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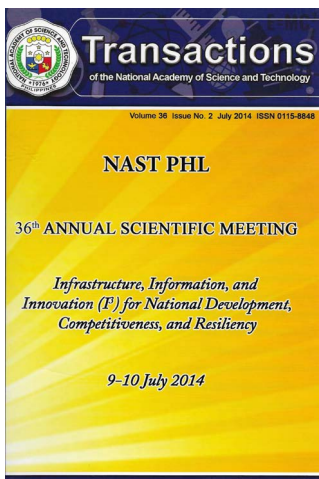
National ICT Infrastructure of the Future: Broadband for Everyone, Everywhere?

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NATIONAL ICT INFRASTRUCTURE OF THE FUTURE: BROADBAND FOR EVERYONE EVERYWHERE?

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Abstract

Broadband and Internet have become very important aspects of human lives in the 21st century, when people are distinguished whether they are digital natives and digital immigrants. Planning and implementing policies and programs for the timely deployment and delivery of appropriate broadband and Internet services are key measures towards the future of Philippines.

Executive Summary

Access to information is very critical in our everyday's lives. As we live in the "Information Age", information can be easily transmitted and received using computer technology and telecommunications. With the establishment of the Internet and the World Wide Web (WWW), together with the development of other technologies related to telecommunications, information technology and other information and communications technologies (ICTs), it has enabled different services and applications to deliver sound, data, pictures and video in all sectors of the countryand anywhere around the world.

The Philippines is undertaking activites to align with the goals and objectives of the World summit on Information Society (WSIS) to improve the life of Filipinos by embracing the power of information and communications technology (ICT) based on the the Philippine Digital Strategy, which is firmly grounded on the principle of universal access and universal service to ICT. This seeks to ensure that Filipino citizens have access to ICTs and can utilize them for livelihood opportunities, education and other socio-economic benefits.

Installation of ICT and broadband facilities in unserved and underserved areas such as in schools will enable them to access the internet and allow the government, with the support of the private sector, to deploy learning resources to each one of them.

Access to the internet and its available resources opens new opportunities for learning for both the students and teachers.

As part of our effort to promote e-government and e-governance, the government is now embarking on an "integrated online government initiative", for improved government services delivery and better accessibility of public services, in addition to more transparency and accountability.   Through this initiative, it integrates all common applications of the Philippine government to allow the ordinary citizens to avail themselves of public services seamlessly at a very affordable rate if not for free. Through this project, Filipinos will get connected, become well-informed and advised on urgent/emergency issues.

One of the core foundations of providing services in the information age is the establishment of a Philippine National ICT Infrastructure (NICTI) that is capable of providing broadband Internet services to everyone, everywhere in the country.

Like with all national infrastructures, designing and constructing the NICTI is not straightforward.   Firstly, it is built upon what is already in place. The telecommunications network for providing telecommunications and ICT-enabled services in the Philippines consists of recently set up high-capacity fiber-optic systems and wireless systems, whether fixed or mobile, that expanded and enhanced the old copper-based networks. Separate components of this network are owned and operated by several private companies, from the big or major telecommunications companies to the small telecommunications companies only present in several municipalities and/or cities. Up to now the level of interconnectivity of this networks is improving very slowly considering that the exsiting policy is to allow public telecommunications entities to negotiate and because of commercial issues that seem difficult to negotiate, public telecommunications services are hostaged or sacrificed to the disadvantage of the subscribers and users.   If we are to improve the overall quality of telecommunications services, we must have a well-interconnected or "seamless" telecommunications network. Secondly, following recent trends around the world, in order to accelerate the expansion and extension of the NICTI, we need to promote and spawn a new breed of enterprising players in the ICT industry. This includes small-to-medium sized enterprises that can by themselves or through partnership provide broadband connectivity and its associated broadband services to unserved and underserved areas thirdly, it is necessary to have a widely shared perspective in the formulation of a long-term development strategy for NICTI considering demand and supply of telecommunications and ICT-enabled services. As an infrastructure, new and emerging technologies in ICT hardware and software should be carefully studied to provide the most cost-effective ICT solutions to the increasingly becoming complex ICT requirements of government, businesses and the civil society. , The Philippines should be able to take the opportunity to select and adopt the best emerging technologies to encourage manufacturers to engage and establish in the domestic

