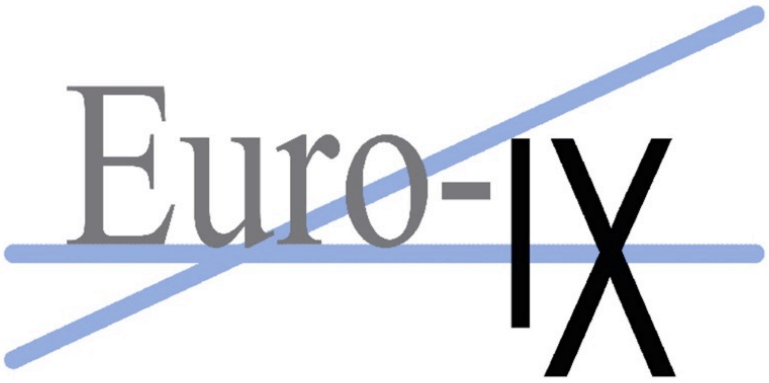


European Internet Exchange Association

2008 Report on European IXPs

Serge Radovcic of Euro-IX

24 October 2008

http://www.euro-ix.net

CONTENTS

5. IXP participants

6. European IXP aggregated peak traffic trends

7. IXP switching platforms

8. Further information

Section 1. Introduction

1.1 Foreword

This report has been compiled by the European Internet Exchange Association (Euro-IX) in an attempt to get a better picture of the past and current situation in regards to the number of Internet Exchange Points (IXPs) operating in Europe, the amount of traffic being exchanged at these IXPs, the number of connected parties peering there, and other relevant statistics and trends that are now appearing in the European IXP market.

1.2 Internet Exchange Point (IXP)

Euro-IX has accepted the industry definition of an IXP as being:

"A physical network infrastructure operated by a single entity with the purpose to facilitate the exchange of Internet traffic between Autonomous Systems. The number of Autonomous Systems connected should at least be three and there must be a clear and open policy for others to join."

1.3 Euro-IX

The European Internet Exchange Association (Euro-IX) was formed in May 2001 with the intention to further develop, strengthen and improve the Internet Exchange Point (IXP) community.

A number of Internet Exchange Points recognised a need to combine their resources so as to co-ordinate technical standards across the continent, develop common procedures, and share and publish statistics and other information. This publishing of information would in turn give all interested parties a better insight into the world of IXPs.

Euro-IX was originally set-up as a discussion forum for European based IXPs however as interest started to grow from other regions it seemed a natural progression for Euro-IX to expand beyond its original boundaries. Thus in January of 2005 the association decided to open its doors to IXPs from outside of Europe and this saw the introduction of allowing non-European based associate member IXPs to join Euro-IX.

Today Euro-IX has 37 member IXPs from some 25 European countries, as well as 9 IXPs from Egypt, Japan, Nepal and the United States and five patrons from the switch vendor community as well as a patron from the collocation sector. The complete Euro-IX affiliated list is presented below [see *1.4 List of Euro-IX affiliates*]

1.4 List of Euro-IX affiliates

1.4.1 Euro-IX Member IXPs (Europe)

AIX	Athens	Greece
AMS-IX	Amsterdam	Netherlands
BCIX	Berlin	Germany
BIX	Budapest	Hungary
BNIX	Brussels	Belgium
CATNIX	Barcelona	Spain
CIX	Zagreb	Croatia
CIXP	Geneva	Switzerland
DE-CIX	Frankfurt	Germany
Equinix	Zurich	Switzerland
ESPANIX	Madrid	Spain
FICIX	3 locations	Finland
GigaPIX	Lisbon	Portugal
GN-IX	Groningen	Netherlands
INEX	Dublin	Ireland
InterLAN	Bucharest	Romania
LINX	London	United Kingdom
LIPEX	London	United Kingdom
LIX	Luxembourg	Luxembourg
LONAP	London	United Kingdom
Lyonix	Lyon	France
MIX	Milan	Italy
MSK-IX	Moscow	Russia
NaMeX	Rome	Italy
NDIX	17 locations	Germany/Netherlands
Netnod	Stockholm	Sweden
NIX	Oslo	Norway
NIX.CZ	Prague	Czech Republic
PacketExchange	26 Locations	Europe and United States
PLIX	Warsaw	Poland
RoNIX	Bucharest	Romania
SIX	Ljubljana	Slovenia
SwissIX	Zurich	Switzerland
TIX-Tuscany	Florence	Italy
TOP-IX	16 locations	Northwest Italy
UA-IX	Kiev	Ukraine
VIX	Vienna	Austria

1.4.2 Euro-IX Associate Member IXPs (outside of the Euro-IX region)

Any2 Exchange	United States
BBIX	Japan
JPIX	Japan
JPNAP	Japan
MEIX	Egypt
NOTA	United States
NPIX	Nepal
Switch and Data	United States
RIX	Iceland

1.4.3 Euro-IX Patrons

Cisco Systems
Extreme Networks
Force10 Networks
Foundry Networks
Glimmerglass
TelecityGroup

1.5 Notes on this report

i. The aggregated peak traffic statistics of the IXPs have been based on the publicly available web statistics that were gathered on the 28h of August 2008. These traffic figures do not take into account Privately Interconnected (PI) participants whose traffic does not pass over the IXP switching fabric.

ii. Not all European IXPs publicly publish aggregated traffic statistics and no attempts at estimates were made where true figures were not presented.

iii. All information has been gathered on a best effort basis and relies on the information that is publicly published by individual IXPs. Therefore all information contained in this report is only as accurate as the information that has been published by these IXPs. If you are planning to base your decision on the information contained in this report we strongly advise that check the information against up to date data.

iv. The IXP traffic statistics are very dynamic and keep changing on a daily basis. While the actual traffic amounts may be outdated, it is nonetheless quite an accurate representation of the ranking of each IXP, city or country in relation to one another. Latest captured traffic rankings will be provided upon request.

v. While the scope of this report does not attempt to analyse each graph in any great depth, further information can be requested for specific sections.

vi. A best effort was made to list all known IXPs in Europe, however it is expected that a very small number of IXPs may have been left out of this report. Euro-IX would welcome any information about IXPs that have not been covered in this report.

vii. Certain IXPs that were listed in the 2007 report have not been included in the 2008 report due to the fact that either no contact can be made with them to verify if they are still operational, or they have no working website or we have received information that they are no longer operational. These IXPs are: BUHIX, GALNIX, KIX, NFX, MIXT, MPIX, NOTA Madrid, SIMIX, TIX, UK6x and WRIX.

viii. In 2008 we have made a substantial effort to get in contact with a larger percentage of the European IXP community so that we were able to provide more accurate information in this report. Euro-IX was in contact with 88 of the 105 listed IXPs. This increase in contact has allowed us to provide much more accurate trends on traffic statistics as well as better details of IXP establishment dates, participants and the switches that are being used at IXPs across Europe.

Section 2. IXPs in Europe

2.1 IXPs listed per country

The following pages list all *known active* IXPs in Europe. This totals some **105 IXPs in 102 different cities in 31 European countries**.

Austria (1)		
VIX	Vienna Internet eXchange	Vienna
Belgium (3)		
BNIX	Belgian National Internet Exchange	Brussels
FreeBIX	FreeBIX	Brussels
PacketExchange	PacketExchange	Brussels
Croatia (1)		
CIX	Croatian Internet eXchange	Zagreb
Cyprus (1)		
CyIX	Cyprus Internet Exchange	Nicosia
Czech Republic (2)		
NIX.CZ	Neutral Internet eXchange of the Czech Republic	Prague
CBIX	Commercial Brno Internet Exchange	Brno
Denmark (1)		
DIX	Danish Internet eXchange point	Lyngby
Estonia (2)		
TIX	Tallinn Internet eXchange	Tallinn
TLLIX	Tallinn Internet Exchange	Tallinn
Finland (4)		
FICIX	Finnish Communication and Internet Exchange	Espoo Helsinki Oulu
TREX	Tampere Region Exchange	Tampere

France (12)

EuroGIX	Euopean Global Internet eXchange	Strasbourg
FNIX6	French National Internet Exchange IPv6	Paris
FreeIX	Free Internet Exchange	Paris
GEIX	Gigabit European Internet eXchange	Paris
Lyonix	Lyonix	Lyon
MAE - Paris	MAE - Paris	Paris
MA-IX	Marseille Internet Exchange	Marseille
PacketExchange	PacketExchange	Paris
PaNAP	Paris Network Access Point	Paris
PARIX	Paris Internet Exchange	Paris
POUIX	POUIX	Paris
SFINX	Service for French INternet eXchange	Paris

Germany (14)

ALP-IX	Alpen Internet Exchange	Munich
BCIX	Berlin Commercial Internet Exchange	Berlin
DE-CIX	Deutscher Commercial Internet Exchange	Frankfurt
ECIX - Berlin	European Commercial Internet Exchange	Berlin
ECIX - Dusseldorf	European Commercial Internet Exchange	Dusseldorf
ECIX - Hamburg	European Commercial Internet Exchange	Hamburg
INXS	Internet Exchange Point in Munich	Munich
KleyRex	Kleyer Rebstocker EXchange	Frankfurt
MAE - Frankfurt	MAE - Frankfurt	Frankfurt
NDIX	Nederlands-Duitse Internet Exchange	Borghorst Emsdetten Greven Gronau Nordhorn Münster Steinfurt
N-IX	Nurnberger Internet eXchange	Nurnberg
PacketExchange	PacketExchange	Frankfurt
S-IX	Stuttgarter internet eXchange	Stuttgart
WORK-IX	WORK-IX	Hamburg

Greece (1)

AIX	Athens Internet Exchange	Athens

Hungary (1)

BIX	Budapest Internet eXchange	Budapest

Iceland (1)

RIX	Reykjavik Internet Exchange	Reykjavik

Ireland (2)

INEX	Internet Neutral EXchange	Dublin
PacketExchange	PacketExchange	Dublin

Italy (5)

MINAP	Milan Neutral Access Point	Milan
MIX	Milan Internet eXchange	Milan
NaMeX	Nautilus Mediterranean Exchange Point	Rome
TIX Tuscany	Tuscany Internet eXchange	Florence
TOP-IX	Torino Piemonte Exchange Point	Alessandria Aosta Asti Biella Cuneo Ivrea Novara Pont Saint Martin Torino Verbania Vercelli

Latvia (1)

LIX	Latvian Internet eXchange	Riga

Luxembourg (1)

LIX	Luxembourg Internet eXchange	Luxembourg

Malta (1)

MIX	Malta internet Exchange	Msida

Netherlands (7)

AMS-IX	Amsterdam Internet Exchange	Amsterdam
FR-IX	Friese Internet Exchange	Leeuwarden
GN-IX	Groningen Internet Exchange	Groningen
NDIX	Nederlands-Duitse Internet Exchange	Almelo Arnhem Deventer Doetinchem Ede Enschede Hardenberg Harderwijk Hengelo Oldenzaal
NL-IX	Netherlands Internet Exchange	Amsterdam
PacketExchange	PacketExchange	Amsterdam
R-iX	Rotterdam Internet Exchange	Rotterdam

Norway (3)

FIXO	Free Internet eXchange Oslo	Oslo
NIX1	Norwegian Internet eXchange	Oslo
NIX2	Norwegian Internet eXchange	Oslo

Poland (4)

LIX	Lodz Internet Exchange	Lodz
PIX	Poznan Internet Exchange	Poznan
PLIX	Polish Internet Exchange	Gdansk Katowice Krakow Lodz Poznan Warsaw Wroclow
WIX	Warsaw Internet eXchange	Warsaw

Portugal (1)

GIGAPIX	GIGAbit Portuguese Internet eXchange	Lisbon

Romania (2)

InterLAN	InterLAN IX	Bucharest
RoNIX	Romanian Network for Internet eXchange	Bucharest

Russia (8)

CHEL-PP	Chelyabinsk Peering Point	Chelyabinsk
EKT-IX	Ekaterinburg Internet Exchange	Ekaterinburg
KRS-IX	Krasnoyarsk Internet Exchange	Krasnoyarsk
MSK-IX	Moscow Internet Exchange	Moscow
NSK-IX	Novosibirsk Internet eXchange	Novosibirsk
SAMARA-IX	SAMARA-IX	Samara
SPB-IX	St.-Petersburg Internet eXchange	St.-Petersburg
VLV-IX	Vladivostok Internet Exchange	Vladivostok

Slovakia (3)

SIX	Slovak Internet eXchange- Bratislava	Bratislava
SIX	Slovak Internet eXchange- Kosice	Kosice
sitelix	Sitel Internet eXchange	Bratislava

Slovenia (1)

SIX	Slovenian Internet Exchange	Ljubljana

Spain (4)

CATNIX	Catalunya Neutral Internet Exchange	Barcelona
ESPANIX	Espana Internet Exchange	Madrid
EuskoNIX	Punto neutro Vasco de Internet	Bilboa

Sweden (11)

GIX	Gothenburg Internet Exchange	Gothenburg
MALMIX	Malmoe Internet Exchange	Malmoe
Netnod	Internet Exchange i Sverige	Stockholm
Netnod	Netnod - Gothenburg	Gothenburg
Netnod	Netnod - Lulea	Lulea
Netnod	Netnod - Malmoe	Malmoe
Netnod	Netnod - Sundsvall	Sundsvall
NorrNod	NorrNod	Umea
RIX-GH	Regional Internet Exchange Gästrikland-Hälsingland	Gavle
STHIX	Stockholm Internet Exchange	Stockholm
SOLIX	SOLIX	Stockholm

Switzerland (3)

CIXP	CERN Internet eXchange Point	Geneva
Equinix	Equinix	Zurich
SwissIX	Swiss Internet Exchange	Zurich

Ukraine (3)

Od-IX	Odessa Internet Exchange	Odessa
KH-IX	Kharkov Internet Exchange	Kharkov
UA-IX	Ukrainian Internet Exchange	Kiev

United Kingdom (8)

LINX	London Internet Exchange	London
LIPEX	London Internet Providers EXchange	London
LONAP	London Network Access Point	London
MaNAP	Manchester Network Access Point	Manchester
MCIX	Manchester Commercial Internet Exchange	Manchester
MerieX	Meridian Gate Internet Exchange	London
PacketExchange	PacketExchange	London Manchester
RBEIX	RBIEX	London

2.2 Number of IXPs per country

This table lists the total number of IXPs that are known to exist in each European country. Where an IXP has multiple connected locations in more than one city within a country, this IXP has only been counted once for that particular country.

