Global Connect Stakeholders: Advancing Solutions

How can we connect the next billions of new Internet users by 2020? With nearly 60 percent of humanity still lacking Internet access, the success of extending universal, affordable connectivity depends on the shared expertise, experiences, and creativity of the global technology, technical, and policy communities.

More than 150 engineers, scientists, development professionals, industry leaders, and others from an array of technology and industry domains globally gathered with global policy experts in Washington on 13 April 2016 to explore real-world opportunities that exist now to extend affordable Internet access in underdeveloped and underserved communities and regions within the next five years and progress toward the 2030 Sustainable Development Goals (SDGs). "Global Connect Stakeholders: Advancing Solutions" was hosted by IEEE, the world's largest professional organization dedicated to advancing technology for humanity, in conjunction with the World Bank, United States Department of State, and White House Office of Science and Technology Policy.

Understanding Common Themes Globally

The event program blended a variety of collaborative sessions. Two rounds of "lightning talks" surveyed the geographic and technical solutions landscape for supplying affordable access and connectivity. The talks illuminated the relationships—generally, across disparate geographic markets—among access to Internet and other digital technologies, digital policies, and regulations, human resources, the information and communications technologies (ICT) industry, and strategic applications in the public and private sectors around the world.

Throughout the day, the importance of advancing *locally* defined solutions with *globally* interoperable, standards-based technologies was affirmed as a point of emphasis. For example, panelists discussed how rural and urban regions offer very different problems to be solved and that existing policies often tend not to suit rural areas. As a result, participants said, perhaps rural-only licenses could be considered to address large gaps in coverage. In addition, differences in geography, topology, and population density mean that various technology solutions must be considered, including fixed, wireless, and satellite.

Extent of connectivity among regions and countries varies enormously; connectivity varies greatly even with a given country, in fact. But the panelists warned that extending access to the Internet in and of itself will not drive demand for its use and yield the progress toward the 2030 SDGs that affordable, universal connectivity could deliver. Comprehensive change and content of local interest and in local language are necessary in order to encourage use as vital for that region or area. Local expertise, engineering skills, and leadership must be cultivated to foster sustainability. Cultivating local capacity will be key in terms of moving beyond the tendency so prevalent today of "drive-by" development, in which equipment and programs might be installed but not maintained, managed, and fully optimized over time.

Ensuring affordability is another key shared challenge across markets. Economics often tend to be the roadblock to deployments around the world today. Cost of radio spectrum, for example, is a major issue in many markets. Participants mulled, what could be done to better leverage TV whitespaces? Is there a way for governments to subsidize access? Can device cost be lowered? In addition, participants discussed the need for competition at every link in the chain of competition (in landing stations, in undersea cables, etc.)

Another issue is taxation. Many governments have a long history of treating telecom as an important source of tax revenue, with high rates on both services and devices. In many economies, this has the effect of severely limiting growth (and, even, gross taxes). Thus, governments need to be persuaded—by convincing data—to adopt lower tax rates with assurance that this will foster Internet growth and, thus, overall economic benefits. In addition to reducing taxes, governments can lower, waive, or eliminate permit costs for new construction if it is an open access or "Dig Once" project, in which underground fiber links are installed as an integrated element of any major infrastructure program, such as building or renovating roads, railways, pipelines, utility infrastructure, and energy distribution channels.

Because costs can't be driven down to zero, value must be better quantified and understood. Specifically: the value created external to Internet services must be quantified: the value is *holistic*, and it is *local*, embracing the health, educational, financial, economic, and safety wellbeing as potential societal benefits and as outcomes to analyze, to quantify, and to track via usable metrics. The *universality* of access suggests also that some resources and knowledge must be pooled on best practices and known problems, on model proposals for work and new advances. As such data become available (or even just given the prospect that such data *will be* available, open and transparent), multilateral development banks (MDBs), administrators, and others will find stronger cases for development finance.

Following the lightning talks and other presentations, focus narrowed to region-specific discussion in "World Café"-model conversations. Participants dispersed among assigned tables to drill down into the specific issues, recommendations, and potential next steps for advancing progress in specific regions: Africa, Asia, Central/South America, Europe, and North America.

Advancing Solutions in Africa

Nowhere will the emphasis on locally defined solutions in extending affordable, universal connectivity be more crucial than in Africa. The continent's highly diverse markets demand a wide range of solutions, potentially ranging from satellites to fiber optics deployed through sewer lines. As a result, it's important that technology and policy solutions be developed at the country level in Africa—and perhaps even country level is too broad a definition of a market. Rural- and urban-specific policies might be necessary, particularly for spectrum. For example, participants considered spectrum-sharing policies that would allow for expanded use of licensed spectrum in rural areas by villages and innovative local providers.

One of the first steps to addressing the challenges of connecting the unconnected in Africa will be more specifically defining what it means to be connected. The lack of access to reliable power

is one overriding consideration that must be taken into account in any connectivity initiative on the continent. As a result, cross-sector development and infrastructure projects (which include power delivery and off-grid power generation) should be emphasized. Regulation and policy that encourage investment and connectivity for rural areas (and better data about the current levels of connectivity) are also important. Discussants also identified that technical assistance and capacity building programs are needed, in order to develop the human capital in Africa to develop, build, operate, maintain, and upgrade broadband networks and locally based services on the continent. In addition, direct outreach to villages and digital skills training will be needed to help villages take full advantage of the benefits of being digitally connected. Demand for connectivity by health, education, government, and non-governmental organizations (NGO) community should be aggregated, as this will lower the cost and risk of up-front capital investment necessary for major connectivity projects. Finally, competition among connectivity providers and power suppliers is insufficient in many countries and should be addressed by policymakers through spectrum, open access, and interconnection policies.

Case studies on individual market successes in Africa—such as on the relationship between removal of roaming barriers and subsequent spikes in usage in Kenya, Rwanda, Uganda, South Sudan, and Tanzania—could be leveraged to encourage other countries to take inventive steps toward expanding connectivity. For example, open access National Research and Education Networks (NRENs) can be used to aggregate demand and accelerate connectivity. In addition, connectivity infrastructure should be included in any infrastructure project; it has been shown that adding fiber optics along a new road adds only 1 percent to the cost of the total project. Creating and sharing case studies that illuminate such best practices and lessons learned would be especially useful in Africa because investors in development there generally cannot expect a quick return on such projects. Stakeholders will have to be convinced of and committed to the long-term societal value in advancing Africa's digital future.

