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TITLE: Quality of Service Framework for Mobile Services. A Singapore Case Study –
An Overview

Quality of Service Framework for Mobile Services A Singapore Case Study – An Overview

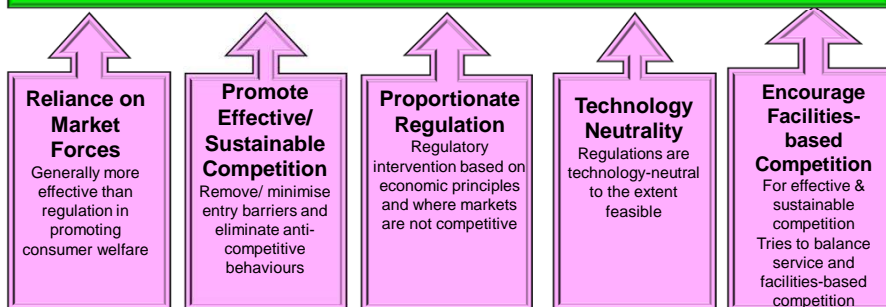
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IDA's Regulatory Philosophies

Effective and Sustainable Competition in the Telecom Sector



Efficient, Transparent and Reasoned Decision-Making by IDA

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Main Considerations



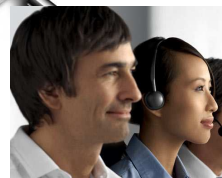
- **Consumers particularly vulnerable due to:**
 - Lack of bargaining power vis-à-vis the telcos
 - Lack of information: telecom service can be technically complicated, with T&Cs difficult to access and understand
 - Possible misuse of end user information
- **IDA's approach:**
 - Impose a set of minimum duties to be observed by all telcos to protect consumers
 - Impose more detailed requirements for specific areas which have created problems for consumers and which the market could not self regulate

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Quality of Service (QoS) Frameworks

- **IDA regulates performance of key services by setting minimum QoS standards**
 - Historically, intended to ensure incumbent maintained acceptable QoS
 - Operators to submit quarterly reports on their service quality
 - Financial penalty for each non-compliance with standards
- **Applicable to following consumer services:**
 - Fixed line telephone services
 - Mobile telephone services
 - Fixed broadband Internet access services
 - Local leased circuit services
 - Postal services



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Public Cellular Mobile Telecom Services (3G PCMTS)

Performance Indicators	Compliance Benchmark
Service Coverage:	
Nation-wide	> 99%
In-building	> 85% (with effect from 1 Apr 2013)
Tunnels	> 99% in new road & MRT tunnels, >95% in existing road & MRT tunnels
Success rates during busy hour:	
Average across all cell localities	>99%
Average in busiest cell locality	>95%
Ave for each cell locality	>70%
Drop call rate:	
Average across entire month	<1%
Ave during busy hour	<2%
Ave during hour with worst performance	<2%

- **Financial penalty of up to \$50,000 for each instance of non-compliance**

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IDA's Monitoring of Quality of Services

- IDA also actively monitors the operators' performance for telecom services:
 - **Mobile service coverage**
 - Independent measurement by IDA for nation-wide outdoor service coverage and MRT tunnels coverage on a half-yearly basis (for 3G) and yearly basis (for 2G)
 - **Short messaging service (SMS)**
 - Independent measurement by IDA on the speed of SMS delivery
 - **Fixed broadband service**
 - Independent measurement by IDA on the throughput, latency and packet loss of some of retail residential broadband services (xDSL, cable and fibre)

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IDA's Monitoring of Performance for Mobile Services

- IDA monitors the mobile operators' performance through independent mobile coverage survey
 - Methodology for data collection follows largely the requirement imposed on the mobile operators

Data collected at various locations

Date Collected	Total Samples	Samples ≥ -100 dBm	Coverage (%)	Total Samples	Samples ≥ -100 dBm	Coverage (%)	Total Samples	Samples ≥ -100 dBm	Coverage (%)
17/5/2012	130	130	100.00	149	149	100.00	129	129	100.00
17/5/2012	292	291	99.66	299	279	93.31	287	284	98.95
17/5/2012	159	134	84.28	154	139	90.26	149	149	100.00
17/5/2012	206	206	100.00	221	211	95.48	202	201	99.50
17/5/2012	190	190	100.00	191	173	90.58	190	183	96.32
17/5/2012	217	217	100.00	209	197	94.26	214	213	99.53
17/5/2012	124	123	99.19	165	161	97.58	120	105	87.50

