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The 2017 Best Practices Forum on Cybersecurity is reviewing the cybersecurity implications of policy recommendations made as part of "*Policy Options for Connecting and Enabling the Next Billion(s): Phase II*". The outcome of this work will help inform policy makers of the important cybersecurity implications of implementing or evaluating a specific policy option.

In order to ensure a comprehensive review, these notes describe a review of the cybersecurity implications of policy options identified as part of "Policy Options for Connecting and Enabling the Next Billion(s): Phase I". While that document did not align with the Sustainable Development Goals, and thus will not be our line of inquiry in approaching the Phase II review, this review is intended to ensure our guidance is comprehensive.

In Appendix A, a set of reviewed policy recommendations, extracted from the Phase I CENB document is listed. Reviewing those, I identified a set of high-level criteria which came up, in many cases repeatedly. I noted some brief security implications of each:

1. Promoting improved and extended broadband infrastructure:
    - Increased broadband increases the risk of vulnerable endpoints being leveraged in high-bandwidth **Distributed Denial of Service attacks**. Whereas unmaintained, unpatched or unlicensed devices on low bandwidth networks have mostly localized impact, on high bandwidth networks the impact is likely to have more implications at the global network level.
2. Promoting spectrum increases and promoting increased reliance on wireless modes of operation:
    - Use of spectrum for internet access is subjected to **local jamming as a Denial of Service attack**, which has different recovery scenarios (they must be triangulated and stopped) than cable disruptions (which can physically be fixed).
    - Wireless network access increases the importance of **strong traffic encryption** controls.
3. Promoting increased power grid capacity:
    - Extension of power grid capacity, in particular over greater distances will involve the deployment and reliance on the **security of Supervisory Control and Data Acquisition (SCADA) equipment**.
4. Promoting the development of Internet Exchange Points:
    - Internet Exchange Points have strong physical security needs, and imply the use of specialized software and hardware which must be maintained. Use of components with **good software security and a standard, maintainable and updatable setup** becomes more important as IXPs are more distributed and perhaps run by local teams with less experience.
5. Promoting user awareness education:
    - Educating users on the use of the internet requires those users to be **made aware of security risks and safe conduct online**.

- It requires the **development of initial services with human behavior in mind**, so the default behavior of users on the services they use as their first entry online is secure.

6. Deploying government services using an Open Data model:
    - **Making data available requires proper anonymization**, which is not an easy challenge. Data must be available in aggregate to be of use, but should not be released in such way that permits de-anonymization.
    - Data released by the government must have **strong integrity** to enable society to make appropriate decisions based on its analysis.
    - When third parties start building on top of the data set, its **availability** becomes important to permit these third parties to function.
7. Addressing unsolicited e-mail and other forms of spam:
    - Spam and unsolicited messages may make otherwise effective communication channels difficult or unpleasant to use. **Abuse management mechanisms** are needed, which should be carefully introduced so as not to lead to censorship or put in place other boundaries on communication.
8. Promoting the increase of locally relevant content and local language support:
    - Increased local language support, in particular when associated with other character sets may increase the risk of **homoglyph attacks** on the URIs used for such content, or other, international content;
    - Locally relevant content may not be required to be available globally. These reduced performance requirements may incentivize content creators to store it on local network resources. Having only a single copy of the information available in a region increases the risk of a **Denial of Service attack** rendering it unavailable, or a local outage causing it to be destroyed.
9. Promoting national domain name infrastructure:
    - National domain name infrastructure is often less robust than the gTLD's on which large international enterprises are deployed, such as .com, .net and .org. Increasing reliance on it requires investment in **secure domain name and registry infrastructure**.
10. Promoting sharing of passive infrastructure:
    - Shared infrastructure may expose infrastructure owned by one operator to another, requiring the implementation of **strong security controls** restricting access;
    - Shared infrastructure **reduces overall redundancy of networks**. An outage of a single site may affect multiple providers.
11. Addressing minority and gender-based online harassment:
    - Addressing minority or gender-specific harassment requires contextual knowledge of what means "harassment" and proper reporting channels. These reporting channels may not always be available when a service provider is in a different country, or operating under a different legal framework.
12. Strengthen telecommunications infrastructure through public private partnerships:
    - Public-private partnerships may include shared operational capability between government and industry providers, which requires **strong security controls and**

separation of duties to ensure the public partners is unable to affect technical implementations for e.g. domestic surveillance.

