From National Hierarchies to International Standardization: Historical and Modal Changes in the Coordination of Telecommunications

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Abstract

The convergence of telecommunications and computer technology stimulated a global expansion of networks and services which was accompanied by a deregulation of this industry. In the liberalized worldmarket a great number of heterogeneous actors must coordinate the development and production of technology as well as the provision of new services. The old mode of hierarchical coordination internalizing technical, economic and political control, which originated from the sovereign state system of earlier decades, could not be transformed into transnational hierarchy. Thus coordination is widely restricted to achieving technical compatibility of telecommunications systems. A network of international and regional standardization committees, growing in number, has evolved. They issue the required technical recommendations, which are usually more complementary and optional than substitutive, so that division of labor instead of competition prevails.

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Die Konvergenz von Telekommunikation und Datenverarbeitung hat eine globale Expansion von Netzen und Diensten ausgelöst, die von einer Deregulierung des Sektors begleitet wurde. Eine Vielzahl heterogener Akteure auf dem Weltmarkt muß die jeweiligen Entwicklungs- und Produktionsaktivitäten ebenso wie das Angebot neuer Dienste koordinieren. Der alte Modus hierarchischer Koordination, der technische, ökonomische und politische Steuerung internalisierte und sich in der Ära souveräner Nationalstaaten früherer Jahrzehnte etablierte, ließ sich nicht in eine transnationale Hierarchie transformieren. Koordination beschränkt sich daher auf die Herstellung technischer Kompatibilität von Systemen der Telekommunikation. Es hat sich ein Netz internationaler und regionaler Standardisierungsgremien herausgebildet, das ständig größer wird. Diese Gremien erarbeiten die benötigten Empfehlungen, die eher optional und komplementär als substitutiv sind, was eine Arbeitsteilung anstelle von Konkurrenz begünstigt hat.

Contents*

Abstract 2

1 Introduction 5

2 Large Technical Systems in National Containment: The Old Order in Telecommunications 6

3 From National Isolation to Minimal International Coordination 8

3.1 Modes of International Coordination: Some Theoretical Considerations 9

3.2 The Long Road to Little International Coordination 11

4 Trans-border Expansion of Telecommunications and the Erosion of the Old Order 15

5 Technical Systems' Compatibility Requirements and the Proliferation of International Standardization 23

5.1 Basic Problems of International Standardization Procedures 24

5.2 The Proliferation of International Standardization Organizations 27

6 Conclusion 35

Bibliography 37

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1 Introduction

Technical standards, especially compatibility standards, have gained considerable attention in recent research and economic modelling. Their increasing significance has been stressed for the national and more so for the regional and international level. Large volumes of technical recommendations and standards were issued within the last two decades, many of them by international standardization organizations. The proliferation of international and regional organizations only in the area of telecommunications, has inspired a Sydney lawyer to publish a compendium of more than a hundred "International Telecommunications Standardization Organizations" including regional organizations and larger international standardization "projects" (Macpherson 1990).

The rapid growth of the number of committee-based standards and of international standardization organizations is associated with a trans-border enlargement of telecommunications networks and their expansion into or convergence with data-processing systems resulting in growing complexity. This complexity can impede further enlargement and transnational integration of the large telecommunications system. But there are, of course, also social and political barriers to growth.

This paper focuses on the historical and systematic relationship between system enlargement, coordination and control in telecommunications. How can coordinated development be managed and who shall control the large transnational system(s)? What do standards contribute to development and control and what is the role of international standardization organizations in this process?

We present and analyze empirical material starting with some relevant aspects of the old order in telecommunications (chapter 2). In the first period of trans-border expansion this order remained widely unaffected and was only supplemented by some elements of international coordination of national domains within the framework of the International Telecommunication Union to be highlighted in chapter 3. A need for new modes of international coordination has emerged in the context of accelerating global expansion of telecommunications with new actors appearing on a deregulated stage - business organizations in addition to telephone administrations. A short description of this process (chapter 4) will be followed by a look at the ecology of standardization organizations. The landscape of these organizations has changed as much as the process of standardization seems to be changing. We refer to some basic features of this process as well as to the

problem of cooperation and competition between the multitude of organizations (chapter 5). In a short conclusion of our analysis (chapter 6) we argue that international standardization does provide a solution to the problem of technical coordination of globally expanding communications networks, but no equivalent mode of political coordination and control has evolved yet.

2 Large Technical Systems in National Containment: The Old Order in Telecommunications

In telecommunications more than in other industries, the evolution of institutional structures governing international coordination in general and technical standardization in particular was shaped by the regulatory and organizational structures on the national level. Until recently this level was rather homogeneous throughout the industrialized world. National telecommunications relied on an encompassing cognitive and normative *concept* that guided its organization and was reinforced by the emerging technical architecture.

This traditional concept rests on two basic principles (see Hutcheson Reid 1985: 4-5). The first holds that telecommunications networks display characteristics which in economic terms are depicted as a 'natural monopoly'. The second postulates extensive public control of the telecommunications sector to be necessary to secure certain functions essential to the public interest.

(1) The theory of natural monopoly states that under certain conditions, which are supposed to prevail in telecommunications, a monopolistic market is likely to emerge (Baumol/ Panzar/ Willig 1982). Due to technical indivisibilities and related economies of scope a strong incumbent firm enjoys an enduring competitive advantage.[1] Its market is protected by high barriers to entry for potential competitors. Public control and intervention into such a monopoly is perceived as legitimate in order to prevent the monopolist to abuse his position.

(2) The other argument for public control maintains that certain politically wanted and socially essential functions will be underprovided, if allocation decisions in the telecommunications domain are exclusively driven by cost

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1 The 'cost sub-additivity'-phenomenon of the monopolistic mode of service provision means that a single firm can produce all a market can take at lower costs than several competing suppliers. A competitive market under this circumstance is a sub-optimal and inherently unstable governance mode (see Sciberras/ Payne 1986: 6).

considerations, be it in a monopolistic or in a competitive context. These functions include infrastructural support for military communication purposes[2] and the goal of universal public telecommunications services. It is argued that this requires a nation-wide provision of telecommunications services on a uniform and equitable basis. Here public regulation is needed to reduce the role of cost considerations in the provision and allocation of services. In the politically influenced system of prices for telecommunications services it is quite common that cross subsidization occurs. Services sold in metropolitan areas may subsidize those offered in rural areas and long-distance lines may subsidize local loops or vice-versa. This is, however, only sustainable if there is no competition in the profitable segments of services.

The prevalence of the two basic principles ultimately produced worldwide a rather homogeneous "organizational paradigm" (Schneider 1991: 25) which remained stable until recently. A single network operator - either owned or tightly regulated by the state - provided all telecommunications services. Whether the operator was a public administration, a PTT[3], as in most countries or a private corporation like AT&T in the United States, was of minor importance with respect to corporate behavior.

Another relevant feature of the traditional governance structure in telecommunications is a certain degree of vertical integration in this sector. Research and development, design and manufacturing of telecommunications equipment were directly or indirectly controlled by the PTTs.[4] Where the PTT could not directly influence the decisisons of the small circle of national manufacturers it could secure compliance through its procurement power. In the shadow of the PTTs, national technical coordination was achieved through small groups of technical experts from the manufacturing firms, interested government agencies, large telecommunications users like banking and insurance companies and the PTT.

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2 For the relevance of military considerations concerning, for instance, the geographical or spatial design of the German **public** telephone network up to World War II see Thomas (1988).

3 The familiar acronym PTT for Post, Telegraph and Telephone Administration indicates that usually the public monopolies also comprised postal services.

4 In some cases this control was based on direct organizational integration, as in the US, but in most countries the production and operation of telecommunications technology were organizationally separated. But even then the network operator controlled most of the decisions relevant to the development, integrity and operation of the network including, of course, the attuning of design and interface specifications for technical compatibility.

The telecommunications domain was clearly hierarchically structured. This structure produced - and was later reinforced by - a fragmentation of the world into sheltered national markets. In this sense the factors discussed above also account for the closed international trading structure in telecommunications technology. National security and social motives favored all vital parts of the telecommunications network to be produced by national manufacturers. Labor market and industrial policy concerns provided additional support for this interest. As a consequence the national PTT was obliged to buy national and, if needed, the national market was additionally protected from foreign competition.