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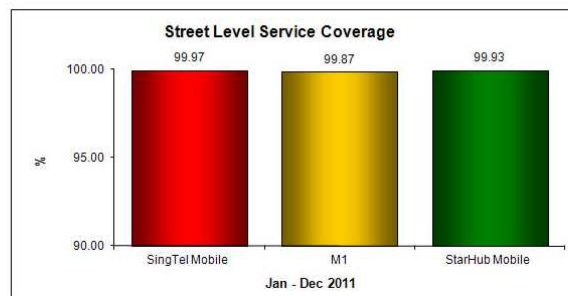
IDA's Monitoring of Performance for Mobile Services

- IDA publishes the results from IDA's independent measurement on IDA's website

3G Mobile Services

Service Coverage

The definition of service coverage is based on signal strength. The availability of service coverage is therefore the ability of a network in achieving a minimum signal strength of -100dBm. Of the successful calls established by the mobile networks along expressways, major and secondary roads/ streets, an average of 108,558 samples of signal strength were obtained for each network.



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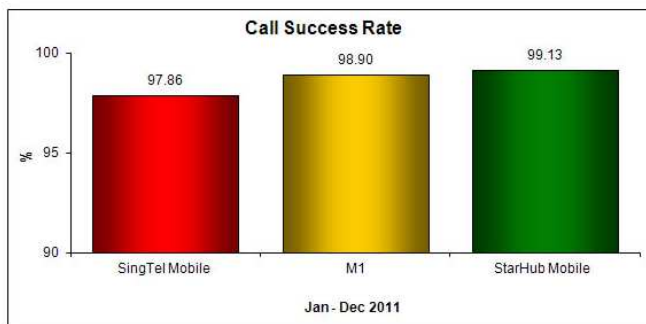
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IDA's Monitoring of Performance for Mobile Services

Call Success Rate

This indicator measures the success of a call attempt. A successful call attempt is when the calling party gets a connection to the called party either through a ringing tone or an engaged tone. The call success rate shown below is based on an average of 1367 call attempts per network.



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Considerations for Performance Measurement

- **IDA's mobile performance measurement are snapshots of operators' performance:**
 - Time – results may vary according to the time measurements were conducted (e.g., peak vs non-peak)
 - Geographical location
- **Results obtained also dependent on site conditions during measurement**

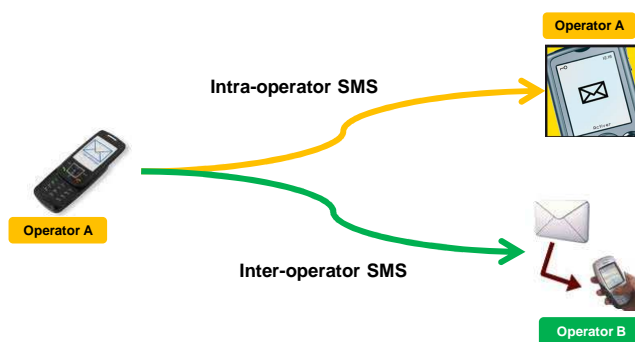
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IDA's SMS Performance Tests

- **IDA also conducts half-yearly SMS performance tests**
 - Since 2009, the testing has included fixed and mobility testing (drive test)
 - Test period randomly selected
 - Test conducted outdoors, island-wide



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IDA's SMS Performance Tests

- **Results from the SMS performance tests are published on IDA's website**
 - Objective: to inform end users about SMS performance, and put some pressure on operators
- **Percentage of SMS transmitted, for both intra-operator SMS and inter-operator SMS**
 - Percentage of SMS messages delivered in less than 15 seconds;
 - Percentage of SMS messages delivered in 15 minutes; and
 - Percentage of SMS messages delivered within 12 hours.

