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Broadband Quality Score

A global study of broadband quality
September 2008

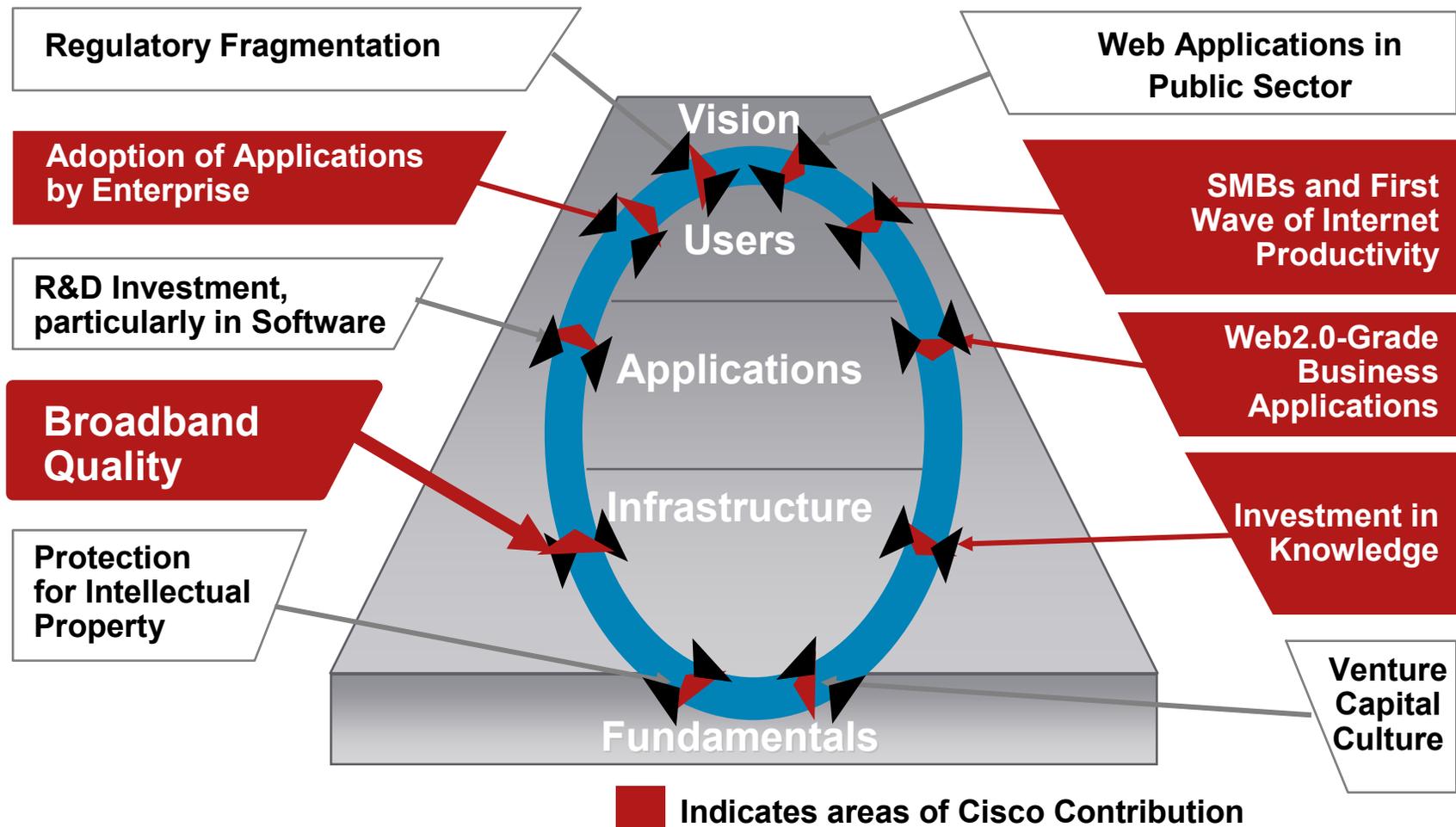
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Executive Summary

- **Broadband leadership is a combination of availability, penetration and quality. Until now *quality* has not been explored comprehensively, yet it is the most important factor in ensuring a positive consumer experience on the web**
- **A country's Broadband Quality Score (BQS) combines actual download and upload throughput, and latency, with different weights matching current and future application requirements**
- **Next wave of web applications demand a step-improvement in broadband quality. Most countries do well for today's applications but Japan is the only country that is future-ready**
- **Broadband quality is correlated with ICT diffusion, the knowledge economy, and web usage. Fibre deployments and upgraded cable networks help drive higher BQS**
- **To establish broadband leadership countries must focus on availability, penetration and quality. Governments, content producers, SPs, vendors and consumers have all a key role**

