# European Internet Exchange Association

# 2006 Report on European IXPs

**Serge Radovcic of Euro-IX**

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*http://www.euro-ix.net*

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# 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 Internet Service Providers. The number of Internet Service Providers 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 32 member IXPs from some 21 European countries, as well as 7 IXPs from Asia and the United States and four patrons from the switch vendor community. The complete Euro-IX affiliated list is presented below [see 1.4 List of Euro-IX affiliates]

## 1.4 List of Euro-IX affiliates

*Euro-IX Member IXPs (Europe)*

| | | |
|---|---|---|
| AIX | Athens | Greece |
| AMS-IX | Amsterdam | Netherlands |
| BCIX | Berlin | Germany |
| BIX | Budapest | Hungary |
| BNIX | Brussels | Belgium |
| CATNIX | Barcelona | Spain |
| CIXP | Geneva | Switzerland |
| DE-CIX | Frankfurt | Germany |
| ESPANIX | Madrid | Spain |
| FICIX | Helsinki | Finland |
| GigaPIX | Lisbon | Portugal |
| GN-IX | Groningen | Netherlands |
| INEX | Dublin | Ireland |
| LINX | London | United Kingdom |
| LIPEX | London | United Kingdom |
| LIX | Luxembourg | Luxembourg |
| LONAP | London | United Kingdom |
| MaNAP | Manchester | United Kingdom |
| MIX | Milan | Italy |
| MSK-IX | Moscow | Russia |
| NaMeX | Rome | Italy |
| NDIX | 13 locations | Germany/Netherlands |
| Netnod | Stockholm | Sweden |
| NIX | Oslo | Norway |
| NIX.CZ | Prague | Czech Republic |
| PARIX | Paris | France |
| RoNIX | Bucharest | Romania |
| SIX | Ljubljana | Slovenia |
| TIX | Zurich | Switzerland |
| TIX-Tuscany | Florence | Italy |
| TOP-IX | 16 locations | Northwest Italy |
| VIX | Vienna | Austria |

*Euro-IX Associate Member IXPs (outside of Europe)*

| | |
|---|---|
| BBIX | Japan |
| Equinix | United States |
| JPIX | Japan |
| JPNAP | Japan |
| NIXI | India |
| NOTA | United States |
| Switch and Data | United States |

*Euro-IX Patrons*

- Cisco Systems      - Force10 Networks
- Foundry Networks    - Glimmerglass

## 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 30<sup>th</sup> of August 2006. These traffic figures do not take into account Privately Interconnected participants whose traffic does not pass over the IXP switching fabric.*

ii.  *Not all European IXPs publicly publish aggregated traffic statistics thus no attempts at estimates were made where true figures were not presented. For example while Denmark has an IXP with significant peering traffic, these figures were omitted from the report.*

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.*

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.*

## Section 2. IXPs in Europe

## 2.1 IXPs listed per country

The following pages list all *known* IXPs in Europe some of which may not be currently active, this totals some **99 IXPs in 66 cities in 31 countries**.

### Austria

| | | |
|---|---|---|
| VIX | Vienna Internet eXchange | Vienna |

### Belgium

| | | |
|---|---|---|
| BNIX | Belgian National Internet Exchange | Brussels |
| FreeBIX | FreeBIX | Brussels |

### Croatia

| | | |
|---|---|---|
| CIX | Croatian Internet eXchange | Zagreb |

### Cyprus

| | | |
|---|---|---|
| CyIX | Cyprus Internet Exchange | Nicosia |

### Czech Republic

| | | |
|---|---|---|
| NIX.CZ | Neutral Internet eXchange of the Czech Republic | Prague |

### Denmark

| | | |
|---|---|---|
| DIX | Danish Internet eXchange point | Lyngby |

### Estonia

| | | |
|---|---|---|
| TIX | Tallinn Internet eXchange | Tallinn |
| TLLIX | Tallinn Internet Exchange | Tallinn |

### Finland

| | | |
|---|---|---|
| FICIX | Finnish Communication and Internet Exchange | Helsinki |
| TREX | Tampere Region Exchange | Tampere |

### France

| | | |
|---|---|---|
| EuroGIX | Euopean Global Internet eXchange | Strasbourg |
| FNIX6 | French National Internet Exchange IPv6 | Paris |
| FreeIX | Free Internet Exchange | Paris |
| GEIX | Gigabit European Internet eXchange | Paris |
| GNI | Grenoble Network Initiave | Grenoble |
| Lyonix | Lyonix | Lyon |

## France  (cont.)

| MAE - Paris | MAE - Paris | Paris |
| --- | --- | --- |
| MA-IX | Marseille Internet Exchange | Marseille |
| MIXT | MIXT | Paris |
| PaNAP | Paris Network Access Point | Paris |
| PARIX | Paris Internet Exchange | Paris |
| POUIX | POUIX | Paris |
| SFINX | Service for French INternet eXchange | Paris |

## Germany

| 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 - Leipzig | European Commercial Internet Exchange | Leipzig |
| FraNAP | Frankfurt Network Access Point | Frankfurt |
| INXS | Internet Exchange Point in Munich | Munich |
| KleyRex | Kleyer Rebstocker EXchange | Frankfurt |
| MAE - Frankfurt | MAE - Frankfurt | Frankfurt |
| NDIX | Nederlands-Duitse Internet Exchange | Munster & Dusseldorf |
| N-IX | Nurnberger Internet eXchange | Nurnberg |
| WORK-IX | WORK-IX | Hamburg |

## Greece

| AIX | Athens Internet Exchange | Athens |
| --- | --- | --- |

## Hungary

| BIX | Budapest Internet eXchange | Budapest |
| --- | --- | --- |

## Iceland

| RIX | Reykjavik Internet Exchange | Reykjavik |
| --- | --- | --- |

## Ireland

| INEX | Internet Neutral EXchange | Dublin |
| --- | --- | --- |

## Italy

| MIX | Milan Internet eXchange | Milan |
| --- | --- | --- |
| NaMeX | Nautilus Mediterranean Exchange Point | Rome |
| TIX Tuscany | Tuscany Internet eXchange | Florence |
| TOP-IX | Torino Piemonte Exchange Point | Torino |

## Latvia

| LIX | Latvian Internet eXchange | Riga |
| --- | --- | --- |

### Luxembourg

| LIX | Luxembourg Internet eXchange | Luxembourg |
|-----|------------------------------|------------|

### Malta

| MIX | Malta internet Exchange | Msida |
|-----|-------------------------|-------|

### Netherlands

| AMS-IX | Amsterdam Internet Exchange | Amsterdam |
|--------|------------------------------|-----------|
| FR-IX | Friese Internet Exchange | Leeuwarden |
| GN-IX | Groningen Internet Exchange | Groningen |
| NDIX | Nederlands-Duitse Internet Exchange | Enschede |
| NL-IX | Netherlands Internet Exchange | Amsterdam |

### Norway

| NIX1 | Norwegian Internet eXchange | Oslo |
|------|------------------------------|------|
| NIX2 | Norwegian Internet eXchange | Oslo |

### Poland

| GIX | Global Internet eXchange | Warsaw |
|-----|---------------------------|--------|
| KIX | Krakow Internet eXchange | Krakow |
| TIX | Tysiaclecie Internet eXchange | Tysiaclecie |
| WIX | Warsaw Internet eXchange | Warsaw |
| WRIX | Wroclaw Internet eXchange | Wroclaw |

### Portugal

| GIGAPIX | GIGAbit Portuguese Internet eXchange | Lisbon |
|---------|---------------------------------------|--------|

### Romania

| BUHIX | Bucharest Internet Exchange | Bucharest |
|-------|------------------------------|-----------|
| RoNIX | Romanian Network for Internet eXchange | Bucharest |
| SViX | Suceava Internet Exchange | Suceava |

### Russia

| MPIX | MPIX | Moscow |
|------|------|--------|
| 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 |

### Slovakia

| SIX | Slovak Internet eXchange | Bratislava |
|-----|---------------------------|------------|

## Slovenia

| SIX | Slovenian Internet Exchange | Ljubljana |
|-----|------------------------------|-----------|

## Spain

| CATNIX | Catalunya Neutral Internet Exchange | Barcelona |
|--------|--------------------------------------|-----------|
| ESPANIX | Espana Internet Exchange | Madrid |
| EuskoNIX | Punto neutro Vasco de Internet | Bilboa |
| galNIX | Galicia Neutral Internet eXchange | Santiago |
| MAD-IX | Madrid Internet Exchange | Madrid |
| NOTA Madrid | Terremark: NAP de las Americas Madrid | Madrid |

## Sweden

| GIX | Gothenburg Internet Exchange | Gothenburg |
|-----|-------------------------------|------------|
| Netnod | Internet Exchange i Sverige | Stockholm |
| Netnod | Netnod - Gothenburg | Gothenburg |
| Netnod | Netnod - Malmoe | Malmoe |
| Netnod | Netnod - Sundsvall | Sundsvall |
| NorrNod | NorrNod | Umea |
| SOLIX | SOLIX | Stockholm |

## Switzerland

| CIXP | CERN Internet Exchange Point | Geneva |
|------|-------------------------------|--------|
| Swissix | Swiss Internet Exchange | Zurich |
| TIX | Telehouse Internet Exchange | Zurich |

## Ukraine

| UA-IX | Ukrainian Internet Exchange | Kiev |
|-------|------------------------------|------|

## United Kingdom

| 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 |
| RBEIX | RBIEX | London |
| ScotiX | Scottish Internet Exchange | Edinburgh |
| SovEx | SovEx | London |
| UK6x | UK IPv6 Internet Exchange | London |
| WorldIX | WorldIX | Edinburgh |

## 2.2 Number of IXPs per country

The total number of IXPs that are known to exist in each European country.

| Country | No. of IXPs |
|---|---:|
| France | 13 |
| Germany | 12 |
| United Kingdom | 12 |
| Sweden | 7 |
| Spain | 6 |
| Netherlands | 5 |
| Poland | 5 |
| Russia | 5 |
| Italy | 4 |
| Romania | 3 |
| Switzerland | 3 |
| Belgium | 2 |
| Estonia | 2 |
| Finland | 2 |
| Norway | 2 |
| Austria | 1 |
| Croatia | 1 |
| Cyprus | 1 |
| Czech Republic | 1 |
| Denmark | 1 |
| Greece | 1 |
| Hungary | 1 |
| Iceland | 1 |
| Ireland | 1 |
| Latvia | 1 |
| Luxembourg | 1 |
| Malta | 1 |
| Portugal | 1 |
| Slovakia | 1 |
| Slovenia | 1 |
| Ukraine | 1 |
| **31 countries** | **99** |

## 2.3 Number of IXPs per city

The total number of IXPs that are known to exist in individual European cities. Where an IXP has multiple connected locations in one city, this is calculated as being simply one IXP in that city. IXPs are present in 66 different cities across Europe. Where IXPs have multiple connected locations in different cities, only the original city location has been noted below.

| City | Country | No. IXP | City | Country | No. IXP |
|---|---|---|---|---|---|
| Paris | France | 9 | Leeuwarden | Netherlands | 1 |
| London | United Kingdom | 8 | Leipzig | Germany | 1 |
| Frankfurt | Germany | 4 | Lisbon | Portugal | 1 |
| Madrid | Spain | 3 | Ljubljana | Slovenia | 1 |
| Amsterdam | Netherlands | 2 | Luxembourg | Luxembourg | 1 |
| Berlin | Germany | 2 | Lyngby | Denmark | 1 |
| Brussels | Belgium | 2 | Lyon | France | 1 |
| Bucharest | Romania | 2 | Malmoe | Sweden | 1 |
| Dusseldorf | Germany | 2 | Marseille | France | 1 |
| Edinburgh | United Kingdom | 2 | Milan | Italy | 1 |
| Gothenburg | Sweden | 2 | Msida | Malta | 1 |
| Manchester | United Kingdom | 2 | Munich | Germany | 1 |
| Moscow | Russia | 2 | Munster | Germany | 1 |
| Oslo | Norway | 2 | Nicosia | Cyprus | 1 |
| Stockholm | Sweden | 2 | Novosibirsk | Russia | 1 |
| Tallinn | Estonia | 2 | Nurnberg | Germany | 1 |
| Warsaw | Poland | 2 | Prague | Czech Republic | 1 |
| Zurich | Switzerland | 2 | Reykjavik | Iceland | 1 |
| Athens | Greece | 1 | Riga | Latvia | 1 |
| Barcelona | Estonia | 1 | Rome | Italy | 1 |
| Bilboa | Spain | 1 | Samara | Russia | 1 |
| Bratislava | Slovakia | 1 | Santiago | Spain | 1 |
| Budapest | Hungary | 1 | St.-Petersburg | Russia | 1 |
| Dublin | Ireland | 1 | Strasbourg | France | 1 |
| Enschede | Netherlands | 1 | Suceava | Romania | 1 |
| Florence | Italy | 1 | Sundsvall | Sweden | 1 |
| Geneva | Switzerland | 1 | Tampere | Finland | 1 |
| Grenoble | France | 1 | Torino | Italy | 1 |
| Groningen | Netherlands | 1 | Tysiaclecie | Poland | 1 |
| Hamburg | Germany | 1 | Umea | Sweden | 1 |
| Helsinki | Finland | 1 | Vienna | Austria | 1 |
| Kiev | Ukraine | 1 | Wroclaw | Poland | 1 |
| Krakow | Poland | 1 | Zagreb | Croatia | 1 |

