

IXL Liverpool (IXL) Board Meeting Minutes 23rd March 2017 @ 7:00pm at AIMES Data Centre - Liverpool
Innovation Park

Present:

Prof. Matt Wilson, Chairman (MW)
David Parr, Independent Director (DP)
Liam Givens, Technical Director (LNG)
Richard Spragg, Member Nominated Director (AIMES) (RS)
Mark Russell (MR)
Paul Furley, Guest Speaker (PF)

Several members of the public as observers.

Apologies :

Dr. Simon Holgate, Member Nominated Director (Sea Level Research) (SH)
John McKenna, Non-Executive Director (JMK)
Mr Jamie Roberts, Director (JR)

Start

MW welcomed everyone to the meeting and thanked to AIMES for the use of the board room at their Data Centre in the Liverpool Innovation Park 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.

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

The board reviewed minutes from the last session.

LNG and RS are still waiting to coordinate times and dates to meet in order to ratify network design for the AIMES node as well as the setup of a second node for Liverpool Community Grid.

MW gave the board an update on the Internet of Things LoRaWAN gateways located around the city that are connected to IXL's newly launched Internet Exchange for IOT devices and that the 10 nodes will be fully completed once the power issue on the cathedral is resolved. MW also said that he has potentially secured Bidston Hill as a site to mount wireless equipment for both as a LoRaWAN node and backhaul for IXL.

PF volunteered to host a LoRaWAN gateway at his house in the city centre.

DP updated the board regarding conversations with Liverpool's Anglican Cathedral and the issue of obtaining reliable power for one of IXL's nodes and that a second meeting has been arranged after the first meeting was not successful.

LNG updated the board as to the progress of the Liverpool Community Grid Project and that two new servers have been donated to the project in the last month and was pleased to announce that since going live LCG has donated 2 years and 181 days of processing time.

RS suggested that once the second LCG node goes live over the spring time, AIMES could donate free power to the project using the solar panels that are currently being installed on their data centre.

DP gave an update to the board regarding future events and was pleased to announce that the entire year ahead has been planned with five community events planned so far.

LNG gave a technical update regarding the technical planning and operational updates of the Internet Exchange, including his intent to use IXP Manager for the setup and management of IXL going forward.

RS gave an update regarding his meeting with the Bunker/Littlewoods building and the installation of a IXL node at this site, it now appears that Capital and Centric are no longer interested. MW said that we should now strike these sites off the list of possible city nodes for the IXL metropolitan network, especially given that we have been waiting around 12 months for a commitment.

LNG started a discussion around the full time use of radio for connectivity between the nodes and that some people in the peering community had concerns towards the use of radio for BGP. RS said that many are comparing what IXL are doing to a national network in which case it would be a concern, stating that IXL are a startup and have no other option to establish an IX given the sale of the city fibre assets by Liverpool City Council.

MW said that IXL has still not heard from Liverpool City Council regarding and update as to the fibre tender.

MW thanked AIMES for the tour of their data centre

AOB

None.

End

Next Meeting 25th May 2017 @5pm at Liverpool Science Park, 131 Mount Pleasant, Liverpool

Action Points from the meeting

- LNG and RS to meet to discuss technical plans for the setup of the AIMES LCG node, set for by end of April
- LNG to ensure that the events part of the website reflects the meetup events

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 boundary. 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 3.4×10^{38} 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 co