

PAPER

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On

REGULATIONS AND STANDARDS OF
TELECOMMUNICATION SERVICES

At the occasion of

National Conference and Annual General Meeting
of

THE NIGERIAN SOCIETY OF ENGINEERS

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ABSTRACT

The phenomenal discovery of digital technology and its applications in telecommunication services have brought about radical changes in networks and services. Over the last three decades the world of telecommunications has evolved from being pure telephone/telegraph services to that of very sophisticated intelligent networks with multifarious value-added services. Deregulation, privatisation, market liberalisation, globalisation and convergence of technology have all resulted in tremendous interests and investments in the industry. This demands serious control, monitoring and coordination and introduced new challenges for regulating institutions. This paper looks into the issues of Standards, standards-making process and the imperatives of new approaches to regulation of the industry. The telecommunication services and the dynamics of the industry are also brought into focus.

INTRODUCTION

Over the last few years there has been tremendous growth in the digital technology and microelectronics, changing significantly the state of the telecommunications industry the world over. The application of computer technology in the main fabric of telecom services and equipment has also added high level of intelligence into the telecommunications networks. The inefficient manual switching methods in

exchanges were replaced with the efficient state-of-the-art, self-configuring, self-managing electronic computer-controlled systems. Switches, multiplexers, routing devices, gateways are being built with special microprocessors called Application Specific Integrated Circuits (ASIC). Exchanges are now digital, although there still exist a few analogue ones within networks around the world. The experience with the digital exchanges shows much better quality and robustness, and with new added services being provided like caller ID, call waiting, call diversion, call forwarding, etc. Convergence of technologies is therefore at the heart of this technological advancement. Information Technology and Communications Technology all helped drive faster the convergence trend, making it increasingly difficult to delineate between computer systems and telecommunication systems.

The radio communications technology development was almost stagnating until the application of digital technology and microelectronics in this field. Digital Radios have better performance than its analogue counterparts. Digital Microwave Radios (DMR) have good performance indices in terms of Reliability, Availability, Mean Time Before Failure (MTBF), Throughput and so on. Some manufacturers of DMRs claim that their MTBF is up to 25 years. With efficient DMRs, it became possible to implement the telecommunication last mile segment on wireless. The use of wireless in Local Loop has facilitated the access to remote communities, off-shore bases and other inaccessible locations.

In addition to these technological innovations, political changes, privatisation and deregulation have modified the fundamental organisation of telecommunications. A lot of new entrants into the telecommunications industry and enlargement of the incumbent operators, and provision of new services are today being experienced in the telecommunications industry. All these vying for whatever resources, like spectrum, that are available

In view of these dynamics, sophisticated standardisation policies and regulation framework become imperative for an organised economy.

HISTORY / EVOLUTION OF STANDARDS AND REGULATION

The story of regulations and standardisation in telecommunications sector started with the discovery of telegraph by Samuel Morse in 1844, which within a decade was available to the general public. In those days this service was limited to the confines of individual nation, because each country used a different system. When the telegraph required transmission to a foreign country, the message was handed over to the next country at the frontiers, where it was transcribed, translated, re-coded again and retransmitted over the telegraph network of that neighbouring country. To reduce this cumbersome practice, several bilateral agreements were reached by the individual country and her neighbours. Nigeria, for instance would have, at that time, reached as many bilateral agreements as the number of countries that she would wish to relate.

On 17 May 1865, after two and a half months of arduous negotiation, the first International Telegraph Convention was signed in Paris by the 20 founding members, and the *International Telegraph Union* (ITU) was established to facilitate subsequent amendments to this initial agreement.

Today that union has the membership of almost all the countries of the world and over 500 private members including recognised operating agencies, industries, scientific organisations, information technology, broadcasting, and other international organisations.

The Telephone was patented in 1876. Wireless telegraphy was also invented in 1896, ushering in the age of radio communications and wireless systems. ITU convened a preliminary radio conference in 1903 to study the issue of international regulations for radiotelegraph communications. The first international radiotelegraph conference held in 1906 was the Berlin radiotelegraph convention, and the annex to this Convention contained the first regulations governing wireless telegraphy. These

regulations, which have since been expanded and revised by numerous radio conferences, are now known as the *Radio Regulations*.