manufacturing facilities of both hardware and software components of the technology. Another important aspect of the NICTI development strategy is the generation of experts that will continually research and develop, operate and maintain as well as manage the different components of the infrastructure, its corresponding ICT and ICT-enabled services as well as digital content forming the dynamic national ICT ecosystem. Finally, it is important that we think broadband. (Basically, broadband is "always on, high-capacity connectivity enabling combined provision of multiple services simultaneously."). The establishment and continuous expansion of the NICTI and the broadband telecommunications services that it provides will depend on the market demand for such services. We need to develop different kinds of content and application services that are appropriate for nationwide consumption. Moreover, we also need to encourage the setting up of platforms that facilitate the development of and access to such services.

In a nutshell, in order to attain our goal of having broadband for everyone, everywhere, we must plan and build the national ICT infrastructure and all the various systems that use this infrastructure, simultaneously.

Introduction

ICT Infrastructure is very important in the overall development of a country. This importance was emphasized in the Philippine Development Plan 2011-2016. In the Association of South East Asian Nations (ASEAN), ASEAN ICT Infrastructure was considered as one of the foundation thrusts recognized to be necessary for the successful implementation of the thrusts on economic transformation, people-engagement and empowerment and innovation.

The paper briefly describes the status of the ICT Infrastructure in the Philippines, where Philippines is situated in terms of National ICT Infrastructure compared to other countries and what a National ICT infrastructure should look like for the Philippines in the future.

Definition of Broadband

Broadband definition varies widely depending on each country's unique needs and history which includes economic, geographic and regulatory factors. However, many references normally define it as the speed of transmitting data (minimum data rate) or high-speed access to the Internet. There are also different kinds of services that are being provided by broadband, such as the delivery of telecommunications company-provided digital subscriber line (DSL) or Long Term Evolution (LTE) mobile services.

The ITU Standardization Sector (ITU-T) recommendation I.113 has defined broadband as a "transmission capacity that is faster than primary rate Integrated Services Digital Network (ISDN), at 1.5 or 2.0 Megabits per second (Mbit/s)".

National governments have adopted different minimum bandwidths and maximum latencies ranging from this minimum of 256kbit/s up to 4.0Mbit/s. The trend is to raise the threshold of the broadband definition as the marketplace rolls out faster services.

In general terms, broadband refers to telecommunication that provides multiple channels of data over a single communications medium, typically using some form of frequency or wave division multiplexing. In relation to the Universal access/service, broadband access/service refers to the initiatives/programmes that ensure that all citizens are served by emerging broadband technologies. Such initiatives include the roll out of networks that allow the delivery of an entirely new breed of media services and communications-oriented applications.

Broadband is increasingly regarded as being central to the development of an information and knowledge-based society able to leverage information and communications technology (ICT) for national development and achieving "digital inclusion" across the spectrum including remote, regional and rural areas.

The Philippine Digital Strategy (PDS) 2011-2016 has referred to a broadband target of at least 2Mbps in 2016. Because of technology development and growth of market, the said target speed shall be reviewed annually and updated if deemed necessary.

Components of Broadband

As defined above, broadband is something that is provided to the end-user. Therefore, it is an end result of a numerous telecommunications and/or Information and Communications Technology (ICT) infrastructure/systems starting from the international connectivity, domestic connectivity, the last mile connectivity up to the user-initiated in-premise connectivity.

Current ICT Infrastructure International Connectivity

International fiber linkages are   critical to connect the Philippines to the rest of the world and the Internet to allow information and communications or "Infocom" services between people in the Philippines and the rest of the world. This will let all market players collaborate to ensure adequate redundancy and sufficient international

bandwidth capacity to meet growing demand as more individuals and enterprises would be connected to the broadband grid.

This is particularly important for the Philippines because the major portion of Internet traffic, about 90%, goes overseas particularly to the United States. The ratios are different for other Asian countries like the CJK or China, Japan and South Korea. In these countries, major portion of the content being accessed by users is hosted locally because of language and cultural considerations.