Why Broadband Quality is Relevant

CONTEXT OF STUDY: REMOVING BOTTLENECKS OF ICT DIFFUSION IN EUROPE

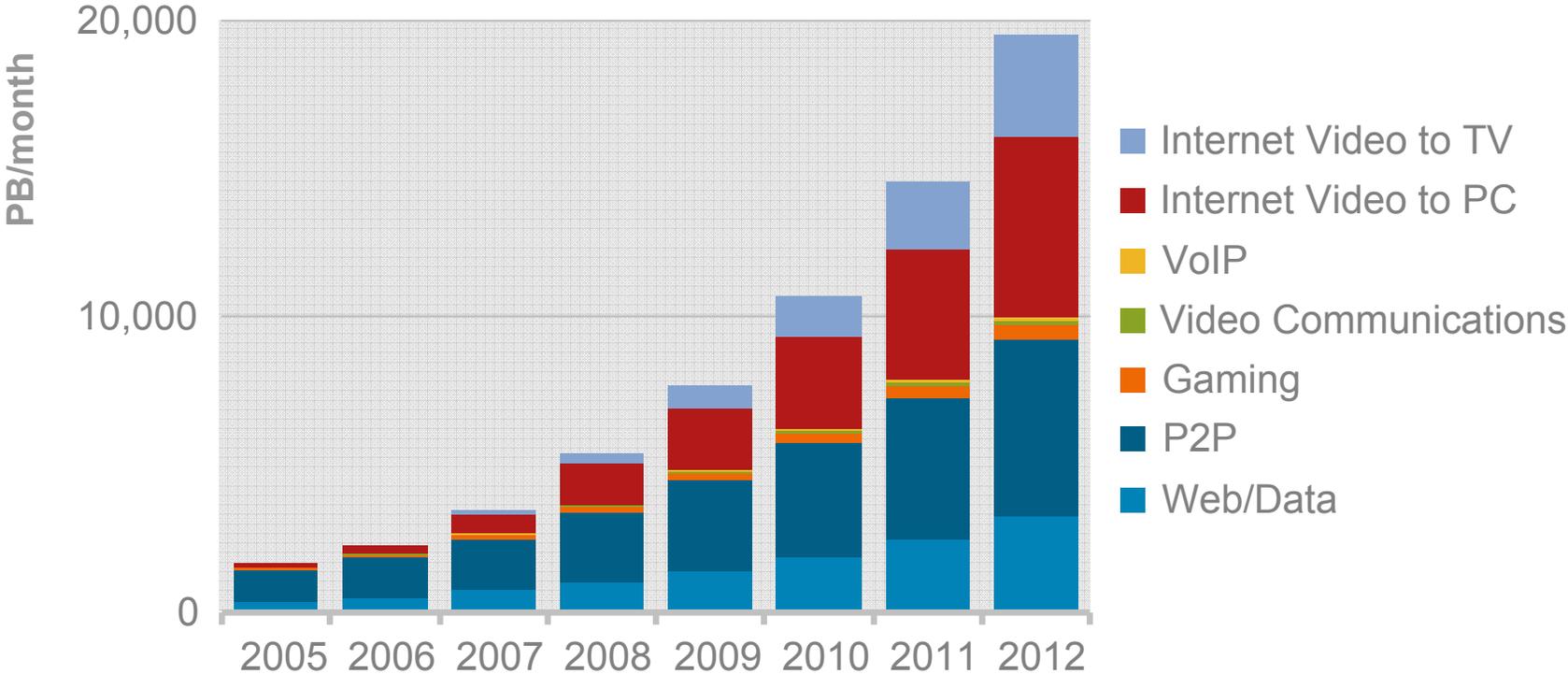


Source: Cisco IBSG, Jan 2008

Impact of Video on Internet Traffic

GROWTH OF GLOBAL CONSUMER INTERNET TRAFFIC MIX

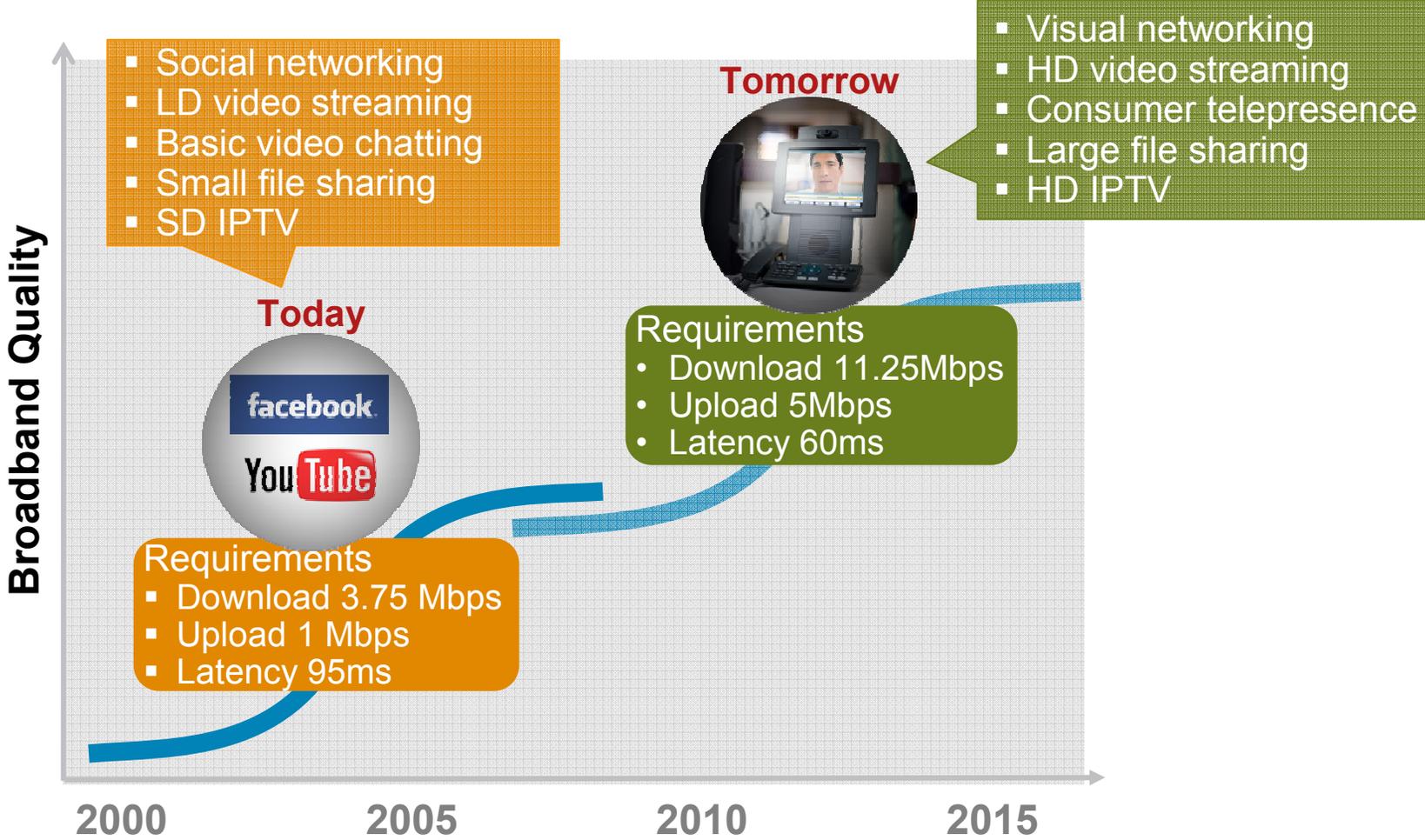
41% CAGR 2007-2012



Source: Cisco Visual Networking Index – Forecast, 2007-2012

Changing Quality Requirements

TWO WAVES OF BROADBAND SERVICES



Source: California Broadband Task Force, Jan 2008; Cisco IBSG; Expert interviews; Oxford Team analysis, Aug 2008

Main Broadband Quality Factors

KEY FACTORS IN DETERMINING BROADBAND EXPERIENCE

Factor	Description	Example
Download Throughput	Net bit rate of downstream data that transverse the network and the broadband connection	Critical for streaming high quality video, sharing large files such as pictures or video
Upload Throughput	Net bit rate of upstream data that transverse the network and the broadband connection	Increasingly relevant for two-way high-quality video communications, uploading/sharing pictures and videos
Latency	Time taken for a packet of data to reach from source to destination	Very important for real-time applications such as VoIP communications and gaming
Other	Network oversubscription, packet loss, jitter, service continuity. Typically embedded in throughput factors	Critical for video broadcast distribution and overall end-to-end experience

Source: Expert interviews; Oxford Team analysis, Aug 2008

Broadband Quality Score (BQS)

BQS CALCULATION

- BQS is calculated based on normalised values of:
 - Download and upload throughput, and latency
- About 8million records sourced from actual tests from Speedtest.net (Ookla) during May 2008
- Weights assigned to each factor for *today's* and *tomorrow's* (3 to 5 years) applications.

