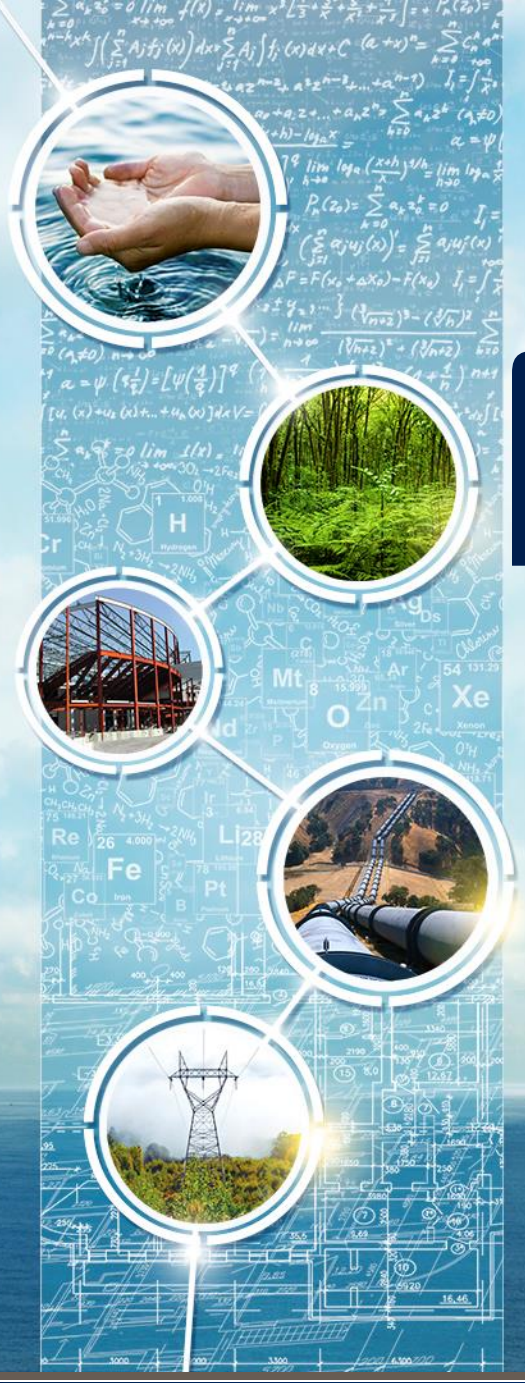

The Top 10 Issues Facing the Telecom Sector

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Agenda

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- Convergence
- Regulatory Frameworks
- Interconnection
- Licensing
- Spectrum Sharing
- Digital Dividend in Spectrum
- Open Access
- Universal Access
- Trust
- Privacy
- Cybercrime/Cyber Security
- Internet of Things

Convergence: Definition

- Convergence is the coming together of two different entities, and in the contexts of computing and technology, is the integration of two or more different technologies in a single device or system.
  - It can also be defined as the ability of one or different networks to carry different services. Or the bringing together of industries in the communications area, which were previously viewed as separate and distinct in both the commercial and the technological sense.
  - The simple concept of convergence allows multiple tasks to be performed on a single device, which effectively conserves space and power
    - Examples are the provision of Internet access and TV to smart phones, carrying separate devices – like a cell phone, camera, TV and digital organizer, or the triple or quad play services offered by ISPs or Cable TV Operators.

Convergence Benefits

- Convergence creates possibilities for companies to develop and deliver services across technology platforms, increases economic growth, and allows for users to gain access to new kinds of communication and media services
  - Many different applications allow people to create multiple effects using simply their phone as the camera instead of carrying a separate device. There are even full length movies that have been created using only cell phones instead of a video camera
- Convergence promotes the expansion of competition, allowing the introduction of inter-modal competition where networks and technologies compete with each other with no technological or regulatory restrictions;
  - Mobile money is another kind of convergence. It allows your phone to be a bank account

Convergence: Benefits (continued)

- Technology convergence provides the possibility for new competitors to enter the markets.
  - Telephony can be offered by cable TV operators, TV to telephony providers. Amazon and Netflix have become the largest TV providers.
    - Their shows are not weekly but the entire season is released at one time allowing consumers to watch as they would like.
  - Time shifting allows programs to be saved and then watched whenever and wherever the consumer wants.
- Other benefits of Convergence are that it reduces costs of telecommunications services;
  - Fosters the development of more efficient technologies and services;
  - Opens the door for new ways for people to obtain Internet access

Regulatory Frameworks

- There are three approaches taken by countries to address convergence:
  - a legislative approach;
  - a regulatory approach; and
  - a self-regulation approach.
- Although the first two are most commonly used among policy-makers, the self-regulation approach is gaining increasing popularity.

Legislative Approach

- The legislative approach develops legislation that responds to convergence.
  - Legislative solutions define new laws or create new regulatory frameworks to respond to convergence and guide future policy direction, either by developing and implementing a reform of the legal framework or by amendments to existing laws.
  - An advantage of the legislative approach is that it allows for the introduction of a new framework to deal with convergence, without the constraints imposed by other regulations or by the existing telecom, broadcasting, financial, or ICT law that may contain categories where converged services do not fit.
    - A new law or an amendment of an existing law can eliminate contradictions and inconsistencies in regulatory classifications.

Regulatory Approach

- Under this approach, countries do not develop new legislation rather they modify existing regulations to address new technologies.
- This approach can be a practical way of addressing convergence provided that existing regulations can be modified or new ones introduced relatively quickly.
  - This approach must be carefully managed to minimize inconsistencies between new and existing rules as such it is often used by policymakers to complement a legislative approach.
  - This complementary mix allows governments to establish new legal frameworks while dealing with its specific effects through regulation. However, for this combined approach to work the legislation must be sufficiently flexible to allow periodic regulatory adjustments

Self Regulation

- The self-regulation process consists of developing and designing convergence policy through an ad hoc or existing consultative body or through a multi-stakeholder advisory group consisting of stakeholders from all sectors
  - The role and functions of these consultative bodies varies, but they generally issue recommendations to the government addressing the need for changes in convergence legislation and/or regulation.
  - The outcome is often self-regulation or industry guidelines.
  - These consultative bodies often address specific issues of convergence or undertake a more comprehensive analysis assessing the consequences of the legislative and regulatory environment
  - The self-regulation process has certain potential problems, e.g., the intervention of industry representatives may pose a risk in those jurisdictions where competition has not developed since the consultative body may be dominated by these operators and its conclusions could reflect narrow interests.

