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Global Telecommunication Development and Its Influences on International Community: An International Lawyer's Perspective

I. Introduction

What is "telecommunication"? The evidence shows that communication is one of human beings' instincts and should be equally protected. By communicating with each other, human's feelings, demands, and opinions can be observed and known. In this way, mankind understands each other and actively exchanges information. After the Revolution of Information, telecommunications mechanisms are now an elemental force, used in almost every aspect of daily lives. Without these mechanisms, the information age would not even exist. Today, telecommunications followed by with new technologies, are developing and increasing speedily and becoming one of the requisite components in our daily life. Through the definition of "telecommunication" and its history, this article will review the global telecommunication development. The article concerns the relationship between human rights and telecommunications. The article will question why is international telecommunication cooperation necessary? Why is there still a huge gap between industrialized and developing countries in access to basic telecommunications? Why is a stable and forceful international telecommunication system necessary in international community? The article will examine the position of different international organizations in the international community and how it evolved in telecommunication cooperation among countries. The article will also discuss regional telecommunication cooperation and see if it matters with different telecommunication technologies and service develop among the Asia-Pacific region, the European Union, and the Americas?

Second, the article will focus the position of Radio Regulations in international telecommunication cooperation. It will scrutinize the review of Radio Regulations and highlight the characteristics of the radio frequency spectrum as an example to support and showcase the importance of international negotiations and cooperation in sharing telecommunication resources and new technologies. Hereafter, the article will consider the relationship between international business issues and telecommunications. What kind of

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international organization does support the commercial negotiations and trade agreements concerning telecommunications? What kind of influences did it or will it have on global telecommunication development and markets? Why foreign investment plays a critical role in global telecommunication development and does it have a close connection with the "universal access"? Does foreign direct investment bring any impact to the international telecommunication community? Finally, this article will make a conclusion based on the basic points of "the right to telecommunicate" and "universal access" to further examine global telecommunication development.

II. Definition of Telecommunication

What is "Telecommunication"? In Greek, "Tele" means "distant" and "graphic." Telecommunications refers to long-distance communication. According to the Annex of the Constitution of the International Telecommunication Union (ITU), "Telecommunication" means any transmission, emission or reception of signs, signals, writing, images and sounds or intelligence of any nature by wire, radio, optical or other electromagnetic systems.[2] The "Signals", which can be visual, audible, or electrical, can be made by a variety of means, including lighted torches, smoke, flags, lamps, drums, guns, telegraph, telephone, and radio. In earlier times, smoke signals, drums, light beacons, and various forms of signals were used for communication. Nowadays, telecommunication is carried out with the aid of electronic equipment such as the radio, telegraph, telephone, and television. Thus "Telecommunications" can simply imply "the transmission and reception of signals by any electromagnetic means" which is defined by the Annex on Telecommunication of the General Agreement on Trade in Service (GATS) of the World Trade Organization (WTO).[3] Electrical signals can be transmitted very quickly over great distances and are known as "Telecommunication" now. The information that is transmitted can be in the form of voice, symbols, pictures, or data, or a combination of these. The physical equipment for a telecommunications system includes a transmitter, one or more receivers, and a channel or means of communication such as the air, water, wire, cable, satellite, or some combination of these. Telecommunication means can be used to control railroad trains and vehicular traffic on roads and highways and to communicate with ships, airplanes, and other vehicles. Through telecommunication, people also can get necessary information and knowledge to improve their living conditions, medicine, education, as well as business transactions. As to the 1996 Telecommunication Act of the United Sates, "Telecommunication" means the transmission, between or among points specified by the user, of information of the user's choosing, without change in the form or content of the information as sent and received.[4] Obviously, the Telecommunication Act of USA exerts a wider method to describe telecommunications.

[2] 1012, Annex on Definition of Certain Terms Used in this Constitution, the Convention and the Administrative Regulations of the International Telecommunication Union; the Constitution of the International Telecommunication Union; Kyoto, 1994.
[3] Art. 3 (a), Annex on Telecommunication of the General Agreement on Trade in Service (GATS).
[4] Sec. 3. (48), Definitions, Telecommunication Act of the USA, 1996.

III. History of Global Telecommunications Development

Telecommunication development can be tracked back thousands of years ago and always is closely connected with human history. One of the most famous events of "Telecommunications" was the Marathon Run in Old Greece. In September 490 BC, a bitter battle was going on at the coast of the Aegean Sea, near the town of Marathon. A small well armed Greek army fought against a numerically stronger army of Persians, but nevertheless the Greeks gained victory. The leader of the Greek army sent a courier with the message of victory back to Athens. After the messenger had completed the more than 40 kilometers long run and reached the streets of Athens, he collapsed with the words: "Be glad! We are the winners!" and died. This is a very original way to transmit news in early human records.[5] In forest areas, the drum was developed into one mean of telecommunications and called as the "Jungle Telegraph." In Africa, New Guinea and the tropical America, natives used drum telegraphy to communicate with each other from far away for centuries.[6] When scientific expeditions came into the jungles and explored the primeval forest, there were accompanied by a never-ending roar of signal drums. Hence, the message of their coming and their intention was carried through the woods always a step in advance. In ancient China, people used another music instrument "Tamtam" or "Gong" made from a large, free hanging, and circular plate of metal as telecommunication appliance.[7] The keystroking of this plate created a far-reaching audible tone. In the Northern American Continent, Indians were using smoke signals to exchange information. Those are earlier methods to transmit news and information.

A more systemic communication method started in Old Rome. The old Romans worked with a smoke telegraph net, which had a total length of about 4,500 kilometers.[8] The telegraph net consisted of towers within visible range of each other. Hundreds of such towers for military signaling were needed to be able to reign over such a fast expanding empire. In addition, the ancient Greek and Roman empires organized another well-developed telegraph system, fire signals.[9] The fire signals were given from mountains to mountains or from towers to towers. The receiving and transmitting stations were built of two separated walls, which were placed on hills and each one had battlements between where torches were put. Depending on how many torches were burning between the battlements on the right and the left wall, the message could be read. In the Far East, ancient Chinese also used fire signals for military purpose to communicate along with the frontiers of the Empire during the Han Dynasty.[10] Different from smoke signals, fire signals were also visible at night. This kind of pre-electric telegraphy required alphabetic signaling. By 300 BC, the Greek invented the method of signaling consisting of 24 Greek letter alphabets. Moreover, navies and ships had used maritime flags and semaphore for centuries.