Country	No. of IXPs present
Germany	14
France	12
Sweden	11
United Kingdom	8
Russia	8
Netherlands	7
Italy	5
Finland	4
Poland	4
Belgium	3
Norway	3
Slovakia	3
Spain	3
Switzerland	3
Ukraine	3
Czech Republic	2
Estonia	2
Ireland	2
Romania	2
Austria	1
Croatia	1
Cyprus	1
Denmark	1
Greece	1
Hungary	1
Iceland	1
Latvia	1
Luxembourg	1
Malta	1
Portugal	1
Slovenia	1
31 Countries	

2.3 Total Number of IXPs per European City

City	Country	# IXPs
Paris	France	8
London	United Kingdom	6
Frankfurt	Germany	4
Amsterdam	Netherlands	3
Manchester	United Kingdom	3
Oslo	Norway	3
Berlin	Germany	2
Bratislava	Slovakia	2
Brussels	Belgium	2
Bucharest	Romania	2
Dublin	Ireland	2
Gothenburg	Sweden	2
Lodz	Poland	2
Malmoe	Sweden	2
Poznan	Poland	2
Tallinn	Estonia	2
Warsaw	Poland	2
Zurich	Switzerland	2
Alessandria	Italy	1
Almelo	Netherlands	1
Aosta	Italy	1
Arnhem	Netherlands	1
Asti	Italy	1
Athens	Greece	1
Barcelona	Spain	1
Biella	Italy	1
Bilboa	Spain	1
Borghorst	Germany	1
Brno	Czech Republic	1
Budapest	Hungary	1
Chelyabinsk	Russia	1
Cuneo	Italy	1
Deventer	Netherlands	1
Doetinchem	Netherlands	1
Dusseldorf	Germany	1
Ede	Netherlands	1
Ekaterinburg	Russia	1
Emsdetten	Germany	1
Enschede	Netherlands	1
Florence	Italy	1
Gavle	Sweden	1
Geneva	Switzerland	1
Greven	Germany	1
Gronau	Germany	1
Groningen	Netherlands	1
Hamburg	Germany	1
Hardenburg	Netherlands	1
Harderwijk	Netherlands	1
Helsinki	Finland	1
Hengelo	Netherlands	1
Ivrea	Italy	1
Kharkov	Ukraine	1
Kiev	Ukraine	1
Kosice	Slovakia	1
Krakow	Poland	1
Krasnoyarsk	Russia	1
Leeuwarden	Netherlands	1
Leipzig	Germany	1
Lisbon	Portugal	1
Ljubljana	Slovenia	1
Lulea	Sweden	1
Luxembourg	Luxembourg	1
Lyngby	Denmark	1
Lyon	France	1
Madrid	Spain	1
Marseille	France	1
Milan	Italy	1
Moscow	Russia	1
Msida	Malta	1
Munich	Germany	1
Münster	Germany	1
Nicosia	Cyprus	1
Nordhorn	Germany	1
Novara	Italy	1
Novosibirsk	Russia	1
Nurnberg	Germany	1
Odessa	Ukraine	1
Oldenzaal	Netherlands	1
Pont St. Martin	Italy	1
Prague	Czech Republic	1
Reykjavik	Iceland	1
Riga	Latvia	1
Rome	Italy	1
Rotterdam	Netherlands	1
Samara	Russia	1
St.-Petersburg	Russia	1
Steinfurt	Germany	1
Stockholm	Sweden	1
Strasbourg	France	1
Stuttgart	Germany	1
Sundsvall	Sweden	1
Tampere	Finland	1
Torino	Italy	1
Tysiaclecie	Poland	1
Ulyanovsk	Russia	1
Umea	Sweden	1
Verbania	Italy	1
Vercelli	Italy	1
Vienna	Austria	1
Vladivostok	Russia	1
Wroclaw	Poland	1
Zagreb	Croatia	1
		102			**31**	

Section 3. European IXP growth since 1992

3.1 IXP growth in Europe since 1992

This table details the 'official' establishment dates of IXPs in Europe since 1992. In some cases the IXP may have been 'unofficially' established (i.e. actually operating without any legal entity being established) earlier than some of the dates used in this table, however this report has been based on official establishment dates only.

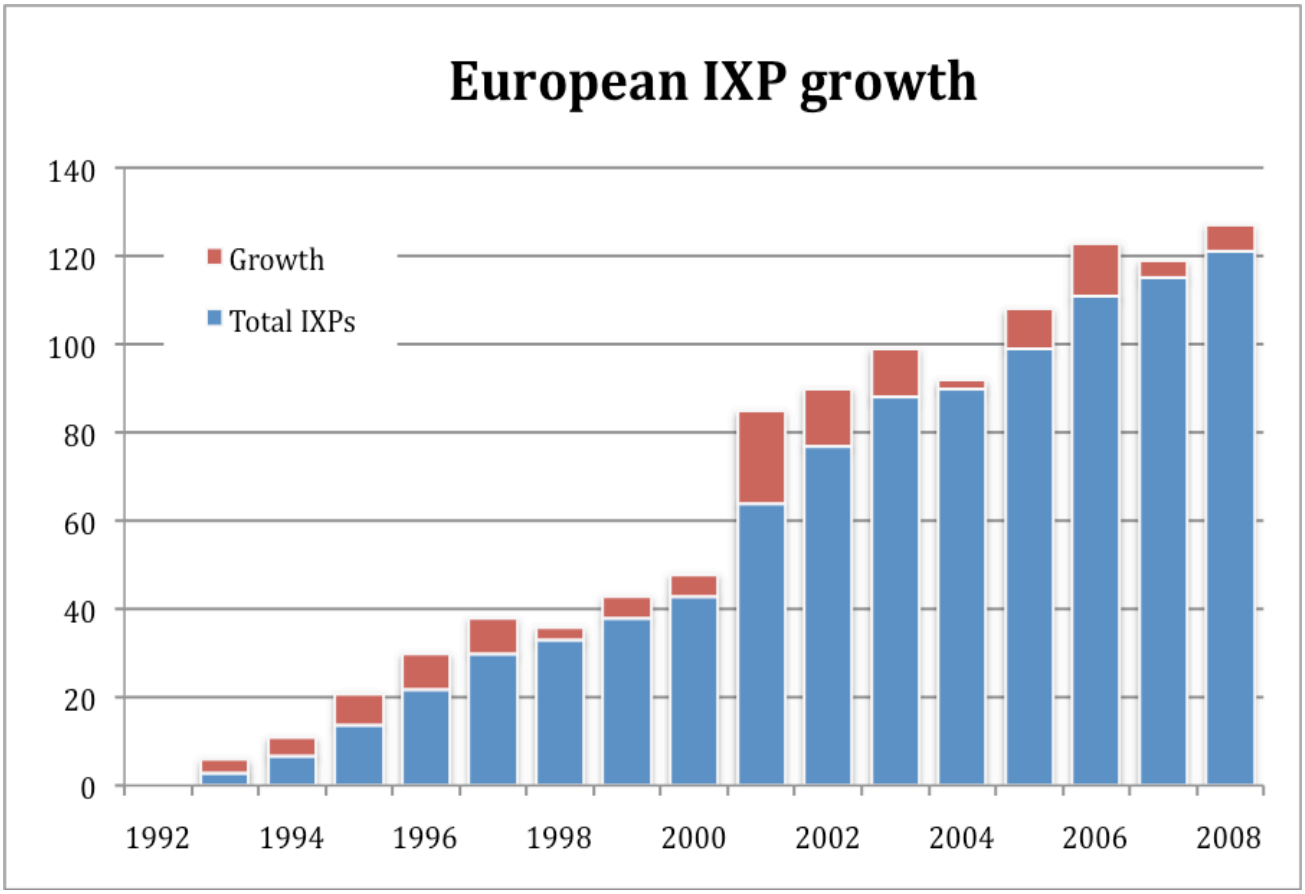
The three-year period between 2001 and 2003 saw the establishment of some 45 new IXPs in Europe. While the growth of new IXPs had definitely slowed down since then, it is still evident that there is some growth in the IXP sector.

Year	New IXPs	Total IXPs
1992	0	0
1993	3	3
1994	4	7
1995	7	14
1996	8	22
1997	8	30
1998	3	33
1999	5	38
2000	5	43
2001	21	64
2002	13	77
2003	11	88
2004	2	90
2005	9	99
2006	12	111
2007	4	115
2008	6	121

Note: The table above only indicates the establishment of the IXPs and not the closure date of those that have ceased to operate as this data can be quite difficult to properly establish. Thus the table shows the 121 IXPs that have ever been known to exist while it is believed that 105 of these are currently still operating.

3.2 Additional and total IXP growth per year

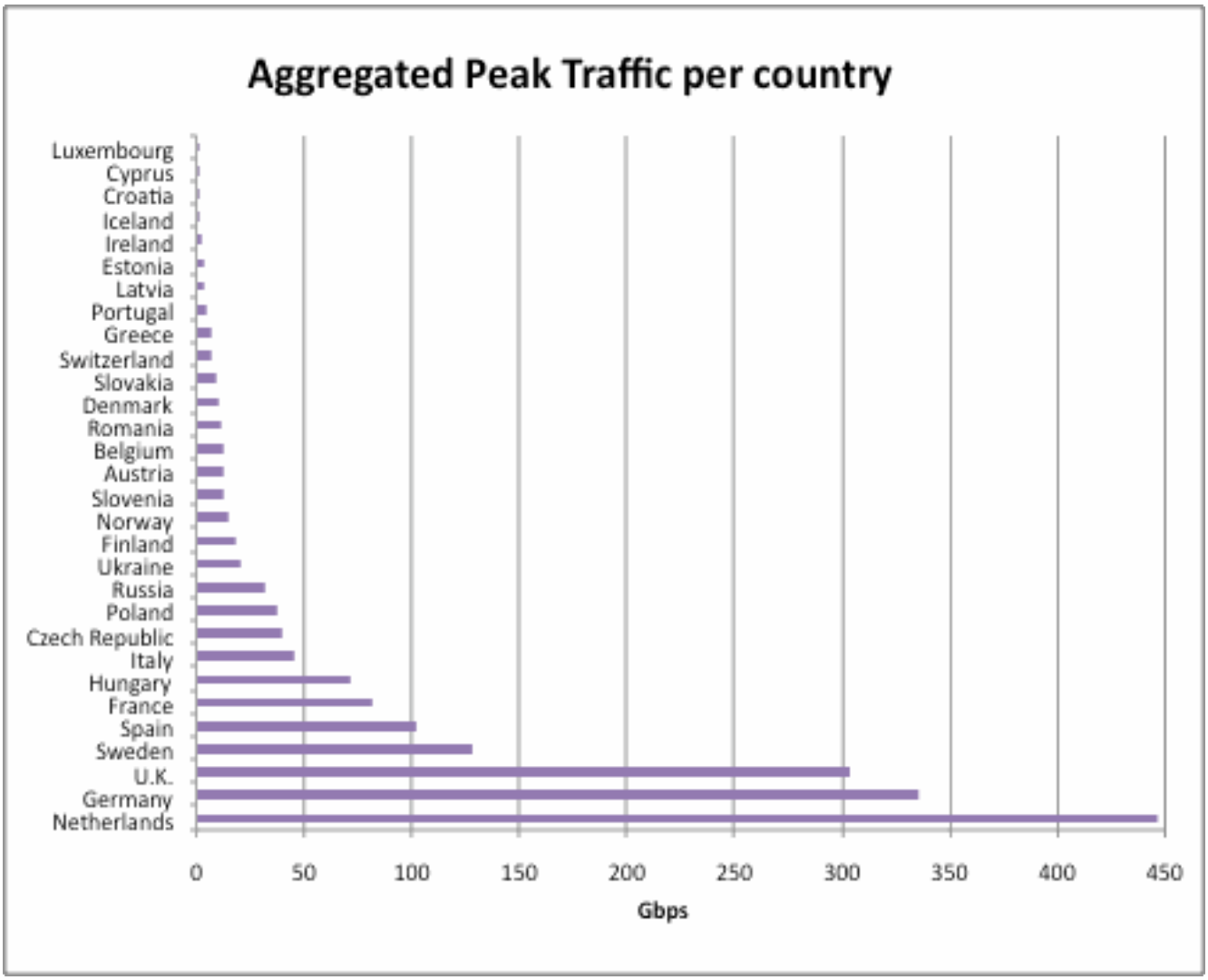
This graph highlights the establishment of new IXPs, per year, in comparison to the total amount of existing European IXPs. One can see from the graph that 2001, 2002 and 2003 were all years of exceptional growth in the establishment of IXPs in Europe. The last three years have seen the establishment of no less than 20 IXPs which would suggest that the growth is still present.



Section 4. IXP peak traffic

4.1 Aggregated peak traffic per country

This graph outlines the total aggregated peak IXP traffic per country in Europe. The totals for each country have been reached by adding the various IXP's traffic together from any one particular country. It should be noted that this data is taken from publicly viewable traffic statistics and information that is provided to Euro-IX via IXPs directly. These statistics do not include Private Interconnect traffic that does not pass over the public peering infrastructure.



Note: This traffic data was captured on the 28th of August 2008.