# Section 3. European IXP growth since 1992

## 3.1 IXP growth in Europe since 1992

This table details the 'official' establishment dates of both non-profit and commercial IXPs in Europe since 1992.

| Year | New IXPs | New NP IXPs | Total NP IXPs | NP as % of all IXPs | New comm. IXPs | Total comm. IXPs | Comm as % of all IXPs | Total IXPs |
|------|----------|-------------|---------------|---------------------|----------------|------------------|-----------------------|------------|
| 1992 | 0  | 0 | 0  | 0%   | 0 | 0  | 0%  | 0  |
| 1993 | 3  | 3 | 3  | 100% | 0 | 0  | 0%  | 3  |
| 1994 | 4  | 3 | 6  | 86%  | 1 | 1  | 14% | 7  |
| 1995 | 7  | 6 | 12 | 86%  | 1 | 2  | 14% | 14 |
| 1996 | 6  | 5 | 17 | 85%  | 1 | 3  | 15% | 20 |
| 1997 | 6  | 6 | 23 | 88%  | 0 | 3  | 12% | 26 |
| 1998 | 2  | 2 | 25 | 89%  | 0 | 3  | 11% | 28 |
| 1999 | 5  | 3 | 28 | 85%  | 2 | 5  | 15% | 33 |
| 2000 | 4  | 3 | 31 | 84%  | 1 | 6  | 16% | 37 |
| 2001 | 16 | 9 | 40 | 75%  | 7 | 13 | 25% | 53 |
| 2002 | 12 | 6 | 46 | 70%  | 6 | 19 | 30% | 65 |
| 2003 | 10 | 5 | 51 | 68%  | 5 | 24 | 32% | 75 |
| 2004 | 2  | 0 | 51 | 66%  | 2 | 26 | 34% | 77 |
| 2005 | 4  | 1 | 52 | 64%  | 3 | 29 | 36% | 81 |
| 2006 | 3  | 2 | 54 | 64%  | 1 | 30 | 36% | 84 |

**NP = Non profit IXP**
**Comm. = Commercial or for profit IXP**

*Note: While there are some 99 known IXPs in Europe today. Accurate information could only be gathered in relation to 84 of these IXPs.*

## 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.

**European IXP growth**
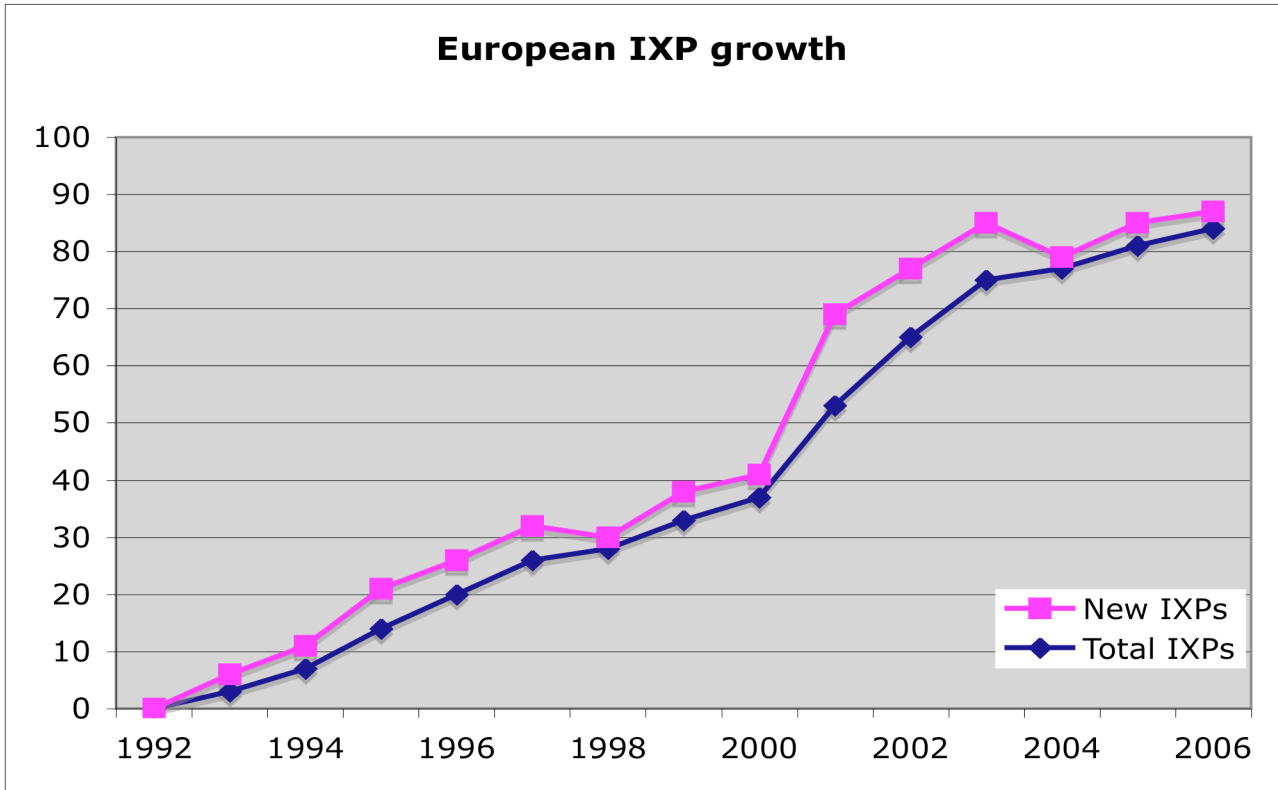
## 3.3 Additional IXPs per year (Non profit vs. Commercial)

The graph details the establishment of additional IXPs, both non-profit and commercial, in relation to total IXP growth since 1992.



**New non profit vs new commercial IXPs**

Legend:
- Additional NP
- Add. Commercial
- Total additional IXPs
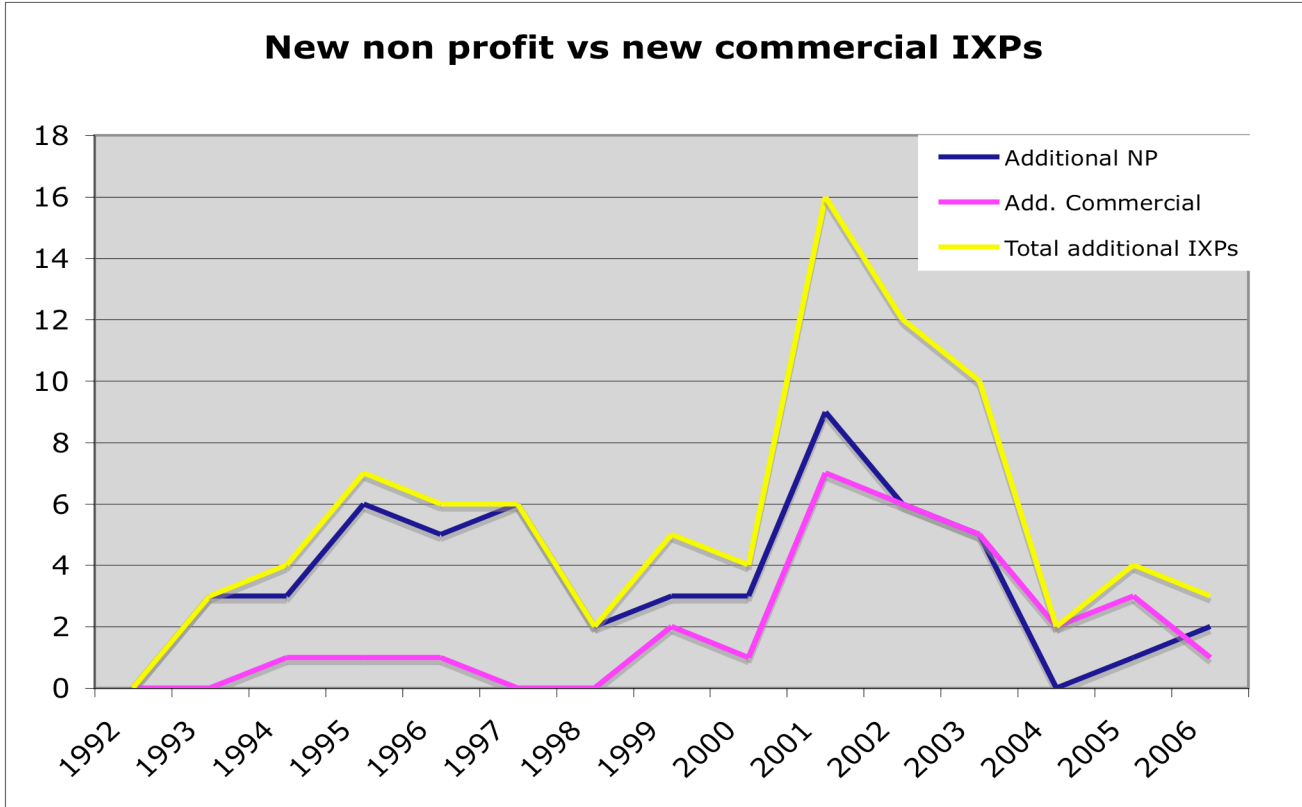
## 3.4 Overall growth of IXPs (non-profit vs. commercial)

This graph shows non-profit versus commercial IXP growth in Europe since 1992.

**Non profit vs commercial IXP growth**

Legend:
- Non profit IXP
- Commercial IXP
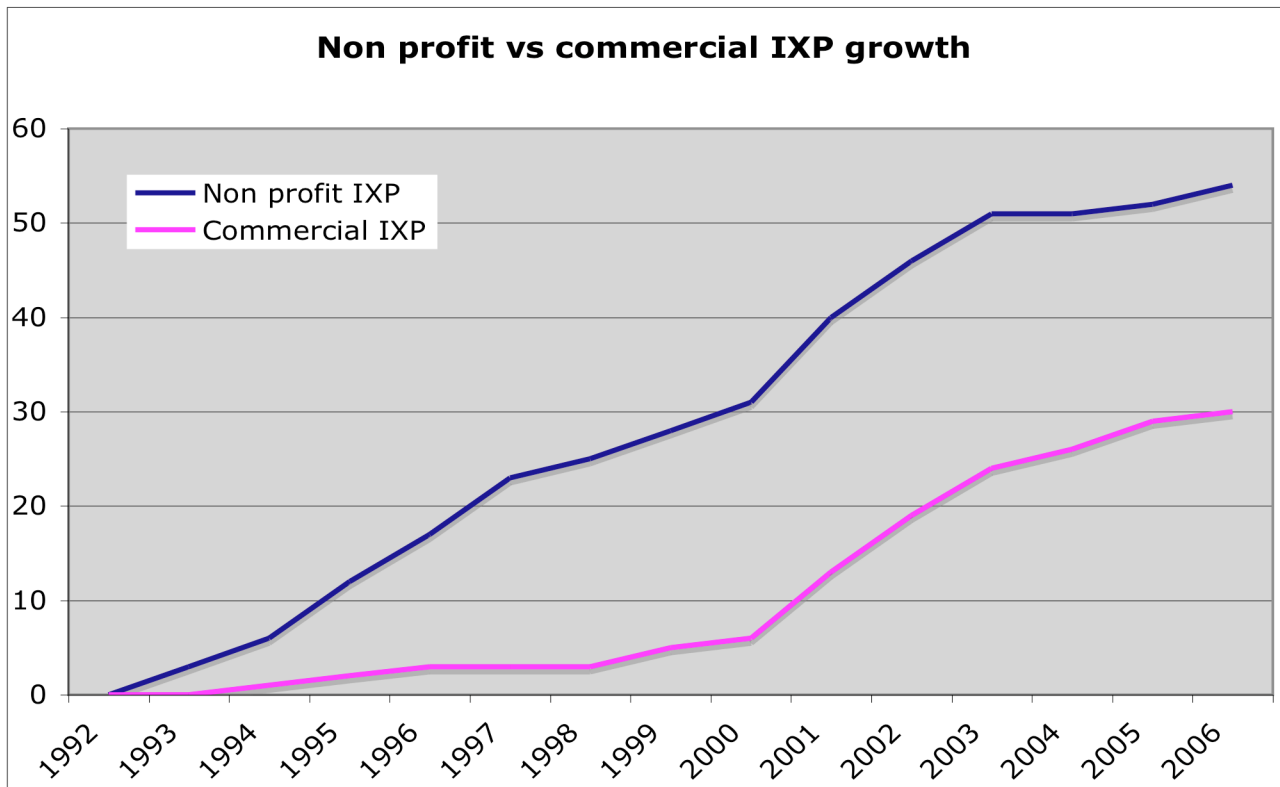
## 3.5 Percentage growth of IXPs per year (Non profit vs. Commercial)

This graph details the growth of both non-profit and commercial IXPs in Europe in relation to the total amount of IXPs in Europe.