The Philippines has cable systems connecting the country to the outside world. These systems are as follows:

- APCN2 – Asia Pacific Cable Network-2 (Trans-Asian region);
- AAG. – (connects North Asia to the United States);
- EAC – East Asia Crossing (Asia);
- C2C – City to City (Intra-Asian cable);
- SJC - South East Asia- Japan Cable – connects Japan to Southeast Asia;
- SMW3 – Southeast Asia-Middle East-Western Europe;
- ASE – Intra-Asian Cable
- TGN-Pacific – connecting the U.S. to Japan, with north route linking Emi and   Hilsboro, and south route linking Toyohashi and branches to Piti Guam and Los Angeles
- Japan-US – first high capacity trans-pacific cable system which connects Japan to the United States
- Unity – between Chikura, Japan and Los Angeles, USA

PLDT invested in international connection and is hosting ASE, AAG, APCN2, EAC, SMW3 cable systems.

On the other hand, Globe has made investments to TGN-IA, C2C, APCN2 and SJC, and is linked with major Trans-Pacific Cable systems, which encompasses the Unity, Tata Global Network-Pacific, (TGN-Pacific) and the Japan-US Cable Network (U-US).

As the name implies, the new ASE cable system is designed to connect countries in Asia, especially those of the Association of Southeast Asian Nations (ASEAN). ASE system initially links Japan, Philippines, Hong Kong, and Singapore. It will also connect to Malaysia, and in the next phases, potentially to other Asian countries, such as China, Vietnam and Thailand. One important thing to note is that this cable system uses a new cable landing station situated at the eastern coast of the country. Complimenting this system is the AAG cable system, which is a diversity route terminating at the other side of the Philippines, at the La Union cable station situated

strategically at the eastern coast. International cable systems in the Philippines include the following landing stations:

PLDT Batangas Cable Landing Station – the first international cable landing station in the Philippines; covers APCN, APCN-2 and SMW3 cable systems.

Globe Telecom Nasugbu Cable Landing Station – second cable landing station in Nasugbu, Batangas and Globe Telecom's first landing station.

La Union Cable Landing Station – owned by PLDT which started the constructed the station from 2007 to 2009 for the landing of AAG (Asia-American Gateway) cable system.

Ballesteros Cable Landing Station – Globe's second cable landing station located in Ballesteros, Cagayan.

Capepisa Cable Landing Station – one of the nine cable landing stations of the EAC; connects the Philippines to other Asian neighbor countries.

Daet Cable Landing Station – new cable landing station built by PLDT; located in the east coast of the Philippines; forms a diversity to existing Batangas and La Union cable landing stations.

Internet exchanges are used to connect ISPs to each other and to the rest of the world. Local peering (e.g., through an Internet Exchange) is expected to have many benefits, including
- Lower cost to users – minimizing use of external bandwidth
- Attract content providers (foreign and local) to set up shop locally
- Attract connectivity providers to haul their bandwidth to the country
- Attract critical internet resources to mirror their services locally

Based on a study conducted by ASEAN, the Philippines has the following Internet exchanges:
- MIX - Manila Internet Exchange Manila
- PHIX - Philippine Internet Exchange Manila
- PHOpenIX - Philippine Open Internet Exchange Makati City
- PHNET CORE - Philippine Common Routing Exchange Makati City
- VIX - Vitro Internet Exchange Pasig City
- GIX – Globe Internet Exchange Makati City
- Bayan Telecommunications Internet and Gaming Exchange.

Domestic Connectivity

The Philippines is one of the few countries in the world that has a competitive fiber-backbone infrastructure. The first national fiber-backbone is owned by PLDT and the second national fiber-backbone, called the National Digital Transmission etwork (NDT), while officially owned by a consortium of other operators, is largely under the control of Bayantel. Recently, there were some arrangements with Globe Telecom, who also has an extensive fibre-backbone network, on the use of DT
N   N.

Some countries might have duplicate regional or city-wide fibre-backbone networks, but very few countries around the world have three fully-developed and working national fibre-backbone networks. In addition, various other players have regional digital backbone infrastructure including fibre-backbone. As discussed in the Intelecon paper on Universal Access, the backbone capacity of the Philippines promises well for future broadband development. Here are some highlights of the current domestic connectivity as provided in the information available online from the three major domestic backbone providers:

1. Globe
Globe's network, surpassing 200Gbps IP port capacity, enables borderless communication and access to information through connectivity to multiple IP Peers and Content Providers on strategically diverse International PoPs in US, Hong Kong, Singapore and Japan. This ensures enterprises the best route to access content and to reach destinations across the Internet.