4.2 IXP traffic per country

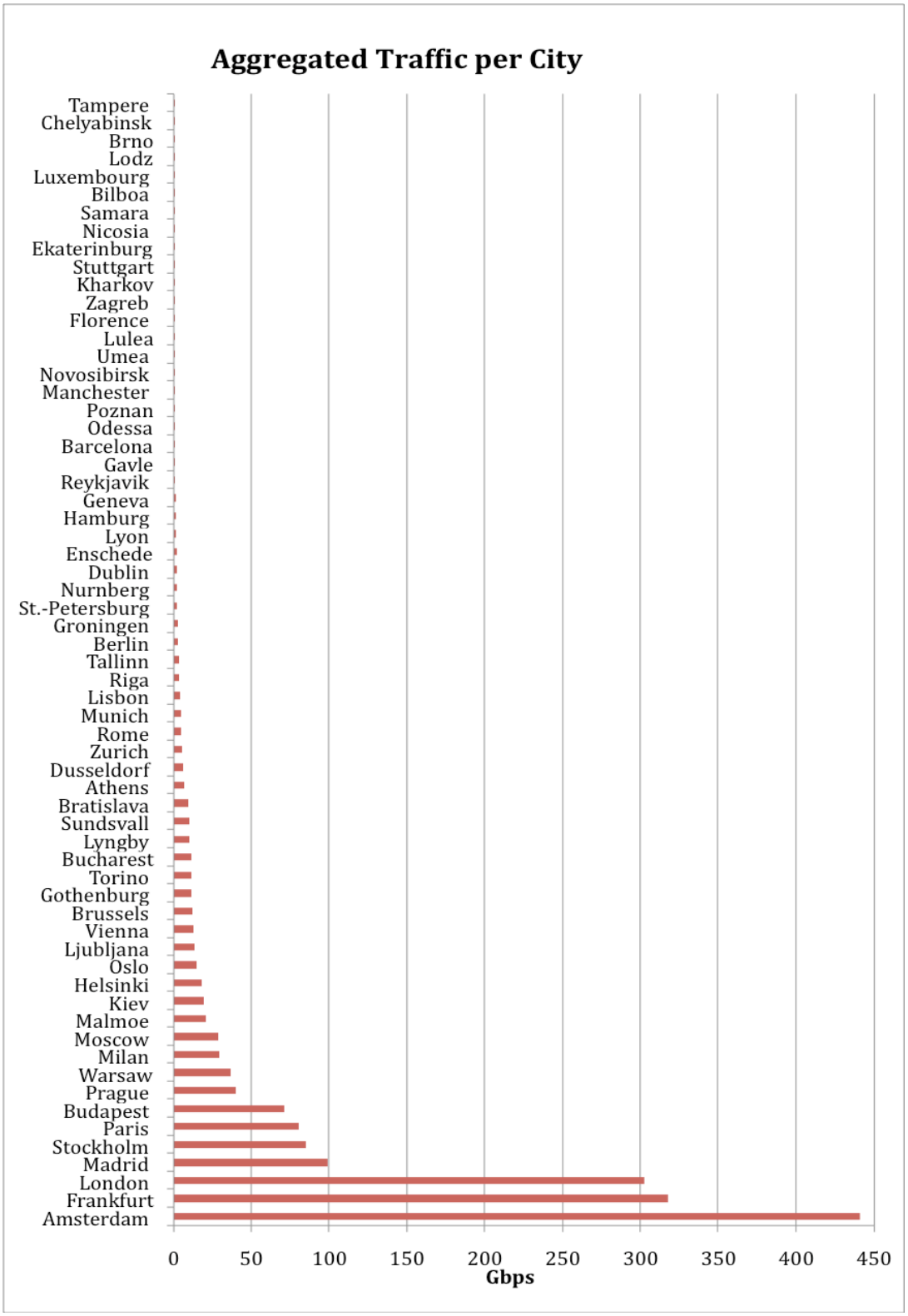
This table details the total aggregated peak IXP traffic per country in Europe. The totals for each country have been reached by adding the various IXPs' traffic together from any one particular country. It should be noted that this data is taken from publicly viewable traffic statistics and information that is provided to Euro-IX via IXPs directly. These statistics do not include Private Interconnect traffic that does not pass over the public peering infrastructure.

Country	Gbps	% of total
Netherlands	**445.580**	25.23%
Germany	**334.545**	18.95%
U.K.	**302.920**	17.16%
Sweden	**127.623**	7.23%
Spain	**101.425**	5.74%
France	**81.925**	4.64%
Hungary	**70.800**	4.01%
Italy	**44.958**	2.55%
Czech Republic	**39.620**	2.25%
Poland	**36.830**	2.09%
Russia	**31.421**	1.78%
Ukraine	**19.892**	1.13%
Finland	**17.716**	1.00%
Norway	**14.800**	0.84%
Slovenia	**13.000**	0.74%
Austria	**12.880**	0.73%
Belgium	**12.000**	0.68%
Romania	**11.020**	0.63%
Denmark	**10.100**	0.57%
Slovakia	**9.312**	0.53%
Switzerland	**6.850**	0.39%
Greece	**6.400**	0.36%
Portugal	**4.280**	0.24%
Latvia	**3.500**	0.20%
Estonia	**3.060**	0.17%
Ireland	**2.000**	0.11%
Iceland	**0.960**	0.05%
Croatia	**0.208**	0.01%
Cyprus	**0.100**	0.01%
Luxembourg	**0.055**	0.01%
Total	**1,765.780**	**Gbps**

Note: This traffic data was captured on the 28th of August 2008

4.3 Peak aggregated traffic per city

This graph illustrates the total aggregated peak IXP traffic per European city.



Note: This traffic data was captured on the 28th of August 2008

4.4 IXP traffic per city (A - L)

This table details the total amount of aggregated peak IXP traffic per European city and further shows what percentage the city's IXP traffic is compared to Europe's IXP traffic as a whole. In some cases there is more than one IXP present in a city, in these cases the total traffic of all those IXPs is shown.

City	Country	Traffic Gbps	% of total
Amsterdam	Netherlands	**440.910**	24.97%
Athens	Greece	**6.400**	0.36%
Barcelona	Spain	**0.360**	0.02%
Berlin	Germany	**2.700**	0.15%
Bilboa	Spain	**0.060**	0.00%
Bratislava	Slovakia	**9.312**	0.53%
Brno	Czech Republic	**0.020**	0.00%
Brussels	Belgium	**12.000**	0.68%
Bucharest	Romania	**11.020**	0.62%
Budapest	Hungary	**70.800**	4.01%
Chelyabinsk	Russia	**0.010**	0.00%
Dublin	Ireland	**2.000**	0.11%
Dusseldorf	Germany	**5.850**	0.33%
Ekaterinburg	Russia	**0.150**	0.01%
Enschede	Netherlands	**2.000**	0.11%
Florence	Italy	**0.214**	0.01%
Frankfurt	Germany	**317.805**	18.00%
Gavle	Sweden	**0.379**	0.02%
Geneva	Switzerland	**1.250**	0.07%
Gothenburg	Sweden	**11.436**	0.65%
Groningen	Netherlands	**2.670**	0.15%
Hamburg	Germany	**1.400**	0.08%
Helsinki	Finland	**17.715**	1.00%
Kharkov	Ukraine	**0.202**	0.01%
Kiev	Ukraine	**19.370**	1.10%
Lisbon	Portugal	**4.280**	0.24%
Ljubljana	Slovenia	**13.000**	0.74%
Lodz	Poland	**0.050**	0.00%
London	United Kingdom	**302.620**	17.14%
Lulea	Sweden	**0.219**	0.01%
Luxembourg	Luxembourg	**0.055**	0.00%
Lyngby	Denmark	**10.100**	0.57%
Lyon	France	**1.500**	0.09%

Note: This traffic data was captured on the 28th of August 2008

4.5 IXP traffic per city (M - Z)

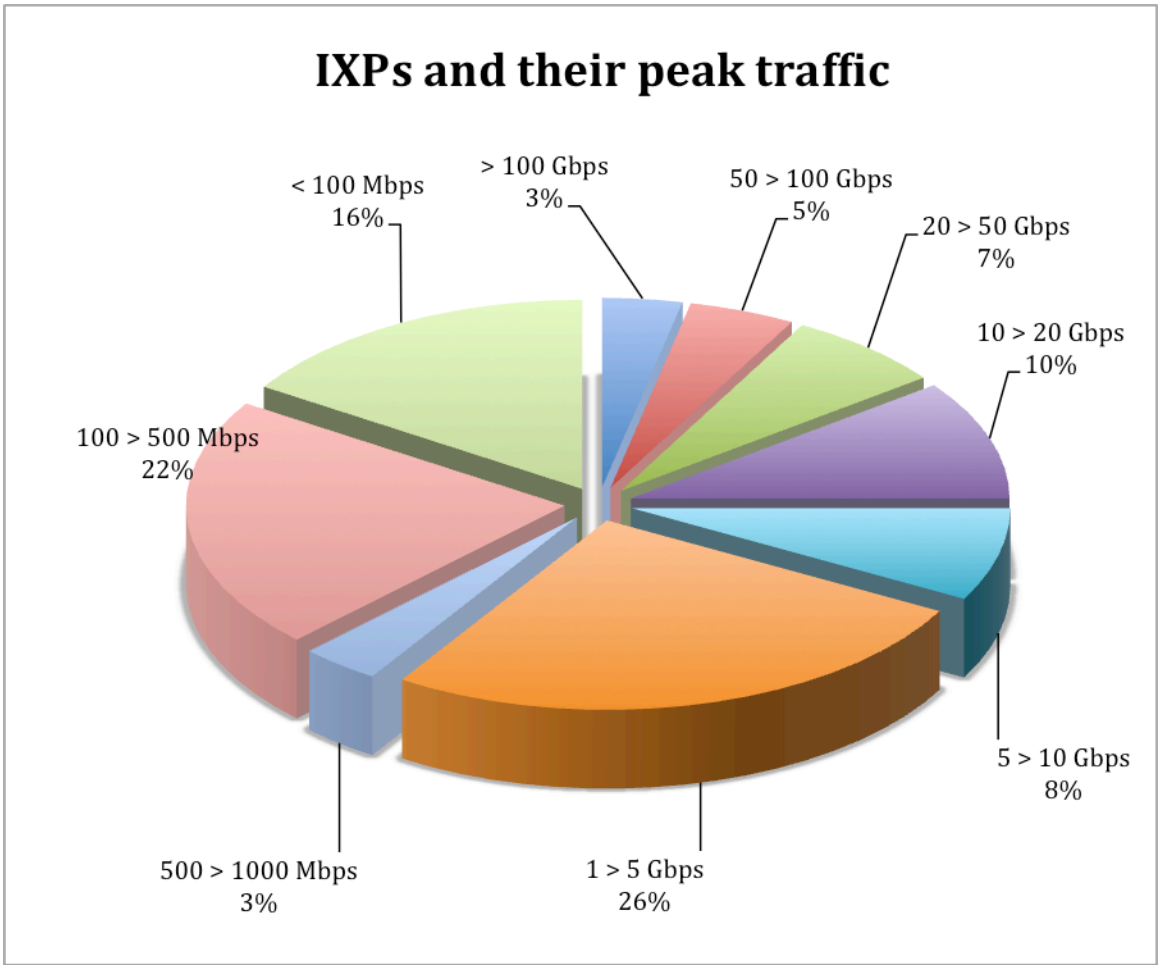
This table details the total amount of aggregated peak IXP traffic per European city and further shows what percentage the city's IXP traffic is compared to Europe's IXP traffic as a whole. In some cases there is more than one IXP present in a city, in these cases the total traffic of all those IXPs is shown.

City	Country	Traffic Gbps	% of total
Madrid	Spain	**98.500**	5.58%
Malmoe	Sweden	**20.702**	1.17%
Manchester	United Kingdom	**0.300**	0.02%
Milan	Italy	**28.871**	1.64%
Moscow	Russia	**28.796**	1.63%
Munich	Germany	**4.500**	0.26%
Nicosia	Cyprus	**0.100**	0.01%
Novosibirsk	Russia	**0.230**	0.01%
Nurnberg	Germany	**2.120**	0.12%
Odessa	Ukraine	**0.320**	0.02%
Oslo	Norway	**14.800**	0.84%
Paris	France	**80.425**	4.56%
Poznan	Poland	**0.320**	0.02%
Prague	Czech Republic	**39.600**	2.24%
Reykjavik	Iceland	**0.960**	0.05%
Riga	Latvia	**3.500**	0.20%
Rome	Italy	**4.564**	0.26%
Samara	Russia	**0.065**	0.00%
St.-Petersburg	Russia	**2.170**	0.12%
Stockholm	Sweden	**84.864**	4.81%
Stuttgart	Germany	**0.170**	0.01%
Sundsvall	Sweden	**9.799**	0.56%
Tallinn	Estonia	**3.060**	0.17%
Tampere	Finland	**0.001**	0.00%
Torino	Italy	**11.309**	0.64%
Umea	Sweden	**0.224**	0.01%
Vienna	Austria	**12.880**	0.73%
Warsaw	Poland	**36.460**	2.07%
Zagreb	Croatia	**0.208**	0.01%
Zurich	Switzerland	**5.600**	0.32%
Total		**1765.780**	**Gbps**

Note: This traffic data was captured on the 28th of August 2008

4.6 Percentage of IXPs and their peak traffic

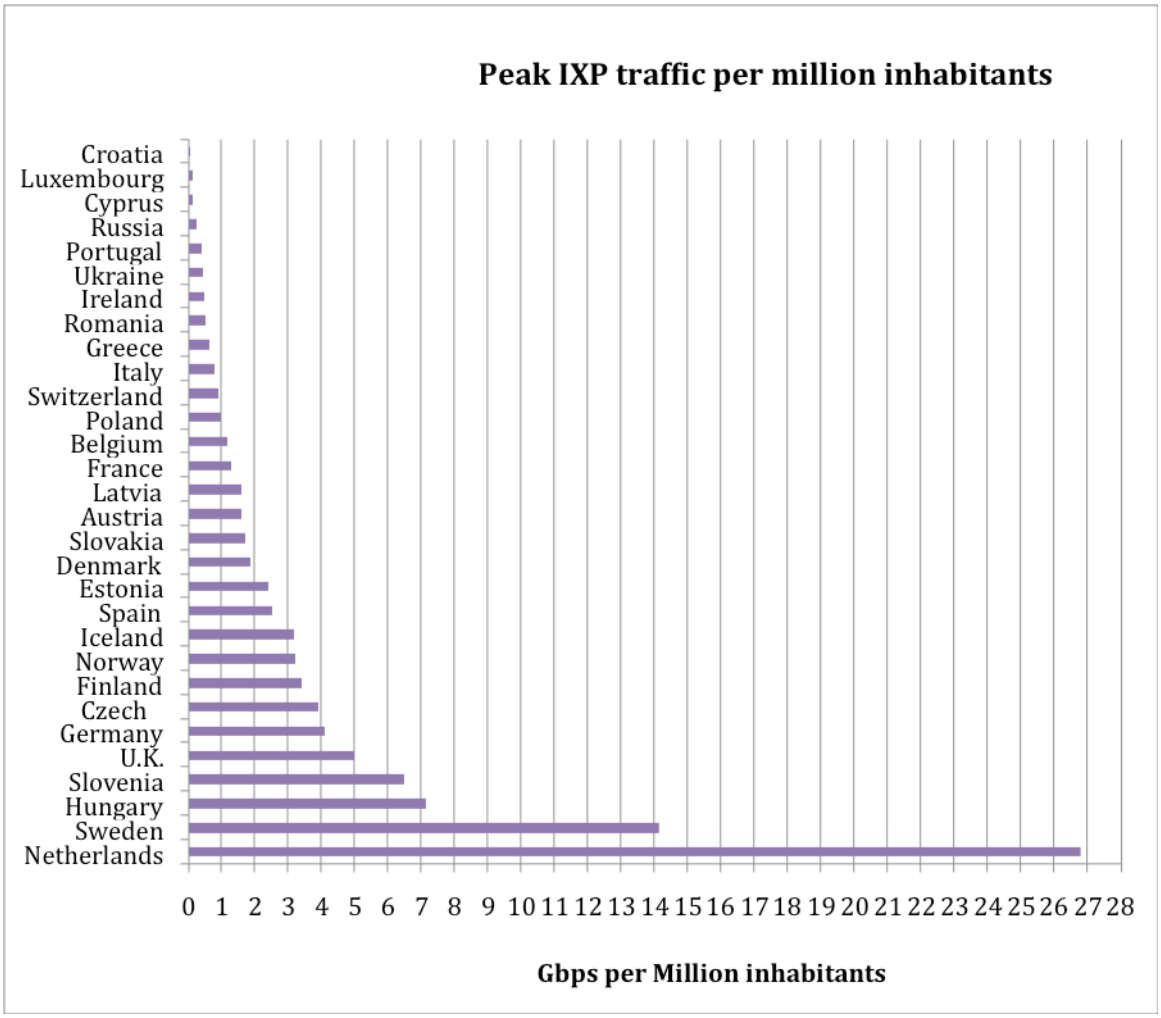
This graph highlights the percentage of European IXPs having a particular amount of peak traffic at their exchange. It should be noted that reliable traffic statistics could only be gathered from 88 of the 105 European IXPs, these percentages are therefore based on these 88 IXPs.



