Networking Technologies and Applications

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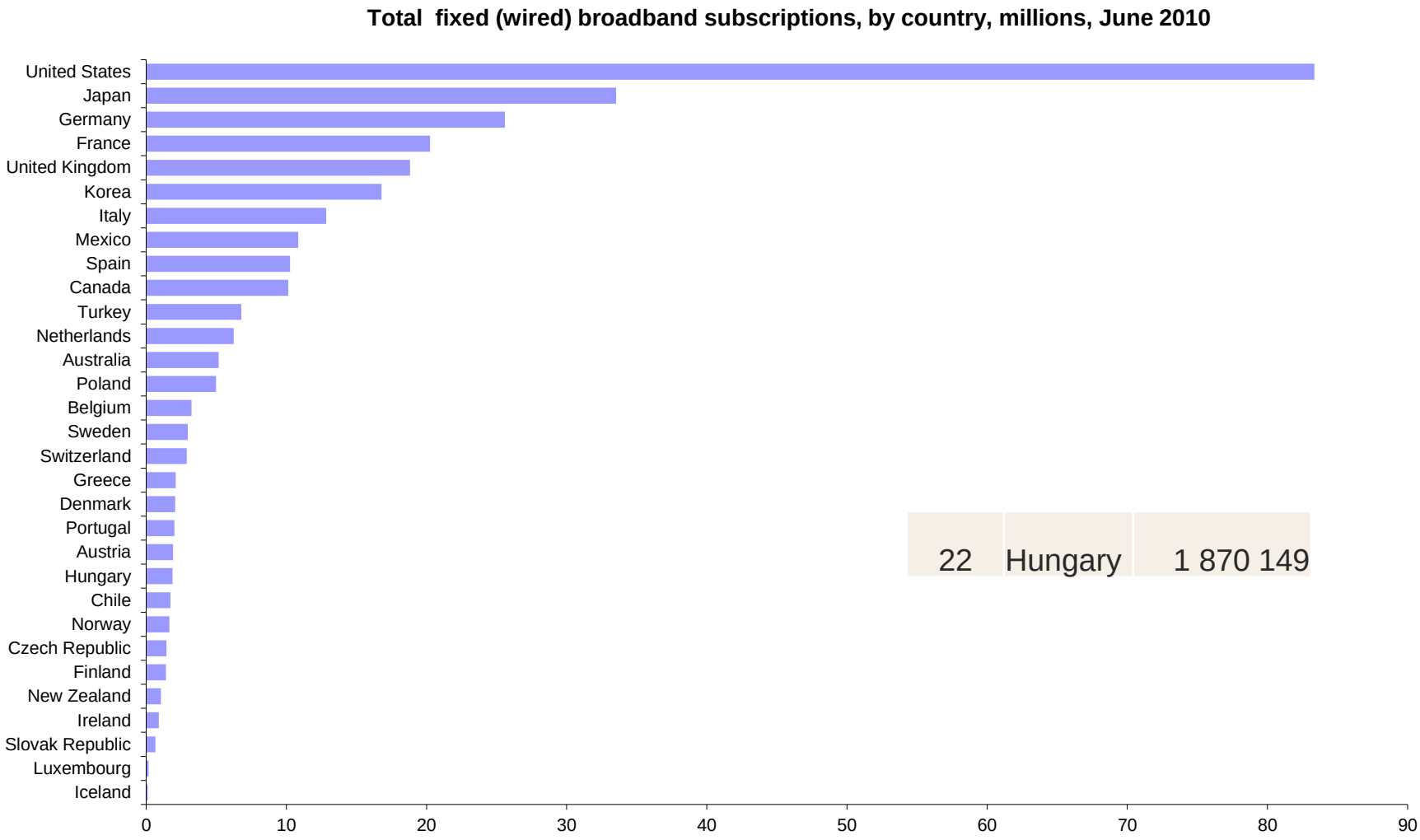
Broadband statistics

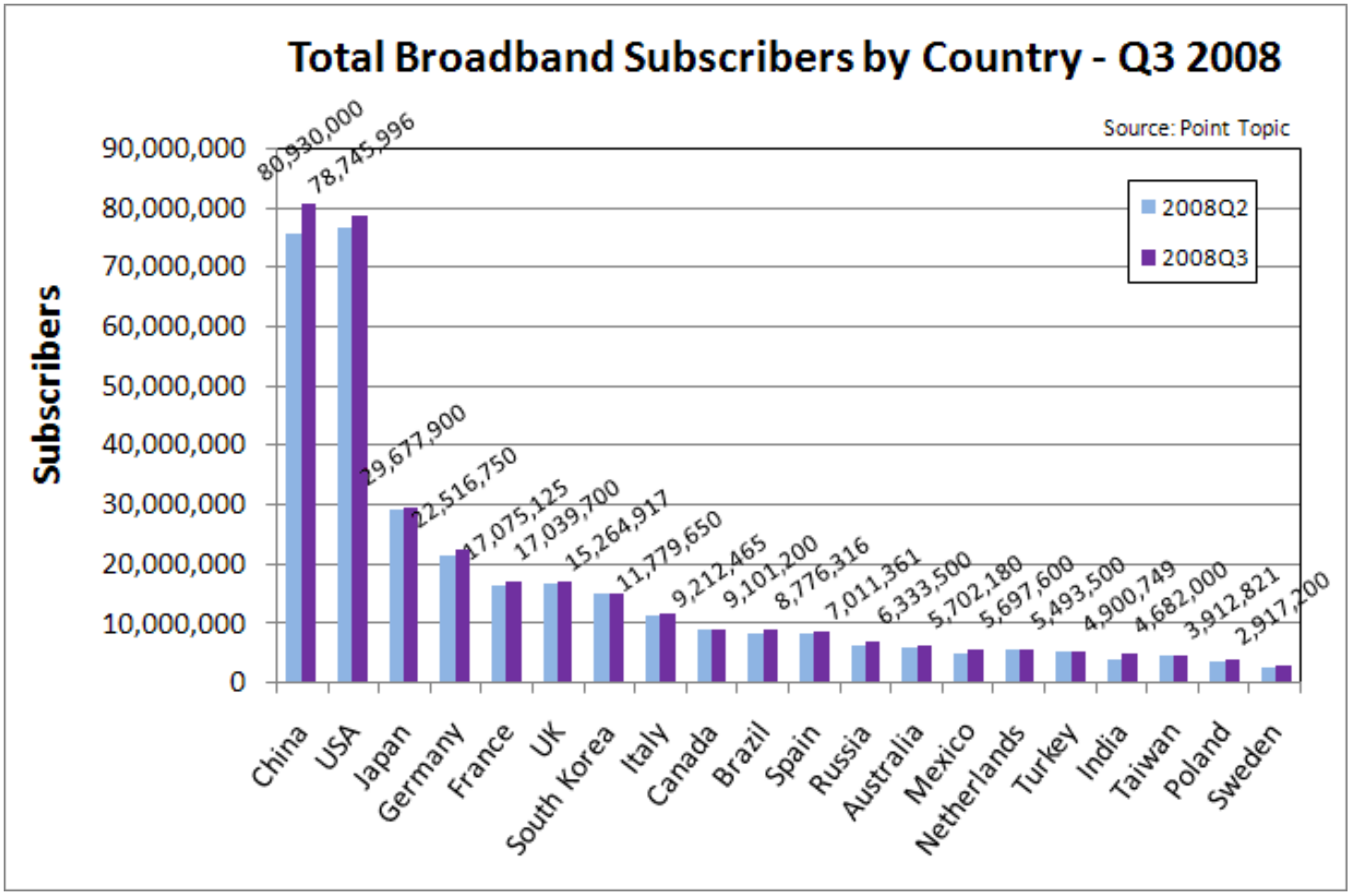
- OECD - Organization for Economic Co-operation and Development
  - 30 countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Holland, Hungary, Iceland, Ireland, Italy, Luxemburg, Norway, Poland, Portugal, Slovakia, Spain, Sweden, Switzerland, Turkey, United Kingdom, Canada, Mexico, USA, Japan, South Korea, Australia, New Zeeland
- Worldwide statistics
  - China has an important role
  - Russia, India