Globe's core IP network is also IPv6 ready, allowing users to access both IPv4 and IPv6 websites. IPv6 peering with top global carriers and content distribution networks have also been initiated to ensure business continuity and seamless connectivity to Internet users and enterprise customers as moves to IPv6 as IPv4 nears exhaustion.

2. PLDT
PLDT's Domestic Fiber Optic Network (DFO   ) was established in 1997 to serve the consolidated data transmission requirements of the PLDT Group. Today, DFON is the largest and most extensive domestic fiber optic backbone in the Philippines with an operating capacity of 4.78 Terabits per second. It consists of inland and submarine cable systems connecting the major islands of the country and spans around 78,000 Km. It uses 10G, 40G, and 100G fiber optic technologies.

The configuration of DFON provides for diversity and added reliability because it has 10 nationwide loops for redundancy in case of single-fiber cable breaks. Recently, PLDT launched the Palawan DFON project, which is composed of 620

kilometers state-of-the-art fiber optic inland and submarine cables that now link Palawan to the PLDT network. It is designed to support the ever-increasing demand for reliable telecoms and data services in one of the most popular tourist destinations in the country by using undersea cable links as well as inland transport facilities that run from Puerto Princesa to Taytay in Palawan and San Jose de Buenavista to La Paz, Iloilo City. It's capacity is at 40 GBPS, expandable to 100 GBPS.

3. TELICPHIL

Another fiber-optic backbone was established by existing telecommunications service providers through a consortium called Telecommunications Infrastructure of the Philippines (TELICPHIL), which is composed of the following public telecommunications entities:

- Bayantel
- Globe
- Smart
- ETPI
- Express Telecom
- PT&T
- Digitel

The National Digital Transmission Network (NDTN) established by TELICPHIL connects Northern Luzon to Southern Mindanao.

2.3 Internet Service Provision to Users

Delivery of multimedia services and high-speed internet connectivity directly to users is made available because of broadband facilities such as fiber optic cables and fiber-to-the-home (FTTH) facilities. Other technologies include the ultra-fast Long Term Evolution (LTE) services, a wireless broadband service, on top of 3G services users. As part of value added service, some Cable TV companies also offer internet services to its users.

2.4 Users of ICT

In terms of the number of internet users in Southeast Asia, the Philippines has the second largest number of users. According to the Statistics Portal Statista, in the Asia Pacific region as of January 2014, Indonesia had 73 million internet users while Philippines accounted for 38 million internet users. The following are the current statistics on ICT use based on available data as presented in the National ICT Summit 2014:

- 55.42% of cities and municipalities have broadband access
- 38M use the Internet
- 20% of population use computers
- 98.52% of cities and municipalities have access to CMTS
- 2 Million Text/SMS everyday

- 94.2 active mobile phones

Philippine ICT in Comparison with those of other Countries Compared with the Global Averages

The International Telecommunications Union (ITU) uses the ICT Development Index (IDI) to measure the Information Society. IDI is a composite index that monitors the ICT infrastructure (Access sub-index), use of the infrastructure (Use sub-index) and skills of the people to use and derive benefit from the infrastructure (Skills sub-index). Access sub-index measures statistics related to fixed telephone subscriptions, mobile telephone subscriptions, international internet bandwidth, percentage of household with computers and percentage of household with Internet access. Use sub-index measures statistics related to percentage of individuals accessing the Internet, fixed broadband subscription and wireless broadband subscription. Skills sub-index includes statistics related to adult literacy rate, secondary enrollment and tertiary enrollment.

In terms of Access sub-index, in 2012 the Philippines' rank was 103 with a score of 3.41. Hong Kong, China got the highest spot with 9.18 score. According to ITU, the simple average of all countries is 4.74. This means that the country is way below the global average. If you compare the Philippines to the global average for developing countries of 3.9, the country is still below average.

The Philippines ranked as 101st with a score of 1.46 when it came to Use sub-index, with Sweden on the highest spot with a score of 8.25. According to ITU, the simple average of all countries is 2.8 and this means that the country is way below the global average. Moreover, the Philippines is still below the level when compared to the global average for developing countries which is 1.8.

Skills sub-index of the Philippines in 2012 was ranked 86th with a score of 6.94. Having 9.86 score, Korea earned the highest spot. Based on ITU, the Philippines is above the global average compared to the simple average of all countries of 6.6. Comparing the country's score to the global average for developing countries of 5.8, the Philippines is still above average.