Peak traffic	# of IXPs	% of total
> 100 Gbps	3	3%
50 > 100 Gbps	4	5%
20 > 50 Gbps	6	7%
10 > 20 Gbps	9	10%
5 > 10 Gbps	7	8%
1 > 5 Gbps	23	26%
500 > 1000 Mbps	3	3%
100 > 500 Mbps	19	22%
< 100 Mbps	14	16%
Total	88	100%

4.7 IXP traffic per million inhabitants

This graph displays the total amount of peak IXP traffic per country in Gbps per million inhabitants. The July 2008 population estimates were taken from the *CIA World Factbook*.



Note: This data was captured on the 28th of August 2008

4.8 IXP traffic per million inhabitants

This table details the total amount of peak IXP traffic per country in Gbps per million inhabitants. The July 2008 population estimates were taken from the *CIA World Factbook*.

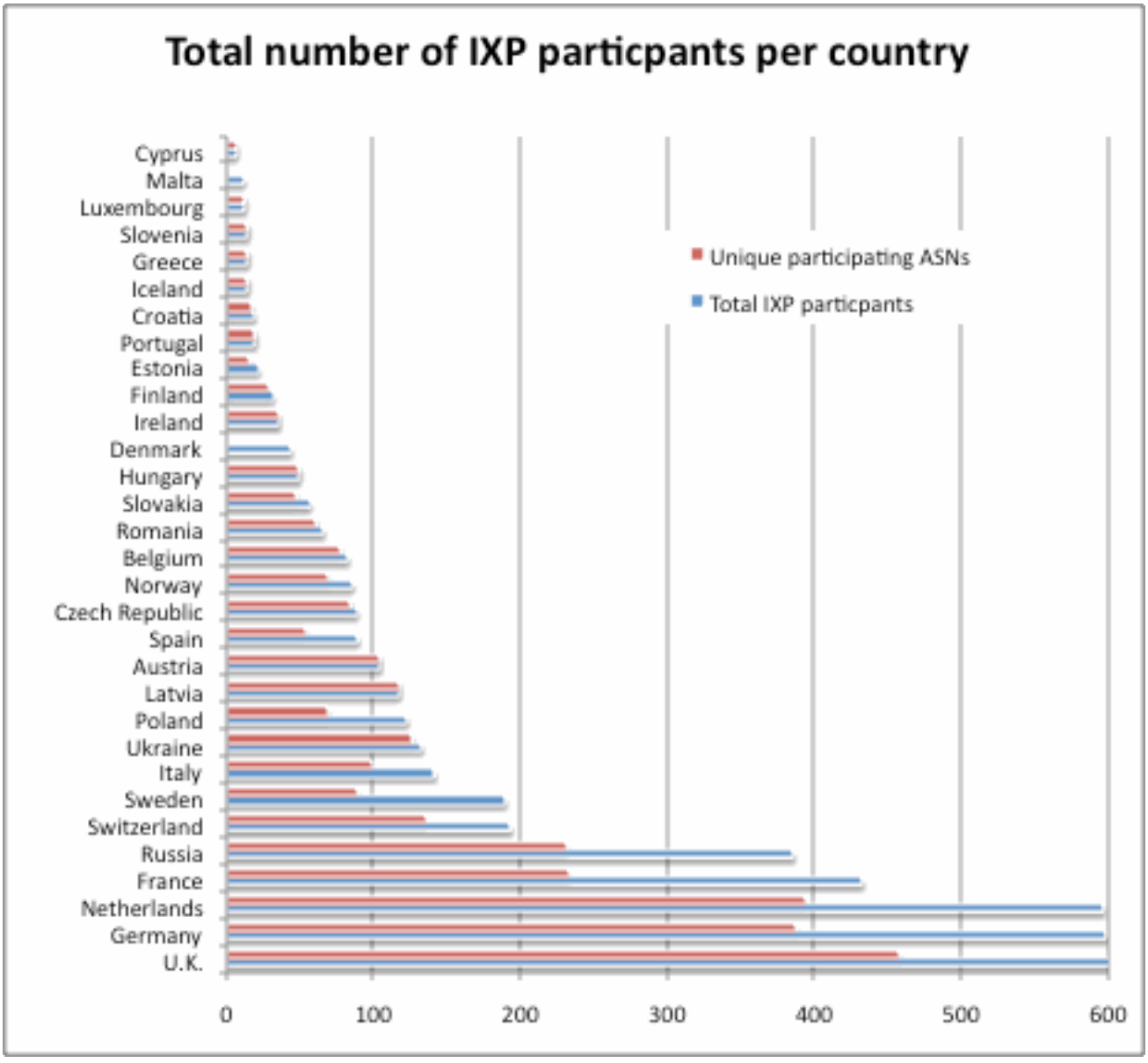
Country	Gbps	Population M	Gpbs/M people
Austria	12.880	8.206	**1.570**
Belgium	12.000	10.403	**1.154**
Croatia	0.208	4.492	**0.046**
Cyprus	0.100	0.793	**0.126**
Czech Republic	39.620	10.221	**3.876**
Denmark	10.100	5.485	**1.841**
Estonia	3.060	1.308	**2.394**
Finland	17.716	5.245	**3.378**
France	81.925	64.057	**1.279**
Germany	334.545	82.369	**4.062**
Greece	6.400	10.722	**0.597**
Hungary	70.800	9.931	**7.129**
Iceland	0.960	0.304	**3.158**
Ireland	2.000	4.156	**0.481**
Italy	44.958	58.145	**0.773**
Latvia	3.500	2.245	**1.560**
Luxembourg	0.055	0.486	**0.113**
Netherlands	445.580	16.645	**26.770**
Norway	14.800	4.644	**3.186**
Poland	36.830	38.501	**0.957**
Portugal	4.280	10.676	**0.401**
Romania	11.020	22.246	**0.495**
Russia	31.421	140.702	**0.223**
Slovakia	9.312	5.455	**1.707**
Slovenia	13.000	2.008	**6.474**
Spain	101.425	40.491	**2.505**
Sweden	127.623	9.045	**14.109**
Switzerland	6.850	7.582	**0.903**
Ukraine	19.892	45.994	**0.433**
United Kingdom	302.920	60.943	**4.971**
Total	**1,765.780**	**683.500**	**2.583**

Note: This data was captured on the 28th of August 2008

Section 5. IXP participants

5.1 Total number of IXP participants per country

This graph displays combined number of IXP participants in any given country. It further details the amount of unique ASNs peering in each county i.e. if an ASN is peering at more than one IXP in a country it is not being counted twice.



Note: This data was captured on the 28th of August 2008

5.2 Total number of IXP participants per country

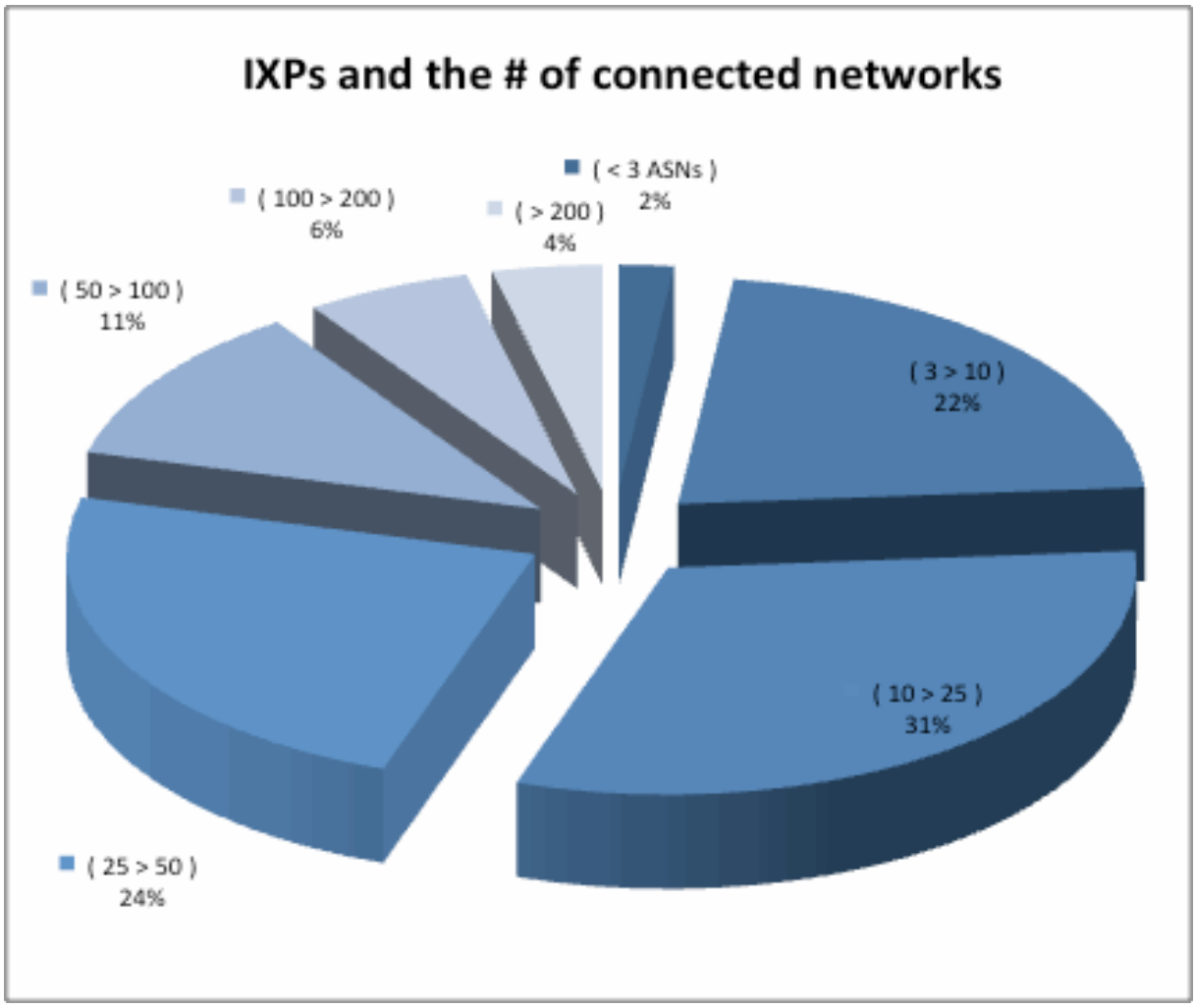
This table details:

a. Combined total number of IXP participants per country. This figure will include those participants that are present at more than one IXP in any given country.
b. Total number of listed or published ASNs per country. In some circumstances IXP participants to not wish to publicly advertise their ASN at a particular IXP or the IXP does not publish a list of their participant's ASNs.
c. Total number of unique ASNs participating per country. ASNs that participate at more than one IXP per country are only counted once in this column.