Broadband subscribers

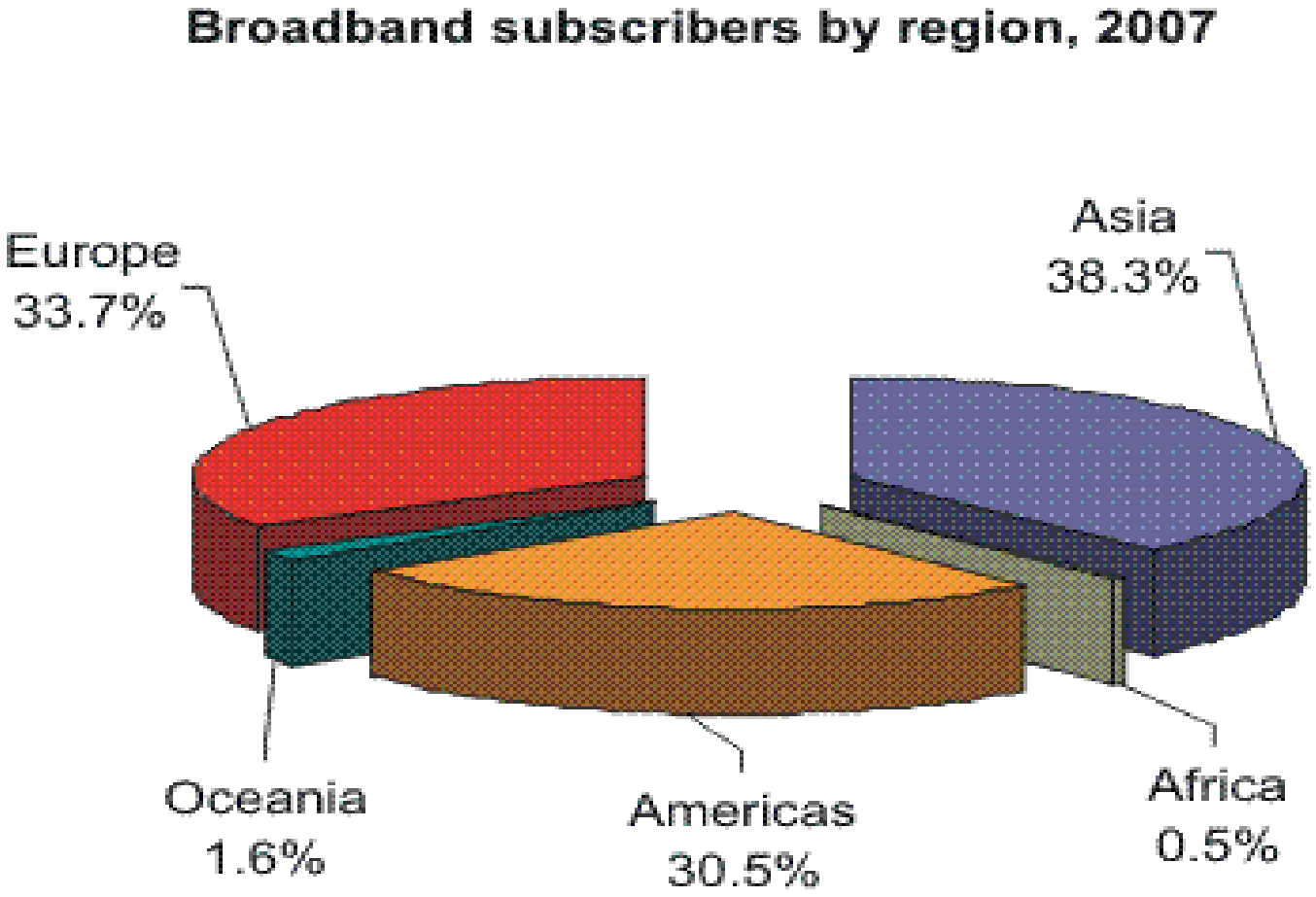


22	Hungary	1 870 149

Broadband subscribers

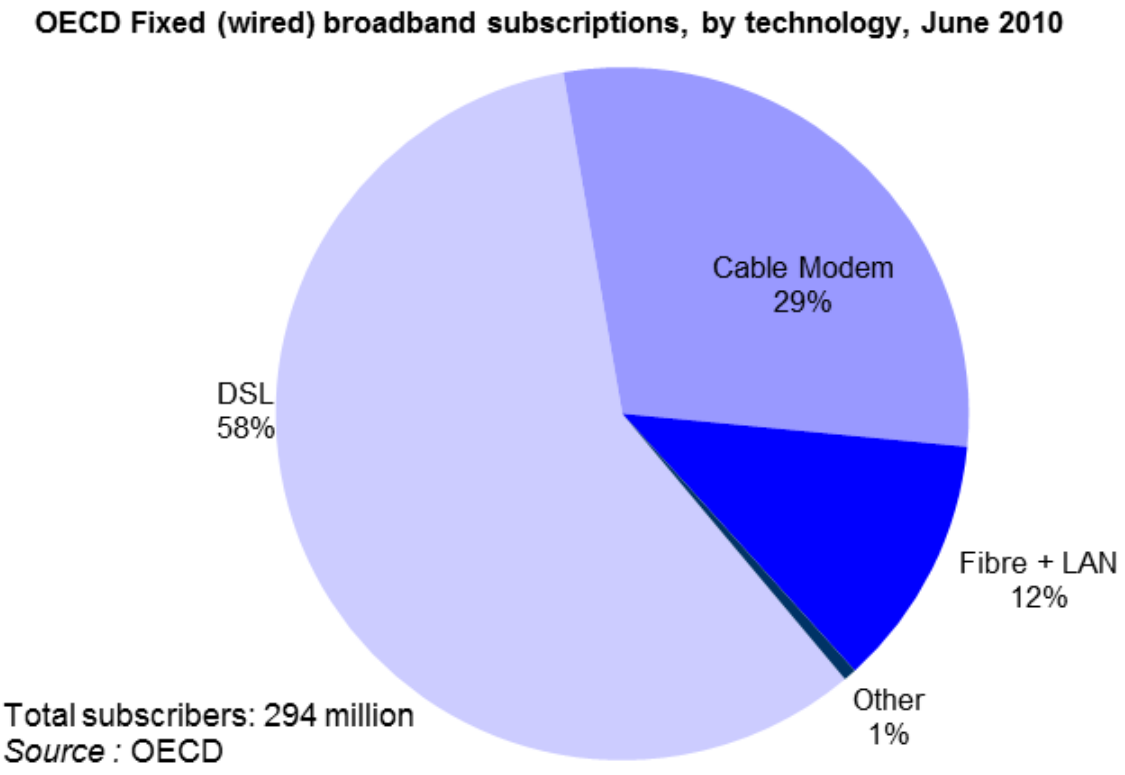


Broadband subscribers worldwide

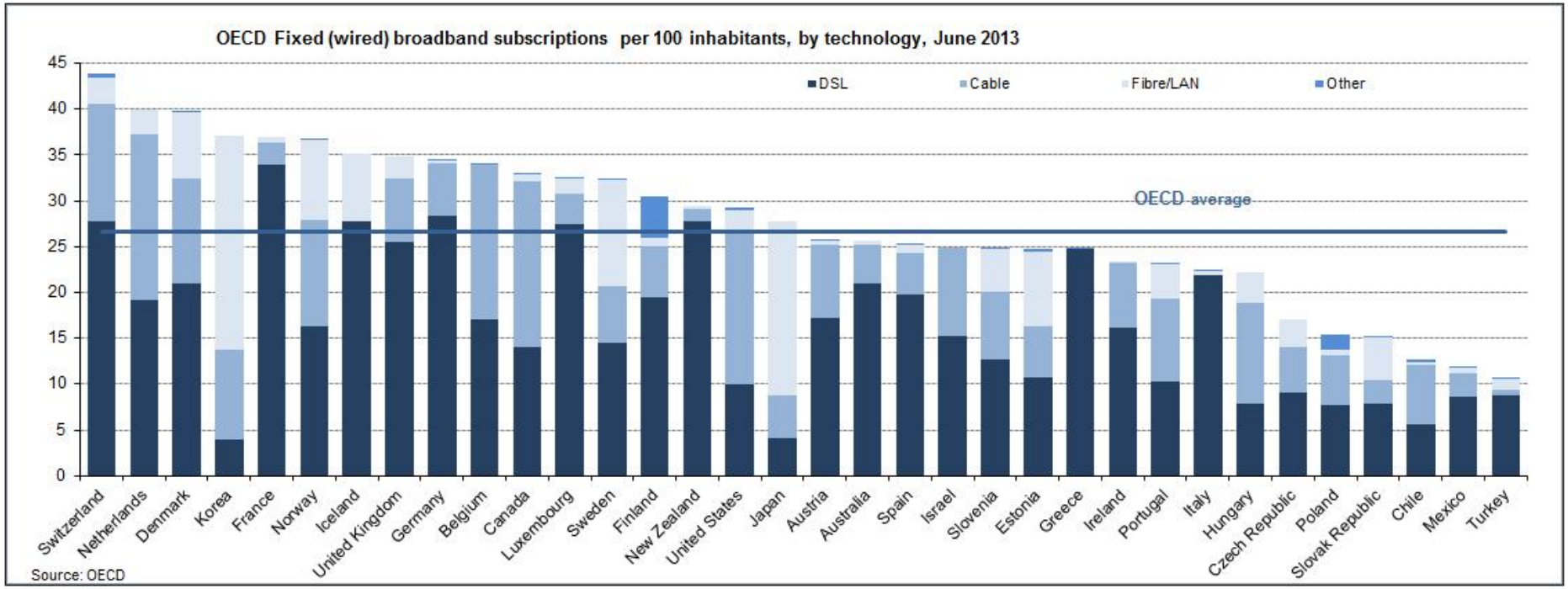


DSL vs. other technologies

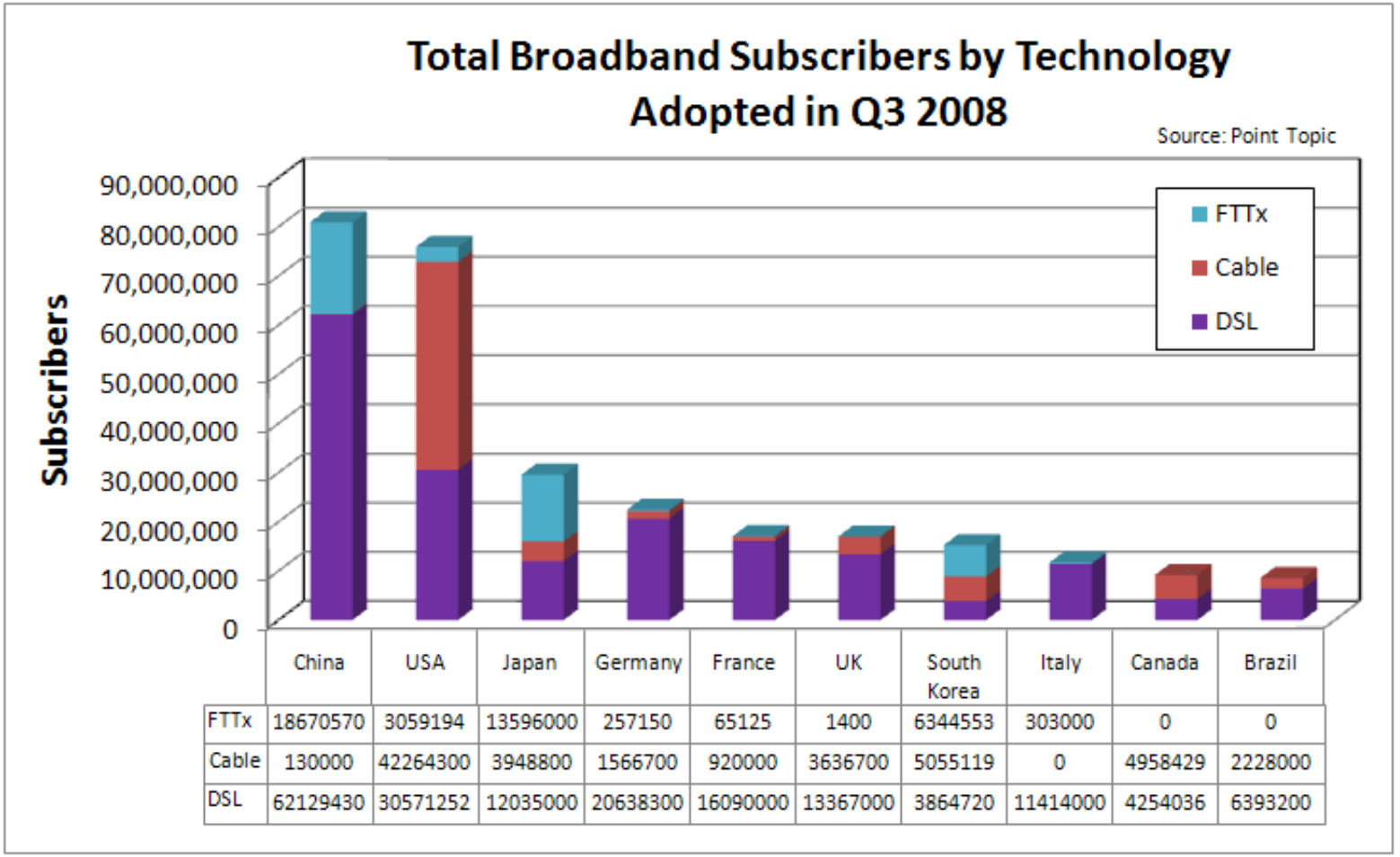
- DSL is the most popular broadband technology
  - Here the term DSL includes al the different versions