**% Growth of NP vs Commercial IXPs**



Legend:
- ■ % commercial
- ■ % non profit
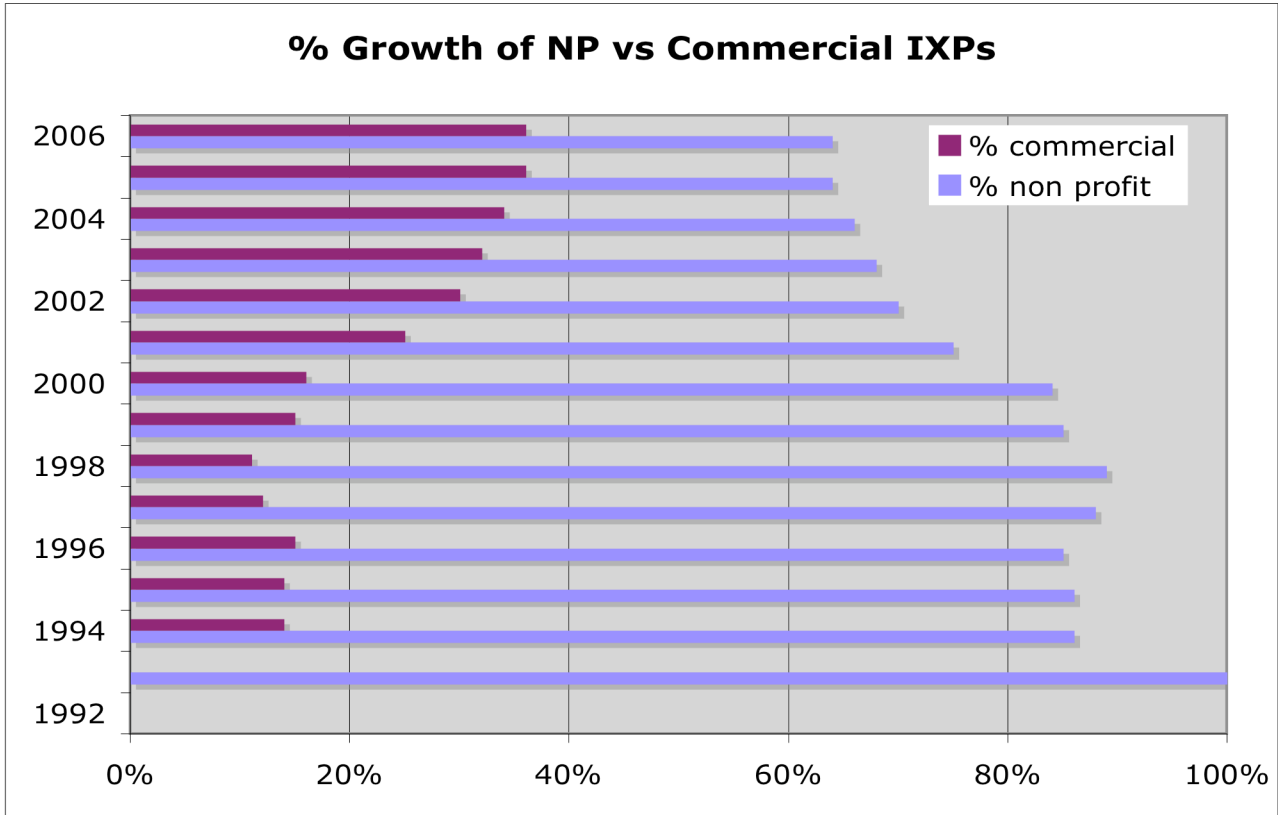
# *Section 4. IXP peak traffic*

## 4.1 Aggregated peak traffic per country

This graph outlines the total aggregated peak IXP traffic per country in Europe. It should be noted that this data is taken from publicly viewable traffic statistics.
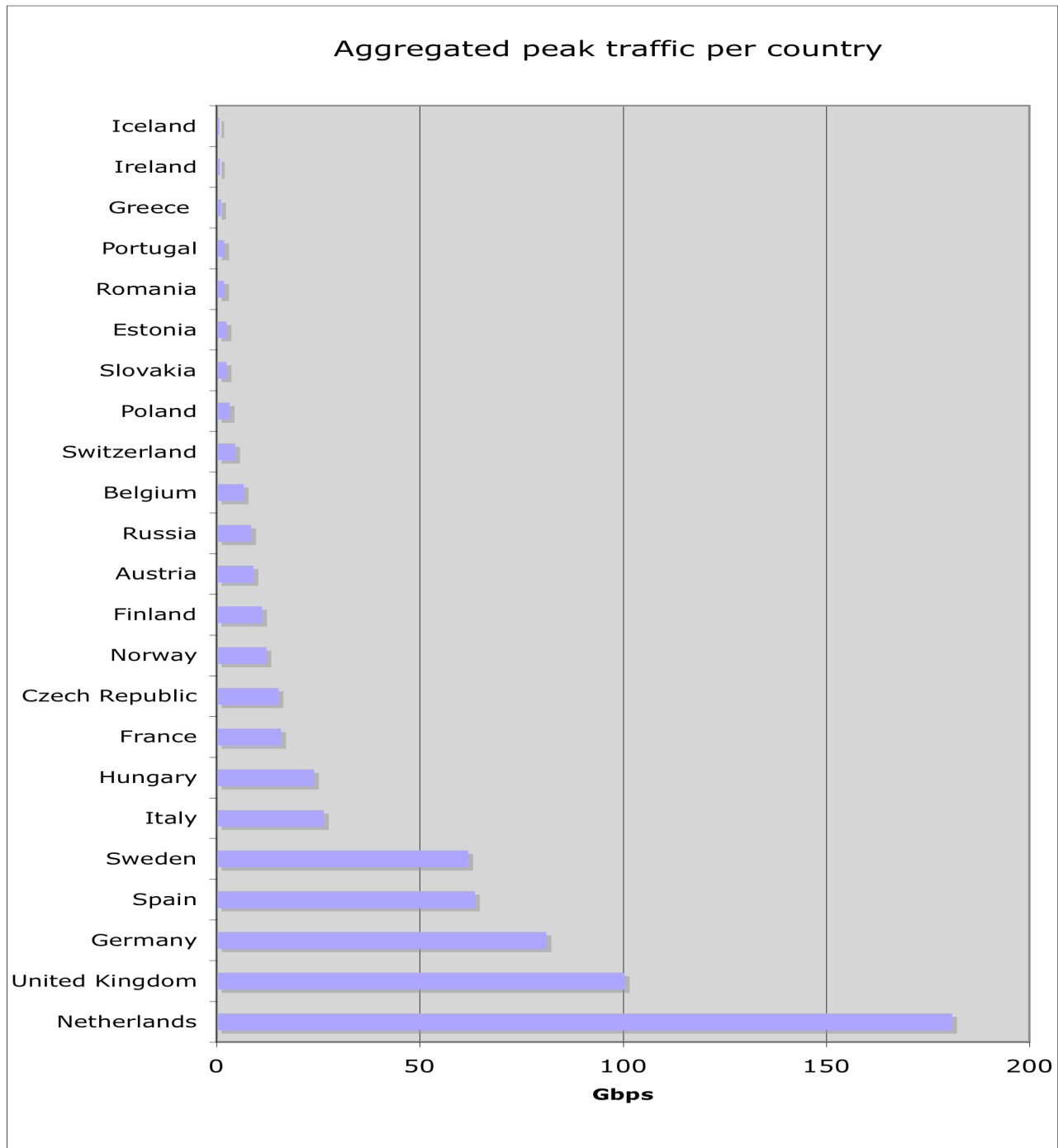


Note: This traffic data was captured on the 30th of August 2006.
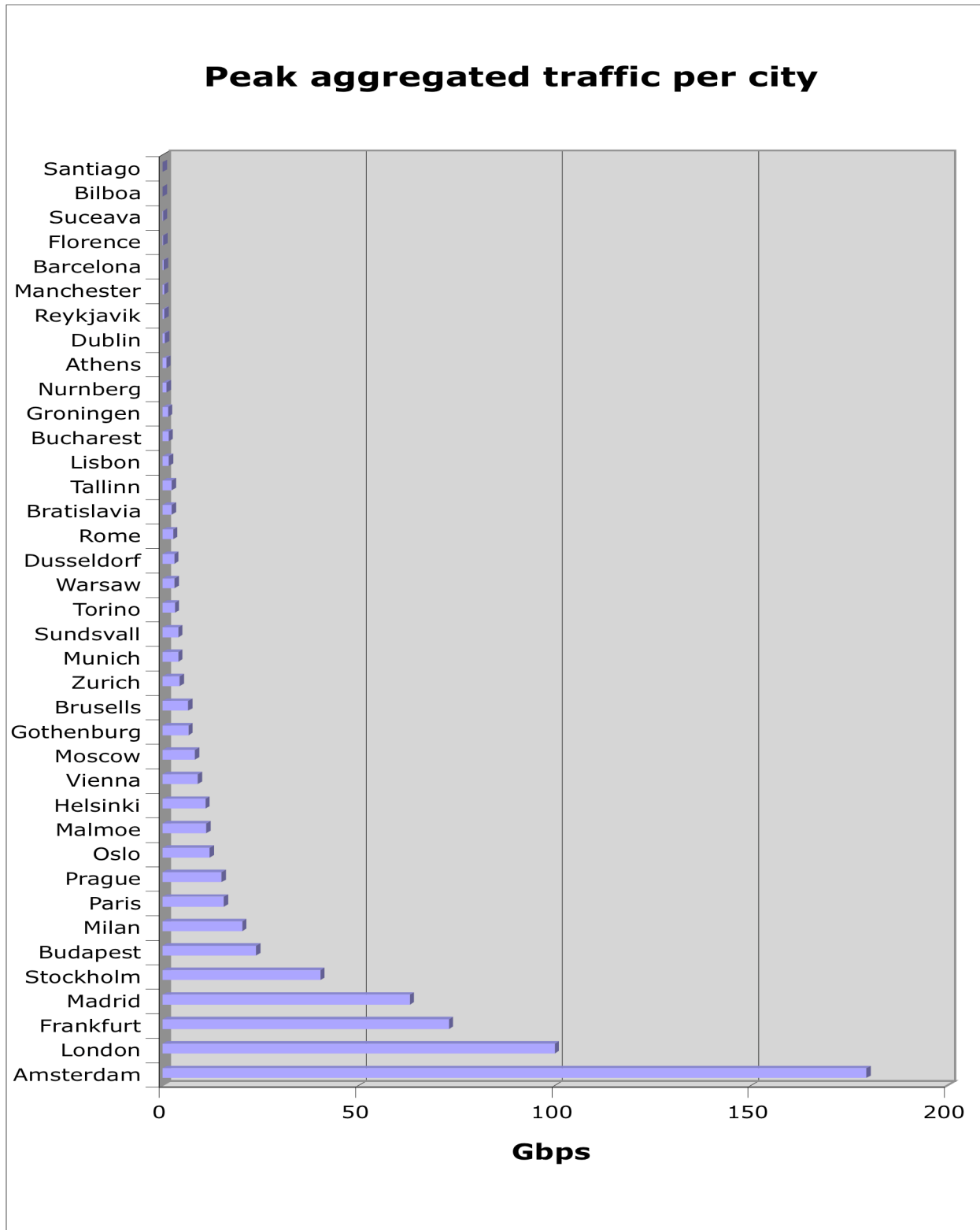
## 4.2 IXP Traffic Ranking per country

