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Working Party on Communication Infrastructures and Services Policy

OECD WORKSHOP ON BROADBAND METRICS (LONDON, JUNE 2012): SUMMARY OF RECOMMENDATIONS

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FOREWORD

The OECD Working Party on Communication Infrastructures and Services Policy (CISP) discussed this document in December 2012 and agreed to recommend it for declassification to the Committee for Digital Economy Policy (CDEP). The CDEP Committee approved the report in April 2014.

The document provides a summary of the recommendations from Rapporteur Group's 1, 2, 4 and 5 of the OECD Workshop on Broadband Metrics, held in London, United Kingdom, in June 2012.

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Introduction

The OECD High Level meeting on the Internet Economy, held in June 2011, urged OECD member countries to develop a revised set of metrics for improving broadband benchmarking. They commended the United States' initiative in proposing a new and harmonised set of metrics (the "Metrics Checklist") for measuring broadband infrastructure and the impact of the Internet Economy, in order to better gauge the level of broadband penetration in member countries and the economic and social development it enables.

In October 2011, the United States took the initiative to drive this work forward by hosting a workshop in Washington to assess current broadband and Internet economy metrics and data collection, with a view to accelerating the development of a new metrics framework. The Workshop made significant progress in examining current approaches and methodologies for measuring broadband and the Internet Economy, as well as underscoring the need for revising such metrics and further developing the proposed metrics checklist.

The outcome of the workshop was reported to the meeting of the ICCP Committee, held in October 2011, and the December 2011 meetings of the ICCP Working Parties (i.e. WPCISP, WPIE and WPIIS).

June 2012 London Workshop

At the December 2011 CISP Working Party meetings, it was decided to hold a second workshop to develop the work further. As before, a Steering Group was convened, including the chairs and other representatives of the ICCP Working Parties, plus members of the ICCP Secretariat, in order to prepare for the second Workshop. The workshop agenda was divided into seven sessions consisting of experts in the relevant fields, for each of which a lead Rapporteur and Rapporteur Group members were appointed. The individual Rapporteur Groups had the responsibility for discussing the relevant issues beforehand and preparing papers for presentation and discussion at the Workshop itself.

The Workshop took place in London in June 2012. The Rapporteur Groups presented their papers, and, following discussions, the conclusions and recommendations for each session were agreed. Following the Workshop, the final papers were updated to include the consensus recommendations reached at the close of the Workshop. The papers are available at: http://stakeholders.ofcom.org.uk/internet/oecd/technical-workshop/. In addition the Workshop was webcast and this two-day discussion can be accessed at: http://stakeholders.ofcom.org.uk/internet/oecd/presentations/. As a general observation, the preparation for the workshop and the papers were of an excellent standard and the success of the workshop was a direct result of the solid preparation beforehand by the Rapporteur Groups.

Decisions made and next steps

The final recommendations/conclusions relevant to the Working Party on Communication Infrastructure and Services Policy (WPCISP) of Session 1, Session 2, Session 4 and Session 5 from the London Workshop are contained below. They were discussed by the WPCISP which agreed that they should become part of the methodology used by the OECD (see next sections). The recommendations relating to the metrics in the 'short-term' goals concerning broadband measurement (those from Sessions 1 and 2) were adopted by WPCISP. They were to be implemented immediately and the Committee was informed at its next meeting.

Each Working Party was to consider whether it accepted the recommendations from the London Workshop and decide how to implement those metrics within its own area of responsibility. The metrics in the Broadband and Internet Economy "Metrics Checklist" were divided into 'short-term goals' and

'longer-term' goals. Following analysis of the broadband and Internet Economy "Metrics Checklist", it was agreed that broadly the responsibilities fall as follows:

- **WPCISP** would lead on data obtained from regulators/operators in relation to broadband measurement; and secondarily, contributes on data obtained from regulators/operators related to demand/usage and on data obtained from surveys/traffic flows/Big Data related to supply.
- **WPMADE** (former WPIIS) would lead on data obtained from surveys/traffic flows/Big Data: these are primarily demand-side metrics, with contributions from other WPs on policy matters.
- **WPMADE** would also lead on issues of broadband data in relation to the measurement of the digital economy and the international data framework for assessing the economic impact of the Internet (Rapporteur Group 6 -RG6- and RG7), with contributions of WPCISP on valuation of infrastructure and Internet service provision.

An updated copy of the Metrics Checklist showing how the responsibilities align by Working Party is attached at Annex 1.

Session 1: (Rapporteur Group 1)

A summary of the recommendations from Session 1 can be found in Annex 2**.**

Rapporteur Group 1 was charged with producing analysis that built on past discussions, making specific recommendations concerning the definition of broadband and proposing categorisations to inform the core broadband metrics collected by the OECD. It is anticipated that these categories would generally apply to both subscription and coverage data. The data will be more useful if subscription and deployment categories align to the extent possible.[1]

Short term recommendations

1. Definition of Broadband

1.1. That the existing OECD definition of broadband be maintained (i.e. a baseline speed of 256 kbit/s). Rather than change the definition, OECD members can apply the speed tiers according to their national circumstances.

2. Speed Tiers

2.1. That data on fixed (wireline) broadband speeds be collected at the following speed tiers:

- 256 kbit/s to less than 1.5/2 Mbit/s [2]
- 1.5/2 Mbit/s to less than 10 Mbit/s
- 10 Mbit/s to less than 25/30 Mbit/s
- 25/30 Mbit/s to less than 100 Mbit/s
- 100 Mbit/s to less than 1 Gbit/s
- 1 Gbit/s and above

3. Definition of Next Generation Access (NGA)

That for the purposes of current data collection efforts, NGA networks be considered access networks which consist wholly or in part of optical elements and which are capable of delivering broadband access services with enhanced characteristics (such as higher throughput). These are compared to those provided over existing copper network, supporting a multitude of advanced digital converged services., with a focus on fibre to the premise, fibre to the cabinet/node, and upgraded cable technologies of DOCSIS 3.0. and beyond.

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1 There may be instances where this is not possible/practical. For example, categories may not align well with mobile broadband technologies. Subscription data is often based on the type of device and/or usage plan (e.g. standard vs. dedicated or handset vs. laptop dongle) whereas coverage is often based on the type of network technology (e.g. 3G, or more specific: HSPA, EV-DO, HSPA+, and LTE). Devices often work with multiple radio technologies (e.g. HSPA and LTE) and therefore can be difficult to classify in the same manner as network deployment.

2 It is expected that most countries will report data at the threshold of 2 Mbit/s. However, accommodation is proposed for countries that standardised data collection using the 1.5 Mbit/s threshold. A similar arrangement is proposed for the small number of instances where data is collected at 25 Mbit/s rather than 30 Mbit/s.

4. Technology Categories

4.1. That in addition to existing technologies, wireline (e.g. DSL, regular cable, FTTP) data be collected for FTTC and DOCSIS 3.0 technologies.

4.2. That data be collected for the following mobile wireless technologies: 3G/UMTS, EV-DO, HSPA, HSPA+, WiMAX, LTE.

4.3. That the OECD collect data on the number of machine-to-machine (M2M) connections.

5. Other

5.1. (Subject to the recommendations from Rapporteur Group 2), that the OECD and country delegations continue to explore the use of data from broadband performance testing tools such as online speed tests, in addition to the data outlined above.

Session 2: (Rapporteur Group 2)

A summary of the recommendations from Session 2 can be found in Annex 3.

1.1 – Broadband availability metrics and mapping

Maps provide a very powerful tool for understanding, visualising and analysing the international broadband availability landscape. The OECD is uniquely placed to co-ordinate mapping initiatives and lead the standardisation of data collection and presentation in order to facilitate international comparison. It is proposed that the OECD incorporate the following into its programme of work:

i) Pilot the presentation of key statistics from its existing broadband metrics as interactive Internet mapping, both as a valuable aid for existing users and a step towards sub-national mapping. By doing a pilot, OECD sets a very limited time, scope and budget for presenting a high value success. Once a pilot is successful, rapid deployment for mapping other metrics can happen.

ii) Map availability at the sub-country level through encouraging and supporting the development of an availability data ecosystem and using the results it produces to drive international comparisons and improvements.

iii) Work with other organisations to collect data in a coordinated way.

iv) Play a key role in defining internationally agreed metrics; e.g. the definition of technology coverage

1.2 – Broadband infrastructure investment metrics

Given the capital intensity of broadband networks, capital investment is a useful metric for assessing and comparing broadband deployment, especially when associated with other measures of the information economy (e.g., broadband deployment, complementary investment adoption of information technologies, productivity, output and employment). It is proposed that the OECD does the following:

i) Collect investment data for multichannel video system operators (e.g., cable) and aggregate with existing public telecommunications data. Provide a breakdown of public telecommunications data by type of provider (fixed telecom, fixed cable or other multichannel video provider, and mobile wireless). Also, consider whether "public" telecommunications investment is the appropriate label for broadband networks, which are often privately financed and do not have regulated returns.

ii) Assess whether it would be feasible to isolate "investment in broadband infrastructure" from non-broadband investment. Assess costs-benefits of getting investment data, taking into account data confidentiality issues as well as practicalities of allocation.

iii) Assess costs-benefits of getting investment data categorised to as granular a level as possible, taking into account data confidentiality issues as well as practicalities of allocation.

iv) Consider the ways that broadband investment data may be useful in achieving the broader goals of the OECD in measuring the information economy, e.g., impact on productivity and economic output. Specifically, consider encouraging and working with government statistical agencies to collect and report investment data in the context of broader economic metrics related to broadband and the information economy.

1.3- Broadband performance metrics

The performance of an Internet connection is a fundamental metric for consumers as it determines the quality of experience and to a certain extent the usefulness of different kinds of applications. The speed of Internet connections is also central to policy considerations and targets. Measuring broadband performance is problematical and there is an absence of agreed metrics for comparing performance between countries on a like-for-like basis. It is proposed that the OECD does the following:

i) Assesses currently available datasets, and adopts in the short-term those datasets which provide robust data offering like-for-like comparison between countries and over time. Ookla/speedtest.net, Google M-Lab, Akamai and YouTube are recommended as options for consideration.

ii) Work towards a long term goal of assembling a dataset based on data collection from representative panels of broadband users using common methodology which measures speed and other service qualities delivered directly to consumers' routers. The first step is to agree on principles of best practice by which broadband performance data should be collected.

1.4 – Competition metrics

In order to be able to accurately identify and compare the competitive characteristics of residential broadband markets it is necessary to collect market share data which distinguishes between retail, wholesale and infrastructure (or facilities)-based competition, and to incorporate data about the choices available to individual households. It is proposed that the OECD do the following:

i) Update market share data to distinguish resale competition from facilities-based competition.

ii) Provide availability data by technology, including cable modem and wireless broadband. Determine the portion of households or population that has access to one, two, or more competitors. Assess whether data could be broken out by speed tiers, technology, or both.

iii) For market share and availability, to the extent that data reflect resale, retail-level metrics should be reported separately from last mile facility-level metrics, though both should be based on the same set of end-users.

iv) Determine the geographic unit to be used for reporting. When data more granular than national data are available (e.g., state or province) and would provide for better comparisons to similarly sized regions, OECD could consider publishing these data.

Session 4: (Rapporteur Group 4)

New approaches to measuring mobile broadband

The full report from Session 4 can be found in Annex 4.

The objective of the session was to identify specific mobile broadband metrics which should be collected in order to track and compare the deployment, take-up and use of mobile broadband networks in member countries.

The following key issues are to be addressed:

- What are the issues with current OECD mobile broadband data?
- What are the characteristics of mobile broadband that require different metrics or a different approach to data collection?
- How to measure demand for mobile broadband?
- How to measure capacity of mobile broadband networks?
- How to measure actual performance of mobile broadband networks?

Basic take-up indicators: Proposal

Rapporteur Group 4 proposes to:

- Evaluate the option of measuring mobile broadband separately from terrestrial fixed wireless and satellite broadband and include these two technologies as a part of fixed broadband:
  - Fixed terrestrial wireless and satellite connections are more closely aligned to wireline broadband in terms of the relevant product market. These connections tend to have different price/usage characteristics from mobile connections, only one connection is purchased per household and they are used as the primary access similar to a wireline connection.
  - However, the decision to categorise connections as wireline vs. wireless (rather than fixed versus mobile) was made relatively recently. It could be confusing to change this again.
- Better capture the different user segments by
  - separating subscriptions based on the use/non-use of voice services

    AND

  - defining five categories based on the data allowances: no data allowance, less than 500MB, less than 1GB, less than 5GB, at least 5GB

Demand-side metrics for mobile broadband

Proposal

Demand-side metrics for mobile broadband may be broken down into three categories, depending on the source: survey-based data (which can be produced by regulators, statistical offices, IGOs, etc.), other data from mobile operators/regulators and data from other industry stakeholders.

It is crucial to highlight the importance of having metrics on the demand side, as they are better adapted to capturing the actual use of mobile broadband service. However, most metrics are based on surveys, which are resource demanding and provide data with a considerable delay. Decisions about the number of metrics to collect and the frequency is up to the national authorities and will be based on resources.

Rapporteur Group 4 recommends that the following metrics should be collected, via general ICT surveys or (preferred option) in ad-hoc studies with some common methodology across OECD countries:

Survey-based data

Households/consumers:

- Penetration of mobile broadband (handset, laptop, tablet).
- Applications used (social networks, mobile banking, email, etc.), frequency, usage patterns (time of the day, etc.).
- Socio-economic profile of mobile broadband users (age, gender, education, etc.).
- Consumer satisfaction with mobile broadband.
- Obstacles to using mobile broadband (e.g. security, costs, low performance)

Businesses:

- Mobile broadband penetration
- Applications used (email, ERP, etc.)
- Frequency of use, usage patterns, etc.
- Obstacles to using mobile broadband (e.g. security, costs, low performance)

Detailed information on socio-economic variables for households and individuals, and economic variables for businesses, has proved to be extremely useful to support the economic analysis.

Data from mobile operators/regulators

This area includes:

- Number of active mobile broadband connections (OECD methodology).
- Mobile broadband traffic (total and per subscriber) – included in CO2013 questionnaire.
- Usage patterns (breakdown of consumers by number of days of use, data allowances, actual data consumption, etc.)
- QoS data (actual speed, etc.) – addressed by other Rapporteur Group (RG).

Recommendation: These data should continue to be collected, bearing in mind the possible commercial confidentiality concerns. They are extremely useful to derive further metrics (e.g. pricing), as well as for detailed demand analysis.

Data from other industry stakeholders

This data is subject to availability/willingness from the industry and to possible commercial confidentiality concerns. Some examples are:

- Top mobile Internet sites.
- Traffic data (Cisco, Akamai)

Recommendation: Regulators should try to engage more with industry stakeholders in order to achieve a better understanding of their data.

Supply-Side Metrics

Proposal

Rapporteur Group 4 recommends the following mobile broadband supply-side metrics, grouped into the four categories of *Coverage, Capacity, Speed, and Competition*. Primary recommendations are shown in bold. Secondary recommendations are options included to foster and facilitate additional discussion.

Coverage Metrics:

- **Nationwide percent of population with mobile broadband coverage, all major providers considered**
- Population coverage measured separately for each major provider

Capacity Metrics:

- **Spectrum: Total spectrum bandwidth available nationwide on average, considering the major mobile bands in use worldwide, and where "available" is defined to mean allocated, assigned to a licensee, and not encumbered by other uses. May use population-weighted or geographic-weighted bandwidth average. May want to distinguish bandwidth frequencies—e.g., spectrum above and below 1 GHz frequency. May also want to count FDD and TDD spectrum separately.**
- **Air interface: Nationwide percentage of population and/or geography covered by each major air interface technology that meets the definition of broadband. Also separately indicate air interface carrying voice traffic.**
- Air interface: Capture impact of interface technology by measuring speed performance. (See next section for speed measurement options.)
- Physical infrastructure: Cell sites per population covered or per km2 covered.
- Physical infrastructure: Capital expenditure per population covered or per km2 covered. Track both annual and cumulative capex.

Speed Metrics:

- **Actual speed, captured by testing: national average and for major sub-national areas.**
- Measure speed indirectly by (as above) identifying air interfaces: nationwide percentage of population and/or geography covered by each major air interface technology.
- Advertised peak download speed: national average and for major sub-national areas.
- Advertised average speed: national average and for major sub-national areas.

Competition Metrics:

- **A cumulative distribution showing the percentage of the population by number of facilities-based service providers available from which to obtain (close to) nationwide service. i.e., a table showing:**
  - **Percent of population with coverage by 5 or more providers:**
  - **Percent of population with coverage by 4 or more providers:**
  - **Percent of population with coverage by 3 or more providers:**
  - **Percent of population with coverage by 2 or more providers:**
  - **Percent of population with coverage by 1 or more providers:**
- **National market shares of the major facilities-based providers, measured by subscribers or revenue**
- Number of MVNOs that provide (close to) nationwide broadband coverage
- Overall national subscription market share of MVNOs

Mobile broadband pricing:

Proposal

On the collection stage

Recommendation 1: unless time- metered tariffs are widespread, it is better to ignore them for price benchmarking purposes since they may appear as the "winning offers" (i.e., minimum expenditure tariffs) when in fact they are seldom offered.

Recommendation 2: collect tariffs offered clearly and transparently in the web site of the operators. Promotions and other components of the tariff plans should be clearly stated.

How should mobile BB tariffs be compared?

Recommendation 3: since laptop, tablets and smartphones type of subscriptions are to be collected and, for each, a different expected usage intensity is assumed, the comparison of prices/ tariffs should be made at least from two different scenarios:

- Stand alone mobile BB or data only service (for laptops and tablets).
- Bundled services, for smartphones and other devices with which people usually make phone calls, send SMS and access the internet. These shall include voice, SMS and data.

Some "winning offers" may be bundled with services not considered in the tables, such as roaming services, or VOIP services. We consider that this should be described somewhere in the outcome tables.

Recommendation 4: in general for bundling, a periodic revision of the extension of bundles may be needed. Bundles may evolve not only in terms of volume of services included in the flat price, but in the number of the services included in the contract or in the tying of a set of specific services with other (complementary) ones.

Recommendation 5: to the extent that is possible (i.e., enough sample size is obtained), not only the **minimum expenditure tariff** should be provided for each country, but the **median** tariff as well. This will yield a better picture on the range of prices that any specific country has. Additionally, the **number of offers collected** for each segmentation shall provide interesting information. The total number of offers/ tariffs encountered per country and per dimension /segmentation category should be provided.

How can the methodology be improved in the long run?

Recommendation 6: if representative prices for the "average consumer" are to be obtained and compared across countries, i.e., prices that reflect what an average consumer actually pays for its connection, a different methodology is needed, one based on factual information of what consumers actually pay for their BB connection. Bill harvesting or web based tariff collection methods that collect micro- data are possible ways to achieve this.

Recommendation 7: in several countries subsidies to terminals are an important element in the tariffs offered. The amount of subsidisation may be high, and may affect the final expenditures obtained, given a specified consumption pattern. It would be relevant to know the extent of the subsidisation effort in several markets and its effects on the tariffs used. This could be analysed independently of the periodic metrics provided by OECD.

Session 5: (Rapporteur Group 5)

New approaches to measuring broadband pricing

Broadband is an important stimulant to a nation's economic activity and development and the prices charged for broadband services influence broadband take-up. Further, broadband Internet access is an essential component for social and economic inclusiveness in the 21st century, thus it must be affordable to the whole population. But broadband is a service that may suffer from insufficient competitive rivalry, consumer choice and market innovation. For these several reasons, it is important that broadband prices be tracked and benchmarked to inform policymakers about the status of this important economic stimulant.

Short term recommendations

- Prices should be tracked for a range of residential BB offers that are both widely-available to the public and allow for access to the full internet address space.
- Recorded prices should be the monthly cost of broadband service, including all taxes and fees. Any one-time costs or discounts should be pro-rated over a 36 month subscription period.
- Prices should be collected: for standalone broadband services and for double-play bundles that include broadband. Collecting both prices will allow an "effective" incremental price for broadband in double-play bundle to be computed.
- Prices should be collected for offers from the three largest operators in each country. If this results in less than 70% of national subscription coverage, additional operators should be polled to reach this threshold.
- If national prices are reported for a country, both the cheapest available offer and the median-priced offer for that country should be reported.
- Residential offers should be segmented into the following categories in terms of upload and download speeds and monthly usage allowances:

Service Speeds		Bandwidth Usage Profile (in GB/month)		
Download Speed (in Mbit/sec)	**Minimum Upload Speed**	**Low**	**Median**	**High**
≤1.5/2.0	256 Kbit/sec	5	10	20
>1.5/2.0 –≤10	512 Kbit/sec	5	15	50
>10 –≤25/30	768 Kbit/sec	10	25	100
>25/30 –≤100	1 Mbit/sec	15	50	200
>100 -≤1000	3 Mbit/sec	25	100	400
>1000	10 Mbit/sec	100	250	1000

- Given the great heterogeneity of business broadband offers and paucity of sales made pursuant to public tariffs, it may not be terribly useful to track business broadband prices. Consideration should be given to retiring the collection of leased line prices – possibly in favour of collecting data on evolving high speed Ethernet services – if such data prove to be widely available.

Longer-term recommendations

- An affordability metric for broadband within a country should be developed based on the cost of an entry broadband service in that country – possibly stated as a percentage of 1st or 2nd decile household income in that country.

- Research efforts should be made to develop Hedonic regression parameters to capture the cost and value contribution of differently composed broadband services. This will allow a consistent evaluation of heterogeneous broadband offers among countries and the ability to track quality changes over time and to make comparisons between fixed and mobile broadband services.
- Rather than employing simple averages across offers, subscription data should be collected so that offer prices may be weighted by subscription popularity. Further, rather than collecting only public tariff prices, actual purchase transaction prices should be collected so that off-tariff pricing and discounts may be captured.

Further work and next steps

The experience of the two Workshops has been that substantial and significant progress has been made. The preparation for the London Workshop proved extremely helpful in identifying and clarifying the challenging methodological issues and allowed for substantive debate among experts with a wide-range of technical and policy backgrounds.