BQS (today) = 55% Download + 23% Upload + 22%Latency

BQS threshold: 32

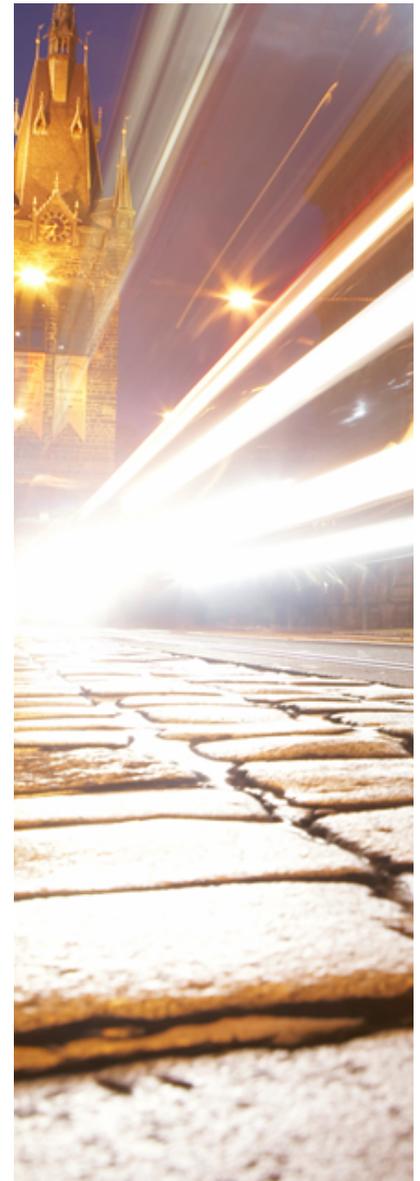
- Download 3.75 Mbps
- Upload 1 Mbps
- Latency 95ms

BQS (tmrw) = 45% Download + 32% Upload + 23%Latency

BQS threshold: 75

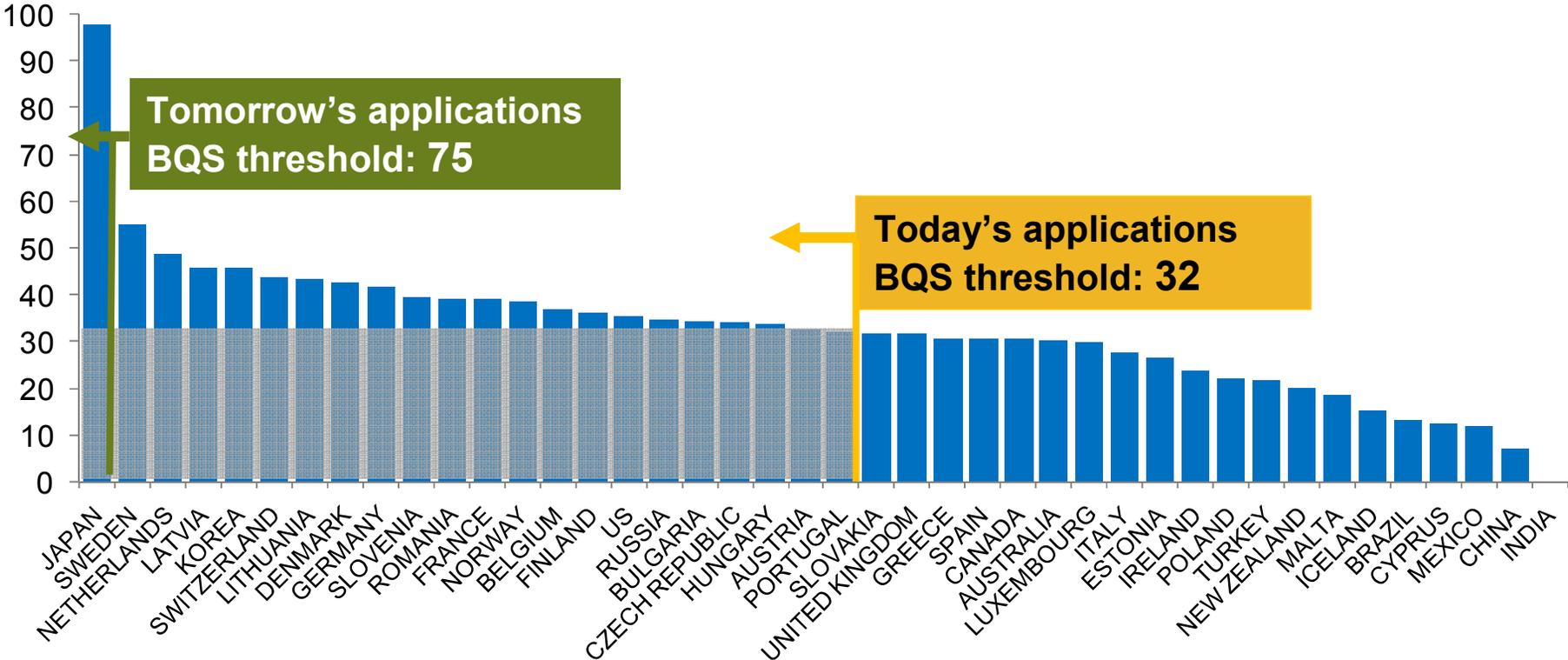
- Download 11.25Mbps
- Upload 5Mbps
- Latency 60ms

Source: University of Oviedo; Delphi interviews; Oxford University Team Analysis, Aug 2008



