

IX Liverpool (IXL) Board Meeting Minutes 8th December 2016 @ 7:00pm at Baltic Creative

Present:

Prof. Matt Wilson, Chairman (MW)
David Parr, Independent Director (DP)
Richard Spragg, Director Elect (RS)

Apologies :

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

Public Observers : Liam Givens (LG) (Stack Data Solutions Ltd), Mark Russell (MR) (bmicro), Patrick Fenner (Def Proc Engineering), James Pulver and others

Start

MW welcomed everyone to the meeting and thanks Baltic Creative for the use of the room once again and hoped we can use the science park as originally planned at one of our future meetings 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.

Telecoms Cloud have sponsored the costs of this meeting.

LG updated the board on Stack Data Solutions may no longer being interested in connecting to IXL. LG also discussed the other old HSBC Data Centre in the Sefton area, which is owned by Benchmark Properties (and has a connectivity into the Hibernia Networks Submarine Cable) and he is currently in talks with them to make them aware of our presence, what IXL could offer to them in the longer term.

MW gave an update on talks with Sensor City and confirm that he has a meeting arranged with them to explore their interest in working with IXL. RS said that AIMES could be working with them in the future and there could be mutual collaboration.

MW opened a discussion surrounding the JANET node in Liverpool and asked the board if they have any contacts with anyone at JANET to see if they would be interested in peering at IXL. RS shared his knowledge regarding JANET and that the node is at the University of Liverpool, which has connections to Liverpool John Moores University and The School of Tropical Medicine. RS said that at some point in the future and when EyeBall networks are peering at the exchange, then there would be more of a case for JANET to peer. The board confirmed that it was a long term project and it would take quite a long time before gaining any substantial traction on this, but our offer would remain open to JANET for when they believe it would be worthwhile to connect to IXL.

No update from SH on the SuperPort, the board is awaiting a response.

The board debated the current situation regarding the lack of Internet Routable IP addresses, and the high cost of joining RIPE in order to obtain these, and given the current financial situation at IXL, they felt that RIPE should have IP addresses set aside for fledgling exchanges like ourselves. RS said that AIMES don't have any space IP addresses to donate to IXL currently, but offered various hosting services that IXL might need some of the IP address for.

MW said that we have still not heard back from Tim or Louise Kilbride at Capital and Centric for the installation of the node at the Bunker and the Tempest Buildings along with enabling the Liverpool Film Studios on Edge Lane, which the board debated would make perfect sense and that connectivity would be key to the success of this location.

A member of the public present said that there is a general opinion that the Film Studios won't be that successful as there is little infrastructure planned and very poor connectivity in the area, and instead will be used as a storage facility.

DP gave an update on the events and expressed concern that since the last board meeting little progress had been made, and the board discussed the list of speakers that could present at future events organised by IXL. Several members of the public offered to put the board in contact with several speakers that may be interested. MW confirmed the brief that formed the basis of the IXL talks and what type of speakers would be ideal, and asked for members of the board to consider speakers from their personal contacts and networks.

DP also asked for greater contact between volunteers and himself in order to improve communication between the team for a more coordinated approach as he expressed concerns with how the event team are currently operating.

MR suggested that the social network Hive and Paul Furley (who runs the Mersey Net WIFI project) should be invited to talk at future events.

MW gave an update on I.T answers and that they expected them to join IXL shortly now that they have received their RIPE allocation and AS number and looked forward to seeing them peer on the exchange.

MW said that Cogent, GTT and RETN had been in touch a number of times, offering transit on the exchange and asked that if any member wanted to buy such transit from them, to get in touch with Kevin Watson directly.

MW confirm that IXL has been invited to the next IX Leeds board meeting and asked for board members to attend with him subject to the date being confirmed. RS and DP volunteered to attend.

MW updated the board about discussions with the Technical Director at MetroNET and said that they are not going to peer currently. MW stated that the door will always be open and hope to see them as a member on the exchange in the future. DP expressed disappointment as they are an eyeball network and the benefits should be clear for traffic remaining local, which would benefit everyone involved, and it is silly with the traffic going to London and back for traffic originating and terminating in Liverpool. DP said that this was down to a lack of vision and Liverpool is in danger of being a “follower” type of city, rather than a “challenger”, and behind Manchester and others, which is a worrying position for the citizens of the region. The board agreed and debated the lack of vision in the city as a whole and confirmed that IXL will struggle as result and that IXL was an uphill struggle.

MW confirmed that the bank account is still not set up and are still waiting for JR to complete this, which is disappointing as the organisation still does not have a bank account after 9 months in operation, the board agreed that this should be given great importance.