ANNEX 1

OECD BROADBAND & INTERNET ECONOMY "METRICS CHECKLIST"

(Annotated to show reference to relevant CDEP -former ICCP- Working Party and London Workshop Rapporteur Group)

A. BROADBAND MEASUREMENT

Overarching Goal: Development of meaningful cross-sectional and time series broadband data that can be used to describe the broadband services available and who receives them. While not all countries may provide data for each series, providing as

Short-term goals

Rapporteur Group 1/ CISP responsible for:

1. Broadband deployment at a disaggregated, statistical, geographic area level for residential and business grade services together, and separately for residential grade services and business grade services where possible

a) Speed tiers

b) Number of competitors (including facilities-based and non-facilities-based providers with annotations of the member country's definition of "facilities-based")

c) Differentiated by technology including fibre, hybrid fibre/coax (HFC), twisted pair copper, fixed and mobile wireless, satellite and others.

2. Broadband adoption at a disaggregated, statistical, geographic area level, for residential and business grade services together, and separately for residential grade services and business grade services where possible

a) Speed tiers

b) Number of competitors (separately for facilities-based providers and non-facilities-based providers with annotations of the member country's definition of "facilities-based")

c) Differentiated by technology including fibre, hybrid fibre/coax (HFC), twisted pair copper, fixed and mobile wireless, satellite and others.

Not covered

3. Demographic metrics at a disaggregated, statistical, geographic area level

a) Including education, income, age, household type, gender, employment, occupation and other factors as appropriate

b) Urbanicity metrics, particularly urban versus rural

c) Metrics for household dispersion to compare/normalise availability figures]

Rapporteur Group 5/ CISP responsible for:

4. Continued discussion of purpose and methods for broadband price collection, including issues such as:

a) Price benchmark methodology and "affordability" analyses

b) Usage structure of packages (such as data caps, metered pricing, and other elements), bundling, roaming

c) Metrics such as revenue per bit

d) Frequency of data collection

e) Enterprise metrics, such as ICT and broadband investment by industry and geography, and how businesses use those investments.

Longer-term goals

Rapporteur Group 5/ CISP responsible for:

1. Mass market subscriber price data (including analysis of promotional pricing and bundling)

Rapporteur Group 2/ CISP responsible for :

2. Discussion of cost of broadband deployment by technology (*e.g.* initial cost vs. recurring costs, access to rights of ways, ducts, and conduits)

3. Network performance data, including actual vs. advertised speeds, security, and reliability

Not covered

4. Usage data (correlated with usage caps/plans) by demographics and geography, including: time of day (such as peak hours, peak days, peak periods), usage patterns for high bandwidth/low latency applications and content; and analysis of identified factors for why population is not using broadband

Rapporteur Group 2/ CISP responsible for

5. Standardised broadband mapping methods

6. Discussion of metrics for assessing the competitiveness of markets (*e.g.* gauges of market power)

Rapporteur Group 4/ WPMADE, former WPIIS responsible for:

7. Special considerations for data on mobile broadband services

   a. Demand side customer-survey metrics such as frequency and purpose of broadband Internet use by owners of mobile devices of various types, customer awareness of available mobile applications, and customer willingness to use new mobile applications; survey information about pricing and other customer concerns that affect adoption

Rapporteur Group 4/ CISP responsible for:

   b. Supply side metrics such as cell size, capacity utilisation, and spectrum availability

WPMADE, former WPIIS responsible for:

8. Data on consumer demand for applications and content (such as VoIP, email) and social media best practices for data collection (e.g. granularity that allows aggregation to larger sub-national geographies; connections/person vs. connections/household)

B. MEASURING INNOVATION AND PRODUCTIVITY IN THE INTERNET ECONOMY

Overarching goal: Development and implementation of comparable cross-section and longitudinal data, both qualitative and quantitative, that can be used to estimate both the drivers of Internet usage and its effects on innovation and productivity within and across countries. The data series outlined in this section encompass the set of wide-ranging measures that researchers would find optimal for analyses of the inter-twined relationships of ICT, innovation, and productivity in the Internet economy. Not all countries may collect all the data series outlined in this section. Sharing countries' experience about the data they do collect allows for refinements of definitions and possible best practices that will benefit all.

Short-term goals:

Rapporteur Group 6/7 WPMADE, former WPIIS responsible for:

1. Identify when internationally recognised definitions of measurement concepts such as "innovation," "productivity," and "broadband" exist, and where they need to be developed

2. IT and ICT investment levels in the business and government sectors

3. Innovation in business practices and public administration

   a) Management and organisational practices

   b) Innovation in goods, services, and/or processes

4. Innovation in services and products

5. Supply chain and ICT usage

6. Survey instruments that include analysis of education/skills levels

7. New survey instruments that address current knowledge gaps in statistical instruments

Longer-term goals:

Rapporteur Group 6/7 WPMADE, former WPIIS) responsible for:

[Note: We assume these annotations are more in the nature of guidelines rather than strict demarcations as there is some overlap. In particular, the first bullet addresses work by Rapporteur Group 1 and the CISP.]

1. Reaching consensus, through the OECD/DSTI/ICCP working party structure, on internationally comparable definitions for broadband and similar Internet access technologies.

2. Pursuing collection of detailed longitudinal micro data on broadband availability and adoption, together with measures of basic economic variables required for productivity analysis and the impact of broadband on productivity, such as number of employees, total compensation, total revenues, capital investments, and spending on materials.

3. Conducting analyses of the impact on productivity and other economic outcomes of broadband and Internet use by businesses, accounting also for capital, labour, energy, materials (KLEM) variables, using micro-data at the business unit level.

4. Building on and co-ordinate with existing work on definitions and data collections on concepts such as innovation, research and development, and intangible assets.

ANNEX 2.

OECD METRICS WORKSHOP JUNE 14-15, 2012 (LONDON)

Workshop Session # 1

Rapporteur Group Members: Pamela MILLER, Industry, Canada
Andre ARBOUR, Industry, Canada
Sangwon KO, KISDI, Korea
Sam PALTRIDGE, OECD
Shinya SHIMADA, Japan
Lucilla SIOLI, European Commission

Issue: To agree on a recommended definition for broadband and propose categorisations which will inform the core broadband data which should be collected.

Introduction

The need for methodologically rigorous and internationally comparable data was clearly identified during the OECD's June 2011 High Level Meeting on the Internet Economy. Attended by Ministers, high level officials and leaders from all stakeholder groups, there was an agreement that collecting additional data, consistent across the OECD community, is critical for determining factors that affect broadband deployment and adoption, assessing the impact of public policy concerning broadband and the Internet economy, and ensuring these issues are prioritised by decision makers.[3] The importance of this data was highlighted in the HLM Communiqué on Principles for Internet Policy-Making, which subsequently formed the basis for a Council Recommendation.[4]

Following the HLM, a first technical workshop on broadband and Internet economy metrics was jointly hosted by the United States Federal Communications Commission and the Department of Commerce in Washington, D.C. in October 2011. The workshop was designed to take stock of existing international data collections and to consider future work to further harmonise and augment broadband related data collections across OECD. The discussion was based on an assessment of the OECD's proposed Metrics Checklist (see DSTI/ICCP(2010)19/REV2) with an eye towards its revision, adoption and ultimate implementation.[5]

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3. For background on the HLM, please see: www.oecd.org/internet/innovation

4. OECD Council Recommendation on Principles for Internet Policy Making, 13 December 2011, http://www.oecd.org/dataoecd/11/58/49258588.pdf

5. Event summary and presentations available at: http://www.fcc.gov/events/oecd-broadband- metrics-workshop

A significant underlying theme that emerged from the October 2011 workshop was the need to standardise terms and benchmarks employed by the OECD and member countries. Rapporteur Group 1 of the second technical workshop was charged with producing analysis that built on these past discussions and made specific recommendations concerning the definition of broadband and propose categorisations that will inform the core broadband metrics collected by the OECD.

It is anticipated that these categories would generally apply to both subscription and coverage data aggregated by the OECD. The data will be more useful if subscription and deployment categories align (to the extent possible).[6]. For reference, the relevant metrics from the checklist are included in Box 1 below. While not all countries may provide data for each series, providing as much data as possible in internationally comparable forms, and in a central repository, will benefit all.

Box 1. Relevant Metrics from the Checklist

(Short-term metrics)

- Broadband deployment at a disaggregated, statistical, geographic area level for residential and business grade services together, and separately for residential grade services and business grade services where possible
  - Speed tiers
  - Differentiated by technology including fiber, hybrid fiber/coax (HFC), twisted pair copper, fixed and mobile wireless, satellite and others
- Broadband adoption at a disaggregated, statistical, geographic area level for residential and business grade services together, and separately for residential grade services and business grade services where possible
  - Speed tiers
  - Differentiated by technology including fiber, hybrid fiber/coax (HFC), twisted pair copper, fixed and mobile wireless, satellite and others

The paper's analysis and recommendations are organised into five topics:

1. The definition of broadband
2. Broadband speed tiers
3. The definition of Next Generation Access (NGA)
4. Broadband technology categories
5. Other

Key considerations in developing the analysis and recommendations include the extent of previous work on these issues, both at the OECD and elsewhere; relevance for policy making and the need to track new market developments; as well as concerns regarding efficiency and practicality. A common thread throughout these discussions was the extent that there was common ground and the potential for

[6] There may be instances where this is not possible/practical. For example, categories may not align well with mobile broadband technologies. As devices often work with multiple network technologies subscription data is often based on the type of device and/or usage plan (e.g. standard vs. dedicated or handset vs. laptop dongle) whereas coverage is often based on the type of network technology (e.g.3G, or more specific: HSPA, EV-DO, HSPA+, and LTE).

harmonisation across OECD members and with organisations that also collect internationally comparable broadband data such as the International Telecommunications Union (ITU) and the European Commission (EC).

A summary of the group's consensus recommendations are outlined in Box 2 below. There is a certain degree of emphasis on advancing the discussion by proposing near-term concrete improvements, but recommendations that concern the need for further study or monitoring over the longer term are also proposed.

Box 2. Recommendations

1. Definition of Broadband

1.1. That the existing OECD definition of broadband be maintained. Rather than change the definition, OECD countries can apply the speed tiers according to their national circumstances.

2. Speed Tiers

2.1. That data on broadband speeds be collected at the following speed tiers: 256 kbit/s to less than 1.5/2 Mbit/s, 1.5/2 Mbit/s to less than 10 Mbit/s, 10 Mbit/s to less than 25/30 Mbit/s, 25/30 Mbit/s to less than 100 Mbit/s, 100 Mbit/s to less than 1 Gbit/s, and 1 Gbit/s and above.

3. Definition of Next Generation Access (NGA)

3.1. That for the purposes of current data collection efforts, Next Generation Access be defined as specified in Section 3, with focus on FTTP, FTTC, and DOCSIS 3.0. technologies.

4. Technology Categories

4.1. That in addition to existing technologies, wireline data be collected for FTTC and DOCSIS 3.0 technologies.

4.2. That data be collected for the following mobile wireless technologies: 3G/UMTS, EV- DO, HSPA, HSPA+, WiMAX, LTE.

4.3. That the OECD collect data on the number of machine-to-machine (M2M) connections.

5. Other

5.1. Subject to the recommendations from Rapporteur Group 2 – Infrastructure and supply metrics: Measuring deployment and performance of broadband networks, that the OECD and country delegations continue to explore the use of data from broadband performance testing tools such as online speed tests, in addition to the data outlined above.

Background/Summary:

There is no universal definition for use of the term "broadband", in the collection and reporting of metrics. This being the case, national and international stakeholders have adopted the practical measure of excluding what they do not consider to be broadband. In the early years, of high-speed data collection this enabled the exclusion of some technologies. For example, one of the first definitional uses of the term broadband was by the ITU, which in Recommendation I.113 of the ITU Standardisation Sector (ITU-T), defined broadband as a transmission capacity that was faster than Primary Rate ISDN. The

definition was for speeds higher than 1.5 Mbit/s or 2 Mbit/s, reflecting the different transmission speeds used for Primary Rate ISDN across different countries.[7]

The ITU's use of the term established, in practical application, that broadband could be defined by the exclusion of ISDN. Had ISDN become more widely used, and the range of technologies that superseded it, been launched with speeds greater than 1.5 or 2 Mbit/s these speeds may have been adopted as a baseline for the reporting of data on broadband subscriptions.

Shortly after the commercialisation of the Internet the first cable modem, and then DSL access offers, were launched in Canada and the United States. In the United States, the Federal Communications Commission (FCC) established one of the first thresholds for reporting on the deployment of high-speed services. The FCC adopted a definition that stated advanced telecommunication infrastructure was that which was capable of delivering a speed of 200 kbit/s in each direction, while the term "high-speed" was applied to those services with over 200 kbit/s capability in at least one direction.

By the turn of the century, a small but growing number of regulatory authorities began to report data for the number of DSL and cable modem subscriptions. In addition, a growing number of operators began to report these data as they launched new services. The OECD collected and undertook analysis of commercial broadband offers across all member countries in 2001. This work found that there were no DSL or cable modem service advertised at less than 256 kbit/s for downstream connectivity. With that in mind, OECD countries took the decision to adopt this as the baseline speed for data collection and reporting.[8]

As this threshold was higher than basic ISDN (i.e. 128 kbit/s) it seemed a convenient benchmark by which to exclude ISDN, which was counted elsewhere, and record the new services that had become widely known under the collective term of broadband access. The ITU also began collecting data using this baseline definition. For the purpose of statistical collections, ITU's fixed broadband indicator is called "Total fixed (wired) broadband Internet subscriptions" and refers to subscriptions to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than 256 kbit/s.

In June 2002, the European Commission's Communications Committee (COCOM) established a working definition for the collection of broadband data in the European Union area. The threshold speed for both incumbent telecommunication carriers and new entrants was set by COCOM at 144 kbit/s. The objective was also to exclude basic ISDN lines (that is, 128 kbit/s) but include a number of services, below 256 kbit/s, that had by then emerged in a small number of markets.

Over time the commercial offers for broadband services have dramatically changed across the OECD area. In 2003, Telecom New Zealand and France Telecom's baseline speeds were both 128 kbit/s. At the close of 2004 they were increased to 256 kbit/s and 512 kbit/s respectively. In 2003, the highest speed offered by France Telecom to residential users was 1 Mbit/s. At the close of 2004 an 18 Mbit/s service was introduced for a similar price. In the United Kingdom, the cable operator NTL raised its baseline speed from 128 kbit/s to 10 Mbit/s between 2003 and 2005.

Just over a decade after the OECD, ITU and EC first adopted baseline broadband speeds to collect data on a comparable basis, offers below 1.5/2 Mbit/s are the exception rather than the rule. At the other

7 Several countries such as the United States and Canada adopted the T-carrier of 1.544 Mbit/s for primary rate ISDN, while Europe and other countries adopted the E-carrier of 2.048 Mbit/s.

8 OECD, "The Development of Broadband Access in OECD Countries," DSTI/ICCP/TISP(2001)2/FINAL, http://www.oecd.org/dataoecd/48/33/2475737.pdf.

end of the scale, there are an increasing number of offers advertised at up to 100 Mbit/s and a few at 1 Gbit/s. All indications point to the median speeds of broadband continuing to increase and that advertised offers below 2 Mbit/s will become increasingly rare. For example, in Canada the share of fixed subscriptions below 1.5 Mbit/s declined from 24.8% in 2006, to 6.1% in 2010.[9] Similarly, the share of fixed subscriptions below 2 Mbit/s declined from 35.6% to 12% between January 2008 and July 2011 across the European Union.[10] Common applications for broadband have also evolved to become more bandwidth intensive and 256 kbit/s is less relevant in this context. For example, YouTube suggests a minimum 500 kbit/s connection.[11]

Analysis:

1.1 Baseline Definition

As a result of technological and commercial changes, as well as the need to provide relevant data to all stakeholders, regulatory authorities or other bodies that collect data on Internet access services, have begun to adjust and redefine their definition of broadband.

As noted the FCC originally set the speed for high-speed access at 200 kbit/s in one or both directions. In 2008, The FCC raised its baseline level, for services it designated as "Basic Broadband" to between 768 kbit/s to 1.5 Mbit/s. Services below 768 kbit/s were redesignated as "first generation data services". In 2010, the FCC set a target for broadband as being 4 Mbit/s downstream and 1 Mbit/s upstream.

An increase in the baseline speed of the definition beyond 256 kbit/s would bring it more closely in line with common perceptions of what can be expected from a broadband connection. An examination of common speed tiers suggested 1.5/2 Mbit/s as the next logical tier. However, there are a number of practical challenges that militate towards maintaining the current definition. For example, certain OECD members have incorporated broadband into their universal service regimes with a definition below 1.5/2 Mbit/s. It is also not clear that the definition could be extended to wireless, thereby frustrating technological neutrality and comparisons between wireline and wireless services. While fixed wireline broadband services are frequently marketed and categorised by speed, this is typically not the case for mobile subscriptions or coverage. A variety of factors affect mobile broadband speeds such as physical obstruction, movement into different coverage areas, speeds experienced while in motion, distance from the cell tower, and number of simultaneous users within a cell site. These factors make it difficult to associate mobile wireless with a particular speed tier. Finally, altering the baseline for the OECD could complicate comparisons to other datasets that continue to have a baseline of 256 kbit/s or similar speed. Consequently, it is suggested that the existing baseline speed be maintained. The tiers outlined in the next section allow for comparisons of connections at higher speeds and can be interpreted by OECD member states according to their particular priorities.

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9 Canadian Radio-television and Telecommunications Commission (2011) Communications Monitoring Report, Table 5.3.3, http://www.crtc.gc.ca/eng/publications/reports/PolicyMonitoring/2011/cmr5.htm#t533

10 European Commission Communications Committee (2011), Broadband Access in the EU: Situation at July 1, 2011, Main Tables, http://ec.europa.eu/information_society/digital-agenda/scoreboard/pillars/broadband/index_en.htm

11 Youtube, "System Requirements – Youtube Help," Accessed May 3, 2012, http://support.google.com/youtube/bin/answer.py?hl=en&answer=78358.

Additional Background:

Canadian Radio-television and Telecommunications Commission (2011) Communications Monitoring Report 2011, Table 5.3.3, http://www.crtc.gc.ca/eng/publications/reports/PolicyMonitoring/2011/cmr5.htm#t533

European Commission Communications Committee (2011), Broadband Access in the EU: Situation at July 1, 2011, Main Tables, http://ec.europa.eu/information_society/digital-agenda/scoreboard/pillars/broadband/index_en.htm

FCC (2011) Internet Access Services: Status as of December 31, 2010, FCC, Washington DC, http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-310261A1.pdf,

OECD (2001) "The Development of Broadband Access in OECD Countries," Working Party on Telecommunication and Information Services Policies, DSTI/ICCP/TISP(2001)2/FINAL, http://www.oecd.org/dataoecd/48/33/2475737.pdf.

OECD (2011) Guide to Measuring the Information Society 2011, OECD, Paris, http://browse.oecdbookshop.org/oecd/pdfs/free/9311021e.pdf

2 – Speed Tiers

Proposal:

2.1 That data on broadband speeds be collected at the following speed tiers: 256 kbit/s to less than 1.5/2 Mbit/s, 1.5/2 Mbit/s to less than 10 Mbit/s, 10 Mbit/s to less than 25/30 Mbit/s, 25/30 Mbit/s to less than 100 Mbit/s, 100 Mbit/s to less than 1 Gbit/s, and above 1 Gbit/s.

Background/Summary:

Since 2010, OECD and ITU broadband statistics are categorised as Fixed (wired) broadband subscriptions and Wireless broadband subscriptions. Fixed (wired) broadband subscriptions include: DSL, Cable modem, Fibre to the home/building subscriptions and other fixed (wired) broadband subscriptions such as power lines. Wireless broadband subscriptions include: Satellite subscriptions, Terrestrial fixed wireless subscriptions, Terrestrial mobile wireless subscriptions (the sum of active mobile broadband and dedicated mobile data subscriptions).

The ITU Expert Group (EGTI) decided to introduce a new indicator "Fixed (wired) broadband by speed" which distinguishes broadband connections according to five different ranges of speed.[12] The ITU has collected broadband speed using tiers since 2010. To prepare for the biennial Communications Outlook, the OECD has also used these tiers since 2008. The tiers used by the OECD and ITU are shown in Table 2.1.

The European Commission also collects broadband data based on tiers. They are in line with those used by the OECD and ITU, with an additional breakout of speeds between 10 Mbit/s to 30 Mbit/s and 30 Mbit/s to 100 Mbit/s. Currently the ITU and OECD aggregate data between 10 Mbit/s and 100 Mbit/s.

Table 2.1: Current OECD and ITU collection of broadband data

Fixed (wired) broadband by speed	
256kbit/s to less than 2Mbit/s subscriptions	All fixed (wired) broadband Internet subscriptions with advertised downstream speeds equal to, or greater than, 256 kbit/s and less than 2Mbit/s.
2 Mbit/s to less than 10 Mbit/s subscriptions	All fixed (wired) broadband Internet subscriptions with advertised downstream speeds equal to, or greater than, 2 Mbit/s and less than 10 Mbit/s.
10 Mbit/s to less than 100 Mbit/s subscriptions	All fixed (wired) broadband Internet subscriptions with advertised downstream speeds equal to, or greater than, 10 Mbit/s and less than 100 Mbit/s.
100 Mbit/s to less than 1Gbit/s subscriptions	All fixed (wired) broadband Internet subscriptions with advertised downstream speeds equal to, or greater than, 100 Mbit/s and less than 1 Gbit/s.
Above 1Gbit/s subscriptions	All fixed (wired) broadband Internet subscriptions with advertised downstream speeds equal to, or greater than, 1Gbit/s.

[12] ITU (2010), Definitions of World Telecommunication/ICT Indicators, ITU, Geneva, www.itu.int/ITU-D/ict/handbook.html.

Analysis:

2.1 Rationale for Speed Tiers

The metrics check-list discussed in the first workshop recommended that data should be collected by speed tiers. Broadband connections of the same technology can exhibit different performance levels depending on the specific deployment specifications chosen by the operator.