Country Broadband Quality Scores

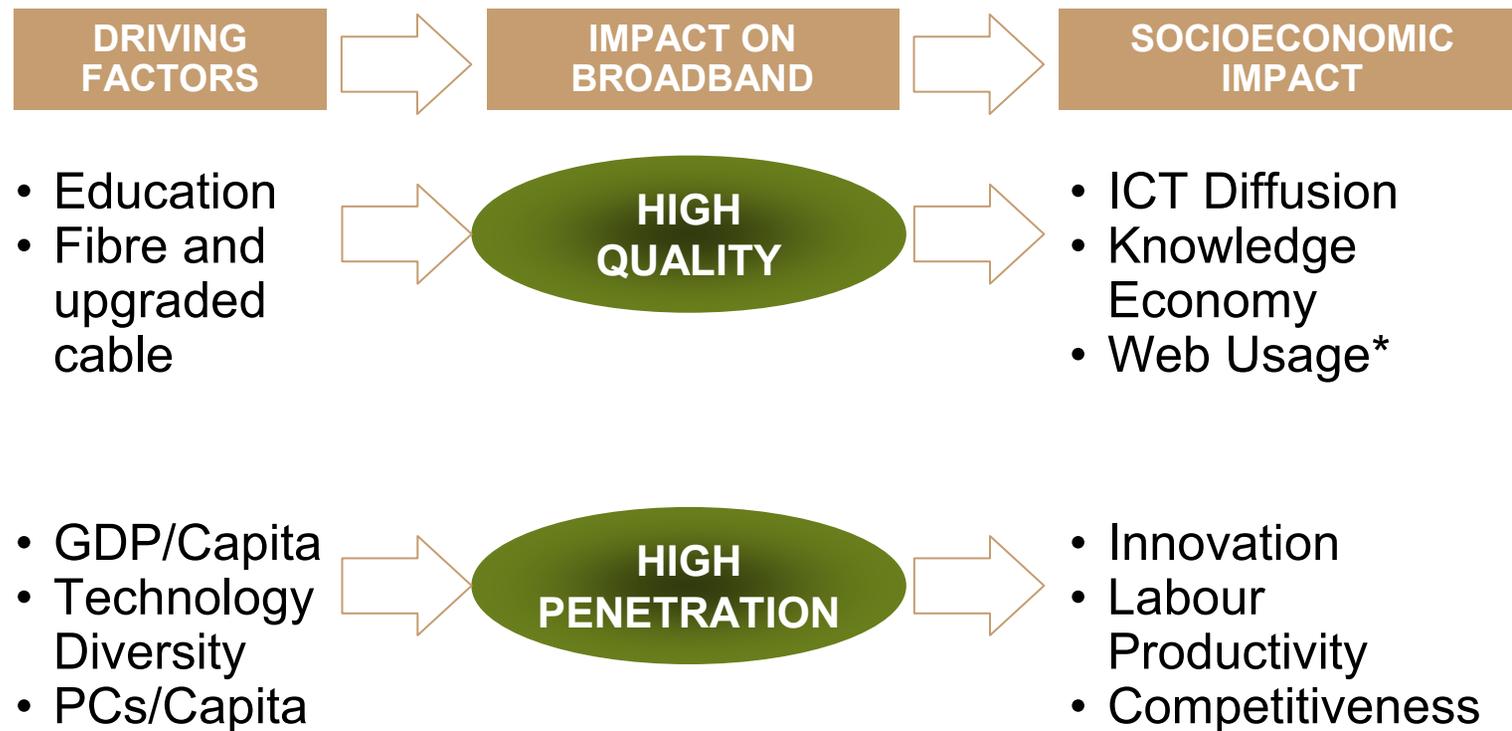
BROADBAND QUALITY SCORE BY COUNTRY



Source: Speed Test database, Expert Interviews, BQS Team Analysis, Aug 2008

Impact of Quality and Penetration

MAIN FACTORS ASSOCIATED WITH BROADBAND QUALITY AND PENETRATION

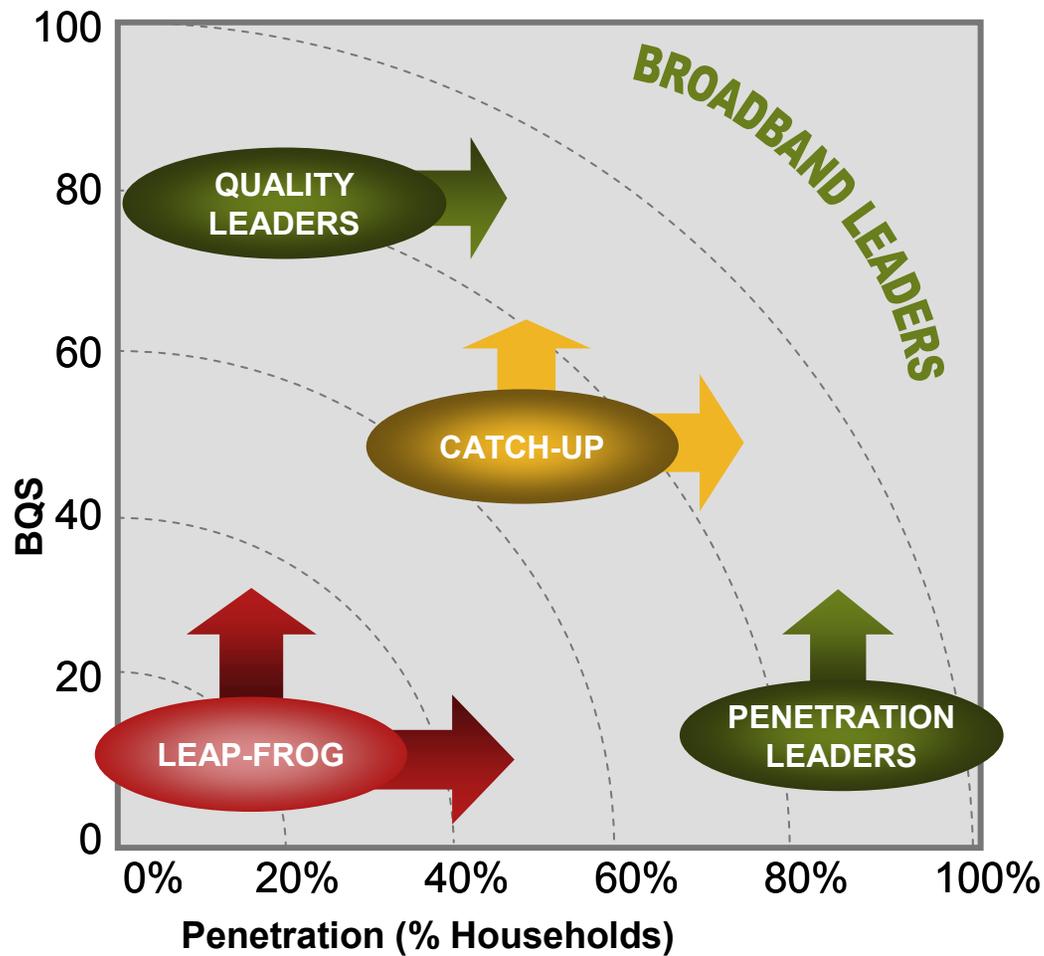


* based on limited sample of ComScore data

Source: Speed Test database; University of Oviedo and Oxford University Team Analysis, Aug 2008