13. Enabling initiating economic opportunities, such as starting a company, online:
    - Bringing services critical to the economy such as these online requires secure development processes to ensure the **underlying data stores are protected from unauthorized access and modification**;
    - A **Denial of Service attack** against such services may hamper the ability of businesses to do their work, or citizens to become economically active.
14. Make internet devices more affordable
    - Increased price pressure without specific quality requirements may result in vendors saving on costly, but important processes such as **quality control**. This may result in devices being introduced without passing through a software development lifecycle that includes security testing, or a supportable update process.

Appendix A: Policy options identified from the Phase I document

http://www.intgovforum.org/cms/documents/policy-options/654-igf-policy-options-for-connecting-the-next-billion-compilation/file

1. **Deploying infrastructure**

    a. *Physical, interconnection layers and enabling technologies*
        i. Promote broadband infrastructure (Africa IGF)
        ii. Promote power grid capacity (Africa IGF)
        iii. Explore creation of continental common toll-free Internet platform to preserve the identity and cultural heritage of Africa (Africa IGF)
        iv. Stabilize pricing for internet access service (Ministry of Comm. Brazil)
        v. Improve transcontinental submarine cabling (Ministry of Comm. Brazil)
        vi. Groups with major market power are obliged to connect to traffic exchanges, offer full peering, paid peering and traffic (Ministry of Comm. Brazil)
        vii. Stimulate investments for broadband roll-out (EuroDig)
        viii. Provide public funds where private investment is not enough (EuroDig)
        ix. Development of public-private partnerships (EuroDig)
        x. Open access and spectrum for Wi-Fi development (APrIGF)
        xi. Spectrum is a common good, policy should be inspired by criteria of public and general interest (EBU)
        xii. Pro-competitive broadband policy (ICC Basis)
        xiii. Policy initiative targeted at specific socio-demographic groups (Annenberg School for Communication)
    b. *Mobile*
        i. Half of the world's population has a mobile subscription – mobile helps to provide underserved regions with the opportunity to overcome socio-economic challenges (GSMA)
        ii. Making prepaid mobile services available to non-elites, increasing mobile competition to reduce prices (ICT Africa)
        iii. Stimulate 3G networks in Niger – mobile credited for nearly all progress on connectivity (IGF Niger)
        iv. Promote wireless in areas with reduced electricity coverage (Movimento de Espectro Livre)
        v. Spectrum is finite, ITU estimates 1340-1960 Mhz of spectrum required for 2020 demand (GSMA)
    c. *Funding sources: Universal service funds, Public Private partnerships*
        i. Universal Service Provision Funds should be used to engender infrastructure into underserved areas and enable affordability (African Regional IGF)
        ii. USAF should address institutional environment: oper. Independence, legal clarity, internal capacity + support broadband supply. Successful

funds are targeted to address affordability and gaps (Alliance for Affordable Internet)

iii. Investments are currently typically redirected to urban and semi-urban areas (Universal Access Fund and ICT Infrastructure Investment Africa)

d. Deployment

i. Development of IXPs and IPv6/IDN deployment play a crucial role (EuroDig)

2. Increasing usability

a. Applications

i. Causal relationship between low usage of mobile media tools and internet literacy – even when people have access to the internet, they lack the understanding of it (World Bank)

b. Services

i. Citizens need to have information on what governments and private sector are doing to increase access and connectivity, especially in rural areas. Geography and culture must be taken into account (civil society)

ii. Digital content and services are important to drive internet adoption and usage (World Economic Forum)

c. Local Content, Multilingualism

i. Content in local languages is important – accessible, cheap and interesting are content requirements (EuroDig)

ii. Representation and participation are uneven, many people are left out of the debate (IGF local content 2014)

iii. Encourage locally relevant content, including protections for freedom of expression, press, privacy and intellectual property, e-commerce infrastructure, consumer protection, trusted online payment systems. Policies must be market driven and based on voluntary commercial arrangements (ICC Basis)

iv. Promote local content (Iberoamerican federation of IT associations)

v. Local content promotion in Spanish and native American languages (Paraguay IGF)

d. Media

i. Most traffic is driven by professionally produced quality content. Local content promoters are now in competition with global content industry (EBU)

e. Accessibility

i. Legislative framework on accessibility exists, but awareness raising, education and training of specialists is needed. (Swiss IGF)

ii. Items paid for by the public must be accessible for the public – open access to publicly funded research (Swiss IGF)