To better inform the question of speed tiers data have been gathered on the tiers currently collected by OECD countries. These data are shown in a separate spreadsheet and delegates are invited to verify and provide any missing points of data collection. The reporting of these data is shown next to the most common speeds. These data indicate the most common speed used to categorise broadband is 2 Mbit/s either in terms of speeds up to 2 Mbit/s or its use to collect subscriptions between 2 Mbit/s and 10 Mbit/s. A relatively small number of authorities use 1.5 Mbit/s consistent with the original ITU definition of broadband and the historical use of this speed (e.g. marketing and data collection). Notably, the United States uses 3 Mbit/s and Denmark 4 Mbit/s instead of 2 Mbit/s. That being said, the United States also collects subscriber and deployment data at speeds of 1.5 Mbps along with other tiers.[13]

In the short term, the number of tiers above 2 Mbit/s and below 10 Mbit/s (e.g. 3 Mbits – 6 Mbit/s) may continue to change if stakeholders find these tiers useful in relation to the provision of a specific service. It is important to note that any proposal for tiers at the international level does not preclude the use of additional tiers. Rather the critical point is can the authorities collecting these data (a) break out the data in agreed tiers to ensure maximum comparability and/or (b) provide tiers that are accepted as reasonably comparable (e.g. 1.5 Mbit/s and 2 Mbit/s have long been used to compare other services such as leased lines).

As most of the differences currently exist at lower speeds it is critical that all stakeholders agree on the tiers of higher speed broadband services. Over time the differences at lower speeds will become less important – if indeed this has not already occurred to a significant degree.

The London Workshop is invited to propose that broadband data be collected in tiers as described in Table 2.2 below. Choice of tiers was based on considerations of harmonising existing data collection by national and international bodies as well as the need to reflect the market and relevance for policy.

The use of 30 Mbit/s as a category in the statistics could enable users to distinguish between older generation broadband networks and next generation broadband networks. It may also give insight into how next generation networks are positioned and marketed. Earlier generation networks (i.e. ADSL 2+ and Cable using Data Over Cable System Interfaces Specification (DOCSIS), typically have technical limitations in the range of 15 – 30 Mbit/s.[14] Next generation access networks, like FTTC/VDSL2 and

13 See FCC/NTIA (2012), Broadband Statistics Report: Access to Broadband Technology by Speed, http://www.broadbandmap.gov/download/Technology%20by%20Speed%20JUNE%202011.pdf, and FCC (2011), Internet Access Services: Status as of December 31, 2010,. http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-310261A1.pdf, p. 22.

14 The exact limitation can vary. ADSL deployments commonly have a theoretical maximum speed of 24 Mbit/s (ADSL2+) and can be sold at speeds of "up to" 20 or 24 Mbit/s. ADSL equipment with a speed threshold of 28 Mbit/s is also available in certain markets. DOCSIS 2.0 and EuroDOCSIS 2.0 have theoretical maximum downstream speeds of ~40 and ~50 Mbit/s respectively. However, as cable access networks are shared, headline speeds for end user subscribers are typically less than the theoretical maximum.

DOCSIS 3.0 can support speeds of up to 50 Mbit/s or up to 120 Mbit/s using standard configurations and double that when using additional techniques. FTTH has the possibility of going far beyond 100 Mbit/s, but is often sold in the 30 Mbit/s to 100 Mbit/s range. By introducing the 30 Mbit/s category, the more advanced offers are arguably captured and better distinguished from previous generation technologies. In discussions with member countries, there was at least one instance where data was collected using a threshold of 25 Mbit/s rather than 30 Mbit/s. Recognising that advertised speeds can be a rough approximation of actual throughput and that it is often preferable to have the data than not, it is proposed that 25 Mbit/s be included in these cases. It is expected that data for most countries will use the 30 Mbit/s threshold, but data for the OECD member(s) that collect speeds at 25 Mbit/s instead will be included.

At a minimum, these speed tiers would categorise subscription data, but ideally coverage data according to these speed tiers would also be reported.

Table 2.2 Proposed Speed Tiers

Fixed (wired) broadband by speed	
256 kbit/s to less than 1.5/2 Mbit/s	Fixed (wired) broadband Internet connections with advertised downstream speeds equal to, or greater than, 256 kbit/s and less than 1.5/2 Mbit/s.
1.5/2 Mbit/s to less than 10 Mbit/s	Fixed (wired) broadband Internet connections with advertised downstream speeds equal to, or greater than, 1.5/2 Mbit/s and less than 10 Mbit/s.
10 Mbit/s to less than 25/30 Mbit/s	Fixed (wired) broadband Internet connections with advertised downstream speeds equal to, or greater than, 10 Mbit/s and less than 25/30 Mbit/s.
25/30 Mbit/s to less than 100 Mbit/s	Fixed (wired) broadband Internet connections with advertised downstream speeds equal to, or greater than, 25/30 Mbit/s and less than 100 Mbit/s.
100 Mbit/s to less than 1Gbit/s	Fixed (wired) broadband Internet connections with advertised downstream speeds equal to, or greater than, 100 Mbit/s and less than 1 Gbit/s.
Above 1Gbit/s	Fixed (wired) broadband Internet connections with advertised downstream speeds equal to, or greater than, 1 Gbit/s.

Additional Background:

Canadian Radio-television and Telecommunications Commission (2011) Communications Monitoring Report 2011, Table 5.3.3

http://www.crtc.gc.ca/eng/publications/reports/PolicyMonitoring/2011/cmr5.htm#t533

European Commission Communications Committee (2011), Broadband Access in the EU: Situation at July 1, 2011,

http://ec.europa.eu/information_society/digital- agenda/scoreboard/pillars/broadband/index_en.htm

FCC/NTIA (2012) Broadband Statistics Report: Access to Broadband Technology by Speed, FCC/NTIA, Washington DC.

http://www.broadbandmap.gov/download/Technology%20by%20Speed%20JUNE%202011.pdf,

FCC (2011), Internet Access Services: Status as of December 31, 2010, Wireline Competition Bureau, Washington DC, http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-310261A1.pdf, p. 22.

ITU (2010), Definitions of World Telecommunication/ICT Indicators, ITU, Geneva, www.itu.int/ITU-D/ict/handbook.html.

ITU (2011), Measuring the Information Societ 2011, ITU, Geneva, http://www.itu.int/ITU-D/ict/publications/idi/index.html.

3 – Definition of Next Generation Access

Proposal

3.1 That for the purposes of current data collection efforts, Next Generation Access be defined as specified in Section 3, with focus on FTTP, FTTC, and DOCSIS 3.0. technologies.

Background/Summary:

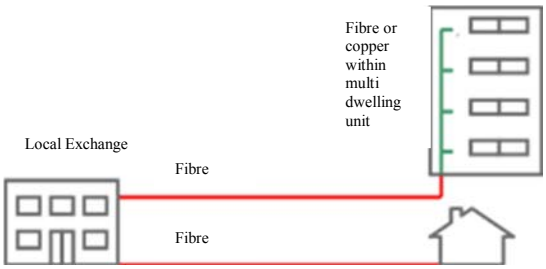
The terms "next generation network" (NGN) or "next generation access" (NGA) can be associated with a variety of attributes. The term is generally used to depict the shift to higher network speeds using broadband, the migration from the PSTN to an IP-network, and a greater integration of services on a single network. From a more technical point of view, the ITU defines NGN as a "packet based network able to provide services including telecommunication services and able to make use of multiple broadband, QoS-enabled transport technologies and in which service related functions are independent from underlying transport-related technologies."[15] While there is often a preference for technological neutrality, it is also typical that the characterisation includes some explicit or at least implicit deployment of fibre optics to some extent.[16]

A distinction can be made between next generation "core" networks which concern the backbone and aggregation elements of the network, and next generation access networks which involve upgrades to the local loop. The focus of this section is on next generation access.

NGA networks correspond mostly to the following 3 categories of technology:

- fibre to the premises (FTTP)
- fibre to the cabinet (FTTC)
- cable TV networks (DOCSIS 3.0 and above) standard

Main characteristics are:



FTTP is provided via fibre deployments to individual (usually residential) premises.

Optical network architectures may be broadly divided into:

15 OECD (2008), Convergence and Next Generation Networks, Ministerial Background Report, DSTI/ICCP/CISP(2007)2/FINAL, http://www.oecd.org/dataoecd/25/11/40761101.pdf., p.9

16 See for example ibid and OECD (2011), "Next Generation Access Networks and Market Structure", OECD Digital Economy Papers, No. 183, OECD Publishing. http://dx.doi.org/10.1787/5kg9qgnr866g-en, p. 14, 65.

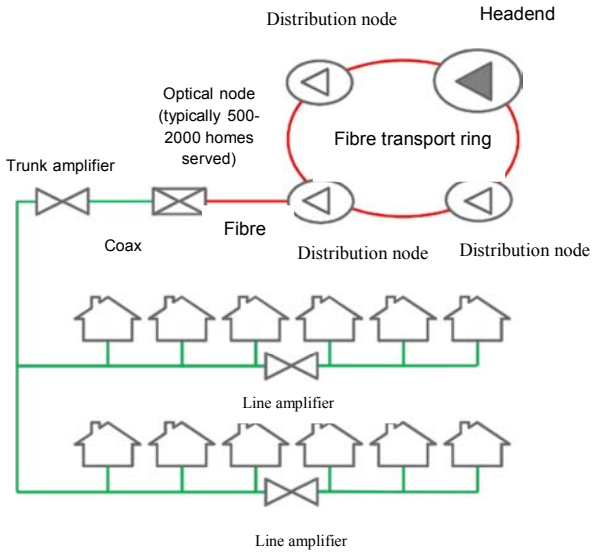
- PTP active networks (usually Ethernet-based), in which separate fibres run from the local exchange or street cabinet directly to each customer
- PONs which incorporate passive splitters to create a tree-and-branch structure

FTTP is regarded as a 'future-proof' solution designed for high-bandwidth services, including video. Besides its high speed, its strengths include increased geographical coverage and lower maintenance costs than copper networks, and performance that is less affected by distance from the exchange

FTTC is provided via fibre deployments to a street cabinet with copper sub-loops, usually running very high bitrate digital subscriber line version 2 (VDSL2) for the final drop.

VDSL2 offers significantly higher maximum speeds than ADSL2+ over short distances (up to around 1000m) and equivalent performance over distances in excess of around 1500m. In practice most commercial FTTC/VDSL deployments are aiming for maximum copper sub-loop lengths of around 500m which means that the vast majority of end users benefit from next-generation broadband speeds.

Provision of triple-play services (including video) is the main driver behind the deployment of FTTC.



Cable Internet is provided via cable television infrastructure using DOCSIS technology, which was developed by CableLabs. The ITU-T has also approved various versions of DOCSIS as international standards.

Modern cable networks are based on a hybrid fibre coaxial (HFC) architecture with the premises on a co-axial bus which may incorporate line amplifiers to maintain adequate signal levels along its length.

The depth to which fibre penetrates the cable network varies between operators but for high-speed broadband each co-axial tree will typically pass 500-2000 homes (only a minority of which may subscribe), located within around 500m of the optical node which forms the interface between the fibre and coaxial media. Cable carriers are increasingly moving towards fewer homes passed per node. e.g Vidéotron in Canada started moving to 125 – 250 HH/node in 2008.[17]

By upgrading to DOCSIS 3.0/EuroDOCSIS 3.0 along with other enhancements, operators can offer significantly higher speeds and is thus considered an NGA.[18]

As with FTTC and FTTP, the deployment of cable Internet is driven by the desire to offer triple-play services

Analysis:

3.1 Definition of Next Generation Access

For the purposes of data collection, it is proposed that NGA networks be considered access networks which consist wholly or in part of optical elements and which are capable of delivering broadband access services with enhanced characteristics (such as higher throughput) as compared to those provided over existing copper network, supporting a multitude of advanced digital converged services. Therefore, NGA networks are at the current stage of market and technological development for fibre-based or advanced upgraded cable networks (using at least 'DOCSIS 3.0' cable modem standard) and above. Similar definitions are used in EU legislative documents such as the NGA Recommendation and the Guidelines on the use of state aid for broadband.[19] It is recommended that data be collected in relation to the rollout (houses passed) and the take up of the access networks identified above (FTTP, FTTC, cable DOCSIS 3.0).

In principle, NGA could include wireless. However, the current constraints of wireless technologies result in them being more complements to FTTP/FTTC/DOCSIS 3.0 rather than substitutes. As a result, for the purposes of data collection, it is recommended that the analysis focus on the three wired technologies. In the future, this approach could be modified should wireless technologies evolve to the point where they can act as substitutes. This does not preclude data on terrestrial wireless from being collected, as is contemplated in Section 4 on Technology Categories.

Additional Background:

Chung, H. (2010), "Developments in Cable Broadband Networks", OECD Digital Economy Papers, No. 170, OECD Publishing. http://dx.doi.org/10.1787/5kmh7b0s68g5-en,

17 Jeff Baumgartner, "Videotron Plants 'Fiber Deep'" Light Reading (July 24, 2008) http://www.lightreading.com/document.asp?doc_id=159499&site=lr_cable. In some cases, operators are moving to less than 100 HH/node, Chung, H. (2010), "Developments in Cable Broadband Networks", OECD Digital Economy Papers, No. 170, OECD Publishing. http://dx.doi.org/10.1787/5kmh7b0s68g5-en, p 18. and FCC (2010), OBI Technical Paper No 1, http://download.broadband.gov/plan/the-broadband-availability-gap-obi-technical-paper-no-1- chapter-4-network-economics.pdf, p. 106

18 For discussion of speeds enabled by DOCSIS 3.0, see Chung, H. (2010), p. 30.

19 EC (2009), "Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband networks," Official Journal of the European Union (2009/C 235/04), 52- 54 and EC (2010), "Commission Recommendation of 20 September 2010 on regulated access to Next Generation Access Networks (NGA)," Official Journal of the European Union (2010/572/EU)

EC (2009), "Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband networks," Official Journal of the European Union (2009/C235/04). http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52009XC0930(02):EN:NOT

EC (2010), "Commission Recommendation of 20 September 2010 on regulated access to Next Generation Access Networks (NGA)," Official Journal of the European Union (2010/572/EU), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32010H0572:EN:NOT

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FCC (2010), The Broadband Availability Gap, OBI Technical Paper No 1, http://download.broadband.gov/plan/the-broadband-availability-gap-obi-technical-paper-no-1-chapter-4-network-economics.pdf, p. 106.

OECD (2008), "Convergence and Next Generation Networks," Ministerial Background Report, DSTI/ICCP/CISP(2007)2/FINAL, http://www.oecd.org/dataoecd/25/11/40761101.pdf.,

OECD (2011), "Next Generation Access Networks and Market Structure", OECD Digital Economy Papers, No. 183, OECD Publishing. http://dx.doi.org/10.1787/5kg9qgnr866g-en

4 – Technology Categories Of Broadband

Proposal

4.1 That in addition to existing technologies, wireline data be collected for FTTC and DOCSIS 3.0 technologies.

4.2 That data be collected for the following mobile wireless technologies: 3G/UMTS, EV-DO, HSPA, HSPA+, WiMAX, LTE.

4.3 That the OECD collect data on the number of machine-to-machine (M2M) connections.

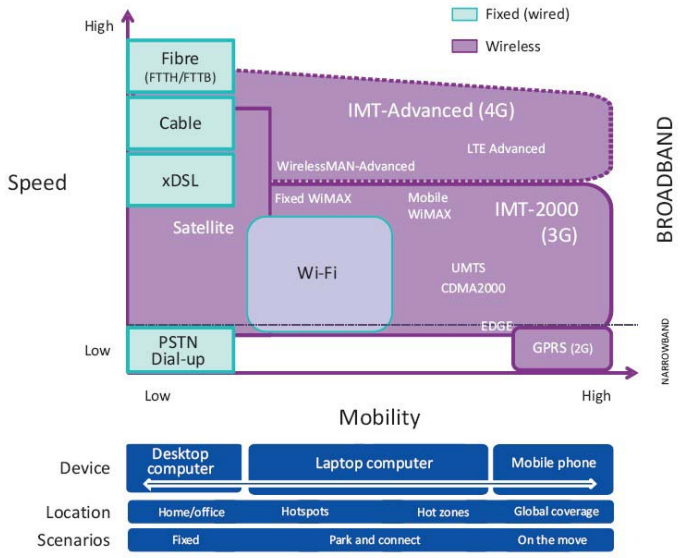
Background/Summary

A particular country's technology development of broadband depends on the existing level of its infrastructure. Countries without much PSTN or CATV network find it difficult to deploy ubiquitous fixed broadband networks, but they may be more comfortable with upgrading the existing wireless networks. Countries would find it financially more attractive to leverage the existing network through upgrades and evolution than to deploy the latest state-of-the-art technology by building acompletely new network.

Although technologies determine the evolutionary path of broadband deployment, it is a supply side variable and other indicators are important to show the status of broadband market. The OECD has identified five main categories which are important for assessing broadband markets. They are penetration, usage, coverage, prices, and services and speeds. Among these five main categories, data on penetration, coverage, and speeds are collected for different broadband technologies. Currently, the OECD has categorised broadband subscribers by four fixed broadband technologies and four wireless broadband technologies. Four fixed broadband technologies are DSL, cable modem, fiber+LAN, and others. Four wireless broadband technologies include satellite, fixed terrestrial, standard mobile and dedicated data.

Figure 4.1 below provides a general overview of fixed and wireless broadband technologies at various speeds and mobility. Generally, fixed broadband technologies offer higher speeds, while wireless broadband technologies offer higher mobility.

Figure 4.1 Broadband technology-speed versus mobility[20]



In Korea, FTTH, FTTB and LAN installations reached over 55% of broadband subscriptions in 2010. All the broadband connection in Korea was over 2Mbit/s and more than 95% of broadband subscribers were offered over 10Mbit/s. The fastest broadband speed by the incumbent telecommunication operator in 2010 was 102 Mbit/s. Every major carrier is running LTE, with LG Telecom's U+ and SK Telecom having launched last year and KT launched this year. Korea plans to commercialise the 1Gbit/s internet which makes internet connections 10 times faster than existing 100Mbit/s. The pilot project is underway with a participation of 5 consortiums led by 3 major telecommunications service operators and 2 major CATV service providers.

If planned investments in fixed and wireless infrastructure are realised, the speed and quality of broadband service will be significantly enhanced in Korea. Many developed countries will follow Korea's deployment of faster broadband and there will be a greater need to have data collection that is able to reflect the market evolution.

Analysis

4.1 New Wireline Categories: FTTC/VDSL and DOCSIS 3.0

Technology categories are used as proxies for speed and quality of broadband access. While some new wireless technologies promise higher speeds equal to those delivered over fixed broadband and some xDSL, cable modem technologies offer speeds up to the level comparable to FTTH. When a particular technology offers a significantly higher speed than other technologies in the same technology category, it would be better to collect the data separately to rightly indicate the current state of broadband market. In addition to downstream speed, one can make inferences of other performance characteristics such as potential upstream speed. Collecting data by technology also provides insight on the state of intermodal competition between rival networks.

20 ITU (2011), Measuring the Information Society, ITU, Geneva. http://www.itu.int/ITU-D/ict/publications/idi/index.html

DSL technologies have evolved to accommodate higher speeds. According to ITU, ADSL 2, ADSL 2+, VDSL, VDSL2 provide downstream speed of 8 Mbit/s, 16 Mbit/s, 52 Mbit/s and 100 Mbit/s, respectively.[21] Operators have been building fibre-optics deeper into their networks to the street cabinet or node, often in conjunction with VDSL2 equipment. As DSL equipment is quite distance sensitive, these fibre-to-the-cabinet (FTTC) deployments are very important for improving service speeds.[22] Further technological enhancements are available by bonding multiple lines and/or incorporating new techniques such as "vectoring".

Cable modem technologies have also been enhanced in terms of speeds. Data over Cable Service Interface specification (DOCSIS) was first introduced in 1997 at the connection speed of 10Mbit/s and recently developed to increase the speed to 145 Mbit/s for DOCSIS 3.0 and 200 Mbit/s for EuroDOCSIS 3.0.

Per section 3, FTTC, DOCSIS 3.0, and FTTP are considered Next Generation Access (NGA) technologies. It is recommended that data on FTTC/VDSL and DOCSIS 3.0 also be reported.

Although different technology categories for broadband have the potential to offer the highest speeds available, the actual speeds might possibly be lower than the estimated highest speeds depending on commercial offers and user needs. It would be desirable to collect data on recently emerging high speed technology category such as VDSL2, DOCSIS 3.0 with actual average speeds. This issue is further discussed in Section 5.

An alternative option to consider is to leave current technology categories as they are and collect the data for broadband services for each category with the breakdown of the advertised or actual speeds. ITU currently collects fixed broadband subscription by three speed categories: between 256 kbit/s and 2 Mbit/s, between 2 Mbit/s and 10 Mbit/s, and over 10 Mbit/s. We might consider adding 30 Mbit/s and 100 Mbit/s as an additional threshold for broadband speeds for DSL and cable modem technology. In practice, there is less practical difference between reporting data based on cable connections at speeds of 30 Mbit/s and above or DSL connections at speeds of 30 Mbit/s and above. However, there are still some "current generation" technologies with advertised speeds of 30 Mbit/s (e.g. using EuroDOCSIS 2.0) suggesting that it would be useful to identify the specific underlying technology if possible. This provides a better picture of the connection's overall capabilities.

4.2 Mobile Wireless Technology Categories

Measuring subscriptions by technology can be challenging as handsets have multiple radio technologies and operate at different speeds depending on the coverage and network conditions. As users are mobile this can change. It is possible that subscription data may become sufficiently refined as to be useful, but at a minimum, deployment data would help assess the relative investments in mobile wireless and technological development.

Given the proliferation of different technologies, technological evolution over time, and different deployment choices by operators across OECD countries, a challenge is selecting a representative number

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21 Note that other variants of ADSL exist with different theoretical peak downstream speeds. For example, ADSL2+ with a maximum of 24 Mbit/s is common.