The board debated the recent Liverpool City Council bid for use of the 172KM NET ducts around the city and after a long debate expressed their disappointment about how LCC have handled this and by not contacting or engaging with IXL nor the digital community, especially given the previous communication that IXL have had with them as we expressed our interest and aims being 1. To make Liverpool the best digitally connected city outside London, 2. To support the development of connectivity (based on openness, transparency, mutuality and neutrality) throughout Liverpool by the creation of a network of Internet Exchange points so that members can exchange traffic locally; making the Internet faster and more reliable for end users and 3. To be a voice for digital organisations through the monitoring, informing, educating, persuading and participation and representation in local and national public policy.

RS said that they were disappointed that LCC had not been in touch with AIMES either (regarding the use of the fibre), especially given that they currently use a small portion of it for connections to end users.

MR expressed his deep disappointment with LCC over the bid and although he felt the IXL letter was defensive and took quite a negative tone, he believed that their shortsightedness could set Liverpool back years, and does not see how their decision will help create the much needed jobs within the region, and that LCC could have collaborated and engaged with IXL and the community to listen to their needs and expectations. MR (who is also a business owner) also said that IXL could have made a real contribution to the overall objectives of the LCC overarching strategy, and instead of seeing the bigger picture, LCC have taken a short term position that will ultimately affect our digital futures.

MR said that he hopes that we are not stuck with the current providers and poor speeds and connectivity for the next 5 years thanks to the LCC’s short term “cash raid” on public assets.

JMK (via Slack) gave examples of poor internet speeds, including a client he knows that works out of the Igloo collaborative space in Hannover street has to leave her office and go to Starbucks or tether to her phone for Skype meetings.

MW confirmed that IXL has been in touch with LCC since the start of the year and has had several conversations with them regarding what we are wanting to achieve and is equally disappointed with LCC's handling of the bid, explaining that the real implications won't be felt for sometime, but he feared that LCC will only realise their mistake when the "brain drain" worsens even more (local talent moves out of Liverpool to another city, depriving the available talent pool for local businesses), jobs are lost and businesses are faced with the stark choice of "move or fail", referring to businesses that require internet to survive will have to move out of Liverpool altogether, taking many direct and indirect jobs with them, making Liverpool into a digital backwater.

DP said he was also frustrated and disappointed with the outcome of the LCC bid and could not believe that LCC have simply ignored the major advantages that an IXL and the use of the fibre ducts could bring to the region and agreed that LCC's poor decision will have long term implications and consequences for all of us.

MW also stated that depending on who has won the bid (assuming the bid was successful) it could have significant repercussions for the wider community, jobs and businesses in Liverpool. He stated that although IXL would like to work with the successful bidder, regardless of the outcome, he does still think that LCC have deprived the community of an important asset, potentially creating another monopoly within the region, leading to higher costs and poorer service levels for businesses and consumers.

MW said that IXL felt the needs of our community are clear, they want open access to the underground ducts and fibre optic network to help bring ultra-fast broadband to more businesses and citizens that is based on openness, transparency, mutuality and neutrality and with an Internet Exchange at its core.

LG said he was equally disappointed with the outcome and hopes LCC will reply to our letter.

MW said that IXL should be a collective voice of the digital community, as one of its core functions is policy, and that we must remain professional as there is a danger that given the temperature of the community and the anger behind the decision that our core message would be lost. MW said that IXL should still be working with LCC to offer them options during the next 5 years.

MW also confirmed that IXL's reply to LCC's bid has been published on the blogs section of our website.

MR asked the board why local politicians have not engaged with IXL and why they don't see Internet Access and the Digital Economy as an important part of the local economy and wondered if they were correctly representing citizens longer term needs.

MW discussed the recent announcement in the Autumn Statement regarding “fibre tax” and how that would have impacted the LCC bid in any case, but was pleased to hear that this is now unlikely to be charged as part of the broadband initiative.

MR gave an update regarding the social media, website and external communications that he and his team look after, explaining that engagement is rising and looking positive. The board asked that more people write blogs for our website.

The board reviewed its last community event at Launch22 and were concerned about using it as an event space again given the problems experienced from the last event, which included the power being cut off to the entire building, problems gaining entry and confusion around the date of the event. MR confirmed that he would find out what happened on the night and report back.

MW gave an update regarding LINX, and LINX95 and after brief meetings with John Souter the CEO, he is hoping that LINX could make a donation of old equipment, time and other items in the future, confirming that LINX are still in support of what IXL are doing. MW is due to speak with John Souter again soon with a view to taking this further. MW asked for volunteers from IXL to attend the next LINX event with him.

The board reviewed the use of Slack as a communications tool and invited others to come onto the channel for ongoing communication of IXL outside of the board meetings.

MW confirmed that he had managed to obtain a number of letters of support that have now been uploaded to the IXL website and asked the volunteers to keep pressing for more as IXL are still very low on the amount of letters. MW also said that SH is working with Shop Direct in order to obtain a letter from them and looked forward to SH giving an update to the team on this. RS confirmed that he would supply a letter of support on behalf of AIMES. The board discussed that they have still not heard from Starship, doES Liverpool, and around 18 other organisations that has been asked. MW said that it is still a disappointing result.