Regulatory Frameworks: Design

- In selecting the appropriate institutional structure, countries have various design options available, including economy-wide, infrastructure-wide, industry-wide, communication-wide or purely sector-focused institutions.
  - The choice depends in part on the extent the chosen sector, e.g., ICT, energy, water, transport, is similar to (or different from) other sectors of the economy in a particular country
  - It also depends on the availability of suitably qualified staff and on the state of reform and infrastructure development of each utility sector.
- Determining the ideal organizational structure for a regulatory authority requires an assessment of various factors including: the country's needs and objectives; political environment; legal requirements; and available expertise in the labor market

Institutional Design

- Single-sector regulatory bodies are one whose sole function is to oversee one particular sector e.g., telecom, water, and electricity.
- “Converged” regulator combines Broadcasting, Telecom, and Cable into one authority
- Multi-sector regulatory authority (MSRA), normally encompass various industry or economic sectors that are considered public infrastructure services, e.g., telecommunications, water, energy, and transportation.
- The fourth format is not a regulatory authority, but an approach where general competition policy is used to oversee and govern the specific utility sector.

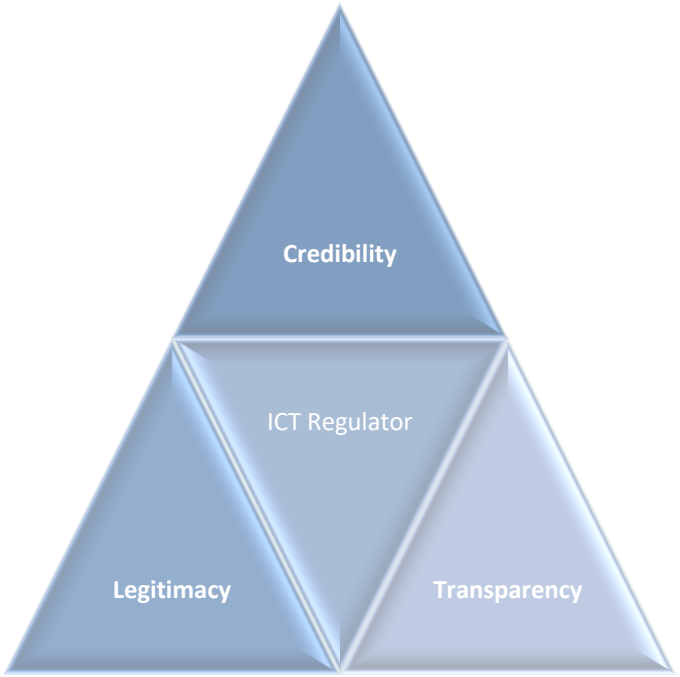
Institutional Design (continued)

- Countries with converged regulators include Australia, Finland, Iraq, Italy, Japan, Kenya, Mali, Malaysia, South Africa, Singapore, Uganda, United States and United Kingdom
- Despite this trend, most OECD countries still have separate regulators for broadcasting and for telecommunications content regulation is typically addressed by a separate ministry or government authority (e.g., in India and Saudi Arabia) or by the broadcasting authority (e.g., in Botswana, Chile and Colombia).

Regulatory Success

- The choice of institutional design does not guarantee success of the regulator. Success will come only if based on the following principles
  - Regulators must be perceived by industry to be independent
  - Regulators should have the expertise to assess and make sound judgments on both technical and industry-specific issues
  - The regulator must take into account various viewpoints and interests, including economic, social and political objectives.
  - The institutional design, internal structure, and administration must be flexible enough to allow the regulator to adapt to market realities.
- The following chart best illustrates this:

Regulatory Success



- **Credibility**: Investors must have confidence that the regulatory system will honor its commitments.
- **Legitimacy**: Stakeholders must be convinced that the regulatory system will protect them from the abuses of significant market power, whether through high prices, poor service, or both.
- **Transparency**: The regulatory system must operate transparently so that investors, industry stakeholders, and consumers know the "rules of the game."

Regulatory Independence

- Effective regulation also requires that the Regulator adopt and implement procedures that are transparent and open to public participation and ensure accountability.
- Independence depends on:
  - Robust and transparent governmental and legal institutions
  - The number and quality of the regulatory staff.
  - The administrative structure of the regulator, including staffing processes,
    - The legal status of the staff,
    - Remuneration principles
    - The ability to hire outside consultants provide key insights into the independence, depth of knowledge, and impartiality of the regulator, as well as its ability to attract and retain qualified personnel.

Stakeholder Consultations

- Consultations are an essential part of the decision-making process as they reinforce regulatory autonomy and accountability.
- Consultations can make the regulator more accountable without comprising its independence
  - Not only do consultations enhance the confidence the industry and the wholesale providers have in the regulator, but they also increase consensus and support for regulatory decisions, and provide a mechanism for input and feedback to the regulator from the stakeholders
  - It is critical that the Agency be willing to debate and answer questions openly and publicly.
- If the Regulator is seen as being weak or ineffective industry, consumers, and other stakeholders, will not trust him.
  - If these stakeholders lose trust in the Office of the Regulator or in the Regulator him/herself, foreign investors will pick up on this and be hesitant to invest in the country because of this uncertainty and trust in the market and in the Regulator's ability to ensure a level playing field.

Accountability & Transparency

- Ensure that regulators and others involved in the regulatory process are held accountable for their actions
  - Improving the transparency of a regulator can make it more accountable without comprising its independence.
  - Increasing a regulator's accountability by providing for more formal and informal consultations will also improve the transparency of the regulator and can show the competitive carriers that the regulator has not fallen prey to regulatory capture.
- Mechanisms for ensuring accountability and transparency include:
  - Allowing stakeholders to appeal agency decisions to the courts,
  - Providing a detailed specification of the tasks to be performed by the regulator
  - Providing for clear rules and deadlines, transparency of the regulatory decisions An open regulatory process along with existence of feedback procedures
  - The supervision of regulator actions by auditors and watchdogs
  - Mechanisms of removal when moral incapacity or misconduct is proved
  - Scrutiny of budget, and commissioners or directors serving fixed term

Enforcement

- Rules governing behavior of the Operators and other Stakeholders should be fully, fairly, and vigorously enforced so as to tolerate no breaches.
- Regulators must be able to impose appropriate sanctions, take enforcement actions, if regulatory decisions, license conditions, laws and/or regulations are violated.
- The central purpose of regulation is to protect consumers, including future consumers, and look after interests in the short and long terms.