22 Moreover, VDSL2 and vectoring have enhanced performance over relatively short distances, but the performance declines to be roughly equivalent with ADSL2+ over longer distances.

of technologies while minimising administrative burden. An overview of the development of mobile broadband technology families is outlined below.[23]

3GPP - GSM family		
Name	**Theoretical Peak Downstream Speed**[24]	**Notes**
UMTS	384 kbit/s	First 3G standard, commonly collected as 3G minimum baseline
HSPA	1.2 - 14.4 Mbit/s (commonly 3.6 and 7.2 Mbit/s)	Includes HSDPA and HSUPA
HSPA+	21 Mbit/s to 84 Mbit/s and above	Also known as Evolved HSPA
LTE	150 Mbit/s	
LTE-Advanced	1 Gbit/s	Not yet commercially available

3GPP2 - CDMA2000 family		
Name	**Theoretical Peak Downstream Speed**	**Notes**
CDMA 1x RTT	153 kbit/s	Sometimes debated as to whether it should be considered 3G or variant of 2G
EV-DO	3.1 Mbit/s	Popular deployment for CDMA 2000 operators
EV-DO Rev B.	14.7 Mbit/s	Has some support but North American CDMA 2000 operators have typically migrated to HSPA+ and/or LTE.

IEEE 802.16 - WiMAX		
Name	**Theoretical Peak Downstream Speed**	**Notes**
802.16e WiMAX	37 Mbit/s[25]	
802.16m WiMAX-Advanced	1 Gbit/s	Not yet commercially available

23 For further detail see OECD (2010), "Mobile Communication Developments in the OECD Area," DSTI/ICCP/CISP(2010)3/FINAL http://www.oecd.org/dataoecd/22/59/48459973.pdf, and 4G Americas (2011), "3GPP Release 10 and Beyond - HSPA+ SAE/LTE and LTE-Advanced," 4G Americas White Paper, http://www.4gamericas.org/documents/4G%20Americas_3GPP_Rel-10_Beyond_2.1.11%20.pdf

24 These tables cite speeds of common implementations but are not exhaustive. Note that each technology is often subject to multiple implementations which can have different theoretical peak downstream speeds. Peak downstream speeds can also vary depending on the amount of spectrum used and the devices available. Actual speeds are also typically much lower than the theoretical maximum and are affected by a variety of factors.

25 WiMAX Forum (2010), "WiMAX and the IEEE 802.16m Air Interface Standard," http://www.wimaxforum.org/sites/wimaxforum.org/files/document_library/wimax_802.16m.pdf

Besides the GSM family of technologies, particularly UMTS and HSPA, there are significant deployments of CDMA2000 and WiMAX in certain countries. As operators transition to faster speeds, there are meaningful and growing deployments of HSPA+ and LTE.[26]

Data on these technologies is already reported in many jurisdictions, with governments focusing on the technologies that are most relevant to their markets. The European Commission reports data for 3G/UMTS (i.e. at least 384 kbit/s) and HSPA (more specifically HSDPA though the category HSPA encompasses both HSDPA and the subsequent release which includes HSUPA). The United States Federal Communications Commission collects data on HSPA, EV-DO, and WiMAX. Canada's telecommunications regulator, the CRTC, reports data as 3G and 3G-equivalent (UMTS, CDMA2000, and above), HSPA+ at speeds of 21 Mbit/s, and will begin reporting data on LTE coverage in 2012.

Data on some or all of these technologies are already collected to some extent by OECD countries:

- 3G/UMTS
- HSPA (Theoretical peak downstream speeds from 1.2 - 14 Mbit/s)
- HSPA+ (Speeds of 21 - 84 Mbit/s+)
- EVDO
- WiMAX
- LTE

The London Workshop is therefore invited to endorse the proposal that the above data on the above technologies be reported. UMTS may not be necessary as most operators have upgraded to HSPA, but it is often used as a baseline. Delegations will eventually want to consider measuring LTE-Advanced and WiMAX-Advanced deployments once they are commercially introduced.

Categories could be organised according to the ITU's IMT-2000 (3G) or IMT-Advanced (4G) specifications. Terms such as 3G+ or 3.5G are also used to report this data, typically in reference to HSPA or EVDO. The OECD currently collects data on 3G network coverage. However, these terms can be subject to conflicting interpretations, particularly for the classification of 4G. To some, arguably only LTE-Advanced and WiMAX-Advanced meet the definition of 4G. Some will extend the definition to current LTE, but exclude HSPA+ and WiMAX. Others will include these latter two technologies as well. A further challenge is the wide range in performance of 3G technologies. The early 3G standard UMTS had peak theoretical speed of 384 kbit/s while newer variants of HSPA have theoretical maximum extending to 84 Mbit/s and beyond although these are commonly marketed as 4G and where one draws the line is subject to debate.

An alternative option in the interest of administrative simplicity would be to report 3G and 3G+ which may be less contested, and then HSPA+, WiMAX, and LTE individually for the OECD member states of which there is data available.

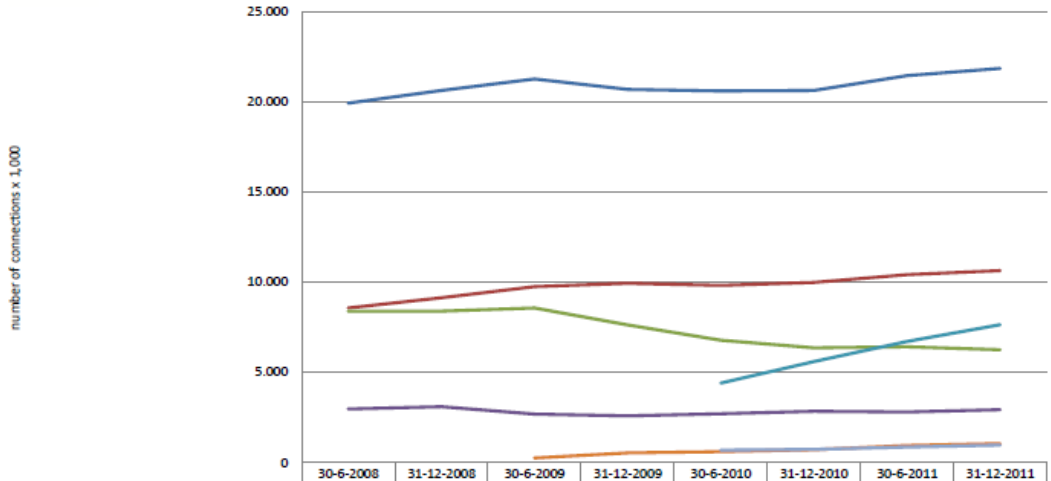
[26] The Global mobile Suppliers Association (GSA) reports that as of January 2012, 187 HSPA+ networks had been commercially launched (41% of HSPA networks). Forty-nine LTE networks had been commercially launched with firm commitments for 226 in total. GSA (2012), "GSM/3G Market/Technology Update," February 7, 2012. http://www.gsacom.com/gsm_3g/info_papers.php4.

4.3 Machine-to-machine (M2M) Connections

The use of machine-to-machine connections is an emerging trend for mobile wireless networks. Proliferation of M2M may lead to a dramatic proliferation of devices, with some estimates suggesting a tenfold increase.[27] Certain regulatory authorities have begun reporting these types of connections. For example, in the Netherlands, the Dutch regulatory authority (OPTA) has also started to report these data using the term M2M (see below).

M2M connections have different characteristics from traditional cellular mobile subscriptions. It is increasingly important to have comparable data tracking the evolution of this phenomenon. As such, it is recommended that the OECD begin collecting data on the number of M2M connections.

Figure 4.2 OPTA – Number of Retail Mobile Connections Including M2M[28]



	30-6-2008	31-12-2008	30-6-2009	31-12-2009	30-6-2010	31-12-2010	30-6-2011	31-12-2011
Total	19.927	20.627	21.267	20.682	20.599	20.627	21.453	21.848
Postpaid MNO	8.565	9.139	9.750	9.934	9.825	9.983	10.421	10.644
Prepaid MNO	8.391	8.393	8.573	7.628	6.784	6.357	6.423	6.252
Connections MVNO	2.971	3.095	2.688	2.587	2.702	2.839	2.805	2.933
Connections with mobile broadband					4.410	5.602	6.711	7.646
Dedicated mobile broadband connections			255	533	600	712	943	1.053
M2M					688	736	861	965

Additional Background:

4G Americas (2011), "3GPP Release 10 and Beyond - HSPA+ SAE/LTE and LTE-Advanced," 4G Americas White Paper

http://www.4gamericas.org/documents/4G%20Americas_3GPP_Rel-10_Beyond_2.1.11%20.pdf

4G Americas (2011a), "The Evolution of HSPA," 4G Americas White Paper, http://www.4gamericas.org/documents/4G%20Americas%20White%20Paper_The%20Evolution%20of%20HSPA_October%202011x.pdf

27 OECD (2012), "Machine-to-Machine Communications: Connecting Billions of Devices", OECD Digital Economy Papers, No. 192, OECD Publishing. http://dx.doi.org/10.1787/5k9gsh2gp043-en.

28 OPTA (2012), "Public report mobile Q4 2011," Market figures for the fourth quarter of 2011.https://www.opta.nl/en/news/all-publications/publication/?id=3585

EC (2011), Monitoring fast and ultra-fast Internet access, EC, Brussels, http://ec.europa.eu/information_society/digital-agenda/scoreboard/pillars/broadband/index_en.htm

FCC (2011), Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993

Annual Report and Analysis of Competitive Market Conditions with Respect to Mobile Wireless, Including Commercial Mobile Services, FCC, Washington DC, http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-11-103A1.pdf

ITU (2011), Measuring the Information Societ 2011, ITU, Geneva, http://www.itu.int/ITU-D/ict/publications/idi/index.html .

IDATE (2011), Broadband Coverage in Europe 2010, Report for the European Commission, http://ec.europa.eu/information_society/digital-agenda/scoreboard/docs/pillar/broadband_coverage_2010.pdf

OECD (2010), "Mobile Communication Developments in the OECD Area," Working Party on Communication, Infrastructures and Services Policy, DSTI/ICCP/CISP(2010)3/FINAL http://www.oecd.org/dataoecd/22/59/48459973.pdf,

OECD (2012), "Machine-to-Machine Communications: Connecting Billions of Devices", OECD Digital Economy Papers, No. 192, OECD Publishing. http://dx.doi.org/10.1787/5k9gsh2gp043-en.

Ofcom (2011), International Comunications Monitoring Report, Ofcom, London, http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr11/icmr/ICMR2011.pdf

OPTA (2012), "Public report mobile Q4 2011," Market figures for the fourth quarter of 2011. https://www.opta.nl/en/news/all-publications/publication/?id=3585

WiMAX Forum (2010), WiMAX and the IEEE 802.16m Air Interface Standard, http://www.wimaxforum.org/sites/wimaxforum.org/files/document_library/wimax_802.16m.pdf

5 – Other

Proposal

5.1 Subject to the recommendations from Rapporteur Group 2 – Infrastructure and supply metrics: Measuring deployment and performance of broadband networks, that the OECD and country delegations continue to explore the use of data from broadband performance testing tools such as online speed tests, in addition to the data outlined above.

Background/Summary

There is considerable interest in the use of broadband performance measurement tools/speed tests to augment the data collection discussed in the previous sections. The advantage of such tools may be to keep pace with technological and commercial developments. Members of Rapporteur Group 1 identified a number of interesting potential applications of these tests:

- Inform a decision to raise the baseline for broadband once the proportion of users reached a specified amount (e.g. if X% of users experienced actual speeds above a certain level it is reasonable to consider this is consistent with their understanding and expectations for what the term broadband means).
- Report a metric, which compares the actual speeds experienced to the speed tiers identified in Section 2.
- Compare actual speeds experienced across different geographic regions (e.g. major cities, medium cities, small towns).
- Report on the actual speeds experienced by different technologies such as FTTC, DOCSIS 3.0, and FTTP.
- Track the performance of business broadband connections

Analysis:

While the popular online tools available provide interesting data, they are typically not able to control a number of important factors such as the quality of the local network. Self-selected tests can also result in unrepresentative samples sensitive to technical aspects of the testing methodology. A number of countries have measurement projects in place that are sufficiently rigorous to have a statistically representative sample and a hardware- based testing mechanism that controls for important confounding factors. These hardware based tests require non trivial financial support and may not be sufficiently deployed across the OECD. Rapporteur Group 2 of the London workshop is specifically mandated with examining the use of broadband performance measurement. However, these tools are still promising and can provide useful data. As a result, subject to the recommendations of Rapporteur Group 2, the London Workshop is invited to endorse the proposal that the OECD continue to explore the potential use of data from broadband performance measurement tools to complement the data collection efforts outlined above.

Additional Background:

Bauer, S., Clark, D., and Lehr, W. (2010), Understanding Broadband Speed Measurements, http://mitas.csail.mit.edu/papers/Bauer_Clark_Lehr_Broadband_Speed_Measurements.pdf

FCC (2011), Measuring Broadband America, FCC, Washington DC, http://transition.fcc.gov/cgb/measuringbroadbandreport/Measuring_U.S._-_Main_Report_Full.pdf

Ofcom (2011), UK fixed-line broadband performance, November 2011, Ofcom, London, http://stakeholders.ofcom.org.uk/binaries/research/broadband-research/Fixed_bb_speeds_Nov_2011.pdf

Table 1. Table summarising Broadband reporting by speed tiers for OECD countries

	Australia	Austria	Belgium	Canada	Chile	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Iceland	Ireland	Israel	Italy	Japan	Korea	Luxembourg	Mexico	Netherlands	New Zealand	Norway	Poland	Portugal	Slovak Republic	Slovenia	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States	European Commission
<56 Kbps					x																														
56-128 Kbps					x																														
Less than 256kbps	x			x(4)																															
128-256 Kbps					x																														
256-512 Kbps					x																											x(30)			
512 Kbps-1 Mbps					x																														
Less than 1.5 Mbps	x																																		
1-2 Mbps					x										x										x										
<2 Mbps			x				x(8)		x		x	x		x	x		x(11)					x(12)	x(13)			x(21)	x	x	x(24)	x	x	x(31)	x	x(37)	x
>2 Mbps								x					x			x								x											
2-10 Mbps	x(1)		x	x(5)	x		x(9)				x	x		x	x		x					x	x(14)		x	x	x	x	x(25)	x	x	x(32)	x(34)	x(38)	x
>10 Mbps						x		x				x	x	x	x		x							x (17)		x	x	x		x		x(33)		x(39)	
10-30 Mbps	x(2)		x	x(6)			x		x		x											x	x(15)		x(19)	x(22)	x		x(26)	x	x(28)		x(35)	x (40)	x
30-100 Mbps	x(3)		x	x(7)			x(10)		x		x											x	x(16)		x(20)	x(23)	x		x(27)	x	x(29)		x(36)	x (41)	x
>100 Mbps	x			x				x	x		x											x		x (18)		x	x		x	x			x	x
100Mbps-1 Gbps					x																														
>1 Gbps					x																														
Broadband Subscriptions/penetration reporting available for:																																			
Business only	x														x									x				x							
Residential only	x			x											x									x				x				x	x		
No breakdown between Bus/Res available					x				x	x		x	x	x		x	x	x	x		x		x		x	x	x	x				x			x
Upload speeds provided?	no			x	no				no	no		no		no	no		no	no	no		no		x	no	no	no	no	no	no			no	no	yes	no

Legend:

Notes:

No breakdown available

X No breakdown available, but speed tiers provided in the OECD Communications Outlook 2011 questionnaire.

X Do not match very well - see notes below

This file is also available in Excel format on the CISP Clearspace website under item 9 of the CISP Agenda.

Australia: (1) 1.5Mbps to less than 8Mbps; (2) 8Mbps to less than 24Mbps; (3) 24Mbps to less than 100Mbps

Canada: (4) Lite and wideband up to 256 Kbps; (5) 1.5 to 4.9 Mbps / 5 to 9.9 Mbps; (6) 10 to 15.9 Mbps / 16 to 24.9 Mbps / 25 to 29.9 Mbps; (7) 24.9 to 29.9 Mbps / 30 to 49.9 Mbps / 50 to 99.9 Mbps

Denmark: (8) At least 144 kbit/s, below 4 Mbit/s; (9) At least 4 Mbit/s, below 10 Mbit/s; (10) At least 30 Mbit/s, below 50 Mbit/s + At least 50 Mbit/s

Italy: (11) 144 Kbps-2 Mbps

Netherlands: (12) OPTA (2011c) Structurele, Monitoring Markten – breedband – rapportages Q2 2011, oktober 2011

New Zealand: (13) less than 1.5Mbps; (14) 1.5Mbps to less than 8Mbps; (15) 8Mbps to less than 24Mbps; (16) more than 24Mbps

Norway: (17) greater than 8 Mbit; (18) greater than 128Mbit

Poland: (19) 10-19,99 Mbit/s / 20-29,99 Mbit/s; (20) more than 30Mbit/s

Portugal: (21) 144 Kbps - 2 Mbps; (22) 10 - 20 Mbps / 20 - 30 Mbps; (23) 30 - 50 Mbps / 50 - 100 Mbps

Spain: (24) < 3 Mbps; (25) 10-20 mbps; (26) 20-50 Mbps / > 50 Mbps; (27) 20-50 Mbps / > 50 Mbps Switzerland: (28) >= 10Mbit/s et < 100 Mbit/s; (29) >= 10Mbit/s et < 100 Mbit/s

Turkey: (30) <512 Kbps; (31) 1 Mbps / 2 Mbps; (32) 1 Mbps / 2 Mbps / 4 Mbps / 8 Mbps; (33) >8 Mbps

United Kingdom: (34) < 8/10 Mbps ; (35) < 20/24 Mbps ; (36) > 24 Mbps

United States: (37) 200Kbps - 1.5 Mbps; (38) 1.5-10 Mbps; (39) >6 Mbps; (40) 10-25 Mbps; (41) 25-100 Mbps

ANNEX 3

Workshop Session 2: Infrastructure and supply metrics: Measuring deployment and performance of broadband networks

Rapporteur Group Members:

Ian Macrae (Ofcom, UK)
Pat Brogan (US Telecom, USA)
Mike Byrne (FCC, US)
Tim Johnson (Point Topic, UK)
Nori Sugira (MIC, Japan)
Frederic Bourassa (OECD)
Sam Paltridge (OECD)

Session objectives:

(1) To agree on recommendations for the collection of broadband deployment data

(2) To agree on the most appropriate metrics for measuring the performance of broadband networks

Broadband availability metrics

I. Purpose and Scope of Metrics

a) Data on the geographical availability of broadband services is essential for policy making and valuable for various commercial applications.

b) Availability data needs to show what levels of broadband service are available to homes and businesses.

c) The availability landscape is very complicated and requires multiple variables at multiple scales in order to truly explain its complexities. Availability data needs to show variations between regions within countries as well as for countries as a whole.

d) Mapping is useful for many metrics, not just availability. While the scope of this effort speaks to availability mapping, mapping is appropriate for any number of metrics including those that may be outside our immediate scope (e.g. adoption, penetration, etc).

II. Current Metrics

a) Current metrics of availability often include, but are not limited to, the name of the service provider for a given location, the technology of the service provided, the advertised upload and download speeds of the service provided, and combinations of the technology/speeds offered.

b) In some countries/regions only a single or small set of national providers exit, in others a more complicated array of providers, conglomerates, multi-national and/or local carriers offer services.

c) Individual services are usually defined by fixed technology (e.g. ADSL, VDSL, FTTP, Standard Cable, Docsis 3 Cable, Fixed Wireless etc.) and mobile (e.g. HSPA, 4G etc.).

d) Most of these technologies have variation in the offered or advertised up and down speeds available to customers. Understanding the speed footprint is fundamental to policy making.

e) Coverage can also be defined by "technology combinations". These can show the net coverage (that is after overlapping has been taken into account) of technologies that provide a comparable level of service. For example, a technology combination which aimed to show the coverage of fixed broadband services able to provide 25 Mbps or more is the combination of VDSL, FTTP and Docsis 3.

f) The geographic dimension of the metrics is varied. Many regulators and other public bodies collect, and often publish, data according to administrative geographies, ranging from regions or provinces through municipalities and counties down to census output areas. Communications providers have their own unique geographies, based on exchange areas, network footprints and signal strengths. Marketing organisations use different geographies again, often based on postal sectors.

g) It is common for the metrics discussed above to be expressed in terms of the percentage of the population or premises (homes and/or businesses) able to receive broadband services.

h) Providers, technologies, and speeds are already collected at the national level by OECD.

III. Observations

a) It is not sufficient to simply track "broadband" availability based on a single definition of what constitutes broadband. We do need to define and track the changing range of products within broadband. Each country and operator will have its own definitions, but ideally these would be expressed in terms of a standard set of parameters (principally, technology and performance characteristics such as upstream speeds) which would allow a reasonable level of comparability.

b) The essential geographic unit of collection, from the point of view of the OECD and other public bodies, has to be administrative (e.g. prefectural, departments, county, etc). Administrative units allow for the incorporation of demographic and other policy based information to further visualise variation in the landscape.

i. The US's effort in the National Broadband Map has states collecting data at the smallest census unit, a geography of about 400 to 600 people, and then providing that data to the federal government.

ii. For the European Union, Point Topic, is now completing a project to map broadband availability by NUTS 3.[29]

These experiences show that, in order to ensure consistency in data collection across all entities, effective tools for data integration and cross checking to aggregate geography is required. A successful effort would be one where each individual nation performs its own collection, at a sufficiently fine scale resolution and OECD integrates the data to an aggregate geography.

c) A key issue for decision-making, as far as broadband mapping is concerned, is the segmentation of geographies into urban, semi-urban and rural areas. These are now generally defined in terms of population density, which is the single most important variable as far as the economics of broadband deployment is concerned. Commonly accepted and reasonably precise statistics for density by geography are not yet available and are greatly needed – for any infrastructure developments, not just broadband.

d) The availability of data on broadband coverage varies hugely and it is often provided only under restricted conditions. Gathering it is a major task for both researchers and providers. The various data-seeking bodies need to co-operate to avoid repeated requests to data providers for the same or similar information. For example, many of the national regulatory authorities in Europe are now producing good broadband coverage data which needs to be used rather than replicated.

e) Use Case / Function – Mapping does not serve a purpose in and of itself; it is put into place to help the policy goals of the program. Use cases or functions for the map are then illustrated as a part of the common goal of the program. Typically, we see several key use cases for Internet based mapping.

i. Policy User – The policy user is investigating the data in order to understand the context for policymaking or the impact of a policy. They want to understand the landscape such that the identification of a new policy might be illustrated by current patterns in the data as seen in the map. Additionally, maps can be used to aid in the communications strategy around a new policy directive (e.g. "this new directive will have this impact on these geographies"). Often the scale of the policy user is very small such as at national level.

ii. Consumer User – The consumer wants to better understand what is happening to her. She wants to know what is available to her at what benefit and at what cost. The consumer user wants the ability in a map to compare locations across metrics. Often the consumer user wants information at a very local level in order to understand what is going on at their address or town.

iii. The Developer – The developer is a technical user (often a programmer) in some other agency or entity who wants to have access to the data and or services for their own purpose, not necessarily the same purpose as the data owner. In many cases, the developer will develop new innovative pushes on the data which may not have been thought of yet by the data owner. The developer is most interested in the data being released as downloads and/or services that they can build off directly.