Country	Participants (a)	Published ASNs (b)	Unique ASN (c)
Austria	105	105	105
Belgium	83	83	78
Croatia	19	17	17
Cyprus	7	7	7
Czech Republic	89	89	85
Denmark	44	0	N/A
Estonia	22	22	16
Finland	32	32	29
France	433	417	233
Germany	599	595	388
Greece	15	15	15
Hungary	50	50	50
Iceland	15	15	15
Ireland	36	36	36
Italy	142	128	99
Latvia	118	118	118
Luxembourg	13	13	13
Malta	12	0	N/A
Netherlands	597	496	394
Norway	86	86	69
Poland	123	71	69
Portugal	20	20	20
Romania	66	66	62
Russia	386	232	232
Slovakia	57	57	48
Slovenia	15	15	15
Spain	90	68	54
Sweden	190	170	90
Switzerland	194	191	136
United Kingdom	675	640	458
Ukraine	133	133	127
Totals	**4466**	**3987**	**3078**
Total Unique ASNs peering at IXPs in Europe			**2340**

5.3 Percentage of IXPs and their number of participants

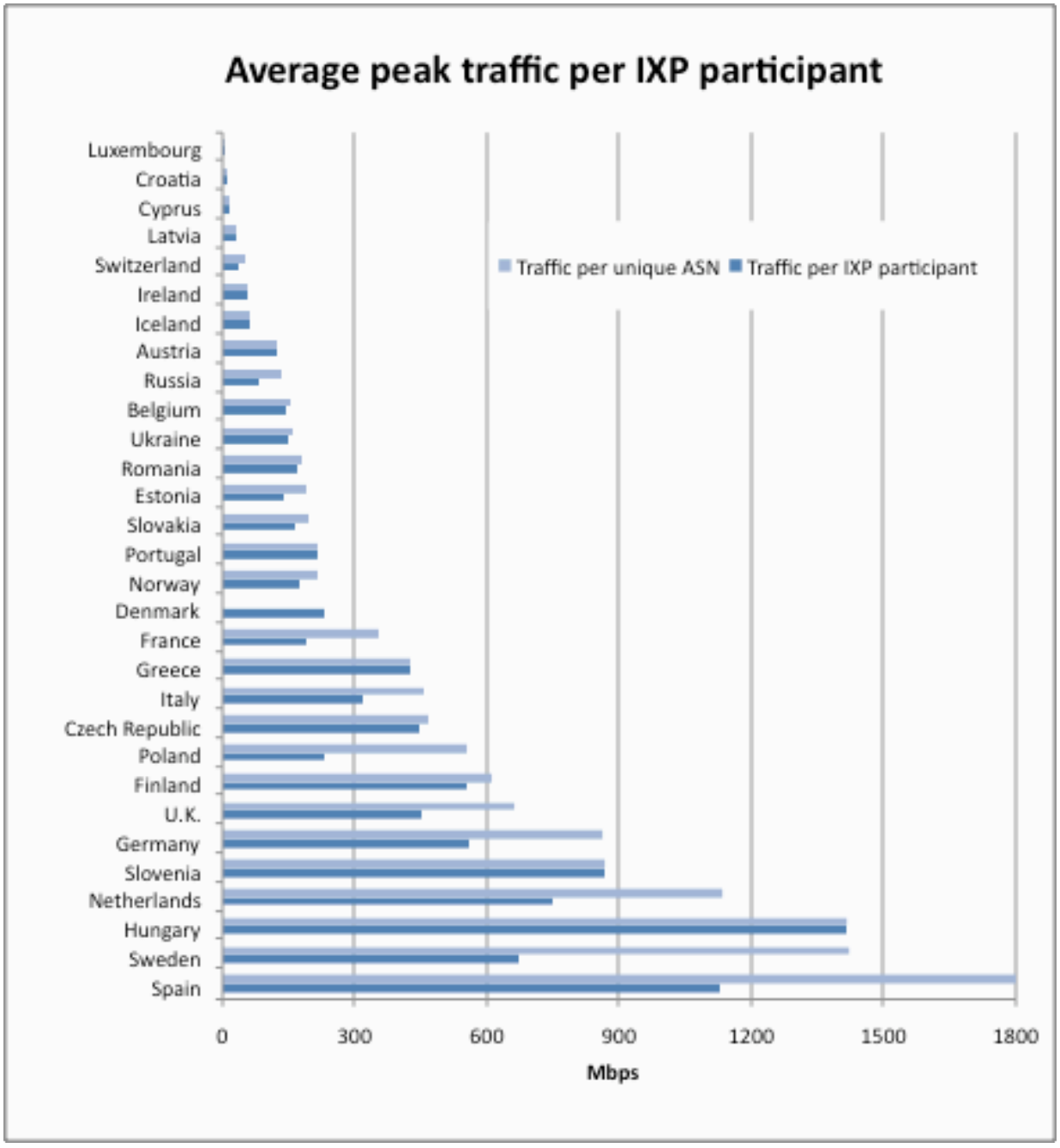
This graph highlights the percentage of European IXPs having a particular amount of participants at their exchange.



# of ASNs	# of IXPs	% of total
(< 3 ASNs)	2	1.9%
(3 > 10)	23	21.9%
(10 > 25)	33	31.4%
(25 > 50)	25	23.8%
(50 > 100)	12	11.4%
(100 > 200)	6	5.7%
(> 200)	4	3.8%
	105	

5.4 Average peak traffic per IXP participant per country

This graph displays the average amount of peak traffic per IXP participant per country and furthermore displays the average amount of peak traffic per unique ASN peering in each country.



Note: This traffic data was captured on the 28th of August 2008

5.5 Average peak traffic per IXP participant per country

This table details the average amount of peak traffic per IXP participant per country as well as identifying the average peak traffic per unique participant per country. The average traffic per participant has been derived by dividing the total amount of IXP participants, in a country, by the aggregated IXP traffic within that same country. While the traffic per unique ASN has been derived by dividing the total amount of unique ASNs known to be peering in a country by the total amount of IXP traffic in a given country.

Country	Traffic in Gbps	Participants	Traffic per particpant in Mbps	Unique ASNs	Traffic per unique ASN in Mbps
Austria	12.880	105	**122.667**	105	**122.667**
Belgium	12.000	83	**144.578**	78	**153.846**
Croatia	0.208	19	**10.950**	17	**12.235**
Cyprus	0.100	7	**14.290**	7	**14.290**
Czech Republic	39.620	89	**445.168**	85	**466.117**
Denmark	10.100	44	**229.546**	N/A	**N/A**
Estonia	3.060	22	**139.091**	16	**191.250**
Finland	17.716	32	**553.625**	29	**610.897**
France	81.925	433	**189.203**	233	**351.609**
Germany	334.545	599	**558.506**	388	**862.229**
Greece	6.400	15	**426.670**	15	**426.670**
Hungary	70.800	50	**1416.000**	50	**1416.000**
Iceland	0.960	15	**64.000**	15	**64.000**
Ireland	2.000	36	**55.556**	36	**55.556**
Italy	44.958	142	**316.606**	99	**454.121**
Latvia	3.500	118	**29.661**	118	**29.661**
Luxembourg	0.055	13	**4.231**	13	**4.231**
Netherlands	445.580	597	**746.365**	394	**1130.914**
Norway	14.800	86	**172.093**	69	**214.493**
Poland	36.830	123	**229.431**	69	**553.768**
Portugal	4.280	20	**214.000**	20	**214.000**
Romania	11.020	66	**166.970**	62	**177.742**
Russia	31.421	386	**81.402**	232	**135.435**
Slovakia	9.312	57	**163.368**	48	**194.000**
Slovenia	13.000	15	**866.667**	15	**866.667**
Spain	101.425	90	**1126.944**	54	**1878.241**
Sweden	127.623	190	**671.700**	90	**1418.033**
Switzerland	6.850	194	**35.309**	136	**50.368**
U.K.	302.920	675	**448.770**	458	**661.397**
Ukraine	19.892	133	**149.564**	127	**156.630**
Europe	**1765.780**	**4454**	**326.431**	**3078**	**444.382**

Note: This traffic data was captured on the 28th of August 2008

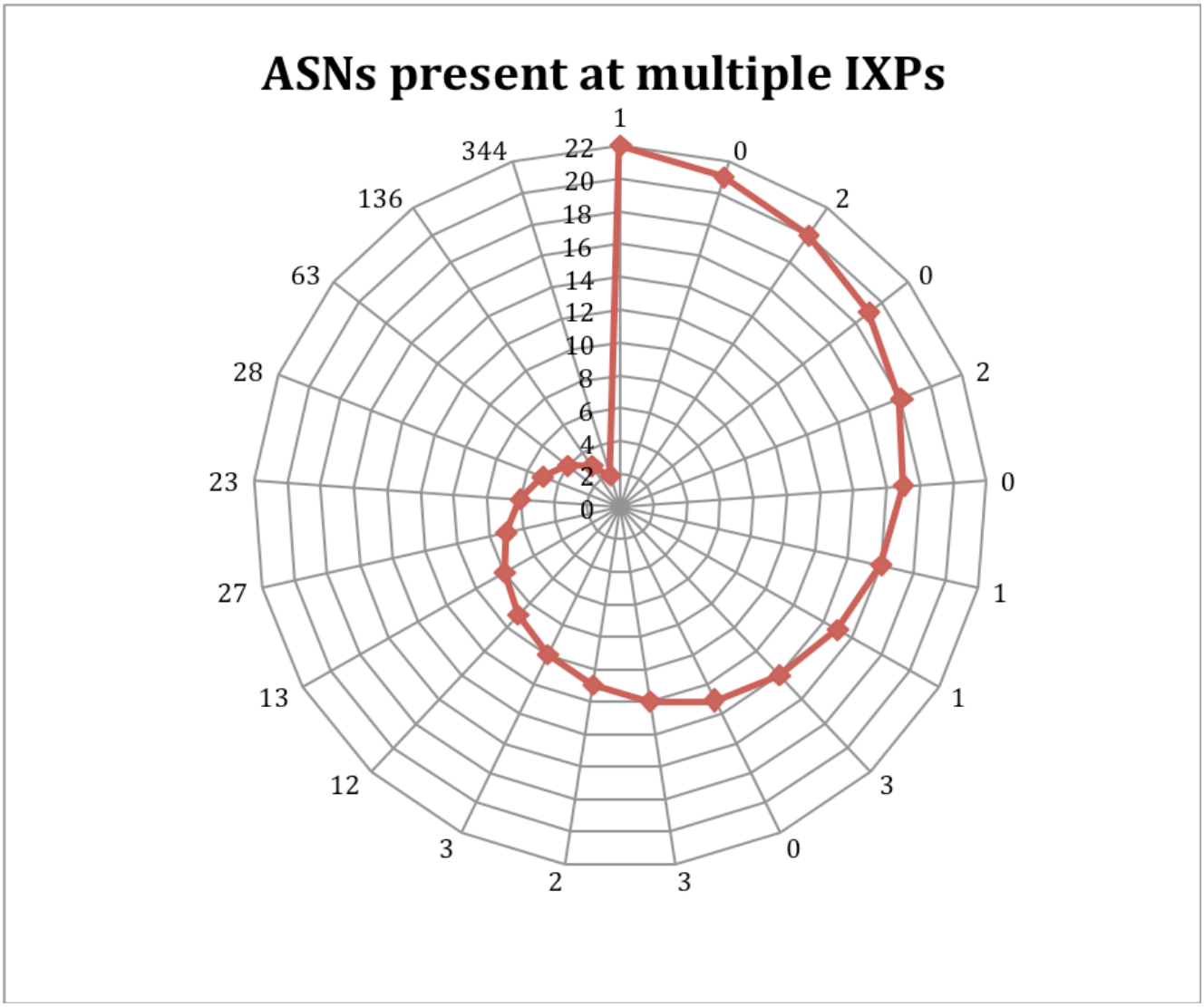
5.6 Number of ASNs present at more than one IXP in Europe

The chart below details the number of ASNs that are present at more than one European IXP.

The numbers bordering the circumference of the chart are the amount of ASNs that peer at a certain number of IXPs. The numbers starting at the centre of the chart and moving to the outside are the number of IXPs that the ASNs are present at.

Starting from the centre the chart shows that 344 ASNs peer at two IXPs, 136 ASNs peer at three IXP, 63 ASNs peer at four IXPs, etc. While the outermost ring of the chart shows that one ASN peers at no less than 22 different European IXPs.

In total some 661 ASNs peer at more than one European IXP this is around 15% up on 2007 numbers of 577 ASNs peering at more than one IXP.



Note: This data was captured on the 28th of August 2008

5.7 ASNs present at more than one IXP in Europe

The table below details the number of ASNs that are present at more than one European IXP. The ASN column displays the actual AS number of those 18 participants that peer at 10 or more European IXPs.

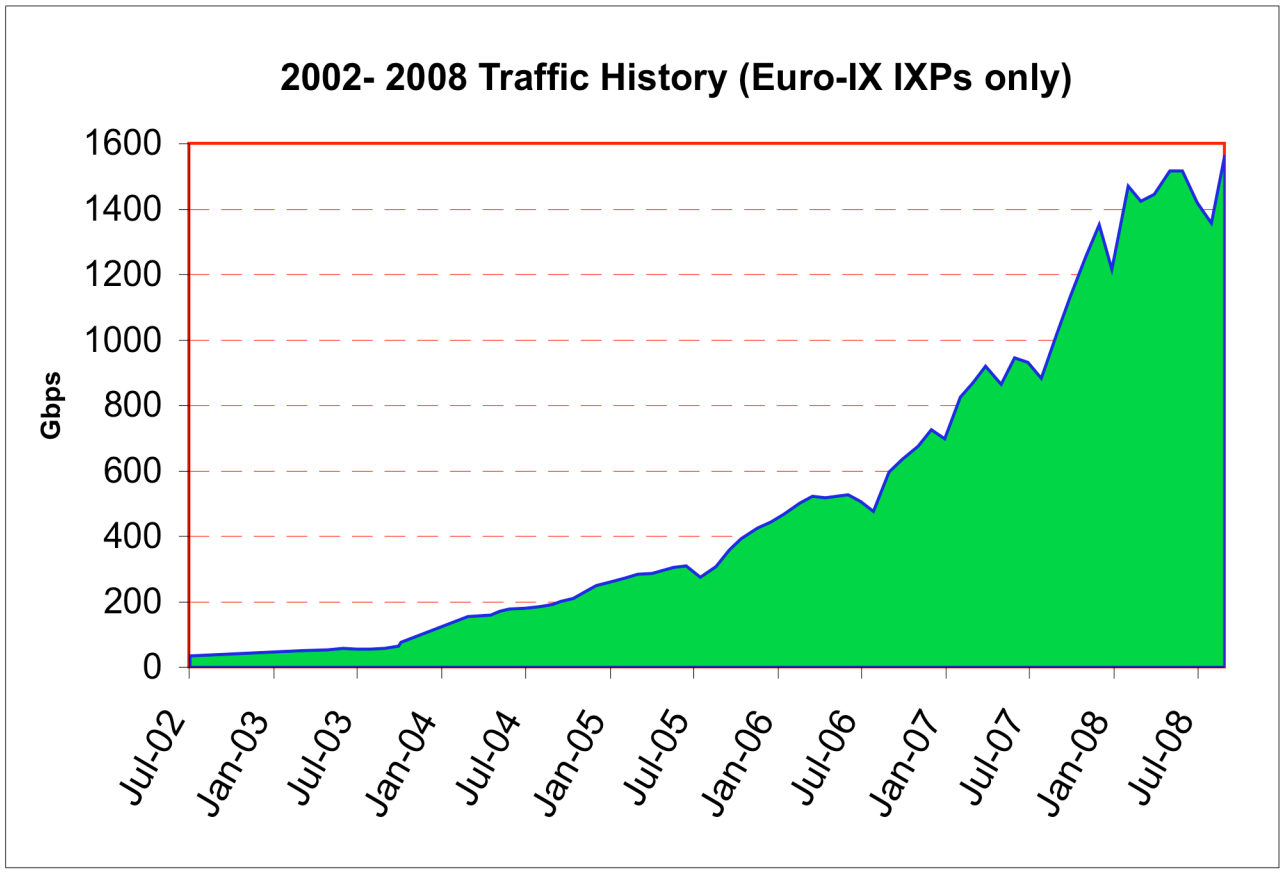
# of IXPs	# of ASNs	ASN
22	1	174
21	0	-
20	2	8220, 8928
19	0	-
18	2	702, 2686
17	0	-
16	1	4589
15	1	20940
14	3	286, 1257, 6830
13	0	-
12	3	3303, 13030, 13237
11	2	6774, 15169
10	3	5400,12399, 16276
9	12	-
8	13	-
7	27	-
6	23	-
5	28	-
4	63	-
3	136	-
2	344	-
Total ASNs at > 1 IXP		**661**