Table leaders/ subject matter experts (SMEs):	Steve Song Justin Caso Ericas Napjus Christopher Jannuzzi Nathan Johnson

Issues:	Highly diverse markets demanding locally defined solutions Lack of reliable sources of electricity Presence of both highly dense urban and highly diffuse rural populations Lack of intra-African network interconnection Human capacity to operate and run networks needs to be developed through adequate training/education Spectrum policy not necessarily responsive to local/community needs Lack of provider robust competition in many countries Decision-making silos exist both within and between countries Regulation for the few not the many – consideration of rural connectivity policy High upfront and installation costs are prohibitive
Current projects:	Regional Communications Infrastructure Program (World Bank/Malawi) and demand aggregation to incentivize investment American Tower "Internet Town Squares" (shared tower, power generation, Internet kiosks)

Possible solutions:	*Technology* • Wide range of potential solutions (satellites, wireless, TV white spaces, fiber optics) • Rapid increase in wireless telephone penetration/prepaid solutions • Opportunities for creative and dynamic use of underutilized spectrum • Off-grid power solutions and more competitive power providers • Creation and/or connection to NRENs *Regulatory* • Spectrum policy attuned to needs, including (1) low-power spectrum "underlays"/shared licensing spectrum approaches (which would, for example, allow local operators in rural areas to use underutilized spectrum), (2) licensing/allowing white space and similar dynamic spectrum uses, and (3) creative licensing policies that would foster innovative and local entry (license registry, license preferences for local uses) • Embed a universal service obligation in the upcoming 700 MHz spectrum auctions: prior to the auction establish build-out, service, and interconnection policies customized to fit the particular country's needs as conditions imposed on the auction winner—and then ensure compliance with those commitments before allowing use of the spectrum in urban areas • Reduce/waive/eliminate rights-of-way way and permit fees for networks that adhere to Dig Once principles and/or open access policies • Establish and maintain affordability policies (Subsidize subscriptions? Bundle subscriptions with other government/social services/commercial?) • Provide technical assistance and promote regulatory cooperation/harmonization across Africa (like roaming policy) *Technical Assistance and Capacity Building for Self-Sustaining African ICT sector* • Promote intra-African interconnection of networks and open access networks • Create/promote creation of national/regional education/health/nonprofit networks that are staffed and operated with (mentored) local talent • Scale technical assistance and capacity building programs for local network operator and IT skills • Outreach to villages and consumers on value and uses of digital technology to promote social/economic growth • Promote and facilitate local content and tailored local connectivity solutions • Enhance cooperation and coordination within and between countries *Finance* • Finance construction of networks that adhere to Dig One practices, open access policies, utilize (mentored) local talent, establish power solutions, and aggregate demand from government, health, NGO aid community, and education sectors
Next Steps:	Define "connectivity." Create and share case studies that illuminate best practices (such as on the relationship between removal of roaming barriers and subsequent spikes in usage in Kenya, Rwanda, Uganda, South Sudan, and Tanzania).. Establish technical assistance and capacity building programs for both regulatory and ITC network operations areas.

Advancing Solutions in Asia

Participants at the Asia tables discussed the distinct challenges of connecting various markets across the continent (the island communities of the Pacific, Indonesia, and the Philippines vs. landlocked countries such as Bhutan, for example). There are key successes on which to build. For example, government digital platforms can make a big difference. Singapore SMART Nation is government expansion of eGov initiatives, generating wide and broad local content that is relevant for business operations, personal development, and family whole-of-life care. In addition, the Association of Southeast Asian Nations (ASEAN) has successfully implemented power-grid sharing (some countries are "day countries;" others, "night countries"). The same collaboration model can be leveraged in the region for the Internet.

A number of innovative technologies that are being developed should be supported and fast-tracked in order to extend affordable, universal connectivity in Asia. For example, participants noted that powerline technologies could play a large role in these markets because their suspension high above the ground conveys some protection from damage during monsoons. Associated policy innovation will be needed, as well. But while policy should be pro-technology (integration of ICT in any development project should be encouraged or even mandated), participants noted that policy also should be technology-agnostic. A funding structure that ensures that funding yields the promised benefits will be necessary to instill trust among investors. And emphasis should be given to programs that incent cross-sector projects, in which ministers of finance join with two or more of other ministers within a government and partner with NGOs and/or civil society to utilize ICT in progressing toward the 2030 SDGs.

Also, respecting the cultural/behavioral customs of specific markets will be of key importance to projects in Asia. People in many instances do not know what they can do with connectivity. Generating local content in local languages will be key besides helping communities to become "prosumers" who both produce and consume content. And, in order to reach women and children specifically in Asia and other parts of the Global South, faith-based communities (instead of, say, libraries, which are more frequently used by men) could be targeted as community centers for extending Internet access.

A repository of successes and failures to reaching the 2030 SDGs in Asia should be curated. Also, participants agreed that a regional convening of envoys to talk about what can be done and learned together would be helpful.

Table leaders/SMEs:	Steven Huter Clara Tsao Mei Lin Fung Tim Kostyk Dilip Krishnaswamy Deepak Maheshwari Karen McCabe

Issues:	Need to connect island communities of the Pacific, Indonesia, and the Philippines People in many instances do not know what they can do with connectivity Costs too high to generate demand Business case of public access providers has been impacted by accelerated proliferation of low-cost mobile devices/tablets with parallel improvements in network coverage and capacity and reductions in data prices From operator's point of view, Afghanistan is still opening up; competition can bring down prices India largely unconnected; prices down but still unaffordable; competition, infrastructure and accessibility are coming Landlocked countries present their own challenges, as they must negotiate access with their neighbors or have great satellite coverage, because adding an undersea cable is not an option Telecomm operators don't own fiber in Bhutan, per government policy Myanmar has invested in fiber networks, not just how it was developed but how it's being run Opportunity for ICT skill development in South Asian markets but even bigger one for skill development for jobs outside of ICT (janitor, welder, etc.)
Current projects:	Singapore SMART Nation is government expanding eGov initiatives, generating wide and broad local content that is relevant for business operations, personal development, and family whole-of-life care Association of Southeast Asian Nations (ASEAN) has successfully implemented power-grid sharing (some countries are "day countries;" others, "night countries") India case studies (sometimes SMS solves problem, not necessary for data plan; programs on public access/shared access/kiosks and local content for reaching and empowering rural and poor communities) Sri Lanka case study (reduction of corruption, institute services more in the local language) Georgia case study (mobile government and e-government reduce corruption) Kiva, change.org, branch and imerit are examples of companies that are connecting supply to demand, creating markets, economic incentives, demand and value propositions

Possible solutions:	*Technology* • Leverage ASEAN power-grid sharing model for the Internet • Powerline technologies • IPv6 deployment across government and private sector networks • Giving students laptops? • Rotating machines around classes in schools? *Regulatory* • Cross-sector synergy and alignment *Policy* • Pro-technology but also technology-agnostic • Integration of ICT in any development project should be incentivized • Train consumers on importance of being digitally connected • Public access is critical for capacity building within communities *Finance* • Structure must ensure that funding yields the promised benefits • Emphasize programs that incent cross-sector projects

Next Steps:	Co-create content with local context in local languages beyond just text, and develop tools for the same to promote societal benefit of connectivity. Generate local content in local languages to promote societal benefit of connectivity. Design public access *with* communities (rather than *for* communities), as societal norms and behaviors are critical for capacity building. For example, in some markets, locate community centers for extending Internet access in faith-based communities in order to more effectively reach women and children. Curate repository of successes and failures to reaching the 2030 SDGs. Convene regional envoys to talk about what can be done and learned together. Reach out to insurance and cybersecurity companies for input on embracing a global approach to fostering trust in connectivity. Encourage regulators to establish incentives for cross-sector (energy, transport, telecom, etc.) synergy and alignment. Explore "Connectivity Corps" (modeled after the Peace Corps) to provide technical assistance and create reference designs for individual underserved markets. Provide IoT- and mobile-focused training and technical assistance for the regulatory environment and public. Expand IPv6 deployment from government networks, to mobile networks and eventual full national penetration. APNIC is undertaking work in this space. Expand isolated initiatives into national programs in South Asia. Support NGOs that bring in underrepresented groups (such as Tech4Women). Explore potential of giving top students laptops and/or rotating machines around classes to spur demand. This imitative is from Afghanistan Telecom Regulatory Authority (ATRA). In 2G areas, provide access to content that does not require greater bandwidth. Offer training by having someone from local area deliver in English versus English speaker from outside the locality.. Explore how to help social enterprises become more efficient and address opportunities such as helping people get out of poverty.