[29] NUTS or the Nomenclature of Territorial Units for Statistics is a standard developed and regulated by the European Union, and is a geocode standard for referencing geographical subdivisions of countries. NUTS 3 is the third tier of categorisation which typically constitutes areas with a population between 150 000 and 800 000.

f) Internet based mapping technology has significantly increased (e.g. allowing more functions) over the past several years while costs have significantly decreased. Several open source competitors have published means by which deployment of internet interactive maps is inexpensive, easy to publish and easy to consume.

g) Being mindful of the vehicle for consumption (e.g. in many parts of the world internet maps may only be consumed on a mobile device or device with small bandwidth) is fundamental to the design, technology employed and function of the resulting map(s).

h) Internet maps need to be interactive and beautiful. Single static images are now far below the expected value of published data and no longer a worthwhile bar to shoot for. Moreover, the cartographic representation needs to harmonise with the policy goals of the data. The technology needs to be able to present complex data in a systematic and elegant way.

IV. Case Studies

Several nations and third parties have offered excellent examples of mapping efforts recently which add value to a better understanding of what is possible and essential for an OECD effort.

a. United States – http://www.broadbandmap.gov

i) Functions – search by location, multi-scale/multi-metric interactive mapping, statistical roll-up of data by aggregate geography, aggregate geography ranking (highest to lowest), full data download, map and data services etc.

ii) Metrics – provider, technology, advertised speed

iii) Level of geography – US Census Block (400 – 600 people units)

b. United Kingdom – http://maps.ofcom.org.uk/broadband/

i) Functions – multi-scale/multi-metric interactive mapping, statistical roll-up of data, by aggregate geography, broadband index ('score') approach, aggregate geography ranking, full data download, data reporting and analysis summary, broadband guide.

ii) Metrics – take up, population, superfast speed, average sync speed

iii) Level of geography – Unitary authorities (Equivalent to NUTS 3)

c. Germany – "Broadband Atlas" – http://www.zukunft-breitband.de/BBA/Navigation/breitbandatlas.html

i) Functions – primarily for end-user information on availability, performance and providers. Interactive map allows users to drill down to street level. Map printout facility but apparently limited data download.

ii) Metrics – download speeds, wireless or fixed line technology, service providers

iii) Level of geography – apparently by a cell grid within municipal areas. Viewable to a scale of 1:20000

d. Norway

i) Functions – search by location, multi-scale/multi-resolution interactive mapping, multiple layer interaction, point identification

ii) Metrics – Technology service, distance to infrastructure, speed availability

iii) Level of geography – Building availability

e. Japan – internal use only at this time

i) Functions – still in development

ii) Metrics – data collected on availability of high-speed wired/wireless access (ADSL, super-fast (greater than 30 mbps down) broadband, carriers and CATV operators w/ geographic coverage

iii) Level of geography – c units

f. Australia - http://www.nbnco.com.au/rollout/rollout-map.html

i) Functions – search by location, point identification, multi-scale/multi- resolution mapping, multiple layers

ii) Metrics – Service available, infrastructure build-out

iii) Level of Geography – Administrative districts

V. Recommendations

a) The OECD should pilot the presentation of key statistics from its existing broadband metrics as interactive Internet mapping, both as a valuable aid for existing users and a step towards sub-national mapping.

b) Good data about broadband availability at the sub-country level will have substantial economic value as well as contributing to the development of transparent and competitive markets. But it is not practical or desirable for the OECD to collect it directly. Instead the OECD should be aiming to encourage and support the development of an availability data ecosystem and using the results it produces to drive international comparisons and improvements.

c) The OECD should work with other organisations to collect data in a coordinated way rather than making repeated information requests.

d) The OECD can play a key role in defining internationally agreed metrics, for example in how the definition of technology coverage should relate to performance and what end-users can actually receive.

e) The OECD can also lead in defining segmentation, especially by population density and rural-urban distinctions. The need is not just the formal definition, although that is required and is not straightforward, but also to provide sound statistics which correspond to the definition.

Broadband investment metrics

I. Purpose and Scope of Metrics

a) Capital intensity is a defining characteristic of broadband networks.

b) The prospect for earning a return on capital investment drives decisions regarding broadband deployment. Therefore, policies should be informed by the extent of capital investment needed to achieve policy goals such as deployment.

c) We may be able to measure capital efficiency by comparing normalised capital investment data with other measures of demand (usage, data consumption) and supply (performance, quality).

d) Tracking capital stocks in broadband networks may provide useful insight when associated with other measures, such as complementary investment in information technologies, adoption of broadband-enabled applications, and economic indicators such as productivity, economic output and employment.

e) Scope: limited to broadband provider network infrastructure investment; excludes content, applications, and devices.

II. Current Metrics

a) The OECD currently collects data on Telecommunication sector investment with a subset for Mobile infrastructure investment.

i) Total Investment in telecommunications (Fixed, cellular mobile and other wireless): The expenditure associated with acquiring the ownership of property (including intellectual and non-tangible property such as computer software) and plant. These include expenditures on initial installations and on additions to existing installations where the usage is expected to be over an extended period of time. Excludes expenditures on research and development and fees for operating licenses and for the use of radio spectrum. Also referred to as capital expenditure.

ii) Investment in cellular mobile infrastructure: The expenditure associated with acquiring the ownership of property (including intellectual and non-tangible property such as computer software) and plant in order to conduct cellular mobile telecommunication activities. These include expenditures on initial installations and on additions to existing installations where the usage is expected to be over an extended period of time. Excludes expenditures on research and development and fees for operating licenses and for the use of radio spectrum. Also referred to as capital expenditure.

b) The ITU wants to implement an indicator on "Investment in fixed (wired) broadband services" (definition below). Although it would be challenging to introduce a question on Broadband investment in the OECD questionnaire, it is realistic to expect a good rate of response from our delegates as we could benefit from synergies with the ITU questionnaire revision.

i) Indicator 70b: Investment in fixed (wired) broadband service: It refers to investment in fixed (wired) broadband service for acquiring property and network within the country. This indicator refers to the annual capital expenditure for fixed (wired) broadband networks. It does not cover investment in fixed telephone line networks or mobile broadband networks. It refers to annual capital expenditures and not fixed assets.

A detailed excerpt of the ITU definition for "Investment in fixed (wired) broadband service" in the context of the broader ITU definition of "Investment in telecommunications services," taken from the ITU Handbook, is included in the Addendum.

III. Observations

a) Ideally, one might envision having information about capital investment broken out along several dimensions. However, from a practical standpoint, based on provider reporting practices and statistical agency collection activities, our ability to collect data broken down is likely to be very limited.

b) As discussed in item c. below, a breakdown at the industry level is likely to be the most feasible. Breaking out broadband and non-broadband investment is a desirable goal, but may be beset by challenges discussed in greater detail below. Finally, for most countries, the most granular data are likely to be at the national level—though there may be some countries where supplemental state or provincial data may be feasible. Additional granularity is likely to be extraordinarily difficult or impossible to obtain.

c) Below we list some categories we would like to see broken down and discuss the feasibility of each:

i) **Industry** (wired telecom, mobile wireless telecom, cable operator, satellite, resellers, and other). Data should be available by type of service providers, including cable television system operators.

ii) **Geography** (national, state, regional, other). Companies generally do not report, and agencies generally do not collect, investment data at levels any more granular than national. Furthermore, some investments span multiple geographies. Therefore, national data are the most practical data to collect.

iii) Type of capital (broadband / non-broadband; more granular breakdown, e.g., network equipment and software, network structures, non-network capital). Providers do not typically report capital expenditures by these categories of investment. In any case, it will be a challenge to define what constitutes "broadband" investment. For example, cable system investment for video delivery—a large consumer of bandwidth and a significant component of the converged video market—could be considered broadband investment. Even though the cable operator is investing in its legacy business, it is presumably doing so to compete in a converged video market. Even when economic statistics agencies collect cross-tabulated investment data by industry and investment-type, there are many challenges with cross-national comparisons. For example, the United States Bureau of Economic Analysis publishes detailed investment by industry and type. But the industry data are aggregated to include industries outside our sphere of interest (e.g., television and radio broadcasters). Also, in the U.S., the Census Bureau Annual Capital Expenditure Survey (ACES), which is the source of the current OECD time series in Outlook 2011 table 3.6, breaks out structures and equipment, plus new and used capital. *Any definition of broadband capital investment is likely to be broad. This is because the vast majority of broadband provider investment is likely for the purpose of building, enhancing, and operating broadband networks to provide services in "converged" markets.*

iv) **Service** (broadband Internet access, video, voice, mobile, data center /cloud services, other). Most investment by broadband network providers is likely to be for broadband networks that are increasingly carrying converged traffic, e.g., voice, video, and data. Therefore, a breakdown by type of services is likely to be impossible. At best, it would involve arbitrary allocations.

v) **Customer Segment** (large enterprise, small and medium business, residential). Companies do not report, and agencies do not collect investment data by customer segment. Furthermore, like service segments, while some portion of investment may be allocated to business or residential segments, a significant portion is for joint use. Therefore, a breakdown by customer segment is likely to be impossible; and, like service segments, it would involve arbitrary allocations at best.

vi) Network Level (access, metro area / transport / backhaul; core / backbone, etc.). Companies do not report, and agencies do not collect investment data by network level. Therefore, a breakdown by customer segment is likely to be impossible.

vii) Type of Competitor (e.g., incumbent vs. new entrant). It may be useful to break down investment by incumbents and new entrants. Such a breakdown may be most informative in locations where competition typically involves new entrants deploying their own network equipment while leasing fixed wireline incumbent lines; it might be less informative where competition is primarily facilities-based, e.g., the U.S. and Canada. Furthermore, such a breakdown may be a challenge in countries such as the U.S. where "incumbents" may own competitive national or regional long-haul and transport facilities and may also compete with other incumbents and non-incumbents outside of their local territories.

d) Broadband investment both affects and is affected by competition. Competition at the network level includes traditional telcos, mobile wireless providers, cable operators, resellers, satellite, and others. It appears the current OECD public telecommunications investment figure includes only traditional telecom, mobile wireless, possibly satellite, resellers, and others. It does not include cable operators. (Note, U.S. data separates cable operators, who provide distribution to end users, from cable programmers, who provide content production. Programming is generally excluded from recent investment data, though not so for some older historical data.)

e) As noted in the module on competition metrics, mobile wireless broadband is increasingly competing with fixed broadband, and this substitution may increase over time as 3G and 4G achieve wider availability and adoption. Even when purchased as a complement, mobile wireless broadband penetration is growing rapidly. Therefore, it would appear that collecting data on mobile wireless broadband investment is as important as fixed broadband investment. At a minimum, we would want the option to look at both, either separately or in combination.

f) It is important to normalise broadband investment data by a range of geographic and economic characteristics. For example, to enable cross national comparisons, cable investment should be normalised by the percentage of the population or households served in a particular area. Likewise, an attempt should be made to capture - or at least acknowledge - investment costs not reflected in provider capital expenditures, e.g., broadband investment costs financed through general public expenditures or subsidised access to public assets.

IV. Recommendations

While we are unable to address all the issues identified in the observations above, we can take a series of incremental steps to enhance our understanding of capital investment in national broadband markets.

a) Collect data for multichannel video system operator (e.g., cable) investment and aggregate with existing public telecommunications data.

i) Provide historical revisions to the public telecommunications investment data or, alternatively, issue a separate series that includes cable operators in the total aggregated amount.

ii) Provide a breakdown of public telecommunications data by type of provider (fixed telecom, fixed cable or other multichannel video provider, and mobile wireless).

iii) Consider whether describing the data as "public" telecommunications investment is appropriate, given that much of the broadband investment is privately financed and, in many areas, returns on investment are not regulated.

b) Assess whether it would be feasible to isolate "investment in broadband infrastructure" from non-broadband spending. Also, assess whether it would be worthwhile, given that a reasonable definition is likely to be very broad and encompass the vast majority of reported capital spending.

c) For the purpose of making the assessment described in paragraph b., the OECD must define "investment in broadband infrastructure". For an indicator's data collection, the definition sets the limits as to what is included in the numbers reported and what should not be included. The challenge is to find the appropriate equilibrium between technical accuracy and flexible 'broadness' to adapt the different national realities and the feasibility of data providers (often regulators) collecting and processing these financial data. We have to remember that operators do not typically disclose this type of strategic information, and very rarely publish disaggregated figures. The data collection should be done by first collecting the total telecommunications investment (total capex). This data would have two sub-categories: (a) Investment in fixed infrastructure and (b) Investment in mobile wireless infrastructure. Then these two sub-categories would be divided into additional sub-categories

The definition would be structured this way:

a. Investment in <u>fixed</u> infrastructure:

a1. Investment in fixed telephone service;

a2. fixed broadband service;

a3. multichannel video distribution service.

b. Investment in <u>mobile wireless</u> infrastructure:

b1. Investment in mobile communication service;

b2. Mobile wireless broadband services.

As the definition refers to corporate financial data, it should use the accounting terms of operators' financial reports. The ITU definition of Investment in telecommunication

services should be used as an example (see Addendum). The key differences between our proposed approach and the ITU approach are that: we propose including multichannel TV distributors among fixed providers; fixed providers are not necessarily limited to wired providers, although all wired providers are fixed providers; and we propose breaking out mobile wireless broadband investment.

d) To the extent the OECD is able to and decides to collect isolated "investment in broadband infrastructure" data, it should not limit the data collection and reporting to fixed broadband. It is important to also capture mobile wireless broadband investment.

e) Consider the ways that broadband investment data may be useful in achieving the broader goals of the OECD in measuring the information economy, e.g., impact on productivity and economic output. Specifically, consider encouraging and working with government statistical agencies to collect and report investment data in the context of broader economic metrics related to broadband and the information economy.

Addendum

From ITU Handbook : Indicator 70: Annual investment in telecommunication services

Definition

Also referred to as annual capital expenditure, this refers to the gross annual investment in telecommunications services (including fixed, mobile and Internet services) for acquiring property and networks. Investment means the expenditure associated with acquiring the ownership of property (including intellectual and non-tangible property such as computer software) and plant by the operator. It refers to investment on telecommunications infrastructure in the country. This covers all operators offering services to the public within the country. It includes expenditure on initial installations and on additions to existing installations where the usage is expected to be over an extended period of time. It excludes expenditures on research and development, fees for operating licenses and for the use of radio spectrum, investment in telecommunication software or equipment for internal use.[30]

Annual investment in telecommunication services can be broken down into:

Indicator 70a: Investment in fixed telephone service
It refers to investment in fixed telephone service for acquiring property and network within the country.

This indicator refers to annual investment in fixed telephone networks. It should exclude investment in fixed broadband networks. It refers to annual investment and not to fixed assets or to investments made by operators in other entities. It may be difficult to distinguish capital expenditure on fixed telephone networks and fixed broadband networks.

Indicator 70b: Investment in fixed (wired) broadband service
It refers to investment in fixed (wired) broadband service for acquiring property and network within the country.

This indicator refers to the annual capital expenditure for fixed (wired) broadband networks. It does not cover investment in fixed telephone line networks or mobile broadband networks. It refers to annual capital expenditures and not fixed assets.

[30] Internal use refers to utilisation of assets by the operator for its own administrative processes

Indicator 70c: Investment in mobile communication service
It refers to investment in mobile telephone service for acquiring property and network within the country. It should include investments made for mobile broadband services.

This indicator refers to annual investment for mobile communication networks. It should include investment on mobile broadband networks. It refers to annual investment and not to fixed assets or to investments made by operators in other entities. The data should exclude license fees.

Clarifications and scope

The indicator refers to the total capital expenditure each year on property and plant for all telecommunications (including Internet) services that are provided to the public. Non-tangible capital expenditures should be included except for license fees. It does not refer to the fixed assets of enterprises in the sector. It refers to investment spent on telecommunications infrastructure in the country and therefore should not include capital expenditures made by domestic operators for networks they own in other countries.

Method of collection

The data can be collected from fixed and mobile operators and ISPs.

Relationship with other indicators:

Indicator 70 is equal to the sum of values of Indicators 70a to 70c. Indicator 70 includes the value of Indicator 71 (Annual investment in non-tangible assets).

Methodological issues

Countries may differ in how they interpret annual capital expenditures in the telecommunications services industry. Of particular importance is ensuring that the indicator does not include license fees, which can create significant comparability problems. This indicator is often divided by Gross Fixed Capital Formation to gauge the intensity of telecommunications investment within the economy.

It may be difficult to distinguish capital expenditure on fixed telephone networks and fixed broadband networks. Operators usually report data in terms of investment in "fixed" networks and "mobile" networks. Given the move to NGN and IP-based networks the distinction between fixed telephone and broadband is reducing. Another issue is triple play. If an operator invests in FTTH, it may be difficult to distinguish the investment as telephone or broadband if it is also providing telephony (VoB) and TV (IPTV) service.

Some countries include license fees in mobile capital expenditure. This can create significant distortion since these fees tend to be relatively high compared to investment in plant and property.

Example

The French Telecommunications and Posts Regulator (l'Autorité de Régulation des Communications Electroniques et des Postes, ARCEP) publishes data on investment in the telecommunications sector, disaggregated by fixed and mobile services (Example 32). Total investment was EUR 6.0 billion in 2009 with EUR 3.7 billion for fixed services and EUR 3.3 billion for mobile services. Total telecommunications investment as a percentage of national fixed capital formation was 1.5% in 2009.

Example 1. Telecommunications investment, France, EUR billion

Source: ARCEP. 2010. Les chiffres clé des communications électroniques en France en 2009. http://www.arcep.fr/fileadmin/reprise/publications/chiffres-cle/chiffres-cle-2009-juin2010.pdf.

Broadband performance metrics

I. Purpose and Scope of Metrics

a) The performance of an Internet connection is a fundamental metric for consumers as it determines the quality of experience, and to a significant extent can determine the availability of certain kinds of services – for example, good quality video streaming requires sufficient download speeds and low levels of packet loss, while VoIP telephony requires sufficiently low latency.

b) The speed of connection is also central to policy considerations and targets. Broadband is often defined in terms of a speed threshold– for example a universal service obligation in Switzerland requires Internet access with a minimum of 600 kbit/s download and 100 kbit/s upload, and universal service obligation in Finland is a minimum of 1 Mbit/s. Speeds of connection are also the basis of targets for broadband plans around the world – for example the European Commission's Digital Agenda sets a target of 100% coverage of broadband at 30 Mbit/s or higher by 2020, and 50% take-up of broadband at 100 Mbit/s, and the United States National Broadband Plan targets at least 100 million homes having affordable access to broadband speeds of at least 100 Mbit/s downstream and 50 Mbit/s upstream by 2020.

c) However, there is large variation of broadband speeds even within the same technology, there are often very big gaps between the "advertised" or "headline" speeds and the speeds actually delivered, and there are very significant challenges in measuring and comparing speeds and other broadband metrics.

d) There are also many different initiatives for collecting and reporting broadband speeds and they often deliver markedly different results.

II. Current Metrics

a) "Advertised" or "headline" speeds. Usually referred to as 'up to' speeds, these speeds represent either the maximum theoretical speed of the connection, or the speed tier that has been sold and remain a very common way of reporting and tracking the take-up and availability of broadband by speed category.

i) The OECD collects and publishes on its broadband portal information on "average advertised download speed by country", with further splits by technology

ii) The European Commission collects and publishes data based on advertised speeds.

b) Theoretical speed projections based on technology and infrastructure. Based on the infrastructure deployed and its topographical characteristics, it is possible to model and map the performance capabilities of DSL and mobile access networks (as the performance of fibre-to-the-premises and cable services are generally unaffected by topographical characteristics, modeling performance is not necessary). Point Topic, for example, has modeled fixed-line performance in the UK and Europe.

c) User-initiated 'crowd-sourced' speed tests. These tests require users either to run a single speed test from a website or download a speed testing application. There are many examples, including:

i) The largest such speed testing company is Ookla (speedtest.net)

ii) US-based CarrierCompare focuses more on mobile performance and enables users to compare the performance of the Internet service they are receiving with the performance received by others with different providers.

iii) In the UK, in 2011 a joint project between Epitiro and the BBC sought to map mobile performance across the UK by encouraging UK mobile users to run tests by downloading Epitiro's application.

iv) AGCOM in Italy and the FCC in the US are examples of national regulators who offer their own online speed measurement tools.

d) Measurement of speeds deeper in the Internet. For example:

i) Akamai (a US-based content delivery network) captures speed based on the connection speeds of the systems delivering requests to their servers and publish global statistics in their State of the Internet quarterly reports.

ii) Content-hosting servers and applications can potentially measure connections which are making requests. For example, Google's YouTube reports average speeds of connections making requests.

iii) Netflix reports the average performance it experiences with a variety of ISPs in Canada and the United States.

e) Panel-based measurement programmes. The absence of robust data on broadband performance has prompted a number of initiatives by regulators and policy makers to measure and report broadband performance using panels of broadband consumers.

i) The most established methodology is that developed by UK-based SamKnows who have set up broadband measurement panels in the UK, the US, across the European Commission and have also been awarded contracts in Brazil and Singapore. The methodology used involves creating a representative panel of broadband users, connecting a monitoring unit to their routers and running a suite of performance tests to a pre-defined schedule.

ii) The New Zealand Commerce Commission was one of the first regulators to set up a broadband measurement programme, in partnership with Epitiro based on a panel of users downloading an application to their PCs

iii) EETT, the telecoms regulator in Greece has launched a broadband measurement portal using Google M-Lab's network Diagnostic Tool.

iv) Cofetel, the telecoms regulator in Mexico also provides speed tests on its website, via Apple and Android mobile applications and maps the data.