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[5] "Ancient Greece and Rome III," NY: Scribner, 1998, p25.
[6] Margaret Mead: "Growing Up in New Guinea;" William Morrow; NY, 1930, p43.
[7] Neville H. Fletcher: "Nonlinear dynamics and chaos in musical instruments" Complexity International, Volume 1, 1994. The tamtam is almost completely flat, with a shallow central dome, a turned over edge, and several rings of hammered bumps. It is typically nearly a meter in diameter and is made from metal. The tamtam is played by striking it in the center with a large and softly padded beater.
[8] Friedrich Kittler: "The History of Communication Media;" Canada: Ctheory International Journal, July 30, 1996.
[9] Ibid.
[10] M. Aurel Stein: "Ruins of Desert Cathay: Personal Narrative of Explorations in Central Asia and Westernmost China," Macmillan and Company, Limited St. Martin's Street, London, 1912.

Telecommunications mechanism such as telegraph, telephone, radio, TV, satellite, even internet, each was developed for dozen of years and paved the way for the final invention by thousands of people and steps. Those tools also utilized electricity as a drive force. For harnessing electricity, the ancient Chinese initially discovered and used the lodestone, a natural magnet, and knowledge of it traveled westward. Afterward, Roger Bacon suggested the use of electricity for communication as early as 1267.[11] An English named Stephen Gray described the basic principles of telegraphy in 1730, and his partner, Wheeler, suggested that the wire suspended by a silk thread. The first useful optical telegraph was invented during the period of the French Revolution. A French named Claude Chappe, a former priest, introduced a mechanical-optical telegraph that consisted of a column with a moveable crosswise beam.[12] This beam also had two moveable arms. With ropes it was possible to show many different signal pictures, all together 196 with upper and lower case letters, punctuation marks and numbers. The equipment stood on rooftops or towers and was visible from far away. This sort of telegraphs called "Semaphore System," and its first line sort was run for operation in 1794.[13] The telegraph line comprised 15 stations and linked Lille with Paris, a distance of over 240 kilometers. It only took about 4 to 7 minutes to transfer a message from Paris riding across France. The modern telegraphy was initially invented Samuel Morse.[14] He got the idea for the concept when he returned to America from Italy on board the ship "Sully." He used about six years to finish this invention and received a patent called the "Morse Telegraph" in 1838.[15] In May 1844, the first telegraph line was operated from Washington DC to Baltimore.[16] Started by Henry O'Reilly,[17] the telegraphy lines were sooner or later expanded to Philadelphia, New York, Boston and many other cities and areas around the USA.[18]

On the other hand, telegraphy became more and more popular in Europe as well. Meanwhile, some improvements were achieved such as an invention to use one line for different telegrams at the same time and to send signs in both directions. The Austrian Physicist Julius Wilhelm Gintl created Duplex telegraphy allowing simultaneous transmission of signals in opposite directions in 1853.[19] Gintl's method was called the method of

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[11] George P. Oslin: "The Story of Telecommunications;" Mercer University Press, Macon, Georgia, 1992, p2.

[12] Ibid, pp4-7. During the French Revolution, Claude Chappe operated three different semaphore systems and then built a shutter system with a rectangular frame at each station. Afterward, he and his two brothers received governmental financial aid and constructed a third system with a tall pole and a long arm across the top in each station.

[13] Ibid. Semaphore Systems; "Semaphore" comes from the Greek. Sema means "a sign," and phero is "I bear."

[14] Samuel F. B. Morse, born in Massachusetts in 1791 was one of the most important investor in telegraph history. From the Morse Code, Morse key and stylus recorder, he produced telegraph equipment practical and simple enough to attain general use in the USA.

[15] Ibid, pp 13-28.

[16] Ibid, pp 14-43. On May 24, 1844, one of the most important days in the American history, the first telegraph line invented by Samuel Morse was tested successfully. He sat in the High Court of Justice in Washington and sent the first message out to the Baltimore & Ohio railway station in Baltimore where many illustrious people were waiting. The content was a quotation of the bible and said: "What hath God wrought". The message reached Alfred Lewis Vail, the collaborator of Samuel Morse, in Baltimore, who sent it back at once.

[17] Henry O'Reilly, born in Ireland in 1806, started the expansions of Morse Telegraph lines in the USA. On June 13, 1845, he obtained a contract from his friend and the authority to "raise capital for the construction of the Morse line from Philadelphia to which cities he may select." Beginning that day, O'Reilly contracted and built telegraph lines not only within east coast but also progress to the South and West of USA. American called him as "The Greatest Of The Pioneer Line Builder."

[18] See supra note Oslin, pp 37-56, also see Dexter Perkins: "Rochester History;" Rochester Public Library, Jan. 1945.