In 1920, Marconi Company succeeded in sound broadcasting giving rise to another form of communication. The 1920's saw the establishment of many committees. In 1924 the international telephone consultative committee (CCIF) was established, while in 1925 the international telegraph consultative committee (CCIT) was setup. The international radio consultative committee (CCIR) was formed in 1927, to be responsible for coordinating the technical studies, tests and measurements being carried out in the various fields of telecommunications, as well as for drawing up international standards.

The 1927 International Radiotelegraph Conference also allocated frequency bands to the various radio services in existence at the time (fixed, maritime and aeronautical mobile, broadcasting, amateur and experimental), to ensure greater efficiency of operation in view of the increase in the number of radiocommunication services and the technical peculiarities of each service.

In 1993 ITU was reorganised into the three current sectors. Telecommunication Standardisation sector, ITU-T (formerly CCITT) - deals with standards for telecommunications; Radiocommunication sector, ITU-R (formerly CCIR) - responsible for radio communications; and Telecommunications Development ITU-D sector is responsible for telecommunications development worldwide.

ITU is the highest international regulatory body that nations and regional groupings take cue from. Membership to this body is not mandatory. It is not also mandatory to comply to its guidelines and recommendations, but it is found that almost all the countries comply, even those that are not members.

Nigeria is a member of the ITU under the auspices of the Ministry of Communications. Other relevant organisations in the country like NCC, NBC, the security agencies,

amateur, etc, participate actively in the activities of the Union. The Nigerian Communications Commission is recognised as a sector member of the ITU.

THE TRENDS IN TELECOMMUNICATIONS ENVIRONMENT

In the past telecommunications services were largely provided by state-owned telecommunications administrations. Recent wave of privatisation and market liberalisation has encouraged the entry of a lot of private companies into the sector.

Since 1984, British Telecom, NTT, Deutsche Telecom, France Telecom, and Swisscom and other public network operators have been successfully privatised. Concomitant with privatisation, the telecommunication markets were deregulated, thereby allowing more competition, and new players such as new service and equipment vendors. Many regional and domestic standardisation organisations were formed, such as the European Telecommunications Standardisation Institute (ETSI) in Europe, T1 committee in United States, and Telecommunication Technology Committee (TTC) in Japan to maintain regional and domestic interconnectivity. The task for telecommunications standardisation was first divided among ITU and these various organisations. Other areas of standardisation require the emergence of new types of organisations in the form of consortia or fora to produce technical specifications. As a result, market forces are now deciding which standards will prevail.

STANDARDS AND STANDARDS-SETTING

By the definition of Advanced Learners, “Standards - (i) a level of quality, especially one that people think is acceptable” or (ii) “unit of measurement that is officially used” or (iii) “an official rule used when producing something”. These definitions highlight three points:

- Quality control
- Unit of measurement
- Production Specifications

When each point is expanded, the activities of a regulatory body become clearer.

Standards can be grouped into two categories: regulatory and voluntary. Regulatory standards are imposed by various regulatory agencies. Voluntary or consensus standards are employed by users and providers as a market -enhancing method of doing business. The market usually decides the viability of any voluntary standard.

The two types of voluntary standards are *de facto* and *de jure*. The *de facto* standard is a standard that is offered initially by a single provider and subsequently become accepted by the market. Eventually a number of vendors may adopt the standards, particularly if the original provider is a dominant vendor.

De jure standard is not the product of a single vendor, but represents the collective consensus of the industry. A *de jure* is developed by a body of interested parties and organisation. Standards produced by such standards developing organisations as ITU-T, ISO and IEC fall into this category.

Standards are critically needed because of compatibility, interoperability and interconnectivity, and to allow users to choose from among a large selection of products. Industry and government have widely recognised that consensus standards and procedures are needed to preserve the integrity of nationwide telecommunications, and facilitate the interconnection and interoperability of carrier services.