Next Generation Networks

- Next Generation Network is a broad term that describes key architectural evolutions in core and access IP based networks.
  - It refers to the future networks that support fixed, mobile and nomadic users and able to carry voice, data and multimedia services.
  - It is based on IPV6 and MPLS technologies and protocols.
- The Telecom network is evolving toward a future in which IP-based networks replace circuit-switched networks, both for fixed and mobile (3G, 4G, and 5G) services.
  - Legacy interconnection regulations will not disappear– indeed, the complex interconnection environment calls for greater oversight.
- Convergence has forced a reassessment of Interconnection policies
  - Effective interconnection arrangements are crucial in fostering the development of integrated ICT markets
- IP networks will coexist with older legacy networks, including 3G mobile and PSTN networks.

Interconnection

- While “interconnection” and “access” are related they are distinct.
  - Interconnection is a bridge between different networks to enable customers of each network to communicate with each other.
  - Access enables an operator to use the facilities and / or services of another operator
- Regulators also need to consider quality standards for interconnection.
  - Is the quality of service provided by an incumbent to an interconnecting entrant the same as to its own retail customers?
  - Is the overall level of quality consistent with that of increasing competition; would some customers sacrifice quality for lower prices, sparking a “race to the bottom” for quality?

Interconnection in an IP World

- Traditional interconnection regulation was established for telecom operators with interconnection rates generally based on time (*i.e.,* per minute).
- Services based on IP protocol, however, do not fit within the traditional schemes of switched voice interconnection, e.g., IP interconnection separate out transport from service, while legacy networks combine them.
- Interconnection between PSTN networks is relatively simple and well established, and does not raise interoperability issues, but IP Interconnection requires different kinds of access and different kinds of charges.
- Countries are addressing these needs by introducing: (i) both symmetrical & asymmetrical interconnection, (ii) new kinds of "access" through interconnection regulation and (iii) a technology-neutral interconnection charging system based on capacity, instead of time and distance

International Gateways

- An International Gateway is defined as any facility through which international telecommunications traffic is sent and received.
  - IGWs are potential bottlenecks in any nation's telecom market as they often restrict international traffic flows and maintain artificially high prices.
- A nation's ability to fully participate in the global Information Society may be impeded due to the high costs of Internet access or international communications.
- By liberalizing the IGWs and allowing large number of operators, including those who operate domestic networks, to operate international gateways, incentives for illegal behavior, i.e., bypass, will disappear as the termination rate drops significantly.
- International calls will flow through legal channels, yielding taxes to the government and drying up the corrosive flow of black money.

Pricing

- It is important to be clear about what is meant by "prices".
  - A price for a given telecommunications service is more than just the charges for that service it consists of a description of the service, the terms and conditions of service provision and the applicable charges
- Prices are based on underlying cost using an acceptable methodology, LRIC, FDC
- Prices are non-discriminatory
- Prices are transparent

Cost Models

- What is a cost model?
  - A methodology for estimating a provider's cost of offering a service (or facility)
  - Motivated by widely-accepted premise that service tariffs/prices should be cost-orientated
    - Prices should relate to underlying costs
  - Measures the direct and indirect costs of providing interconnection
- Captures the volume sensitive & fixed costs that are directly identified with interconnection + a share of common overhead cost
  - Involve determination of many input variables
  - Typically implemented in spreadsheet program or similar software

Types of Cost Models

- Fully Distributed Costs
  - Allocating all costs of the firm to the services provided
- Incremental Costs
  - Changes in firm's cost due to change in output of one service, holding other output constant
  - Must account for fixed ("overhead") costs
- "Long Run" adds notion of efficient costs, rather than embedded costs. These are the Costs associated with a provider employing efficient technology & operations

Licensing

- Traditionally, the number of licensed voice telephony or broadcasting operators has been limited.
- Previously, authorization and licensing of service providers was based on the type of service (voice, data, and video) or technology (cellular, fixed telephony, terrestrial broadcasting).
- However, in a converged setting, it is difficult to maintain these boundaries because of overlaps, broadcasters are offering telecom services (Internet, voice), while telecom service providers (e.g. phone companies) are offering broadcasting services (IPTV).
- Further, cellular operators are providing mobile television services
- Other providers are offering shows only available on the Internet.

Licensing (continued)

- Many regulators and policymakers have already modified their licensing regimes from the traditional one-service or technology license to a technology neutral, simplified set of licensing categories, and in some cases, a unified (single) license or market entry procedure for all technologies and services.
- Many countries are combining this simplification with the introduction of flexible licenses that use a technology and service neutral approach to determine the rights and obligations granted by the licenses.
- These update the obligations for Interconnection, numbering, universal service and consumer protection rules to the new environment of convergence
- Along with a new licensing structure, it is also necessary to simplify market entry procedures as well as to simplify the administrative requirements for all telecom operators.
- This involves modifying general authorization to allow more services to be provided

Classes of Licenses

- There are five classes of licenses
  - Individual
  - Class
  - Registrations
  - Notifications
  - Open Entry
- Additionally there are several other types of licenses
  - Social Purpose
  - Experimental

Classes Of Licenses

- Individual Licenses are the most complex
  - Require the regulator to consider each license individually and conduct a competitive selection process or auction
- Class Licenses are less complex
  - Require only an approval process for a broad category of service.
  - Issued without competitive bidding and are available to all qualified applicants who meet certain eligibility criteria established by the Regulator
  - Set out the basic rights and obligations and regulatory provisions to the particular class of service being offered.
  - Allow for Service obligations to be applied to class licenses for extra comfort and protection of the Government

Classes of Licenses (continued)

- In recent years there has been a trend away from granting individual licenses to granting Class Licenses that authorize the provision of telecom services of the same type, regardless of who provides these services.
  - This is due to increased competition, increased flexibility in the type of licenses issued, the proliferation of service providers, and the convergence of the ICT sector and new innovative services and technologies coupled with telecom reform and deregulation.
- Registration requires the operator to formally register with the regulator before operation of the service, but do not require approval.
- Notification requires the operator simply to notify the regulator of the service, but no regulatory approval is necessary.
- Lastly, open entry is the most flexible and requires neither notification nor registration.