Advancing Solutions in Central/South America

Among the particular issues identified in discussions of the Central/South America markets were the relative paucity of providers per nation, the low prioritization of ICT and telco in budgets across the region (not more than 2 percent, typically), and widely differentiated levels of connectivity among nations. On the other hand, participants noted that increased political stability in the region affords business comfort for increased investments and that there is

evidence that governments are becoming more and more aware of the value of investing in public ICT infrastructure (with Colombia, Paraguay, and Peru among the examples).

Participants recommended that ICT be built into each country's strategy for development. Areas that increase connectivity should be encouraged; demand for state-of-the-art services should be fostered (especially among the very young); and policy barriers should be addressed (such as around cloud services and privacy laws, for example).

In this region, a combined top-down and bottom-up approach might be needed to most effectively advance progress. ICT requirements for broadband, fiber, and other methods of Internet delivery, such as mobile and satellite, could be built into MDB funding requests, with sufficiently stiff penalty fees to induce compliance. Groups such as IEEE can provide the technical expertise and guidance to help local leaders address their barriers to spreading last-mile connectivity and develop educational programs. Online safety and privacy could be interwoven in education; mobile health models potentially could help inform such programs. At the same time, by pushing broadband to schools and libraries, for example, a next generation of users could be fostered to expect and demand state-of-the-art access and services (i.e., "I *expect* this access"). Furthermore, IEEE 802.11™[1] "Wi-Fi®" connectivity that is used while schools are in session could be availed to the community at large when schools are out of session.

Table leaders/SMEs:	Antonio Garcia Zaballos Mary Lynne Nielsen
Issues:	Few providers per nation Low prioritization of ICT and telco in budgets Ministries do not necessarily communicate within countries Widely differentiated levels of connectivity among nations and different definitions for "access" Privacy laws vary per country There is money from privatization and UASF (where present), but it is so far unused (or underutilized or used for other things) World Bank needs a way to identify programs with ICT funding.
Current projects:	

[1] IEEE 802.11, IEEE Standard for Information technology--Telecommunications and information exchange between systems Local and metropolitan area networks--Specific requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications

Possible solutions:	*Technology* • Encourage small businesses to take advantage to their access to privatization money • Push public access to connectivity of the highest affordable bandwidth, to begin to build broader access for small and medium enterprises and build market opportunities *Regulatory* *Policy* • Address policy barriers (around cloud services and privacy laws, for example) • Make case for collective demand to impel action on policy front • Reduce/waive/eliminate wayleave/right-of-way and permit fees for Dig Once and/or open access networks *Finance* • Build ICT into each country's strategy for development • Incent areas that increase connectivity • Foster demand for state-of-the-art services • Ensure that universal access fees, in public/private partnership, can get back to those areas that really need assistance • Fund connectivity programs for the very young • Fund commercial enterprises that extend reach, increase bandwidth, and/or reduce effective cost of Internet service to consumers

Next Steps:	*Top-down* • Build ICT into every country's strategy for development. • Ensure appropriate requirements are attached to MDB funding requests to require that broadband, fiber, and other methods of Internet delivery.. • Offer technical expertise and guidance from bodies like IEEE and others that can engage in neutral technical offerings. • Offer educational programs for ministers and other government leaders coordinated from World Bank, IEEE, and others to share training on the ICT challenges and opportunities that can be used to bridge the last-mile challenge. • Create a council (tied to local leadership) that offers expertise and implementation leadership coordinated with funding tools that can evaluate proposals and offer a diverse model within any country. • Offer training and education at regional finance minister meetings, and use their input in creating ICT incorporation or council creation. • Explore creating reports and more data on the ICT challenges and the ICT tools that exist that can serve as the foundation for World Bank funding, and get that out to the SDG community.. • Discuss top-down barriers, learn where they are, and feed that back into the governmental discussions. *Bottom-up* • Get to the young, and provide funding through education institutions. Explore parsing e-health to this. Build as a public/private partnership. Help use this to expand to the family networks. Add skills and infrastructure.. • Make IEEE 802.11 Wi-Fi available after school hours to the public. Add Wi-Fi signals on light posts.. • Make sure that the young need to insist on ICT, and ensure the unconnected are heard. • Build community-based design to this planning, and ensure that the local community norms are considered. • Make sure that online safety and privacy are delivered as part of the education, and then ensure that this is balanced against censorship. • Demonstrate bottom-up success to government and make that an incentive to drive policy development and redirection. • Leverage mobile health models in planning *Universal access* • Explore incentives for providers of last-mile access that factor in return on investment. • Use MDB funding requirements to include a push to universal connectivity, and ensure that penalty fees are high enough to incent fulfilling the requirement for this. • Examine legal barriers, to ensure that restrictions are lifted. Find balance between prudent financial success to drive investment and having incentives that encourage innovation and creative solutions. Search for gap opportunities like unlicensed spectrum, for example. • Ensure digital tech includes governance and cybersecurity.

Advancing Solutions in Europe

Participants at the event's Europe-focused tables emphasized the continent's unique structure. Not only is Europe unlike other continents, it also is not any of its single countries—each national market is quite different from its European neighbors.

In Europe, more solid metrics are needed around, for example, the link between extending connectivity and boosting economic growth. A better understanding of the societal benefit of extending affordable connectivity is needed, so that projects are not viewed or become, in fact, about adding more shopping sites for already connected populations to enjoy. Reliable data and best practices on both successes and failures in individual markets would help build trust in local plans for modernization. For example, success stories from specific countries (Estonia, Sweden, and Portugal, among others) could be used to understand how a successful balance of regulation, funding, and technical infrastructure buildout can contribute to achieving measurable added value in exploitation of the Internet. And data on Internet rollouts, connections, and usage for the most poor populations should be available in real time and transparently to anyone, to visualize progress as projects are rolling out.

Ultimately, participants shared their doubt that currently planned increases in ICT spending in the region could prove sufficient to extend affordable, universal connectivity to all and accelerate toward the 2030 SDGs. They said that better data and sharing around individual European countries' successes might help illustrate the funding gap.

Related recommendations for extending affordable connectivity in Europe included:

- embracing non-telecom components;
- leveraging appropriate public-private partnership incentives to drive gains;
- exploring collaborations between countries (as in fiber builds and spectrum allocation);
- developing in-country, collaborative agreements among ministries;
- empowering high-level champions;
- making data open and available;
- collecting/publishing successes and failures for learning;
- adopting a strategy of "dig once/light twice" in anticipation of technology innovations;
- promoting usage by end users;
- planning for modernization;
- leveraging end points in order to build the middle mile; and
- adopting posture of thinking regionally and educating locally.