The national markets, developing in isolation from each other, locked into rather different paths of technical development. Which path a market took was largely determined by the particular problems and concerns, concepts and biases, strategies and interaction sequences that ruled the processes within the national telecommunications domain at certain branching points of technical development. They were embodied in the technical layout of the national network. The result was considerable technical diversity of the different networks, which precluded the interchangeability of equipment. Technical components designed to match the historically developed specific features of one country's network could only be adapted to another network at high costs. More frequently technical specifications of networks were either proprietary or not transparent enough to provide a basis for competitive design.

3 From National Isolation to Minimal International Coordination

The only contact between the self-contained national systems was through the conjoint provision of international services. This was arranged on the basis of bilateral operation agreements between the PTTs. They fixed the administrative and technical conditions of providing a service between the respective countries. Administrative rules detailed the procedures for collecting and apportioning tariffs. Technical agreements defined the operating procedures and arranged for technical *compatibility* of the networks *at the network interconnection points.*

Especially in Europe, where many states crowded a geographically small area, a multitude of bilateral agreements would have been necessary to establish international traffic including transit modalities. Here it was recognized very early that the application of common terms would greatly enhance the

efficiency and diffusion of international services. Thus, in Europe the first attempts were made to coordinate international telecommunications.

Before the historical development of international coordination in telecommunications will be analyzed in more detail, we discuss which options to achieve coordination exist from a theoretical point of view.

3.1 Modes of International Coordination: Some Theoretical Considerations

From a theoretical perspective different "organizational" solutions to the problem of international coordination are available. With Commons, one of the founders of "institutional economics", we distinguish two general modes of coordinated collective action, the "corporative" and the "regulative".[5] The corporate mode of international coordination implies that the states empower an agency to act on their behalf. They consent to be legally bound by the decisions of the agency, i.e. the states create a transnational agent and transfer sovereign rights to it. What evolves is a formally legitimized transnational "hierarchy". The regulative mode achieves coordination decentrally, creating a system of formally binding norms and rules, which set limits to or regulate the states' freedom of action by changing the cost and benefit structure of individual strategies (Stein 1982: 301). Some kind of body or bureau may be commissioned to give assistance and legal advice, but it has no competence to act on behalf of the states.[6] This regulative mode has the form of an international law or treaty and is often called an international "regime".[7]

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5 In the 1930s Commons spoke of concerted action instead of coordination. In the corporative form, individual actors create a new corporate body entrusted with the right to act and negotiate within a specific area in the name and interests of the founders, respectively members. Thereby individual action is excluded in that specific area. Within the regulative mode, actions are still taken by individual actors who are committed, however, to abide by specific rules, laws or norms that restrict their actions. Individual action is not excluded but limited (Commons 1961: 342; see also Schneider/ Werle 1990).

6 The implied distinction of a transnational and an international mode of coordination is widely similar to Huntington's distinction of transnational and international organizations, but we put less emphasis on organizational aspects. Huntington depicts international organizations as requiring accord among nations, whereas transnational organizations require access to nations. "International organizations embody the principle of nationality; transnational organizations try to ignore it" (Huntington 1973: 338).

7 In contrast to Krasner's (1982: 186) definition of regimes as "sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors' expectations converge in a given area of international relations" we favor a more restricted definition treating regimes as "multilateral agreements

Corresponding to the different modes there are different means of coordination available. Hierarchies rely on authority whereas regimes use regulations.

Diagram 1: Four Modes of International Coordination

Formal Obligation	Mode of Collective Action: centralized/ corporate	Mode of Collective Action: decentralized/ regulative
high (binding)	Hierarchy (Authority)*	Regime (Regulation)
low (voluntary)	Hegemony (Power)	Committee (Recommendation)

* Means of Coordination

In an international context these two types of de jure agreements are often difficult to accomplish. In some areas like technical coordination states may hesitate to generally agree to the imposition of binding norms.[8] Technical change, for example, might be impeded by static legal conventions. Thus other forms of coordination evolve which can be called de facto solutions. The explicit distinction of de jure and de facto arrangements provides for a second dimension of corporative and regulative coordination. Diagram 1 shows that in addition to de jure hierarchy and regime two forms of de facto coordination can be identified. The de facto corporate solution can be designated "hegemony". Here the states do not consent to be bound by the decisions of the agent, but have no viable alternative to do so because of the

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among states which aim to regulate national actions within an issue area". This definition addresses regimes as "examples" of cooperative behavior. They "facilitate" cooperation, but cooperation can also take place in the absence of regimes (Haggard/ Simmons 1987: 495). Regimes presume interdependence of autonomous actors, who voluntarily eschew independent decision making in certain issue areas (Stein 1982).

8 Also contradicting political ideology or a generalized conflict may hinder nations to come to any legally binding arrangement.

high opportunity costs involved.[9] The de facto regulative form of coordination takes the form of negotiation systems or, what in our context shall be called, "committees". Here states and other actors or their delegates congregate on a voluntary basis. Both procedural and membership rules for a specific arena can be provided by a regime, but negotiation systems may as well be established ad hoc. The decisions of committees usually have the nature of recommendations, the observance of which is voluntary. In the technical domain these recommendations are generally called technical norms or standards.[10] Compliance with recommendations reduces transaction costs as long as relevant other actors also comply. In contrast to recommendations or standards in the case of committees, in hegemonies power is the means of coordination.

3.2 The Long Road to Little International Coordination

A transfer of the hierarchical model of coordination as it had evolved in the national telecommunications systems to the international sphere would have made it necessary to assign the provision of international services to a transnational agency. This, however, would have sapped national sovereignty and was therefore highly unlikely. Especially in the 19th century such a solution was without precedent in any international policy domain. But also later, in the 1920s, a suggestion to entrust the monopoly of European international telephone communications to a single company with sufficient capital to assume full responsibility was rejected.[11]

For the very reason that a transnational agency was unacceptable, the hegemonic solution was not available. Public control in telegraphy and in the

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9 This agent, in fact, may be a multinational business enterprise, which is a genuine transnational organization. Multinational business enterprises existed already at the beginning of this century, but on a small scale and with less important effects compared to today's large conglomerates like IBM (see for this type of transnational organizations Nye/ Keohane 1973: 376-379; Huntington 1973).

10 Standards in this context shall be explicitly confined to technology-related specifications, definitons and conventions which are collectively agreed on by independent actors. For a discussion of much broader theorizing on all kinds of compatibility standards, including "market standards" see David/ Greenstein (1990). Such a comprehensive view sometimes makes it difficult to distinguish standards from products, technologies or straightforward notions of uniformity instead of compatibility.

11 This proposal was made by the President of the Institution of Electrical Engineers of Great Britain in 1922. He would have accepted a private company, in which only governments would have been shareholders (Chapuis 1976).

early decades of telephony had produced fairly self-sufficient national telecommunications systems. There were no exchange relationships, therefore, which could have created (power)inequalities and constituted a hegemony. One exception can be found in the old British Empire. Intercontinental traffic within the Empire was dominated by Cable & Wireless which had end-to-end ownership of the international facilities. Ergas/ Paterson (1991: 31) call Cable & Wireless a "hegemonic power" in the British hemisphere.

Instead of corporate, regulative solutions to the coordination problem were more likely to emerge. Drafting international treaties as a mode of coordination was the routine approach in the "sovereign state system" of the 19th century. International treaties do not impede state sovereignty, because they only provide a framework of contractual rules, a regime that leaves concrete decisions to the discretion of the contracting parties. Yet for this very reason international regimes are quite inflexible. It normally proves difficult and at least time-consuming to adapt their terms to changes in the domain to be coordinated. Thus, in domains where change is the rule rather than the exception, the establishment of committees which issue recommendations and standards may be the more appropriate mode of coordination, although problems of implementation and compliance may arise.