Unified Authorizations

- Unified Authorizations
  - Technology and service neutral
  - Allow licensees to provide all forms of services under the umbrella of a single authorization, using any type of communications infrastructure & technology capable of delivering the desired service.
  - In most countries, unified authorizations are issued as individual licenses.
  - However, in some countries, the process for issuing the unified authorization blends aspects of general authorization processes and competitive licensing regimes.

Multi-service authorizations

- Multi-service authorizations
  - Allow service providers to offer multiple services under the umbrella of a single authorization, using any type of communications infrastructure & technology capable of delivering the services in question
  - Technology neutral -- like unified authorizations
  - More limited than unified authorizations -- licensees are permitted to provide any of a designated set of services, but not all services
  - Issued as general authorizations or as individual licenses.
  - Not uncommon to have both general authorization & individual license regimes for multi-service authorizations

Social Purpose Licensing

- One example of innovative licensing is a “social purpose” license. This is a license granted in rural unserved or underserved areas to non-traditional network operators, such as community network operators.
- By setting aside spectrum for non-traditional operators, regulators can remove the competitive barriers to spectrum access and prioritize spectrum for social-use purposes.
- Social purpose licensing has proven to be tremendously successful in launching community networks.
- Mexico is at the forefront of innovative, social purpose licensing.
  - In 2015, the Mexican communications regulator, Instituto Federal de Telecomunicaciones (IFT), amended its frequency plan to set aside 2 x 5 megahertz of spectrum in the 800 MHz band for “social” use.
  - To qualify for a social-use license, applicants must demonstrate that the spectrum would be used to service communities of 2,500 people or less, or communities located in a designated indigenous region or priority zone.

Experimental Licenses

- Experimental licenses are another way to provide communities direct access to spectrum.
- Experimental licenses authorize the licensee to test and develop new technologies and services, while protecting incumbent services against harmful interference.
- India has also issued experimental licenses for community network projects.
  - In 2016, for example, the Indian government issued eight experimental licenses in the 470-582 MHz band to carry out experiments of Television White Space-type rules and regulations
- Experimental licenses are generally temporary. Many community networks find that experimental licenses help them establish their operations, but they also run the risk of the experimental license taking considerable time to be transformed into a more permanent license

Licensing

- As with licensing regimes, new advanced technologies and converged services that use spectrum are demanding more flexible and service/technology neutral frameworks
- Need to keep in mind that spectrum management is about addressing the problems of potential interference between different licensed users, which is why regulators have created different classes of licenses.
- Consideration should also be given to whether there should be flexibility in spectrum allocation to take full advantage of new services and new technologies for existing services that may evolve with time.
  - A technology- or service-neutral approach to spectrum use might be another good option to consider.

Spectrum Policy

- To expand Connectivity, Regulators need to do certain key things:
  - Ensure that spectrum remains open, transparent, fairly allocated and that the licensing mechanism is technology and service neutral.
  - Ensure that there is a harmonization of spectrum to global standards
- Regulators should also create a flexible spectrum policy that allows for innovative usage through unlicensed spectrum and also allows easy ways for people to reuse spectrum that is not being used within rules that avoid harmful interference.
- Making more spectrum available:
  - Spectrum is the lifeblood of wireless Internet access.
  - Spectrum solutions that take advantage of innovative approaches can advance connectivity and help countries roll out broadband to more people in the country

Spectrum Innovation: Increasing Access To Broadband

- Other ways to expand connectivity within the country are:
  - Encouraging the development of license exempt technologies, for example, White spaces, Delay Tolerant Networking, Mesh networks, CubeSats, WiFi, WiMAX and other wireless technologies.
  - Reviewing spectrum use policies that are related to license free spectrum especially for rural applications to facilitate the deployment of technologies that use these frequencies for universal access or other projects.
  - Increasing and encouraging the deployment of and experimentation with local access networks using new wireless and wireline technologies, such as, but not limited to, White Spaces, Mesh Networks, WiFi, WiMAX, SCPC DAMA and PLC
  - Facilitating the use of unlicensed spectrum to reach rural and remote areas and also for deploying applications
  - Creating specific national local access licenses for remote and rural applications to advance connectivity for the un connected, using USF fees

Spectrum Sharing

- Spectrum sharing encompasses several techniques – some administrative, technical and market-based.
- Spectrum can be shared in several dimensions; time, space and geography.
- Spectrum sharing typically involves more than one user sharing the same band of spectrum for different applications or using different technologies.
  - When a band already licensed to an operator is shared with others it is known as *overlay spectrum sharing*. For example a spectrum band used for TV distribution in one geographical area could be used for an application such as broadband wireless access in another area without any risk of interference, despite being allocated on a national basis
- Spectrum sharing can be achieved through technical means and through licensing arrangements.

Spectrum Sharing (Continued)

- Cost is one factor to consider in determining whether it makes sense to share spectrum, this include the costs of regulation and transaction costs.
  - Whether spectrum sharing will deliver on the promise of developing innovative broadband applications for developing country users', positively impacting accessibility and affordability of ICT services?
- Spectrum sharing is required when sufficient demand for spectrum exists, causing congestion among users requiring intervention to avoid interference problems.
  - It is used when adjusting spectrum use and assignment have become burdensome and costly undermining the goals of economic and technical efficiency.
  - Interference cannot be eliminated and so identifying management models supporting spectrum sharing under administrative, market-based and spectrum commons remain as an ongoing requirement and challenge for managers

Unlicensed Spectrum

- A spectrum commons is a part of the spectrum that is free from centralized control where anyone can transmit without a license.
- For this reason it is sometimes referred to as unlicensed spectrum.
- There are varying approaches by regulators for managing the unlicensed but regulated spectrum commons ranging from imposing license and permits constraints to few if any constraints at all beyond technical specifications.
- In some countries, a more liberalized approach towards spectrum management has evolved resulting in considerable innovative approaches in the use of Wi-Fi, WiMax, Ultra-wideband (UWB), White Spaces bands.