Table leaders/SMEs:	John Ryan Jim Wendorf Robert Ballance Neal Bergano

Issues:	Unique structure (unlike other continents, not any of its single countries) Infrastructure exists; context/content is lacking European Union has a good regulatory framework, but other parts of Europe do not Financing gap among neighboring EU countries Continent is starting to fall behind in broadband and mobile infrastructure A better understanding of the societal benefit of extending affordable connectivity is needed Currently planned increases in ICT spending likely insufficient
Current projects:	
Possible solutions:	*Technology* • Embrace non-telecom components • Make data open and available • Leverage end points in order to build the middle mile • Context/content must be relevant to users, wherever they are • Leverage electricity infrastructure to extend connectivity • Standards for "software-ized" networks and data interchange • Open definitions/application programming interfaces (APIs) for software and data *Regulatory* • There should not be localization laws; there needs to be rule of law above local countries • People need peers, between departments in their own countries and with like-minded people in other countries *Policy* • Explore collaborations between countries (as in fiber builds and spectrum allocation) • Develop in-country, collaborative agreements among ministries • Adopt strategy of "dig once/light twice" in anticipation of technology innovations • Plan for modernization *Finance* • Leverage appropriate public-private partnership incentives to drive gains

Next Steps:	Produce more solid metrics are needed around, for example, the link between extending connectivity and boosting economic growth. Reliable data and best practices on both successes and failures in individual markets. Examine success stories from specific countries (Estonia, Sweden, and Portugal, among others) to understand balancing regulation, funding, and technical infrastructure build-out. Make data available in real time and transparently to anyone, to visualize progress as projects are rolling out. Establish and support digital evangelists. Bring visibility to ICT champions in all EU departments. When any infrastructure is being rolled out, leverage it to include introduction of connectivity/ICT (for example, powerline communications as backbone infrastructure). Trial solutions through smaller projects and testbeds. Create local example contracts, to enable the required rights of way for ICT and other infrastructure improvements (examples include Catalonia and Slovakia). Encourage gender equality in accessing the Internet (potentially leverage EU digital single market directive).

Advancing Solutions in North America

Participants reviewed the experiences in the United States with the National Telecommunications and Information Administration (NTIA) Broadband Technology Opportunities Program (BTOP). Through the American Recovery and Reinvestment Act of 2009 (Recovery Act), NTIA invested $4 billion to expand broadband access and adoption in the United States, primarily through expanding middle-mile connectivity and equipping community anchor institutions for public access, training, etc.

Participants brainstormed recommendations in terms of how BTOP could have been even more successful: For example, there were suggestions that BTOP would have been even more successful if there had been:

- a comprehensive, accurate broadband-connectivity map and gaps assessment that also included data regarding middle-mile and long-haul fiber and microwave networks;
- proactive planning offices for broadband in each state;
- subsidy financing, low-cost debt financing, planning grants, and mitigation for business-case risk;
- programs to spur both residential and business usage;

- a sustainable model led by neutral, independent carriers which do not compete for the retail customer but purely serve as a carrier's carrier, and would reinvest profits in network technology;

- technology-agnostic infrastructure, both wired and wireless; and

- planning for innovation (around the Internet of Things, for example) built into the business plan.

Moving forward, greater understanding is needed around the divergent challenges and possibilities in North America's underserved rural and urban populations. To maximize the return in investment of public funds, focus should be given to ICT's potential usage and value in sectors that cut across multiple initiatives and goals.

Many of the United States' federal and state subsidy programs operate in silos today (e.g., schools, healthcare, and high-cost rural last-mile). While these individual programs help attract private investment, the time required to build across an entire unserved or underserved area will take longer. Thus, leadership is required by state and local governments that have developed holistic strategies and leverage funds across disparate federal and state investment programs. States like Michigan, New York, and California have demonstrated tremendous leadership at developing comprehensive strategies for their underserved regions, and then helping local public and private partners work across the funding silos. They would develop a strategic plan that has the following principles:

- Evaluating gaps across all user bases (e.g., residential, commercial, community institution, public safety, etc.)

- Encompassing many elements of a smart city that require broadband, including applications related to energy efficiency (e.g., smart meters) and public safety (e.g., video cameras)

- Funding open-access middle-mile fiber that incentivized private Internet service providers to develop a targeted last-mile business case

- Spreading business-case risks across the community rather any particular user base (e.g., aggregating demand at the community level to maximize revenue potential)

- Forming a consortium of partners—carriers, technology vendors, non-profits, institution network operators, etc.—to develop sustainable business cases for specific markets

- Raising financing from the variety of commercial, non-profit, and public sources

- Forming a governance strategy that provides oversight and enforces accountability from a multitude of stakeholders

For example, health sectors could look at integrating connectivity when thinking about securing funding. Participants at the North American tables and other regions' tables considered, too, whether a "Connectivity Corps" (modeled after the Peace Corps) could be marshaled to provide technical assistance and create reference designs for individual underserved markets. Also, what leadership training would be required to engender broad public support of local connectivity initiatives, and could more funds be allotted for broadband grants and initiatives that drive demand?

Table leaders/SMEs:	Eileen Healy Gary Bolles Suhas Subramanyam Gary Carter Sandeep Taxali
Issues:	Greater understanding is needed around the divergent challenges and possibilities in North America's underserved rural and urban populations There's still a digital divide based on income, and affordability/financial inclusion remain issues, along with the global digital divide between broadband speed and rates offered in the United States compared to other more developed countries Adoption and digital literacy have contributed to the divide—47% of people without Internet have the infrastructure in place but choose not to use it Speed/cost for many urban markets is far behind South Korea Lack of technical talent advising on projects (particularly government projects), policies, and procurement Lack of metrics and data-driven decision making on connectivity Data analytics is in need of authentic assessment; there is a need for data cleansing to ensure data integrity of the markets in need Need to maximize the return in investment of public funds and increase subsidy funding for projects in urban poor/rural/tribal areas

Current projects:	NTIA BTOP complete Broadband Opportunity Council has brought many federal agencies together to: • Modernize federal programs to expand program support for broadband investments • Empower communities with tools and resources to attract broadband investment and promote meaningful use • Promote increased broadband deployment and competition through expanded access to federal assets • Improve data collection, analysis, and research on broadband President signed Dig Once Executive Order streamlining permitting processes and requiring Dig Once in federal projects Gigabit cities being formed to take certain areas to next level Administration has launched ConnectEd to connect all schools, ConnectHome for certain promised zones, and ConnectAll CEA just released study on connectivity United States Unified Community Anchor Network (US UCAN), led by Internet2 in conjunction with regional networking partners, connects over 90,000 community anchor institutions such as K-20, libraries, museums, and hospitals to the Internet