The official history of treaty-based international coordination in telecommunications can be traced back to the year 1865, when delegates of twenty European countries attended a conference on the harmonization of the provision of international *telegraph* services. The meeting proceeded along established routines deciding to base coordination on an international treaty, the "International Telegraph Convention". This convention fixed rules that governed legal, commercial, operational and technical aspects of an international telegraph service.

In two points, however, the conference transcended established routines. Firstly, it decided to meet periodically to review the terms of the treaty.[12] The conference, secondly, decided to complement the treaty by an international organization, the *International Telegraph Union* (ITU).[13] In 1868 a permanent "International Bureau" was set up in Berne, Switzerland. Its purpose was to ease communications between governments with respect to telecommunication affairs and to help prepare the periodic conferences. But very soon the smooth adaptation of the treaty's rules and norms to technical and

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12 The review of the Convention remained the domain of the Conference entirely.

13 According to Codding/ Rutkowski (1982: Introduction) this was the very first intergovernmental organization.

administrative developments within the new ITU framework proved to be incompatible with comprehensive political control demanded by the member states.[14]

Therefore the Saint Petersburg conference of 1875 decided to group together technical and administrative details in a separate document entitled "Regulations" and leave its periodic revision to an "Administrative Conference" of specialists from the ranks of the network operators. That changed the role of the "political" Conferences, shifting most of the continuous workload to the Administrative Conferences, in which governments were not directly represented (Mili 1973: 289). Their control was to reject the regulations partly or entirely.

As long as *telephony* remained chiefly a domestic issue with minimal interconnection between countries and almost no international trade of telecommunications equipment, the depicted mode of coordination did not change. It was only challenged in the 1920s with an attempt to arrange for an international telephone service. The first steps were taken outside the ITU which considered telephony "a mere appendage to the telegraph service" (Chapuis 1976a: 203). In 1923 a meeting of delegates from six European PTTs invited by France, proposed to set up a permanent *International Consultative Committee on Long-Distance Telephony* (CCIF) to support and coordinate the administrations in their efforts to establish long-distance and international connections. It was established in 1924 with twenty member-administrations (Chapuis 1976; see also Savage 1989: 168-184).

The purpose of the CCIF was defined to study technical, operational and tariff questions in order to "propose standards for long-distance telephony with which the various European countries, in their own interest as well as in the general interest, are invited to conform as strictly as possible".[15] Emphasizing the voluntary character of the standards they were called "Recommendations". Thus, in contrast to the ITU, the CCIF aimed at international coordination through recommendations instead of treaties and regulations. Suggesting focal solutions, standards should help to achieve the necessary

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14 The international conferences, whose delegates were recruited from the diplomatic corps and the national bureaucracy lacked the time and expertise to consider all the technical and administrative difficulties involved in arranging for international connections.

15 Recommendation of the Preparatory Technical Committee on International Telephony in Europe cited in Chapuis (1976: 186).

international technical uniformity without having to rely on formally negotiated rigid administrative rules prevailing in the ITU.

In 1925 the CCIF was officially recognized and attached to the ITU but retained autonomy concerning its structure and working procedure. The statutes of the CCIF remained basically unchanged until the follow-up organization, the *International Telegraph and Telephone Consultative Committee* (CCITT) was set up in 1956 by the merger of the CCIF with the *International Telegraph Consultative Committee* (CCIT).[16]

The CCITT is open to the PTTs of the members of the ITU[17] and to so-called recognized private operating agencies (RPOAs), which have been approved for participation by a member state (Codding/ Rutkowski 1982: 93).[18] The working projects are issued and the working results are finalized by a *Plenary Assembly* of all members of the CCITT. This Conference identifies technical, operational or administrative areas where clarification and perhaps standardization is wanted, formulates these wants as 'questions' and issues them to the Study Groups for consideration. The Study Groups consist of experts of the member administrations and an advisory capacity of specialists from private industry and academia. While they are allowed to take part in the deliberations they are not allowed to vote, and their contributions have to be authorized by the respective national administration.[19]

From the outset of telegraph and telephone services it took about 100 years to gradually establish an institutional setting which provided minimal coordination of international telecommunications. Any corporate types of institution which might have infringed national sovereign rights were rejected by the nation states. Most of the states, especially those in Europe, operated the telecommunications system through a public administration. The systems developed on technically partly different paths, although the general architecture of networks was similar. From a technical point of view the divergent

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16 The CCIT had been established by the International Telegraph Conference in Paris in 1925. It had operated under quite different conditions from those of the CCIF (Chapuis 1976).

17 Since 1932 the ITU calls itself International Telecommunication (instead of Telegraph) Union. After World War II, the ITU has achieved the status of a UN treaty organization.

18 This membership category covers private network operators like AT&T in the United States.

19 Improvements of the status of these two groups, achieved in the 1989 Plenipotentiary Conference in Nice, can be neglected in our argument.

paths would have urged early international coordination in order to reduce costs of trans-border communication. But coordination remained on a low level and was almost exclusively based on the regulative mode. Here a gradual shift from de jure systems of international regulations to de facto standardization by means of recommendations could be observed. But by the time the CCITT was founded, the "production" of standards was still almost negligible. Within the international telecommunications regime with the ITU as the central international organization with a long tradition, however, the CCITT provided the arena in which technology- and service-related coordination activities could be concentrated.

4 Trans-border Expansion of Telecommunications and the Erosion of the Old Order

Since the late 1960s several of technical, economic and political factors have contributed to weaken the old nation-based control mechanisms in telecommunications. The common denominator of the developments to be discussed might be depicted as the *internationalization* or *globalization* of this sector. This trend may have been technology-driven, but it was of course channelled by corporate actors with partly complementary and partly competing interests.

When we exclude telegraphy,[20] the first highly visible indicator of the general trend which must be mentioned is international telephony. In the 1950s and 1960s the more or less inherent tendency of the telephone systems to expand reached the national borders and utilization gradually crossed these frontiers. Automated signalling and switching in combination with an international numbering and routing scheme provided by the CCITT were the crucial innovations on the long road to a comfortable international telephone service. But tariffs remained high, especially for overseas communications.[21] They

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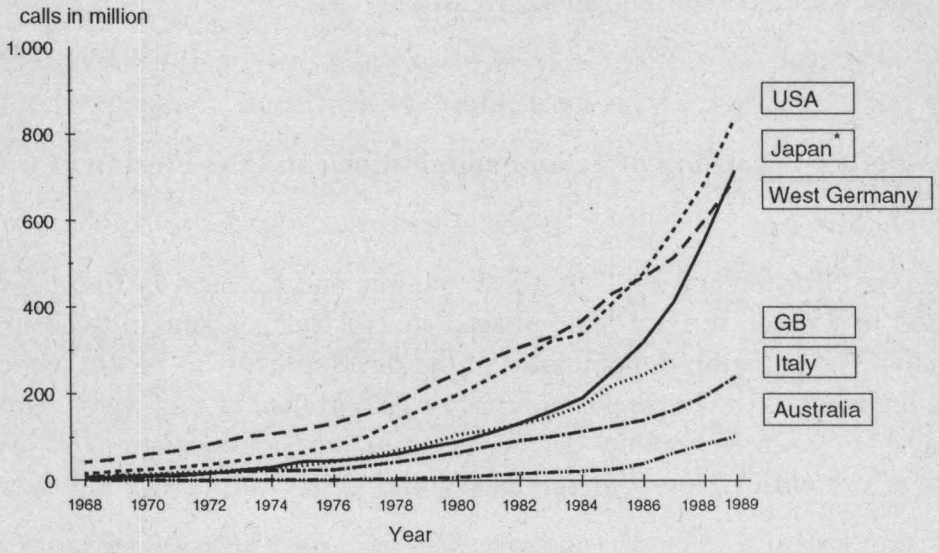
20 Today telegraphy, the pioneer of international telecommunications, only plays a minor role in the industrialized world. For the history of transatlantic telegraphy see Still (1946).