Penetration by technology

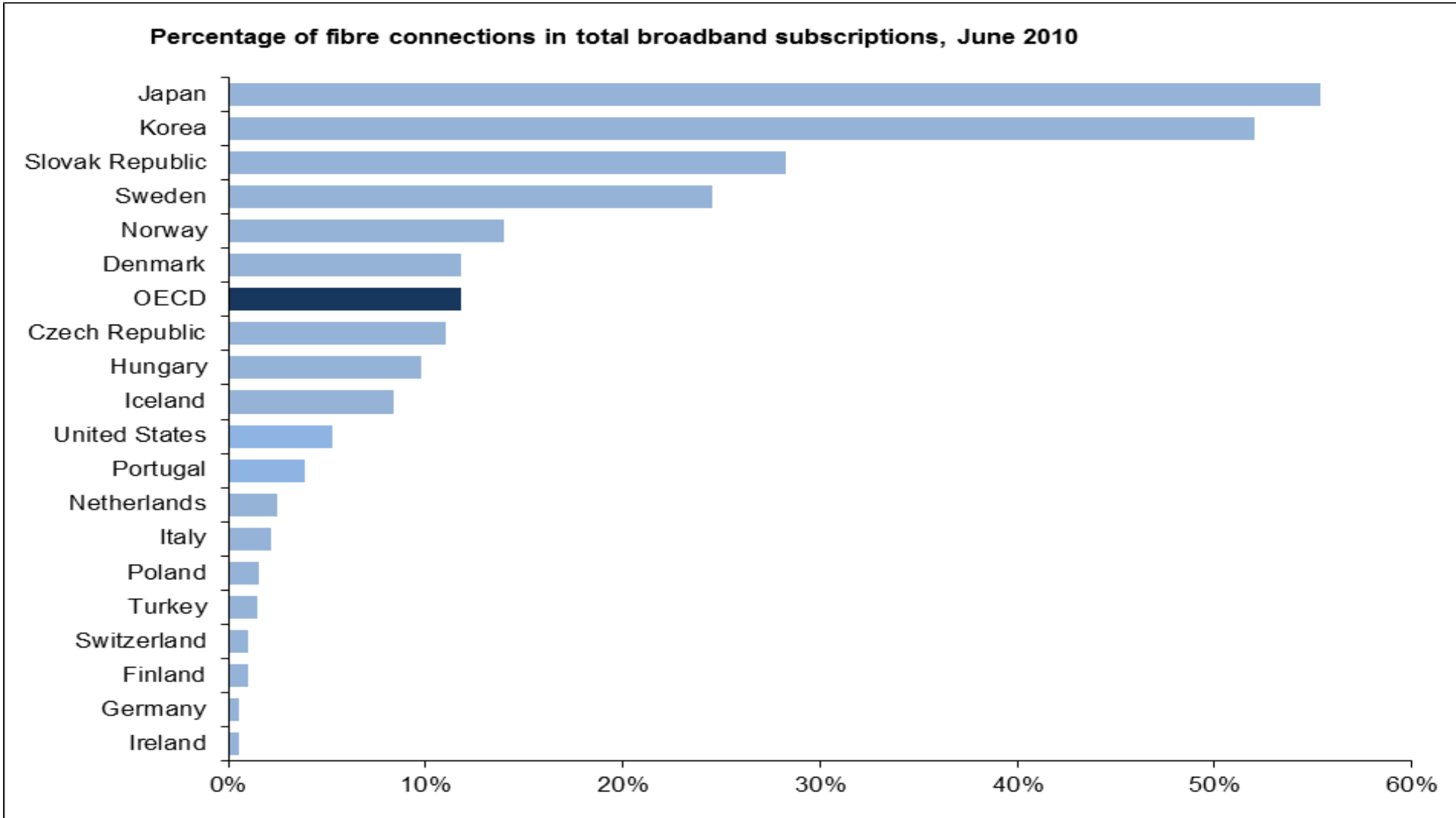


Broadband subscribers

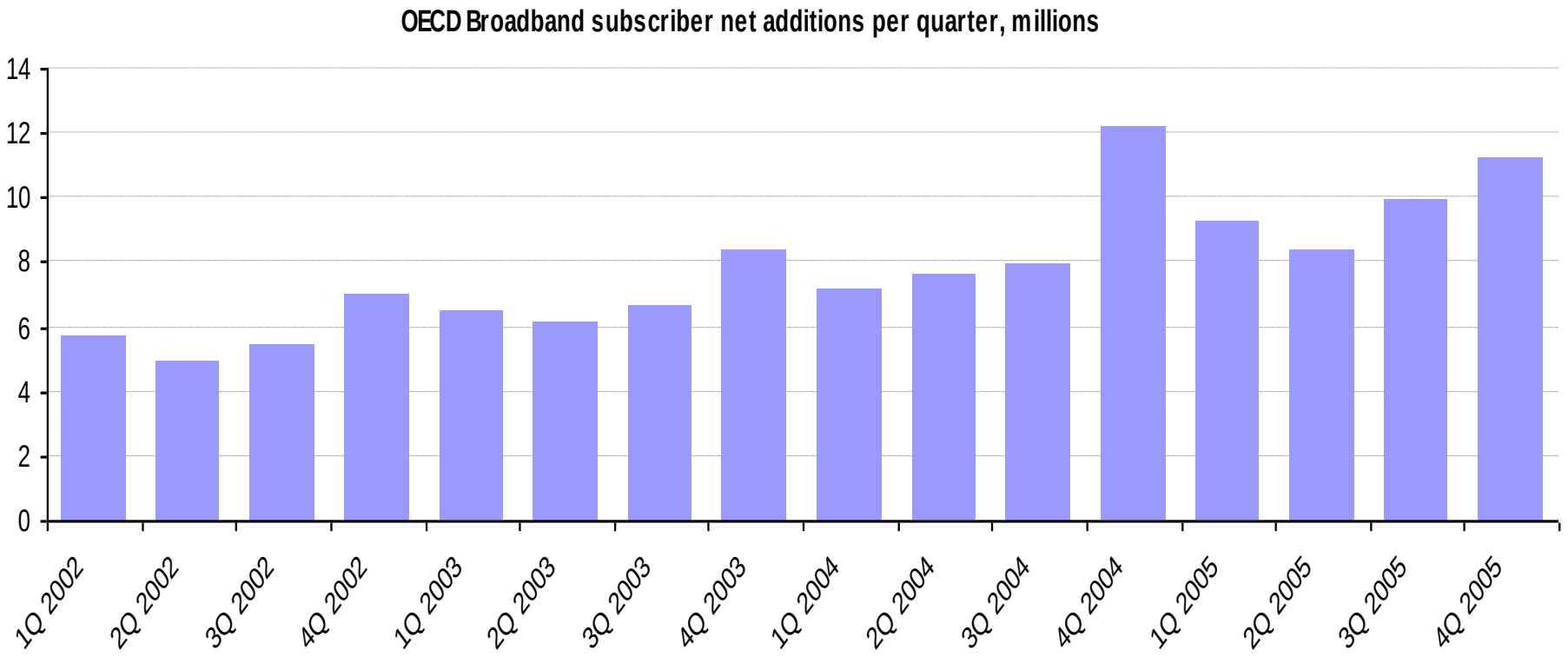


	China	USA	Japan	Germany	France	UK	South Korea	Italy	Canada	Brazil
FTTx	18670570	3059194	13596000	257150	65125	1400	6344553	303000	0	0
Cable	130000	42264300	3948800	1566700	920000	3636700	5055119	0	4958429	2228000
DSL	62129430	30571252	12035000	20638300	16090000	13367000	3864720	11414000	4254036	6393200