White Spaces

- In telecommunications, white spaces refer to frequencies allocated to a broadcasting service but not used locally
- A white-spaces device" (WSD) is a device intended to use these available channels.
  - WSD are designed to detect the presence of existing but unused areas of airwaves, such as those reserved for analog television, and use these airwaves to send signals for Internet connectivity.
- On November 4, 2008, the FCC voted 5-0 to approve the unlicensed use of white space
- Singapore's Regulator is the second regulator in the world to have TV White Space regulated, ahead of UK and Canada.
  - The Singapore efforts were driven mainly by the Singapore White Spaces Pilot Group (SWSPG). The Institute for Infocomm Research subsequently spun off Whizpace to commercialize TV White Space radio using strong IPs that were developed in the institute since 2006.

White Spaces (Continued)

- Both Microsoft and Google have been using White Spaces to extend broadband access to rural areas, both in the US and elsewhere.
  - However, in the US these have only been done on a trial basis and only in limited bands for short range applications.
  - It is hoped that TV white space will be able to provide affordable broadband service to rural America
  - Extending the internet to rural areas through underground cables is expensive: It can cost $30,000 per mile for fiber-optic cable and $1 million to run cable under a river.
  - White Spaces can do this at a fraction of the cost
- All agree that White Spaces alone cannot be the magic bullet that solves the problem, but it is an integral piece of the puzzle just as Google's Project Loon is another piece of the puzzle

White Spaces Trials

- In June 2011 in the UK, Microsoft, using technology developed by Adaptrum & backed by a consortium of ISP's and tech companies, launched one of the largest commercial tests of white space Wi-Fi.
  - These applications were demonstrated under a highly challenging radio propagation environment with more than 120 dB link loss through buildings, foliage, walls, furniture, people etc. and with severe multipath effects.
- In 2017, Microsoft further expanded their research to show that small cell LTE eNodeB's could be used to provide cost effective broadband to affordable housing residents.
- Since then, Microsoft has been using white spaces to deliver Broadband access in rural areas of Kenya, Namibia, Argentina, and in rural areas of the US
- Google has been experimenting with white space in South Africa

White Space Trials

- According to the Dynamic Spectrum alliance there are white space trials in all five continents
- In the US, Microsoft's Airband Initiative is pursuing 12 pilot projects in 12 states.
- Microsoft is asking the FCC, the US Regulator for three channels in the 600-MHz band for white-space devices.

Spectrum Policies

- Spectrum policies should address incentives for innovation, promote flexibility, establish spectrum users' rights and determine practical methods for compliance monitoring, interference management and dispute resolution.
- These factors apply whether spectrum is used in the spectrum commons or shared by some other means where implementation relies heavily on advanced radio technologies designed to facilitate spectrum sharing.
- Convergence of wireless technology with Internet technology is not a new topic. The challenges are to address the evolution of technology and growth in demand, ensuring that sufficient spectrum is available for current and future generations of services while protecting public safety and security

Spectrum Trading

- Spectrum Trading is a mechanism whereby rights and any associated obligations to use spectrum can be transferred from one party to another by way of a market-based exchange.
- With spectrum trading, the right to use the spectrum is transferred voluntarily by the present user, and a sum is paid by the new user of the spectrum which is retained, either in full or in part, by the present (transferring) user.

Digital Dividend

- What is the Digital Dividend and why is it so important?
  - It is the amount of spectrum in the VHF and UHF bands that is above that amount required to accommodate existing analog TV programs and that might be potentially freed up in the switchover from analogue to digital television.
  - Spectrum is freed-up since digitally transmitted broadcast services require less spectrum than the amount needed to accommodate existing analog transmissions (principally, TV)
  - The Digital Dividend resides in the range of broadcast spectrum– VHF (30 MHz –300 MHz) and UHF (300 MHz – 3.0 GHz).

Digital Dividend (Continued)

- There are two categories of Digital Dividend Spectrum:
  - **Cleared spectrum** refers to the broadcast spectrum that will become available once Digital Switchover occurs.
  - **Interleaved spectrum (whitespace)** is additional capacity available within the spectrum that will be used in digital broadcast based on how digital terrestrial TV (DTT) networks are deployed.
  - The white space spectrum got its name because it can be used at a local level by different users on a shared (interleaved) basis with terrestrial TV

Spectrum Allocation

- In choosing how much spectrum to allocate and for whom, regulators place emphasis on market valuations and economic efficiencies but also on social, development and cultural goals.
- Spectrum regulators are also faced with issues related to future use.
  - Should some of the Digital Dividend be reserved for future use?
  - The central issues are the uncertainty over the best use of the reserved spectrum both now and in the future and the lack of information available, as well as the potential for regulatory decisions to have undesirable effects on the incentives for spectrum efficiency.

Spectrum Allocation (Continued)

- It is in the public interest to ensure that the exploitation of the Digital Dividend is managed as efficiently and effectively as possible, that results satisfy the maximum demand for spectrum, and that obstacles to efficient use are removed by policy makers and regulators.
- If the Digital Dividend is properly organized and if the results are coordinated and harmonized, then a wide range of uses is possible, as virtually all wireless applications could make use of this part of the spectrum.
- If we are to achieve the goal of efficiency and effective use of the Digital Dividend, an important issue centers on who should lead the migration process.
  - The policy maker, the broadcast regulator, the telecommunication regulator or the spectrum agency?

Spectrum Allocation (Continued)

- The key question for the allocation of the Digital Dividend appears to be what is the best way of maximizing the total value to society and what are the trade-offs.
- Assessing the trade-offs is important in considering whether to intervene or allow markets to determine how the Digital Dividend is to be used.
- The use of Digital Dividend spectrum to meet universal access goals, such as access to wireless broadband is another important policy consideration.
- The Scarcity of spectrum and the growing using of mobile data and other wireless applications has increased the pressure on the regulators to more efficiently use the available spectrum, especially as concerns the digital dividend

Spectrum Allocation Benefits

- The benefits of increased spectrum efficiency are widely accepted to include promoting growth, innovation, and competition derived from liberalized and more flexible spectrum use
- The tremendous growth of innovative services and applications that use the unlicensed spectrum has led to great pressure by others to allocate more spectrum to unlicensed users