[19] Russell Naughton: "2500 Years of Communications History;" Adventures in cybersound, 2000.

compensation. He got the golden Medal of Honor at the exhibition of industry in Paris in 1855. During the year of 1836, two Englishmen, William Fothergill Cooke and Charles Wheatstone formed a partnership in research for the needle telegraph.[20] In June 1837, they were granted a patent on an instrument using six wires, connected to five galvanometer needles arranged in a row across the face of a grid that displayed 20 letters of the alphabet. Each letter was sent in the form of currents flowing down two wires, causing the appropriate needles to swing against stops and point to the right letter. One month later, the first experimental line with the new telegraph was started and connected between the stations Euston Square and Camden Town over a distance of 2.4 kilometres. In 1838 Cooke and Wheatstone improve and patented their new two-needle telegraph that used fewer wires and was cheaper to use. In 1845, another improvement was proposed, the one-needle telegraph. The needle stroke against small metal pipes that emitted sounds in different pitches.[21] That "two tone melody" represented a code of the telegram. This kind of telegraph was used for nearly 80 years in England.[22]

Since 1842, the telegraph cable was initially laid cross the Hudson River and New York Harbor.[23] But these submarine cables lacked a required quality and could not last long. The discovery of a form of rubber called "gutta-percha" in 1847 led to a suitable insulation and could let submarine cables keep longer under water.[24] The first across-national-boundary submarine cable telegraphy began with a wealthy English merchant family named Brett, who financed a cable crossing the English Channel to France in 1850.[25] At the same period, several American and European had an image to use a telegraph cable to cross the Atlantic to connect both continents. Cyrus Field, a wealthy New York paper merchant, was enthusiastic about such an idea and decided to lay a submarine cable from the USA to England.[26] From 1854 to 1856, he formed the "New York Newfoundland and London Telegraph Company" and the "Atlantic Telegraph Company" to experiment several trials.[27] Due to scientific and engineering problems, many trials failed. Meanwhile, the British Government appointed a commission to investigate the whole subject and experiments. Since July 1865, a giant British ship, the Great Eastern, began to participate in new trials.[28] However, all trials to lift up the cable failed, so new attempts had to start again in 1866. After five months, the new cable had been manufactured till the first message was transmitted across the Atlantic Ocean. The first

[20] Brian Winston: "Media Technology and Society, A History: From the Telegraph to the Internet;" pp 22-29.
[21] James B. Calvert: "The Electromagnetic Telegraph;" April 7, 2000.
[22] See Needles and Wires "Naturwissenschaft und Technik" Zweiburgen Verlag, Weinheim, Germany.
[23] Jack Rohan: "Yankee Arms Maker: The Incredible Career of Samuel Colt;" NY: Harper Brothers, 1935; also see supra note Oslin pp157-158. It said Samuel Colt laid a cable in New York Harbor in 1842.
[24] Dr. Ernst Werner von Siemens developed a heat machine in 1847 that eliminated leaky seams in insulation as the gutta-percha was applied.
[25] Jacob Brett and his elder brother, John Brett laid the first cable across the English Channel from Dover to Cap Gris-Nez in 1850. However, it failed after a few messages were exchanged, but a permanent channel cable was laid by T. R. Crampton, an English engineer, in Sep. 1851.
[26] Cyrus W. Field, born in Massachusetts in 1819 was a wealthy New York paper merchant and warehouseman. His persistence resulted in the laying of the first successful transatlantic cable.
[27] See supra note Oslin, pp161-186.
[28] Originally named Leviathan, the Great Eastern, a British cargo ship of 22,500 tons and 700 feet long was the only one ship in the world large enough to carry the 2,300 miles and 9,000 tons submarine cable at that time.

functional telegraph line between Europe and America was finally finished in 1866 and stood for a new era in telecommunications.[29]

The original idea of telephone was from Charles Boursel's, a civil engineer working for a French telegraph company. He initially published this idea of the electrical transmitting of sound in 1854 in the magazine "L'Illustration de Paris."[30] Later on, in 1876, in Boston Massachusetts, an American named Alexander Graham Bell invented the telephone.[31] His system was composed of a microphone and a speaker. Bell filed his patent application just hours before his competitor, Elisha Gray. Bell's microphone changed sound waves into a pulsating voltage that is faster and easier to transmit than sound waves. Because Bell believed in the commercial use of his telephone system, he published his invention after he had patented it. At the world exhibition in Philadelphia in 1876, he demonstrated his telephone and caused a sensation. Bell's telephone system reached the public's attention, although many researches in the field of electrical voice transmission had done before. For the commercial purpose, Bell founded the "Bell Telephone Company." This company delivered and installed 50,000 telephones within the first three years and became the world's largest telephone company known as "American Telephone and Telegraph Company" (AT&T).[32] The development of the Telephone in industrialized countries became very popular and common at that time. At the beginning, people had to talk to an operator first and waited a long time until the operator built up the connection manually on a connecting board. In 1889, Almon B. Strowger invented a system that allowed individual telephone subscribers to establish their own telephone connections.[33] In 1892, Strowger set up his "Strowger Automatic Telephone Exchange Company" which was the first telephone exchange without operators to establish connections.[34] Nowadays, telephones have become the basic telecommunication tool in our daily life.

In 1882, a Croat's electrical engineer, Nikola Tesla, developed the alternating current power system called AC that provides electricity for homes and business buildings.[35] He constructed an AC power system to replace the weak direct-current (DC) generators and motors that were in use. Tesla moved to the United States in 1884 and registered more than 100 patents. He also invented a high-frequency transformer called it the "Tesla coil" that made AC power transmission practicable. He experimented with radio waves and designed an electronic tube, which was used as the detector in a voice radio system.[36] The invitations of Tesla had great influences to future telecommunication development. In 1888, Friedrich Hertz

[29] Ibid, pp 173-178. The Anglo-American Telegraph Company raised enough capital and prepared for this try in 1866. On the other hand, the TC&M Company made 1,600 miles of new cable and the ship, the Great Eastern, started west flanked by telegraph ships Medway and Albany with the Terrible leading the way. After laying 1,896 miles of cable in 14 days, the Great Eastern arrived off Trinity Bay, Newfoundland on July 27, 1866.
[30] Petar Lesic and Dirk R. Gierhake from Telekom Unterrichtsblaetter, Germany.
[31] Thomas E. Bolger: "Introduction: The Telephone's First Century and beyond," essays on the Occasion of the 100 th Anniversary of Telephone Communication by Arthur C. Clarke, Michael L. Dertouzos, Morris Halle, Ithiel de Sola Pool, and Jerome B. Wiesner, published by Thomas Y. Crowell Company and AT&T, 1977, pp 1-8, pp21-36; also see supra note Oslin, pp 215-221.
[32] See Oslin, pp 228-231.
[33] Ibid, p 251.
[34] Ibid, p 440.
[35] Ibid, p 283.
[36] See Compton's Encyclopedia by Petar Lesic and Dirk Gierhake.