FTTH percentage

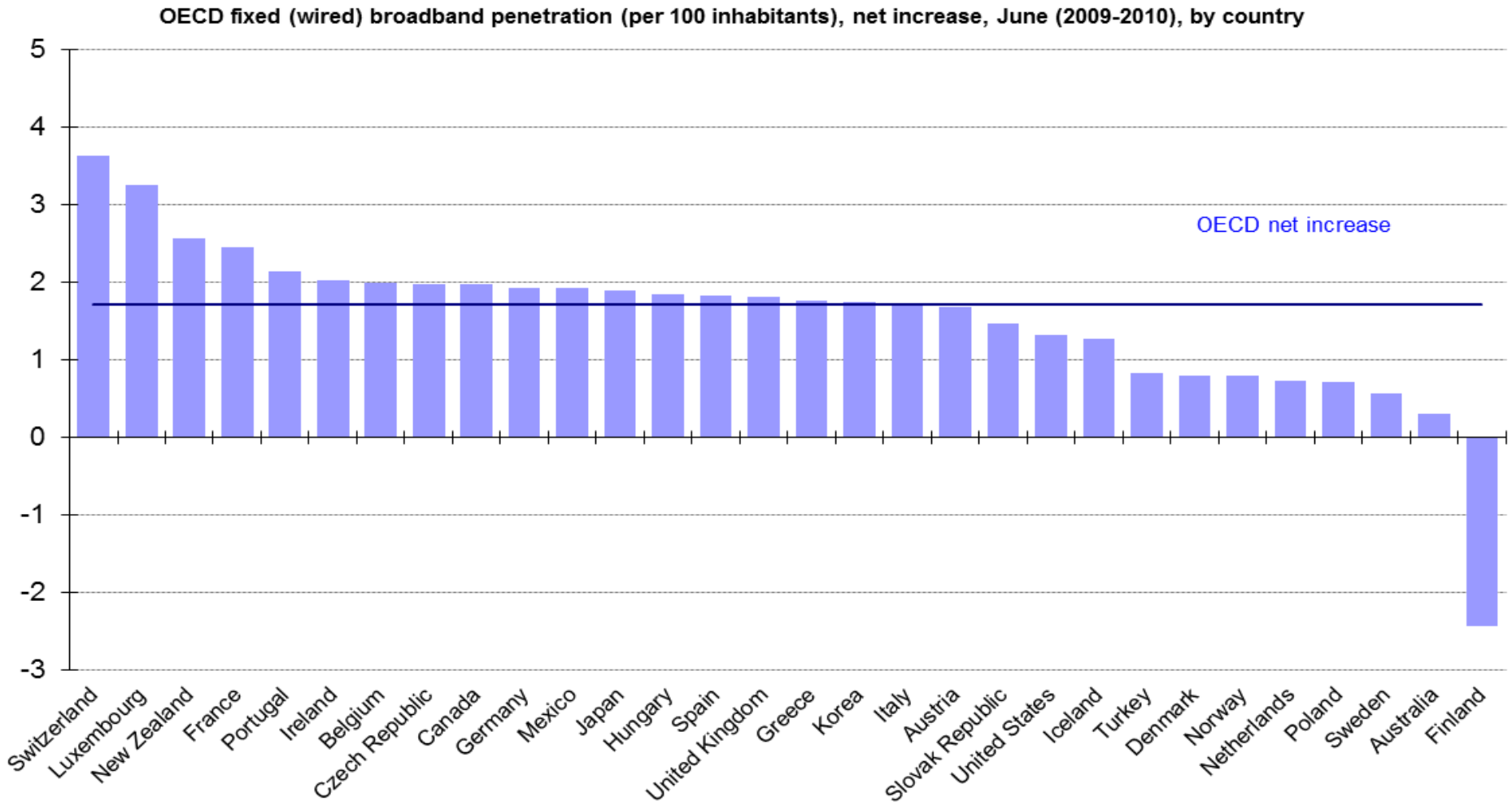


New subscribers



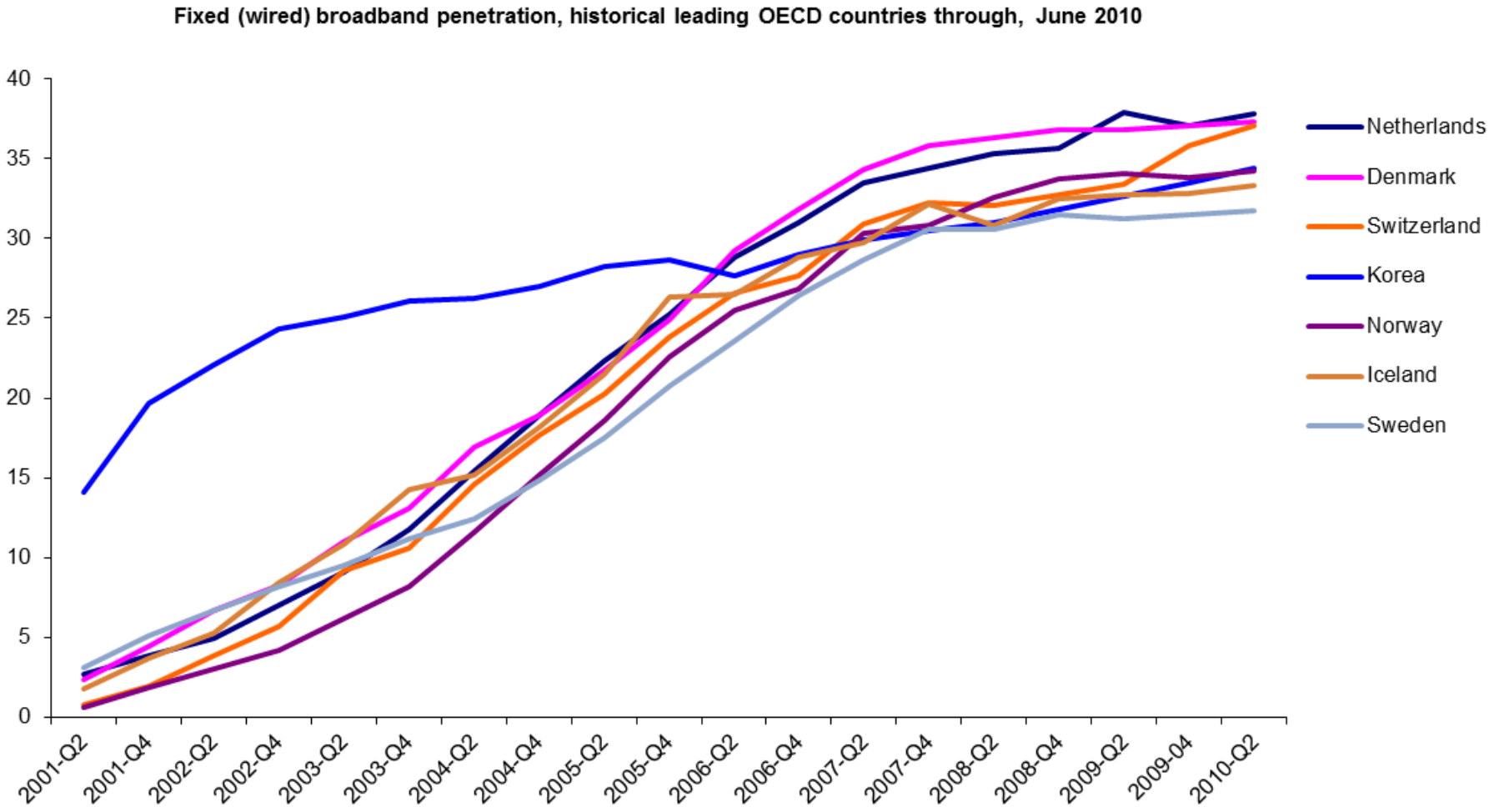
Source : OECD

Increase in 2009-2010



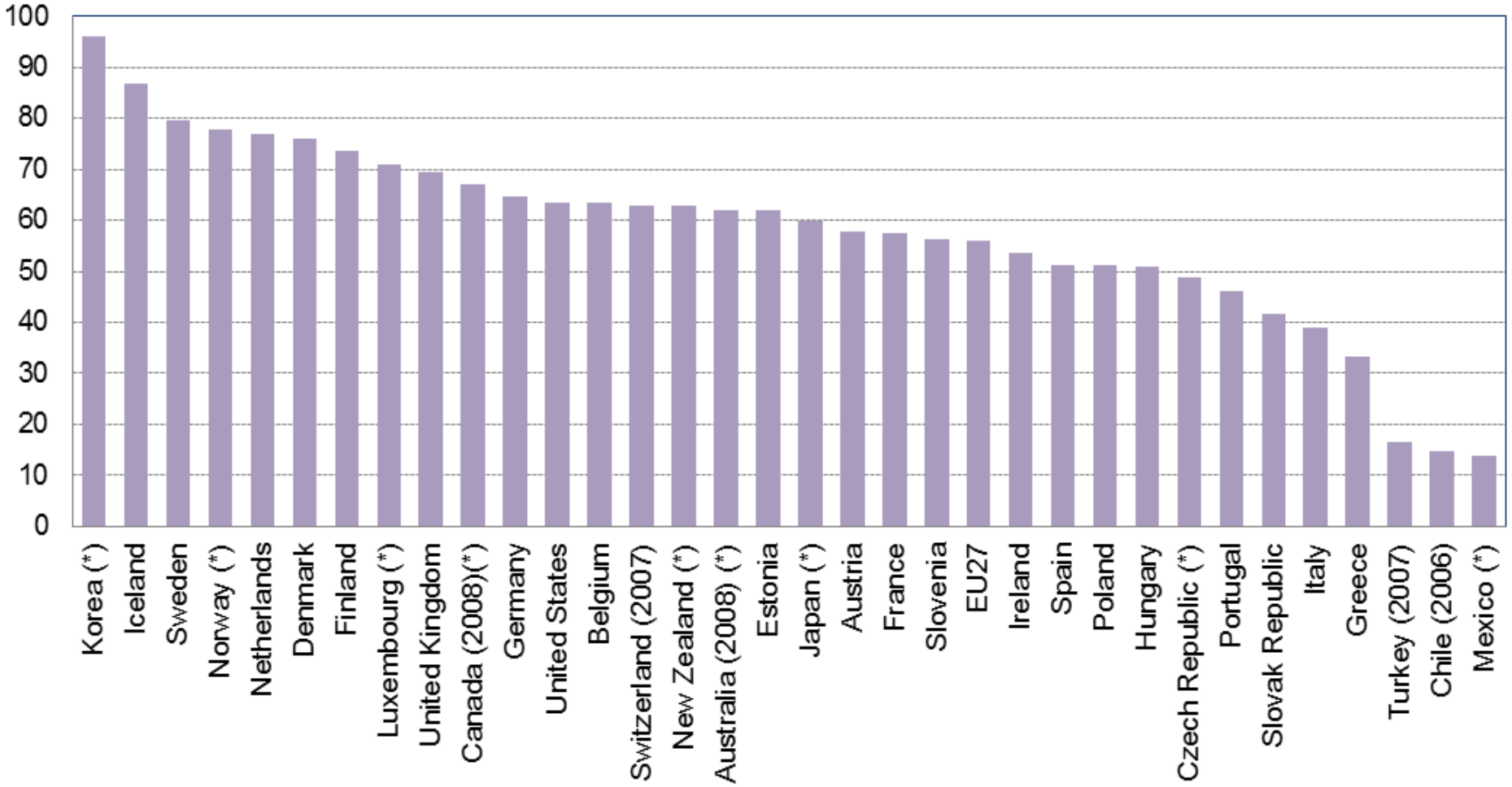
Source : OECD

Increase in the last 10 years



Source : OECD

Broadband subscriptions per household



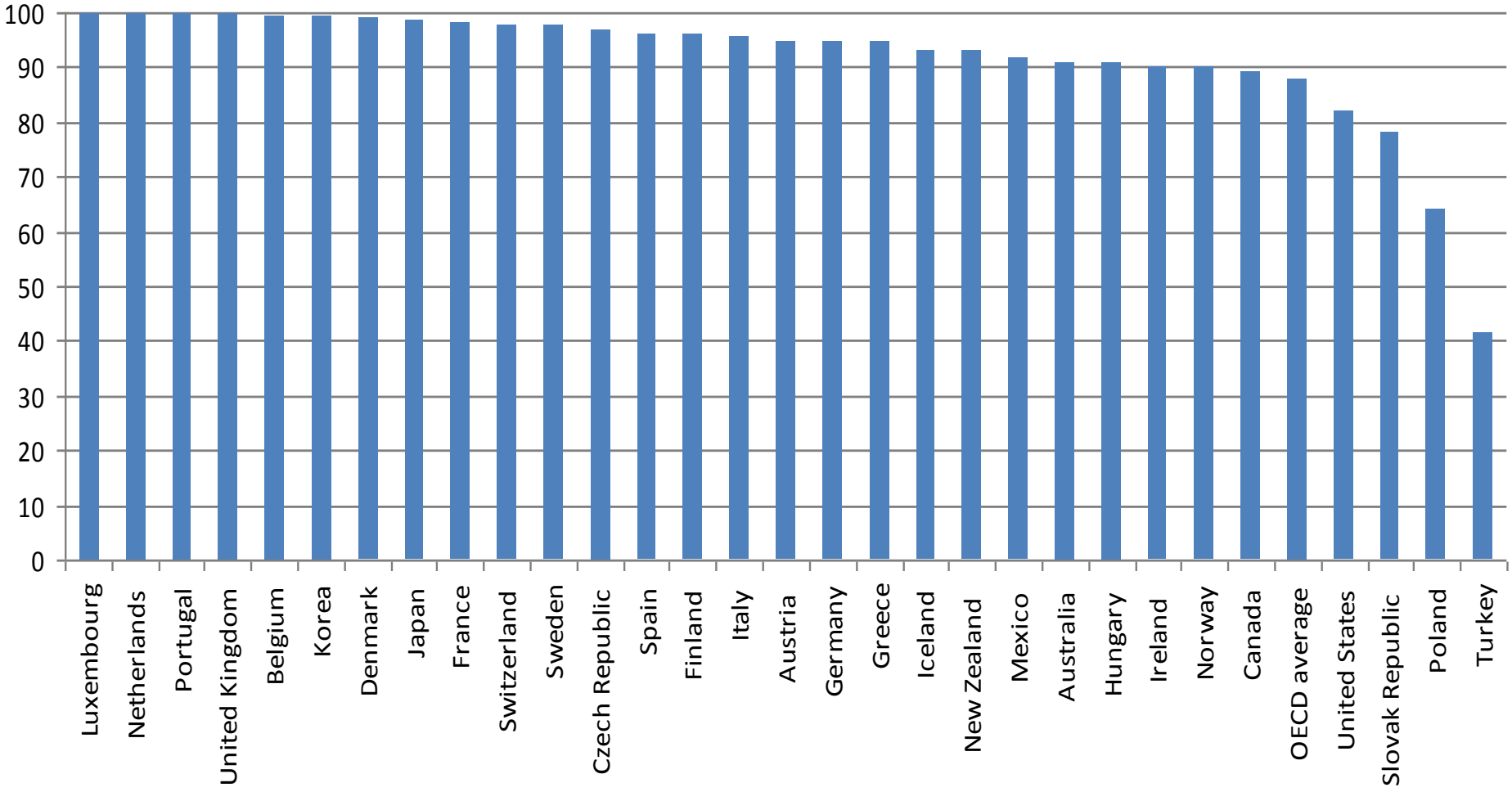
Source: OECD, ICT database and Eurostat, Community Survey on ICT usage in households and by individuals, July 2010.