Considering the rankings and scores above, the Philippines will benefit most should it implement a special program to increase the Access sub-index and Use sub-index. In particular, the program should increase the scores of the country above the general simple average and simple average for developing countries.

Comparison with South East Asian Countries

In 2008 and 2010, the Philippines ranked 6th among its ASEAN neighbors in terms of ITUs ICT Development Index (IDI) and in 2011 and 2012 the Philippines slid down to the seventh, overtaken by Indonesia. As of 2012, ranking of ASEAN countries are as follows.

	IDI 2012 Ranking	IDI 2011 Ranking	IDI 2010 Ranking	IDI 2008 Ranking
Singapore	15	14	19	15
Brunei	58	56	42	42
Malaysia	59	57	58	57
Vietnam	88	86	81	91
Thailand	95	94	89	80
Indonesia	97	97	101	107
Philippines	98	98	92	95
Cambodia	120	121	117	120
Lao	123	122	121	119
Myanmar	134	132	119	118

	IDI 2012 Ranking	IDI 2011 Ranking	IDI 2012 Access Score	IDI 2011 Access Score
Singapore	15	14	8.31	8.21
Brunei	58	56	6.55	6.35
Malaysia	59	57	6.09	5.76
Vietnam	88	86	4.04	3.87
Thailand	95	94	4.00	3.77
Indonesia	97	97	3.62	3.35
Philippines	98	98	3.41	3.19
Cambodia	120	121	3.14	2.72
Lao	123	122	2.53	2.36
Myanmar	134	132	1.62	1.53

On the Access sub-index, the Philippines got a score of 3.41 compared with Vietnam's 4.04 and Thailand's 4.00. Considering the discussions above, the Philippines should strive to achieve a score of 4.10 or better in the Access Sub-index.

Infrastructure is closely linked with the availability of applications, services and digital content. This is so because ICT applications and digital content are the drivers of infrastructure use. In today's world, people embrace the technologies around the Internet. Applications for getting a ride, music or video streaming, gaming, navigating through the locality, reading news, finding some terminologies or just communicating with someone using the social media have become an integral part of living.

Therefore, the future ICT infrastructure should be designed to allow individuals or organizations to benefit from the use of such infrastructure.

National Broadband Policy

According to a report of the International Telecommunications Union (ITU) on the implementation of Universal Access to Broadband Services, the development of innovative policy frameworks, business models and financing arrangements needed to facilitate growth in access to broadband worldwide, stimulate content production in local languages, and enhance local capacity to benefit from and contribute to the digital revolution requires the involvement of all stakeholders in the public and private sectors.

In the Philippine Digital Strategy (PDS) 2011-2016, there are measurable targets under the "Internet Opportunities for All" on the universality of broadband services in the country. These are:

1. Improved and cost-efficient broadband service delivery, network infrastructure expansion and upgrades through increased competition
    - The Herfindahl-Hirschmann Index (HHI), measuring the competitiveness of the   telecom market, is lowered from currently above 4000 to below 3500 (around 20% reduction) by 2016;
    - Average prices for basic broadband Internet are reduced annually by at least 5%; and
    - Investment in infrastructure expansion and development are increased by at least 10% annually.

2. Universal broadband Internet service at consumer level

- For business: All Central Business Districts to have broadband coverage with average download speeds of 20 Mbps available for customers by 2016; and
- For households: Available broadband with average download speed of at least 2 Mbps to be available for 80% of customers throughout the country by 2016 (i.e., broadband coverage of 80% of the population).

3. Universal basic broadband Internet by 2016 to all barangays through publicly shared access
- Each barangay to have at least one public Internet center (e.g., Internet café, Community e-Center or similar) that provides reliable Internet service, 80% of which have basic broadband (2 Mbps) by 2016.
- The remaining 20% will have the service by 2020; and
- CeCs shall run ICT awareness campaigns throughout their communities demonstrating how people can make use of ICTs for their benefit at least once a year. Furthermore, CeCs shall offer and promote ICT training for community members.

4. Universal broadband Internet access for public schools by 2016
- 100% of High Schools provided with broadband (at least 2 Mbps) by 2016; and
- 80% of Public Elementary Schools provided with broadband (at least 2 Mbps) by 2016.