Possible solutions:	*Technology* • Technology-agnostic wired, wireless, and satellite infrastructure • Reference network designs for connectivity deserts that will speed deployment and create high-speed affordable internet at lower costs • Nonprofit carrier that will administer and own fiber on the ground *Regulatory* • Streamline permitting process • Dig Once, including implementing Executive Order • Reference network designs for connectivity deserts that will speed deployment and create high-speed affordable Internet at lower costs *Policy* • Proactive planning offices for broadband • Connectivity Corps that will go out to regions and advise on best practices and ways to save money and accelerate project timelines • Programs to spur both residential and business usage • Digital literacy broadband grants (NTIA did some a while ago, were very successful) • Digital inclusion broadband grants focused on supporting equal broadband access for low-income urban, rural, and tribal areas (the grants would support demonstration projects incorporating innovative applications of broadband by and for low-income urban, rural, and tribal areas, requiring any participating provider to offer these protected areas broadband speeds and service equivalent to their highest broadband speed and service in high-income metropolitan areas) *Finance* • Continue to support grant-based middle-mile infrastructure programs for those rural regions that still lack middle-mile. • Subsidy financing • Grant or funding for remaining connectivity deserts (perhaps through infrastructure bill) • Always account for and include connectivity when funding is granted for other infrastructure projects (i.e., if building a hospital in a remote area, see if money can be set aside for connectivity in that hospital to make it an Internet hub) • Low-cost debt financing • Planning grants. A planning grant program would provide planning grants to unserved and underserved communities (and regions) seeking to develop a comprehensive economic and technology assessment of options to close the digital divide. The grants would help with facility inventory, gaps analysis, technology options, economic assessment (e.g., cost and revenue projections), and consideration of various public and private investment sources. Planning grants offer a tremendous return on investment. For example, a viable plan may ultimately constitute a competitive threat to the incumbent, which may lead the incumbent to upgrade or expand its existing network. Or, it may lead to requests for proprosals for a public-private partnership model. The ensuing capital investment could be 100 times or greater than the cost of the planning grant. • Mitigation for business-case risk

Next Steps:	Focus on ICT's potential usage and value in cut-across sectors in order spur broadband development and increase deployment in connectivity deserts. Broadband Opportunity Council is already addressing. Leverage community anchor institutions. Broadband Opportunity Council is working on pilots; ConnectEd is using schools as community anchors. Better metrics: CEA just did study. Companies could release more data on connectivity. Digital literacy and PSA campaigns. NEC/NTIA (ConnectAll campaign is focused on this). Dig Once. U.S. executive order is already complete, but Congress needs to pass a bill, as well. Explore deployment of teams of connectivity experts (i.e., Connectivity Corps, modeled after the Peace Corps) to provide technical assistance and create reference designs for individual underserved markets. White House OSTP will lead. Explore leadership training to engender broad public support of local connectivity initiatives. The bitEcology project is a non-profit, leveraged through the Carnegie Mellon Open Learning initiative in conjunction with the IEEE Internet Initiative, to provide this leadership through education and empowerment at anchor institutions. Explore opportunities for more funds to be allotted for broadband grants and initiatives that drive demand. U.S. Government (worth doing a USG-wide policy or convening where connectivity experts work with HUD, HHS, DOT, DOE, etc.) Further discussion. Internet2 is willing to host future discussions this summer. More funding for connectivity and E-Rate funding. Congress, FCC. Also, Connectivity Corps of tech experts to provide further guidance. Host a conference that brings all BTOP grantees together (in early 2017, three years from when their projects closed) to discuss successes, challenges, and overall lessons learned with regard to their impact on broadband access and adoption, as well as their business model.

Getting There From Here

The importance of affordable Internet access to humanity globally is no longer a point of dispute. Consensus has emerged across geographic markets, industry sectors, professional disciplines, and walks of life that universal, affordable Internet access is closely linked with the wellbeing of people around the world. The United States' $40 billion in commitments to Global Connect is one clear sign that there is now high-level political and financial support for implementing bold ideas to bring global universal access. The conversation today has shifted from "Why?" to "How?"

But while governments globally are increasingly aware of their ICT needs, participants at Global Connect Stakeholders: Advancing Solutions noted that there is more work to be done in this area. For example, MDBs need a better understanding of the value that ICT can bring to every

project that they might fund and the low marginal cost of bandwidth in almost all architectures. The Dig Once idea for infrastructure expansion should be core to what banks and government ministers do every day.

Similarly, evidence is clear that it behooves nations to make connectivity *more* affordable, not less. Participants urged that connectivity must no longer be viewed as a "cash cow" and that the taxes levied on it are hindering it use and building an inappropriate association in the local communities. More evidence-based studies and economic analysis are needed to convince ministers to move forward in new directions with connectivity to support progress toward SDGs. Indeed, it is proven that extending affordable connectivity increases job growth or security in a country or region. These arguments around economic security must underpin all discussions about connectivity moving forward.

Common needs across regions that were gathered from the Global Connect Stakeholders: Advancing Solutions discussions include the following:

- **Technical**
  - Connectivity Corps/fellowship (a team of network engineers to coach on reference network designs and best practices)
  - Technical design by strong engineers that can then be funded
  - Public access as an economical and equitable method of reaching the greatest number of new users soonest, by first connecting community institutions (such as libraries, schools, high-density housing, kiosks, telecenters, etc.)
  - Technology solutions (fixed, wireless, or satellite) based on local conditions
  - Policy support for the deployment of connectivity technologies such as IPv6

- **Regulatory/policy**
  - Less tax/regulatory burden on connectivity, ICT investment, and equipment
  - Dig Once policy for infrastructure projects
  - Less-burdensome permitting processes
  - Connectivity integrated across sectors
  - ICT built into every country's strategy for development
  - Broadband, fiber, and other access methods built into funding requests

- **Financing**
  - More money/subsidies/tax incentives for governments to support projects
  - More financing of ICT/connectivity projects from MDBs and the World Bank
  - More data to support that investment in connectivity leads to economic growth and broad benefit to humanity
  - More data generally and a commitment to data-driven outcomes
  - Increased engagement between the financing agencies and the technical community

In addition, the need to have requests and requirements from users will be critical to the success of any initiative. Documenting good practice will provide great learning opportunities for all, but each country's challenges are unique and may require different kinds of engagement. Listening is

the first step to driving toward successful solutions.

IEEE is eager to work with finance ministers, MDBs, NGOs, and industry globally to expand the conversation, prioritize next steps, and further explore the opportunities for extending affordable Internet access to more and more people globally and, along the way, leveraging ICT toward achieving all of the 2030 SDGs. Please visit http://internetinitiative.ieee.org or email internetinitiative@ieee.org for more information.

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Annex: Continuing the Conversation

Editing of this document on the group discussions at Global Connect Stakeholders: Advancing Solutions elicited valuable, new input in the wake of the 13 April 2016 event. These comments are captured here and organized by their contributors, to inform ongoing discussion on extending affordable, universal Internet and working toward the 2030 SDGs.