DSL coverage

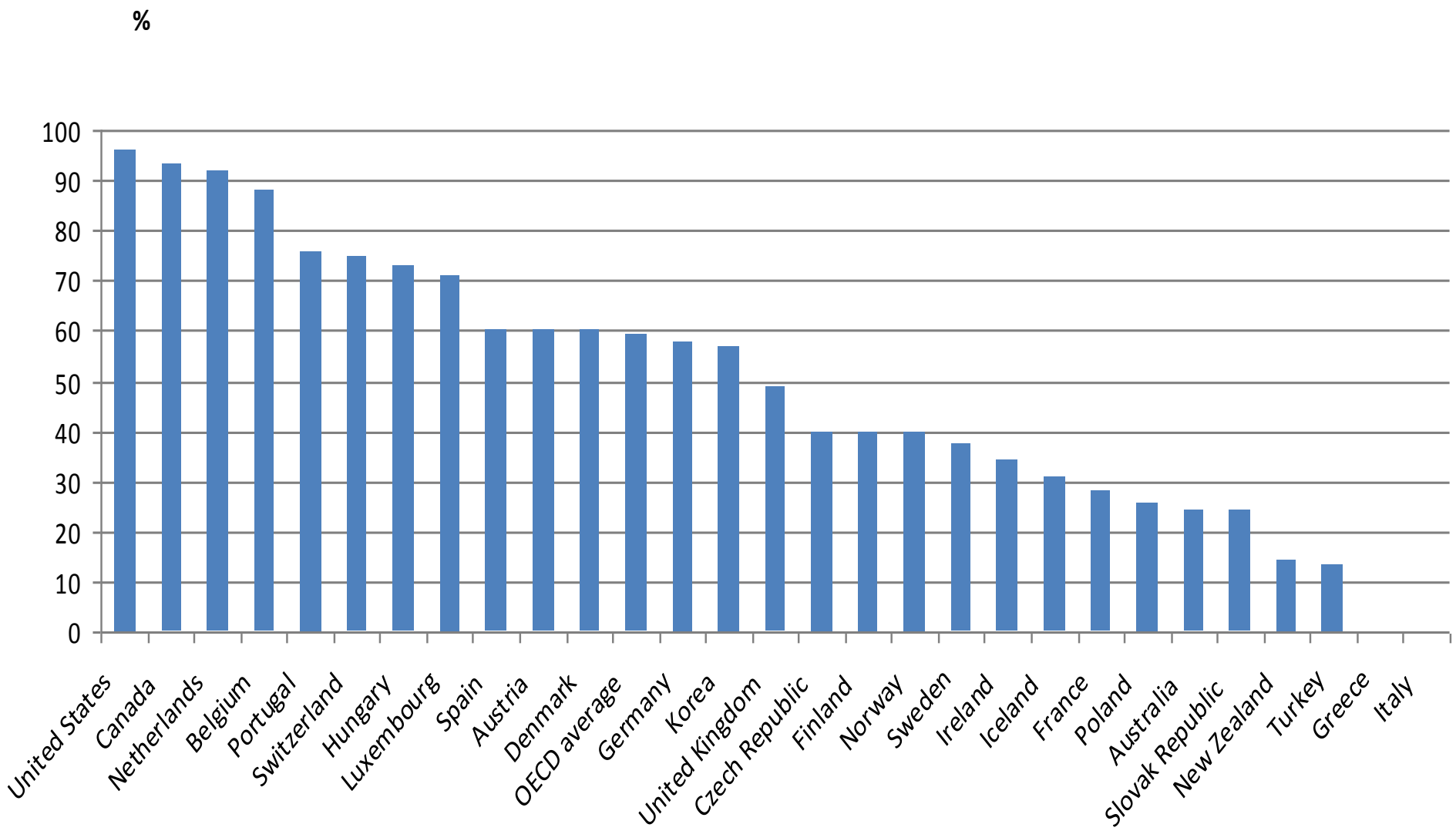
- On what percentage of the territory is DSL service available?
  - What percentage of the phone lines is able to provide DSL service
    - If the local exchange is far away, phone is OK, DSL not
  - On a global scale quite high coverage, but in many countries far from 100%

- Two important limitations
  - Distance
    - In sparsely populated areas, isolated places, is not worth deploying, or even not possible technically
  - Applications asking for high bandwidth
    - Traditional applications (web, e-mail) are still important
    - High bandwidth applications are more and more popular (video, triple play)
    - Supporting high speed DSL technologies might be more important than extending coverage for „slow” versions

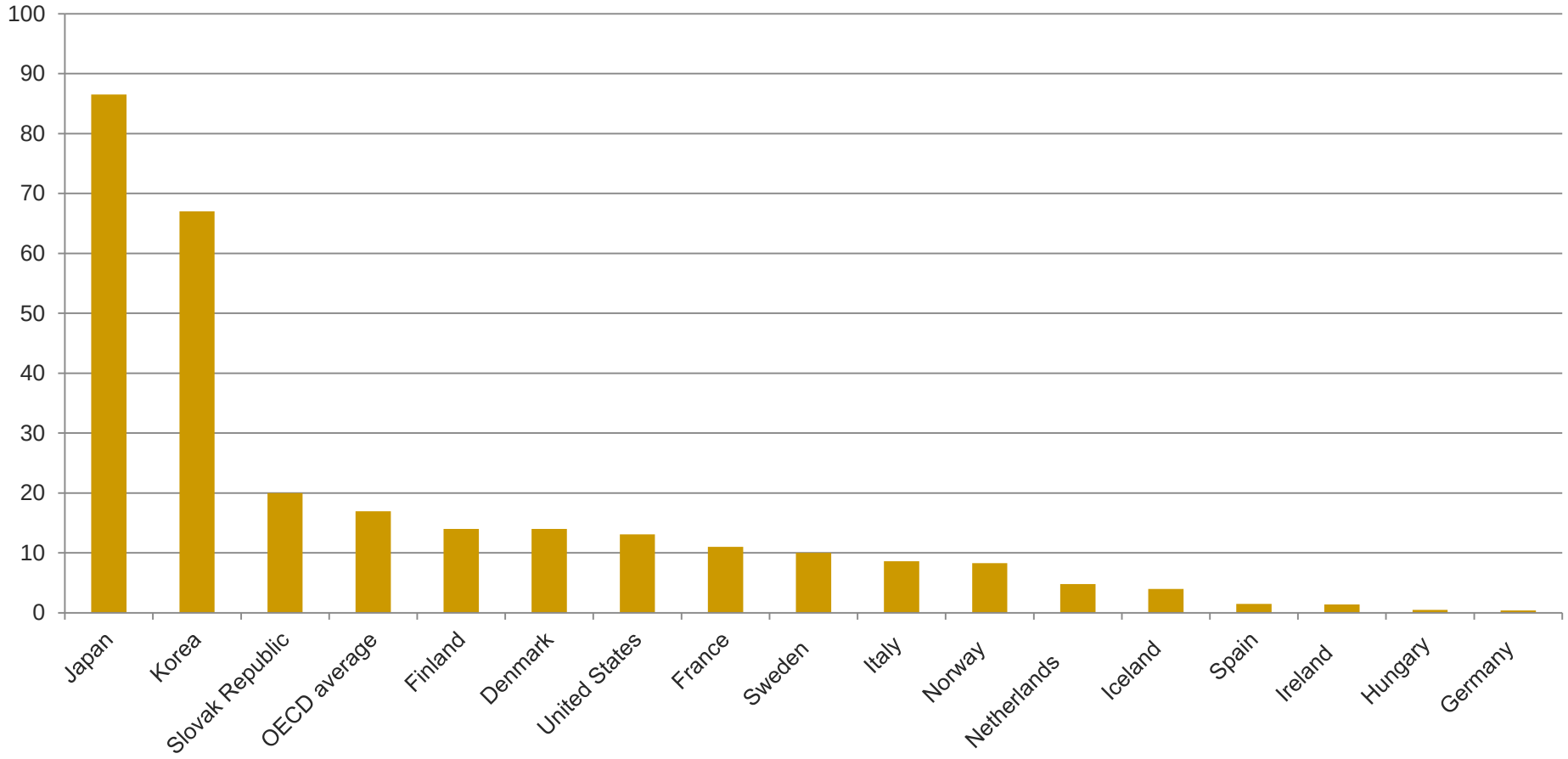
DSL coverage (OECD, 2009)



Cablenet coverage (OECD, 2008)