discovered the electromagnetic wave. He opened new ways of transmitting information. In 1895, the Italian Guglielmo Marconi experimented with wireless telegraphy.[37] He was successful to send his messages across the English Channel from France to England in 1899. Only two years later, the first transatlantic signals were sent across the Ocean from Europe to North America. His radio equipment was composed of a transmitting and a receiving part. The transmitting part was composed of a conductor that was connected to an antenna and to the ground. The receiver had an antenna and a ground pole the same way the transmitter had so that the transmitted signal could be received on the receiving side. Later, Marconi founded "Marconi Wireless Telegraph Company" in London to produce his receiving and transmitting system and rent it to ship owners under the condition that only his personnel were allowed to operate these machines.[38] So he could keep his monopoly on his transmitting system. The first voice transmitting system with electromagnetic waves was built in America in 1906.[39] Four years later, the first song was transmitted by electromagnetic waves and it was the voice of the famous singer Caruso right out of the Metropolitan Opera in New York.[40] In April 1920, an experimental public station was held at Hague, Netherlands, and began to transmit sounds between England and the European Continent.[41] In the following years, several radio stations started broadcasting their programs in England as well.[42] The first radio broadcasting station started in the USA in 1921 and later built up all over the nation quickly.[43] The vacuum tube was invented in 1910 and allowed voice transmitted over further distances and transmitted more than one conversation at once on one wire.[44] It was very important that the different units and platoons could communicate. Even ships and aircraft were equipped with transmitters and receivers when these devices became small enough to fit in an aircraft or boat. The first Teletype writer was introduced in 1914.[45] Teletype writer became very popular because anything written and transmitted by a Teletype writer is still legally valid. Afterward, facsimile played an important role in long distant communication during 1920 to 1940 and also revived the idea of television.[46]

As one of modern telecommunication tools, television has become an indispensable requisite to acquire information and of knowledge in human's daily life. A German named Paul Nipkow initially invented the practical wired image transmission.[47] Later on, Georges Rignous

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[37] Two years before Marconi demonstrated his wireless telegraphy in 1895, Nikola Tesla already showed radio transmission at the 1983 World's Columbain Exposition at Chicago. The US Supreme Court ruled that Tesla's radio patents predated Marconi's.

[38] See supra note, pp78-83.

[39] Stanley Leinwoll: "A History of Radio Communication: From Spark to Satellite;" NY: Charles Scribner's Sons, 1979, pp 34-40. On Christmas Eve, 1906, Reginald Aubrey Fessenden made the first radiotelephone broadcast in history.

[40] See supra note Brian, pp 60-64.

[41] Ibid, pp 101-104. The station was signed as PCGG operating on 285 kHz.

[42] Meanwhile, six of Britain's largest manufactures of radio equipment including Marconi Company formed the British Broadcasting Corporation, Ltd. That was known as BBC.

[43] See supra note Stanley, pp 83-96. In 1921, the US government issued licenses to Charles Herrold's Radio Station "KQY" and a frequency of 833 kHz.

[44] See supra note Oslin, pp 283-286.

[45] Ibid, pp 303-307.

[46] At the time, facsimile was hailed as "the telegraph of tomorrow." See R. J. Murphy: "Telecommunications Networks: A Technical Introduction;" Indiana, Howard W. Sams & Company, 1987, pp 163-164 & 190 for definition and standard.

[47] In 1884, Paul Nipkow applied for a German patent for an "Elektrisches Teleskop." The heart of his patent was a revolving apertured disc. The disc had 24 holes in a spiral near the outer rim. This patent had all the elements for a

and Professor A. Fournier built the first operated television system in 1909.[48] Vladimir Kosma Zworykin applied for a patent on the cathode ray tube as a film or slide scanner in 1929.[49] This invention was the foundation of modern television and originally brought rapid development of television. At the same year, the electronic television started in Europe when Manfred von Ardenne successful showed that a cathode-ray tube is not only suitable for the reproduction of transmitted pictures, but also as a scanner for objects and slides.[50] In 1932, an American, Philo T. Farnsworth, had succeeded in converting a photograph into an electronic image and scanning in successive lines.[51] However, the sensitivity of that picture tube was very low because only a very small part of the complete luminous flux entered the aperture in the size of an image point. After couple of months, Vladimir Zworykin developed the "Iconoscope" that would imitate the conditions under which the human eye functions.[52] This picture tube saved the light incidence between two scanning cycles and was sensitive enough for direct transmission of daylight. With that, the way was free for development of modern image converter tubes. In 1935, the Iconoscope camera was developed so television could be done without the Nipkow disk. At the same year, the first official and regular television program service of the world started in Berlin Germany.[53] After one year, the BBC initially broadcasted commercial television programs in England that marked the beginning of modern television broadcasting.[54] In 1939, at the opening of the World's Fair in New York, regular television programs were broadcasted in the United States.[55] During the same period, the first color TV programs were tested in USA as well. In 1952, the Radio Corporation of America (RCA) developed the first picture tubes for cameras with semiconductor storage layer. One year later, color television was finally introduced in the USA in 1953.[56] After 1960s, satellite was connected with television and cable television system had operated with high-speed.[57] At the same year, the Japanese Sony Company developed the first television set that was assembled with transistors instead of electronic tubes. Finally, High Definition Television (HDTV) is presented by the NHK Company in Japan in 1978.[58]

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successful visual transmission system. See Anthony Smith: "Television: An International History;" Oxford University Press, 1995, p15.

[48] Ibid, p 17. This invention of television system had transmitting screen comprised of a bank of selenium cells and relays. As each relay was connected in turn to the communicator, it sent its signal through a single wire to a receiver. Then a modulated light was sent through a set of rotating mirrors where the image was reconstituted on a screen.

[49] Ibid, pp22-28.

[50] Ibid, p20.