Note: This data was captured on the 28th of August 2008

Section 6. European IXP aggregated peak traffic trends

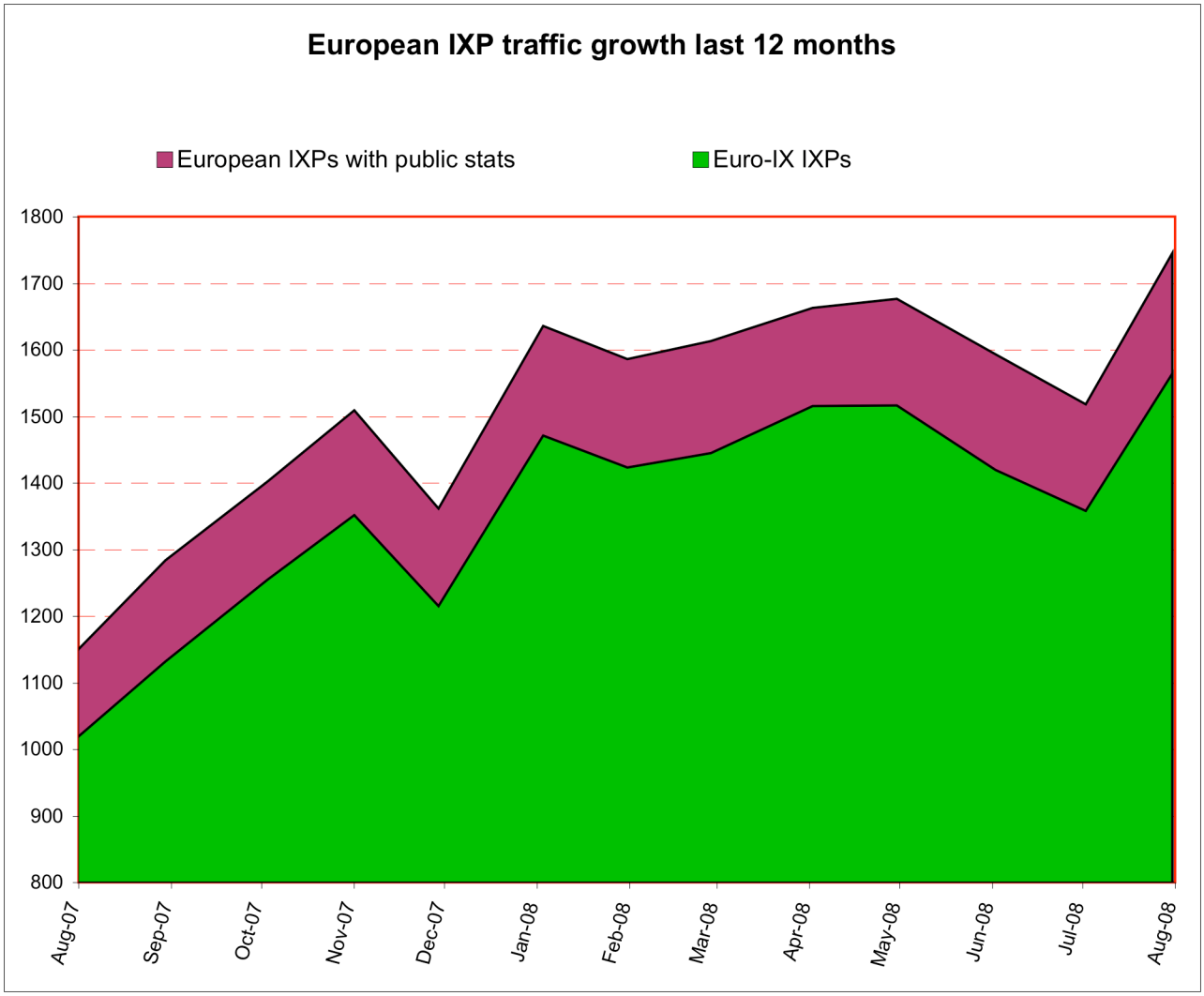
6.1 Aggregated peak traffic history 2002 - 2008

The graph displays the history of peak traffic of the Euro-IX membership since July 2002. The traffic statistics have been taken on a monthly basis from some 38 IXPs across Europe.



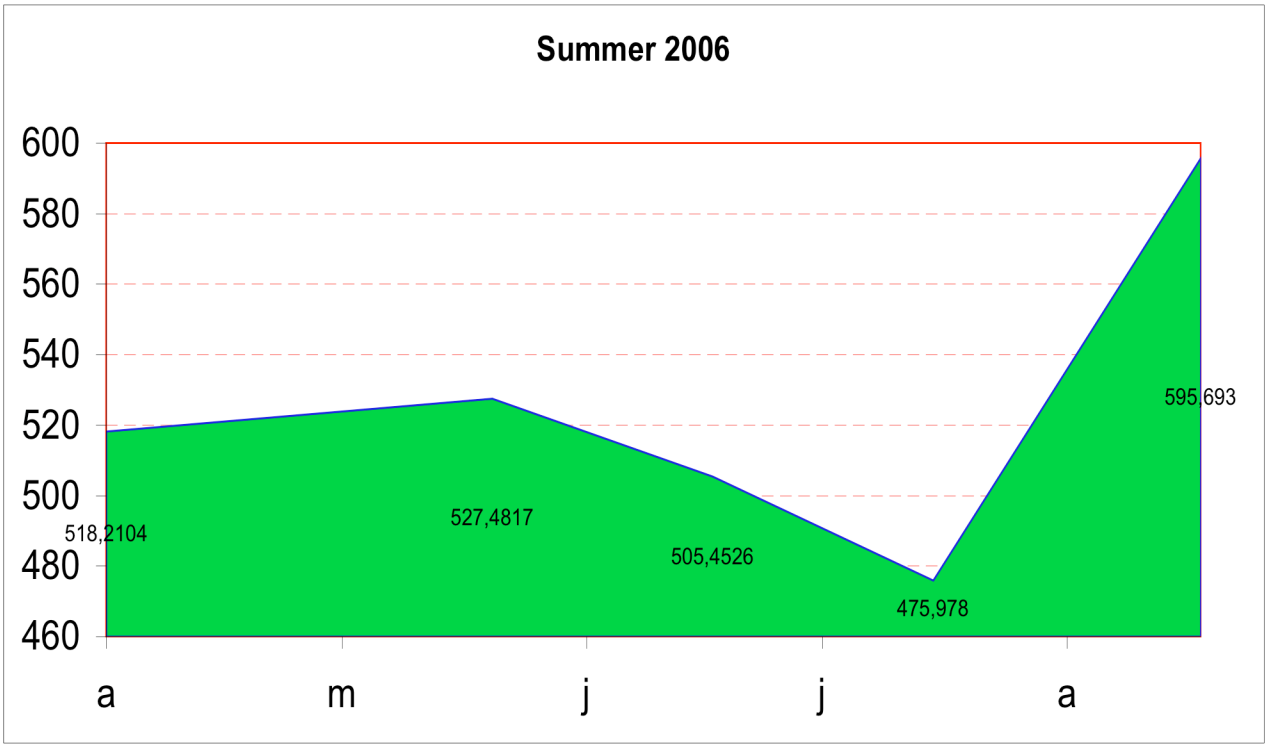
6.2 European traffic growth over the last 12 months

The growth below shows the aggregated peak traffic of the 38 Euro-IX member IXPs that have public traffic statistics as well another 31 European IXPs. On the 28th of August 2008 the aggregated peak traffic of all 69 IXPs that have publicly viewable statistics came to 1.745 Tbps.



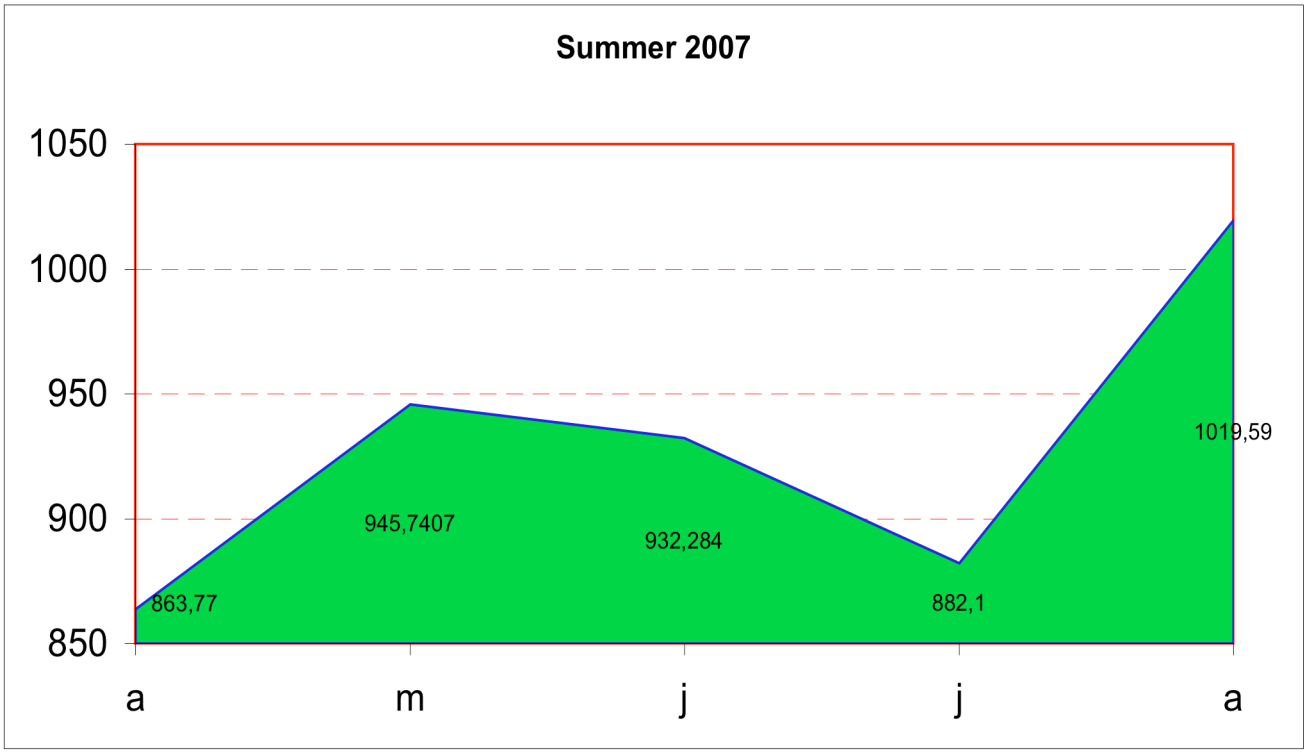
6.3 Summer peak traffic trend in Europe: 2006

This graph displays the aggregated IXP peak traffic during the summer of 2006. Drops in monthly peak traffic can be seen in both June and July of that year. The end of July to end of August peak increase was over 25% in 2006.



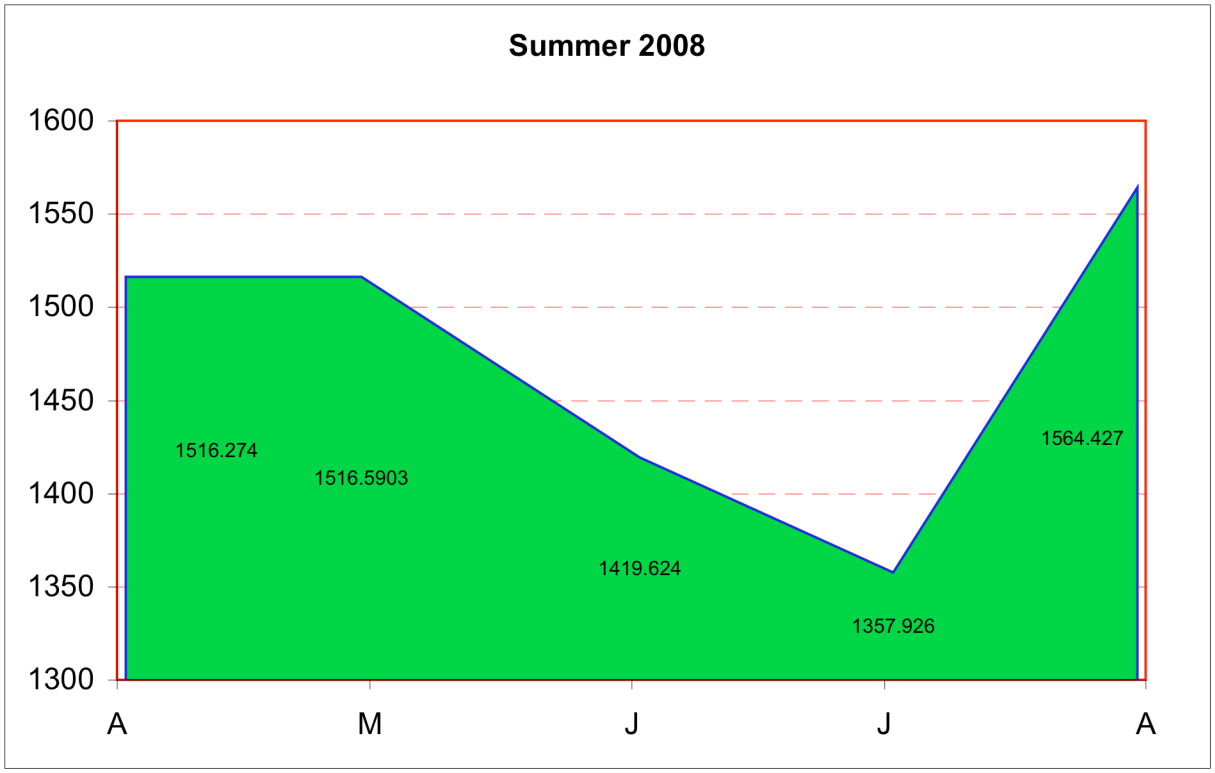
6.4 Summer peak traffic trend in Europe: 2007

This graph displays the aggregated IXP peak traffic during the summer of 2007. Drops in monthly peak traffic can be seen as early as April, this is widely agreed by IXPs across Europe that it was due to the unusually early warm weather that was experienced for about four weeks across the continent. After this warm weather period, the traffic returned to normal in May and then the usual summer trend of a decrease in aggregated traffic occurred and once again by mid to late August the traffic started to increase once again.