Manu Bhardwaj

> *Gene Kimmelman, the president of Public Knowledge, stressed the importance of a human rights framing for infrastructure investments related to connectivity, and this was embraced by all participants. This was identified as a priority by USG officials at the stakeholders conference in statements from myself and other USG speakers.*

Johannes Boersma - Omantel, SM, Wholesale Capacity & Submarine Cables:

> *One party clearly stated committing $40 billion is a great first move, but the USG, the World Bank and the national banks, and governments have to be more proactively involved in committing and using these funds. We all need to change the mindset and move from thinking and talking into kick starting some real projects to realize the planned targets and strategic ideas quickly. These parties should actively consider not to spend this money on a lender-based models only but proactively work with grants (non-refundable donations/contributions). An example right now would be to pay for a submarine cable backbone to support the East Coast of Africa, landing in all countries along the route, to be financed by the USG, the World Bank, national banks, and other governments. In this way, the operators of the countries where this backbone lands, as well from the land-locked countries, can focus their efforts and spend their money to expand their national networks to reach to the access gateways of the centrally funded gateway. By decreasing materially the cost of the submarine backbone, as well by demanding cost-based access to this backbone, it will be much easier to grow Internet connectivity and available bandwidth in the region. This in turn will make privately funded submarine cable owners rethink their pricing strategy, and an overall price drop will follow. which will enormously support the growth of available and so-much-needed Internet connectivity. Such financing must only be given by following a framework, whereby the receivers contractually commit to build the backbone networks and to give access to all parties at rates to avoid abuse of these funds. Similar actions can be started to connect land-locked Ethiopia via Somalia (to allow them connectivity to G2A) and Afghanistan via Pakistan (as extension of the SRG-1). In short, decisions need to be made; projects need to be started; and examples need to be set to live and realize the goal to connect the remaining 1.5B people.*

With regard to advancing solutions in Africa, …

> *Provide substantial financial support to build a submarine backbone along the east coast of Africa allowing parties from the region to focus on building national networks to connect to the submarine backbone financed by the USG, World Bank, national banks,*

and other governments.

Implement the backbone network linked to a framework, whereby the submarine cable owners commit to giving access to all customers at cost-based rates.

Actively make use of grants (donations/contributions) to enable projects which support connecting the remaining 1.5 billion people.

With regard to next steps in Africa, …

Change the mindset and move from thinking and talking to start some real projects to realize the planned targets and strategic ideas. Lead: Erikas Napjus.

Analyze potential projects (G2A-1 and 2 Extensions) to connect countries along the East Coast of Africa, as well as to land-locked countries, and actively make decisions using the committed funds to go from thinking to implementing. Lead: Erikas Napjus.

With regard to possible solutions in Asia, …

Fund and build terrestrial backbone networks financed by the USG, World Bank, national banks, and other governments.

Implement the terrestrial backbone networks linked to a framework, whereby those being funded contractually commit to building the backbone network and give access to all customers at cost-based rates.

Although some sanctions are in place, in relation to Iran, the policy for telecommunications should change and all governments, led by the USG, should remove restrictions and allow Iran to use all telecommunications products supporting the connectivity of people living in Iran.

Actively make use of grants (donations/contributions) to enable projects which support connecting the remaining 1.5 billion people.

With regard to next steps in Asia, …

Change the mindset and move from thinking and talking to kick starting some real projects to realize the planned targets and strategic ideas. Lead: Rajendra Singh.

Analyze potential project6s (SRG-1 Extensions) to connect countries along the Silk Road (Afghanistan, China, Pakistan, Turkmenistan, and Tajikistan), as well as other land-locked countries, and actively make decisions using the committed funds to go from thinking to implementing. Lead: Rajendra Singh.

Remove the telecommunications import sanctions hindering growth of connectivity in Iran. Lead: Rajendra Singh.

Vint Cerf:

With regard to the potential use of powerline communications in Asia, …

Actual use of powerlines to carry data has not worked well at least in the United States, where the link to the home passes through a power transformer that tends to interfere with the modulated data signal.

With regard to the European Union's regulatory framework, …

Where might the Digital Single Market concept fit into this program?

With regard to the issue of trust in connectivity in Asia, …

The trust problem extends all the way to applications and the companies/individuals that support or offer them, not just connectivity

Carolyn Flory, DIAL:

With regard to advancing solutions in Africa, …

One potential frame for consideration of connectivity and future access initiatives on the African continent are the Principles for Digital Development[2], which provide best practice guidelines that should be considered before funding, designing, or implementing any technology-supported development work. The Principles[3] are intended to support well-informed decision-making. For example, Principle 2: Understand the existing ecosystem, is critically important in understanding how to increase access with regard to connectivity, considering the political, technical, regulatory environment, and key relationships that include the resources, incentives, and business models that give a holistic view of how to effectively address connectivity constraints.

Anna M. Gomez, attorney at law, Wiley Rein LLP:

With regard to advancing solutions in Africa, …

In the Democratic Republic of Congo, the mobile provider has been able to extend service to over 700 rural sites using satellite technology.

Florence Hudson, Internet2:

There are also best practices that can be leveraged more broadly around the world to increase connectivity for more people. For instance, Internet2 leads the US UCAN (United States Unified Community Anchor Network), working with regional networking

[2] www.digitalprinciples.org
[3] Design with the user; understand the existing ecosystem; design for scale; build for sustainability; be data driven; use open standards, open data, open source, and open innovation; reuse and improve; address privacy and security; and be collaborative

partners across the U.S. to connect over 90,000 community anchor institutions such as K-20, libraries, museums, and hospitals to high-speed networks. Developing a similar "WE CAN" program (World Economic/education Community Anchor Network) leveraging NRENs similar to Internet2, which exist in over 100 countries, could enable connections to local community anchor institutions and then to the local people in villages around the world.

Susan Hyon Parker, Carnegie Mellon Open Learning:

With regard to the issue of digital divide in North America, …

Digital literacy needs to be reassessed as to its core meaning and functionality. What digital literacy means to the corporate tech audience will differ from education and policy makers, as well as the consumer. Adoption of existing infrastructure and/or any emerging infrastructure is heavily dependent on socioeconomic factors, in addition to behavioral economics, in the markets in question.

With regard to the issue in North America of speed/cost being far behind South Korea, ...

Korea is not a competitive telecommunications and consumer technology market. The market dynamics are much different to the United States, and, while it is a long-range goal to achieve a comparable speed/cost model, it isn't an ideal parallel. Further discussion to create a next step can be concluded with Internet2 and Broadband Opportunity Council to gain input.

With regard to advancing solutions in Africa, …

There is much to be done in Africa. There are parallels to training consumers on being digitally connected as with other World Café areas.

With regard to advancing solutions in Asia, …

Further definition is needed regarding the implementation of a successful power grid sharing in ASEAN. Many consumers in Nepal and Bhutan experience multiple power outages daily.

India's unconnected are primarily using non-smart devices and are heavily dependent on voice and SMS only. Rural and poor countries in India are sharing devices to stay connected. Public access to connectivity is sparse in the majority of India, and pay-per use connections are operating on 2G connectivity.

With regard to possible next steps in India, …

The bitEcology project is willing to offer IoT- and mobile-focused training via the Carnegie Mellon Dubai campus, which has the most graduates in India and can assist with offering native Indian English speakers to deliver in English. Identification of

cybersecurity lead can be identified through the IEEE Experts in Technology and Policy (ETAP) Forum on Internet Governance, Cybersecurity, and Privacy.

The approach of faith-based community centers to address extending access to women and children should be reevaluated. Education of women and children is a part of the SDGs and not tackling gender disparity issues of the same by not allowing libraries and education institutions to provide a higher level of service. Religion is not a part of the SDGs.