This table details the amount of peak aggregated traffic per country and further shows what percentage the countries traffic is compared to Europe has a whole.

| Ranking | Country | Traffic | % of Total |
|---|---|---:|---:|
| 1 | Netherlands | 180,80 | 28,65% |
| 2 | United Kingdom | 100,27 | 15,89% |
| 3 | Germany | 80,98 | 12,83% |
| 4 | Spain | 63,39 | 10,04% |
| 5 | Sweden | 61,74 | 9,80% |
| 6 | Italy | 26,14 | 4,15% |
| 7 | Hungary | 23,80 | 3,77% |
| 8 | France | 15,60 | 2,43% |
| 9 | Czech Republic | 15,00 | 2,36% |
| 10 | Norway | 12,00 | 1,90% |
| 11 | Finland | 10,93 | 1,73% |
| 12 | Austria | 8,95 | 1,42% |
| 13 | Russia | 8,24 | 1,30% |
| 14 | Belgium | 6,50 | 1,02% |
| 15 | Switzerland | 4,30 | 0,69% |
| 16 | Poland | 3,00 | 0,47% |
| 17 | Slovakia | 2,30 | 0,36% |
| 18 | Estonia | 2,29 | 0,35% |
| 19 | Romania | 1,62 | 0,27% |
| 20 | Portugal | 1,59 | 0,25% |
| 21 | Greece | 0,97 | 0,15% |
| 22 | Ireland | 0,56 | 0,09% |
| 23 | Iceland | 0,48 | 0,08% |
|  | **Total** | **631,43** | 100,00% |

Note: This traffic data was captured on the 30th of August 2006

## 4.3 Peak aggregated traffic per city

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

**Peak aggregated traffic per city**

Cities (top to bottom): Santiago, Bilboa, Suceava, Florence, Barcelona, Manchester, Reykjavik, Dublin, Athens, Nurnberg, Groningen, Bucharest, Lisbon, Tallinn, Bratislavia, Rome, Dusseldorf, Warsaw, Torino, Sundsvall, Munich, Zurich, Brusells, Gothenburg, Moscow, Vienna, Helsinki, Malmoe, Oslo, Prague, Paris, Milan, Budapest, Stockholm, Madrid, Frankfurt, London, Amsterdam

X-axis: **Gbps** (0, 50, 100, 150, 200)

Note: This traffic data was captured on the 30th of August 2006

20

## 4.4 IXP Traffic Ranking per city

This table details the amount of peak aggregated traffic per European city and further shows what percentage the cities traffic is compared to Europe has a whole.

| Ranking | City | Country | Traffic Gbps | % of total |
|---------|------|---------|--------------|------------|
| 1 | Amsterdam | Netherlands | 179,40 | 28,41% |
| 2 | London | United Kingdom | 99,91 | 15,82% |
| 3 | Frankfurt | Germany | 72,97 | 11,56% |
| 4 | Madrid | Spain | 63,00 | 10,11% |
| 5 | Stockholm | Sweden | 40,17 | 6,36% |
| 6 | Budapest | Hungary | 23,80 | 3,73% |
| 7 | Milan | Italy | 20,27 | 3,21% |
| 8 | Paris | France | 15,60 | 2,43% |
| 9 | Prague | Czech Republic | 15,00 | 2,36% |
| 10 | Oslo | Norway | 12,00 | 1,90% |
| 11 | Malmoe | Sweden | 11,10 | 1,76% |
| 12 | Helsinki | Finland | 10,93 | 1,73% |
| 13 | Vienna | Austria | 8,95 | 1,42% |
| 14 | Moscow | Russia | 8,24 | 1,30% |
| 15 | Gothenburg | Sweden | 6,57 | 1,04% |
| 16 | Brusells | Belgium | 6,50 | 1,02% |
| 17 | Zurich | Switzerland | 4,30 | 0,68% |
| 18 | Munich | Germany | 4,00 | 0,64% |
| 19 | Sundsvall | Sweden | 3,96 | 0,63% |
| 20 | Torino | Italy | 3,10 | 0,48% |
| 21 | Warsaw | Poland | 3,00 | 0,47% |
| 22 | Dusseldorf | Germany | 2,94 | 0,46% |
| 23 | Rome | Italy | 2,66 | 0,42% |
| 24 | Bratislavia | Slovakia | 2,30 | 0,36% |
| 25 | Tallinn | Estonia | 2,29 | 0,35% |
| 26 | Lisbon | Portugal | 1,59 | 0,25% |
| 27 | Bucharest | Romania | 1,53 | 0,24% |
| 28 | Groningen | Netherlands | 1,40 | 0,22% |
| 29 | Nurnberg | Germany | 0,99 | 0,16% |
| 30 | Athens | Greece | 0,97 | 0,15% |
| 31 | Dublin | Ireland | 0,56 | 0,09% |
| 32 | Reykjavik | Iceland | 0,48 | 0,08% |
| 33 | Manchester | United Kingdom | 0,36 | 0,06% |
| 34 | Barcelona | Spain | 0,32 | 0,05% |
| 35 | Florence | Italy | 0,12 | 0,02% |
| 36 | Suceava | Romania | 0,09 | 0,01% |
| 37 | Bilboa | Spain | 0,04 | 0,01% |
| 38 | Santiago | Spain | 0,03 | 0,01% |
| **Total** | | | **631,43** | **100,00%** |

Note: This traffic data was captured on the 30th of August 2006

## 4.5 IXP Traffic per million inhabitants

This graph displays the total amount of aggregated peak IXP traffic per country in Gbps per million inhabitants.

**IXP Traffic per million inhabitants**
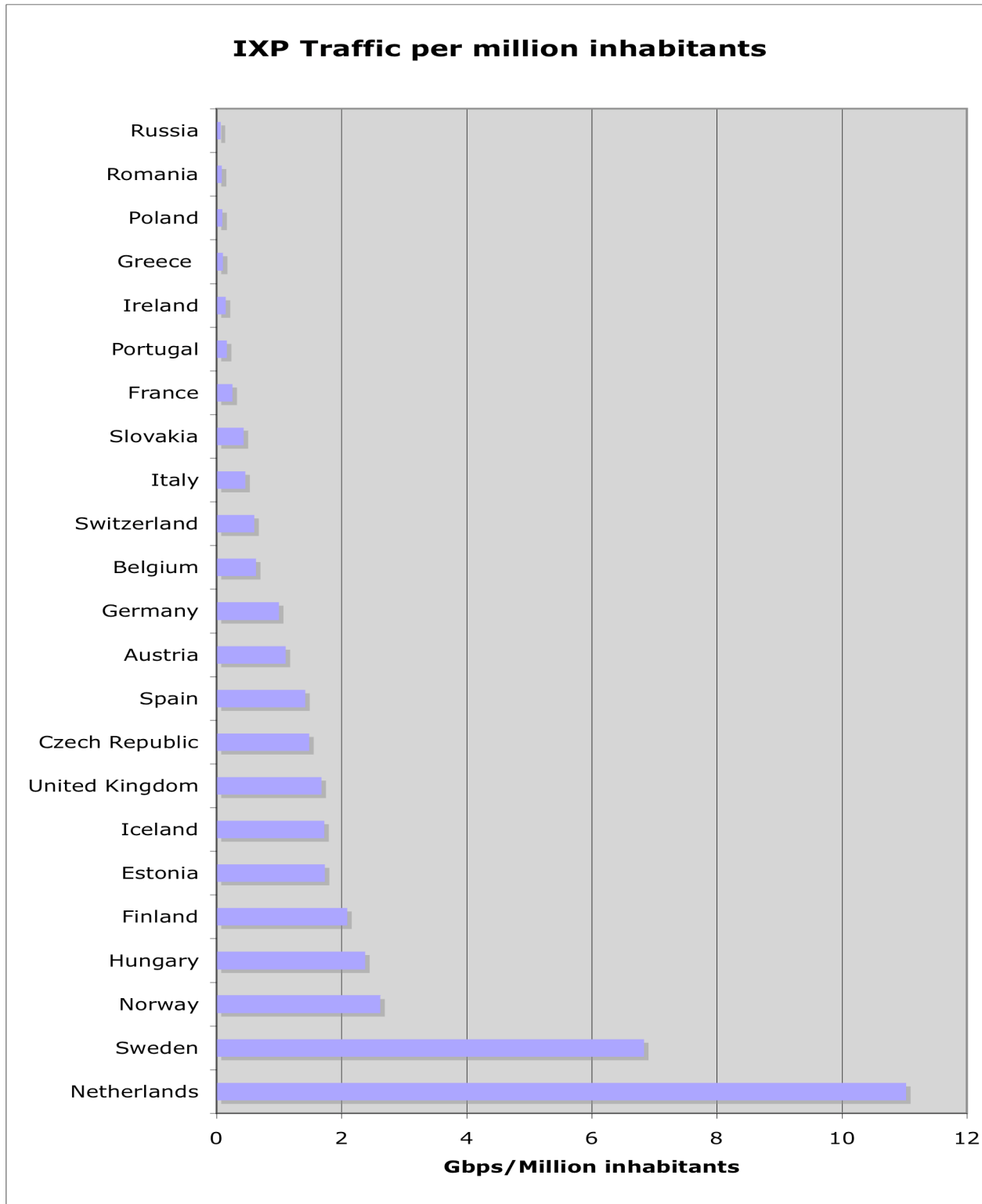


Note: This traffic data was captured on the 30th of August 2006

## 4.6 IXP Traffic per million inhabitants country ranking

This table details the amount of aggregated peak IXP traffic per million inhabitants, this has been derived by dividing the country's population in million inhabitants into the total amount of peak IXP traffic. The "traffic ranking" column on the right hand side shows the counties ranking in traffic *before* the population has not been taken into account.