5. Secure, reliable ICT infrastructure and safe online experience
- Appropriate online consumer protection has been established by 2016 including awareness and education on cybercrime;
- Data security and privacy regulations are in place and are enforced by 2016;
- Cybercrime laws are in place and a special task force within the police exists, is trained and pursues cyber crimes by 2016; and
- Coordination measures and procedures among stakeholders are in place to protect vital ICT infrastructure by 2016.

One of the key actions under the "Internet Opportunities For All People" strategic thrust is to craft and implement a national broadband policy that:
- helps to create an enabling environment for broadband development and use;
- promotes infrastructure sharing and leverages the existing backbone infrastructure, including that of alterative infrastructure providers such as power companies and cable TV operators;
- establishes incentives for private sector investment, in particular for rural and unserved areas;
- develops an open access policy;

- ensures the availability of appropriate data to enable measurement and assessment of broadband coverage and service levels;
- develops broadband affordability measures;
- evaluates the potential introduction of a universal access and service fund (UASF).

In other words, initiatives that would promote the broadband service uptake at the demand side as well as the enabling policy, regulatory and business environment to attract investors and service providers to enter all markets, including unserved and underserved areas. Important demand side policy initiatives, including digital capacity building, promotion of ICT literacy, and schemes for demand stimulation, have to be pursued. It may be noted that there are some examples of these schemes under the other strategic thrusts of the Philippine Digital Strategy (PDS). Moreover, as mentioned in the Broadband Commission Report "State of Broadband 2013", policy-makers need to support innovation, entrepreneurship and talent through educational measures, fiscal incentives and industrial policy.

The ICT Office in partnership with the International Telecommunications Union (ITU) is in the process of drafting a National Broadband Policy. The following are some of the points that came out from the consultations that were conducted and the views of the consultant hired by the ITU:

• Creation of an enabling environment for broadband investment, development and use;

The primary law governing the ICT sector, RA 7925 otherwise known as the Public Telecommunications Policy Act of 1995, is the enabling law that provides the policy and regulatory framework that fosters a competitive environment in the telecommunications sector. However, it has to be updated to consider the concept of convergence of telecommunications and information technology for the development and long-term sustainability of the telecommunications sector.

• Promotion of tower sharing;

With an estimated 99% population coverage through mobile signal, the Philippines already has much tower infrastructure in place, including in rural areas. However, the expansion of wireless broadband coverage will require many more towers as the various wireless technologies (3.5G/HSPA/LTE/WiMAX) typically have smaller cell radii.

• An open access policy for national backbone infrastructure;

Competition in the telecommunications and ICT sectors will only bear fruit if competing service providers have access to national broadband backbone infrastructure (i.e., national fiber-optic cables) on fair and non-discriminatory terms and conditions, including at reasonable prices. In the absence of such access, retail

prices for broadband services will be unduly high and investment decisions risk being distorted by encouraging investment into areas where it is not needed or where it is duplicative of investments that have already been made. This would also limit the potential for vertically integrated operators with their own fibre-backbone networks from discriminating, either intentionally or unintentionally, against their downstream competitors and in favor of their own retail arms. Most commonly, this is experienced in the price advantages that a vertically-integrated operator can give itself as it is both its own customer and competes with the other customers it supplies. Non-discriminatory access to incumbent backbone networks is therefore vital.

The principle of "open access" allows multiple downstream competitors to share a facility that is a critical input for the services that are provided using it. The access is open if it is sufficiently non-discriminatory that all competitors can access the facility at the same cost and level of quality. In the present case, open access to backbone infrastructure would mean that the terms and conditions under which licensees and VAS providers (such as ISPs) are provided with wholesale capacity on the existing national fibre-backbone networks operators would be non-discriminatory and transparent, at prices that are cost-orientated and subject to regulatory oversight by the NTC.

• Collection and analysis of broadband data;

In order to track broadband improvements over time, update targets and policy planning, it is necessary to develop a web-based database for broadband statistics including broadband coverage and availability, penetration, broadband prices and broadband average download speeds or similarly useful indicators on a geographically disaggregated basis. This is being addressed through the National ICT Statistics Portal.

•Broadband affordability;

Broadband needs to be a mass market service if the Philippines is to reap the full potential of the broadband era. Thus the longer term aim should be that all people in the Philippines have individual access to high speed internet services through broadband. Anything less will result in digital divides that would make the resources of a transformed society and economy available to some but not others in the community. The achievement of this aim requires that broadband is affordable.