21 In an analysis of a basket of international telephone charges in November 1989 the OECD states that "international calls have long been one of the most profitable parts of the business of public telecommunications operators and they are growing in importance as international trade and travel grow". The most attractive prices for international calls for businesses, though not for residential users, are offered by the Scandinavian countries. Australia is cheap both for residential and for business use. Rather expensive are the Southern European countries, not to mention Turkey with extremely high tariffs (OECD 1990: 12, 13).

have been slowly reduced after traffic seemed to have reached a "critical mass", which has induced an exponential growth of transportation capacity via copper and optical fibre cables as well as satellites.[22] Diagram 2 and Table 1 give an impression of the development of international telephone traffic from 1968 to 1989 measured by the number of outgoing calls from a selection of highly industrialized countries.

Diagram 2: Telephone Service: Outgoing International Traffic



* Minutes in million
Sources: ITU (1978, 1987, 1989); Siemens (1991)

Growing transmission capacity and a high global density as well as an almost completely automated operation of network in all industrialized countries has reinforced what Collin Cherry already twenty years ago in the first (1971) edition of his famous treatise on "World Communication" called "the communication explosion" (Cherry 1978: 57-102). In the field of telephony the monopolistic PTTs have for a long time successfully resisted to grant control of the international traffic to any kind of supranational carrier organization.

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22 The first automatic international link was established between Brussels and Paris in May 1956. In the same year the first transatlantic submarine telephone cable (TAT 1) was laid. Before that date transoceanic communications were possible only by means of high frequency radiotelephone circuits (Chapuis 1976). The first commercially used satellite INTELSAT I ("early bird") was launched in 1965.

Table 1: The Development of International Telephone Traffic [a]

	1977		1982		1987	
	Internat. Traffic	% of Total Traffic	Internat. Traffic	% of Total Traffic	Internat. Traffic	% of Total Traffic
Australia	3.6	0.08	16.5	0.26	56.6	0.61
GB	54.6	0.34	132.2	0.63	199.4 [b]	0.80 [b]
Italy	34.0	0.30	93.1	0.63	164.3	0.83
USA	101.5	0.02	274.0	0.08	562.0	0.13
West Germany	155.0	0.95	308.0	1.27	515.0	1.70

a Calls in million
b Data for 1985

Source: ITU (1985, 1987)

An exception has been the *International Telecommunications Satellite Organization* (Intelsat), a non-profit consortium based on an intergovernmental agreement. This agency was charged with the installation and operation of a global satellite system. It was controlled by national PTTs and similar common carriers holding shares based on their use of the system.[23] The originally small circle of shareholders has developed into a rather large group of about 120 members (Komiya 1990). Intelsat coordinates utilization and technical functioning of satellites providing transmission capacities for telephone, telegraph and data communication as well as radio and television broadcast services.[24] Concerning its organizational form and internal decision rules, Intelsat, on the one hand, departed significantly from the existing practices in international telephony. On the other hand, however, as a common carrier

23 The US shares of Intelsat, however, were held by COMSAT, founded in 1962, which in turn was owned to equal parts by the established telecommunications carriers and the general public.

24 Here Intelsat has the general authority to establish standards for approval of earth stations for access to the space segment (Levy 1975: 658). This is more similar to a hierarchical mode of technical coordination than to a committee-based standard setting procedure.

for common carriers it was designed and functioned to reinforce the international telecommunications regime (Krasner 1991: 357).[25]

With the *deregulation* of the telecommunications sector in the US in the early 1980s and the "challenge of the monolith" AT&T (Galambos 1988) the old international order came under pressure. AT&T had to restrict its activities to the operation of trunk calls within the United States and overseas. Competitors, the most prominent being MCI and US Sprint, were allowed to enter the market and to offer long-distance telephone services nationally and internationally.

Rather early Japan and the United Kingdom jumped on the deregulation bandwagon and allowed for competition in the telephone domain on separate networks as well as on leased lines to be provided under fair conditions by the old dominant network operators.[26] The Commission of the European Community pushed the liberalization of the telecommunications market by means of a "Green Paper" in 1987 and subsequent Directives to the member states. This is perceived as a significant step toward the completion of the Internal European Market without barriers to trade of goods and services and to the movement of capital and labor by the end of 1992 (see Foreman-Peck/ Müller 1988; Schneider/ Werle 1990).

Outside the market of telephone or telephone-based services like facsimile transmission a wide range of services in the field of trans-border computer- and data-communication has emerged. Since these services are usually not confined to the mere transmission of information, but offer functions such as storage, multiple distribution, conversion of formats, codes and transmission speed or encoding and decoding, they are called *value-added services* (VAS). When they are performed in dedicated networks one speaks of *value-*

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25 The differentia specifica was not, as implicitly suggested by Krasner, the departure from the one-nation-one-vote rule of the ITU. As far as cables for the transmission of signals from one country to another were concerned they were, of course, constructed on the basis of bilateral or multilateral agreements and contracts and were not subject to ITU decisions. What made the difference was that Intelsat and not national carriers owned the satellites. But nicely compatible with the traditional regime of general collective control of international telecommunications, the major Western European states effectively pushed the Intelsat idea although the United States had originally tried to maximize its own influence through bilateral arrangements with users.

26 Although induced by technological changes, deregulation was not technology-determined. It has partly autonomous political-ideological and cognitive-scientific roots (see for a detailed analysis of deregulation in the United States Horwitz (1989: esp. 196-263) who speaks of a "culture" of deregulation).

added networks (VAN). Many VAN have evolved either as industry-specific solutions in the banking and financial information services business[27] or as in-house networks of multi-national corporations, which have a high need of internal communication and data exchange among the headquarter and their branches all over the world.[28] Especially distributed design and manufacturing processes in a multi-national context demand high capacity telecommunications networks.

The world market for VAS is rapidly growing. Table 2 gives an impression of the growth perspectives in the area of information, processing, messaging and some other services typically defined as VAS.[29] The amount of trans-border activities in VAN and VAS is difficult to assess, but it is much higher than trans-border telephony.

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27 Some of the earliest VAN are the British REUTERS financial information services, SWIFT and EDS (Electronic Data Systems). SWIFT was initiated in the early 1970s. The first transactions took place in 1977. At that time 240 banks in 15 countries were members. In 1985 already five times as much banks in 46 countries had joined. EDS has offered VAS since 1984 and was bought by General Motors in the same year. In the middle of the 1980s more than 5.000 banks and credit institutions only in the United States were costumers of EDS.

28 Not only the largest but also many "medium-sized" multi-national corporations have built up private networks. Initially restricted to in-house communication and in this function predominantly used to reduce coordination costs (Antonelli 1984), they are now being offered to other users by specialized subsidiaries of these corporations. The German telecommunications equipment manufacturer Siemens, for example, began to establish a transnational network in the 1970s. In the mid-1980s the SIEKOM network already connected 140 companies' computer centers. The highly complex worldwide network interconnects different national and regional sub-networks with different technical specifications and standards (Pace 1990: Section 4C, 21-28).

29 Unfortunately, the problem of delineating VAS contrasted to basic services has led to differing evaluations of the present and future market for VAS. But most researchers agree that information, processing and messaging services constitute the core of VAS and that they grow with high rates (see Mowlana 1986: 93-109; Datapro Research 1989).

Table 2: World Market for Value-Added Network Services (US $bn)

	1988	1989	1990	1995
UK	0.83	1.12	1.41	2.50
France	0.32	0.42	0.57	2.07
West Germany	0.31	0.42	0.56	1.55
Rest of Europe	0.61	1.86	1.39	3.70
USA	5.96	8.48	11.24	20.27
Japan	1.70	2.75	4.00	9.15
World	9.74	14.04	19.25	39.17

Source: PACE (1989)

The improving and expanding opportunity structure for trans-border communications constitutes, on the one hand, an attractive market not only for users and service providers but also for the equipment manufacturing firms which, on the other hand, are confronted with sharply increasing research and development costs for the technical components of the networks. Growing complexity of multifunctional telecommunications networks and terminals requires high speed and high capacity transmission and switching devices as well as intelligent network management tools. Microprocessors and computers have become the backbone of network operation and management. The knowledge base of data processing and technical communication is more and more overlapping. Manufacturers of telecommunications equipment try to enter the market for data processing, as producers of data processing devices fight for a share of the market for telecommunications technology. This market is growing and becoming more international. Table 3 shows the past and future development of the world market for telecom and computer equipment.[30]

30 There are and will be two large regional markets, the North American constituting an estimated 38% and the European with 32% of the world market for telecom equipment in 1993. In 1987 public (20%) and private (11%) networks switching technology held the highest share of the market. Transmission technology summed up to 20% and terminals to 13% of the market (Eurostrategies 1989: 15-26).