3. Enabling users

a. *Human Rights*
    i. States and private sector must commit to developing clear standards, procedures for protection and transparency to strengthen human rights on the internet in the region (Asia Pacific Regional IGF)
    ii. African IGF session on Human Rights on the Internet:
        1. Establish mechanisms to promote, monitor and popularize African Declaration on Internet Rights and Freedoms and UNESCO's concept of internet universality
        2. Self regulatory, independent objective oversight and sanctioning mechanisms
        3. Meaningful access to ICT includes control over ICTs as a key resource towards advancing status of women and girls and their human rights
        4. Address emerging issue of violence against women
b. *Inclusiveness (Gender, Youth)*
    i. Issues: unequal access to internet infrastructure, affordability, gender disparity in education, digital literacy, uneven capacity to use internet for needs and priorities, specific gender-based challenges and barriers (relevant content, gender-based harassment and violence) (2015 IGF BPF on Countering Abuse against Women online)
c. *User literacy*
    i. Support open data models, local content development, eLearning initiatives (African Regional IGF)
    ii. Principles on Public Access in Libraries (IGF DCPAL)
d. *Digital Citizenship*
    i. Fostering public access points in public libraries and community centers, and promoting content creation and digital literacy activities in those places (LAC IGF)
    ii. Accessible voting machines, supporting school for blind students, working with low income populations. Promoting access to information. (Microsoft)
e. *Entrepreneurship*
    i. Those formerly excluded from economic opportunity can use the internet for all phases of starting their own companies (WEF 2015)

4. Ensuring affordability

a. *Digital divide*
    i. Improve investment in R&D to allow Brazil to compete with foreign-produced goods. Otherwise the country does not fully benefit from the internet economy (Movimento de Espectro Livre – Brazil)
    ii. Focus on increasing supply and lowering cost of access (Internet Society)

iii. Address spectrum availability for 3G and 4G (Arab IGF)
iv. Increase IXPs at national and regional levels (Arab IGF)
v. Educate on computer literacy and reduce device cost, which will drive internet use and support establishment of local content (Arab IGF)

b. Costs of Access per Capita

i. Infrastructure sharing (e.g. independent tower companies) lowers industry costs (Alliance for Affordable Internet)
ii. Identify appropriate balance between taxation revenue and long-term socio-economic growth. Develop evidence based policies (Alliance for Affordable Internet)
iii. Develop firmware for devices already on the market, so existing devices can be re-used (e.g. OpenWRT) (Movimento de Espectro Livre – Brazil)

5. Creating an enabling environment

a. Government, Regulatory Authorities and IGO frameworks, laws and regulations

i. Connecting the next billions should be driven as a project (African Regional IGF)
ii. Ministries of Communications should review plans through multistakeholder cooperation (African Regional IGF)
iii. Governments should demonstrate ability to implement viable policies already in place (do not replace previous govt projects) (African Regional IGF)
iv. Deploy government services using open data model (African Regional IGF)
v. Effective monitoring of projects and online reporting (African Regional IGF)
vi. Regional multistakeholder approach at the AU-level (African Regional IGF)
vii. Infrastructure sharing at the backbone level and open access to cut costs (Mozambique IGF)
viii. Fiscal policy and taxation (Mozambique IGF)
ix. Research and Data Collection (Mozambique IGF)
x. National broadband strategies require extensive public consultation with all stakeholder groups (APC)
xi. Eliminate market protections for incumbent operators (APC)
xii. Increase government investment in public access facilities and awareness raising, focused on disenfranchised groups (APC)
xiii. Allow innovative uses of spectrum and new spectrum sharing techniques (APC)
xiv. Promote local ownership of small-scale communications infrastructure (APC)
xv. Using public funds and utility infrastructure to ensure national fibre networks move into sparsely populated areas (APC)

xvi. Adopt effective infrastructure sharing (APC)
xvii. Reduce taxes on ICT goods and services (APC)
xviii. Established broadband targets in Digital Agenda for Europe (EC)
xix. Creation of ad-hoc funds to stimulate investment (EC)
xx. Improve digital skills and literacy (Coding week, networks of Digital champions) (EC)
xxi. International organizations should show benefits of investments in access, high capacity connectivity, promote healthy, competitive and stable market environments, develop private-public partnerships for non-commercially viable areas, transfer expertise and share best practices (EC)
xxii. Promote corporate social responsibilities (Nigeria IGF)
xxiii. Broadband policy, ICT Policy encouraging investment and Local Content Policy (Nigeria IGF)

