United Nations

Economic and Social Commission for Asia and the Pacific

An In-Depth Study of Broadband Infrastructure in the ASEAN Region
August 2013

This study has been prepared for ESCAP by Michael Ruddy and Esra Ozdemir, Terabit Consulting.

The generous funding support provided by the Ministry of Science, ICT and Future Planning, Republic of Korea, is gratefully acknowledged.

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I. EXECUTIVE SUMMARY

Between late 2012 and mid-2013, Terabit Consulting performed a detailed analysis of the broadband infrastructure in the nine largest member countries of the Association of Southeast Asian Nations (ASEAN): Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Viet Nam. Terabit Consulting's analysis also included trans-border broadband projects extending into contiguous regions such as Yunnan Province, China.

The analysis revealed that, although extensive investment has been made in fibre and other broadband infrastructure, both domestically and internationally, there is a wide chasm between markets, with a clear "broadband divide" demonstrated when richer markets are compared with poorer ones, when major metropolitan areas are compared with smaller cities and rural areas, and when coastal markets are compared with inland ones.

This broadband inequality has manifested itself in the form of:

- widespread inaccessibility to next-generation broadband services, including fibre or fourth-generation wireless;
- unacceptably low levels of international bandwidth in many of the region's countries (with the per-capita bandwidth in the country's richest market, Singapore, more than 900 times that of its poorest market, Myanmar);
- extremely expensive prices for international bandwidth;
- lack of affordable broadband services.

The analysis also shows that international connectivity and the pricing of international bandwidth varies greatly among the nine subject ASEAN countries, and that even in the markets with lower costs, bandwidth is still significantly more expensive than in Europe and North America. A limited number of international bandwidth hubs have emerged to serve the Southeast Asian region, most notably Singapore and Hong Kong, China, offering the region's lowest international bandwidth prices and greatest overall international capacity. Much of the region's international fibre infrastructure has developed in a hub-and-spoke configuration around these two hubs, although telecommunications carriers and other investors of means have constructed their own direct interregional fibre infrastructure wherever possible.

Although trans-border terrestrial fibre optic links have been constructed across almost all international links, their actual role in the region's connectivity is limited. Most of the links are operating at extremely low capacity, usually 10 Gbps or less (by comparison, the entire international bandwidth for the nine subject countries was 3,420 Gbps as of year-end 2012). They are typically constructed on a bilateral basis by a pair of major (and often dominant) carriers from each side of the border, which often prevents their competition from cost-effectively accessing the network. The bilateral, point-to-point nature of the links, combined with the region's wide range of international bandwidth prices (IP transit in poorer markets such as Myanmar and Lao PDR costs more than ten times that of Singapore), often allows dominant operators in wealthier nations to exploit the terrestrial links by using them to sell access to their own submarine cable gateway or IP transit capacity, thereby imposing an additional intermediate layer of cost between consumers and the international Internet content that they are seeking to access.

A strong opportunity presents itself for a pan-regional terrestrial fibre optic network offering open access, a mesh configuration, and central management, constructed along the rights-of-way of the region's existing transport or energy infrastructure such as highways, railways, or power

transmission networks. The realization of such a network would likely require the intervention of governments and international organizations.

Table 1: Overview of Broadband Status by Country

	GDP per Capita, YE 2012 (PPP, USD)	Int'l Band-width per Capita (Kbps)	Int'l Connect-ivity	Domestic Connect-ivity	IP Transit Price	Competi-tiveness of Telecom Market	Fixed and Mobile Broad-band Infra-structure	Annual 1 Mbps Broadband Subscription + Installation as % of Nominal GDP per Capita
Cambodia	$2,400	0.8	Weak	Adequate	Very expensive	Reasonably competitive	Very limited	48.7%
Indonesia	$4,900	1.0	Weak	Adequate	Expensive	Competitive	Growing	5.5%
Lao PDR	$2,900	0.4	Weak	Limited	Very expensive	Less competitive	Very limited	27.4%
Malaysia	$16,400	15.6	Excellent	Adequate	Reasonably priced	Reasonably competitive	Relatively strong	4.4%
Myanmar	$1,900	0.3	Weak	Limited	Very expensive	Uncompetitive but planned liberalization	Very limited	132.8%
Philippines	$4,300	5.5	Excellent	Relatively strong	Very expensive	Less competitive	Growing	11.2%
Singapore	$59,500	258.3	Excellent	Very strong	Inexpensive	Reasonably competitive	Very strong	0.1%
Thailand	$9,240	6.6	Average	Relatively strong	Very expensive	Reasonably competitive	Average	0.5%
Viet Nam	$3,550	5.2	Somewhat weak	Limited	Expensive	Less competitive	Limited	7.9%