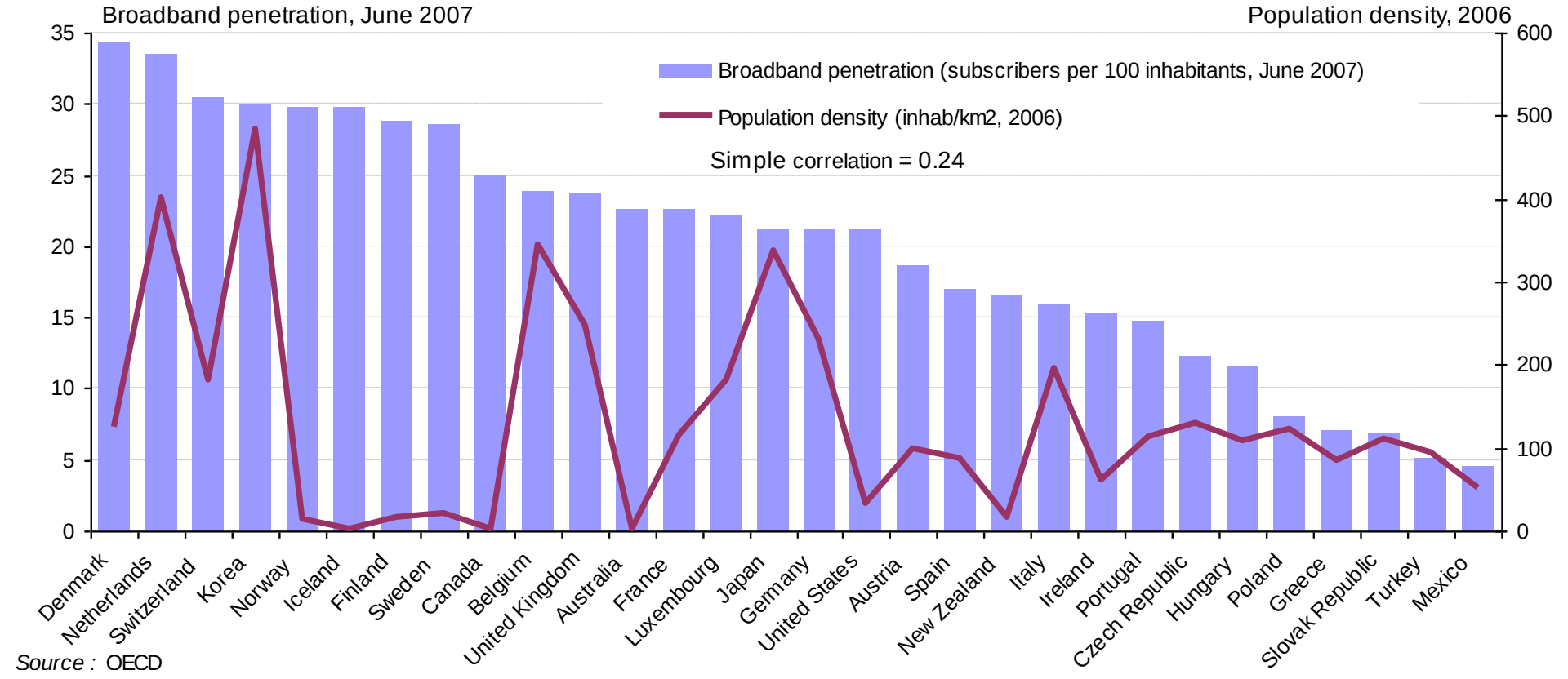


FTTH/B coverage for households



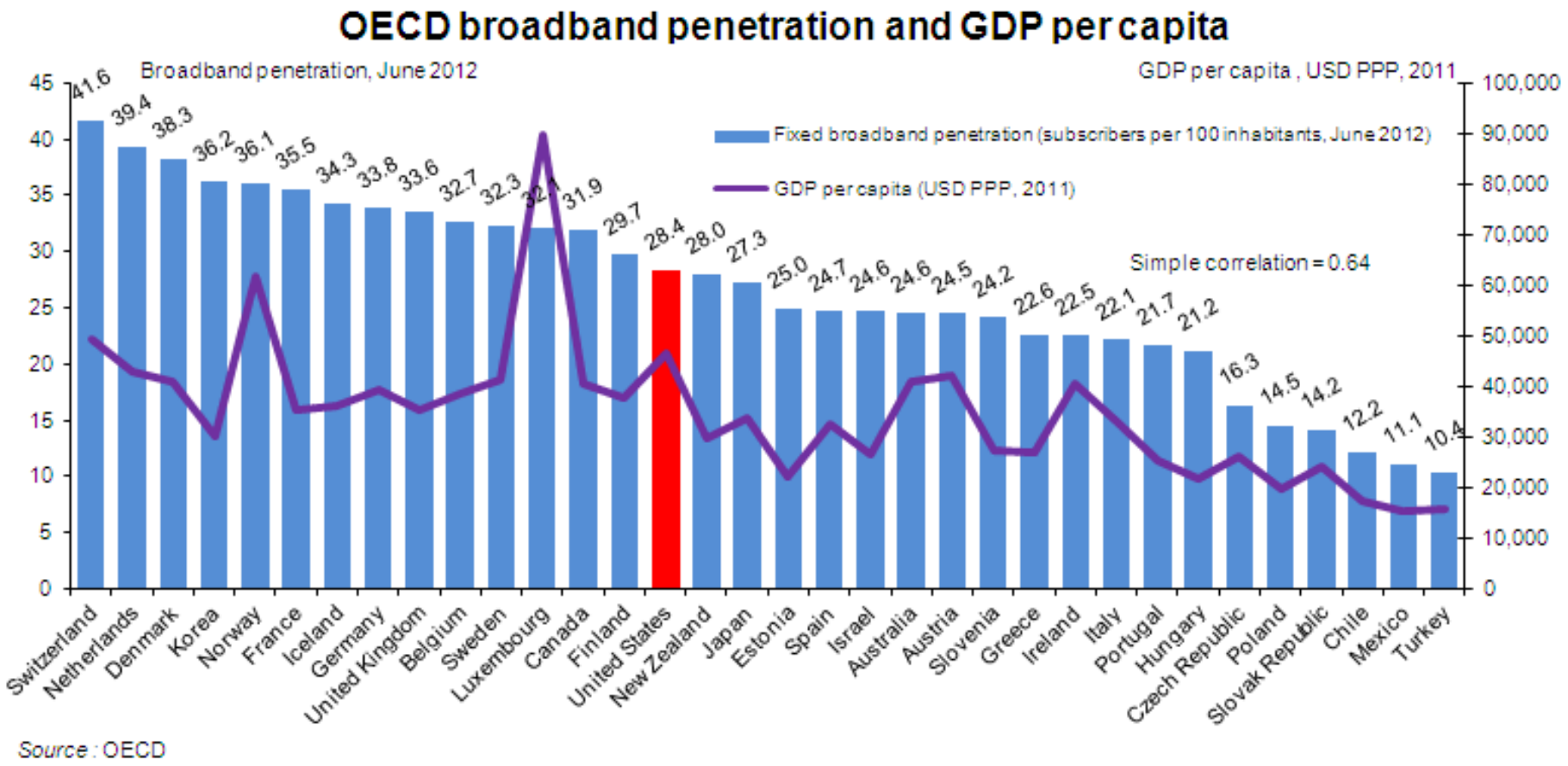
Penetration vs. Population density

OECD broadband penetration and population densities



Source : OECD

Broadband vs. GDP



Source : OECD

International regulations

- In many countries governmental intervention on the market, to lower the prices for the broadband services
  - Direct participation in building and maintaining the infrastructure
  - Regulations to support a healthy competition on the broadband market
    - Eliminate the privileges of the incumbent operator, having a monopoly on a market sector

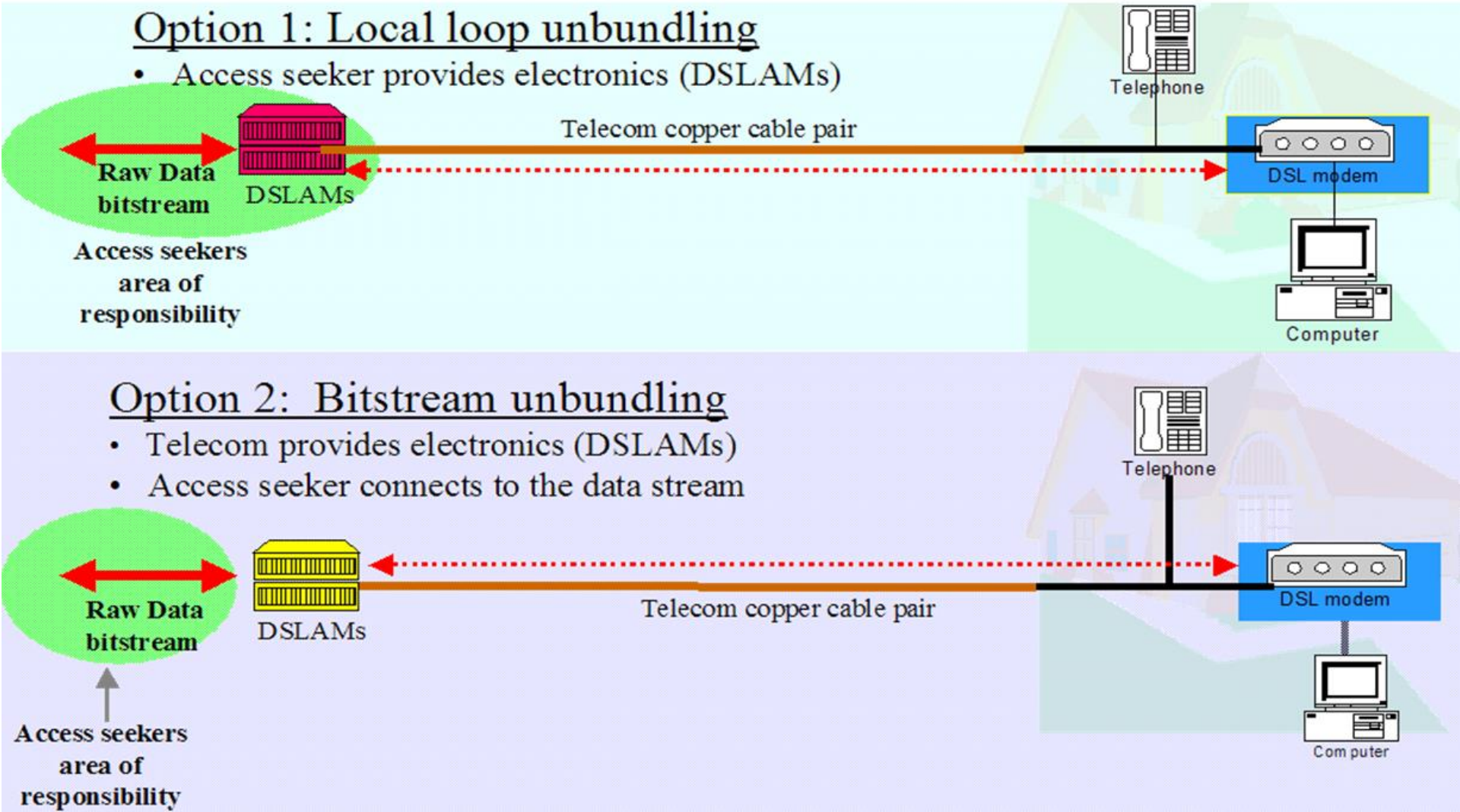
International regulations

- A new operator can hardly enter a market dominated by an incumbent operator
  - Limited size market
  - Lack of economic stability
  - High initial investment, slow return
- This should be eased, to create a competition on the market
  - Simplify the long licensing procedures
  - Eliminate the restrictions regarding foreign investors
  - Tax reductions
  - Help the operators that invest in building new infrastructures
    - Good solutions to support the development of a long-term competition on the market
  - Oblige the incumbent to ensure free access to the infrastructure

Local Loop Unbundling - LLU

- Operators with existing infrastructure are obliged to ensure the access of potential competitor companies
  - Mostly in the local loop
  - Fair, non-discriminative way, for fair prices
- Many solutions
  - *Full unbundled access*
    - The competitor operator has total control over the loop, for voice and broadband service as well
  - *Shared access to the local loop*
    - The competitor operator provides only the voice, or only the broadband service over the loop
  - *Bitstream access*
    - The incumbent operator provides a high speed connection reaching the subscriber, but it is the competitor that provides all the services over that connection
    - The technical maintenance of the line and the service is the responsibility of the incumbent operator

Unbundling solutions

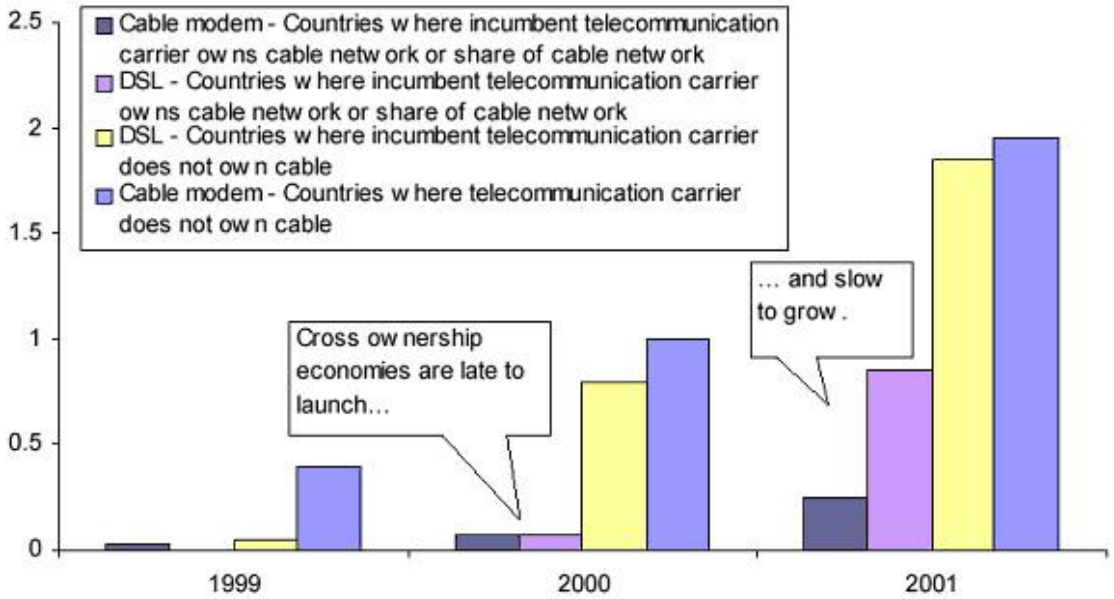


Local Loop Unbundling - LLU

- Until 2002, introduced in 58 countries worldwide, with different success ratio
  - In Japan, NTT West and NTT East the incumbent operators
    - LLU introduced in 97, but no real success
      - Result: at the end of 2000 only 70.000 ADSL lines
    - In 2000, stricter rules introduced
      - LLU prices decreased
      - Decreased the period in which the incumbent should open the access to the local loop
      - Result: beginning of 2003, 6.5 million ADSL lines
        - 70% of the ADSL market owned by competitors
  - Lower success ratio in the EU
    - 80% of the market at the incumbent operators

Cross ownership of services

- Regulating the market is difficult if the same operator has DSL and cable TV infrastructure
  - Broadband is provided (mostly) on only one of the infrastructures
    - No competition between the services
    - Negative impact on the prices, and the spreading of the services



Cross ownership of services

- Bad example in Scandinavian countries
  - Many PSTN, mobile, and cable subscribers, but few broadband users
  - In Sweden, Telia has the biggest PSTN network, and is the biggest cable TV operator
    - Result: in Sweden only 3.5% of the Telia cable TV subscribers had broadband on cable (2002)
  - In Denmark, Telia is not the incumbent operator
    - Competition with the incumbent TDC
    - Result: in Denmark 32% of the Telia cable TV subscribers received broadband as well (2002)
- New EU regulations
  - Companies obliged to separate the accounting, and finally separate completely their cable and telecommunication branches
  - Deutsche Telekom stopped its cable TV service for some time