Prior to divestiture, AT&T set many standards for compatibility and interoperability of all devices connected to the United States telecommunications network. While these standards may have been for internal use, many became *de facto* standards.

Without standards confusions would result. For example, manufactures of equipment would not have uniform physical or electrical performance parameters as guidelines to design their products that are compatible with each other to meet business needs.

Major Standards-Making Bodies

International Telecommunications Union ITU

ITU is now a United Nations charter organisation. ITU is the major international organisation for developing global agreements on the use of the radio spectrum, for example, for satellite transmission. For regulatory purposes, the ITU divides the world into three regions:

- Region 1: Europe and Africa;
- Region 2: North and South America, and
- Region 3: the Soviet Union, Asia and Australia

International Standards Organisation (ISO)

This is an international organisation dedicated to the writing and dissemination of technical standards for industry and trade. All member nations provide input to ISO, however, it is not treaty organisation and therefore does not require official government representation and approval of contributions.

American National Standards Institute (ANSI)

This is not a standards-developing organisation. It neither develops standards nor undertakes the technical work required to create a standard. Instead it develops and maintains the consensus process for all US standards-developing organisations by accrediting such organisation.

Other organisations include

- **Exchange Carriers Standards Associations (ECSA)**
- **Electronic Industries Association (EIA) Interface standards; RS-232**
- **Institute of Electrical Electronic Engineering (IEEE) Electronics standards**
- **International Electrotechnical Commission (IEC) International standards**
- **National Institute Science and Technology (NIST) U.S. standards**
- **European Telecommunications Standards Institute (ETSI), etc.**

- This list is not exhausted but we shall limit it to this

Areas of standardisation can be classified into three areas:

- 1) regulation-related areas
- 2) competitive areas (non-regulated areas), and
- 3) intermediate areas between these two areas

See the table below.

	Regulated Areas	Intermediate areas	Competitive Areas
	Mandatory	Mandatory or Voluntary	Voluntary
Manager/Controller	States/government	State/government or private sectors	Private Sector
Example Standards	<ul style="list-style-type: none"> • Frequency allocation • GEOS orbit assignment • Numbering/Addressing • Charging • Interconnection rules 	<ul style="list-style-type: none"> • IMT-2000(global roaming) • Callback • Global services • e.g. IP Telephony number 	<ul style="list-style-type: none"> • ATM • ISDN • SDH • IN • Multimedia • Internet • Other new Technologies
ITU's role	Predominant player over many years		

Standards for regulation-related areas are mandatory and managed by government or its agent. The standards for competitive areas are voluntary and managed by the private sector and equipment vendors. The standards for the intermediate areas are either mandatory or voluntary depending on each country's domestic regulations. Standards on the competitive areas are developed by de jure and/or de facto standards development organisations (SDO). De facto SDOs are various consortia, fora, and industry consensus-making organisations for developing "industry standards" on specialised subjects.

Standards-setting procedure

In the past standards were developed from existing technical solutions. This is somewhat not true today. Many standards are agreed to before they are implemented. Formal standards development can be divided into four phases:

- Conceptualisation;
- Discussion;
- Exposition;
- Implementation

After it becomes evident that a standard is needed, the search for technical solution and a means for developing the standard begin. During conceptualisation, a standards-developing organisation with the appropriate jurisdiction is identified. An industry call for participation is published. For example, in the United States, such a notification may be issued in the American National Standards Institute's ANSI Standards Action, which is a newsletter to the general industry.

People from interested manufacturers, carriers, users, special interest groups, etc, may respond to the invitation, participating on voluntary basis. Once a committee is formed discussions begin. The committee defines its mission, its resources and its structure. This can take between six months to two years. Once this phase is over, the next is creating a standard. This could take one to many years. After clearing the problems of divergent positions of the committee members a consensus agreement emerges.

Once the proposed standard is firm, it is prepared into a document called draft standard, and released for public review. When all comments, both negative and positive are cleared, reaching a consensus, a standard is made.

