

# Latin American Telecommunications Networks

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HIS ARTICLE DESCRIBES TELECOMMUNICATIONS systems in Latin America with specific details of networks in Colombia, Uruguay, and Costa Rica. The points of view and comments in this article are the sole responsibility of the author and not necessarily the views of the Organization of American States (OAS), the Inter-American Telecommunications Conference (CITEL), Administrations, or their representatives.

## Early History

The first reference to telecommunications in Latin America is found in an article by Marcus Vinicius Carvalho Rodrigues of Brazil. He described the history of Brazil's telegraph system. Work began on January 22, 1808 with the arrival, in Brazil, of D. Joao VI, who led the first installations of semaphores, i.e., optical telegraphs in Morro da Babilonia, do Castello, Villegagnon, and the Fortaleza de Santa Cruz. Inauguration of the first telegraphs occurred in 1857 with the first line between Rio de Janeiro and Petropolis in Brazil. This was followed in 1860 with a telegraph between Buenos Aires and Moreno, Argentina; 1863 in Paraguay; 1865 in Colombia; and 1870 in El Salvador.

Submarine telegraph cables were laid in 1870 by the British Western Telegraph Company of the West Indies and the Panamá Telegraph Company. These were placed in the Antilles between Santiago de Cuba and Jamaica. In 1873, the British Eastern Telegraph Company began operation of the first submarine intercontinental telegraph cable between Portugal and the coast of Brazil. It continued to expand to Uruguay and Argentina along the Amazon River.

In 1882, All American Cables Inc., began to lay submarine telegraph cable towards Latin America, interconnecting with the segment from Vera Cruz-Coatzacoalco on the eastern coast of México. From that city, a land cable was installed to Tehuantepec. From Tehuantepec, the Inter-American submarine cable extended southward. From each southward landing, terrestrial systems provided services into the various countries. In that same year, submarine cables landed at Chorrillos, Perú. In 1891, cables were placed in Iquique, the North of Chile. Meanwhile, in 1890, a long surface telegraph line crossing the Andes was constructed between Santiago de Chile and Buenos Aires, where Chile enters the telegraph communications network with Europe, and through it, with the U.S. In 1906, Pacific submarine cables were placed to Valparaiso in Chile, interconnecting via terrestrial links to the Atlantic cables.

Table I. Main Telephone Statistics in Colombia\*

Administration	Lines	Contract
ETB-Bogotá	1,163,354	168,646
EP-Medellín	614,400	122,000
EM-Cali	278,812	89,000
TELECOM	300,830	182,667

Source: Ministerio de Comunicaciones de Colombia.

\* As of 12/31/90

## American International Conferences

Between October 2, 1889, and April 19, 1890, in Washington, D.C., the First American International Meeting was held to establish the International Union of American Republics. This was later renamed the OAS. Two Commissions were created to study electrical communications matters between the member countries. The Commissions recommended a submarine telegraph cable between San Francisco and Valparaiso.

The First International American Conference held in Santiago, March 25–May 3, 1923, made several important decisions regarding Inter-American Telecommunications. One determined basic principles, and another created the Inter-American Electrical Communications Conference, predecessor of the current CITEL. The First Electrical Communications Conference, was held in México City from May 27–June 22, 1924. The conference covered the following:

- Conventions and Legislation
- Telegraph Communications and Cables
- Radio Communications
- Tariffs, Accounting, and Traffic

On December 13, 1937, the Inter-American System established a permanent office of telecommunications in Havana, Cuba, and was named the Inter-American Radio Office (OIR). This Inter-American Telecommunications process continued until 1959.

## Inter-American Telecommunications, CITEL

During the 1959 Plenipotentiary Conference of the International Telecommunication Union (ITU) in Geneva, represen-

Table II. Telephone and Telex Lines in Colombia\*

Year	Lines	Subscribers	
		Telephone	Telex
1980	1,322,285	1,075,700	4,340
1982	1,562,780	1,293,030	5,050
1984	1,931,420	1,506,427	5,795
1986	2,146,952	1,798,793	6,251
1988	2,372,920	2,070,710	6,452
1989	2,627,456	2,176,541	6,160
1990	2,890,338	..	..

Source: Ministerio de Comunicaciones de Colombia.

\* As of 12/31/90

tatives from Latin America agreed with the requirement to plan and implement an Inter-American Telecommunications Network (RIT). A Planning Committee for Latin American Projects was created, i.e., an International Consultative Committee for Telephone and Telegraph/International Radio Consultative Committee/ITU (CCITT/CCIR/ITU) Committee directed by Carlos A. Nunez Arellano, from México. The Mexican government sponsored the first meeting in May 1960, with the OAS; the first Inter-American Telecommunications Experts meeting.

