the services of a provider.

POTS
Plain Old Telephone Service - A traditional fixed-line copper cable phone service. See PSTN and PTO.

PPP

Public-Private Partnership A partnership between the private sector and government in a common project. In some cases, IXPs are established as a partnership between privately operated commercial networks and government bodies. Not to be confused with the PointtoPoint Protocol as used in computer networking or with Purchasing Power Parity (a mechanism to compare the relative values of currencies).

Private Peering

See Peer/peering.

Protocol

At a technical level in the ICT world, a protocol is usually a set of rules that determine the way in which two networked devices communicate with each other, e.g., routers exchange routing information using the border gateway protocol (BGP), just as all devices connected to the Internet must exchange traffic using the Internet Protocol (IP).

PSTN

Public Switched Telephone Network The traditional circuit switched voice telephone system; however, may also refer to mobile networks.

PTO

Public Telecom Operator - Usually the circuit switched fixed line telecom operator although technically, as communication technologies converge toward the Internet, the distinction between fixedline operators, cellular operators and ISPs is becoming increasingly blurred. PTOs usually have a different business culture to the new Internet network operators and are often the dominant network operator, a status that may limit their interest in peering locally as opposed to selling transit.

Q

QOS

Quality of Service A measure of the level of service provided by a network. There are many different QOS measures. Common examples include uptime (e.g., five 9's – operational for 99.999% of the time), packet loss, roundtrip time, etc. QOS may be defined in a business relationship called a Service Level Agreement (SLA). QOS rules can also be applied to different types of traffic passing through a router; for example, voice traffic might be given a higher priority than email. IXPs may provide certain QOS and SLA commitments to their members.

R

Regulator

A government entity with legally mandated responsibility for executing national ICT policy by establishing a set of regulations that govern the sector. Ideally, the regulator is semiautonomous with an income derived from license fees that provide substantial independence although the state usually appoints the executive body. Ideally the regulator helps ensure that there is a level playing field in telecom and Internet markets. In this respect, it often has a major responsibility to curb the impact of market dominance of the incumbent operator, especially in developing countries. (In some economic regions with a high level of integration, such as the EU and ECOWAS (West Africa), a significant level of policy and regulatory development takes place at the regional level that the member states are obliged to adopt.) The regulator does not normally have a direct role in IXP development although in some countries, the IXP may be hosted by the regulator or facilitated by regulatory proceedings allowing the IXP to exist. The regulator can also play an important role in helping to ensure dominant operators participate fully in the IXP and in ensuring there is a competitive market for national and international Internet capacity.

Remote Hands

A facility provided by IXPs and data centres where participants can make use of a local onsite engineer to perform physical activity at the exchange, such as rebooting a router, installing patch cables etc.

RFC

Request For Comment. The IETF procedure used for the development of Internet standards. For example, RFC 5963 describes how IPv6 may be deployed at IXPs.

RIPE NCC

Réseaux IP Européens Network Coordination Centre One of the 5 regional Internet registries (RIRs) around the globe that provide Ipv4 and Ipv6 address allocation services (for Europe and the Middle East).

RIR

Regional Internet Registry One of the regional organisations that are allocated blocks of IP addresses and ASNs by ICANN/IANA for onward allocation to individual local networks (except for 10 countries in Asia and Latin America which operate their own national registries). Currently, there are five RIRs – one for each major geographic region: ARIN, APNIC, AFRINIC, LACNIC and RIPE NCC.

Root name server

Root nameservers are used to determine the location of other DNS servers. DNS servers are the authoritative source of information about toplevel domains (e.g., .com, .org, .int, and, .arpa). There are currently 13 root servers around the world, with the domain names ‘a.rootservers.net’, ‘b.rootservers.net’ etc., to ‘m.rootservers.net’. Copies of these root server databases are often hosted at IXPs or other wellconnected locations in order to increase the resiliency of the Internet locally in the event of international connectivity interruptions. Copies of these rootservers are often called ‘instances’ or ‘mirrors.’ Click here for a map of these entities: http://rootservers.org/map/.

Route

The path through one or more networks that is taken by IP packets. Due to the dynamic nature of routing on the Internet, packets from the same data stream may travel to their destination by different routes.

Router

A device that receives IP packets and decides where to send them based on which device is ‘closest’ or ‘least expensive' on the way to the packets’ final destination. Routers usually make these decisions based on a set of preconfigured rules combined

with dynamic routing information exchanged with other routers on the Internet, usually based on the BGP routing protocol. Routers with only one physical connection to another network are usually configured with a 'default route' that is the upstream connection to the rest of the Internet. Normally, a network participating in an IXP will have a router at the IXP premises that will be connected to the other participants' routers via an Ethernet switch.

Routing Policy

The routing rules a network applies when carrying traffic from other networks.

S

Spam

Unsolicited email, used in questionable marketing practices. Some IXPs provide an antispam service.

T

TCP/IP

Transmission Control Protocol/Internet Protocol – the key protocols for transmitting packet based data, on which the Internet is built.

Terabit

One thousand gigabits.

Tiered ISP model

Internet Service Providers have traditionally been classified by size into 3 tiers – Tier 1 being the largest, usually global ISPs that peer directly with each other, while Tier 3 ISPs are the smallest local ISPs and Tier 2 ISPs fall somewhere in the middle. These distinctions are blurring as the ISP sector evolves, but normally it is assumed that ISPs from lower tiers usually have to purchase transit from higher tier ISPs.

TLD

Top Level Domain See gTLD and ccTLD. http://en.wikipedia.org/wiki/Toplevel_domain; http://archive.icann.org/en/tlds/;http://www.icann.org/en/resources/cctlds.

Transit

The capacity or routes purchased from a larger network, usually to reach remote networks on the Internet. See Peer/peering.

U

U

A unit of measurement mainly used to describe the height of rackmounted computer equipment (especially servers and routers) and the racks into which they are fitted. One “u” is 1.75 inches or 4.445 centimetres. IXPs may have policies on the amount of rack space that can be occupied by each participant at the exchange.

Upstream Traffic

Traffic that a network must usually purchase as transit in order to make connections with other networks, in contrast to downstream traffic which is usually the revenue generator for a commercial access provider (‘eyeball’) network or for a lower level wholesale capacity provider. See Peer/Peering.

UTP

Unshielded Twisted Pair A type of data cable containing four pairs of conductors, each pair being twisted together. UTP is used extensively in connecting local Ethernet network devices together.

V

VoIP

Voice over Internet Protocol - There are many Internet based VoIP services, such as Skype and Google Talk. Traditional circuit switched voice networks are also increasingly migrating to the Internet. The 'best effort' model of Internet service provision requires that specialised traffic management techniques may need to be applied to deliver the same level of QOS that is expected by customers of traditional voice networks. In addition, gateways between IP and circuit switched voice networks may require specialised signalling to support features such as caller ID. Some IXPs are now

implementing these techniques so that voice networks can continue to migrate smoothly to an all IP environment.

W

WAN Wide Area Network A network normally spanning a larger physical area than a LAN, in particular denoting the use of different physical transmission media. The most common use of WAN terminology is in the WAN port(s) on a router which collects traffic from the LAN and passes upstream traffic to the WAN links, usually to the rest of the Internet, and vice versa.