Open Access

- Open Access to Infrastructure Sharing
  - Open Access is about creating competition in all layers of the network allowing a wide variety of physical networks and applications to interact in an open architecture.
  - Allows anyone to connect to anyone in a technology-neutral framework
  - Encouraging innovative and low-cost service delivery
  - Encourages market entry from smaller, local companies by lowering the entry barriers and reducing the likelihood of one entity becoming dominant.
- Requires trust in parties.
  - The service provider needs to feel that the infrastructure provider is going to tackle his/her needs with same degree of attention as if the organization was doing it itself.
  - That pricing and access terms will be transparent and nondiscriminatory.
  - That the Incumbent's transport services will be separate from its access services to build this essential trust.
  - That Governance structures with oversight powers will be set up to monitor the operators

Universal Service

- First Generation Definition of Universal Access (Service)
  - Universal Service refers to all households in a country having a telephone, so that all individuals can make a telephone call from home.
  - Universal Access as all individuals having reasonable access to a telephone that they can use within a reasonable distance and at a reasonable cost. This could either be in their own home, at a business, or some public facility. It is seen as an interim step.
- Universal Service and Universal Access measure different things, and require different policy measures.
  - Absolute Universal Access is achieved when 100% of the population has access to a given service.
  - Absolute Universal service is achieved when a given telecom service is affordable to 100% of individuals or households

New Definition of Universal Service

- Need to modify the definition of what is UA and what is US
  - Is it voice, dial-up Internet access, or Broadband
  - Do we need to have different definitions for Urban as opposed to Rural?
  - What about Voice and Internet?
  - Is there a need to create a new term, such as UAS that covers all three of these issues?
- Need to move away from defining Universal Access by technology and move to defining it by its usability.
- New definition: Universal Access as the ability for a government to make it possible for someone to use technology to its full potential.
  - Universal Access then empowers people in rural and underserved areas by providing them with the ability to harness the power of the Internet.
  - This definition moves us away from a numerical counting of technology to ensuring that those having these technologies know how to use it effectively to make a difference in their day-to-day lives.

Universal Access Concepts

Issues	Basic Meaning	Differentiation
Availability	Coverage of inhabited geographic territory	Region/Area Locality/Size
Accessibility	All people can use	Gender, Race, tribe, religion Ability /disability
Affordability	Ability to Pay	Access device (Handset, PC, subscription costs) • Cost of calls & services • Minimum "basket" below a certain national limit (e.g., 3% of family income)

Universal Access Measurement

- Need to find better ways of measuring success of UA programs moving away from coverage to usage and quality of service
- The question then becomes are people able to use the access they have? Or is climbing a tree the only way they can get service? And does this count towards meeting UAS goals?
- Is Broadband defined differently in urban areas as opposed to rural areas?
  - What are the allowed contention ratios?
- UAS goals will continue to rise with technology & service development – towards e-Inclusion
- Focus shifts away from simple access to:
  - Bandwidth/speed, ICT capacity/ability, Applications/services

Trust

- Trust is a key ingredient for a sustainable, evolving and global Internet.
  - It is the cornerstone for all successful connectivity strategies
  - An ‘open and trusted Internet’ is a globally interoperable Internet that cultivates innovation and creates opportunities for all.
  - Its foundation lies in user trust, technologies for trust, trusted networks and trustworthy ecosystem.
- Without trust, users feel vulnerable and marginalized and are reluctant to take advantage of the many legitimate benefits that the Internet offers.
- Privacy is one of the biggest challenges regarding identity on the Internet.

Building User Trust

- User trust is important to the future success of the Internet because if users do not trust the Internet, they will restrict their use, and may even cease using it for certain activities.
  - This could have a serious impact on the evolution of the Internet, its use and growth.
    - However, building user trust does not mean simply reassuring people and hoping for a positive outcome.
  - Building user trust means putting in place the right infrastructure (trusted networks), empowering users to protect their activities (technologies for trust), setting the right policies, and providing a responsive environment that properly addresses users' well-founded concerns (trustworthy ecosystem).

Technologies of Trust

- Technologies for trust are the technical building blocks for establishing and maintaining trusted networks, applications and services.
  - They are the technical foundation for a trusted Internet
  - These Technologies are used to secure the networks, applications and services that we use everyday.
  - Without encryption, governments, companies and individuals would not be able to keep their communications confidential and their information secure.
- As threats continue to emerge and grow, we must ensure we all have the necessary tools for privacy, security, and, ultimately, economic and social opportunities.
- We need policies that support rather than hinder the development, availability and use of trust technologies.

Privacy

- Data privacy and data protection are very closely interconnected, so much so that users often think of them as synonymous.
- But the distinctions between data privacy vs. data protection are fundamental to understanding how one complements the other.
- Privacy concerns arise wherever personally identifiable information is collected, stored, or used
- Data protection is about securing data against unauthorized access.
- Data privacy is about who is authorized to have access to this information.
- Another way to look at it is: data protection is a technical issue, while data privacy is a legal one.

Privacy-Definition

- Broadly speaking, privacy is the right to be let alone, or freedom from interference or intrusion.
  - The right to be free from surveillance and to determine whether, when, how, and to whom, one's personal or organizational information is to be revealed.
- Information privacy is the right to have some control over how your personal information is collected and used.
- As the technology gets more sophisticated, so do the uses of data. And that leaves people facing an incredibly complex risk matrix for ensuring that personal information is protected.
- As a result, privacy has fast-emerged as perhaps the most significant consumer protection issue today—in the global information economy.

Data Privacy Definitions

- Data privacy is focused on the use and governance of personal data—things like putting policies in place to ensure that consumers' personal information is being collected, shared and used in appropriate ways.
- Security focuses more on protecting data from malicious attacks and the exploitation of stolen data for profit.
  - While security is necessary for protecting data, it's not sufficient for addressing privacy.
- When comparing data privacy vs. data protection is that data privacy can only be ensured through a technology approach.
  - If someone can steal your personal data, than that the privacy of your data is not guaranteed, which puts you at risk for identity theft and other personal security breaches.
  - But the opposite relationship is not necessarily true: personal data can be protected while still not being reliably private.

Privacy (Continued)

- The point is technology alone cannot ensure the privacy of personal data.
- Most privacy protection protocols are still vulnerable to authorized individuals who might access the data.
- Technology is still implicated in data privacy, precisely because the authorized users of technology have a responsibility to the privacy law.
  - In short, no number of technological safeguards can eliminate the central role of trust in ensuring data privacy.
- The only mode of protection that personal data in transit can rely on is encryption, so that an unauthorized third party may see the data but not read or collect it.
  - With end-to-end encryption, however, the only "authorized users" (you and the recipient) with known IP addresses can get through the privacy shield and gain access to the data.