A member of the public asked what the letters of support are for and who would be ideal supporters so they could help target various people.

MW gave an update on the new initiative “Liverpool Community Grid” that is racking up many years of time and is looking for volunteers to head this project up inside or outside IXL. He also asked for members to be on the lookout for more old computers to donate to the cause as Liverpool could pioneer the way forward with helping scientists to find cures for diseases by creating the bigger city wide community grid cluster in the world: a proud achievement from a “load of donated scrap computers”.

JMK (via Slack) said that that he was in discussion with VIP computers in Warrington about some of their retired and surplus equipment as they are currently recycling and paying for someone to take away.

MW gave an update as to his attendance of the Parliament and Internet Conference in the Houses of Parliament where he met Matthew Hancock MP, who gave his support to the creation of IXL and confirmed that he wants Britain to be the best place in the world to do digital business, and that Liverpool was part of the Northern Powerhouse initiative and IXL should be a key asset in this proposition.

MW gave an update from the team working on the new idea for the creation of an Internet Exchange for the Internet of Things and that in the next few days we will be connecting a LoraWAN gateway (a project in collaboration with Def Proc Engineering and doES Liverpool) and believe that (based on recent research) that IXL have just created the UK's first IOT Internet Exchange. The board debated that although it was very early days, they did not expect many members to join onto the new LAN in any large numbers (in the short term), and that the longer term vision of the new IOT LAN would become an important fixture of the exchange, especially that Liverpool is becoming a leader in IOT nationally, and coupled with the LCC Smart Cities initiative, it would be a good tool for R&D projects while long term it would serve as an important asset to the community as a permanent piece of IOT infrastructure within Liverpool.

MW said that he has recently sent a letter to the Anglican Cathedral with an ask to use their tower for the hosting of the LoRaWAN gateway along with radio backhaul to the IOT LAN and awaits a reply back from the Very Rev Peter Wilcox. MW passed his thanks to Mr. Martin Hudson who is pushing this with the Cathedral directly.

The board was disappointed to hear that Richard Gregory from Tech North has still not come back to IXL about meeting up and engaging with the local digital community and despite promises from his predecessor, who failed to get in touch, the board felt that they have been let down once again and can understand the local resentment against Tech North.

MW gave an outline on IXP Manager and suggests that IXL consider it as our main IX controller for the exchange and asked JR and LG to setup a task and finish group to begin the testing around this, although he appreciated that the project will likely be stalled until we can afford to raise enough money to buy internet routable IP addresses.

RS suggested a meeting with JR and LG to discuss an update to the IXL network topology for connecting new members to the exchange.

The board debated the creation of a third node on IXL in the AIMES Data Centre (complementing Elevator & Baltic Creative nodes). RS suggested that AIMES could donate the equipment required to setup a node within the AIMES DC and also provide other connectivity onto the node from other providers such as Console network services and Virgin Media (who have their own node within the AIMES DC)

It was collectively agreed that a third node within AIMES would be planned and that JR's team would look to meet in January to arrange this.

It was suggested by the board to approach the PR Expert Mick Ord with the view to Mick becoming IXL's PR Communications and PR advisor.

It was also suggested by the board that IXL could be a host location for a future UKNOF conference. MW gave an update about being invited to Telehouse for the opening of Telehouse Two, a new DC in London where he met the Japan Ambassador Koji Tsuruoka, who agreed that decentralisation of the internet was an important factor in the future, and wished IXL the best of luck.

The board agreed that the longer term vision for the regional exchanges such as IXL will come true once the likes of BT and Virgin begin to peer locally within the region, and although the board understands that much change in terms of engineering works is required in the network topology, the drive will come with the pressure from the likes of LINX and the advent of 4K broadcast television and that the momentum is likely to build soon and a case for more regional peering will be in demand. In the long term, IXL would be taking a lot of strain off the back of such networks. The board also said that in addition to this, they would like to see the likes of Akamai and LimeLight Networks becoming members of the exchange and setting up local caching servers to make services better for brands such as Airbnb, BBC iplayer, Netflix, Clear Channel, IKEA, MET Office, Water Corp, Nintendo and RightMove.

AOB

The board discussed the election of Mr. Richard Spragg as a member nominated director (on behalf of and to represent member AIMES)

A member of the public enquired about the pricing of the IOT LAN and how it would work, asking what the future benefits of the LAN are and how they could take advantage of the connectivity and how the board see the strategic future of the LAN with the likes of Sensor City and others.

End

Next Meeting 26th January 2016 – 7pm at AIMES @ Liverpool Innovation Park

Action Points from the meeting

- LG to get pursue communication letter of support from Benchmark Properties
- MR to contact Hive to speak at a future IXL event.
- MR to report back on Launch22 event space issues
- SH to send out invitation to Patrick Fenner and Richard Spragg for Slack
- JR and LG to meet with AIMES regarding the Topology design for new members
- LG to follow up a lead with NATS for the hosting of an ADS-B receiver

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 to 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