As the population of Russia expands outside of continental Europe, separate totals have been calculated to allow for this factor. The table thus shows that average individual country aggregated peak IXP traffic across Europe is somewhere in the region one Gbps per million inhabitants.
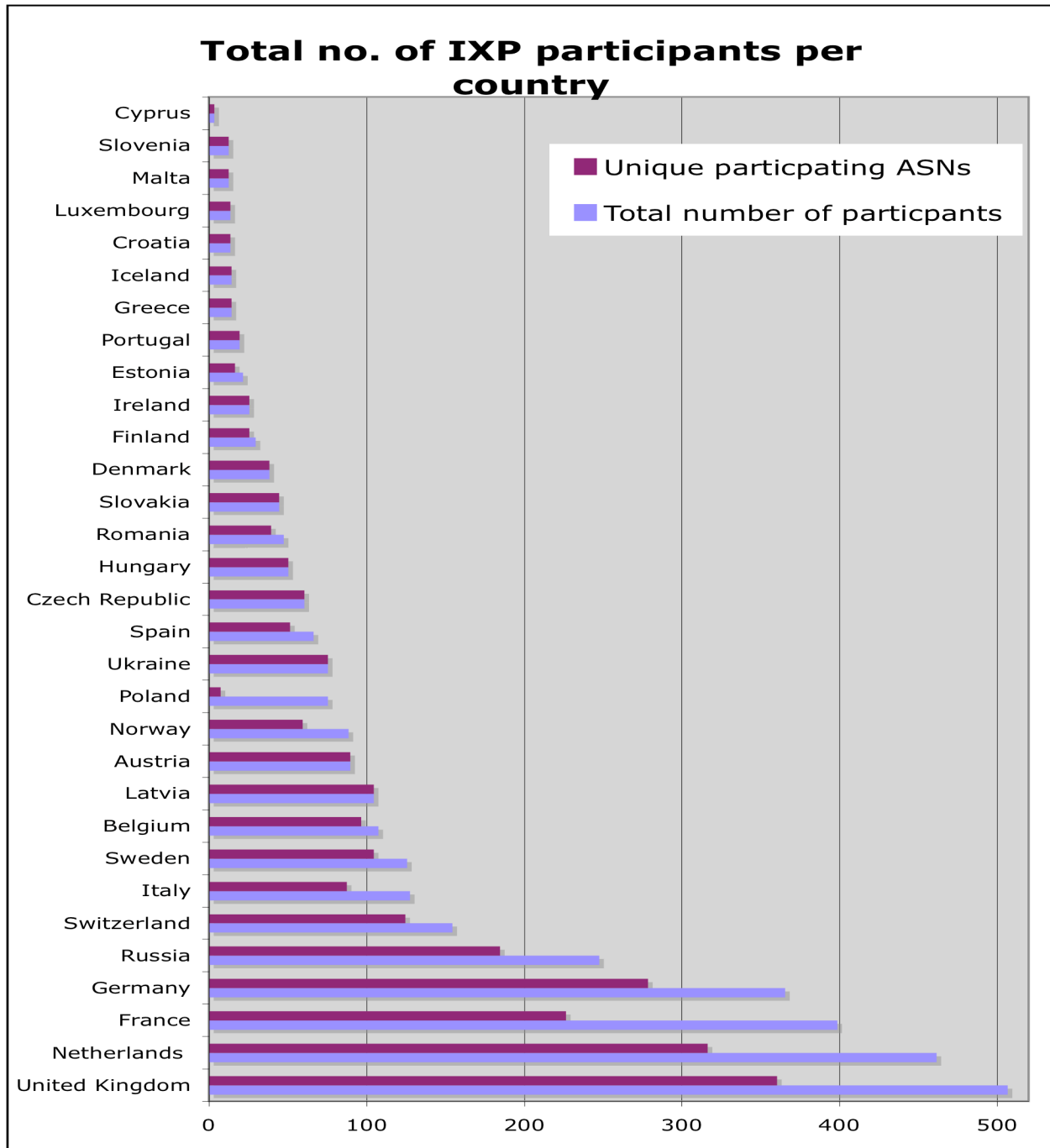
| Rank | Country | Traffic Gbps | Population M | Gbps/M people | Rank traffic |
|---|---|---|---|---|---|
| 1 | Netherlands | 180,80 | 16,41 | **11,02** | 1 |
| 2 | Sweden | 61,74 | 9,05 | **6,82** | 4 |
| 3 | Norway | 12,00 | 4,60 | **2,61** | 10 |
| 4 | Hungary | 23,80 | 10,08 | **2,36** | 7 |
| 5 | Finland | 10,93 | 5,26 | **2,08** | 11 |
| 6 | Estonia | 2,29 | 1,33 | **1,72** | 18 |
| 7 | Iceland | 0,48 | 0,28 | **1,71** | 23 |
| 8 | United Kingdom | 100,27 | 60,21 | **1,67** | 2 |
| 9 | Czech Republic | 15,00 | 10,24 | **1,46** | 9 |
| 10 | Spain | 63,39 | 45,06 | **1,41** | 5 |
| 11 | Austria | 8,95 | 8,21 | **1,09** | 12 |
| 12 | Germany | 80,98 | 82,42 | **0,98** | 3 |
| 13 | Belgium | 6,50 | 10,45 | **0,62** | 14 |
| 14 | Switzerland | 4,30 | 7,25 | **0,59** | 15 |
| 15 | Italy | 26,14 | 58,46 | **0,45** | 6 |
| 16 | Slovakia | 2,30 | 5,43 | **0,42** | 17 |
| 17 | France | 15,60 | 63,59 | **0,25** | 8 |
| 18 | Portugal | 1,59 | 10,61 | **0,15** | 20 |
| 19 | Ireland | 0,56 | 4,13 | **0,14** | 22 |
| 20 | Greece | 0,97 | 11,24 | **0,09** | 21 |
| 21 | Poland | 3,00 | 38,62 | **0,08** | 16 |
| 22 | Romania | 1,62 | 22,33 | **0,07** | 19 |
| 23 | Russia | 8,24 | 143,20 | **0,06** | 13 |
| Total | | 631,43 | 628,46 | 0,99 | |
| **Total excl. Russia** | | **623,19** | **485,26** | **1,27** | |

Note: This traffic data was captured on the 30th of August 2006

# *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.

**Total no. of IXP participants per country**

Legend:
- Unique particpating ASNs
- Total number of particpants

Countries (top to bottom): Cyprus, Slovenia, Malta, Luxembourg, Croatia, Iceland, Greece, Portugal, Estonia, Ireland, Finland, Denmark, Slovakia, Romania, Hungary, Czech Republic, Spain, Ukraine, Poland, Norway, Austria, Latvia, Belgium, Sweden, Italy, Switzerland, Russia, Germany, France, Netherlands, United Kingdom

X-axis: 0, 100, 200, 300, 400, 500

Note: This traffic data was captured on the 30th of August 2006
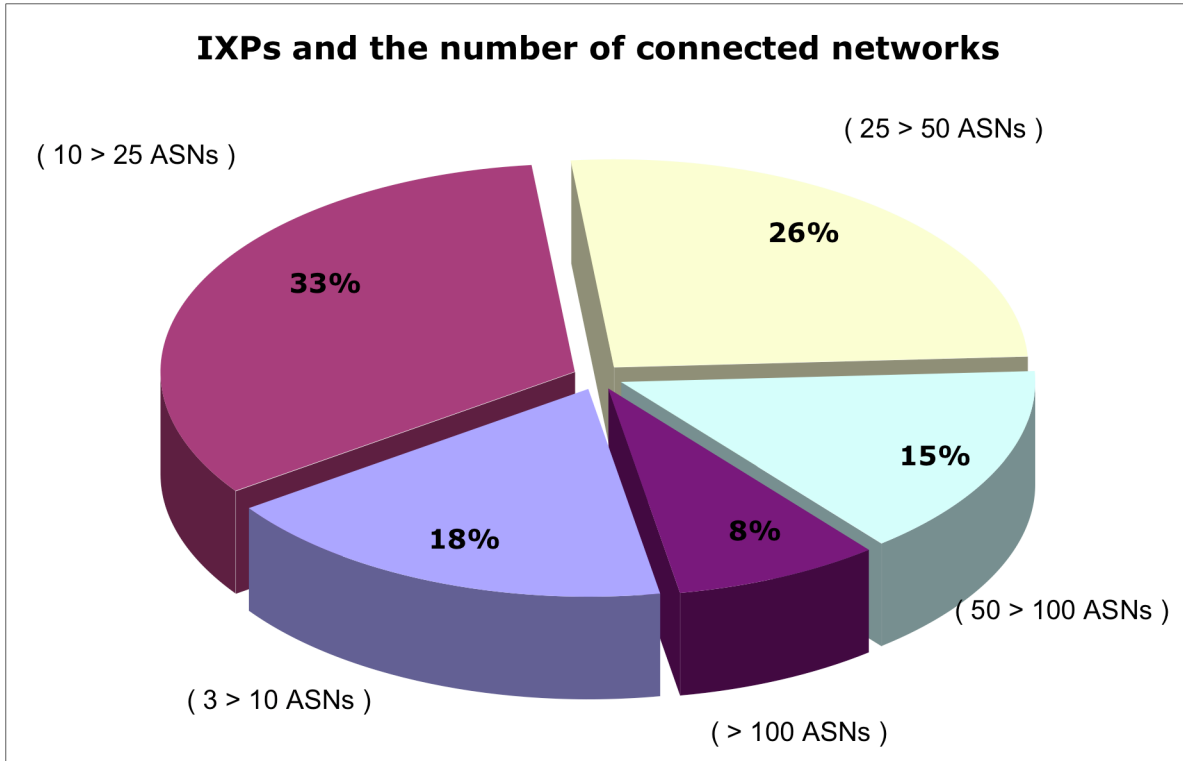
24

## 5.2 Ranking of total number of IXP participants per country

This table details the combined total number of IXP participants per country, the total number of unique participants pert country and then displays the percentage of ASNs that are unique, meaning that percentage that are not unique are peering at more than one IXP in that country.

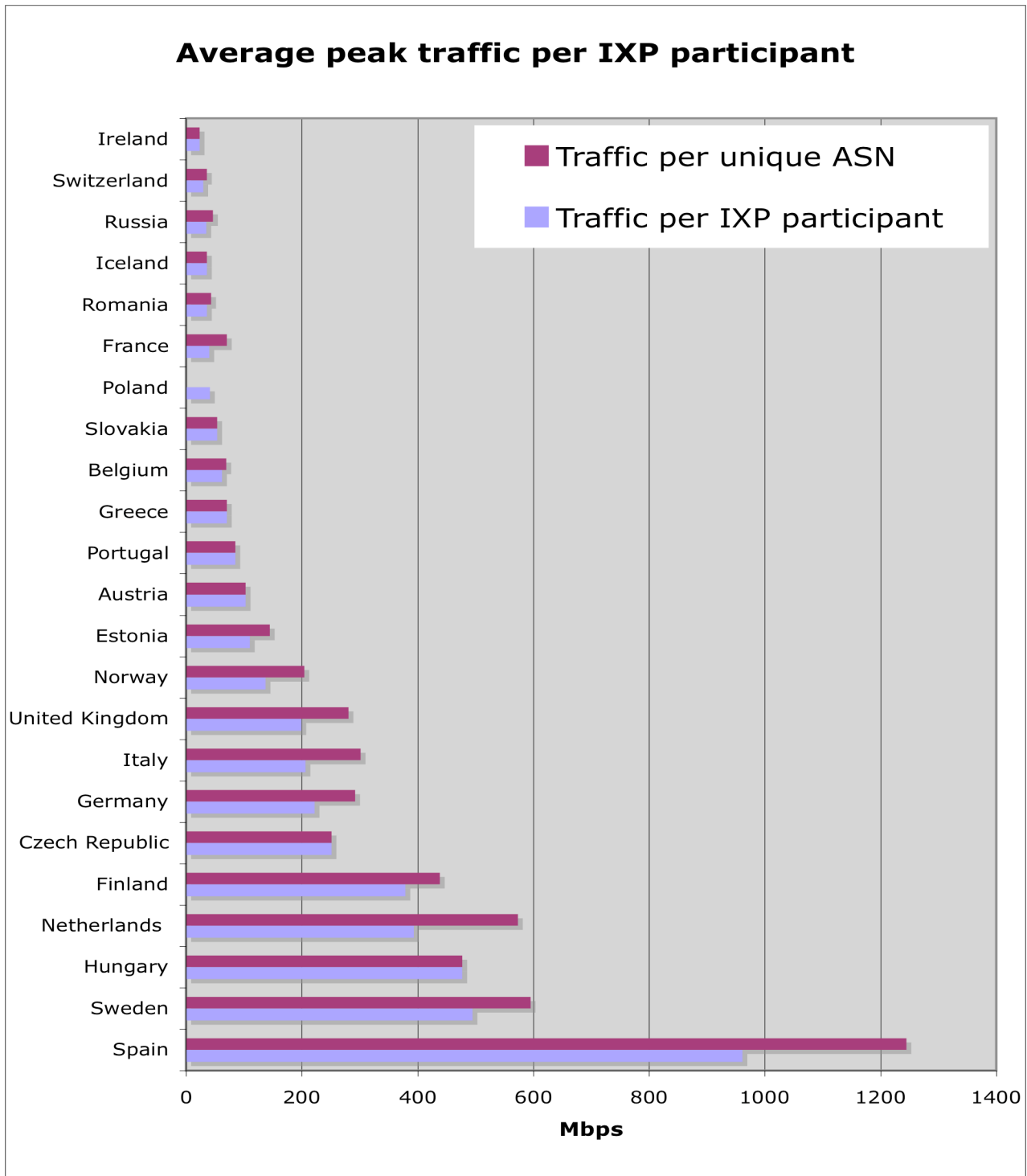| Rank | Country | Participants | Unique ASN | Unique ASN as % of total participants |
|---|---|---|---|---|
| 1 | United Kingdom | 506 | 360 | 71% |
| 2 | Netherlands | 461 | 316 | 68% |
| 3 | France | 398 | 226 | 57% |
| 4 | Germany | 365 | 278 | 76% |
| 5 | Russia | 247 | 184 | N/A |
| 6 | Switzerland | 154 | 124 | 81% |
| 7 | Italy | 127 | 87 | 68% |
| 8 | Sweden | 125 | 104 | 83% |
| 9 | Belgium | 107 | 96 | 89% |
| 10 | Latvia | 104 | 104 | 100% |
| 11 | Austria | 89 | 89 | 100% |
| 12 | Norway | 88 | 59 | 67% |
| 13 | Poland | 75 | 7 | N/A |
| 14 | Ukraine | 75 | 75 | 100% |
| 15 | Spain | 66 | 51 | 78% |
| 16 | Czech Republic | 60 | 60 | 100% |
| 17 | Hungary | 50 | 50 | 100% |
| 18 | Romania | 47 | 39 | 84% |
| 19 | Slovakia | 44 | 44 | 100% |
| 20 | Denmark | 38 | 38 | 100% |
| 21 | Finland | 29 | 29 | 100% |
| 22 | Ireland | 25 | 25 | 100% |
| 23 | Estonia | 21 | 16 | 76% |
| 24 | Portugal | 19 | 19 | 100% |
| 25 | Greece | 14 | 14 | 100% |
| 26 | Iceland | 14 | 14 | 100% |
| 27 | Croatia | 13 | 13 | 100% |
| 28 | Luxembourg | 13 | 13 | 100% |
| 29 | Malta | 12 | 12 | 100% |
| 30 | Slovenia | 12 | 12 | 100% |
| 31 | Cyprus | 3 | 3 | 100% |
| | **Total** | **3401** | **2557** | **75%** |
| **Unique ASNs peering in Europe** | | | **1965** | **58%** |
| Unique ASNs as % of RIPE Total RIPE ASNs | | | 8316 | 24% |
| Unique ASNs as % of all ASNs worldwide | | | 23713 | 8% |