Internet Privacy

- Internet privacy is cause for concern for any user planning to make an online purchase, visit a social networking site, participate in online games or attend forums.
  - If a password is compromised and revealed, a victim's identity may be fraudulently used or stolen.
- Internet privacy risks include:
  - Phishing: An Internet hacking activity used to steal secure user data, including username, password, bank account number, security PIN or credit card number.
  - Pharming: An Internet hacking activity used to redirect a legitimate website visitor to a different IP address.
  - Spyware: An offline application that obtains data without a user's consent. When the computer is online, previously acquired data is sent to the spyware source.
  - Malware: An application used to illegally damage online and offline computer users through Trojans, viruses and spyware.

Data Protection Definition

- Data protection is the process of protecting data and involves the relationship between the collection and dissemination of data and technology, the public perception and expectation of privacy and the political and legal underpinnings surrounding that data.
  - It aims to strike a balance between individual privacy rights while still allowing data to be used for business purposes.
- Data protection is also known as data privacy or information privacy.
- Data protection deals with both the integrity of the data, protection from corruption or errors, and privacy of data, it being accessible to only those that have access privilege to it.
  - The context of data protection varies and the methods and extent also vary for each;
  - Use of techniques such as file locking and record locking, database shadowing, disk mirroring, to ensure the availability and integrity of the data.

Data Protection Laws

- Data Protection Laws are legislation enacted to protect personal, commercial, and governmental data from unauthorized access, alteration (corruption), destruction, or use.
- GDPR is Europe's new framework for data protection laws – it replaces the previous 1995 data protection directive.
- The EU's GDPR website says the legislation is designed to "harmonise" data privacy laws across Europe as well as give greater protection and rights to individuals. Within the GDPR there are large changes for the public as well as businesses and bodies that handle personal information.
  - Both personal data and sensitive personal data are covered by GDPR.
    - Personal data, a complex category of information, broadly means a piece of information that can be used to identify a person. This can be a name, address, IP address… you name it.
    - Sensitive personal data encompasses genetic data, information about religious and political views, sexual orientation, and more.

GDPR

- The General Data Protection Regulation is a rule passed by the European Union in 2016, setting new rules for how companies manage and share personal data. In theory, the GDPR only applies to EU citizens' data, but the global nature of the internet means that nearly every online service is affected, and the regulation has already resulted in significant changes for US users as companies scramble to adapt.
  - The Rules went into effect on May 25, 2018
- Much of the GDPR builds on rules set by earlier EU privacy measures like the Privacy Shield and Data Protection Directive, but it expands on those measures in two crucial ways.
  - First, the GDPR sets a higher bar for obtaining personal data
  - Under GDPR, any time a company collects personal data on an EU citizen, it will need explicit and informed consent from that person.
  - Users can request all the data a company has from them as a way to verify that consent or they can revoke their consent.

GDPR (Continued)

- Before GDPR started to be enforced, the previous data protection rules across Europe were created during the 1990s and had struggled to keep pace with rapid technological changes.
- The GDPR sets rules for how companies share data after it has been collected
  - This means companies have to rethink how they approach analytics, logins, and, above all, advertising.
- The GDPR adds complex new requirements for any company that gets user data secondhand, requiring a lot more transparency on what a company is doing with your data
- It alters how businesses and public sector organizations can handle the information of their customers.
  - It also boosts the rights of individuals and gives them more control over their information.

GDPR (Continued)

- Companies covered by the GDPR are now accountable for their handling of people's personal information.
  - By adding complex new requirements for any company that gets user data secondhand, requiring a lot more transparency on what a company is doing with your data.
  - This can include having data protection policies, data protection impact assessments and having relevant documents on how data is processed.
  - For companies that have more than 250 employees, they need to have documentation of why that person's information is being collected and processed, What is being collected and how long it is being held for along with descriptions of technical security measures in place.
- Under GDPR, the "destruction, loss, alteration, unauthorized disclosure of, or access to" people's data has to be reported to a country's data protection regulator where it could have a detrimental impact on those who it is about.
  - This can include, but isn't limited to, financial loss, confidentiality breaches, damage to reputation and more

GDPR (Continued)

- Additionally, companies that have "regular and systematic monitoring" of individuals or process a lot of sensitive personal data have to employ a data protection officer (DPO).
- There is also a requirement for businesses to obtain consent to process data.
  - When an organization is relying on consent to lawfully use a person's information they have to clearly explain that consent is being given and there has to be a "positive opt-in".
- The regulation also gives individuals the power to get their personal data erased in some circumstances.
  - This includes where it is no longer necessary for the purpose it was collected, if consent is withdrawn, there's no legitimate interest, and if it was unlawfully processed.
- One of the biggest, and most talked about, elements of the GDPR has been the ability for regulators to fine businesses that do not comply with it.
  - If an organization does not process an individual's data in the correct way, it can be fined.
  - If it does not have a data protection officer, it can be fined. If there is a security breach, it can be fined.

CyberCrime

- Cybercrime is any criminal activity that involves a computer, networked device or a network.
  - While most cybercrimes are carried out to generate profit for the cybercriminals, some cybercrimes are carried out against computers or devices directly to damage or disable them, while others use computers or networks to spread malware, illegal information, images or other materials.
  - Some cybercrimes do both -- i.e., target computers to infect them with viruses, which are then spread to other machines and, sometimes, entire networks.
- Cybercrime can include many different types of profit-driven criminal activity, including ransomware attacks, email and internet fraud and identity fraud, as well as attempts to steal financial account, credit card or other payment card information.
- Cybercriminals may target private personal information, as well as corporate data for theft and resale.

Cyber Crime Definition

- The U.S. Department of Justice divides cybercrime into three categories:
  - crimes in which the computing device is the target, for example, to gain network access;
  - crimes in which the computer is used as a weapon, for example, to launch a denial-of-service (DoS) attack; and
  - crimes in which the computer is used as an accessory to a crime, for example, using a computer to store illegally obtained data.
- The Council of Europe's Convention on Cybercrime, also known as the Budapest Convention, defines cybercrime as a wide range of malicious activities, including the illegal interception of data, system interferences that compromise network integrity and availability, and copyright infringements.
  - Other forms of cybercrime include illegal gambling, the sale of illegal items, like weapons, drugs or counterfeit goods, as well as the solicitation, production, possession or distribution of child pornography.