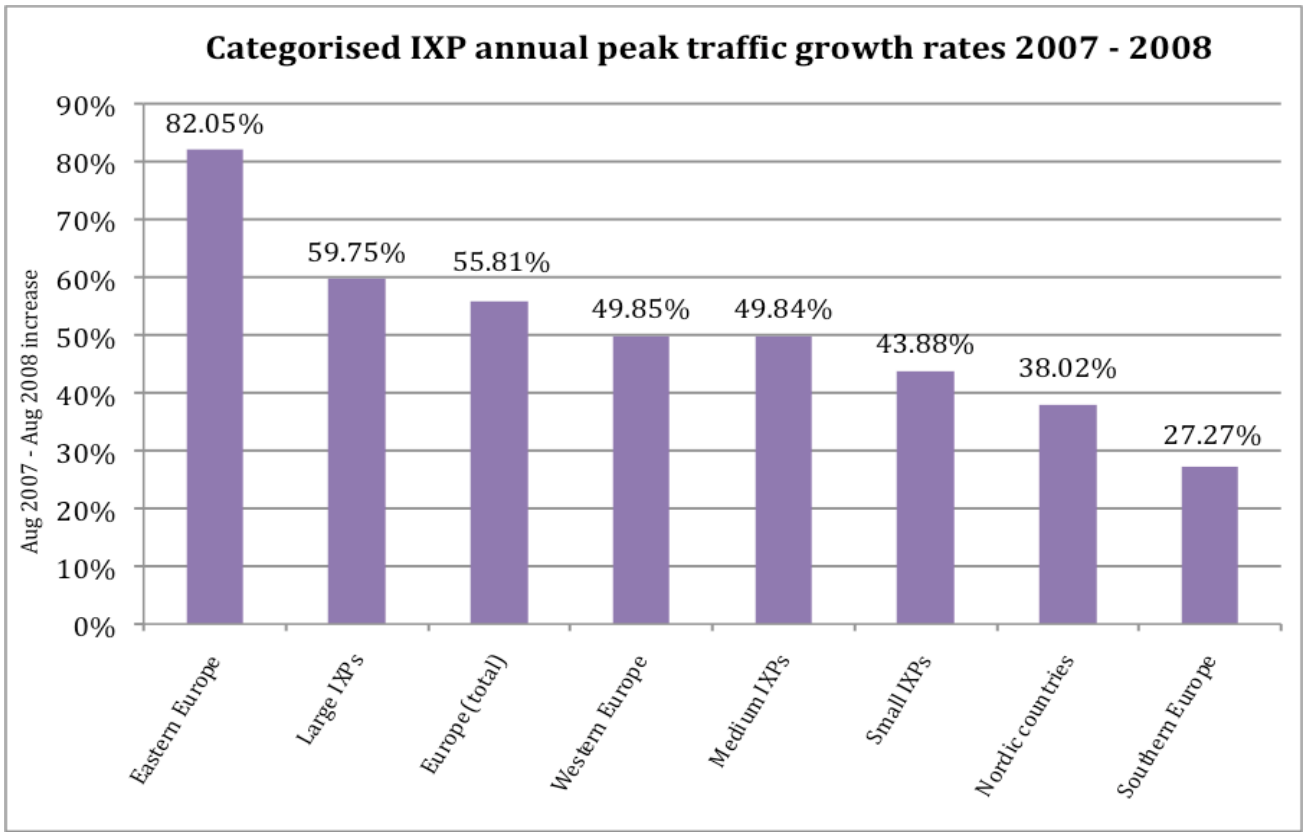
6.5 Summer peak traffic trend in Europe: 2008

This graph displays the aggregated IXP peak traffic during the summer of 2008. Showing a steady drop in peak IXP traffic through the summer months and a clear increase in traffic by the end of August, however the increase in peak traffic from the end of April to the end of August 2008 was only some 3.17% which is significantly down of the increase recorded in 2007 of 18.3% and in 2006 of 14.95% over the same period.



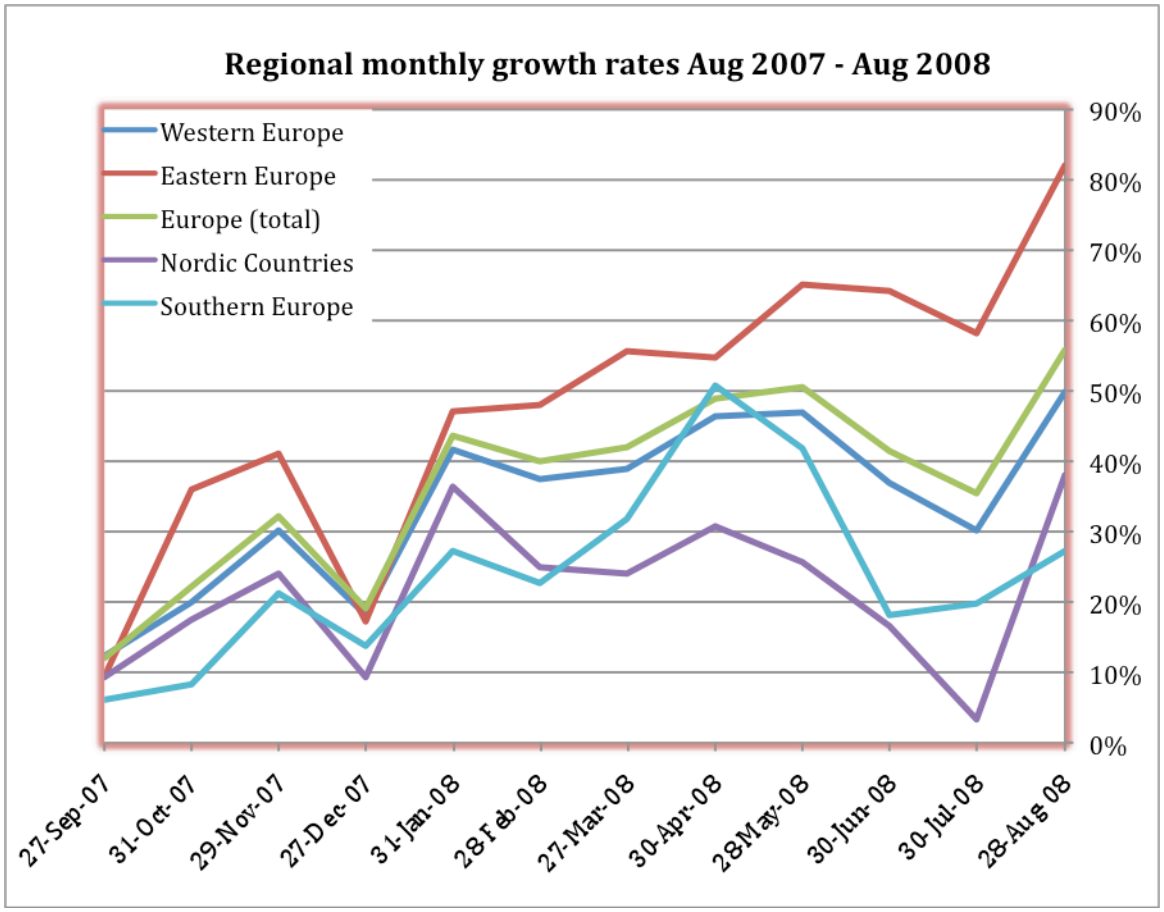
6.6 Categorised and regional IXP annual growth rate comparison

This graph displays the aggregated IXP peak traffic growth between the end of August 2007 and the end of August 2008. The IXPs have been categorized into different regions and sizes. Large IXPs are those whose peak traffic exceeds 100 Gbps, medium IXPs are those whose peak traffic is between 10 Gbps and 100 Gbps and small IXPs are those whose peak traffic does not exceed 10 Gbps.



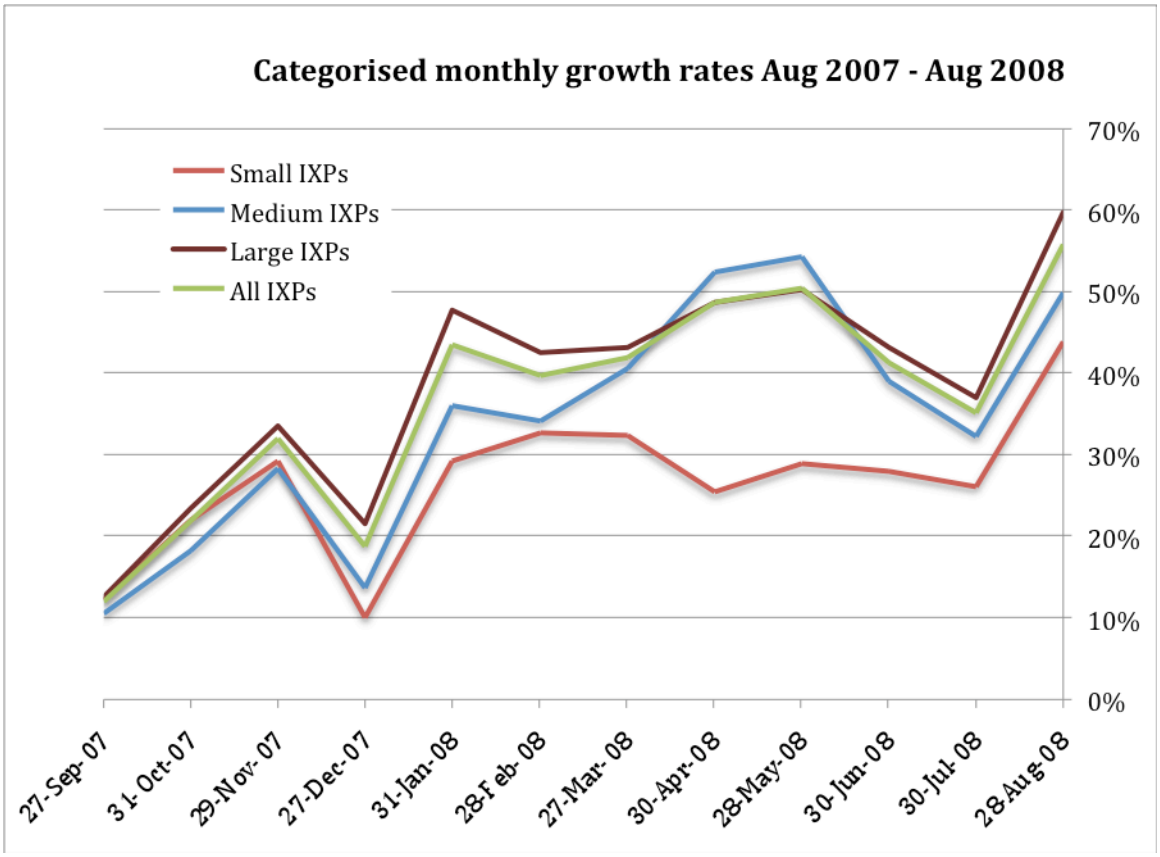
6.7 Regional monthly growth rates

This graph displays the aggregated IXP peak traffic monthly growth rate between the end of August 2007 and the end of August 2008. The IXPs have been categorized into different European regions.



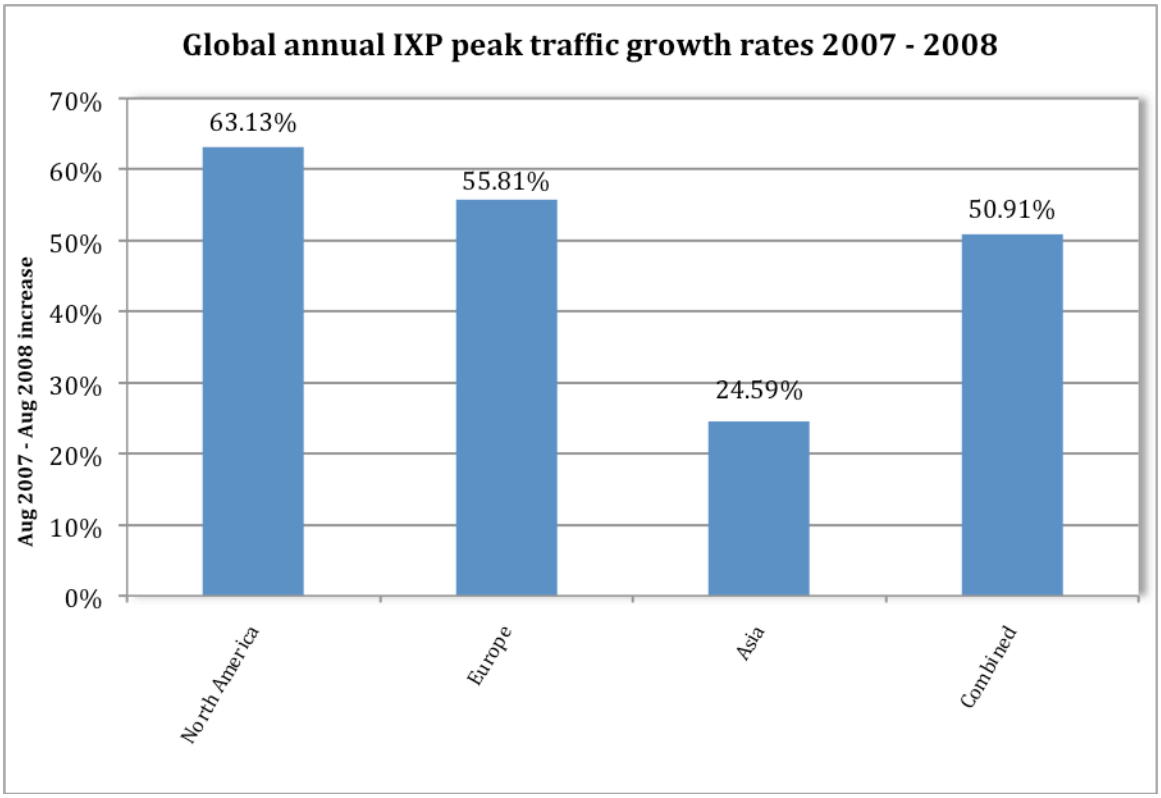
6.8 Categorised monthly growth rates

This graph displays the aggregated IXP peak traffic monthly growth rates between the end of August 2007 and the end of August 2008. The IXPs have been categorized into different sizes. Large IXPs are those whose peak traffic exceeds 100 Gbps, medium IXPs are those whose peak traffic is between 10 Gbps and 100 Gbps and small IXPs are those whose peak traffic does not exceed 10 Gbps.