## 5.3 Percentage of IXPs and their number of participants

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

**IXPs and the number of connected networks**

( 25 > 50 ASNs )

( 10 > 25 ASNs )

33%

26%

15%

18%

8%

( 50 > 100 ASNs )

( 3 > 10 ASNs )

( > 100 ASNs )

## 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 then further displays the amount average amount of peak traffic per unique IXP participant.

**Average peak traffic per IXP participant**

Legend:
- Traffic per unique ASN
- Traffic per IXP participant

Countries (top to bottom): Ireland, Switzerland, Russia, Iceland, Romania, France, Poland, Slovakia, Belgium, Greece, Portugal, Austria, Estonia, Norway, United Kingdom, Italy, Germany, Czech Republic, Finland, Netherlands, Hungary, Sweden, Spain

X-axis: Mbps (0, 200, 400, 600, 800, 1000, 1200, 1400)

Note: This traffic data was captured on the 30th of August 2006

## 5.5 Ranking of 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 Euro-IX IXP participant has 235 Mbps of peak traffic.

| Rank | Country | Traffic | Participants | Tra/Prt Mb | Unique ASNs | Trf/ASN Mb |
|------|---------|---------|--------------|------------|-------------|------------|
| 1 | Spain | 63,39 | 66 | **960** | 51 | 1243 |
| 2 | Sweden | 61,74 | 125 | **494** | 104 | 594 |
| 3 | Hungary | 23,80 | 50 | **476** | 50 | 476 |
| 4 | Netherlands | 180,8 | 461 | **392** | 316 | 572 |
| 5 | Finland | 10,93 | 29 | **377** | 25 | 437 |
| 6 | Czech Republic | 15,00 | 60 | **250** | 60 | 250 |
| 7 | Germany | 80,98 | 365 | **221** | 278 | 291 |
| 8 | Italy | 26,15 | 127 | **205** | 87 | 300 |
| 9 | United Kingdom | 100,27 | 506 | **198** | 360 | 279 |
| 10 | Norway | 12,00 | 88 | **136** | 59 | 203 |
| 11 | Estonia | 2,29 | 21 | **109** | 16 | 143 |
| 12 | Austria | 8,95 | 89 | **101** | 89 | 101 |
| 13 | Portugal | 1,59 | 19 | **84** | 19 | 84 |
| 14 | Greece | 0,97 | 14 | **69** | 14 | 69 |
| 15 | Belgium | 6,50 | 107 | **61** | 96 | 68 |
| 16 | Slovakia | 2,30 | 44 | **52** | 44 | 52 |
| 17 | Poland | 3,00 | 75 | **40** | 7 | na |
| 18 | France | 15,60 | 398 | **39** | 226 | 69 |
| 19 | Romania | 1,62 | 47 | **34** | 39 | 42 |
| 20 | Iceland | 0,48 | 14 | **34** | 14 | 34 |
| 21 | Russia | 8,24 | 247 | **33** | 184 | 45 |
| 22 | Switzerland | 4,30 | 154 | **28** | 124 | 35 |
| 23 | Ireland | 0,56 | 25 | **22** | 25 | 22 |
| **Average in Europe** | | | | **192** | | 235 |

Note: This traffic data was captured on the 30th of August 2006

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

The graph below details the number of ASNs that are present at more than one European IXP. Starting from the top the graph shows that 221 ASNs peer at two IXPs while the bottom of the graph shows that one ASN peers at 21 European IXPs.

In total some 429 ASNs peer at more than one European IXP.



Number of ASNs present at multiple European IXPs
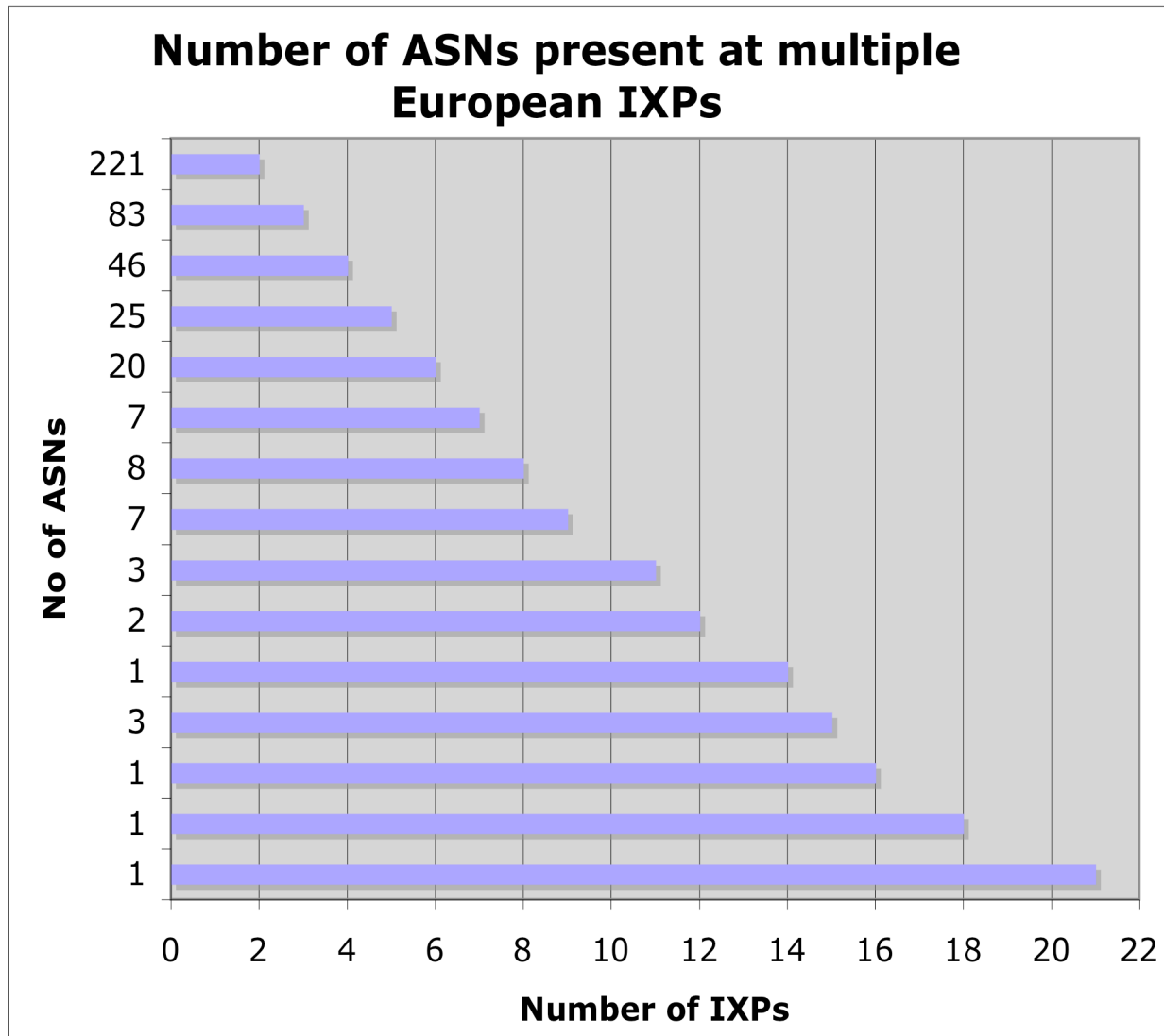
## 5.6.1 ASNs present at more than one IXP in Europe

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 the participants in question.

53% of European IXP participants peer at more than one European IXP while the remaining 47% only peer at one European IXP.

| No IXPs | No of ASNs | ASN |
|---|---|---|
| 21 | 1 | 8220 |
| 18 | 1 | 2686 |
| 16 | 1 | 174 |
| 15 | 3 | 702, 6830, 8928 |
| 14 | 1 | 4589 |
| 12 | 2 | 5400, 13237 |
| 11 | 3 | 286, 3257, 3303 |
| 9 | 7 | - |
| 8 | 8 | - |
| 7 | 7 | - |
| 6 | 20 | - |
| 5 | 25 | - |
| 4 | 46 | - |
| 3 | 83 | - |
| 2 | 221 | - |
| **> 1 IXP** | **429** | |

## 5.6.2 ASNs present at more than one IXP in France

France has 13 IXPs in 5 different cities, 9 of which are located in Paris.

There are:

6 ASNs (***5410, 8975, 15557, 20766, 29075, 30972***) that are present at 5 French IXPs
14 ASNs that are present at 4 IXPs
20 ASNs present at 3 IXPs
45 ASNs present at 2 IXPs

In general **67%** of ASNs peering at an IXP in France also peer at another French IXP while the remaining **37%** of ASNs only peer at one French IXP.

The two largest French IXPs, PARIX of Paris sees 93% of its connected ASNs peer at another IXP in Europe and SFINX of Paris some 91% of its connected ASNs peering at other European IXPs.

### 5.6.3 ASNs present at more than one IXP in Germany

Germany has 12 IXPs in 8 different cities.

There are:

2 ASNs (*5430, 8881*) that are present at 5 German IXPs.
5 ASNs (**174, 4589, 12337, 20940, 25074**) that are present at 4 IXPs
9 ASNs present at 3 IXPs
43 ASNs present at 2 IXPs

In general **40%** of ASNs peering at an IXP in Germany also peer at another German IXP while the remaining **60%** of ASNs only peer at one German IXP.

Germany's largest IXP, DE-CIX of Frankfurt sees 73% of its connected ASNs peer at another IXP in Europe.

### 5.6.4 ASNs present at more than one IXP in the United Kingdom

The United Kingdom has 12 IXPs in 3 different cities, 8 of which are in London.

There are:

2 ASNs (*8468, 16353*) which are present at 5 UK IXPs.
3 ASNs (*6770, 8553, 13285*) that are present at 4 IXPs
20 ASNs present at 3 IXPs
41 ASNs present at 2 IXPs

In general **40%** of ASNs peering at an IXP in the UK also peer at another UK IXP while the remaining **60%** of ASNs only peer at one UK IXP.

UK's largest IXP, LINX of London, sees 74% of its connected ASNs peer at another IXP in Europe.

# *Section 6. European IXP aggregated peak traffic trends*

## 6.1 Aggregated peak traffic history 2002 - 2006

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 27 IXPs across Europe.