Redefining Broadband Leadership

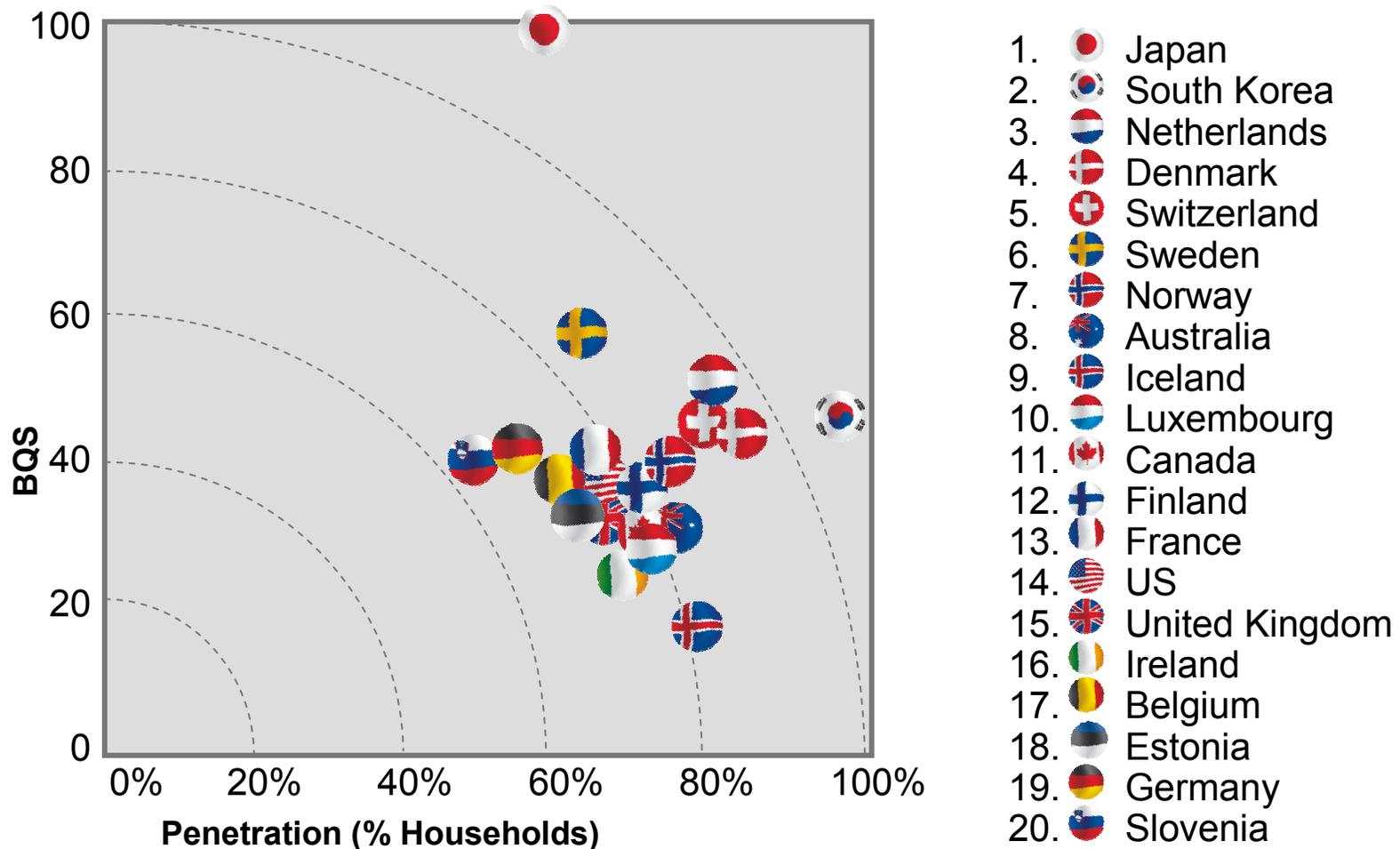
BROADBAND LEADERSHIP MATRIX



Source: Cisco IBSG, Aug 2008

Broadband Leaders

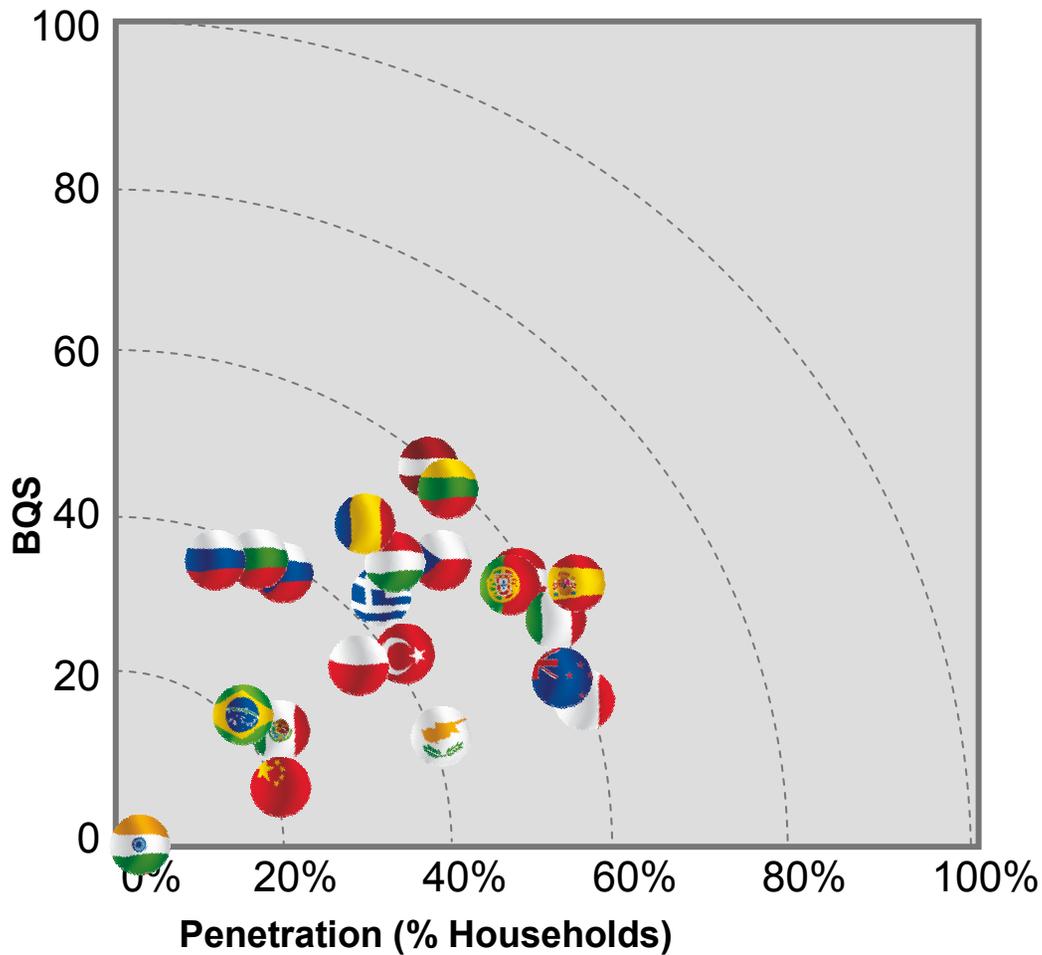
BROADBAND LEADERSHIP MATRIX (TOP-20)