Tom Koutsky, chief policy counsel, Connected Nation, Inc.:

With regard to possible next steps in Africa, …

I am willing to help out on the regulatory component.

Peter Micek, global policy and legal counsel, Access Now:

Rather than an afterthought, respect for human rights must be baked into new ICT systems and infrastructure policies from the start. Investments in Internet connectivity must not contribute to the creation of closed, monitored, and discriminatory networks but rather retain a core understanding that the Internet is a global resource and should be managed in the public interest as a democratic, secure, free, open, inclusive, and pluralistic communication platform. To ensure long-term protection of rights online, net-neutrality policies should be guaranteed wherever Internet infrastructure is being built out. With input from civil-society stakeholders, the private and public sectors should uphold end-to-end access to the open Internet, non-discriminatory traffic delivery, and innovation without gatekeepers or permission required. The 13 "Necessary & Proportionate" Principles, which apply human rights to communications surveillance, and data protection frameworks should also be adopted and implemented to enhance user trust in the Internet economy.

The Best Bits coalition of civil-society organizations from across the world delivered a Letter to Ministers of Finance on Global Connect Initiative during the launch events. The coalition emphasized that the digital divide "prevents the exercise of fundamental human rights for all," and "also reveals an untapped development opportunity."

Best Bits urged finance ministers "to guarantee that internet connectivity becomes an integral part of national development policies moving forward." From the letter: "Internet connectivity consistent with human rights principles should be an essential element in every grant, loan, technology transfer, or policy training program that MDBs facilitate. Stable, secure, and open access to broadband internet is also crucial for the implementation and achievement of the United Nations (UN) Sustainable Development Goals (SDGs) to which all UN member countries committed to in late 2015. Recent data clearly demonstrate how all of the 17 SDGs heavily rely on ICTs to be successfully implemented. Supporting international development negotiations and commitments have

recognized the same crucial role of ICTs. Those include the WSIS+10 outcomes that aim to foster more inclusive and development-oriented knowledge societies, recognizing the centrality of human rights to that goal, and the ITU's Connect 2020 Agenda for Global Telecommunication/ICT Development that promotes a vision where ICTs enable and accelerate socially, economically, and environmentally sustainable growth and development for everyone. We believe that such commitments are fully in line with our view and advocacy for the transformative power of high-speed networks to advance human development and human rights."

Sayed Khodadad Mousavi, board member, Afghanistan Telecom Regulatory Authority (ATRA):

With regard to issues in Asia, …

Lack of reliable electricity, mainly in rural areas of Afghanistan; as per the recent law, private companies can enter in power supply chain, so more competitive power providers need to enter the marketplace.

Major digital divide based on income in Afghanistan.

Financial inclusion in Afghanistan has been an open issue for last decade.

Gender equality in Internet access is a challenge in Afghanistan.

With regard to current projects in Asia, …

Digital Afghanistan or Smart Nation initiative with World Bank is in the initial phase, which focused mainly on connectivity, enabling environment and e-government initiatives.

World Bank is studying impact of 10-percent tax imposed recently on customers in Afghanistan (the outcome of this study might help regulators and policy makers facing similar decisions in other part of the world).

With regard to possible solutions in Asia, …

In Afghanistan, a wide range of potential solutions to be considered, such as satellites, fiber optics deployment and last-mile connectivity through TV white spaces due to terrain.

Making the Internet more affordable is key in Afghanistan.

With regard to next steps in Asia, …

Suggest World Bank, USAID, and others consider ICT as a high-priority sector for giving funds, as ICT has direct impact on reducing corruption, extending more access to information, boosting transparency, and encouraging good governance.

Anna Slomovic:

With regard to Europe's unique structure, …

Should something be said explicitly about EU vs. non-EU countries?

With regard to success stories in Estonia, Sweden, and Portugal, …

These are all EU member states. Can they serve as examples for non-EU countries? If so, how?

Tim Stelzig, federal regulatory attorney, GCI:

With regard to advancing solutions in North America, …

Participants also recognized other public-private partnerships have succeeded in expanding broadband deployment and adoption, including federal universal service programs such as the Federal Communications Commission's (FCC's) High Cost, Schools and Libraries, Rural Health Care, and Lifeline programs. Public-private partnerships should be awarded only after an open, transparent, and competitively neutral process with sensible eligibility criteria to ensure participation by experienced participants that have "skin in the game." NTIA's BTOP program and the FCC's universal service programs are both good examples in this regard.

With regard to potential policy solutions in North America, …

Additional economic development/anchor tenants in rural areas would help the business case.

Sandeep Taxali, Senior Policy Analyst and Broadband Development Specialist, National Telecommunications and Information Administration, U.S. Department of Commerce:

The barriers to widespread use of the Internet, across rural and other underserved markets, involve both access (supply) and adoption (demand) challenges. Both challenges should be addressed holistically to break the digital divide.

The Access Challenge
Limited broadband access in rural markets often stems from the lack of a sustainable business case. The economic challenge starts with low population densities, which requires the heavy upfront capital investment be spread over a potentially lower subscriber base. Moreover, rural markets often have lower Internet subscription rates, due to lower levels of education and income. In addition, these markets may lack large enterprise and government customer accounts, which could serve as anchor revenue clients. The business case for last mile is further undermined by the lack of middle-mile and long-haul connectivity, which requires a larger capital investment given the larger

geographic spans to reach peering points or a major carrier hotel. Satellites have historically addressed this void with their own backhaul services but have offered limited capacity and lower bandwidth—and at significantly higher rates on a cost per MB basis. A new generation of Ka-Band satellites offers promise, however.

In sum, the high investment cost per subscriber coupled with lower adoption rates make it difficult to attract private sector investment and launch a viable business case. In such cases, a myriad of levers are required to lower the capital investment and increase adoption rates.

Policy Solutions
Policy and regulatory reform measures can help lower the upfront costs. For example, streamlining the permitting process for access to rights of ways and other requirements (e.g., environmental review, etc.), or easing the process to obtain pole attachments rights, can lower the administrative costs and time to launch a network. Dig Once policies can further lower the capital investment. Nevertheless, the rural business case often necessitates a capital subsidy or grant to attract private capital. In other cases, a long-term revenue commitment from a series of public and private anchor clients (when available) may lower the business risk just enough to move forward. Other government assistance may include investment tax credits, low interest loans, and contribution of in-kind resources.

Private Financing Solutions
The private investment community has shown increasing willingness to fund broadband in economically challenged markets. A number of innovative financing vehicles consider a long-term payback horizon and have a lower ROI threshold. However, they are dependent upon the government and other partners to reduce the business case risk through the aforementioned approaches and the support of public-private partnerships.