**2002 - 2006 Traffic History (Euro-IX IXPs only)**
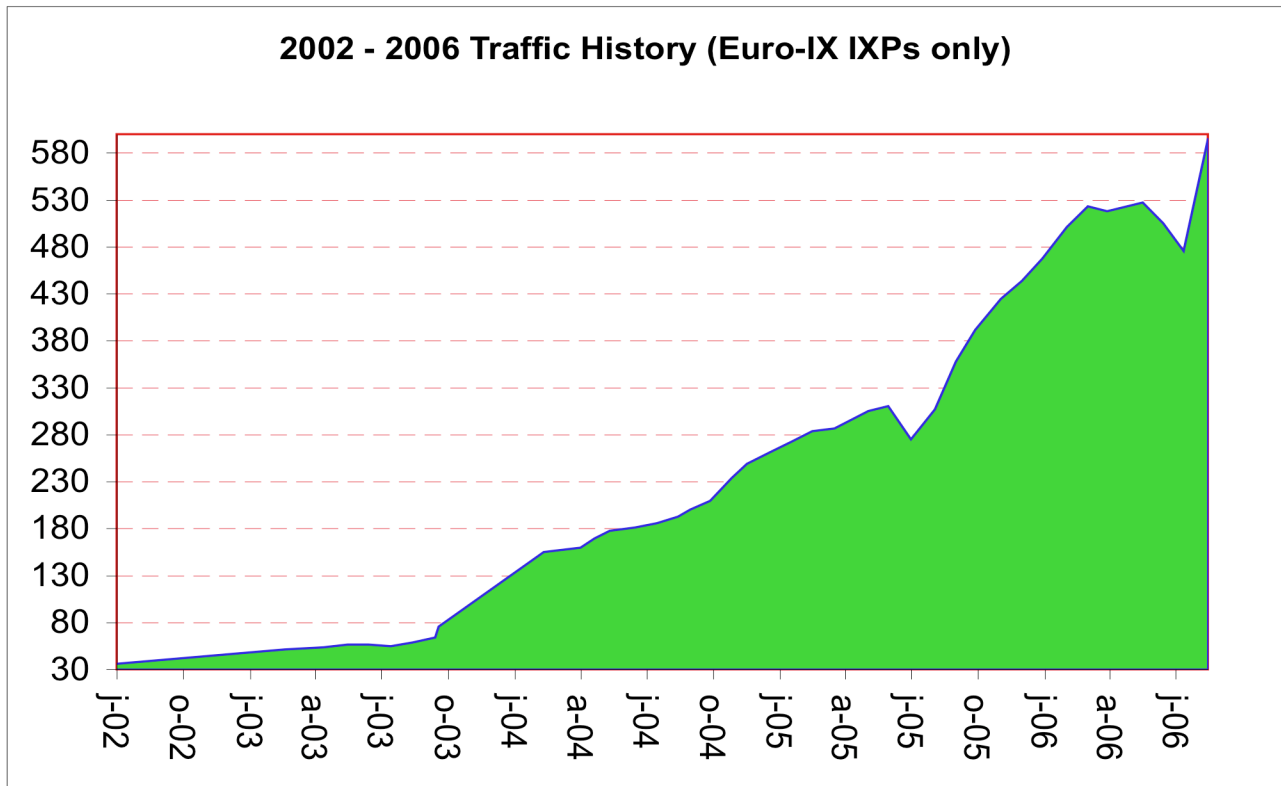
## 6.2 Comparison of traffic growth and different sized IXPs

This graph displays the traffic growth of various sized IXPs over a 24 month period. Combined traffic has increased by 306% over a 24-month period. 'Small' and 'very large' IXPs have increased their traffic by 352% and 337% respectively. While both 'medium' and 'large' IXPs have increased their traffic over the same 24 month period by some 229% and 227% respectively.

**Comparison of IXPs peak traffic growth over 24 months**

Legend:
- Total of all IXPs
- Small IXPs ( < 2Gbps)
- Medium IXPs (2Gbps - 10Gbps)
- Large IXPs (10Gbps - 25Gbps)
- Very Large IXPs (50Gbps - 200Gbps)

Y-axis: Aggragted peak traffic

X-axis (months): Sep-04, Oct-04, Nov-04, Dec-04, Jan-05, Feb-05, Mar-05, Apr-05, May-05, Jun-05, Jul-05, Aug-05, Sep-05, Oct-05, Nov-05, Dec-05, Jan-06, Feb-06, Mar-06, Apr-06, May-06, Jun-06, Jul-06, Aug-06
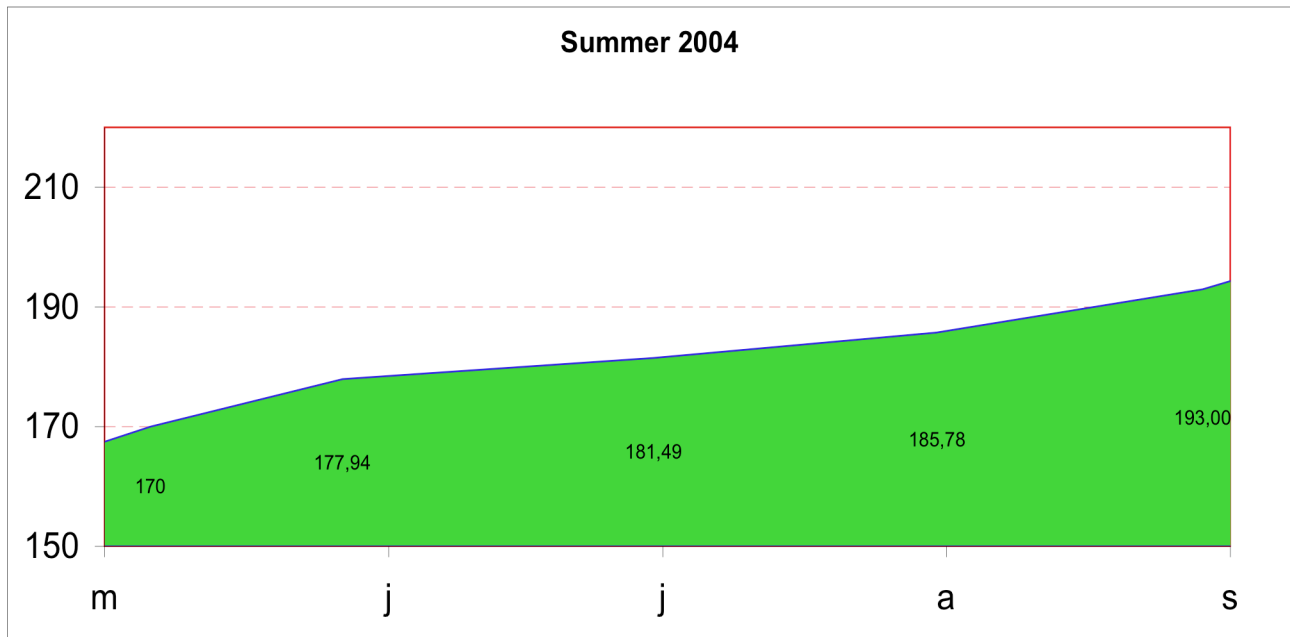
## 6.3 Summer peak traffic trend in Europe: 2003

This graph displays the aggregated IXP peak traffic during the summer of 2003. Drops in monthly peak traffic can be seen in both June and July of that year.

**Summer 2003**

| | | | | | |
|---|---|---|---|---|---|
| 54 | 56,89 | 56,39 | 55,05 | 58,9 | 64 |
| a | m | j | j | a | s |
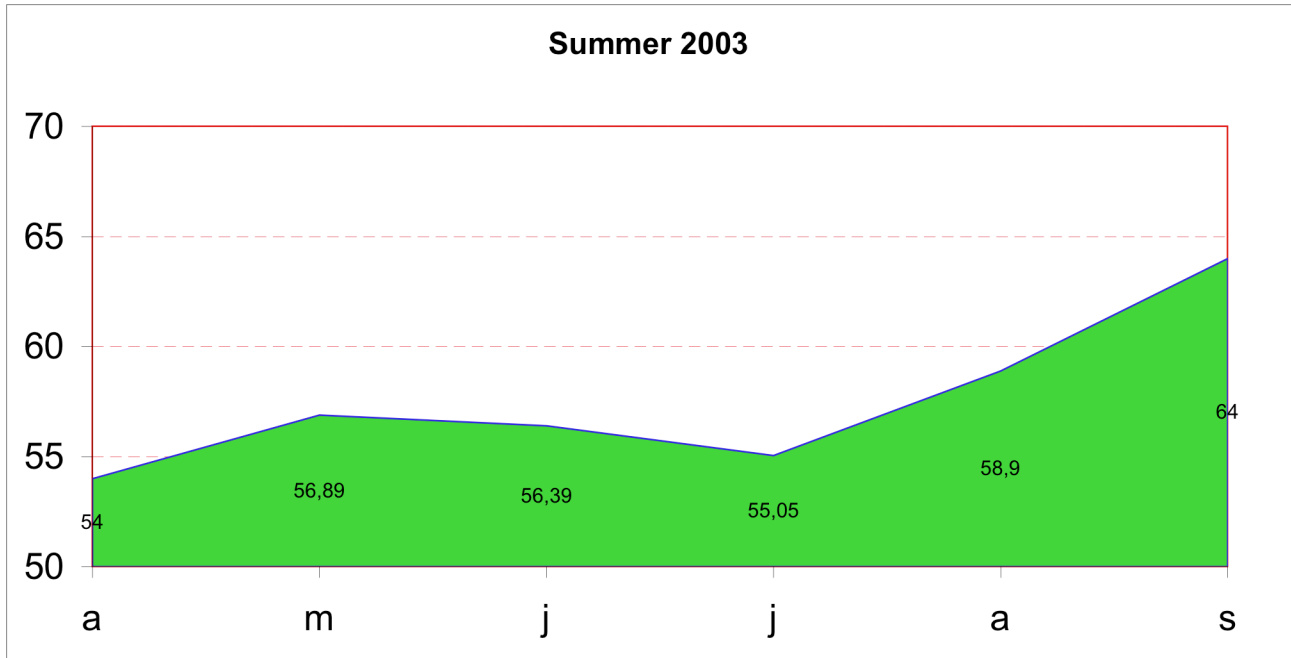
## 6.4 Summer peak traffic trend in Europe: 2004

This graph displays the aggregated IXP peak traffic during the summer of 2004. While traffic was slow to increase, there were no monthly decreases aggregated peak traffic recorded.

**Summer 2004**

170    177,94    181,49    185,78    193,00

m     j     j     a     s

## 6.5 Summer peak traffic trend in Europe: 2005

This graph displays the aggregated IXP peak traffic during the summer of 2005. A decrease of some 11.4% in peak aggregated traffic was recorded between the months of June and July of that year.

**Summer 2005**

- 310,694097
- 305,170931
- 307,431
- 287,02272
- 275,3971

a   m   j   j   a
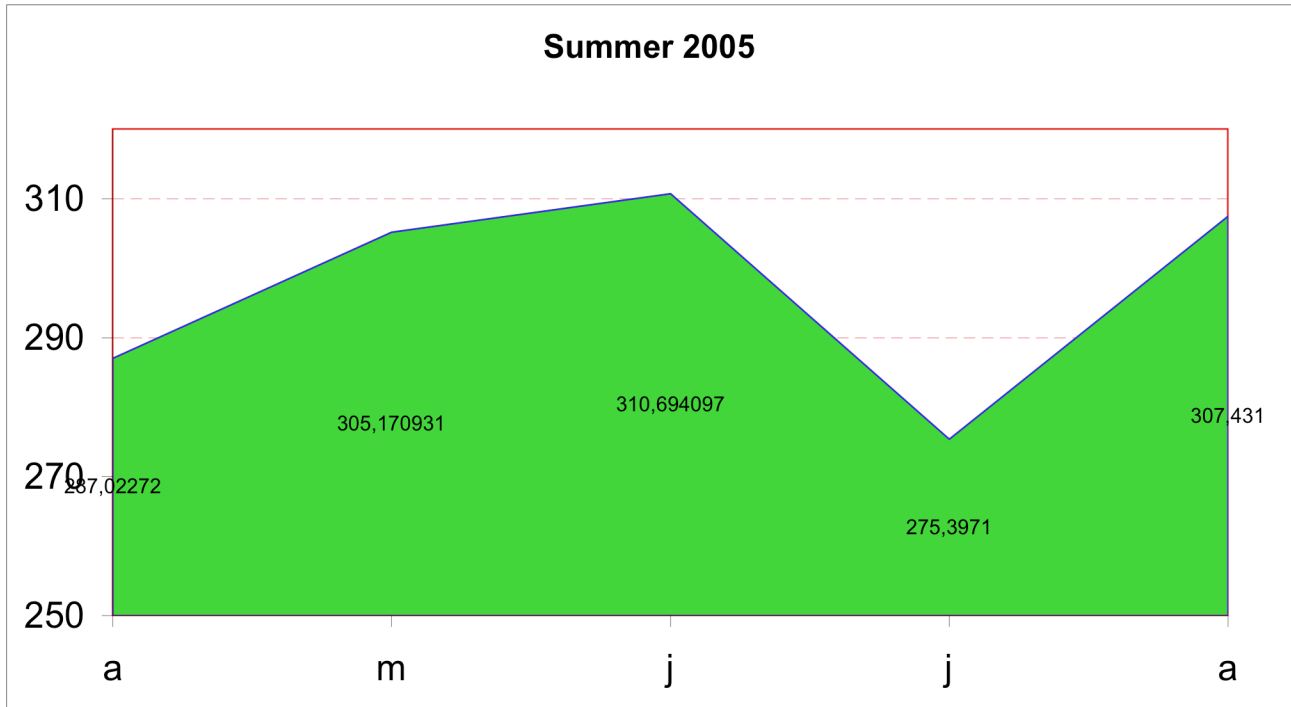
## 6.6 Summer peak traffic trend in Europe: 2006