Source: Speed Test database; Point Topic, BQS Team Analysis, Cisco IBSG, Aug 2008

Catch-up and Leap-Frog Countries

BROADBAND LEADERSHIP MATRIX (21-42)



- 21. Spain
- 22. Austria
- 23. Lithuania
- 24. Latvia
- 25. Malta
- 26. Italy
- 27. Portugal
- 28. New Zealand
- 29. Czech Republic
- 30. Romania
- 31. Hungary
- 32. Greece
- 33. Cyprus
- 34. Turkey
- 35. Bulgaria
- 36. Slovakia
- 37. Russia
- 38. Poland
- 39. Mexico
- 40. Brazil
- 41. China
- 42. India

Broadband Stakeholders

HIGH-LEVEL RECOMMENDATIONS TO KEY STAKEHOLDERS

Government, policy makers and regulators

- Set broadband agenda with goals for availability, penetration and quality. Encourage investment and technology diversity

Content producers, aggregators, and over-the-top players

- Partner with value-chain players to provide high-quality and consistent customer experience

Service Providers

- Build brand equity and business model based on quality as differentiator

Equipment and device vendors

- Focus on simplicity, usability and interoperability

Consumers

- Keep home and personal devices up to date and conduct regular speed tests

Source: Cisco, Aug 2008

Appendix

Broadband Quality Score Country dashboards (Top 10)



Japan

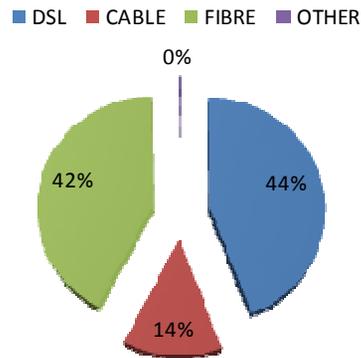
Population: 127.3million
 GDP per capita (PPP) : \$33,577
 Education Index: 94.6%
 Human Development Index: 95.3%



Download Speed	Upload Speed	Latency
16720Kbps	6827Kbps	85ms

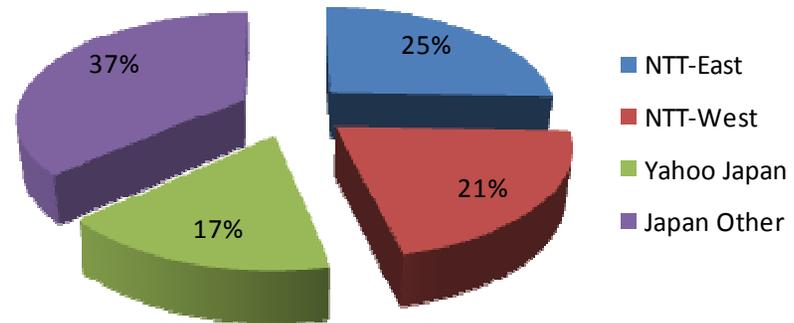
Current BQS score	Future BQS score
98	98

Technologies



Technology Diversity: High

Market Share



Competition Fragmentation: High

Comments:

Japan has the highest Broadband Quality Score by a significant margin. Competition and technology diversity provides an environment to drive quality and high availability of fibre networks. Fibre is supported by government policy and has led to significantly higher download speed.



Sweden

Population: 9.04 million
 GDP per capita (PPP) : \$36,494
 Education Index: 97.8%
 Human Development Index: 95.6%

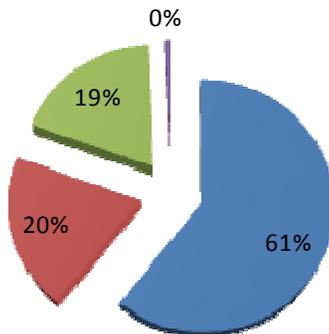


Download Speed	Upload Speed	Latency
8807Kbps	2394Kbps	84ms

Current score	Future score
55	54

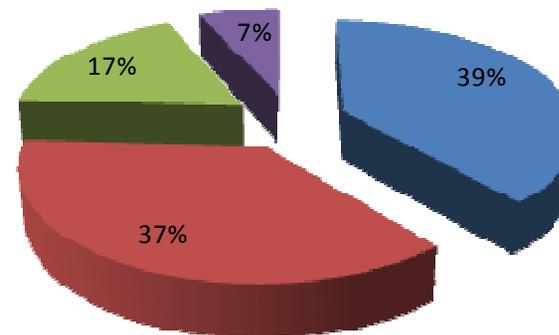
Technologies

■ DSL ■ CABLE ■ FIBRE ■ OTHER



Technology Diversity: High

Market Shares



Competition Fragmentation: High

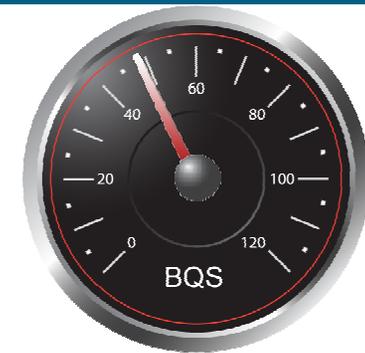
Comments:

Sweden has the highest Broadband Quality Score in Europe
 Broadband prices are affordable, but are higher than prices in Japan
 Sweden is also well prepared to take advantage of future applications as it has high usage levels



Netherlands

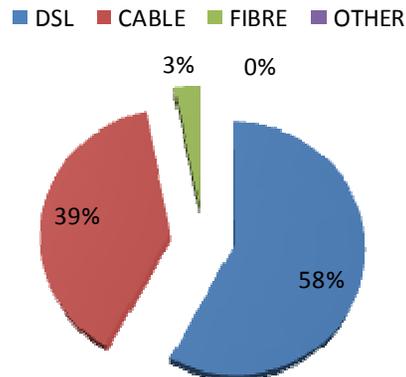
Population: 16.64 million
 GDP per capita (PPP) : \$38,485
 Education Index: 98.8%
 Human Development Index: 95.3%



Download Speed	Upload Speed	Latency
7662Kbps	1271Kbps	65ms

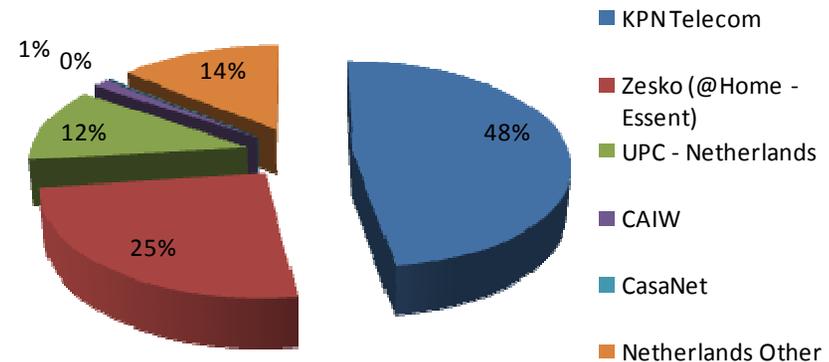
Current score	Future score
49	47

Technologies



Technology Diversity: High

Market Shares



Competition Fragmentation: High

Comments:

With 79.5% penetration and affordable prices, consumers in the Netherlands can truly benefit from good broadband quality
 Good download speed (3rd best) and latency (2nd best) support Netherland's ranking
 Of all the countries analysed, ISPs in the Netherlands are the best at delivering advertised speed
 The Netherlands is also well poised for future application requirements



Latvia

Population: 2.25 million
 GDP per capita (PPP) : \$17,416
 Education Index: 96.1%
 Human Development Index: 85.5%

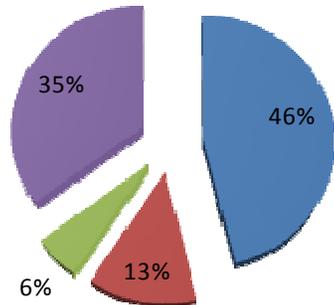


Download Speed	Upload Speed	Latency
6420Kbps	2098Kbps	87ms

Current score	Future score
45	45

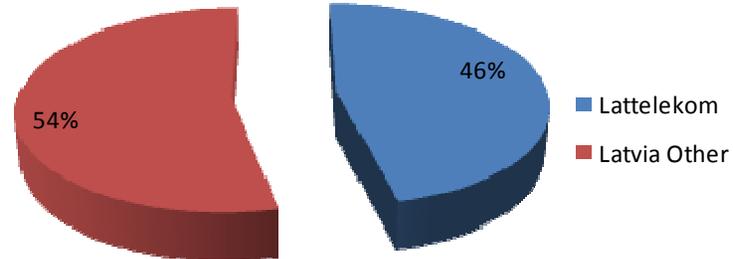
Technologies

■ DSL ■ CABLE ■ FIBRE ■ OTHER



Technology Diversity: High

Market Shares



Competition Fragmentation: Medium

Comments:

Good download and upload speeds put Latvia's Broadband Quality Score above many other European countries
 However, broadband penetration is still relatively low
 Consumers in Latvia have a wide range of technologies to choose from



South Korea

Population: 49.23 million
 GDP per capita (PPP) : \$24,783
 Education Index: 98%
 Human Development Index: 92.1%

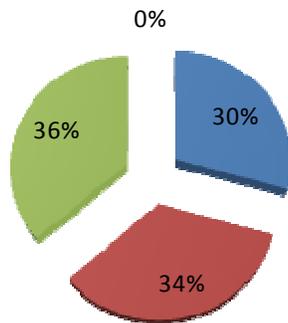


Download Speed	Upload Speed	Latency
7153Kbps	3192Kbps	157ms

Current score	Future score
45	46

Technologies

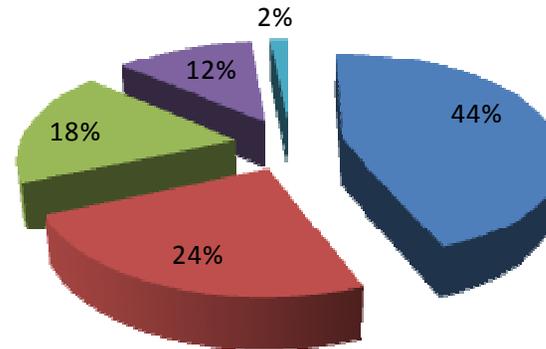
■ DSL ■ CABLE ■ FIBRE ■ OTHER



Technology Diversity: High

Market Share

■ Korea Telecom
 ■ Hanaro Telecom
 ■ Other Service Provider
 ■ Powercom



Competition Fragmentation: High

Comments:

South Korea is in the high range of the Broadband Quality Score although relatively high latency has kept it from achieving a better score
 Broadband is very affordable in South Korea and penetration is the highest of the 42 countries studied



Switzerland

Population: 7.58 million
 GDP per capita (PPP) : \$41,128
 Education Index: 94.6%
 Human Development Index: 95.5%

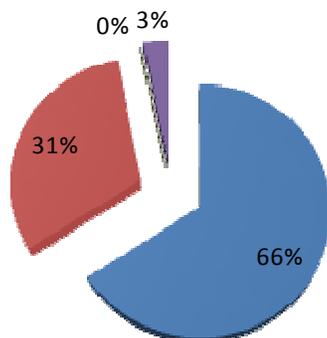


Download Speed	Upload Speed	Latency
6937Kbps	804Kbps	77ms

Current score	Future score
44	41

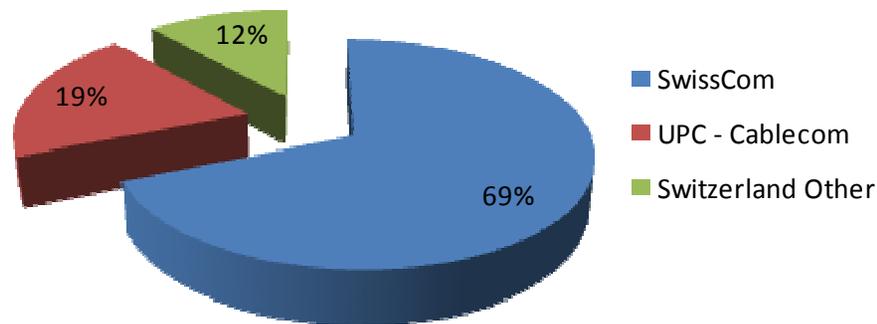
Technologies

■ DSL ■ CABLE ■ FIBRE ■ OTHER



Technology Diversity: Medium

Market Shares



Competition Fragmentation: Medium

Comments:

Switzerland has a high Broadband Quality Score, having fully exploited DSL and cable technologies

Switzerland also has high broadband penetration
 ISPs in Switzerland deliver on advertised speed



Denmark

Population: 5.48 million;
 GDP per capita (PPP) : \$37,391
 Education Index: 99.3%
 Human Development Index: 94.9%