Table 2: Summary and Analysis of International Internet Bandwidth by Country

Country	International Internet Bandwidth (YE 2012)	10-Year CAGR (2002-2012)	Int'l Internet Bandwidth per Capita (Kbps)	Evaluation
Cambodia	**11 Gbps –** The Ministry of Posts and Telecommunications reported that international bandwidth was 8 Gbps as of the first half of 2012; Terabit Consulting's conversations with sources lead it to believe that this figure grew to 11 Gbps by year-end.	98%	0.764	**Very weak**
Indonesia	**250 Gbps –** Telkom, the country's largest international bandwidth operator, increased its international capacity to 100 Gbps in mid-2011 and is currently believed to have between 150 Gbps and 200 Gbps of international capacity.	84%	1.030	**Weak**
Lao PDR	**2.5 Gbps –** As of early 2011, the primary channels for the country's 1,359 Mbps of international bandwidth included the following: 486 Mbps via CAT of Thailand; 310 Mbps via China Telecom; 310 Mbps via Viettel of Viet Nam; and 155 Mbps via Vietnam Posts and Telecommunications (VNPT).	110%	0.383	**Very weak**
Malaysia	**400 Gbps –** Konsortium Renkaian Serantau (KRS) (Regional Network Consortium) formed in 2011 to promote Malaysian operators' purchase of international capacity.	80%	15.6	**Moderate**
Myanmar	**14 Gbps –** Most of the country's connectivity is via the SEA-ME-WE-3 cable in Pyapon.	122%	0.286	**Very weak**
Philippines	**530 Gbps –** PLDT's international capacity grew from 270 Gbps as of year-end 2011 to an estimated 400 Gbps as of year-end 2012, with 60% of demand directed toward North America and 30% to East Asia.	89%	5.450	**Moderate**
Singapore	**1.389 Tbps –** As of mid-2012, Singapore's international Internet bandwidth was 1.326 Gbps, and "total international transmission capacity owned" by Singaporean operators was 6.994 Tbps.	73%	258.3	**Very strong**
Thailand	**463 Gbps –** The country's international Internet bandwidth grew by 77% in 2012.	85%	6.622	**Moderate**
Viet Nam	**360 Gbps –** As of November 2012, reported international bandwidth was 347 Gbps, while domestic bandwidth was 460 Gbps.	119%	5.150	**Moderate**

ary and Analysis of International Connectivity by Country

onnectivity	Evaluation
ent of international connectivity due to historical dependence on satellite. f the few coastal countries in the world without direct access to a submarine fibre optic ı and maintenance agreement for Asia-America Gateway trans-Pacific cable (2010) did ambodian landing point, but a new Malaysia-Cambodia-Thailand cable is under AG consortium in 2007 but was left to negotiate for bandwidth on the cable through l backhaul agreements" with the cable's landing parties in Thailand and Viet Nam; :hased by Ezecom in 2011 and its terrestrial connectivity to AAG through Thailand and ected to be increased from 10 Gbps to 100 Gbps. ng Subregion (GMS) Information Highway Project provides terrestrial connectivity to Lao Viet Nam, operated by Telecom Cambodia. Military Telecommunications Company) operates dual terrestrial fibre optic paths from Nam. t Nam High-Speed Transmission Line was launched by Telecom Cambodia and VNPT . odia-Viet Nam-Hong Kong Fibre Highway initiative was announced in March 2012, with Cambodian partner, allowing access to international submarine cables in Hong Kong. erator TOT and China Telecom were reportedly exploring a partnership to build s between Cambodia, China, Lao PDR, Russia, Thailand, and Viet Nam. f Cambodia and Lao PDR signed a memorandum of understanding in 2013 to improve ivity between the two countries. bodian submarine cable project (2008) did not move forward.	**Weak –** No direct interregional connectivity; reliance on backhaul agreements
interregional submarine cable systems: Indonesia's only intercontinental/interregional 3, which is 14 years old and connects 33 countries in Europe, Africa, Asia, and Australia. 2010, six submarine cable systems were constructed between Indonesia and Singapore, rine connectivity was constructed to Malaysia and Thailand. alf-dozen Indonesia-Singapore links constructed within the last decade, the majority of tional Internet bandwidth now transits through Singapore. in Indonesia have pointed to its comparative shortage of direct interregional bandwidth ng the country at a competitive disadvantage versus Malaysia and Singapore in T investment. Gateway (AAG) submarine cable entered service in January of 2010, and although it does sia, PT Telekomunikasi Indonesia is a member of the consortium and accesses the cable	**Weak –** Limited interregional connectivity and strong dependence on Singapore for transit capacity

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