This was followed by an OAS sponsored meeting in Washington D.C., July 9-18, 1962. The Experts recommended the creation of an Inter-American Telecommunications Committee, that would manage everything related to RIT improvements. This committee was authorized by the Inter-American Economic and Social Council (CIES) in Sao Paulo, Brazil, in 1963, and became CITEL.

The OAS General Assembly elevated CITEL to a Specialized Conference on April 7, 1971.

In September 1991, the 6th CITEL will be held in Santiago de Chile, at Ministerial Level. It is expected that its members

Table III. Colombian International Circuits\*

Country	Circuits	Country	Circuits
U.S.	1,191	Costa Rica	18
Venezuela	125	Switzerland	18
Ecuador	73	Argentina	18
Spain	68	Chile	15
Panamá	47	Netherlands	14
Italy	44	Curaçao	12
U.K.	36	Puerto Rico	12
France	36	Sweden	12
Germany	35	Japan	10
México	32	Austria	8
Brazil	24	Belgium	8
Canada	24	Dominican Republic	8
Peru	23	Bolivia	8

Source: Empresa Nacional de Telecomunicaciones-Colombia.

\* As of 12/31/90

Table IV. Lines and Telephone Sets in Uruguay

	Línes		Sets
	12/31/87	12/31/88	12/31/88
Montevideo	223,034	238,141	354,755
Interior	88,950	107,249	126,809
<b>Total</b>	<b>311,984</b>	<b>345,390</b>	<b>481,564</b>
Lines/100 ha	10.8	11.7	16.4
Coin Sets	3,013	3,443	...

Source: Administración Nacional de Telecomunicaciones.

will take strong and concise measures aimed at strengthening CITEL. CITEL will coordinate the implementation of a new RIT utilizing new technologies with worldwide standards and policies.

## Latin American Telecommunications Networks—Specific Differences

Latin American Telecommunications networks have deep differences with the U.S. networks.

In October 1967, CITEL decided that R2 would be the signaling system between Latin American countries. Consequently, the great majority of switching systems installed in Latin American countries are of Japanese or European construction. North American industries, at the time, did not produce this type of equipment although the product was available at subsidiary locations outside the U.S. Rules adopted by CITEL for transmission equipment recommended application of ITU standards. This is why the frequency allocations for radio channels, levels, and auxiliary equipment are different from the North American system. The great majority of Latin American countries adopted TW39 at the start of their Telex systems installations. These differ from North American systems.

In the planning of domestic networks, the ITU collaborated closely with engineers. This resulted in more opportunity and variety in the selection of equipment suppliers for the various domestic administrations.

Other approaches involved financing. In 1950, Administrations obtained credit directly from suppliers. In 1959, at the initiative of México, Plenipotentiary Conference participants agreed to the famous Resolution 24, i.e., to finance the development of telecommunications in a manner that allows international banks to offer credit at low-interest rates with long grace periods for payback.

## Current Latin American Networks

All twenty countries of Central and South America, except Panamá and Colombia, are interconnected with their neighbors by means of terrestrial microwave networks. A majority of transmission trunk networks in 4 and 6 GHz have a typical

Table V. Telex Traffic (Paid Minutes) in Uruguay

	Domestic	International
1984	172,181	1,970,102
1985	149,857	2,107,245
1986	148,673	2,423,923
1987	149,673	2,671,943
1988	1,010,394	2,627,807

Source: Administración Nacional de Telecomunicaciones.

Table VI. Uruguay's International Telephone and Telex Number of Circuits\*

	Telephones	Telex
<b>Land Links through Argentina:</b>		
Paraguay	8	
Brazil	6	31
Paraguay	3	5
<b>By Satellite:</b>		
U.S.	63	113
Spain	30	6
Italy	17	17
U.K.	11	22
Canada	8	
Venezuela	8	
Germany	7	22
France	7	8
México	6	
Switzerland	5	6
Northern Countries	4	
Chile	3	
Perú	3	
Holland	3	
<b>Land Links Microwaves:</b>		
Argentina	363	49
Brazil	39	
<b>Total</b>	<b>594</b>	<b>279</b>

Source: Administración Nacional de Telecomunicaciones.

\* As of 12/31/88

capacity of 300, 960, 1,200, or 1,800 circuits per radio channel. The layout of these networks started at the end of 1960. Some have been modified or replaced with digital transmission systems.

Long distance switching and signaling systems R2 are established in all countries using crossbar switching systems. All countries have direct long distance dialing.

All countries have a minimum of one antenna for satellites used for international communications via International Telecommunications Satellite Organization (INTELSAT) systems. For satellite communications, the CCITT-5 signaling system is used.

Brazil, the Dominican Republic, Panamá, and Venezuela use submarine cables for traffic to the U.S. Brazil and Venezuela also have direct cables for traffic to Europe.