[51] Ibid, pp23-24 & 29. Philo T. Farnsworth also had patented the cathode ray scanner, the electronic method that became the basis of modern television tubes in 1930.

[52] Ibid, pp26-32.

[53] On March 22, 1935, the German Post Office (DRP) opened a television service consisted of 180 lines at 25 frames from Berlin. However, the picture quality was poor and programming was sporadic. Finally, a disastrous fire stated its failure on August 19 at the same year. See ibid, pp 29-30.

[54] In November 1936, the London Television Service was opened. Two traditional competitors, Baird Television Ltd. and Marconi-EMI were successful at this time. The programming included game shows, musical numbers, drama, and exhibitions, and boxing, etc.

[55] Norm Goldstein: "The History of Television;" Associated Press, 1991, pp 53-56.

[56] See supra note Smith, pp 33-34, and 38-39.

[57] See supra note Goldstein, "Into the Future," pp 254-270.

[58] Ibid, pp 34, 304-308. HDTV was also known as Hi-Vision in Japan.

Space telecommunications satellites were rapidly developed in the United States from the year of 1960.[59] The first earth-satellite called "ECHO I" which reflected radio signals started to operate in August 1960.[60] Later on, the American communications and television broadcast satellite "TELSTAR I" was operated in July 1962.[61] "TELSTAR I" was the first satellite to send television images and telephone calls across the Atlantic Ocean but the received signals were weak.[62] At the end of the same year, an intercontinental television and telephone satellite, "RELAY I" was launched as well.[63] After one year, a stationary satellite for transcontinental television and telephone transmissions called "SYNCOM 2" started from July 1963.[64] Since 1965, "EARLY BIRD 1" had operated as the first commercial international communication satellite and handled transatlantic telephone and television signals.[65] It also was the first step toward a global satellite system. In addition to satellites, the IBM Company introduced "Tele-Processing" to assistant computers work over telephone line in 1961. After the computers could be connected over telephone net, electronic data processing reached a new dimension and information can flow in nationally even worldwide dimensions. Under teleprocessing, computers work with peripheral equipment that consists of input and output unit. The peripheral equipment is connected to the arithmetic unit using interfaces. Data are transmitted serial or parallel. Interfaces can be prepared so that they feed a data flow via the telephone net using an adapter. So it is possible to interconnect computers, respectively to create a big data net. In 1964, telemedicine over satellite radio was successfully connected together in the University Hospital of Nebraska, the Psychiatric Institute of Omaha and the Norfolk hospital in the USA.[66] The satellite connected the hospitals in tone and picture.

In 1966, an American Scientist Charles Kao firstly used light conductor fiber to transmit phone calls. Kao noticed that the fibers work in total reflection and transmit a wide frequency spectrum and a lot of calls can be transmitted simultaneously. After two years, a German electronic firm "Grundig" introduced a small band picture transfer process, which can transfer a TV picture by telephone and print as a photographic recording within a minute.[67] The process is used in photo-telegraphy by press agencies, police search and weather reports. However, the transferred pictures were black and white. In 1969, the Advanced Research Projects Agency (ARPA) of the US Department of Defense commissioned the development of a computer net, which helped to communicate in case of a nuclear attack or relieve the

[59] Kevin C. Ruffner: "Corona: America's First Satellite Program;" Washington DC: History Staff, Center for the Study of intelligence, Central Intelligence Agency, 1995.
[60] "Echo I" is the first passive communications satellite launched by the National Aeronautics and Space Administration (NASA) on August 12, 1960. It is a ten-story-high aluminum coated balloon and soared 1,000 miles on a Delta rocket and expanded to full size when solid-state material in the balloon changed to gas.
[61] "Telstar I" was developed and launched by AT&T with a Delta rocket from Cape Canaveral, Florida on July 10, 1962. It was the first nongovernmental satellite and carried the first live television scenes across the Atlantic Ocean.
[62] The main reason of its failure was because it was not a geostationary satellite, and it was revolved around the earth in 2.5 hours and television programs could not be sent out for longer than 30 to 45 minutes.
[63] "Relay I" was launched by NASA, which was an experimental satellite on December 13, 1962 but it became a silent a year later on December 21. The NASA replaced it with "Relay 2" that provided communications and carried world news scenes covering Europe, East Asia and South America.
[64] "Syncom 2" is the first communications satellite placed in geosynchronous orbit over Brazil in July 26, 1963.
[65] "Early Bird 1" was placed in synchronous geostationary orbit over the Atlantic Ocean and linked the United States and Europe on June 28, 1965. However, it only could operate with five earth stations.
[66] Michiel Hegener: "Telecommunications in Africa- via Internet in particular."
[67] Eli Noam: "Telecommunications in Europe;" Oxford University Press, 1992, p173.

cooperation between the different research departments.[68] The ARPA-NET first connected universities, the military and armament industries. Soon, methods were built into the system for file transfer and for electronic mail (E-Mail).[69] At the beginning, the net kept in function when one or more lines were destroyed and the system automatically switched to another line that was intact between two places. When there came more networks, scientists searched for methods to connect the several systems together so that they could communicate without limits.[70] Thus the Internet was born. Since 1970, the Electronic Time Division Multiplex (TDM) telephone exchange had used in the official telephone net worldwide.[71] The TDM is developed for a better utilization of the telephone channel. The principle of TDM is to transmit several telephone calls over one cable. The Xerox Company put the first telecopy, which the received signals are transmitted by telephone into the market.[72] Compared with the older telephotography, the flat bed system scans the model line for line, projects it on a diode ledge and there it is electronically scanned. The IBM Company also developed Terminals for data-compound-net which are data viewing stations connected to a electronic data processing (EDP) control room by long-distance lines.[73] Terminals principally consist of a monitor and a keyboard. It permitted some geographically separated users to access a central computer system. They are widely used by airports, railway stations, to show the timetables and prices, etc.