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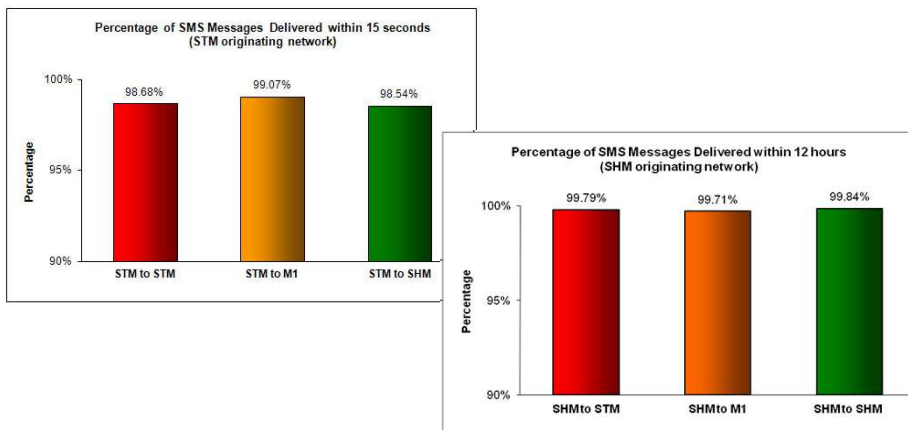
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SMS Performance Results Published on IDA's Website

SMS Performance Measurement for 1H 2012 (February - March 2012)

Percentage of SMS Messages Delivered within 15 seconds

(a) SingTel Mobile ("STM") (originating network)



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IDA's Monitoring of Fixed Broadband Performance

- **IDA currently monitors the performance of some retail residential fixed broadband services (DSL and cable) on a monthly basis:**
 - **Average peak download and upload throughput (local & international):** measures how much bandwidth is available to the connection between the test probe and the test server (in kbps)
 - **Single TCP Upload and download throughput (local & international):** measures speed of a single TCP connection (in kbps). Most webpages uses multiple TCP streams but other protocols like FTP uses only single TCP connection.
 - **Latency:** time that elapsed between sending a data packet to the test server to when the acknowledgement is received (in milliseconds)
 - **Packet Loss:** Data packets that are not received as a percentage of total data packets sent

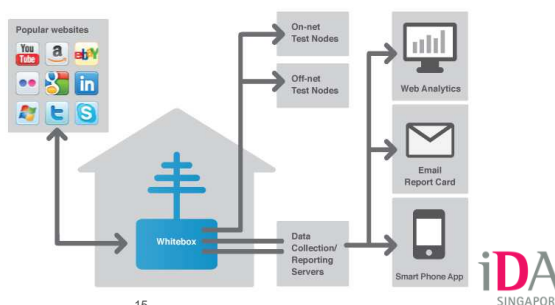
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Data Collection

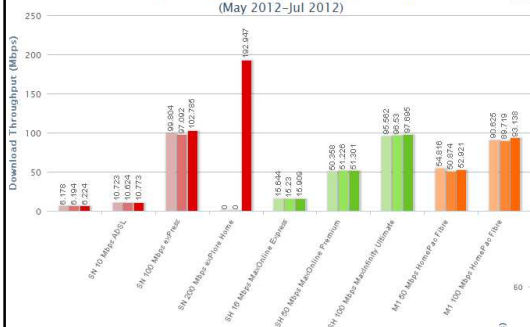
- **Total of 900 test probes installed in the homes of volunteers from both the public and IDA.**
 - Test probes cover a selected range of plans from the major residential broadband service providers in Singapore.
- **At regular intervals, test probes conduct series of tests against IDA's test servers housed in local Internet Data Centres, USA east and west coast, UK and China (Shanghai).**



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Local (SG) Average Peak Download Throughput
(May 2012-Jul 2012)



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 SingNet (SN)
  StarHub (SH)
  M1 (M1)
  SuperInternet (SI)
  MyRepublic (MR)
  Viewwest (VO)

Challenges for Imposing QoS on Throughput of Broadband Services

- **Factors that affect broadband access speeds or throughput may be beyond the ISPs' control**
 - The device being used
 - The capacity the website/content owner has catered at their end
 - Types of applications used & number of concurrent applications running
 - Signal strength of radio signal at that location (for mobile BB)
 - The number of concurrent users at that location (for mobile BB)
 - The building structure which may affect radio signal transmission (for indoor use of mobile BB)
- **QoS framework must be reasonable and not overly onerous, especially for indicators that are for compliance and may attract financial penalty**

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Transparency of Typical Broadband Speeds

- **IDA announced this requirement in March 2011**
 - Decision: ISPs must measure and publish the typical broadband speeds that end users are likely to be able to achieve
 - Rationale: Empower end users with more information about their likely surfing experience so they can make informed choices
- Applies to **residential fixed and consumer mobile broadband plans**
- Larger ISPs (i.e., with more than 10% subscriber base) must follow minimum baseline parameters for their measurement methodology
- Publication of typical speeds must be in all ads and websites
- ISPs began publication from 1 April 2012

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Thank You

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