b. *Private sector-led initiatives and market strategies*
    i. Alliance for affordable internet:
        1. Liberalized market with open, competitive environment
        2. Nurture healthy market competition
        3. Streamline licensing process with no barriers to market ntry
        4. Ensure competitive market structure, with no govt ownership of end user providers
        5. Available access at market rates to international gateway or cable
        6. Transparent disclosure of pricing and service options
        7. Permit pre-paid and tiered pricing
        8. Remove barriers to crossing national borders with infrastructure or traffic
    ii. ICC Basis:
        1. Open and competitive markets, fair, investment-friendly, comparable regulatory intervention for all actors
        2. Strong reliance on voluntary commercial arrangements
        3. Policies that promote efficiency through engineering-driven design (creation of IXPs)
        4. Policies that promote growth of products and services provided over broadband
    iii. Run localized networking initiative with solar backup (Kenya IGF)
    iv. Social enterprise that makes broadband available at low cost, based on national fiber optic network (Kenya IGF)

c. *Non-profit, Public-Private partnerships and Other initiatives*
    i. Arab IGF:
        1. Foster private-public partnerships to invest in telecom infrastructure to reach out to disadvantaged areas
        2. Establish national and local dialogues on benefits of internet and how it improves economic situation of individuals

3. Develop policies and regulations that cater for competitive access-price strategy, macro-level affordability
4. Engage with CSOs to reinforce their role in mobilizing communities they work with

ii. Facilitate deployment of telecoms infrastructure to facilitate access to spectrum and lower taxes (LACIGF)
iii. Companies must develop business models to break restriction income. Universalize through mobile telephony (LACIGF)
iv. Digital inclusion programs such as distributing computers to children in schools (LACIGF)
v. Invest in network services in order to close coverage gap (LACIGF)
vi. Roll-out of optic cables throughout country (Benin IGF)
vii. Promote national TLD (Benin IGF)
viii. Federal Telecommunications Institute of Mexico:
    1. Promote access for persons with disabilities
    2. Make terminal devices and telecom services more affordable and better quality to ensure widespread access
    3. Strengthen telecoms infrastructure by encouraging public-private partnerships
    4. Encourage campaigns for skills building
    5. Encourage multi-stakeholder governance
ix. Facebook:
    1. Reduce the cost of internet access, such as supporting innovative business arrangements like free basics
    2. Promote free and open internet
        a. Do not permit fast lanes, blocking, throttling
        b. Do not introduce laws inhibiting innovation
        c. Innovative practices such as zero-rating can give more people access to content
    3. Expand connectivity infrastructure
        a. Streamline local licensing processes
        b. Reduce legal barriers to entry
        c. Promote sharing of passive infrastructure (dig once, build once)
        d. Tax incentives can accelerate development
x. Colombia IGF:
    1. ICT appropriation linked to access is important to increase impact of government initiatives and reducing digital divide
    2. Promote production of software and local content with social focus
    3. Encourage public internet access strategies, and do not neglect them in favor of mobile access. Public access links vulnerable communities.

4. Expand community wireless networks and connection of schools and libraries to rural areas
5. Reduce or eliminate taxes related to internet access and devices
6. Reduce gender gap and ICTs

xi. Broadband commission:
    1. Prioritize supply and demand-side policies to full range of broadband infrastructure, applications and services
    2. Initiate and prioritize broadband planning process
    3. Invest in ICTs and digital skills as engine of growth
    4. Review and update regulatory frameworks to take into account evolving models
xii. Expand private and public sector engagement, augment stakeholder community, recruit leaders from various sectors (civil society)
xiii. More regional cooperation initiatives to address lack of domestic political will (IGF Niger)
xiv. Microsoft:
    1. Openness to dialogue across partner institutions and organizations
    2. Inclusiveness of local actors aware of local needs
    3. Enabling environment for joint planning and execution
    4. Identification of socio-economic development opportunities and priorities
    5. Application of successful models across disciplines
xv. Promote public-private partnerships for connecting remote regions (Telefonica)
xvi. Address unsolicited e-mail