In 1972, the first cable TV connections where built in USA.[74] At the beginning, television broadcasts were transmitted only by radio but now the Americans transform it into cable TV networks. These cable TV nets have considerable advantages compared with radio. The reception quality is better than radio, because atmospheric disturbances, aerial problems, wave echoes on mountains and high-rise buildings do not matter at all. The program for TV viewers is considerably larger, because it can bring several parallel programs within one cable net. Later on, an American company named "Hewlett-Packard" put the first programmable pocket calculator into the market in 1974.[75] The functions of the calculator were logic operation, limited program branches and other mathematical and scientific functions. From 1970s, the development of modern telecommunication progressed rapidly and widely even than before. Due to the telecommunication revolutionary, the remotest part of the earth also can be reached via the communications networks nowadays. After the development of the first videotape recorder (VTR) in the mid 1960s, which made it possible to register motions on magnetic tapes, Japanese electronic manufacturers improved the VTR system and put into home market in 1975.[76] On the other hand, due to the creation of computers, the most modern telecommunication tools such as Internet, e-mail, telefax, and online also developed speedily

[68] Christos J. P. Moschovitis, Hilary Poole, Tami Schuyler, and Theresa M. Senft: "History of the Internet: Achronology, 1843 to the Present;" Santa Barbara, CA: ABC-CLIO, Inc, pp 33-62.
[69] Ibid, pp 73-74. Ray Tomlinson, a computer engineer at Bolt, Beranek and Newman (BBN), introduced the @ symbol and the user's server in electronic mail address.
[70] Ibid, pp2-4 & 205-232.
[71] See supra note Murphy, pp 73-75 & 101.
[72] See supra note Oslin, p383.
[73] Ibid, p 366
[74] See supra note Smith, pp278-283.
[75] See supra note Winston pp 233-240.
[76] See supra note Smith, pp 307-308.

like lightning. From 1980, the storage capacity of the microchips increased.[77] The chips are able to register up to 6,400 bits. These highly integrated chips are used in computers as well. In addition, the first pocket computers are placed into the market.

The introduction of broadband technology and in particular of the broadband transmission results in many new forms of telecommunication.[78] Whereas the classical Teletype writers and broadcasting networks used the KHz-widths, the new means of transmission uses the MHz bandwidths. Based on those new technologies, a long-distance telephone conference is possible to realize. Telecommunications between single computers also can be connected through a specific expansion of the telephone, Teletype and data nets. Codified messages can be transmitted either as electronic teletypes in form of Teletype conferences or via monitor using videotext and screen text. In times of moved picture communications videoconferences via fixed TV connections are possible. With the introduction of the multi-channel sound, a new era of sound broadcasting begins from the 1980s. New products including CD-players, Floppy Disks and compact disks read by the laser system were also placed on the market. In 1983, the Personal Computer was born and rapidly stormed the office world.[79] Software programs were also published expression of surprise. During the period of the late 1980s, the satellite telecommunications began the other developmental peak. The artificial comet was initially produced by the means of a satellite in mid 1980s. Since 1985, movable transportations such as ships, aircrafts, missiles and so on could navigate by means of navigation satellites. The US Navy also used a navigation system connect with satellites to investigate maritime presumptions. In addition, the survey of the earth surface could be mapped through space satellites as well.

From the late 1980s, one of the most important telecommunication developments was the Internet.[80] It began as a military project and was then developed by a few scientists into the requisite communication tools nowadays. The Internet now can transmit messages, programs, data, pictures, sounds, and even human voices. After discovered the Internet in the late 1990s, the number of hosts have increased dramatically. Today nearly in every country including governments, colleges, and companies are connected to the Internet and can communicate with the rest of world quickly. For the commercial purpose, many people have their own homepage and thousands of "virtual" businesses offers services via the net. On the other hand, Integrated Services Digital Network (ISDN) is an extension of the public telephone network, designed to carry digitized voice calls, or data, from one subscriber to another.[81] Its main advantages over the conventional telephone network are better voice quality, higher data speeds, lower error rate, faster call setup times and greater flexibility. In the 1950s, there were two main types of public networks including the telephone and the telex networks in most countries. In the 1970s, all major telephone networks were replaced with new digital systems, using cables, which could carry 30 such channels interleaved. By the new development of

[77] See supra note Moschovitis, p 29 & pp 43-45.
[78] Robert K. Heldman: "Information Telecommunications: Networks, Products, and Services;" McGraw-Hill Inc., 1994, pp 119-120.
[79] See Oslin at pp366-370.
[80] John Naughton: "A Brief History of the Future: From Radio Days to Internet Years in A Lifetime," Woodstock, NY: Overlook Press, 2000.
[81] See supra note Heldman, pp 9-17 & 29-38.

ISDN, the speeds and qualities of networks including telephone, telefax, Internet were improved and switched to fit to future necessary.

IV. Changes of International Telecommunication Regime

From the moment of childbirth, newborn babies already can express their feeling by crying, shaking hands, and moving bodies. Obviously, communication is one of human beings' instincts and should be equally protected. By communicating with each other, human's feelings, demands, and opinions can be observed and known. In this way, mankind understands each other and actively exchanges information. In the present time, telecommunication mechanisms are an elemental force, used in almost every aspect of daily lives. Without these mechanisms, the information age would not even exist. Today, telecommunications followed by with new technologies, are developing and increasing speedily and becoming one of the requisite components in our daily life. New communication tools such as cellular phones, telefacsimiles, and the Internet have changed human' lifestyle. Furthermore, historically, "the right to communicate" is one of the fundamental human rights. Reviewing the 1789 French Declaration of the Rights of Man and of the Citizen[82], and the First Amendment of US Constitution Law in 1791[83], it is obvious that people strive for this inalienable right. Not only from the historic legal documents but also from several international agreements including Universal Declaration of Human Rights[84], International Covenant on Civil and Political Rights[85], as well as Convention on the International Right of Correction[86], we can glean the importance of the right to communicate in human's history. Since the right to communicate is

[82] In August 1789, the French people overthrew the old Empire and pronounced the well-known revolutionary manifesto "Declaration of the Rights of Man and of the Citizen". Article 11 of the Declaration stated, "The free communication of ideas and opinions is one of the most precious of the rights of man. Every citizen may, accordingly, speak, write, and print with freedom, but shall be responsible for such abuses of this freedom as shall be defined by law."