Cybercrime (Continued)

- Cybercriminal activity may be carried out by individuals or small groups with relatively little technical skill or by highly organized global criminal groups that may include skilled developers and others with relevant expertise.
  - cybercriminals often choose to operate in countries with weak or nonexistent cybercrime laws.
- Cybercriminals often carry out their activities using malware and other types of software, but social engineering is often an important component for executing most types of cybercrime.
- Phishing email is an important component to many types of cybercrime, but especially so for targeted attacks, like business email compromise (BEC), in which the attacker attempts to impersonate, via email, a business owner to convince employees to pay out bogus invoices.

Types of CyberCrime

- There are many different types of cybercrime; most cybercrimes are carried out with the expectation of financial gain by the attackers.
  - Cyberextortion, is crime involving an attack or threat of attack coupled with a demand for money to stop the attack, for example--Ransomware
  - Cryptojacking, uses scripts to mine cryptocurrencies within browsers without the user's consent
  - Identify theft, occurs when an attacker accesses a computer to glean a user's personal information that they can then use to steal that person's identity or access bank or other accounts.
  - Credit card fraud, occurs when hackers infiltrate retailers' systems to get the credit card and/or banking information of their customers. Stolen payment cards can be bought and sold in bulk on darknet
  - Ransomwear--a form of cyberextortion in which the victim device is infected with malware that prevents the owner from using the device or the data stored on it. To regain access to the device or data, the victim has to pay the hacker a ransom.
  - Cyberespionage--occurs when a cybercriminal hacks into systems or networks to gain access to confidential information held by a government or other organization

Cybercrime (Continued)

- Cybercrimes may have public health and national security implications, making computer crime one of the Department of Justice's top priorities.
- In the US, Cybercrime is the responsibility of the Computer Crime and Intellectual Property Section (CCIPS) within the US Department of Justice.
  - It is responsible for implementing national strategies to combat computer and intellectual property crimes worldwide.
  - CCIPS prevents, investigates, and prosecutes computer crimes by working with other government agencies, the private sector, academic institutions, and foreign counterparts.
  - Section attorneys work to improve the domestic and international infrastructure-legal, technological, and operational-to pursue network criminals most effectively.

- The Secret Service's Electronic Crimes Task Force (ECTF) investigates cases that involve electronic crimes, particularly attacks on the nation's financial and critical infrastructures.
  - The Secret Service also runs the National Computer Forensics Institute (NCFI), which provides state and local law enforcement, judges and prosecutors with training in computer forensics.
  - The Internet Crime Complaint Center (IC3), a partnership between the FBI, the National White Collar Crime Center (NW3C) and the Bureau of Justice Assistance (BJA).
  - This group accepts online complaints from victims of internet crimes or interested third parties.

Cyber Security Definition

- Cyber security is the practice of defending computers and servers, mobile devices, electronic systems, networks and data from malicious attacks.
  - It is also known as information technology security or electronic information security.
  - The term is broad-ranging and applies to everything from computer security to disaster recovery and end-user education.
- Cybersecurity is the protection of internet-connected systems, including hardware, software and data, from cyberattacks.
- Cyber security relies on cryptographic protocols used to encrypt emails, files and other critical data.
  - This not only protects information that is transmitted but also guards against loss or theft.
  - End user security software scans computers for pieces of malicious code, quarantines this code and then removes it from the machine.

Cybersecurity (continued)

- Electronic security protocols also focus on malware detection — ideally in real time.
  - Many use what's known as "heuristic analysis" to evaluate the behavior of a program in addition to its code, helping to defend against viruses or Trojans that can change their shape with each execution.
- The most difficult challenge in cyber security is the ever-evolving nature of security risks themselves.
- Traditionally, organizations and the government have focused most of their cyber security resources on perimeter security to protect only their most crucial system components and defend against known threats.
- Today, this approach is no longer sufficient, as the threats advance and change more quickly than organizations can keep up with.
  - As a result, advisory organizations promote more proactive and adaptive approaches to cyber security.

Cybersecurity (continued)

- The US's National Institute of Standards and Technology (NIST) issued guidelines in its risk assessment framework that recommend a shift toward continuous monitoring and real-time assessments, a data-focused approach to security as opposed to the traditional perimeter-based model.
  - Companies must be prepared to "respond to the inevitable cyber incident, restore normal operations, and ensure that company assets and the company's reputation are protected.
- In the US, the Department of Homeland Security (DHS) is the agency responsible for Cybersecurity and for strengthening the security and resilience of cyberspace
- The international community has been trying to develop cybernorms for international behaviour for over a decade.
  - This has been happening through UN processes, through the Global Commission on Cyberspace (GCCS), through international law discourse, and other fora.

The GCSC

- The Global Commission on the Stability of Cyberspace (GCSC) (a multistakeholder commission of experts) sets out to bring perspective by developing ‘proposals
- The GCSC is charged with developing proposals for norms and policies to enhance international security and stability and guide responsible state and non-state behavior in cyberspace
  - One of the outcomes of the 2015 GCCS meeting in The Hague was the establishment of ‘the Global Forum on Cyber Expertise’.
  - Their declaration not only sets out an agenda around five themes (Cyber Security Policy and Strategy, Cyber Incident Management and critical Infrastructure Protection, Cybercrime, Cyber Security Culture and Skill, and Cyber Security Standards), it also clearly defines its guiding principles for reaching these goals.

Internet of Things

- The term “Internet of Things” refers to “scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computers, allowing these devices to generate, exchange and consume data with minimal human intervention.
  - IoT includes consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and more.
  - It presents a new way for users to interact with the network, using devices that are not limited to traditional computers, smartphones, and laptops.
  - Compromised IoT devices, such as webcams or even lightbulbs, can be used to form “botnets”, networks of Internet-connected externally controlled devices.

IoT Security

- Poorly secured IoT devices and services can serve as entry points for cyber attacks, compromising sensitive data and threatening the safety of individual users.
- Attacks on infrastructure and other users, fueled by networks of poorly secured IoT devices, can affect the delivery of essential services such as healthcare and basic utilities, put the security and privacy of others at risk, and threaten the resilience of the Internet globally.
- Understanding the growing impact that IoT security has on the Internet and its users is critical for safeguarding the future of the Internet

Thanks

Questions, Comments, Suggestions

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