III. Observations

a) How to define broadband speed?

i) There are multiple definitions of "speed" that are potentially of interest: is it a measure of potential throughput or capacity or is it a measure of average speed as experienced by endusers? Is speed in peak time of particular interest?

ii) Is the focus the broadband access service or end-to-end performance (i.e the speed of "the Internet")?

iii) What should be reported? Is data required by geographic market and/or technology, and/or ISP?

b) Choices of methodology. Different methodologies can deliver very different results. The results are determined by a range of factors including:

i) What is being measured. The speed of the internet or the speed of the access network? The speed to a device, a router, or a content hosting server? When measuring access networks it is notable that speed measurements taken from a router are typically higher than speed measurement taken from a device. This is because speed to a device can be degraded by a number of factors including the WiFi connection, PC performance, or in-building contention with multiple devices using the same WiFi connection.[31]

ii) The sampling. Speed data provided by voluntary (opt-in) participants may not be representative of broadband users as a whole. For example there is likely to be a bias towards more technically literate consumers who may on average have faster connections. Alternatively, there may be a disproportionate number of consumers who are testing their broadband connection because they are dissatisfied with performance. In addition, test data can be affected if business connections are included alongside residential connections: of course if ultra-fast connections using leased lines are included this can have a very significant affect on mean average speeds.

iii) The particular test methodologies. It has been noted that speeds measured by speedtest.net (Ookla) are typically higher than other online speed testers. This may be because Ookla Speedtest tools utilise multiple TCP connections to collect measurement data which is key to maximising the capacity available compared to using a single TCP connection. These tests are also much more likely to be conducted to a server that is relatively close to the client running the test. Indeed, in order to compare speeds between countries it is important that the location of test servers allows like-for-like comparison (e.g. by using servers in each country being tested).

iv) The statistical methodology employed. This is important for sampling, but also for analysis. At a basic level, there can be very significant differences between mean and median averages due to the distribution of broadband speeds.

c) Advertised or headline speeds. Advertised or headline speeds provide only one indication to consumers purchasing a service on what they might expect and are often a poor proxy for actual speeds

i) Typically they indicate the maximum theoretical speed. In general they provide a high-level indication of speeds relative to other offers (e.g. a consumer with an 'up to' 30 Mbit/s connection should expect better performance than someone with 2 Mbit/s) the actual performance can vary significantly.

[31] The maximum rate of an 802.11b WiFi router (still a very common wireless router) is 11mbps. If wireless signal quality is an issue, the 802.11b router will drop back to 5.5Mbit/s, 2mbps, and then 1 Mbit/s. Newer wireless routers (e.g. 802.11g/n) have higher maximum speeds (e.g. 54 Mbit/s) but will similarly adapt the link speed to improve the signal quality

ii) Advertised speeds are in particular of very limited value when there are large variations in the capabilities of the access network by specific location, as is the case for DSL technologies (when performance varies with the length and quality of the copper line) and mobile technologies (where signal strength and interference varies), and for all technologies headline speeds take no account of constraints in backhaul or the impact of transit/peering relationships between operators in different countries.

iii) For example, research in the UK showed that in November 2011 actual speeds (as measured in an Ofcom project) were 7.6 Mbit/s compared to average headline speeds of 16.3 Mbit/s. Moreover, in the UK the actual speeds delivered via ADSL were only 36% of advertised speeds. In contrast, in the US, ADSL speeds as measured using the same methodology were 93% of headline speeds: therefore comparing broadband speeds in the UK and the US on the basis of headline speeds gives a misleading picture of the comparative capabilities of broadband services.

iv) Moreover, from April 2012 there has been a change in the advertising regulations about broadband in the UK – "up to" speeds can now only be used if at least 10% of customers can actually receive those speeds. The result is that ADSL broadband is now advertised at 14-16Mbit/s instead of 20-24 Mbit/s – therefore tracking UK broadband speeds based on advertised speeds would misleadingly indicate that there has been a decrease in average speeds.

d) If broadband performance data is to be used to inform policy making or to compare technologies or individual ISPs it is important that statistically robust data is collected, but it is a challenge to find a dataset which is consistent and comparable between countries.

i) It is for this reason that often the 'lowest common denominator' is used, and speeds are reported on the basis of headline or advertised speeds.

ii) An alternative may be to use data which is collected globally. Options include Ookla/speedtest.net, Akamai, YouTube and Google M-Lab. However, it is notable that the results from them are markedly different (see Addendum).

e) The most robust speed tests for testing the speed of the access network are those using a managed panel and using hardware to measure speed delivered directly to the router.

i) Ofcom (UK), the FCC (US), the European Commission, the IDA (Singapore) and Anatel (Brazil) have all recognised the limitations of other methodologies and have commissioned research from SamKnows.

ii) However, this is the most expensive type of research and it is not likely that data collected on this basis will be available for all OECD countries in the near future.

f) Broadband performance measurement is about more than download speeds.

i) Other performance metrics include upload speeds, latency, packet loss and jitter. Many broadband speed test methodologies can also capture these.

ii) Traffic management policies are an important determinant of broadband performance and it can be a challenge to capture the impact of these through broadband speed test methodologies.

g) The appropriate level of robustness or precision depends on the purpose of the test, taking into account the costs and benefits. For example, the level of statistical confidence required in the data may be different for consumers, application providers, and policymakers.

IV. Recommendations

The following is recommended:

a) Adoption of the best currently available dataset in the short-term which provides robust data offering like-for-like comparison between countries and over time. Ookla/speedtest.net, Akamai, YouTube and Google M-Lab are recommended as options for consideration. It is preferable to use one dataset, but given the differences it may be necessary to include more than one, perhaps as an index.

b) Work towards long term goal of achieving a dataset based on data collection from representative panels of broadband users using common methodology which measures speed delivered directly to consumers' routers. The first step to achieving this is to agree on principles of best practice by which broadband performance data should be collected.

a. In the short-term the challenge is to find a dataset which is consistent and comparable between countries.

i. In those instances where advertised speed is significantly greater than actual speed, tracking and comparing broadband performance based on advertised speeds may be misleading – it offers few incremental benefits to tracking availability and take-up by technology. However, it is likely that advertised speeds will continue to be required as a categorisation for pricing comparisons as advertised speeds will remain the only indication of the speed for analysis of tariffs.

ii Ookla/spedtest.net, Akamai,YouTube and Google M-Lab all potentially provide datasets which offer useful means of tracking high-level broadband performance metrics (download and upload speeds) in the immediate term. Additional analysis of methodologies and respective limitations is needed. A challenge will be to ensure that the data is represented in a way which makes it clear what is being measured (i.e. not solely network performance).

b. In the long-term the objective should be to use a dataset based on the most robust methodology available for collecting and reporting broadband performance data.

i. A means of working towards this is to define principles for collecting broadband performance data and the tests which should be run.

ii There is an emerging consensus on best practice for measuring broadband, based on the methodology deployed by SamKnows in the UK, the US, the European Commission, Singapore and Brazil – this could form the basis of principles for collecting broadband performance data.

iii. Standardised test scripts, statistical analysis and reporting methodologies should also be used. The work of Google M-Lab suggests a way forward.

Addendum

Comparison of speed-test data collected by different methodologies (download throughput speeds)

	Average download speed (Mbit/s)				
	Google M-Lab Median Apr-12	**Ookla** Mean May-12	**YouTube** Mean May-12	**Akamai** Mean Q4 2011	**SamKnows** Mean Nov-11
Australia	2.9	10.8		4.9	
Brazil		5.9		1.8	
Canada	4.8	12.8		5.6	
France	4.9	12.1		3.7	
Germany	5.8	15.0	4.8	5.0	
Italy	3.3	5.3		3.9	
Japan		19.4		9.1	
Korea		27.7		17.5	
Mexico		5.2		2.4	
Spain	2.2	11.9		3.8	
UK	4.3	15.8		4.9	
USA	5.3	12.5		5.8	
	5.4		6.8		7.6
			7.1		

Akamai State of the Internet http://www.akamai.com/stateoftheinternet/

M-Lab NDT data https://sites.google.com/site/mlabcharts/oecd-stats-2012

Ookla Net Index http://www.netindex.com/

YouTube Video speed http://www.youtube.com/my_speed

SamKnows Ofcom report http://stakeholders.ofcom.org.uk/binaries/research/broadband-research/Fixed_bb_speeds_Nov_2011.pdf

Broadband competition metrics

I. Purpose and Scope of Metrics

a) Provide an overview of competitive characteristics across OECD broadband markets, mostly for residential and small business users.[32]

b) We note that analysis of the competitive environment for policymaking purposes is a highly technical undertaking, dependent on case-specific circumstances, which vary across countries and over time.

c) These competition metrics may be useful to provide a high-level snapshot of competitive characteristics across countries,providing one input point for policy development, augmenting further work undertaken by national authorities.

II. Current Metrics

a) The OECD currently produces the following metrics associated with competition in broadband markets:

i) Local Access (%of access lines): Market share of the largest telecommunication operator for local access services, as percent of total access lines.

ii) DSL Subscribers (% of total): Market share of the largest telecommunication operator (or their ISP) for DSL services, as percent of total DSL subscribers.

iii) Number of competitors in the mobile market and market shares.

b) The OECD currently produces the following metrics associated with availability and these have potential applicability in the context of competition (see observation III.i. below):

i) 3G mobile networks coverage (percent of population)

ii) Availability of digital subscriber lines (DSL) in the OECD area (*)

iii) Availability of Fibre to the home/fibre to the building (percentage of residences)

iv) Households passed by cable TV networks (%)

v) Availability of cable modem service in the OECD area (*)

[32] Depending on definitions, “small business” may refer to businesses at a range of sizes and with a range of broadband connectivity needs. Some small businesses may need only standard residential broadband while others may require greater capabilities. Small office / home office businesses and small proprietors are more likely in the former group. Businesses with a larger number of employees, or in data intensive enterprises, are more likely in the latter group. The challenge is to avoid conflating the two in the competition metrics. In the area of subscriptions it may be more difficult to separate business users who purchase or jointly use standard residential offers. In the area of competitive availability, where statistics are denoted in household terms, it may be easier to distinguish business and residential competition.

Some of these metrics, indicated by an (*), were published in the OECD Communications Outlook 2011. The others are raw data from the collection undertaken for this same publication. They cannot be published without some further verification. Data on FTTH availability and 3G coverage is limited due to a poor response rate in the data collection, but this should improve in the future.

III. Observations

a) There are a number of limitations to what OECD competition statistics can demonstrate for the purpose of policy making. For example, competitive analysis is typically dependent upon case-specific market definitions, including geographic and service markets. National data that are likely available to OECD are not likely to be sufficiently granular for policy making purposes, particularly for fixed services. Similarly, service definitions must be sufficiently flexible to account for rapidly changing technological and market developments.

b) There is a growing body of literature examining the dynamic, cross-industry nature of competition in residential and business broadband, i.e., the competitive pressures exerted among and within "platforms" consisting of network connectivity, devices, applications, and content providers. Therefore, analysis of broadband network access is only one input for measuring competition. In such dynamic markets, analytical frameworks focused solely on broadband network access need to be augmented by further considerations. Innovation, product differentiation, and bundling are essential competitive characteristics in such technologically and commercially converging markets, and they need to be considered alongside traditional metrics such as market share.

c) Regarding scope, we acknowledge the importance of competition in enterprise broadband markets and its relationship to broader measures of economic performance. Nonetheless, we suggest the OECD focus its efforts on broadband offers primarily aimed at residential consumers for several reasons. First, enterprise markets had an earlier history of competition, less regulation, and greater segmentation. Second, as a result, there are greater challenges associated with gathering data on competition. Third, in order to maximise the benefit of the effort it makes most sense to focus on "residential markets". Metrics that isolate residential and business services and competition are likely to provide a more accurate picture of the respective markets.

d) Also regarding scope, voice is but one application enabled on broadband platforms, and voice competition enabled by broadband extends into the broader voice market, including fixed and mobile voice service. While we acknowledge that broadband enables significant competition for voice service, our focus here is limited to broadband service more generally.

e) Similarly, video is another type of application affected by convergence, where broadband video delivery can compete with traditional video delivery. Video is a significant driver of bandwidth demand. Nonetheless, our focus remains broadband service more generally.

f) To the extent metrics focus on retail competition, competition among Internet Service Providers (ISPs) over a regulated wholesale facility is different in nature than competition among or between those who own separate 'last mile' facilities. Metrics that distinguish the two types of competition will be more informative than metrics that do not.

i) A key objective is to distinguish between competition that relies on regulated access to full or partial wholesale last mile services or facilities, on the one hand, and full facilities-based competition that does not depend on any form of regulated wholesale access to last mile facilities, on the other hand. At a minimum, we should aim to distinguish full facilities-based

competition (e.g., telco DSL/fiber vs. cable vs. possibly wireless) from resale competition at the retail ISP level.

ii) Since there are many variations of "resale" competition at the retail ISP level, there may be some challenges that require further definition and categorisation, including structurally separated entities that only provide wholesale local access facilities.

iii) In some locations there may be many ISPs competing by fully leasing broadband connectivity from an incumbent, either via DSL or fiber. On the other hand, some ISPs may be partial facilities-based competitors who lease unbundled last mile facilities from the incumbent and combine with their own co-located broadband transmission facilities (e.g., DSLAMs), or purchase such broadband service from collocated third party competitors to the incumbent, and sell a full retail ISP service to the end-user. In many countries in Europe in particular, 'local loop unbundling' is a key characteristic of broadband competition and the regulatory environment, while 'sub-loop unbundling' may assume increasing importance as VDSL services assume more significance. Similarly, when considering fiber broadband networks there are likely to be different competitive characteristics when access to dark fiber is sold by the network owner than when retail competition is based only on the 'resale' of active fiber optic cable. Finally, some countries have introduced structurally separated local loop providers (e.g. Australia, New Zealand). These wholesale providers do not sell retail products (even over functionally separated entities owned by the same company) and offer access at a higher layer in the network than dark fiber.

iv) Any categorisation scheme would therefore have to reflect evolving business and regulatory practices across a range of countries.

g) While retail and wholesale market share of adoption in fixed broadband access can potentially be an informative metric, they are incomplete measures of competition. This is the case when market share data is collected on a national level as some ISPs operate in local geographic markets. A number of countries had regional or local incumbents for PSTN and cable services, prior to the development of broadband markets (e.g. Canada, Finland and the United States), meaning there is no single national incumbent in those countries. Thus, in these countries, any fixed provider's broadband market share at the national level will understate share in its addressable market. If one were to examine the regional and local PSTN incumbent operators -- either in their incumbent PSTN service areas individually or in aggregate as if they were a single national PSTN operator -- and do the same for the cable operators, there would be no identifiable "incumbent" broadband provider (nationally, regionally, or in most cases locally). The reason is that neither industry has, or ever had, an exclusive right to provide service or a dominant share of the broadband market.

h) The retail market share of incumbent operators may be an informative metric as regulatory initiatives have often been designed to enable alternative operators to compete effectively with incumbents. However, this needs to be informed by data on the availability of multiple full facilities-based alternative networks, especially in countries that rely on end-to-end facilities based infrastructure competition as their primary market structure (e.g. Canada, Korea and the United States).

i) Availability of fixed access technologies is another metric that could enhance understanding of competition in a given market (see mapping / availability module). Availability by speed tiers may provide an additional layer of understanding (see performance module), if based on actual consumption practices rather than hypothetical maximum performance.

j) Cable modem share and availability are significant in many countries and should be included in the metrics.

k) Mobile wireless substitution is increasing, especially as 3G wireless is more widely adopted and as 4G wireless is increasingly deployed and adopted. A measure of market share should include at least those households who have substituted mobile for fixed broadband. It is also important to track mobile wireless broadband availability.

l) Increasingly, it will be important to understand the extent to which mobile wireless broadband is becoming a substitute for fixed broadband, as mobile voice seems to have become forfixed voice for some users.

m) Actual competition and potential competition are both important factors in providing competitive discipline in broadband markets. Metrics describing actual competition are more readily available. Potential competition is more difficult to measure and is often considered in specific circumstances. At a minimum, we must recognise this limitation of our metrics for measuring potential competition. However, some metrics, such as availability, may provide an indication of potential competition, e.g., availability of cable television where cable broadband is not available, or 4G wireless for mobile services as a potential home broadband option.

IV. Recommendations

While we are unable to address all issues identified in the observations above, we can take a series of incremental steps to enhance our understanding of the competitive characteristics of markets for standard broadband offers aimed primarily at residential users..

a) Update market share data to distinguish resale competition from facilities- based competition.

i) To the extent that data reflect resale (e.g., total service resale, bitstream unbundling) or partial facilities-based competition (e.g., DSL provider collocating and using owned DSLAM and incumbent local loop), they should be reported separately from full facilities-based competition (e.g., cable modem). For example, market share at the retail level should be reported separately from market share at the last mile facility level, though both should be based on the same set of end-users. Further work is required to determine the feasibility and practicality of distinguishing various types of resale competition, e.g., full or partial resale. Structural separation of broadband networks, in countries where that is applied, also needs to be reflected in these considerations.

ii) To the extent possible, market share data should include instances where there is mobile wireless substitution for fixed service. If not possible due to data limitations, encourage national regulators to collect such data (for example, the proportion of households which have mobile broadband as their only Internet connection).

b) Provide availability data by technology, including cable modem and mobile wireless broadband.

i) If possible, determine the proportion of households or population that has access to one, two, or more competitors. If not currently possible due to data limitations, encourage national regulators to collect such data.

ii) Assess whether availability data could be broken out by speed tiers, technology (e.g. HSPA/LTE, DOCSIS2/DOCSIS3), or both.

iii) To the extent that data reflect resale or partially facilities-based service, they should be reported separately from full facilities-based competition. For example, availability at the retail level should be reported separately from availability at the last mile facility level, though both should be based on the same set of potential end-users. Further work is required to determine the feasibility and practicality of distinguishing various types of resale competition, e.g., full or partial resale.

iv) Multiple fixed services provided by the same provider (e.g., fiber and DSL to same location) should not be double counted.

c) Determine the geographic unit to be used for reporting. The national level would seem to be a reasonable "common denominator." To the extent that more granular data are available, e.g., state or province, and would provide for additional comparisons to similarly sized regions (e.g. United States and Canada compared to Europe), OECD could consider publishing these data. The geographic unit of analysis required for some purposes may be case-specific and more granular than the available OECD data.

d) Document the utility and limitations of the competitive data the OECD is practically able to collect.

i) Examples include: dynamic cross-industry competition vs. network competition; potential vs. actual competition; and the utility and limitations for analysis, such as pricing and market share analysis.

ii) Acknowledge the importance of enterprise broadband to the broader objective of measuring national economic performance, though the main focus of the current scope of the metrics will be broadband competition for residential and small business users.

iii) To the extent that new metrics and useful data become available to strengthen the utility and address limitations, ensure a process for expeditiously including them among the competitive metrics. Conversely, consider a process for eliminating metrics that no longer serve a useful purpose.

ANNEX 4 .

OECD METRICS WORKSHOP JUNE 14-15, 2012 (LONDON)

Workshop Session 4: New approaches to measuring mobile broadband

Rapporteur Group Members: Balázs Zörényi, European Commission
Agustin Diaz-Pines, OECD
Iñigo Herguera Garcia, CMT (Spain)
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Issue

The objective of the session is to identify specific mobile broadband metrics which should be collected in order to track and compare the deployment, take-up and use of mobile broadband networks in member states.

The following key problems are to be addressed:

- What are the issues with current OECD mobile broadband data?
- What are the characteristics of mobile broadband that require different metrics or a different approach to data collection?
- How to measure demand for mobile broadband?
- How to measure capacity of mobile broadband networks?
- How to measure actual performance of mobile broadband networks?

In addition, the original OECD Metrics Checklist (DSTI/ICCP(2010)19/REV2) includes the following reference to mobile broadband metrics among the long term objectives:

- Demand-side customer-survey metrics such as frequency and purpose of broadband Internet use by owners of mobile devices of various types; customer awareness of available mobile applications, and customer willingness to use new mobile applications; survey information about pricing and other customer concerns that affect adoption;
- Supply-side metrics such as cell size, capacity utilisation, and spectrum availability;

1 Introduction

This paper concerns metrics related to mobile broadband services. Mobile broadband is defined as internet access provided through cellular mobile networks (WCDMA, CDMA2000 EV-DO, 3G, HSPA, LTE, Mobile WiMax and TD-SCDMA). It implies that other fixed-wireless technologies such as WiMAX, WiFi and satellite are out of scope.

The mobile market is the most dynamic segment of the broadband access market. As of 2010, 35% of population was covered by 3rd generation mobile networks (WCDMA/HSPA), which is forecasted to go up to 80% in 2016 worldwide. 4th generation mobile networks (LTE) will cover 35% of the worlds` population in 2016.[33] In the EU, the coverage of 3G mobile networks already reached 90% by end of 2010[34]. Looking at take-up, there were more than 900 million mobile broadband subscribers worldwide in 2011, and this figure is expected to grow to close 5 billion in five years.[35] In OECD countries, the penetration of wireless broadband reached 47.9% with close to 600 million subscriptions as of June 2011. Penetration in Korea, Sweden, Japan and Finland are above 80%.[36] In the EU mobile broadband penetration (subscriptions per population) stood at 34.6% in July 2011 up by more than 50% compared to the previous year in the EU.[37]

Mobile broadband offers ubiquitous, always-on connectivity, which radically changes customer behaviour on internet use. Based on a Google survey of US smartphone users, 89% use their smartphones for purposes other than voice calls every day. As for usage types, 81% browse the internet, 68% use an application and 48% watch videos at least once a week.[38]

With the evolution of mobile technology, mobile operators may compete directly with fixed broadband technologies, which would completely change the competitive situation of the broadband market. Mobile broadband can stimulate investments in the fixed broadband environment, which can accelerate the transition from legacy broadband to Next Generation Access technologies.