Table 3: The World Market for Telecommunications and Computer Equipment (US $bn)

	1984	1987	1990	1993
Telecom Equipment	60.0	89.5	95.0	135.9
Computer Equipment	80.0	--	195.0	--

Note: Values for 1990 and 1993 are estimates
Source: Aronson/ Cowhey (1988: 7); Eurostrategies (1989: 21)

Especially high costs in research and development on the one hand, and low unit costs in production on the other hand, are considered to force producers into "an intense struggle for market entry into foreign markets" (Neu/ Schnöring 1989: 25). Indeed, in the 1980s international trade with telecommunications equipment has increased rather fast (see OECD 1988: 94-111; OECD 1990), though trade patterns vary considerably with regard to the different components of telecommunications systems (transmission technology, switching devices, customer premises equipment). The general impression is that those countries that liberalized their markets first had the highest import rates and a disadvantage concerning their balance of trade (Neu/ Schnöring 1989). From a user's point of view, however, high imports may have been an advantage.

The "liberal" countries' possible political option to reverse their policies and switch to protectionism remained an unused weapon.[31] On the contrary, primarily the United States and the United Kingdom pushed for further and a more comprehensive *liberalization* in the other industrialized countries and of the *ITU-dominated international telecommunications regime* (Cowhey 1990). Not only the markets for telecommunications equipment but also those for all kinds of telecommunications services should be opened. One strategic option is to extend the rules of the *General Agreement on Tarriffs and Trade* (GATT) to telecommunications services (Aronson/ Cowhey 1988: 233-276).

31 That this option has been no phantom is indicated by an actual controversy concerning plans of some US Baby Bell regional companies to manufacture telecommunications equipment, which was prohibited in consequence of the AT&T breakup. Legislation allowing Baby Bells to enter manufacturing entail a limitation of imports to no more than 40% of the value of the Baby Bells' production. The Bush administration supports allowing manufacturing but has threatened to veto legislation because of the import limitation (Financial Times, June 6 1991).

At the end of 1990 the initiative in the GATT *Uruguay Round* failed, but it is likely to be re-issued once GATT negotiations continue.[32]

Internationalization and globalization of telecommunications have been triggered by political and economic as well as technical factors, especially the partial convergence of data processing and telecommunications technology. *Obviously the two basic principles legitimizing the old order have been damaged by this development.* The conception of telecommunications as a natural monopoly proved to be highly static and more or less inappropriate for periods of rapid technological change. The justification of public control in order to secure universal service and compensate or prevent disadvantages of users in peripheral regions can not easily be transferred from the "plain old telephone service (Pots)" to, for instance, highly specialized VAS for business users. General infrastructural considerations beyond Pots are no longer perceived to have a higher significance in telecommunications than in other policy domains. The demand for political intervention and control shifted from the emphasis of classical welfare aspects to concerns for fair competition and efficiency. The old PTTs, though in the large industrialized countries no public administrations anymore, are suspected to take advantage of their still privileged and protected situation, when they must compete with smaller firms.

What in this period of change has certainly remained unchanged is the growing need of international coordination in telecommunications. Internationalization and globalization is, of course, one factor accelerating this need. In national markets, where interoperability of technical components in networks was traditionally achieved through a hierarchical mode of coordination, new modes may be required. National borders no longer correspond with technical borders for interactive communication and coordination cannot be reached by concertation of national hierarchies in order to interconnect their networks. Users of telecommunications equipment and services want to mix or combine different technical devices and service features offered in the world market. What they wish to mix shall match, and this can only be achieved through some form of international coordination (Matutes/ Regibeau 1988).

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32 The reasons for the overall failure of this round lay in fundamentally diverging positions in agricultural policy. For ITU and the Uruguay Round see Woodrow (1991).

5 Technical Systems' Compatibility Requirements and the Proliferation of International Standardization

The erosion of the old nation-based telecommunications order and its transformation into a more heterogeneous and less hierarchical constellation of actors and telecom systems has affected the processes and the institutions of international coordination. As long as international communications predominantly relied on public networks, coordination remained under indirect control of the PTTs. We already mentioned that some standards recommended by the CCITT in the late 1950s and the 1960s, opened the way toward fully automated international telephone service. This trend of internationalization "within public networks" stabilized the position of the just (1956) founded CCITT as the central institution of international coordination and standardization in telecommunications.[33]

Internationalization and globalization of telecommunications not accidentally coincided with the blurring of borderlines between data processing and telecommunications. The well established CCITT experienced first effects of this development already more than 30 years ago, when it started to standardize data modems.[34] What became evident was *a growing need of compatibility* of such technical components, which a few years earlier would not have been expected to become attractive candidates for interoperation within the same encompassing network. The interconnection of data terminals with a central data processing unit through an analogue public telephone network might not have been beyond imagination, but it was not business as usual as it appears today. To render such an interconnection possible compatibility was required. Compatibility problems of the kind just illustrated have since moved into the center of international coordination activities in telecommunications. They entail procedural as well as institutional aspects.

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33 This is clearly expressed by increasing attendance to the Plenary Conferences. The second plenary of the CCITT in 1961 was attended by 58 and the third conference in 1965 already by 114 member countries (Arnold 1975: 334).

34 Wallenstein, for many years one of the leading experts in standardization and active participant in many ITU standardization activities, depicted this experience, "Thirty years ago, I attended a CCITT study group meeting for the first time. It had been called for a working party focused on a single question (number 43) in one study group. The question concerned CCITT's possible standardization of data modems 'for transmission of accounting data over the telephone network'. The meeting was attended by more than one hundred people, many representing companies in the data processing industry. ... The meeting, CCITT's largest up to that time, turned into a somewhat theatralic clash of two cultures" (Wallenstein 1990: xiii).

5.1 Basic Problems of International Standardization Procedures

How can compatibility be achieved? In the old order the hierarchy secured compatibility within its domain, between different domains a few standards and all kinds of gateways, converters and transformers were employed. These technical ex post solutions, emerging outside collectively coordinated procedures, have continued to be one and rather frequently the only option to reach compatibility in today's heterogeneous technical configurations.[35] To directly interconnect N ex ante incompatible components, however, N*(N-1)/2 gateways would be needed. If standards recommending interface specifications were available, ex ante compliance would lead to an obviously less costly solution of the coordination problem.

Thus, such a solution appears most attractive, but it may be difficult to achieve. International organizations like the CCITT, committed to the basic principle that standard setting is "the best solution" of the compatibility problem, heavily engage in standardization.[36] Participation in the study groups and their working parties is voluntary and is not remunerated.[37] Though not de jure imposed, de facto unanimity is required when standards have to be decided upon. CCITT standards have the formal status of recommendations and are not binding, but in general the chance of compliance is considerable.

The decision of firms, PTTs or governments to delegate experts into working groups and technical committees is not only motivated by the goal of joint standard setting. Information exchange, knowledge transfer, identification and definition of future technical problems and trajectories are further incentives. This as well as standards contributes to reducing uncertainty about future developments.[38]

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35 A more detailed discussion of gateway technologies would directly lead the way to the role of markets in mastering compatibility problems in the development of international technical networks (see Schmidt/ Werle 1990). We have neglected market coordination because our central interest is collective coordination. For a comparison of coordination through markets and committees see Farrell/ Saloner (1988).

36 Actually considerable resources have been concentrated on the development of standards for Integrated Services Digital Networks (see Rutkowski 1985).