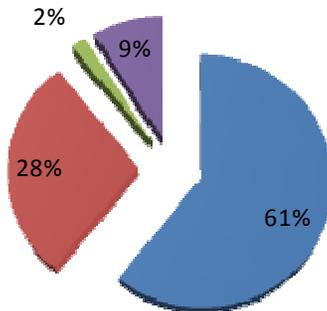


Download Speed	Upload Speed	Latency
5596Kbps	1610Kbps	68ms

Current score	Future score
43	42

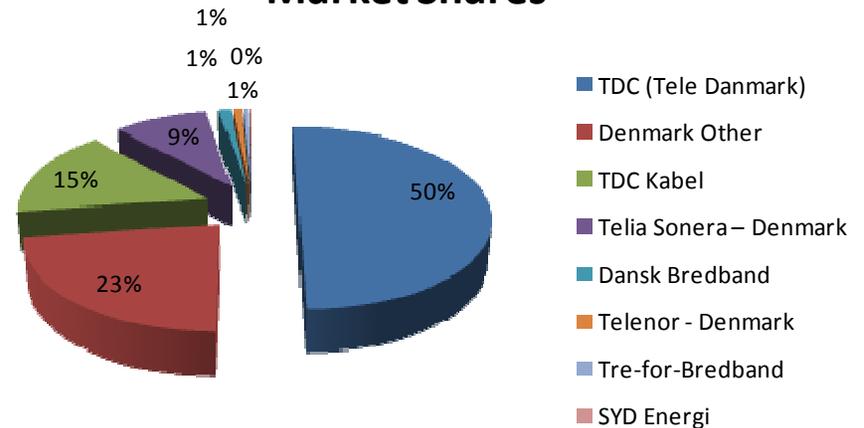
Technologies

■ DSL ■ CABLE ■ FIBRE ■ OTHER



Technology Diversity: High

Market Shares



Competition Fragmentation: High

Comments:

Low latency and high speeds result in Denmark's high Broadband Quality Score. Broadband penetration is the highest in Europe.

Consumers in Denmark have a wide range of technologies to choose from and ISPs in Denmark deliver on advertised speed

Current low-latency infrastructure means Denmark is well-prepared for the future



Lithuania

Population: 3.57 million
 GDP per capita (PPP) : \$17,661
 Education Index: 96.5%
 Human Development Index: 86.2%

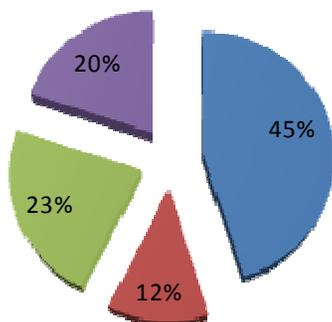


Download Speed	Upload Speed	Latency
5285Kbps	2836Kbps	99ms

Current score	Future score
43	44

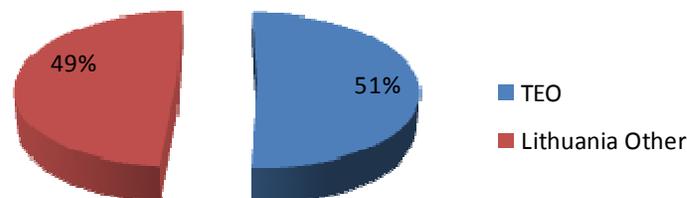
Technologies

■ DSL ■ CABLE ■ FIBRE ■ OTHER



Technology Diversity: High

Market Shares



Competition Fragmentation: High

Comments:

High upload speed and fairly good download speed gives Lithuania a high Broadband Quality Score

Consumers in Lithuania have a wide range of technologies to choose from



Germany

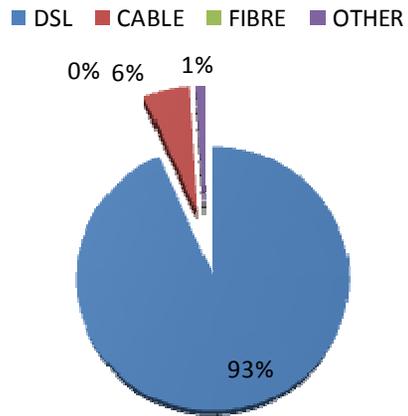
Population: 82.4million
 GDP per capita (PPP) : \$34,181
 Education Index: 95.3%
 Human Development Index: 93.5%



Download Speed	Upload Speed	Latency
6844Kbps	660Kbps	88ms

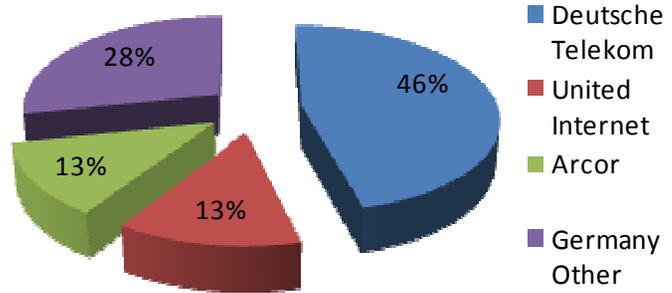
Current score	Future score
42	39

Technologies



Technology Diversity: Low

Market Shares



Competition Fragmentation: High

Comments:

A good Broadband Quality Score for Germany has resulted from high download speeds (2nd highest among G7 nations) and low latency
 Compared to other G7 countries, broadband is most affordable in Germany
 German ISPs deliver on advertised speeds



Slovenia

Population: 2.0 million
 GDP per capita (PPP) : \$27,205
 Education Index: 97.4%
 Human Development Index: 91.7%

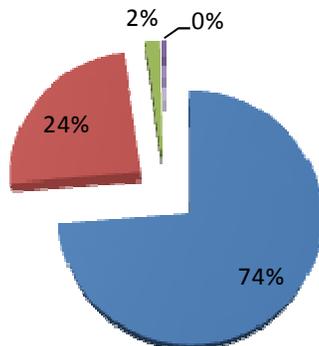


Download Speed	Upload Speed	Latency
4778Kbps	1638Kbps	72ms

Current score	Future score
40	39

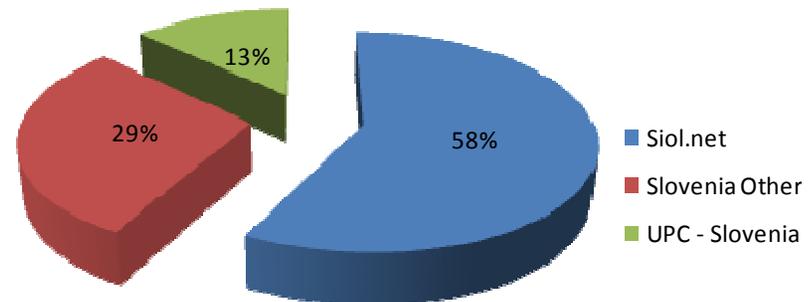
Technologies

■ DSL ■ CABLE ■ FIBRE ■ OTHER



Technology Diversity: Medium

Market Shares



Competition Fragmentation: Medium

Comments:

Good latency and speeds gives Slovenia a high Broadband Quality Score
 Penetration in Slovenia is still relatively low



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