In the case of ITU, the ITU-T and ITU-R are permanent operating units that develop standards for the ITU. The duties of ITU-T are to study technical and operating questions relating to telegraphy and telephony. The duties of ITU-R are to study technical and operating questions pertaining to radiocommunications. The

recommendations developed by these technical committees are regularly published by the ITU.

Plenipotentiary Conferences are the only bodies empowered to adopt revisions to the ITU convention. The Union uses a lot of Study Groups for different topics and areas.

The need for Nigeria to have bodies capable of setting industry standards is very crucial. This is because such bodies respond quickly to any new relevant international and national policies by developing appropriate industry standards to solve any domestic or national problem. This requires that the nation should have the necessary manpower and other needed resources. None of our Higher Institutions offer specialist and practical courses in Telecommunications/Radio Communications Engineering specially tailored for the industry. It is therefore difficult to get sufficient manpower for adequate research works to be done in this field in our Higher Institutions. In developed and some developing countries, the bulk of major breakthroughs come from academic institutions either directly or indirectly. Even the research and development departments of industries are normally linked to such institutions. Another issue is the lack of the technology and industries that are capable of manufacturing telecommunications equipment locally using such standards and research works that are locally generated.

For instance, the NCC licensed some Fixed Wireless Access (FWA) operators in 2002 on the 3.5 GHz band. Many have not rolled out, because they claim that equipment on this band are not off-the-shelf products. If it were in Europe, many telecoms companies would have quickly embraced this new policy initiative to manufacture all needed equipment, devices and interfaces, and sooner or later they would have been de facto standard, with these equipment available off-the-shelf.

Take the example of when the wireless local loop technology was being introduced. Personal Access Communications System (PACS) was developed in the United States based on 1850 - 1910 MHz and 1930 - 1990 MHz, while in Europe, it was Digital

Enhanced Cordless Telecommunications (DECT) standards that was adopted based on 1880 - 1900 MHz. In Japan, Personal Handyphone System (PHS) based on 1895 - 1918 MHz was adopted. These different standards vary widely in some major characteristics, just as their bands are different though they overlap. The problem we have now is that different licensed operators have brought in these various standards into the country before NCC gained its full regulatory powers. The Commission is hamstrung because it does not have a local alternative, and these were already in the country before the Commission could standardise or adopt one system. This is just example of the regulatory challenges that are peculiar to developing countries such as ours.

It is necessary for the Nigerian Society of Engineers to look deeply into this issue in partnership with the relevant bodies, agencies and schools. The NSE should champion research initiatives in various engineering disciplines to encourage development of standards for the Nigerian environment.

REGULATION

Regulation, by dictionary definitions, is an official rule by government or some other authority, while, a regulator is a person or an organisation that officially controls an area of business or industry and makes sure that it is operating fairly.

There are two ways that government may impose regulation on industry. The government can control the structure of the industry, dictating either what companies can produce or what services may be operated. Monopolies are often structure-controlled. The other alternative is the de-regulated approach, which is to control the conduct of companies laying out the actions and behaviour which are permissible. Most regimes comprise elements of both structure and conduct regulation, and real measures are not easily classified into one of the two types.

Structure-controlled regulation controls which companies may operate in an industry, typically restricting entry by licensing operators and by having strict monopolies and company merger policy.

Conduct regulation controls include those governing restrictive practices and prohibiting anti-competitive acts (such as financial cross-subsidisation between two different company products).

Conduct regulation requires a “policing” body to ensure that companies conform to their obligations. Under structure regulation such a body is not necessary, due to smaller number of active companies, and also because the public utility companies are state-owned.

In country undergoing telecommunication deregulations, the shift in emphasis of regulation tends to be away from structural control towards conduct control. Many countries are establishing regulatory bodies (regulators) to oversee the conduct of companies in the industry. In addition it is common for the government to sell off part or all of their ownership of the established monopoly company. The main reason for this is to put the established carrier on an equal business and commercial footing with other new telecommunication market entrants. It affords the company more scope to manage itself and allows the government to handle competing companies more equally.