37 This is typical for many other national and international standardization organizations as well.

38 Therefore firms agree to sponsor "Quarter-Million-Dollar Standards" (Daughtrey/ Fujii/ Wallace 1986: 23) or simply dispense with cost calculation. In addition, the opportunity of a professional discourse and inter-firm social contacts may motivate engineers to collaborate in standard setting committees. In most areas

The rationale of compatibility standardization, as depicted above, suggests this process to be a pure coordination problem. Here the main problem is the identification of a common solution, i.e. the concrete shape of a standard. When different options exist, choice is not conflictive, because the positive effect of any solution by far exceeds the differential advantage of one solution over another. Thus standardization is not very difficult.[39]

An impressive example of a pure coordination problem is provided by the early stages of facsimile telegraphy. In 1972 the CCITT Study Group XIV, at that time in charge for telefax standardization, was about to be dissolved due to a lack of questions to be studied. Nobody seemed to be interested in telefax. After standards were issued for terminals of Group 2 in 1976, a basis was laid for further standardization. Especially with the faster Group 3 terminals, the service gained wide acceptance. An important factor in this rapid diffusion process has been that the Group 3 specifications, recommended in 1980, closely enough followed the preceding Group 2 equipment, so that downward compatibility was attainable (McConnell/ Bodson/ Schaphorst 1989).

Pure coordination-type processes of standardization cannot be considered to predominate. More often the actors' positions diverge with regard to technical, economic or political interests. They make it difficult to reach an agreement under the unanimity rule, although the non-binding status of the recommendations offers a future option to deviate from the agreement. The common, "institutionalized", principle that it is better to have a standard than to leave technical developments uncoordinated does not always help to master *a "distributive" conflict.*[40]

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of standardization - national and international - there seems to be no lack of volunteers (Buckley 1986). The informational function of study group meetings was emphasized very early. In 1958 the Special Assembly of the CCITT in Geneva officially expressed the opinion that on the occasion of meetings the Director of the CCITT in agreement with the Chairman of the Study Group should organize an exchange of views and opinions on new techniques in the telegraph and telephone field.

39 The migration from one standard to another, however, may turn out to be rather complicated (see Leibenstein 1984). For a general discussion of coordination problems in terms of game theory see Snidal (1985).

40 In terms of game theory this type of conflict can be modelled in different variants of the "battle of the sexes" game. Some variants are discussed in Scharpf (1989).

Standardization of interactive videotex can be interpreted as a failure to arrive at a unified international standard. Preparatory activities at the CCITT did not start until different solutions close to implementation already existed (in 1978). At that time Britain proposed its Prestel system as a basis for an international standard, shortly after followed by France with Antiope. One year later Canada appeared with Telidon, other systems followed (see Savage 1989: 198-214). Vested interests in international market dominance and sunk costs in videotex in several national telecommunications systems made it impossible to reach a stable compromise. Thus no unified standard emanated, but different, incompatible options were unanimously recommended by the CCITT. Their value is not much higher than having no standard at all.

Institutional and procedural responses to the "distributive" problem show many facets. Standardization "officials", for instance, put emphasis on the technical nature of standardization. As long as it is perceived as a technical task, a process of scientific effort and a search for the best solution, political or economic arguments appear illegitimate. Also procedural reforms to accelerate standardization and to come to a decision in a very early stage of technical development ("anticipatory standardization") enter the agenda. This shall help to create the conditions for pure coordination problems.[41] But whenever national, regional or other already existing standards make up the input of the CCITT or other high ranking international standardization organizations, pure coordination problems remain difficult to achieve.

5.2 The Proliferation of International Standardization Organizations

The discussion of some basic problems of standardization might suggest that international coordination of the development of technical systems through compatibility standards is declining. This would be obviously misleading. The still prevailing national segmentation of telecommunications which has, especially in Europe, its roots in political sovereignty interests as well as in an installed base of "hard-wired" telecommunications networks could not be removed by means of an uncoordinated strategy of technical modernization. Modern software-based systems and components installed as dedicated private networks across national borderlines, as well as intelligent terminals

41 For a more detailed discussion of standardization procedures within the CCITT see Schmidt/ Werle (1991).

connected to old and new networks have not reduced, but added complexity and heterogeneity.[42]

Not only business users demand more "interconnectivity" in order to reduce costs and enhance the performance of their telecom equipment. Also and chiefly manufacturers articulate a demand for compatibility standards (see Hemenway 1975). Despite the transferability of micro-electronics as a basis technology, even the largest corporations like IBM do not have the competence to produce complete systems of data-processing and telecommunications. Many components, like keyboards, memories, processors, special types of cables or fax machines are increasingly being manufactured by specialists, "but are no longer seen in relation to a product but, on the contrary, in relation to a system" (Dekker 1984: xxxi).

The growing importance of international compatibility standards has not automatically enhanced the standing of the CCITT and the other traditional international standardization organizations like ISO and IEC,[43] which by the convergence of information and communications technologies have gained a say in the standardization of telecommunications. It had rather the reverse effect of destabilizing their position. The traditional bodies were blamed to lag behind the actual demand and to be incapable of producing the standards that were really needed. At the same time the number of organizations producing standards increased. Both developments were perceived by the traditional bodies with a sense of alarm. They conceded difficulties but attributed them to the quantative overload and not to an incapacity to cope with the new challenge. The increased demand for standards could not be met by the usual time consuming working procedures. It was argued that a combination of office automation, tighter time schedules and better funding would alleviate this problem considerably. That the workload has grown is clearly indicated by the output of the CCITT, which increased from 6.360 pages in 1980 to 18.000 pages in 1988 (Drake 1989: 36). The more fundamental problem, however, lies in the diversified demand for international standards. The traditional organizations are structurally ill equipped to cope with this diversity.

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42 A leading executive of the Dutch Philips Corporation depicted the European scene as "paradox". "All the countries of Western Europe are well equipped. Only Europe is not", because compatibility was missing (Dekker 1984: xxxii).

43 International Standardization Organization (ISO) and International Electrical Commission (IEC).

Internationalization and the globalization of telecommunications has superimposed more and more elements of functional differentiation on former segmentary differentiation. In the old order, functionally diverse organizations participating in the production, construction and operation of the telecom system were coordinated hierarchically by the national PTT. That naturally included the match of components and equipment to be employed in the network. International coordination was only needed at the network interconnection points. This could be achieved by the PTTs alone because, due to their paramount position, they represented their national system in its totality including all its actors. This situation was mirrored in the structure of the CCITT which in principle admitted only PTTs to membership.[44] That did not preclude the participation of non-PTT organizations in the work process, but they needed an authorization by the respective PTT. ISO and IEC display a similar structure accepting only the national standardization bodies for membership. Similar to the CCITT, direct participation of industry in the work process is possible but has to be channeled through the respective national standardization organization.

In the process of internationalization of the production of telecommunications equipment and the provision of specialized telecommunications services (VAN) the PTTs have lost their comprehensive vertical and horizontal control of the telecommunications sector. Today companies produce equipment or provide services whose sphere of action transcends national confines. This applies most prominently to the equipment and services which were added to the traditional telegraph, telephone and telex canon of telecommunications by the convergence to the data processing sector. The resulting problems of international coordination differ to a great extent from those encountered in the segmentary divided old order. They do not entail harmonization of *national* but of *organizational* positions. The traditional international standardization organizations with their nation-based membership structure are ill equipped to develop standards which meet these interorganizational coordination needs. This structural deficiency is the backdrop for the proliferation of international standardization organizations.