The expansion of mobile broadband requires new strategies from mobile operators still generating 86% of revenues on traditional voice services. Mobile data traffic surpassed voice traffic in Q4 2009, and was more than twice as high as voice in Q2 2011. By 2016 mobile voice traffic will be a fraction of total mobile traffic.[39] Mobile operators need to manage the traffic-revenue paradigm, where traffic grows exponentially requiring substantial investments, and revenues stagnate or even decline.

We have identified six key characteristics of mobile broadband that should be taken into account when defining metrics.

Mobility

An important benefit a mobile connection can offer is that you can access the internet anywhere and anytime (within the network coverage limits), which completely changes how people use the internet. Mobility can mean accessing the internet on the move (e.g. on a train, on the street). Mobility can also mean using mobile internet in more than one fixed locations (e.g. at home, at work, in a holiday location). It is important to note the most popular place to use mobile internet is at home and that particular attention is to be placed on how to substitute a fixed connection with mobile, and use it very much the same way.

33 Source: Ericsson: Traffic and Market Data Report (November 2011)

34 Source: Idate, http://ec.europa.eu/information_society/digital-agenda/scoreboard/docs/pillar/broadband_coverage_2010.pdf

35 Source: Ericsson: Traffic and Market Data Report (November 2011)

36 Source: OECD Broadband Portal, http://www.oecd.org/dataoecd/21/35/39574709.xls

37 Source: Communications Committee, http://ec.europa.eu/information_society/digital-agenda/scoreboard/docs/pillar/cocom_broadband_july_2011.pdf

38 Source: Google/IPSOS OTX MediaCT: The Mobile Movement (April 2011)

39 Source: Cisco Visual Networking Index: Global Mobile Data Traffic Update, 2011-2016 (2012)

Mobile operators need to decide to what extent they encourage WiFi use at home, or even invest in WiFi hotspots to off-load traffic outside home.

A personal connection

When measuring fixed broadband, we look at the number of households with a subscription or coverage. We report penetration as a percentage of households (and/or businesses). At the same time, mobile broadband is linked to a personal device, and therefore mean a personal internet connection.

Variety of devices

In the past, people accessed the internet on desktop PCs and notebooks. Mobile broadband has made the picture much more colourful, today there is a continuum starting with fairly basic mobile phones, with tablets and netbooks in the middle, and ending with PCs. Having such a variety of devices requires a segmentation, although defining the segments precisely and reporting based on them may not be feasible. The multiple use of devices is also important to consider.

Capacity constraints

Capacity is more scarce than in fixed broadband. Mobile operators manage capacity issues by applying more restrictions on traffic than in a fixed environment. In fixed broadband, offers may be based on speed, whereas in mobile the use data caps is very widespread. Fair use policies are generally much stricter, certain data hungry applications may be restricted or blocked and heavy users may face penalties (additional fees or speed reduction).

Speed constraints

As a consequence of the above described capacity issues, there is a much higher variation in effective end-user speeds between peak and off-peak hours than in fixed broadband. Theoretical maximum speeds are very much above the experienced quality. The available speed may also be limited by the device, e.g. most of the devices currently used do not support LTE.

The international dimension

Mobility also has an international dimension, people use not only mobile voice but also mobile data services abroad. The OECD adopted a recommendation on mobile roaming in February 2012, which mentions the importance of providing customers with transparent information on the costs of data roaming. The OECD considers that imposing a financial limit on data roaming would help. According to a recent OECD report, 1 MB roaming data could cost as much as 25 USD[40]. The European Union has set the objective that the difference between roaming and national prices should approach zero, and will regulate not only the wholesale but also the retail data roaming prices as of July 2012. In the longer term, the EU would like to create real competition on roaming markets to ensure that prices go down.[41]

40 http://webnet.oecd.org/OECDACTS/Instruments/ShowInstrumentView.aspx?InstrumentID=271&InstrumentPID=276&Lang=en&Book=False

41 http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/12/316&format=HTML&aged=0&language=EN&guiLanguage=en

2 Basic Take-up Indicators

Proposal

We propose to

- evaluate the option of measuring mobile broadband separately from terrestrial fixed wireless and satellite broadband and include these two technologies as a part of fixed broadband:
  - Fixed terrestrial wireless and satellite connections are more closely aligned to wireline broadband in terms of the relevant product market. These connections tend to have different price/usage characteristics from mobile connections, only one connection is purchased per household and they are used as the primary access similar to a wireline connection.
  - However, the decision to categorise connections as wireline vs. wireless (rather than fixed vs. mobile) was made relatively recently. It could be confusing to change this again.
- better capture the different user segments by
  - separating subscriptions based on the use/non-use of voice services

    AND
  - defining five categories based on the data allowances:
    - no data allowance,
    - less than 500MB,
    - less than 1GB
    - less than 5GB
    - at least 5GB

Background

The OECD defined a methodology on wireless broadband indicators in 2010.[42] Under wireless broadband the OECD currently reports terrestrial fixed wireless, satellite and terrestrial mobile wireless subscriptions. For terrestrial mobile wireless (that we refer to as mobile broadband in this document), two indicators have been defined: standard mobile subscriptions and dedicated data subscriptions.

Standard mobile subscriptions include those mobile subscriptions that had actual internet use in the previous three months, but no separate data subscription was purchased.

Dedicated data subscriptions include those mobile subscriptions that have a recurring data subscription to dedicated data services over a mobile network that are purchased separately from voice. A data subscription can be a stand-alone subscription (modems/dongles) or an add-on to a voice plan. For these subscriptions the actual use is not a condition.

42 http://www.oecd-ilibrary.org/science-and-technology/wireless-broadband-indicator-methodology_5kmh7b6sw2d4-en

	Active use Used for an Internet data connection over IP in the previous 3 months	**Not Active use** Not used for an Internet data connection over IP in the previous 3 months
Standard Mobile Subscriptions Mobile subscriptions where data is available but not purchased as a separate subscription	INCLUDE	EXCLUDE
Dedicated Data Subscriptions Recurring subscriptions to dedicated data services over a mobile network that are purchased separately from voice. Can be a stand-alone service (modem/dongle) or an add-on service to a voice plan	INCLUDE	INCLUDE*

* Prepaid data plans without recurring subscription fees require active use to be counted.

For both indicators a minimum headline speed of 256 kbps is applied. It is to be noted that the ITU uses the same definition as the OECD in mobile broadband.

Analysis

We have identified four fundamental questions that need to be answered when defining basic take- up metrics for mobile broadband.

Users versus subscribers

Data collection on fixed broadband captures the number of lines/subscriptions without looking at the actual usage. In mobile broadband the situation is more complex, as the majority of users have no specific data subscription, so concentrating only on specific data contract would result in a fairly biased picture. We agree that the current OECD methodology includes those without a specific data contract and reports a mix of users and subscriptions.

Broadband traffic versus internet traffic

There is a wide range of services that can run on mobile networks. The OECD considers that only subscriptions that provide access to the Internet should be included. This means that those services providing access only to a walled garden or an email service are excluded. It also implies that Machine-to-Machine cards are not in scope. We agree with excluding both categories. As for walled garden services, the reason is the significant restriction on the range of available services. Machine-to-Machine subscriptions are a completely different market, which should be looked at separately.

Segmentation models

The choice of the device very much determines the usage of the customer. Based on a recent report by Cisco, the global average usage on smartphones was more than ten times lower than on laptops and netbooks. Tablets are in the middle with more than three times higher usage than smartphones but four

times lower usage than computers. Although these differences are expected to get smaller in the future, they will remain significant.[43]

Mobile broadband average usage (MB/month) for device categories

Device	2010	2011	2016
Smartphones	55	150	2576
Tablets	405	517	4223
Laptop, netbook	1460	2131	6942

Source: Cisco

Device segmentation would definitely make sense, but it can only be implemented using a survey of users, because operators cannot precisely distinguish between these three categories. The OECD survey of operators therefore does not segment the market based on devices. The EU/BEREC methodology differentiates between small and large screen usage by defining a category for the use of data cards, modems and USB keys. These specific devices can be identified by most of the operators based on IMEI numbers. This requires a large reporting effort from the operators and may not be feasible at the OECD level.

We considered two alternative segmentation models to categorise the wide range of mobile broadband users, which are easier to implement by operators. The OECD methodology differentiates between those with and without a recurring data allowance. We consider this as a good proxy to report separately the occasional and regular users, since the pricing structures generally offer much more favourable conditions for those with a data allowance. However, the current methodology does not capture large screen and small screen users separately. We propose to define two sub-categories of the dedicated data subscriptions. Light user could be defined as having a lower than 1GB allowance, and heavy users as having at least 1GB allowance. A more granular segmentation with 3-5 subcategories could also make sense, although this may complicate the reporting of operators. A comparable categorisation of time based offers could also be considered.

Another alternative segmentation model can be based on the availability (or the actual use) of voice services. The small screen and large screen segments can be identified by using this methodology.

It should be noted, however, that none of the above alternative segmentation models can identify tablet users.

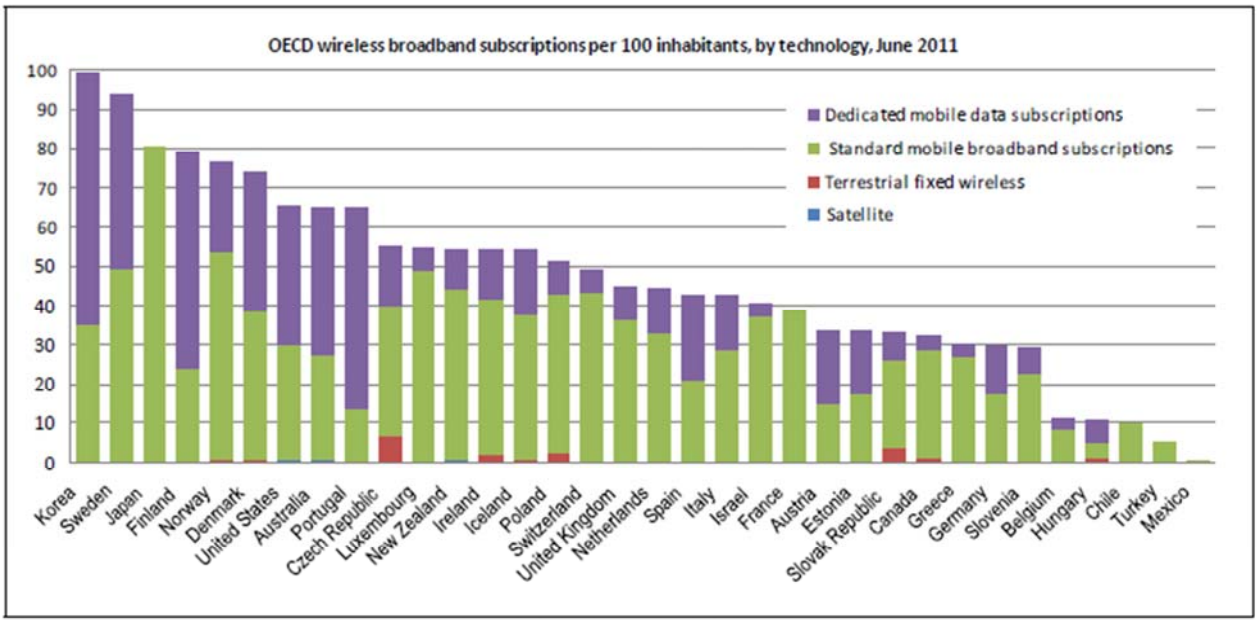
Data collection methodology: survey of operators versus survey of users

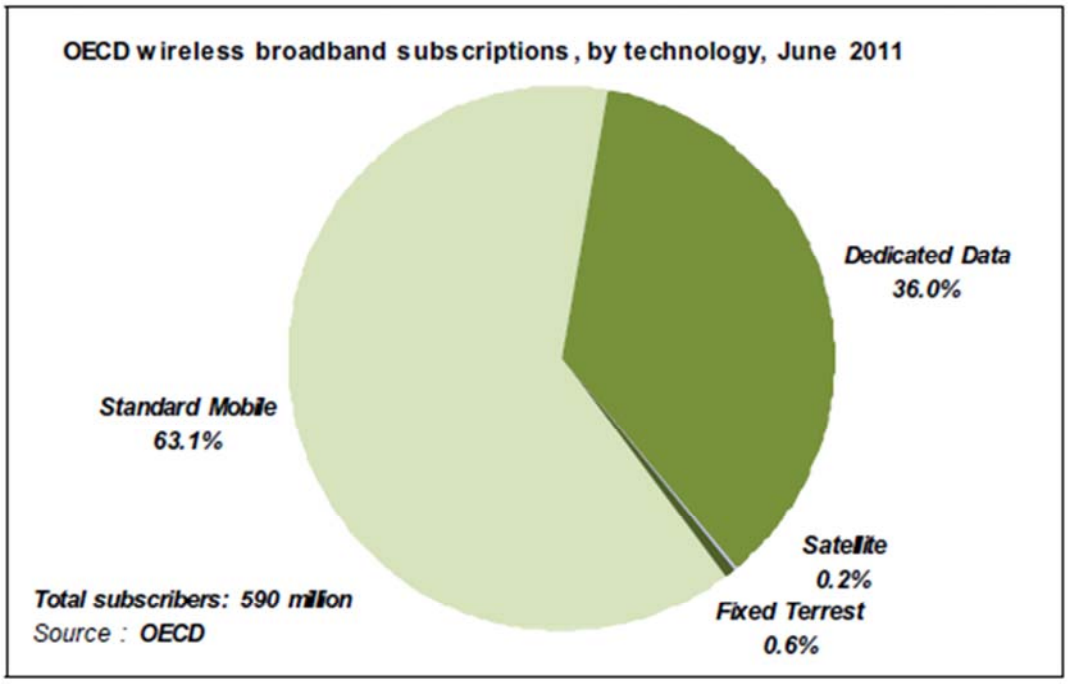
Currently this information is collected from telecom operators (through the regulators or ministries of the member states). This is a cost efficient way and provides factual information. An alternative way would be to survey users, which would have excessive costs looking at large geographic areas. The survey methodology, at the same time, can provide a lot of insights into usage habits, which is discussed in the following section of this paper.

[43] Source: Cisco Visual Networking Index: Global Mobile Data Traffic Update, 2011-2016 (2012)

Additional Background

OECD statistics on wireless broadband take-up[44]





The EU/BEREC definitions on mobile broadband

The definitions of the EU are very similar to those of the OECD and the ITU.

44 http://www.oecd.org/document/54/0,3746,en_2649_34225_38690102_1_1_1_1,00.html

Mobile broadband refers to third generation technologies (3G) and higher speed mobile technologies (i.e,. HSPA or LTE), while excluding GSM/GPRS technologies. Retail access should be reported. In the case of UMTS the unit of reference is SIM/USIM cards (including modem/dongles). For the CDMA standard, the unit of measurement should be the number of User Equipments.

Actual usage of standard mobile subscriptions: Number of subscriptions which made an Internet mobile connection in the last 90 days through a standard mobile subscription. Standard mobile subscriptions are typical voice subscriptions which also provide access to the Internet but are not purchased separately. Standard mobile subscription excludes dedicated Internet mobile subscriptions. An Internet mobile connection is a connection to the open Internet using Internet Protocol (IP). Hence, subscriptions which only offer ―walled garden‖ or email-only services (or SMS/MMS only) as well as those offering access to the open Internet but that only have made access to "walled garden" and email-only services in the last three months will not be considered. Bundled offers (i.e., voice and data access) for a unique (flat rate) tariff are to be counted if a data connection has been made in last 3 months.

Dedicated data subscriptions for stand-alone services via cards/modems/keys ONLY: Number of subscriptions to dedicated data services over a mobile network which are purchased separately from voice services as a stand alone service (modem/dongle), i.e. excluding mobile handset users. All dedicated data subscriptions with a recurring subscription fee are included as "active data subscriptions", regardless of actual use. Pre-paid mobile broadband plans (i.e. all non- recurrent fee subscriptions) require active use in previous 3 months. Subscriptions which only offer ―walled garden‖ or email-only services (or SMS/MMS only) will not be considered. Bundled offers (i.e., voice and data access) are excluded.

Dedicated data subscriptions for add-on data package to a voice service requiring an additional subscription: Number of subscriptions to dedicated data services over a mobile network which are purchased separately from voice services as an add-on data package to voice service which require an additional subscription (i.e. excluding datacards/dongles). Recurrent fee subscriptions (i.e., contract) are included automatically. Prepayment subscriptions (or any other type of non-recurrent subscription) need to pass the activity criterion (a usage occurred in the last 3 months). Subscriptions which only offer ―walled garden‖ or email-only services (or SMS/MMS only) will not be considered. Bundled offers (i.e., voice and data access) are excluded.

3 Demand-Side Metrics

Proposal

Demand-side metrics for mobile broadband may be broken down into three categories, depending on the source: survey-based data (which can be produced by regulators, statistical offices, IGOs, etc.), other data from mobile operators/regulators and data from other industry stakeholders.

It is crucial to highlight the importance of having metrics on the demand side, as they are better adapted to capturing the actual use of mobile broadband service. However, most metrics are based on surveys, which are resource demanding and provide data with a considerable delay. So decision about the number of metrics to collect and the frequency is up to the national authorities and will be based on resources.

Rapporteur Group 4 recommends that the following metrics should be collected, via general ICT surveys or (preferred option) in ad-hoc studies with some common methodology across OECD countries:

Survey-based data

Households/consumers

- Penetration of mobile broadband (handset, laptop, tablet).
- Applications used (social networks, mobile banking, email, etc.), frequency, usage patterns. (time of the day, etc.).
- Socio-economic profile of mobile broadband users (age, gender, education, etc.).
- Consumer satisfaction with mobile broadband.
- Obstacles to using mobile broadband (e.g. security, costs, low performance)

Businesses:

- Mobile broadband penetration
- Applications used (email, ERP, etc.)
- Frequency of use, usage patterns, etc.
- Obstacles to using mobile broadband (e.g. security, costs, low performance)

Detailed information on socio-economic variables for households and individuals, and economic variables for businesses, has proved to be extremely useful to support the economic analysis.

Data from mobile operators/regulators

- Number of active mobile broadband connections (OECD methodology)
- Mobile broadband traffic (total and per subscriber) – included in CO2013 questionnaire
- Usage patterns (breakdown of consumers by number of days of use, data allowances, actual data consumption, etc.)
- QoS data (actual speed, etc.) – addressed by other RG.

Recommendation: These data should continue to be collected, bearing in mind the possible commercial confidentiality concerns. They are extremely useful to derive further metrics (e.g. pricing), as well as for detailed demand analysis.

Data from other industry stakeholders

This data is subject to availability/willingness from the industry and to possible commercial confidentiality concerns. Some examples are:

- Top mobile Internet sites.
- Traffic data (Cisco, Akamai)

Recommendation: Regulators should try to engage more with industry stakeholders in order to achieve a better understanding of their data.

Background

- OECD document ―Proposals for a revision of the OECD model survey of ICT access and use by households and individuals (DSTI/ICCP/IIS(2011)2).
- Eurostat, Model Questionnaire, European Union survey on ICT usage in households and by individuals, years 2006 to 2012

Analysis

As mobile use is largely based on individuals, surveys should focus on them, even though household metrics may also be useful (e.g. how many smartphones are used in a household).

Household metrics also serve comparability purposes with other household-based services (fixed telephony/broadband, TV).

Ideally, survey data could include more detailed questions on mobile broadband usage, but there are serious concerns with this approach (e.g. resource limitation, possible degree of accuracy of the questions, frequency of the data collection, processing time).

However, this data has a certain number of limitations. First, general ICT surveys have to be necessarily limited to a small number of very simple questions, as the scope of the survey is much broader and level of detail may therefore not be very high.

In order to cope with the limitations of general ICT survey data, a number of regulators have developed ad-hoc surveys on mobile broadband usage and gathered very interesting data.

Additional Background

Metrics being collected to date (non-exhaustive list)

A number of mobile-broadband related indicators are being asked to date in ICT households and business surveys. For example:

EU Survey on ICT Usage in households and by individuals 2013

- What types of Internet connections are used at home:

Mobile broadband connections: e) mobile phone networks (at least 3G, e.g. UMT), via handset, f) mobile phone networks (at least 3G, e.g. UMTS) via a card or USB key (e.g. integrated SIM card).Mobile narrowband connection (less than 3G, e.g. 2G+/GPRS, used by mobile phone or modem in laptop).

- Do you use any of the following mobile devices to access the Internet away from home or work: a) mobile phone (or smart phone)….a1) via mobile phone network, a2) via wireless network (e.g. WiFi)., b) Portable computer (e.g. laptop, tablet), b1) via mobile phone network, b2) via wireless network (e.g. WiFi).

EU ICT survey in households and for individuals – Module D – mobile use of Internet

D1- Did you use any of the following portable computers to access Internet away from home or work in the last 3 months?

D2- Which of the following networks did you use?

D3- On average, how often did you use it?

D4- Did you use any of the following handheld devices to access the Internet away from home or work in the last 3 months

D5- Which of the following networks did you use to connect the handheld device?

D6- On average, how often did you use it?

D7- For which of the following activities did you use the Internet via a handheld device in the last 3 months for private purpose (e.g. email, reading news, books, games, audio, social networks)

D8- Did you use location-based applications?

D9- For work purposes, did you use your laptop or handheld device?

D10- Did you encounter any of the following: problems in getting information about cost, unexpected high bills, coverage difficulties, setting parameters, inconvenience with small screen.

D11- What are the reasons for not accessing the internet with a portable computer or handheld device?

Community Survey on ICT Usage and e-Commerce in Enterprises 2012

- - Mobile connection to the Internet for business use

B10- Did your enterprise provide to the persons employed portable devices that allowed a mobile connection to the Internet?

B11- if so, portable computers? Other portable devices?

B12- How many persons employed were provided with a portable device? (No or %)

B13- To those: did your enterprise allow: access to the Internet, to corporate email, corporate docs, corporate business SW (ERP)?

B14- What were the obstacles that prevented your enterprise from using a mobile connection to the

Internet (connectivity problems, costs, security, integration obstacles, etc.)?