Anti-competition behavior

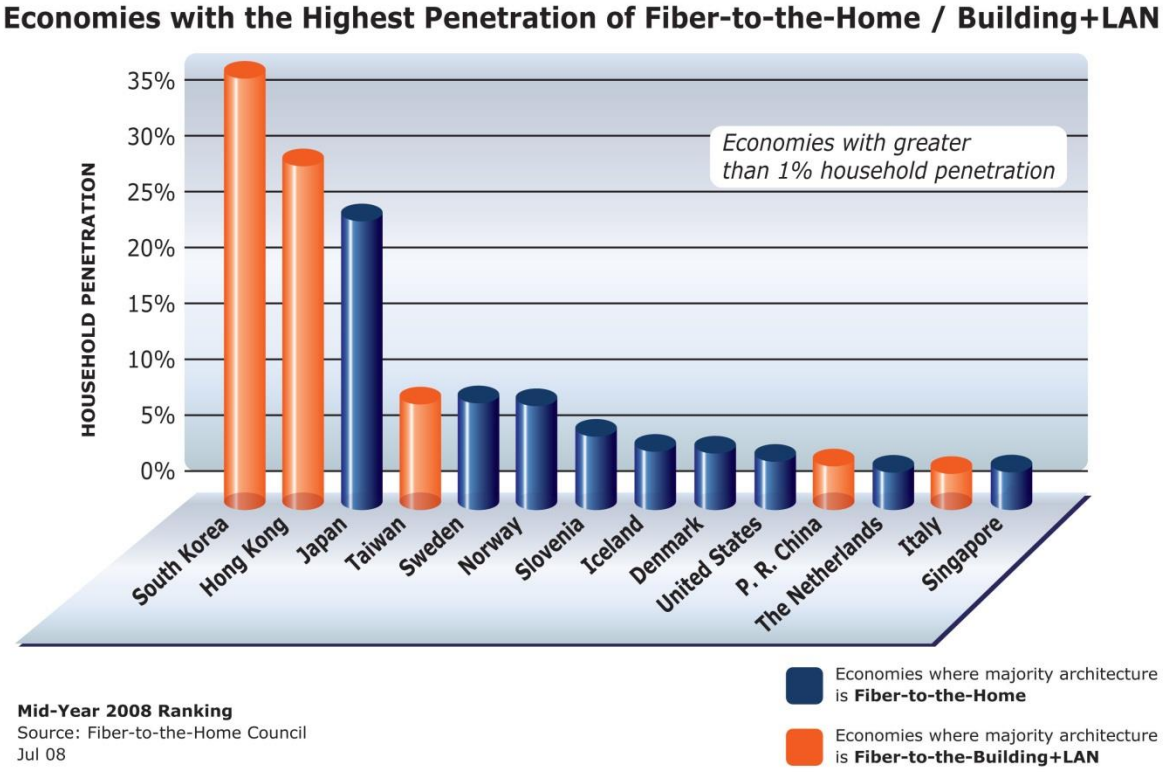
- The incumbent has several possibilities to fight against its competitors
  - Uses his monopoly and his profit obtained in a different sector (e.g., POTS service), to finance his broadband service, and thus lower the subscription prices
  - Bundling and selling together broadband with other services it has a monopoly on
- Wanadoo Interactive
  - Branch of France Telecom
  - Over several years, they were selling the ADSL service on a lower price than the actual costs
    - Accumulated huge losses, but gained control over 72% of the DSL market
    - Some competitors could not keep the pace with these prices, others were intimidated to invest on the market
  - In 2003 10 million EUR fine from the EU Commission for anti-competition behavior

Universal Service Obligation

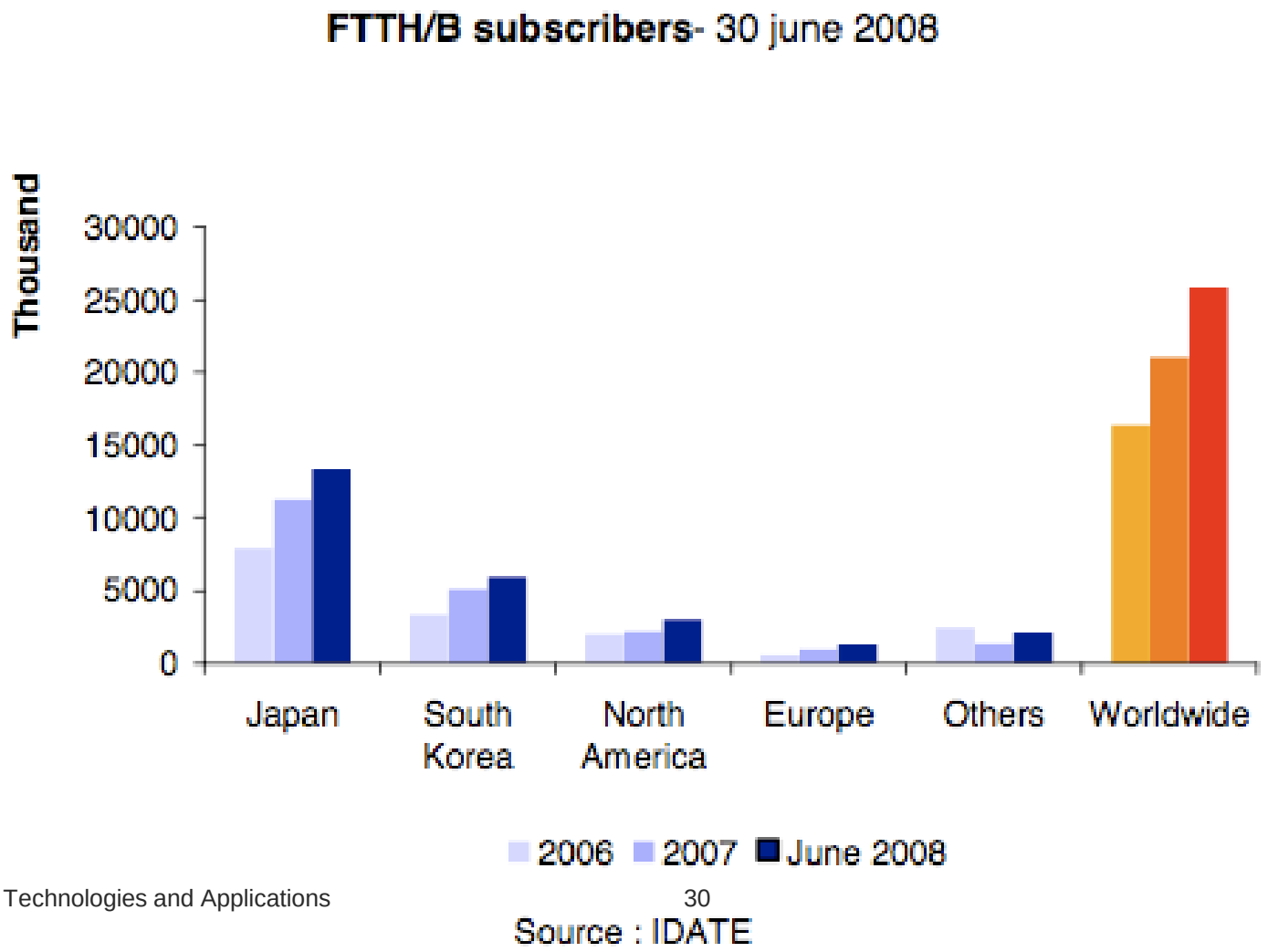
- In many countries strictly regulated for traditional telecommunication services (e.g., POTS)
  - *The operator is obliged to provide a universal basic service, on a standard price, to anyone who requests it, no matter how expensive is for the operator to reach the subscriber with the service*
  - Similarly to postal services, street lighting, or kindergarten
- In some countries used for broadband as well
  - Australia, Iceland
- In most of the countries is not used (yet)
  - Broadband is a relatively new service, its lack does not generate important social and economic disadvantages
    - This is already questionable…
  - Such obligation would significantly increase the costs of building and maintaining the infrastructure
  - It would only strengthen the position of the incumbent operators on the market, the small competitors could not afford it
- The issue is not closed, as broadband deployment is growing the positions might change

Deployment of FTTH

- FTTH is in the starting phase
  - South-East Asia is leading, and will lead the market in the near future
- Few big telecommunication companies introduced it



Deployment of FTTH

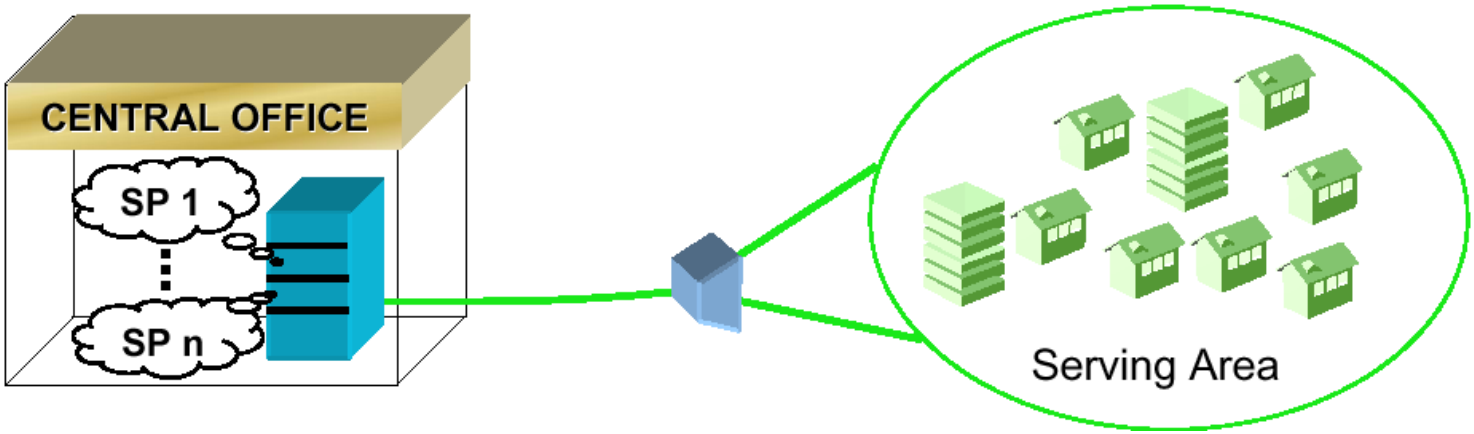


FTTx service models

- Two service models
  - Operator's own network
    - The majority of the FTTx services
    - The operator sells the service directly to the subscribers
    - Like traditional phone and cable tv service
  - Open access
    - In many countries strict regulations
    - The owner of the network opens the access to the service providers, who sign the contracts with the subscribers

Open Access

- The owner of the network opens the access for the different service providers (telco, ISP, video content provider, etc.)
  - The owner is not a competitor himself
- Usually municipal networks
  - The networking infrastructure is considered a basic service such as the water, the electricity or the road network