Since the application of standards is voluntary their development does not depend on any specific formal procedure. As a result there are hardly any restrictions to the formation of standardization organizations. "Effectively,

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44 In a recently published article Rutkowski, a counsellor of the ITU, has put it this way: "In the old world of telecommunications, standards were not particularly important to the ITU - and even then, the standards only applied to the interfaces and boundaries between hard-wired, dedicated networks and equipment. There was also no institutional competition" (Rutkowski 1991: 293).

any two or more parties can agree on anything, and then claim the agreement is 'available' to the market" (Reynolds 1990: 433). Thus, the organizations which felt that their coordination needs were not aptly represented and considered by the traditional incumbent organizations, could congregate to form their own standardization bodies.[45] But this single motive cannot account for the surge of international standards bodies with company-based membership during the early and mid-1980s. It definitely does not explain the pattern of these bodies, the structure of their membership and the field of technical specifications they are involved in. Clues to the explanation of this pattern can be provided by the strategic plans that companies have pursued by forming standardization bodies. SPAG,[46] for example, was established in 1983 by the leading 12 European information technology manufacturers. They intended to strengthen their position vis à vis the American and Japanese producers by developing common European standards for data communication. This intention led to the decision to base these standards on the Open System Interconnection (OSI) reference model - a seven layer *frame of reference* for systems of standards - which was conceived at that time as a competitive project to an IBM proprietary network architecture (Collins 1987).[47]

Also deregulation of telecommunications motivated the establishment of new standardization organizations. The PTTs' control over telecommunications was heavily challenged by political initiatives to cut back their monopoly in the provision of mass services. Competing network operators or service providers were chartered or at least envisaged. That eroded the PTTs' ability to ensure compatibility by hierarchical coordination. The resulting coordination problems were approached by new standardization bodies: T1 in the United States in 1984, TTC in Japan in 1985 and ETSI in Europe in 1988.[48]

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45 Not every coordinated effort to come to a standardization agreement led to the establishment of a new organization, especially when the efforts failed. One example is an activity of more than 30 companies from all over the world to reach consensus on a standard for digital audio sound. Three competing proposals were discussed between February 1978 and April 1981, but no decision was made. Then in late 1982 Sony introduced its compact disc (CD) technology in Japan (Stalk/ Hout 1990: 133-148).

46 Standards Promotion and Application Group (SPAG).

47 Ironically IBM later on implemented OSI-standards much more seriously than its European inventors (naturally without abandoning its proprietary SNA frame of reference altogether).

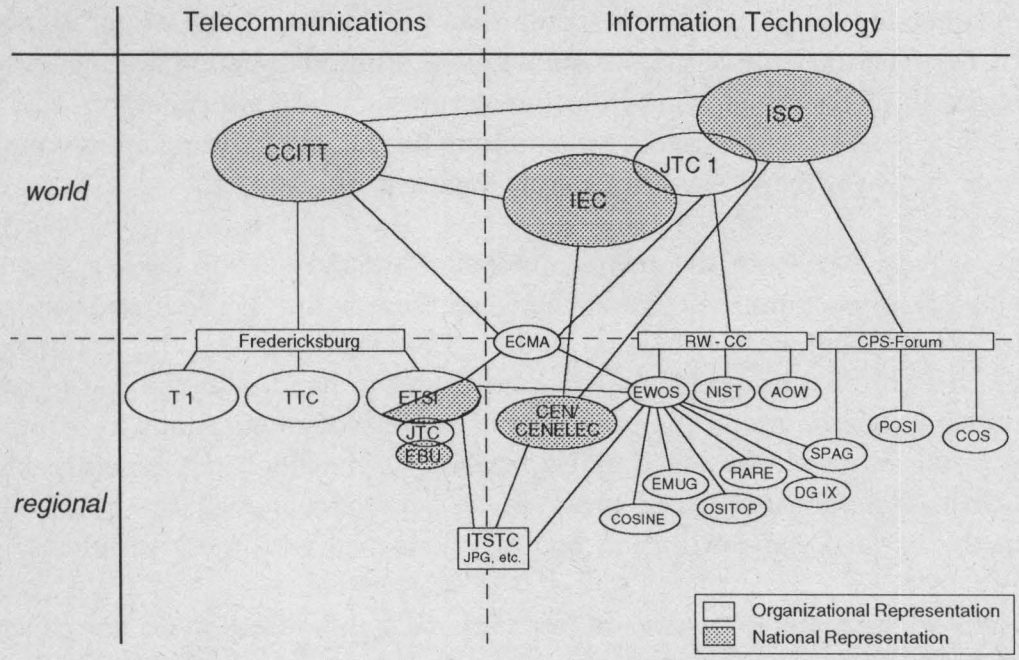
48 T1: Standard Committee for Telecommunications (USA); TTC: Telecommunications Technology Council (Japan); ETSI: European Telecommunications Standard Institute.

All these organizations are regional in scope with participants coming from more than just one country. T1's and TTC's membership structure is company-based while ETSI has a mixed system with some decisions taken by company-based voting and others taken by nation-based weighed voting (Besen 1990; Lifchus 1985).

The proliferation of standards bodies did not lead to competition between them, although competitive concerns were the very motive for the establishment of some of the new organizations like SPAG. The established organizations, because of their specific incapacities, seemed to have good reasons to expect competition. But only in very rare cases were really competing standards issued by the new standardization organizations. The small number of technical experts capable of drafting standards did not turn out to become problematic either, although at the time when T1, TTC and ETSI were established there was some concern in the CCITT that they would constitute a 'brain drain' on the reservoir of experts working for it (Irmer 1990: 5).

Instead of competition a *network* of cooperative relations of the various organizations in the field of international standardization evolved (see Diagram 3). The activities were complementary rather than substitutive, what took competitive pressure from their relationship and allowed the establishment of cooperative relations. In 1990, for example, the CCITT and the three regional organizations ETSI, TTC and T1 decided at a conference in Fredericksburg, Virginia, to coordinate their activities with the aim to develop a division of work which is acceptable to all of them. The emerging design seems to be that the regional organizations take over large parts of the technical work. They provide the CCITT with consolidated input. This input is then discussed and finalized by the CCITT with the participation of countries and organizations which are not members to the regional organizations. While the regional organizations have no guarantee that their input is finalized by the CCITT unchanged, they are compensated by the endorsement of their ideas by the large CCITT membership. Thus the technical expertise and superior decision capacity of the regional organizations is traded for the social generality that the CCITT can offer with its membership coming from all over the world.

Diagram 3: The Ecology of Standardization Organizations



AOW	Asia Oceania Workshop
CCITT	International Telegraph and Telephone
CEN/CENELEC	European Committee for Standardization/European Committee for Electrotechnical Standardization
COS	Corporation for Open Systems
COSINE	Cooperation for Open Systems Interconnection Networking in Europe
CPS-Forum	COS/POSI/SPAG-Forum
DG IX	Directorate General (European Commission)
EBU	European Broadcasting Union
ECMA	European Computer Manufacturers Association
EMUG	European MAP User Group (until 1987)
ETSI	European Telecommunications Standard Institute
EWOS	European Workshop for Open Systems
IEC	International Electrotechnical Committee
ISO	International Organization for Standardization
ITSTC	Joint Information Technology Steering Committee
JPG	Joint Presidents Group
JTC 1	Joint Technical Committee
NIST	National Institute for Science and Technology
OSITOP	European Group on Technical and Office Protocols
POSI	Promoting Conference for Open Systems Interconnection
RARE	Réseaux Associés pour la Recherche Européene
RW-CC	Regional Workshop - Coordinating Committee
SPAG	Standards Promotion and Applications Group
T 1	Standard Committee for Telecommunications (ANSI)
TTC	Telecommunications Technology Council

Very similar arrangements have been established in the standardization of functional profiles between the three regional workshops EWOS from Europe, NIST-OIW from North-America, AOW from Asia and the ISO/IEC Joint Technical Committee 1 (JTC 1) (Macpherson 1990: 263-265) and also in the field of conformance testing between SPAG, COS and POSI (SPAG Standard

2, 1990).[49] This network of formal cooperation agreements is supported by an extensive network of informal contacts and technical experts' multiple membership in the various standardization bodies. Diagram 4 displays CCITT/ITU's cognitive map of the network of interorperation among global, regional and national standardization forums. Even if we consider CCITT's view of the world as biased,[50] rather strong formal and informal cross-connections between many standardization bodies have emerged.

To a good part both the rising number of standardization bodies and the network of cooperative relations between them is due to the high workload in international standardization bodies. The sheer quantity and complexity of the coordination problems that came hand in hand with the use of computers in telecommunications and the use of telecommunications for computer applications in liberalized global markets with many heterogeneous actors might, therefore, very well prove to be a precondition of the coexistence of the various standardization bodies which deal with these problems.[51]

Network relations in the area of international standardization do not generally preclude competition with regard to specific standardization domains or concrete standards. But the incentives and means of the organizations to enter active competition are limited, and direct confrontation is the exception, especially as long as newly issued standards are "located" within the OSI-architecture. In this cognitive frame of reference different standards on the same layer can be seen as options, the selection of which is up to the "market", i.e. outside direct control of any standardization organization.