Types of Regulatory Bodies

The regulatory body needed for policing conduct regulation can take one of three forms:

- A government department;
- An independent body, financed by government or by the industry;
- A self-regulating body composed of a council of delegates from companies active in the industry.

Central to the decision as which form of regulatory body is appropriate, is the question of how much information is available to the regulators. A regulator cannot perform the task if unable either to collect or to comprehend information easily.

Government and independent organisations have the benefit of neutrality and their desire to see fair play, but have less information and expertise available to them than would be the case for a body formed of delegates from active companies. On the other hand, self-regulating bodies (such as UK's Law Society) have more information and expertise available, but only work fairly when the body has an interest preserving a good reputation. Government and independent organisations may make up by utilising the services of consultants where appropriate and continuously training their workforce.

Countries may choose different types of regulatory bodies to oversee the telecommunications, but in the United Kingdom and the United States the regulatory bodies are linked to the government. In the United Kingdom, the regulatory body, the Office of the Telecommunications (OfTel) is linked to the Department of Trade and Industry (DTI), while in the United States the Federal Communications Commission (FCC) reports direct to the US congress. This is now the model shared by most European countries, Australia, and Japan. A notable exception is the regulatory structure in New Zealand where all telecommunications -specific regulation was removed, leaving only the standard industry regulating bodies such as monopolies commission, fair trade, etc. Sweden also largely emulates the New Zealand.

In Nigeria, deregulation and privatisation policies of the Federal Government introduced liberalisation of the industry and consequent influx of private sector involvements. Recognising this fact, the Federal Government of Nigeria commenced series of initiatives to transform the industry. Nigerian Communications Commission (NCC) was established in 1992 by decree 75. There are several other acts since then relevant to the activities of NCC, but the most recent one is the Nigerian Communications Act (NCA) of 2003, signed into law by the President of the Federal

Republic of Nigeria on July 8, 2003, superseding all previous pertinent acts. The government has made provision for an independent regulator for the telecommunications industry, empowered to issue licenses and to regulate all telecommunications licensees, service providers, operators and carriers, numbering plan and to perform such other regulatory functions as are defined from time to time by the Government. The combined effect of the provisions of the new act, NC Act of 2003 is to give the Commission some level of authority as an independent regulator.

For instance:

- Financial authority, SS 17-22
- Security of tenure of office of the Commissioners, SS 15-11
- Power of the Commission to make subsidiary legislation guidelines, S 70

THE INSTRUMENTS OF REGULATION

The regulating body can tackle the issues of regulation and standardisation using the following instruments:

- Responding to changes in the telecommunications industry by developing appropriate Policies and Guidelines to tackle all new services
- Standardising equipment and services
- Outline all available services and determine all their needed resources
- Defining different categories of licenses
- Not granting Licenses indiscriminately to applicants. Should not overheat the system by granting too many licenses in certain services
- Having good Legal Framework to guide the regulator's activities
- Enforcement of the policies/guidelines and the conditions of licenses
- Spectrum Management (Planning, Coordination, Allocations to Services, and Assignment to Individuals)
- Type Approvals of telecommunications equipment
- Numbering Plan for the whole country
- The Regulator should be transparent in all its dealings

This is a dynamic area and information should be exchanged with similar agencies or organisations internationally.

CONCLUSION

ITU, as an intergovernmental organisation responsible for the production of worldwide standards has recognised the need to improve its working methods, procedures and programme to meet the changing environment. This is shown in its approach towards the development of the IP-based multimedia networks and next generation services and systems.

The Nigerian Communications Commission is the National Regulatory authority charged with setting standards for telecom practice in the country as well as regulating the conduct of providers of telecom services in Nigeria.

Globalisation, deregulation, and new technologies are shaping today's telecommunication markets. The convergence of telecommunications, broadcasting, information technology and the entertainment industry presents the regulating bodies and standards organisations with new challenges since they must ensure the interoperability of services and applications as well as the inter-working of the different network platforms. From the customer viewpoint, standards should allow service provisioning anytime and everywhere at a reasonable cost.

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