Public Private Partnerships (Applicable to All Geographic Areas)
A variety of public-private partnerships (PPPs) can attract diverse sources of capital, lower the financial and implementation risks, and maximize the revenue potential. These PPPs include members across the financial, technology, government, academia, and non-profit sectors. The World Bank and many nations have supported, both financially and operationally, a number of PP's. Other ways to promote PPPs include:

- *Formal Training Programs and Online Courses: Propose a formal training program around broadband-based PPPs. Currently, many senior government leaders have to rely on external experts. This approach may work for the short term. However, national and local in-house expertise is instrumental to converting vision into action, strategy into implementation, commitments into accountability, and short-term wins into long-term, sustainable business models. Conferences and webinars are helpful but often do not dive deeply into the subjects surrounding technology developments, financing sources, business models, PPP structure, regulatory analysis, smart cities, etc. SMEs from the World Bank, U.S. federal agencies (e.g., NTIA and FCC), and others can serve*

both as instructors and participants. Such programs could yield certifications. Many of these courses can be published online. The fees should be cost-based, and potential subsidies from government and non-profits should make these affordable. Ideally, the course volume over time would reflect the breadth of general PPP courses offered by the Institute for Public-Private Partnerships (IP3).

- *http://www.ip3.org/ip3_site/index.php/courses/online-courses*

- *ICT Inclusion Incentives: Any public-private partnership around other infrastructure projects (e.g., roads, bridges, trains, buildings, etc.) should include incentives for installing broadband facilities to support wireline and/or wireless facilities. These incentives could include monetary assistance for such program as: a) Dig Once; b) installing fiber and neutral hosted DAS-base station across railroad tracks for rail construction or repair projects; c) obtaining land for future cellular microwave towers and monopoles during building/land projects; d) requiring open access fiber to be installed, and then owned and managed by government or a non-profit, for any publicly financed fiber construction projects.*

- *BTOP Program: This NTIA initiative involved funding over 110 middle-mile networks (the bridge between the access and regional/national backbones). These open-access networks, funding through a variety of PPP arrangements, have served as a catalyst for last-mile wireline and wireless networks. A national middle-mile investment program that integrates funding from the federal government, local/state governments, telecom commercial operators, and community organizations (e.g., higher education, healthcare, etc.) has proven to be an instrumental way for aggregating funding from a variety of sources and building tens of thousands of high-capacity network miles within three years. NTIA looks forward to working with IEEE, the World Bank, State Department, and other partners to share the lessons of this program.*

Adoption
Adoption is often limited due to affordability, but also barriers involving relevance and digital literacy. Affordability pertains to both the subscription rates and devices. Price elasticity studies indicate that broadband adoption, and the specific tier of service purchased, is highly elastic to price for fixed broadband service. While prices for mobile devices and access have decreased due to trends in competition, scale, and innovation, these economics have not applied to fixed broadband solutions. Technology convergence, along with innovations across wireline and wireless technologies, will help deliver some favorable price economics. Government assistance programs can also help.

- *Special Pricing for Vulnerable Populations: Investment-based subsidy programs should also consider downstream impacts, and require discounted pricing for vulnerable populations. Moreover, PPPs for infrastructure deployment should require holistic programs to promote digital training, awareness, and discount pricing programs.*

- *Public Awareness: Allocate resources for implementation of nationwide public awareness campaign that highlights that digital literacy as a critical 21st century skill necessary for the economic wellbeing of the individual, family, community, state, and overall nation.*

- *Launch Similar Program to U.S. Based "Future Ready Schools": Replicate or employ best practices from the U.S. federal program called "Future Ready Schools" which involves helping schools administrators and teachers make the digital learning transition. By signing the pledge, training is provided around the integration of online learning, with a focus on administrative planning, curriculum development, online-based instruction, student assessment, reporting, etc. Program is managed by the U.S. Department of Education. Employ best practices from International Society for Technology in Education (ISTE).*

General Recommendation Regarding Implementation
I have a long tenure in developing corporate and public sector strategy and implementation plans. For each geographic section, I would highlight 3-5 overarching strategies. Then, for each strategy, I would develop a number of initiatives. Each initiative would define the series of work streams, propose measurable goals, have a handful of milestones and dates, clear owners, and lists key dependencies and risks. A master project plan would be developed for each initiative and set of work streams. A program management office (PMO) should be created. Project owners would be required to provide monthly updates to the PMO for each work stream element. The PMO would issue quarterly progress reports. Such a structured process will foster ownership, accountability, transparency, and efficiency (given the number of parallel efforts).

I would also look at the myriad of proposed initiatives and determine which ones are best equipped for the GCI working group, versus the many other noble, respected agencies like the World Bank, IFC, etc. A framework to apply involves: a) initiatives not being addressed by other agencies; b) fits within the mission, scope, and overall strengths of GCI; c) involves resources (time, money, personnel) that are available to the GCI working team; d) and involve a number of short-term projects where "wins" can create momentum and prove the concept of this working team.

Based on my NTIA work in providing technical assistance to communities, there is plenty of good information, knowledge, best practices, case studies, workshops, etc. The gap involves applying this information to the unique problems and opportunities of a specific country or region. The communities really need SMEs who have strong experience in applying all that knowledge to develop customized business plans and policies for any specific client. Some of this work can be scaled, but much of it requires new effort each time. The World Bank has been very adept and successful at providing technical assistance. I think the GCI working group can complement the World Bank works, especially through having a team that includes SMEs from federal government, industry, academia, and non-profits.

- *Sabbatical Program: One potential opportunity involves a sabbatical program, where SMEs (across government, industry, academia) are placed with the World Bank, or other institutional bodies in developing nations, for three-to-12-month rotation programs to help plan and deploy a broadband program. Such a program would not only match highly skilled, experience-rich resources to needs but also foster knowledge sharing and develop global relationships. The owner of the resource would fund the transfer and could be justified as professional and knowledge development.*

With regard to common themes globally, …

Worldwide, rural areas account for approximately half of the population. In developed countries, nearly one-quarter—22 percent—of the population resides in rural areas. In developing countries, that figure more than doubles, to 54 percent. Some of the 4 billion rural consumers are not yet online, while others are online but now require faster, higher-quality networks to access new services.[4]

With regard to next steps in Africa, …

Develop plan to deploy (or extend) fiber-based research and education networks all across major universities and colleges across the continent, which are then interconnected to R&E center across North America, Europe, Asia, etc. This network will include extra fiber strands and conduit, which can be leased to private Internet service providers.

For a handful of African nations with high unserved population rates, consider developing a detailed cost model for the various technology configurations across a range of broadband thresholds (e.g., 10 Mbps, 50 Mbps, 100 Mbps, 1 Gig).

- *Core: Fiber, microwave, satellite, hybrid*
- *Middle mile: Fiber, microwave*
- *Access: Fiber, mobile wireless, fixed wireless*

4 *https://www.bcgperspectives.com/content/articles/telecommunications_digital_economy_connecting_rural_markets_fixed_wireless_unlocking_digital_everywhere/?chapter=2*

This analysis will help better frame the potential solutions – across technology, financing, PPP model, etc.

With regard to next steps in North America, …

Please note that NTIA's BroadbandUSA program already provides technical assistance to communities and their key stakeholders regarding strategies to expand broadband access and adoption. Technical assistance involves policy planning, formation of public-private partnerships, review of technical and economic feasibility studies, business-case development, and sharing of best practices through the lens of the BTOP program and other state/local/international deployments.

With regard to common needs across regions, …

This Connectivity Corps should also include SMEs in other areas beyond network design/engineering, including financial modeling, business-plan development, PPP strategies, implementation. reference designs, and best practices, for all of these are relevant.