Most data systems are private. Equipment and operations are the responsibility of entities such as banks and airline companies.

Operation, administration, maintenance, and provisioning of public telecommunications services is the responsibility of respective governments, except Argentina, Chile, and TELMEX in México.

## Problems With Latin American Telecommunications

Latin American governments do not give priority to implementation and broadening of systems in use inside the economic theater of the country. Although telecommunications are well planned and administered, the economic default rate is very high. Telecommunications companies depend on the government for expansion and better service. Governments distribute resources according to need, at a national level, con-

sidering not only telecommunications but also all other sectors of the economy. This causes telecommunications companies to be subfinanced. Expansion and improvement can be accomplished only in part.

To avoid these problems, a few countries are trying to implement new laws that will permit the flow of private sector capital. Telecommunications development will proceed through associations with government, joint ventures, or concessions.

## Typical Latin American Networks

The following are details of telecommunications networks in Colombia, Uruguay, and Costa Rica. All information has been provided by the respective administrations.

### Colombia

#### Long Distance System

The Colombian domestic long distance telecommunications system is operated by the government owned National Enterprise, TELECOM, founded in 1947. In 1953, TELECOM started domestic network planning using Very High Frequency (VHF) in the 250 MHz trunk network. The network was installed and constructed by RCA with a capacity per radio channel of 93 voice grade circuits. Repeater hops were a little more than 100 mi., and in one important repeater a 100 ft. diameter antenna system was installed at 12,000 ft. above sea level. For domestic long distance switching, type ARM-20 crossbar equipment was used from L.M. Ericsson, of Sweden. The telex and domestic television system was contracted with Siemens equipment from Germany. In Bogotá, June 1954, the first television channel was activated and a new government company was created for its operation. The designer of the system, the English Consulting Company, Preece Cardew, and Rider, was contracted by TELECOM for the supervision and coordination of system installation by each of the suppliers.

Semiautomatic telephone service was initiated toward the end of 1958 between the capitals Bogotá, Medellín, Cali, Armenia, Manizales, Barranquilla, and Pereira. National telex service began toward the end of 1958, extending throughout the country by 1960.

In 1958, fifteen central telex operators were in service with 850 subscribers. In 1960, the national VHF telecommunications system was completed.

In 1950, international telegraph service was inaugurated from Bogotá to the U.S. (White Plains) and Europe (Hamburg) with multiplexer (mux) equipment.

In 1964, a detailed plan was developed to lay a submarine cable to the U.S., shared by Panamá. This project was never accomplished since another project, in 1968, was preferred involving the construction of an earth station in Choconta that became operational in 1970 as part of the INTELSAT system.

Between 1965 and 1966, a new national system was planned at 4 GHz (1,200 voice grade circuits per radio channel) to replace and expand VHF. This system implemented equipment from Nippon Electric Company. Its operation began in 1968 between Bogotá and Cali.

In 1966, the color television system (SECAM) was tried in Bogotá. North American Television Standards Committee (NTSC) was adopted in 1974.

Table VII. Telephone Subscribers and Per 100 Population in Costa Rica\*

	1988	1989	1990	1991
<b>Telephone Subscribers</b>	<b>241,927</b>	<b>156,175</b>	<b>278,294</b>	<b>294,341</b>
<b>Per 100 Population</b>	<b>13.5</b>	<b>13.9</b>	<b>15.2</b>	<b>16.0</b>

Source: ICE.

\* As of 12/31

Table VIII. Costa Rica's Exchanges Telephone Lines\*

	1988	1989	1990	1991
Digital	50,000	57,000	65,000	65,000
Analog	239,916	242,802	241,238	245,663
Manual	2,344	2,644	2,063	1,983
<b>Total</b>	<b>292,260</b>	<b>302,446</b>	<b>308,301</b>	<b>312,646</b>

Source: ICE.

\* As of 12/31

Strong domestic network growth has been started using digital systems to enlarge and replace the current microwave network. The new network will have a 1,920 voice grade circuit capacity per radio channel with 3,840 circuits between Medellín-Barranquilla and Bogotá-Choconta.

International Date Rate (IDR) technology will be introduced into the International Satellite system by the end of 1991.

### Domestic Telephone System

A domestic cellular mobile telephone network will be developed.

The local telephone system is operated by several dozen municipal and government companies and TELECOM.

Automatic dialing was started in 1928 in Pereira City, with the first step-by-step selectors. Bogotá inaugurated the first automatic central telephone system in December, 1948.

Main telephone statistics, telephone and telex lines, and international circuits are shown in Tables I-III.

### Uruguay

The National Domestic Telecommunication Administration (ANTEL) is one of the most recent domestic telecommunication companies in Latin America. It was created by an Executive Power decree in August 1974.