Although broadband services are more affordable today than they were previously, broadband services nonetheless remains unaffordable to many people. A recent benchmarking exercise showed that price of entry level broadband in the Philippines is above the international threshold used to assess broadband affordability, namely 5% of average monthly income (as measured by gross nation income per capita).

Actions towards Broadband Development

In terms of some specific policies or programs that are related to ICT infrastructure, it must be noted again that the national ICT infrastructure has to be designed to be integrated and carry applications, services and content which are requiring increasingly more bandwidth since many of them are "rich data" especially those that have video. To be able to do this, the government should promote a policy environment that would support convergence of infrastructure, services and content.

Moreover, the government, private sector and the civil society should collaborate to achieve a comprehensive ICT Infrastructure that is available, reliable, cost-efficient, and thereby affordable on all segments of the infrastructure. These segments are:
- International Connectivity
- National Backbone Connectivity
- Last Mile Connectivity
- End-user Service provisioning

Future National ICT Infrastructure International Connectivity

International connectivity between the Philippines and other countries should be evaluated to ensure that the country does not rely on few submarine cables and international cable landing stations. Moreover, the utilization of each submarine cable systems should be monitored and evaluated to ensure that the country is not dependent on a few submarine cable systems. It is also wise to examine the configuration of these submarine cable systems so that systems that can provide higher reliability, e.g., those with ring or mesh architecture, can be given more load as compared to other submarine cables that have linear systems.

As you can see above, all international cable landing stations are located in Luzon. Since the Philippines is an archipelagic country and considering the threat of natural and man-made disasters, it may be best to also establish direct connectivity to international submarine cable systems in Visayas and in Mindanao. The Philippines, being part of the Brunei Darussalam-Indonesia-Malaysia-Philippines East Asia Growth Area (BIMP-EAGA) may connect Mindanao to the western and/or eastern part of Borneo Island, where we can connect to our 3 ASEAN neighbours in that part of the world more quickly and less expensively.

National Connectivity

An integrated national backbone based on technologies that can deliver seamless and reliable broadband such as fiber-optic technology or other technologies should be the end goal. All provinces should be connected to the national backbone. All

telecommunications companies operating national backbone should be connected with each other at as many interconnecting points possible so that network efficiency can be achieved.

Internet exchanges should be connected and ISPs should connect to at least one Internet exchange in the country to promote direct connectivity and network efficiency as well as the development and exchange of digital content domestically. This strategy would deepen the innovation of services and applications and promote the availability and sharing of information, especially those considered as public information. The interconnection of telecommunications systems should always be on an open access system and in a non-discriminatory manner.

The existence of several players in the market should not be the sole gauge of a healthy competitive environment. Although we had successes in extending broadband and Internet services to several areas, which were also instrumental in developing the ICT-enabled services industry in the Philippines, there are still many areas to be covered and many of our people that need to be serviced. To promote a conducive policy and regulatory environment for this to happen, it would require the continuation of the light-touch regulatory approach based on a set of principles and policies already enunciated by the government, which includes among others fair and healthy competition, open access, facilitation and use of private capital, strengthening the regulator to address the quality of backbone networks and inter-network settlements.

Last Mile Connectivity

In highly urbanized areas such as in Central Business Districts, ultra high-speed broadband services should be provided. This means that Fiber-to-the-Home (FTTH) or Fiber-to-the-Building (FTTB) should be the end goal. The provision of xDSL especially those providing higher speed should continue to be promoted until such time that demand for FTTH/FTTB become prevalent to provide end-user requirements.

In other urban areas, FTTH should likewise be the end goal. However, since population density may not be as high compared with highly urbanized areas, the use of xDSL, Data Over Cable Service Interface Specification (DOCSIS) cables from cable TV operators, digital terrestrial television broadcasting systems, broadband wireles access (BWA) systems, such as the TV White Space technologies and Wi-Max as well the broadband systems from cellular telephone companies (3G, 3.5G , 4G. etc) should be promoted.