[83] US Congress passed the Constitution Amendments, known as "Bill of Rights" in September 1789 and entered in force in 1791. The US Constitution First Amendment states "Congress shall make no law respecting…or abridging the freedom of speech, or of the press; or of the right of the people peaceably to assemble, and to petition the Government for a redress of grievances."

[84] On Dec. 10, 1948 the General Assembly of UN proclaimed the Universal Declaration of Human Rights. Article 19 of the Declaration states "Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers."

[85] Article 19 of International Covenant on Civil and Political Rights:
"Everyone shall have the right to hold opinions without interference.
Everyone shall have the right to freedom of expression; this right shall include freedom to seek, receive and impart information and idea of all kinds, regardless of frontiers, either orally, in writing or in print, in the form of art, or through any other media of his choice.
The exercise of the rights provided for in paragraph 2 of this article carries with its special duties and responsibilities. It may therefore be subject to certain restrictions, but these shall only be such as are provided by law and are necessary:
(a) For respect of the rights of reputations of others;
(b) For the protection of national security or of public order, or of public health or morals. "

[86] Article 11 of Convention on the International of Correction states " Recognizing that the professional responsibility of correspondents and information and information agencies requires them to report facts without discrimination and in their proper context and thereby to promote respect for human rights and fundamental freedoms, to further international understanding and cooperation and to contribute to the maintenance of international peace and security, Considering also that, as a matter of professional ethics, all correspondents and information agencies should, in the case of news dispatches transmitted or published by them and which have been to be false or distorted, follow the customary practice of transmitting through the same channels, or publishing corrections of such dispatches,…"

fundamental, it follows that telecommunication is also fundamental. Because today's technological world, unless face to face, or through the written word, telecommunication is the primary method that people apply to exercise fundamental right to communicate. The right to communicate relates to the fundamental freedoms of freedom of information and free speech. The expression of these rights is the most essential right for human dignity. With the creation of new technologies, it is believed that readily available access to telecommunication is critically important for human beings. However, due to the differences of economic development and resources distribution, there is still a big gap between industrialized and developing countries in access to basic telecommunications. Billions of people still lack essential telecommunications access such as basic telephone lines. It is believed that everyone has the equal right to telecommunicate, to use public services, and to enjoy the beneficial new technologies. Therefore, it is the global goal to assist people living in remote and rural areas to gain basic telecommunications access in order to connect with the outer world. For this purpose, a stable and forceful international telecommunication system is necessary to promote and achieve the goal.

Why is international telecommunication cooperation necessary? First, due to national security and economic benefits, local governments historically controlled telecommunication industries. Thus, many people could not easily telecommunicate with each other across countries and boundaries without governmental regulations. Second, each country also has different standards regarding the model and use of electricity, telephone, telefax, transistor, and network, etc. Ships, aircrafts, missiles, and related transportation instruments once across national borders enter other countries' jurisdictions, and thus will face different legal systems and regulations. Therefore, any "incident" can quickly become an international issue with a criminal dimension when a commercial dispute occurs. Most important, if an unforeseeable maritime or aeronautical distress or mishap occurs, an "across-territories" safety and assistance system is necessary to guide its resolution. These potential events all require international telecommunication cooperation including multi-national telecommunication organizations to negotiate and universal telecommunication agreements to regulate the myriad related issues. In addition, several telecommunication technologies use related limited natural resources such as radio waves or satellite locations. Radio is an indispensable tool for telecommunication use and covers numerous economic and industrial sectors such as television, sound broadcasting, mobile telephones, and internet, etc. The enormous impacts of radio use on our lives have become large and rapid. However, the incorrect use of radio could cause various harmful interferences and thus nullify the benefits. To avoid such interference, the use of radio should be well arranged and regulated. Because the radio frequency spectrum is a limited natural resource and its use does not respect national borders, it is essential that all countries in the world participate in international negotiations and cooperation to resolve this global issue. Therefore, based on the aforementioned reasons, international telecommunication cooperation is urgent and requisite not only for international community but for the whole of humanity.

Founded in 1865, the former and current "International Telecommunication Union" (ITU) has dealt with numerous international telecommunication matters for over one

century.[87] Poised as the most important international telecommunication organization in the world, the ITU has made a great contribution to international telecommunications cooperation as well as technical arrangements. Because the current telecommunication development is progressing so rapidly and facing so many technical and legal issues, a satisfactory global telecommunication system is absolutely necessary and should cover cooperation from a wide array of issues, including living standards, transportation, technology, trade, and investment. For these reasons, there are still many international organizations playing different important roles in global telecommunication cooperation. First, as alluded to earlier, each country has different standards regarding the model and use of electricity, telephones, telefaxs, transistors, and networks. Therefore, the International Organization for Standardization (ISO) has been set up to endeavor to attain common telecommunication standards for the various countries involved.[88] Second, ships and aircrafts passing over national borders need across-territories telecommunication systems to receive reports and assistance when any unforeseeable, commercial or criminal events occur. The International Maritime Organization (IMO)[89] and International Civil Aviation Organization (ICAO)[90] play such a role in global telecommunication cooperation in the area of transportation. Additionally, following the creation of the most advanced telecommunication technologies, satellite operational organizations such as the International Telecommunications Satellite Organization (INTELSAT)[91] and the International Mobile Satellite Organization (INMARSAT)[92] serve as mediators allowing more and more personnel and industries to gain information immediately and to communicate with each other faster. In addition, there are many regional telecommunication organizations that also act to promote international telecommunication cooperation. Those regional telecommunication organizations include the Asia-Pacific Economic Cooperation Working Group on Telecommunications (APEC TEL), ASEAN Telecommunication Regulators' Council (ATRC), European Conference of Postal and Telecommunications Administrations (CEPT), European Radiocommunications Committee (ERC) and European Radiocommunication Office (ERO), European Committee for Telecommunications Regulatory Affairs (ECTRA) and European Telecommunications Office

[87] Headquartered in Geneva, Switzerland, the ITU is an international organization within which governments and the private sector coordinate global telecom networks and services.