However, telecommunications history started in Uruguay 125 years ago, when the telegraph was installed between Montevideo and Buenos Aires, in February 1878. Other important events are:

- Telephone and wireless telegraphy—1904
- Radiotelephone—1922

Table IX. Circuits in Costa Rica

	1988	1989	1990	1991
Digital	12,840	11,941	18,441	21,591
Microwave	1,080	836	3,626	5,156
PCM Wire	11,760	9,185	9,505	9,925
Fiber Optics	0	1,920	5,310	6,510
Analog	7,798	18,402	18,738	19,099
Carrier	3,564	5,134	5,470	5,831
Microwave	4,234	6,310	6,310	6,310
Trunk Cables	0	6,958	6,958	6,958
International				
Analog	600	600	699	540
Digital	0	0	0	60

Source: ICE.

Table X. Satellite Circuits in Costa Rica\*

Country	Circuits
U.S.	352
Spain	24
Colombia	18
Italy	15
Canada	12
France	11
Venezuela	10
U.K.	9
Germany	9
Brazil	8
Perú	7
<b>Total</b>	<b>475</b>

Source: ICE.

\* As of 1/31/91

- Teletype—1928
- Automatic telephone—1933
- Telex—1954
- 3 kW radiophone output—1955
- Commercial television—1956
- Manual international telex—1964
- Microwave transmission—1968
- Satellite communications—1978
- Color television—1980

From 1866-1887 telegraph services were operated by private companies. In 1882, a government department was created for this purpose; the General Postal Services and Telegraph Department.

In 1915, postal services, telegraph, and telephones were nationalized, while still granting private concessions for telephone services.

In 1931, the Administración General de Usinas Eléctricas y Teléfonos del Estado (UTE), was tasked to enforce the private enterprise laws of 1915.

Between 1933 and 1973, the telephone capacity of Montevideo went from 22,000 to 158,000 telephones. In the interior, it increased from 11,000 to 48,000 telephones.

The microwave network, installed in 1968, between Uruguay and Buenos Aires permitted automation of international telephone service between those countries. Additionally, through Buenos Aires, Uruguay had direct access to the national networks of Brazil, Chile, and Europe.

### Long Distance System

The microwave long distance network of Uruguay joined various cities that surround the country and those that are under the north-south network.

Lines and telephone sets, telex traffic, and international telephone and telex circuits are shown in Tables IV-VI.

### Costa Rica

The government of Costa Rica assigned the Instituto Costarricense de Electricidad (ICE) (the state owned electric utility) with the planning, installation, and operation of the country's telecommunications system.

Table XI. Telephones in Latin American Countries\*

	1950	1960	1970	1980	1990 (Estimated)
Argentina	652	985	1,452	2,125	3,500**
Bolivia		24	43	351	447
Brazil	550	1,025	2,001	7,500	10,800
Chile		194	370	570	1,003***
Colombia		295	975	1,322	2,890
Costa Rica		16	62	236	280
Dominican Republic		21	48	165	382
México	300	523	1,510	5,084	8,500
Panamá		29	105	192	407
Perú		109	225	490	915

Source: 1950-1980: "The World's Telephones," AT&T.

\*\* Argentina : Consejo Nacional de Telecomunicaciones.

\*\*\* Chile : Carlos M. Haramoto N. "Chilean Telephone Development and the Current Telecommunications Policies".

\* X 1,000 as of 12/31.

ICE has been responsible for technical and administrative staff training since it was initiated in 1963. Training has been so successful that their engineers collaborate extensively in expansion of the telecommunications networks of other countries. ICE has one of the most successful records in Latin America in international call completions.

In 1960, Costa Rica had 16,000 telephone lines, this increased to 35,706 by 1970, with a telephone density of 4.4%.

Between 1963-1970, ICE proceeded to develop the first phase of the National Plan for Telecommunications, based on VHF/Ultra High Frequency (UHF). By the end of 1970, a new phase of the plan began utilizing microwave systems of 300 and 960 circuits per radio channel. Two new phases well under way are: 1983-1992 the domestic digital network, and after 1992, the international digital network.

Simultaneously, between 1990-1991, fiber optic and Pulse Code Modulation (PCM) lines are being installed.

ICE Telecommunications network statistics are listed in Tables VII-X. Table XI summarize telephone growth in some Latin American countries.

## Biography

**Mario Pachajoa-Burbano** is a graduate of civil engineering and electronics from Cauca University, Colombia. He was Department Head for Planning for National Telecommunications, TELECOM, of Colombia, in 1967. Mr. Pachajoa joined the OAS as an adviser in telecommunications. In 1972, he assumed the functions of Permanent Secretary of CITELE and has worked for the most part with Latin American countries in matters of telecommunications.