In rural and remote areas, where population are spread thinly and demand for broadband service is low, the use of broadband wireless access systems in addition to broadband services being provided by cellular telephone companies should be

promoted. The government should facilitate partnerships between and among ICT service providers and local entrepreneurs to extend the services of said providers in unserved and underserved areas. The use of emerging technologies such as those employing advanced wireless techniques like the Dynamic Spectrum Allocation (DSA) on unutilized Television Bands or the TV White Space (TVWS) is ideal to extend broadband and Internet services. The TV White Space pilot projects initiated by the ICT Office have connected schools, communities, hospitals and local government units. Moreover, TVWS can also support the connectivity requirements of other government initiatives such as sensors used by project NOAH   ationwide Operational Assessment of Hazards) and for telehealth initiatives. Public wi-fi hotspots in government establishments, state universities and colleges, public hospitals and health centers, public parks, plazas and libraries, and transportation hubs, such as airports, seaports and public transport terminals should be established to improve accessibility to ICT. This has been proposed in both Houses of Congress while the ICT Office has a project to install public wi-fi hotpots in the poorest municipalities nationwide.

As what has been done before, partnership among   ational Government Agencies, Local Government Units, technology providers, telecommunications service providers, broadcasters and the civil society is the key towards creating an enabling environment to foster the impactful use of ICT for development.

As discussed above, broadband access should be monitored for better policy and planning activities as well as for international comparison. Statistics on broadband access segregated or classified by type of access (xDSL, CATV, FTTH, BWA,LTE, etc) and the most appropriate geographic subdivision (barangay, municipality, province, region, congressional district, cluster of geo-political area, service area, etc.) should be gathered periodically.

End-user Service Provisioning

Internet service has become pervasive primarily because of the benefits that it can bring to society such as access to knowledge and delivering various applications on e-Government, e-Business, e-Learning, e-Health, and e-Agriculture among others. On e-Environment, the country has witnessed and experienced that the climate is changing. Severe weather is more frequent and with increasingly greater magnitude.

End users should have the option to select the best available ICT infrastructure to satisfy their needs and requirements. The prevalence of specialized ICT systems to provide online services, which may come from the government providing eGovernment services or the private sector providing eCommerce services or just providing information services for specific areas such for health, education, environment, tourism, or even customer-care, should be encouraged. With a very

strategic importance is the provision of ICT infrastructure to provide ICT services to schools, hospitals and health centers and tourism-related structures. For example, schools are strategic because it does not only provide a venue for children to get their education, they are also used as voting centers during elections. Thus, the choice of technology to connect schools should consider the requirements of sending and receiving education-related content and applications as well as election-related content and applications.

Shared infrastructure should be promoted as it is the most cost-effective solution to provide ICT services to end-users. Shared infrastructure such as the Community eCenters, Internet Cafes, Public Calling Offices and Cloud computing services should be made available to bring ICT services closer to the people, perhaps not more than 30 minutes walk, so that they won't have to travel very far to benefit from ICT services. Community eCenters, for example, are to be converted to Technology-for-Development (Tech4ED) Centers to provide multiple services to the public, including providing ICT-related seminars and training to the public. These access points will enable people to:

- Upgrade their digital literacy
- Increase their knowledge and skill sets for employment
- Access health professionals for proper healthcare
- Start a source of livelihood
- Improve production, business and income
- Become entrepreneurs
- Communicate with family members
- Open new markets outside their communitiies
- Create an agri-tourist destination
- Provide direct inputs for projects needed at the village level and
- Contribute to economic growth.

Assistive technologies for Persons-with-Disabilities (PWDs) should be provided to allow them to benefit from ICTs.

Given the various technologies and processes that would satisfy the requirements and needs of the users, it should always be impressed upon all service providers that they are providing a public service and therefore should always take into account consumer welfare and protection.

Conclusion

Broadband enables social, economic and political development. It is an important ingredient in promoting the transformation of the Philippines. This is what other countries have experienced in the process of creating and nurturing industries and empowering people to become socially-integrated and financially sustainable. The effectiveness of broadband services is therefore to be measured on how people are able to maximize its beneficial use at least cost.

A well-crafted national broadband policy, strategy and implementation plan with the support and the collaboration of all stakeholders are all that the Philippines needs at this time to ensure its development into an information society driven by high speed, reliable, affordable and secure broadband infrastructure.

The Philippines has a long way to go in providing broadband services anytime anywhere. However, with the various initiatives from both legislative and executive branches of government together with the concerted efforts of the private sector and the civil society, the vision of making available broadband services for everyone, everywhere will hopefully become a reality in the shortest time possible.

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