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 July to August increase was over 25% in 2006.
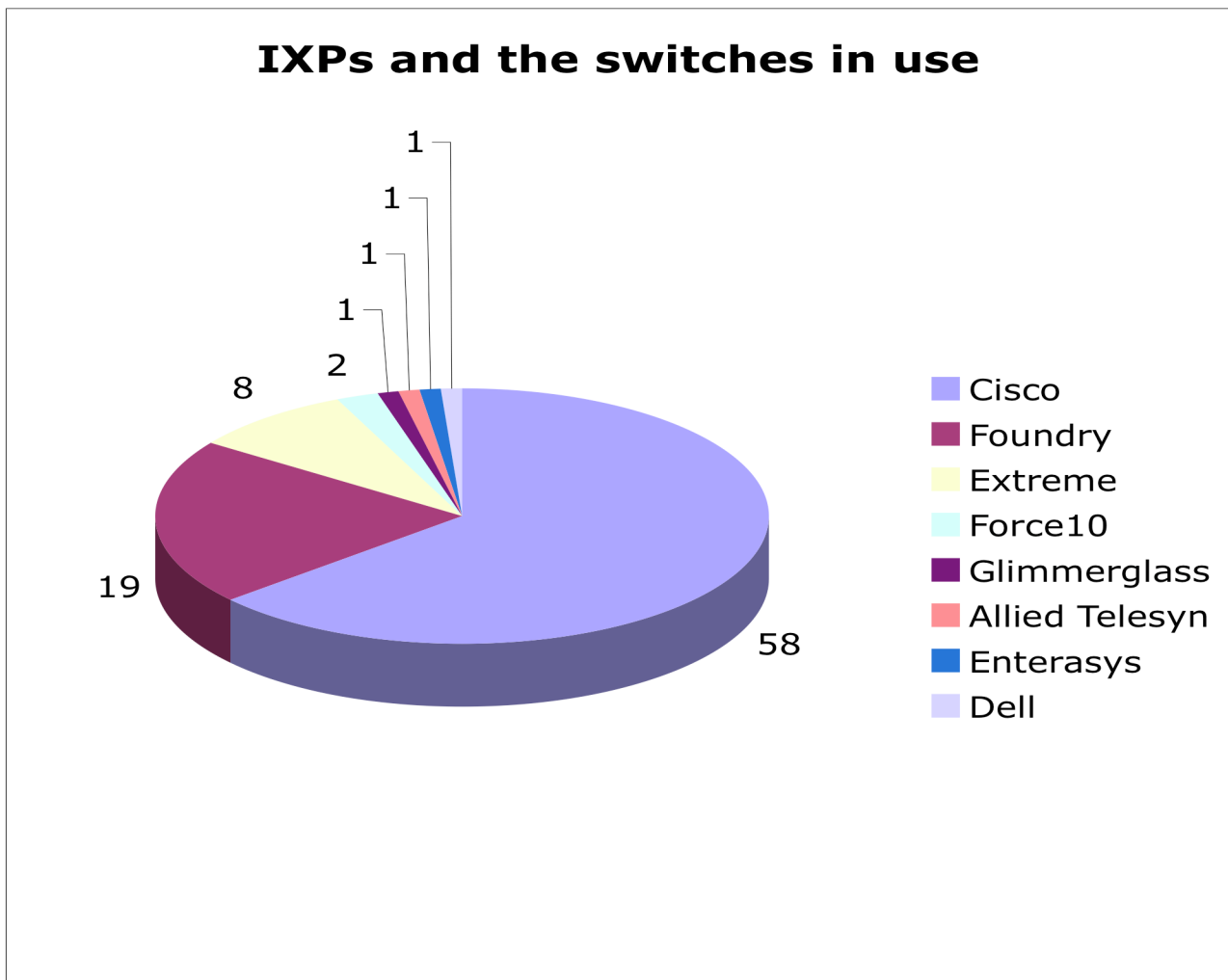
**Summer 2006**

- 518,2104 (a)
- 527,4817 (m/j)
- 505,4526 (j)
- 475,978 (j)
- 595,693 (a)
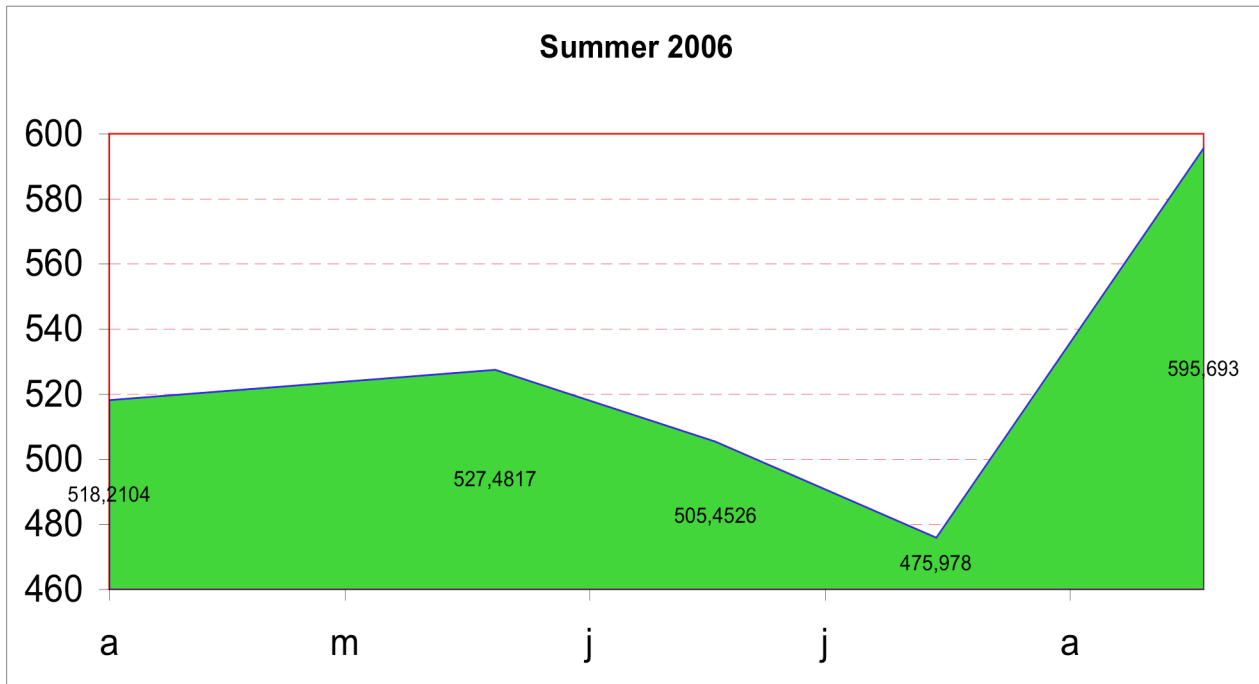
# Section 7. IXP switching platform

*Note:* The following data was taken from both the Euro-IX switch database and public information on individual IXP websites. In some cases the exact switching platform technology and numbers of switches could not be accurately attained. It is estimated that the switch vendor figures in this section of the report are approximately 90% accurate.
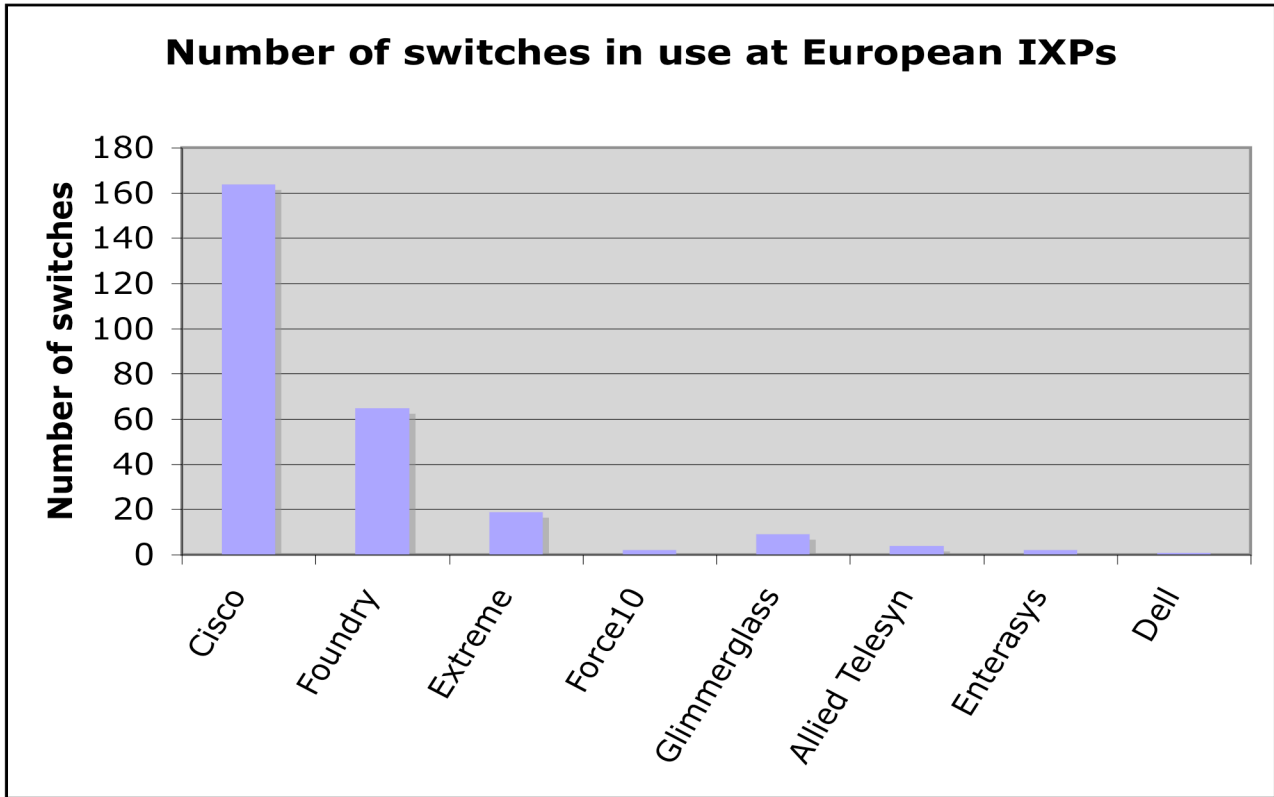
## 7.1 Number of IXPs using a particular switch vendor

This graph outlines the amount of IXPs that are using a particular switching vendor.

### IXPs and the switches in use



Legend:
- Cisco
- Foundry
- Extreme
- Force10
- Glimmerglass
- Allied Telesyn
- Enterasys
- Dell

## 7.2 Number of switches in use at European IXPs

This graph displays the number of particular switches being used by IXPs across Europe.



Number of switches in use at European IXPs

## 7.3 European IXP's choice of switch vendor

This table details the number of IXPs using a particular switch and how many switches are in use across Europe.

### Switches in use at European IXPs

| Switch vendor | No. IXPs | No. Switches |
|---|---:|---:|
| | | |
| Cisco | 58 | 164 |
| Foundry | 19 | 65 |
| Extreme | 8 | 19 |
| Force10 | 2 | 2 |
| Glimmerglass | 1 | 9 |
| Allied Telesyn | 1 | 4 |
| Enterasys | 1 | 2 |
| Dell | 1 | 1 |
| | | |
| | **91** | **266** |

## 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

- **Google**
  http://www.google.com/


Of course I 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 39 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 approximately 60 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*