Open Access examples

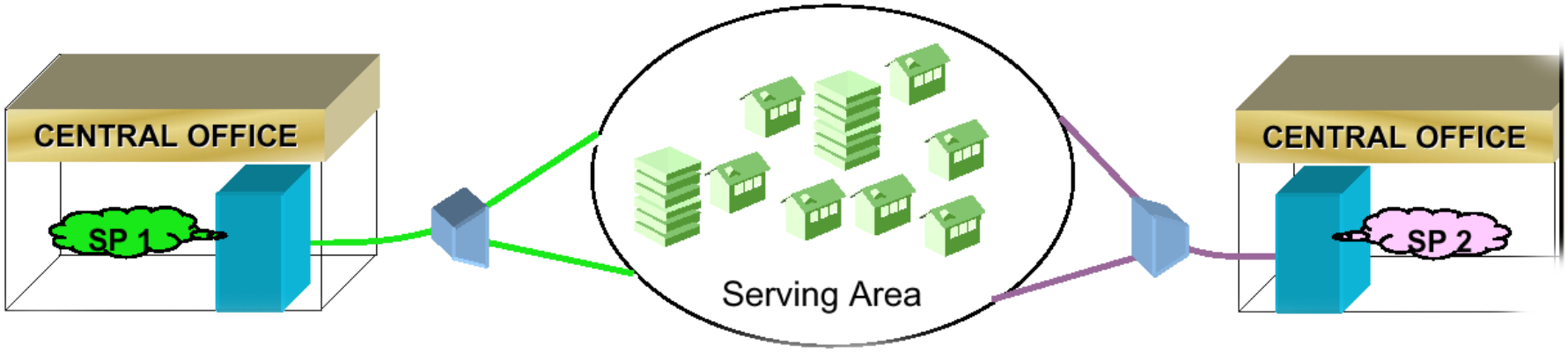
- Many municipal Open Access networks in Western Europe and mainly in Scandinavia
  - 90% of the European FTTH networks in Scandinavia and Holland
  - Stokab (Stockholm) – the first municipal FTTx network (1996)
  - Vasterbotten region – twice as big as Holland, but only 260.000 inhabitants
    - 15 municipalities linked over an FTTx network
  - CityNet, Amsterdam – network connecting 450.000 households (2010)
  - Many municipal FTTH networks in Denmark
- New regulations in France and the UK, to support open access networks
- Some municipal networks in the USA
  - Utopia (Utah)

FTTH in Europe

- In many countries specific regulations
  - National broadband strategies
- Why the incumbent operators do not build optical networks?
  - The dominate the market already, no need for it
  - Because of the short local loops, quite high xDSL speeds
  - In Scandinavia is cheaper to rent a municipal network, than to build one
  - Video streaming is not yet that popular as in the US or Japan
- For the municipalities, FTTH is an important element of the regional development
  - Makes the region attractive, where it is worth to invest in

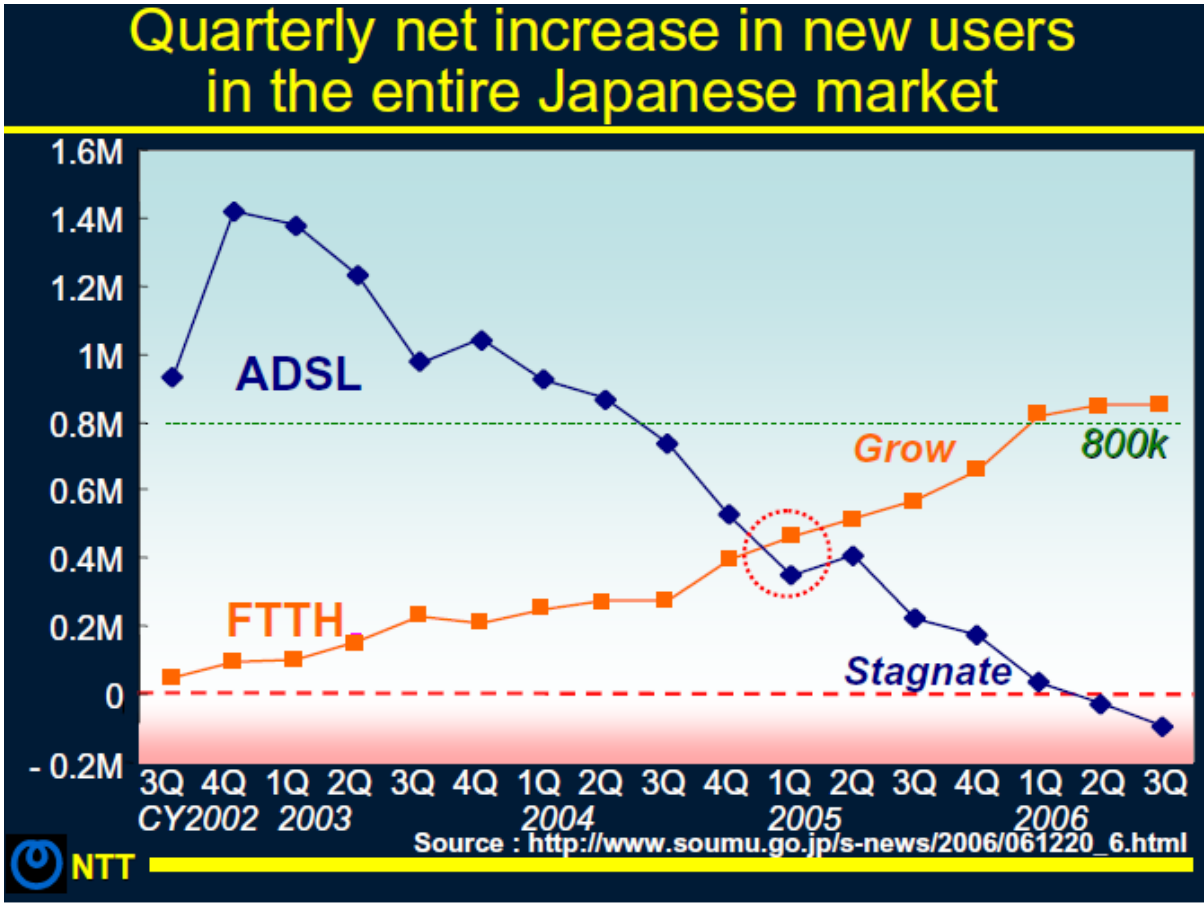
FTTx on private networks

- Each provider has its own network, that covers the same region
  - Specific for the US and Japan
    - 9 Japanese operators have FTTH networks
  - Some examples in Europe as well (Holland)
  - Larger speeds, lower operational expenditures (OpEx)
    - Larger capital expenditure (CapEx)

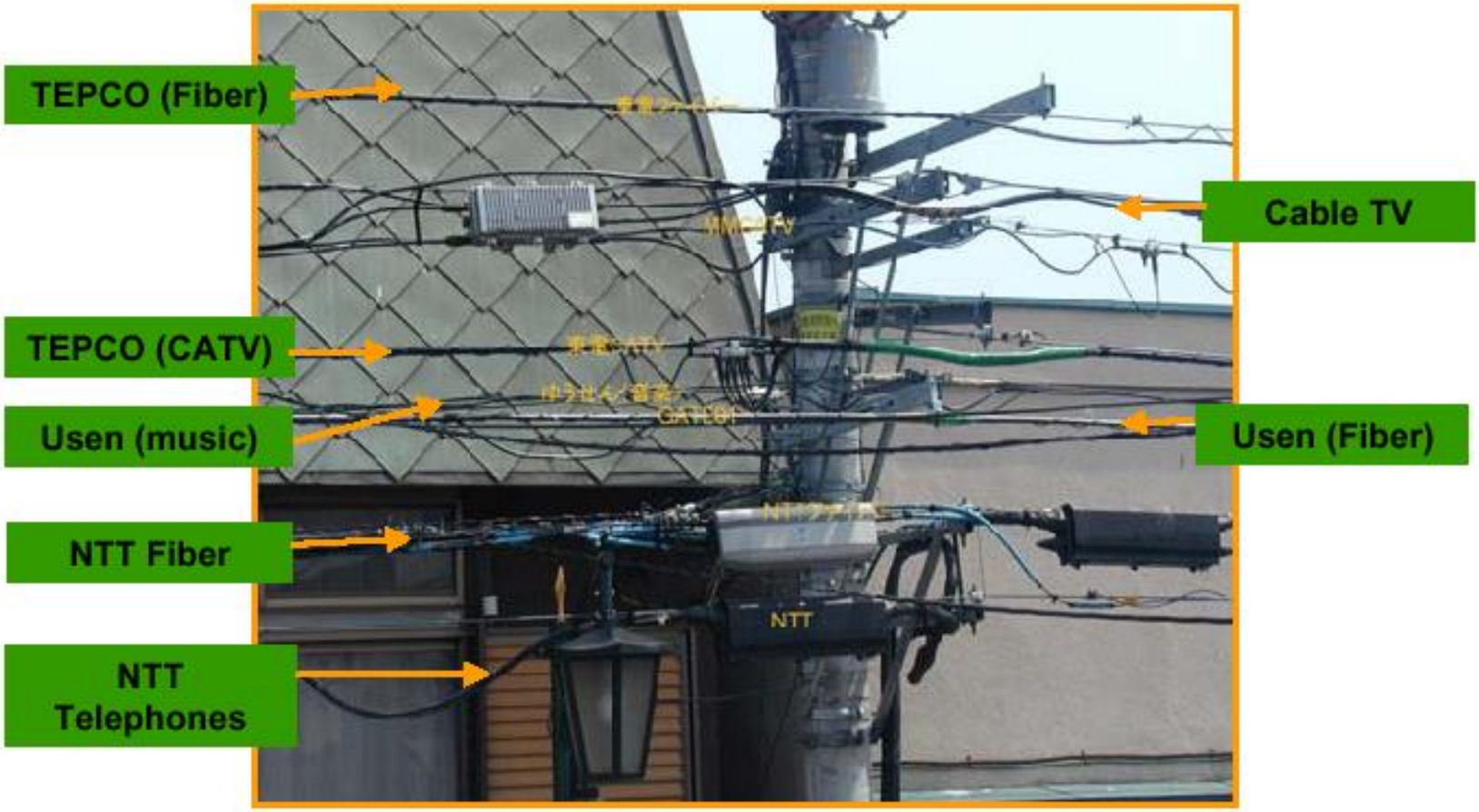


FTTH in Japan

- NTT has the biggest FTTH network
  - Until 2010, 47 nillion USD investment, to reach 30 M subscribers
- Other operators
  - KDDI/Tepco, USEN



FTTH in downtown Tokyo



SWOT analysis

- SWOT
  - Strengths (technological)
  - Weaknesses (technological)
  - Opportunities (business)
  - Threats (business)

- When starting a company, introducing a new product or service on the market
  - Technological and business considerations

DSL SWOT analysis

- Strengths
  - Quite large speed over low distances (VDSL2)
  - Bandwidth is not shared among the uses
    - Individual guarantees can be provided
  - Secure
    - Each user has his own twisted pair
    - The other users do not see my traffic

DSL SWOT analysis

- Weaknesses
  - Quite low speed over large distances
  - Asymmetric speed (ADSL) is not always acceptable
    - Some applications ask for high uplink speeds (e.g., Skype)
  - No support for mobility
    - Technically possible to extend your DSL connection with a wireless link
    - Legal limitations to such extensions

DSL SWOT analysis

- Opportunities
  - Easy to deploy everywhere where there is a phone line
  - Preferred when a minimum bandwidth is always required
    - In a cable modem or WLAN access, congestion can occur if many users in parallel
  - In industrial areas there might be no CaTV network, but phone lines are there
    - Industrial subscribers might also pay more than normal home subscribers, they are an important target

DSL SWOT analysis

- Threats
  - Where there is not yet a wired phone line (country side, developing countries) they might install FTTH from the beginning
  - FTTx (fiber to the home) ensures much higher speeds
    - Industrial subscribers probably will deploy FTTx
  - Wireless solutions (e.g., WLAN, WiMax, 3G) have a serious advantage as they allow mobility
  - In the country side, with sparsely distributed subscribers, it is costly to deploy, some wireless solutions (e.g., Wimax) would fit better