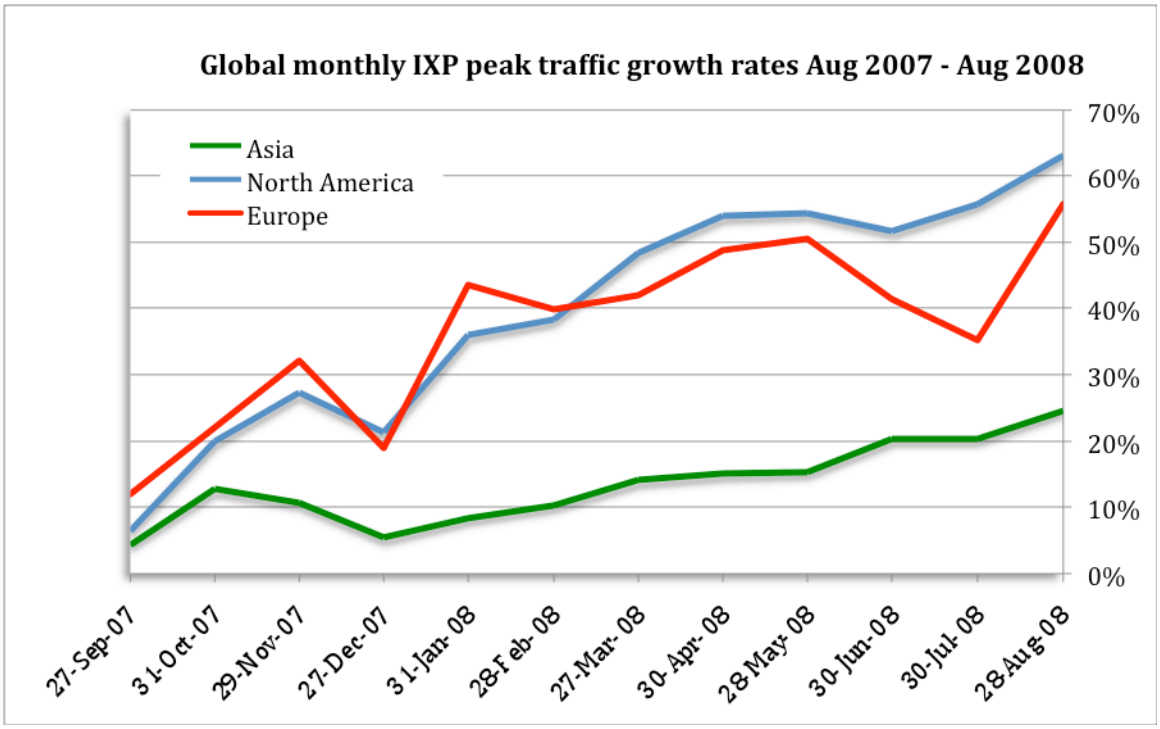
6.9 Global annual IXP growth rate comparison

This graph displays the aggregated IXP peak traffic growth between the end of August 2007 and the end of August 2008, at European, North American and Asian IXPs. It should be noted that the peak traffic data was collected over a 12-month period from some 50 European IXPs while Euro-IX could only gather accurate data from eight Asian IXPs and six North American IXPs.



6.10 Global monthly IXP growth rates

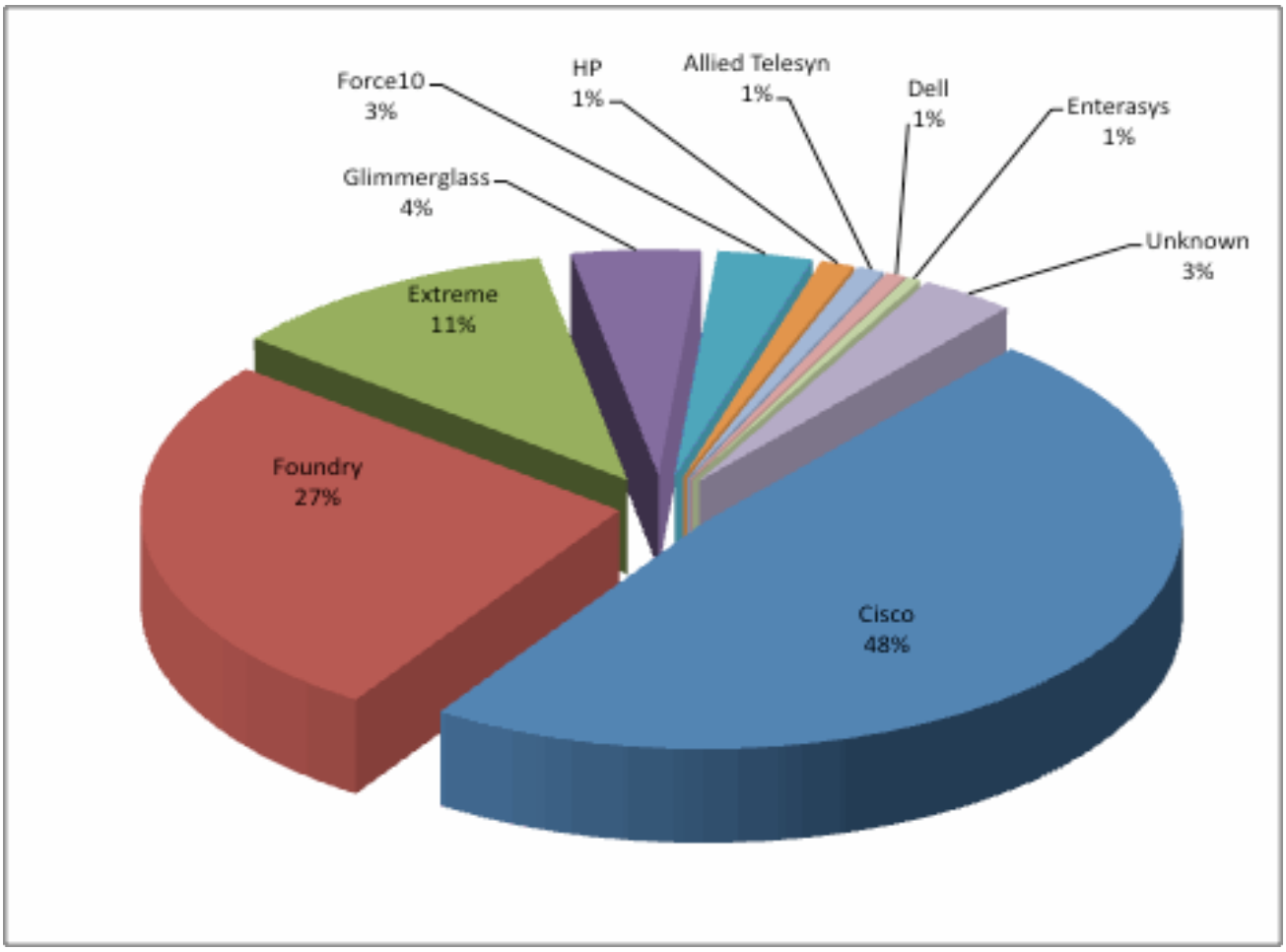
This graph displays the aggregated IXP peak traffic growth per month between the end of August 2007 and the end of August 2008, at European, North American and Asian IXPs. It should be noted that the peak traffic data was collected over a 12-month period from some 50 European IXPs while Euro-IX could only gather accurate data from eight Asian IXPs and six North American IXPs.



Section 7. IXP switching platform technology

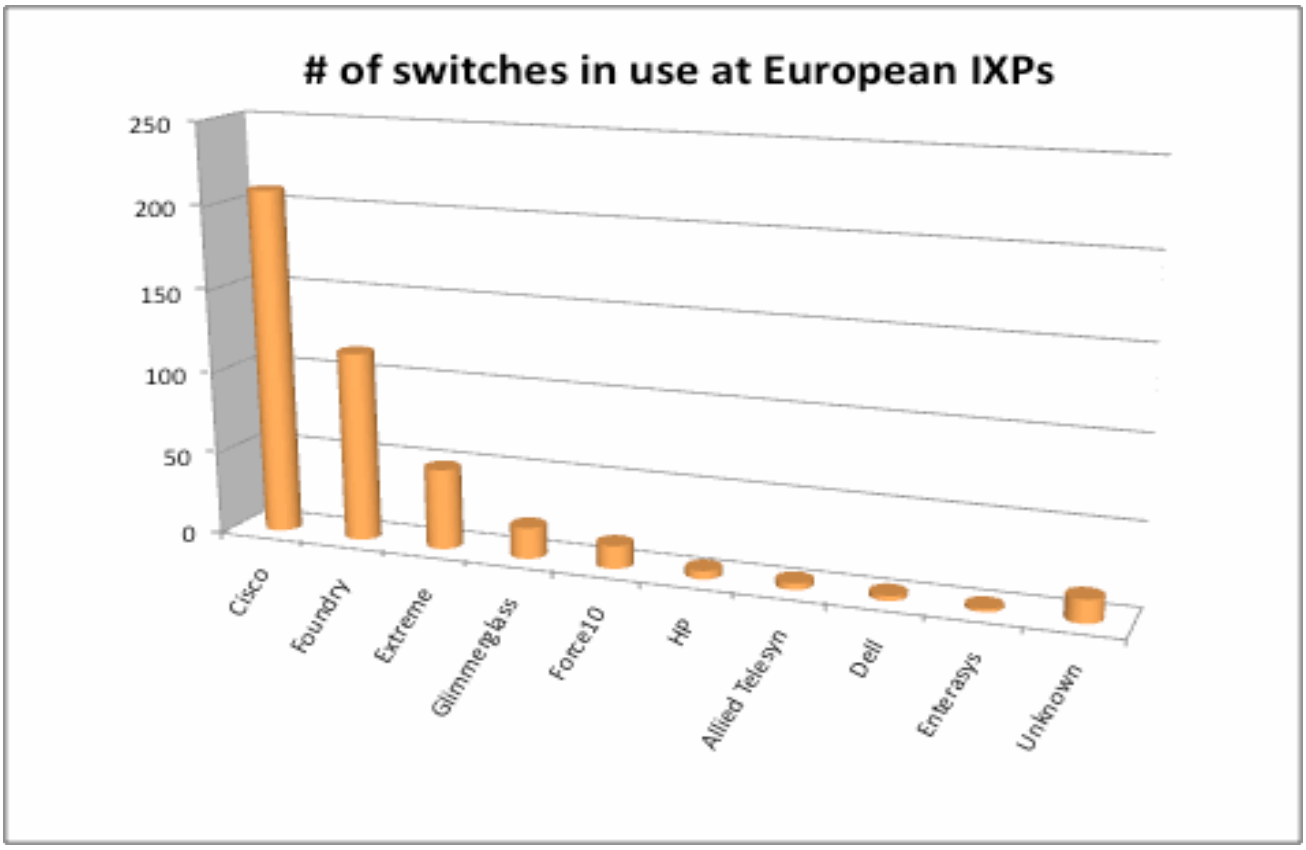
7.1 Percentage of switches being used at IXPs

This graph outlines the percentage of a particular vendor's switches that are being used by the IXPs across Europe. The 'unknown' switches relates to the fact that Euro-IX was unable to collect accurate information on the brand of these switches.



7.2 Number of switches in use at European IXPs

This graph displays the number of a particular brand of switch being used by IXPs across Europe. The 'unknown' switches relates to the fact that Euro-IX was unable to collect accurate information on the brand of these switches.



7.3 European IXP's choice of switch vendor

This table details the number of particular vendor's switches being used at IXPs across Europe. The 'unknown' switches relates to the fact that Euro-IX was unable to collect accurate information on the brand of these switches.

Switch vendor	Number of Switches	Percentage of total
Cisco	209	48%
Foundry	115	27%
Extreme	49	11%
Glimmerglass	19	4%
Force10	14	3%
HP	5	1%
Allied Telesyn	4	1%
Dell	3	1%
Enterasys	2	1%
Unknown	14	3%
Total		**434 Switches**

This table details the number of European IXPs that use a particular brand of switch. Note that in some cases IXPs use more than one brand of switch at their IXP.

Switch vendor	Number of IXPs	Pecentage of all IXPs
Cisco	66	63%
Foundry	23	22%
Extreme	13	12%
Force10	5	5%
Dell	3	3%
HP	2	1%
Allied Telesyn	1	1%
Glimmerglass	1	1%
Enterasys	1	1%
Unknown	9	9%
Total		**105 IXPs**

Section 8. Further information

8.1 Resources

In an effort to seek out every known IXP in Europe, the following online resources were used:

- **Ep.net**
  Exchange Point repository on Exchanges in Europe
  http://www.ep.net/naps_eu2.html

- **The Peering Db**
  https://www.peeringdb.com/

- **Packet Clearing house (PCH)**
  Internet Exchange Directory
  http://www.pch.net/ixpdir/Main.pl

Of course we would like to additionally thank all of the European IXPs, especially those that provide publicly available information of traffic statistics and participant's ASNs.

The biggest *thank you* goes to the 44 affiliated Euro-IX member and associate member IXPs that commit themselves to openly exchanging information with the rest of the IXP community via the Euro-IX website and the biannual Euro-IX Forums. Thank you Euro-IX members ☺

8.2 About the author:

Serge Radovcic is the Secretary General of Euro-IX. After deciding to hang up his paddle and leave the world of whitewater kayak instructing behind, he has since 2000 been closely involved in working with European Internet Exchange Points. He is in personal and regular contact with more than 80 European IXPs and does his best to keep an eye of the rest of the community in Europe and other regions around the world!

8.3 Contact

We very much welcome all forms of feedback and suggestions concerning this report and will do our best to answer any further requests for information.

Serge Radovcic ***serge@euro-ix.net*** ***http://www.euro-ix.net***