Other interesting data/questions:

Korean Survey 2010

- Registered mobile baking users (page 6)
- Internet access method by industry and technology, by establishment size,

US household survey

- When you use your cellular phone or smartphone, do you a) make calls?, b) send texts?, c) browse the web?, d) email, etc?

OECD proposal (2011) - DSTI/ICCP/IIS(2011)2 – data requested

2.-Access at home to any from the following devices (smarphone, PDA< handheld computer), tablet, etc.

2.1-How many devices do you have?

Section on mobile phone use by individuals:

- B1- When did you most recently use it? On average how often? For how many years do you use it? In the last 12 months have you changed? For which of the following activities do you use it? In the last 12 months, have you received texts, images or other messages that were harassing or threatening?
- B3- Mobile wireless use of the internet: In the last 12 months, did you have personal use of the following portable or handheld devices? Did you access the internet through portable computer? Which of the following networks did you use? Did you access the internet through any from the following handheld devices? For which activities did you use them for personal non-business use? On average how often do you use them?

OFCOM – The consumer experience 2011 – data requested

http://stakeholders.ofcom.org.uk/binaries/research/consumer-experience/tce-11/research_report_of511a.pdf (data from Ofcom communications tracking survey)

- % of smartphone owners by age, gender, socio-economic and urbanity profile.

- Places where mobile broadband is used (always in the home, mainly in the home, equally in and outside, mainly outside, always outside).

OFCOM – Measuring Mobile Broadband in the UK

http://stakeholders.ofcom.org.uk/binaries/research/telecoms- research/bbspeeds2010/Mobile_BB_performance.pdf

OFCOM's Communicati ons Market Report 2011 – data requested

http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr11/UK_CMR_2011_FINAL.pdf

- % of mobile users using service: Internet-enabled services, web access, emailing, IMS, downloading programmes.

- % of mobile users browsing news and information.

- Use of Internet on mobile phones, by demography.

- Q13. And which of these do you ever use the internet on your mobile phone for? Base: Those who access the internet via mobile phone (212) – (search engines, emails, browsing websites, looking for jobs, social networking sites, etc.).

- Unique mobile phones accessing social networking services.

- Top ten UK mobile internet sites, by time spent.

- Devices used to visit internet websites in 2010, by age.

- Take-up of mobile broadband, by socio-economic group: Q1 2011.
- Residential consumer satisfaction with aspects of mobile broadband.

(some data are from external sources – Comscore, Enders Analysis)

Spain – information society observatory (Red.es) - data

- % of Internet users that accessed the Internet with handheld device or laptop.

OPTA (Netherlands) – market report

- In H1 2011, 5.9 PB of data were transferred.

NPT (Norway) – market report

- Data traffic in TB of data (breakdown by standard and dedicated mobile broadband)

OFCOM Infrastructure report

http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/bbspeeds2011/infrastructure- report.pdf

4 Supply-Side Metrics

Proposal

We recommend the following mobile broadband supply-side metrics, grouped into the four categories of *Coverage, Capacity, Speed, and Competition*. Primary recommendations are shown in bold. Secondary recommendations are options included to foster and facilitate additional discussion.

Coverage Metrics:

- **Nationwide percent of population with mobile broadband coverage, all major providers considered**
- Population coverage measured separately for each major provider

Capacity Metrics:

- **Spectrum: Total spectrum bandwidth available nationwide on average, considering the major mobile bands in use worldwide, and where "available" is defined to mean allocated, assigned to a licensee, and not encumbered by other uses. May use population-weighted or geographic-weighted bandwidth average. May want to distinguish bandwidth frequencies, e.g., spectrum above and below 1 GHz frequency. May also want to count FDD and TDD spectrum separately**
- **Air interface: Nationwide percentage of population and/or geography covered by each major air interface technology that meets the definition of broadband. Also separately indicate air interface carrying voice traffic**
- Air interface: Capture impact of interface technology by measuring speed performance (see next section for speed measurement options).
- Physical infrastructure: Cell sites per population covered or per square km. covered

- Physical infrastructure: Capital expenditure per population covered or per square km. covered. Track both annual and cumulative capex

Speed Metrics:

- **Actual speed, captured by testing: national average and for major sub-national areas**
- Measure speed indirectly by (as above) identifying air interfaces: nationwide percentage of population and/or geography covered by each major air interface technology
- Advertised peak download speed: national average and for major sub-national areas
- Advertised average speed: national average and for major sub-national areas

Competition Metrics:

- **A cumulative distribution showing the percentage of the population by number of facilities-based service providers available from which to obtain (close to) nationwide service, i.e. a table showing:**

  Percent of population with coverage by 5 or more providers:

  Percent of population with coverage by 4 or more providers:

  Percent of population with coverage by 3 or more providers:

  Percent of population with coverage by 2 or more providers:

  Percent of population with coverage by 1 or more providers:

- **National market shares of the major facilities-based providers, measured by subscribers or revenue**
- Number of MVNOs that provide (close to) nationwide broadband coverage
- Overall national subscription market share of MVNOs

Background

The OECD Broadband Portal contains one mobile broadband supply-side metric: "3G Coverage". However, the "[c]overage data are measured using different indicators and have different reference dates and thus may not be fully comparable. *See* Diaz-Pines, A. (2009), "Indicators of Broadband Coverage", *OECD Digital Economy Papers*, No. 165, OECD Publishing. http://dx.doi.org/10.1787/5kml8rfg777l-en.

The OECD Communications Outlook 2011 contains data on the amount of spectrum available, by country, for next generation mobile service (Table 4.1). It also contains a number of cellular/mobile data series that likely shed some light on mobile broadband, such as the number of cellular providers by country (Table 2.1), mobile market share (Table 2.4), cellular investment (Table 3.7), and mobile connection speeds (4.18).

Analysis

The supply side of mobile broadband service may be reasonably characterised by considering four major concepts.

Coverage. Two similar but distinct coverage issues are of interest. First, who cannot subscribe to mobile broadband service at all, because they reside in locations without broadband coverage (population

coverage)? Second, how complete is mobile broadband coverage in general (geographical area coverage)? We suggest measuring only population coverage. Although geographical area coverage also provides useful information on mobile broadband networks, it would deliver misleading results for scarcely populated countries.

We recognise that mobile broadband coverage data for individual operators may be considered sensitive, and thus may be difficult to collect or make public.

Capacity. The maximum output that a firm or sector can provide per unit of time is its capacity. In the case of mobile broadband networks, this can be defined as the maximum amount of information transmitted per unit of time. Alternatively, it might be defined as information per unit of time normalised for network size, using measures such as bits/second/covered population or bits/second/km2. However, it's not clear that any of these output-based measures is a feasible metric. Thus, we propose several narrower, alternative metrics based on major inputs to the production of mobile broadband service, which follow from modelling capacity as a function of three variables:

Capacity = f (spectrum, air interface technology, physical infrastructure).

Focusing on more than spectrum recognises that there may be important substitution possibilities among the major inputs.

Speed. Speed is one determinant of capacity, but it is also a major characteristic of the service being provided, and thus is, by itself, a key supply-side variable influencing subscription and usage choices.

Competition. A limited number of structural metrics cannot be sufficient to characterise competition in mobile broadband markets. Structural issues are complex; conduct is also a major determinant of performance; and competition may take different forms, for example focusing on quality rather than price. However, competition-related structural metrics that are collected consistently across countries may nonetheless be useful descriptive indicators. Such metrics must be able to reflect the fact that competitive conditions may vary within countries.

Note that the information necessary to develop the primary recommended competition metric—the percentage of the population having access to various numbers of mobile broadband providers— would also be sufficient to yield the recommended coverage metrics identified above.

A differentiation should be made between facility-based and non-facility based competition. Facility-based competition can provide much more value for customers, as the network itself can be a strong differentiator in the value proposition of an operator. This is the reason why we concentrated mainly on facility-based operators, although we suggest two metrics to measure the performance of non-facility based operators.

Additional Background:

A common measure of spectral efficiency, or throughput per bandwidth, is bits/second/hertz. And at the first Metrics workshop, actual Gbits/sec/km^2 was proposed as a measure of spectrum utilisation. Here, in contrast, maximum possible bits/second/covered population and maximum possible bits/second/km^2 are identified as quantifications of overall network capacity, taking account of the effect of spectrum and all other inputs.

5 Mobile broadband pricing

Proposal

On the collection stage

Recommendation 1: unless time-metered tariffs are widespread, it is better to ignore them for price benchmarking purposes since they may appear as the "winning offers" (i.e., minimum expenditure tariffs) when in fact they are seldom offered.

Recommendation 2: collect tariffs offered clearly and transparently in the web site of the operators. Promotions and other components of the tariff plans should be clearly stated.

How should mobile BB tariffs be compared?

Recommendation 3: since laptop, tablets and smartphones type of subscriptions are to be collected and for each a different expected usage intensity is assumed, the comparison of prices/ tariffs should be made as well at least from two different scenarios:

- Stand alone mobile BB or data only service (for laptops and tablets)
- Bundled services, for smartphones and other devices with which people usually make phone calls, send SMS and access the internet. These shall include voice, SMS and data. Some "winning offers" may be bundled with services not considered in the tables, such as roaming services, or VoIP services. We consider that this should be described somewhere in the outcome tables.

Recommendation 4: in general for bundling, a periodic revision of the extension of bundles may be needed. Bundles may evolve not only in terms of volume of services included in the flat price, but as well in the number of the services included in the contract or in the tying of a set of specific services with other (complementary) ones.

Recommendation 5: to the extent that is possible (i.e., enough sample size is obtained), not only the **minimum expenditure tariff** should be provided for each country, but the **median** tariff as well. This will yield a better picture on the range of prices that any specific country has. Additionally, the **number of offers collected** for each segmentation shall provide interesting information. The total number of offers/ tariffs encountered per country and per dimension /segmentation category should be provided.

How can the methodology be improved in the long run?

Recommendation 6: if representative prices for the "average consumer" are to be obtained and compared across countries, i.e., prices that reflect what an average consumer actually pays for its connection, a different methodology is needed, one based on factual information of what consumers actually pay for their BB connection. Bill harvesting or web based tariff collection methods that collect micro- data are possible ways to achieve this.

Recommendation 7: in several countries subsidies to terminals are an important element in the tariffs offered. The amount of subsidisation may be high, and may affect the final expenditures obtained, given a specified consumption pattern. It would be relevant to know the extent of the subsidisation effort in several markets and its effects on the tariffs used. This could be analysed independently of the periodic metrics provided by OECD.

Background

Given the very rapid development of mobile BB services across the world and the very different patterns of use of the BB connections depending on many factors (type of device, moment of use, socio-economic factors, type of network used….), it is relevant to measure mobile BB prices in the OECD, both across countries and over time.

Mobile BB pricing plans have many different features and price discrimination is very common. The variety of tariffs observed, each adapting a different pattern of expected usage, renders it difficult to measure "one" price that is representative. There is a clear need to differentiate tariffs based on use and willingness to pay.

In this section the most important segmentation dimensions are reviewed with the aim of obtaining a set of prices that are comparable across countries and over time. The aim is not to select the representative prices, or the average price paid for a mobile BB connection in a specific country, but a rather limited objective is proposed: **to propose criteria for selecting prices/tariffs that are comparable under a few assumptions across countries.**

Need for tariff segmentation

Mobile BB tariffs are highly differentiated. The main difference in explaining tariffs observed for mobile BB in contrast to those observed for fixed BB, is that for mobile BB usage matters. Across countries some common dimensions of differentiation encountered are:

1- speed of connection,
2- connecting device (big, mid, and small screen),
3- structure of tariff plan (flat rates, n-part tariffs, payments per time or per volume),
4- pricing schemes that allow the customer to self-control expenditure, such as pre-payment, and those that do not,
5- volume and time allowances and the types of overage limits that kick in once an allowance is exceeded by a consumer. These overage limits vary from: being disconnected, reducing the connection speed, or monetary overage payments, and
6- bundled and unbundled services.

Dimensions 2 – 5 are basically based on the *expected usage by the consumer*. Consumers depending on the device they use to connect to BB or depending on other factors as well, have very different patterns of expected usage (downloaded volume and frequency of usage) and operators offer a whole array of tariffs to better meet the expected consumption.

Additionally, consumers value the possibility to control their expenditure and operators offer several control mechanisms to limit total expenditure and/ or usage with different tariffs schemes (volume caps, time based caps, speed- throttling- or money payments). These elements are even more relevant in the case of smartphone (or small-screen) users. It is smartphone usage that is growing at very high rates.

Given the existing variety of final tariffs, a "consumption basket" approach - as used by the OECD - to compare mobile BB tariffs has very attractive properties.

The segmentation criteria listed does not have the same relevance when explaining differences in tariffs. For example, volume allowances are clearly associated with the final price; the higher the volume allowance, ceteris paribus, the higher the price of the monthly connection will be. But other segmentation criteria may not have a clear influence on the final price. Furthermore, the importance of each

differentiation dimension may evolve over time. In the Figure below an example is provided on the relative importance of several characteristics of mobile BB tariffs for a EU sample.

The OECD already has a methodology for collecting and comparing mobile BB tariffs that incorporates many differentiation dimensions. The methodology is based on baskets of consumption, by which a specified set of consumption intensities is first assumed (low, medium, high…) for the services to be included in the plans that are to be compared (voice, SMS and BB connection). Then, the whole set of tariffs collected for all countries are plugged to the different consumption baskets assumed, and the minimum expenditure tariff is selected for each country and for each segmentation made.

Analysis

On the tariffs to be collected

In an exercise done for 17 countries in the EU in 2011 for USB/datacards only tariffs, it was found that:

1- metered tariffs represent only 7,3% of all offers
2- volume capped offers are 80% of all tariffs in the sample (1000). Almost half of them have monetary penalty, and the other half a speed reduction penalty once the allowance has been consumed.
3- 21,3% of the tariffs had some sort of promotion
4- many are tied to a PC or a table sale in conjunction with the data connection
5- even if big-screen plans, 25% of them require some additional payment for the USB or modem.

In establishing criteria to collect and compare mobile BB tariffs, care must be taken in order to **avoid biases that may emerge as a result of comparing tariffs that are not really demanded in the marketplace.**

For example in the EU only 7,3% of all USB/dongle dedicated tariffs existing in 2011 were time-metered tariffs. The majority of the tariffs advertised were volume-capped tariffs (or unlimited ones, together they made 80% of all the existing tariffs). The problem when mixing time-metered together with volume capped tariffs, is that for a given number of hours (and associated volume of downloaded MB), time–metered offers dominate (offer smaller expenditure) than volume capped offers. The comparison of both offers at the same time may bias results in favour of time-metered offers, where in many countries they are a real minority (and seldom used) subscription. These offers (time-metered) are to be eliminated if not representative.

Monthly Tariff for Postpaid Mobile Broadband Subscriptions in the EU 17 (via modems, air cards or USB dongles), *Source:* T- Connect, 2011	
	Fraction of all offers in April 2011
Unlimited offers	3,1%
Volume metered offers with monetary overage charges	44,7%
Volume metered offers with transfer speed penalty	45%
Time metered offers with monetary overage charge	7,3%

Unless time-metered tariffs are widespread, it is better to ignore them for price benchmarking purposes since they may appear as the "winning offers" (i.e., minimum expenditure tariffs) when in fact they are seldom offered.

Bundles and stand alone products

There is a big rise in new devices from which users can access the mobile internet. These devices will most probably increase in number as time evolves. Each device has its own characteristics in terms of viewing easiness, frequency of usage and type of services to be used with. Many of these devices offer only data connection (i.e., no voice or SMS).

Bundles evolve over time in terms of the number of services or volume of each service included in the flat part of the tariff structure. Today, the most widely observed bundles include mobile BB connection together with voice (and SMS) services. The voice services usually relate only to national/domestic calls. In the near future it may well be that international (i.e. roaming inside the EU) may be included in some bundles.

Over-the-top services, OTT, are increasingly observed as well in the market place, either services that allow phone calls to be made over broadband, or content related services that use the BB connection contracted. Even if today OTT services are contracted ―over the top as well, ignoring the ISP provider, it may well be that in the future some of these OTT services are bundled together with the traditional services offered by the connection provider.

A commercial practice already observed in the market is a form of **contractual tying**, by which an operator offers a significant discount of a, say, fixed double pack (fixed voice and BB connection) if and only if, the consumer subscribes as well to the mobile service offered by the same operator. There is no discount on the mobile service, in this example, but there is a big discount in the complementary service (fixed double pack). The question is how to treat these contracts? These types of contracts may grow over time given that many operators are horizontally integrated (they have both fixed and mobile networks).

In general, for bundling a periodic revision of the extension of bundles may be needed. Bundles may evolve not only in terms of volume of services included in the flat price, but in the number of the services included in the contract.

On the way to compare tariffs

The minimum expenditure tariff is a very good parameter to collect. It is important to state clearly that by selecting the minimum expenditure tariff for each country, the comparison does not pretend to signal that these prices represent what an average user, for a specific pattern of consumption, actually pays for the connection.

The minimum expenditure tariff only reflects the tariff associated to a minimum expenditure given a stated pattern of consumption, but does not imply that this tariff is demanded in the market place, nor that the "representative" consumer in a specific country actually contracts this tariff when making a new contract.

Even though the objective is to select tariffs that are comparable across countries by providing additional information, the comparison exercise may give richer information. It is recommended that the median price and the number of offers collected per country and per category is also provided in the benchmarking.

How can the methodology be improved in the long run?

A different objective would be to measure what an average consumer is paying for a specified consumption pattern. In this case, tariffs for those who buy the service or switch provider are to be collected. The majority of consumers are the embedded ones, or the infra-marginal ones, those that already subscribed to the service. For this set of embedded consumers, information on what they actually pay is to be collected from bill harvesting methodologies. These are costly and very interesting research tools.

Bill harvesting or web based tariff collection methods that collect micro-data are possible ways to achieve this. In order to advance in this direction, a common methodology for sampling, for collecting information from bills or consumers, and a common method for treating the information and making inference would need to be agreed upon. These methodologies are very costly and work intensive. On the other hand, they provide very rich evidence not available elsewhere.

An alternative way to obtain a price for all consumers when using mobile BB would be the **average revenue per subscription** (ARPS), a supply side measure. It would entail dividing revenues derived from BB services by the total number of active subscribers of mobile BB. This indicator has a number of problems in order to be useful to make comparisons across countries or over time.

More subscriptions are being bundled together with other (complementary) services. Each operator receives revenues mainly from a subscriber, not from individual services in isolation. Each then has to split the total revenues from bundles (and there are many possible combinations for bundling) to each individual service. We know that each operator may use a different imputation criteria for this split of revenues. This heterogeneity will render the ratio (revenues/subscribers) not comparable across operators and/or countries.

Another problem is related to the level of market development. In several countries it has been observed that actual consumption (of MB, or of minutes) is much higher than in others. Even though prices affect consumption levels, and consumption levels may affect prices, often "exogenous factors", such as institutional features or the state of development of a specific network/technology in a given country, yield consumption patterns that are widely different. It is usual that countries with higher consumption levels

may have a different technological development than others and the price per MB downloaded is simply not comparable in a direct way.

The current OECD methodology already indicates that not only recurrent charges are to be collected, but non-recurrent charges as well. The non recurrent charges are to be spread over a period of 24/36 months. But there are other implicit prices that may lead to biases in the tariff comparison made.

In several countries it is a commonly observed practice that operators subsidise a specific terminal when the consumer buys a data connection/subscription. The terminal subsidy is a problem when comparing prices of mobile BB subscriptions because it will normally lead to higher per unit prices.

One possible way to analyse the subsidies issue is to limit the comparison only to a specified type of terminal and compare two situations, First, when the consumer buys the handset device (from an independent seller) and the BB connection independently. The second case would be when the consumer buys both the terminal (possibly with a subsidy) and the connection plan from same service provider. This analysis may be performed independently of the periodic metrics to be published by the OECD.

The difference may yield an idea of the degree of subsidisation of the terminal. The contract length should be taken into account, as well as the upfront discount that operators tend to offer, depending on the data plan purchased by the consumer. The subsidy given may be a function of the data plan bought. A specific data allowance plan should be chosen, homogeneous across countries, and limit the comparison tariffs that match that allowance. Only one type of terminal for which the subsidisation amount is to be calculated should be chosen as well.

Additional Background

A simple regression for mobile BB tariffs for datacards/USB/modem is included below (only connections and the main characteristics of the offers, tariffs used based on T-Connect 2011). Only the recurrent (i.e., variable, connection related) price has been included in the left hand side. Fixed effects for the set of countries included in the sample (15):

Dependent: ln(Price)	Parameter (t- st ts)
Constant	2,56 (24,04)
Volumen cap	0,036 (15,5)
Speed	0,008 (5.46)
Bundle.: not bundled - (referencecase.: bundled)	0,21 (2,94)
Tablet (ref case:no tablet associated)	-0,14 (-3,87)
Penalty 2:speed reduction (refc se:m rginlprice)	0,062 (1,40)
Pen lty 3:unlimited, (refcase:marginal price)	dropped
Penalty 4 (ref case: marginal price)	-0,022 (-0,18)
PC: no PC associated (refcase:PC sa e attached)	0,38 (9,83)
Country 2 (re case:country 1 :Austria)	0,77 (6,02)
Country 3	0,20 (1,76)
Country4	0,40 (4,25)
Country 5	0,54 (5,58)
Country6	0,14 (1,25)
Country 7	0,506 (5,03)
Country8	0,692 (7.40)
Country9	0,60 (4.44)
Country 10	-0.40 (-4,79)
Country 11	0,58 (6,12)
Country 12	0,74 (7,27)
Country13	0,048 (0.44)
Country14	0,322 (3,91)
R square= 0,499 ;- N= 760	Prob> F= 0;- F(20,739)= 36,9

From simple regression analysis:

-Volume caps affects positively the price

-Speed: affects+ the price (not much)

-Penalty: speed reduction is associated with higher prices than marginal price penalties

-Bundling: with voice (usually) implies higher prices than standard (stand-alone) offers (only mBB subscription is measured, not the bundled offer!!!)

-Association, when selling mBB with a PC affects significantly the price

but not when association with a tablet (iPad)

-Country effects (they may encompass many different fixed type effects) are very significant