[88] The ISO is a non-governmental organization to handle standards issues. Comprised of over 130 countries, the ISO is to promote the development of standardization in the world with a view to facilitating the international exchange of goods and services, and to developing cooperation in the spheres of intellectual, scientific, technological and economic activity. The ISO's work results in international agreements that are published as International Standards.

[89] Located in London, England, the IMO is the United Nations' specialized agency responsible for improving maritime safety and preventing pollution from ships. One of the most important agreements within the IMO is the London Convention 1972.

[90] Headquartered in Montreal, Canada, the ICAO is one of specialized agencies of the UN. It deals with international aviation issues including standardization, technical cooperation, regional planning, as well as communications, navigation, surveillance and air traffic management (CNS/ATM), etc. The heart of the ICAO is the Convention on International Civil Aviation.

[91] The INTELSAT is one of the most important satellite communications organizations to serve governmental, industrial, and commercial sectors globally. The INTELSAT owns 17 geostationary satellites consisted of superior spacecraft. The aims of the INTELSAT are helping people communicate worldwide and providing a wide range of satellite services for telecommunications applications, such as voice, data, Internet, corporate networking and video services.

[92] Established in 1979, the aims of the INMARSAT are to serve the maritime industries by developing satellite communications for ship management and distress and safety applications, INMARSAT currently operates a global satellite system which is used by independent service providers to offer a range of voice and multimedia communications for customers on the move or in remote locations.

(ETO), European Telecommunications Standards Institute (ETSI), and Inter-American Telecommunication Commission (CITEL).[93] It readily apparent that the Asia-Pacific region, European Union, and Americas enjoy different levels of telecommunication development and have different levels of telecommunication cooperation.

The other important international organization concerning telecommunication cooperation is the World Trade Organization (WTO).[94] In 1994, 125 countries participated in the Uruguay Round of Multilateral Trade Negotiations and signed the Final Act under the structure of GATT in Marrakesh. This Round created a new trading system, the WTO, to replace the former GATT. Additionally, the new WTO also promulgated the General Agreement on Trade in Services (GATS) to bring services into future negotiations. The GATS contains the traditional GATT provisions, including specific commitments and specific annexes including movement of natural persons, financial services, telecommunications, air transportation services, as well as maritime services. The newly developed WTO is negotiating and revising the General Agreement on Trade in Services (GATS) to expand WTO's obligations and disciplines into services including movement of natural person, financial services, telecommunications, air transport services, and maritime services. Meanwhile, telecommunication posed special difficulties and the WTO took a long time to achieve an acceptable resolution – the GATS annex on Basic Telecommunication. Although each country has different telecommunication policies and regulations, it is believed a freer global telecommunication market together with future negotiations within the WTO will attain the goal of "the right to telecommunicate" so that human beings can communicate each other without unnecessary restrictions.

Foreign investment recently has rapidly increased and covers a wide spectrum of industries. Foreign investment capital generally spurs economic growth and creates better living standards in the invested countries. From an economic standpoint, international investment theoretically mutually benefits each side but its related regime and legal protection are still not yet completed, especially in the realm of telecommunication. Many developing countries fear that by opening their markets to competition and foreign investment without any restrictions, they will be losing control of strategic industries. Although foreign investment in telecommunications brings technological skills, funds and market competition, and will benefit national telecommunications development, many countries measure policy requirements to control and guide foreign investment to correspond to their economic and developmental strategies. Telecommunications have substantial and essential influences on national security, social stability and economic development, and many other industrial sectors. Due to its particular character, telecommunication industries are often state-operated and monopolized in many countries. Thus the balance between economic gains from foreign investment and national telecommunications sovereignty presents a challenge. Lacking basic telecommunication infrastructure as well as adequate funds and skills, many developing countries are keen on attracting foreign investment to develop their telecommunication

[93] On June 11, 1993, the General Assembly of Organization of American States (OAS) created the existing Inter-American Telecommunication Commission (CITEL) to deal with telecommunications issues within the western hemisphere.
[94] The WTO is an international organization dealing with the rules of trade between countries. At its heart are the WTO agreements, negotiated and signed by the bulk of the world's trading nations and ratified in their parliaments. The goal is to help producers of goods and services, exporters, and importers conduct their business.

equipments. The flow of capital and foreign direct investment from industrialized countries to developing or less-developed ones can improve insufficient telecommunication environments in remote areas and fix the telecommunication gaps between them. Both international cooperation and foreign investment will benefit developing countries' telecommunication development and have the potential to achieve the ideal of "universal access."

V. Conclusion

Because telecommunication plays an important role in human's daily life, without it, the information age would not even exist. However, due to the differences of economic development and resources distribution, there is still a big gap between industrialized and developing countries in access to basic telecommunications. From the point of human right, it is believed everyone and every country has the equal right to communicate, to use public services, and to enjoy the benefit of new technologies. For example, with a good telecommunication system, the people living in the remote areas can get necessary information to improve their medicine, education, and living condition. Therefore, it is the global goal to assist people living in rural areas to get basic telecommunications to access and connect with the outer world. For this purpose, a stable and forceful international telecommunication system is necessary to promote and achieve this goal.

In addition, each country has different standards regarding the model and use of telephone, telefax and network. Ships, aircrafts, and related movable transportation tools once across national borders and enter other countries' jurisdictions will face different legal suits and become an international issue if any criminal events or commercial disputes happen. Most important of all, if unforeseeable maritime or air distress caused, an across-territories assistance network is necessary to guide this problem. Those all need international telecommunication cooperation to negotiate and make universal telecommunication agreements to regulate related issues. Because the radio frequency is a limited natural resource and its use does not respect national borders, it is necessary that all countries in the world process international negotiations and cooperation to resolve this global issue. Therefore, based on those reasons, international telecommunication cooperation is necessary not only for international community but for the whole human beings.