Network relations do not imply a completely egalitarian distribution of power among the organizations either (Kenis/ Schneider 1991; Mayntz 1991).

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49 EWOS: European Workshop for Open Systems; NIST-OIW: National Institute for Science and Technology - OSI Implementor's Workshop; AOW: Asia Oceania Workshop; COS: Cooperation for Open Systems; POSI: Promoting Conference for Open Systems Interconnection.

50 Besen/ Farrell (1991) predict that ITU/CCITT will lose "pre-eminence" in setting international telecommunications standards to the three regional standard bodies, whereas Cowhey/ Aronson (1991) modifying a much more critical position expressed three years ago (Aronson/ Cowhey 1988) are now convinced that "ITU has to be a major player in international communications because its expertise is needed" (1991: 310).

51 As Rutkowski (1991: 295) put it, "With the appearance of digital technologies, competitive provisioning and the global marketplace, the demand for standards has been driven through the roof. ... In large measure, all these [standardization] bodies are actually needed to meet today's diverse standards-making requirements".

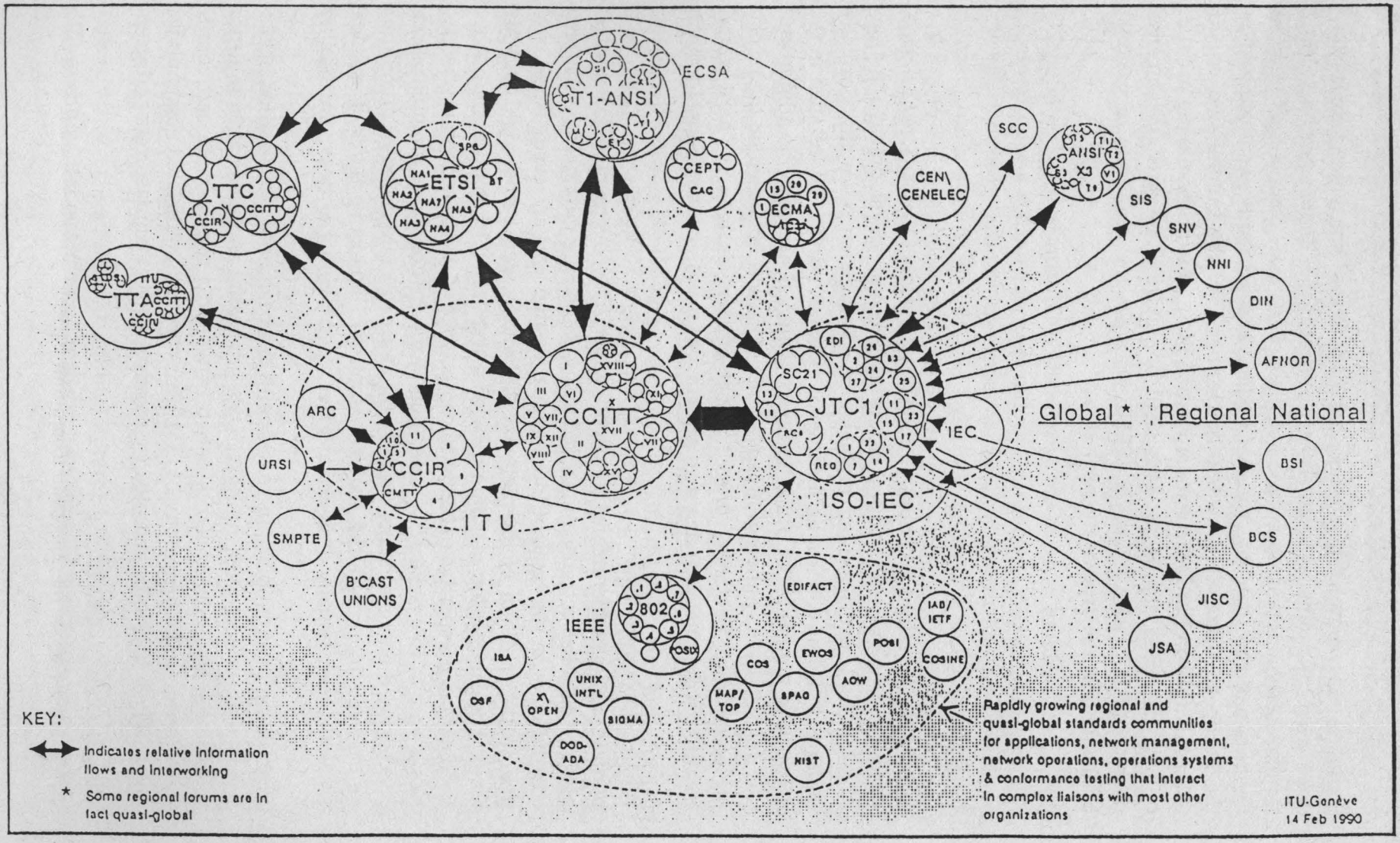

Diagram 4: ITU´s View of the World of Standardization

Some are more powerful or influential than others, but none is completely dominated by another. The emergence and growing significance of regional standardization organizations and activities exerts more competitive pressure towards national than international bodies. This is clearly demonstrated in the European Community, where in October 1990 the Commission issued a Green Paper on European standardization in order to accelerate the production of European standards. This shall be achieved by strengthening the position of ETSI and CEN/CENELEC vis à vis the multitude of national bodies within the twelve member states.[52]

6 Conclusion

In its early decades telecommunications was contained in national systems. Technical, economic and political factors advanced the development of national hierarchies, which settled problems of coordination internally. Formally binding decisions concerning features of technical parts to be installed in the network or modalities of utilization were issued, if necessary, as administrative decrees. Concertation of independent actors was not based on the principle of equality. Hierarchy proved rather efficient as long as "hard-wired" technology dominated and system growth was restrained to national territory.

When telecommunications systems slowly began to grow beyond national borders, national hierarchies remained stable. The sovereign states rejected plans to establish a transnational hierarchy. Thus only minimal international coordination on the basis of international treaties was achieved. These treaties, in the tradition of international diplomacy, were rather rigid and abstract. Formal decision making procedures were ruled by political rationality. Each nation, irrespective of technical competence or vested economic interests, had a vote in this regime. Coordination of international telecommunications concentrated on agreements regarding investments into cables or accounting and served to protect the national domains. Interconnections of national networks were usually designed as gateways providing ex post compatibility.

Problems of compatibility increased with the beginning globalization of networks and services after the 1960s. Data processing and data communication outside the traditional telecom networks was to a considerable part coordinated through the hegemony of IBM. This corporation dictated compatibility rules, which had to be accepted by mostly smaller manufacturers and users.

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52 Commission of the European Community (1990).

In telecommunications, however, the lack of ex ante compatibility threatened to retard transnational expansion. The sovereign states, just transforming their national telecommunications hierarchies into more pluralist and competitive structures, would not accept a transnational hierarchy nor any form of hegemony.

Enlargement and globalization could therefore only be accomplished on a pure technical basis, if problems of compatibility could be mastered.

Committee-based compatibility standards, increasing in number very rapidly, seem to offer a solution for the underlying technical coordination problem. These standards facilitate transnational enlargement of telecommunications systems on a pure technical basis. Systems can expand without hierarchical or hegemonic "assistance", when their components are designed in accordance with standards. Global integration of networks, operated not only by PTTs but also by a multitude of business organizations, is possible without organizational integration or hierarchical control.

Of course, a world of pure technical interests being negotiated in hedged and protected circles of engineers is not the "real" world. Political as well as economic interests "interfere" with standardization processes, and with the convergence of telecommunications and data processing also technical opinions and interests diverge considerably. This diversity and heterogeneity triggered a proliferation of international standardization organizations, which are partly competing but are mostly complementary and do not hesitate to cooperate. The coordination of coordinating organizations, however, has emerged as a new issue. But also in this area standardization may offer a solution. Not a single standard, but a frame of reference for standardization, providing *cognitive coordination* of standardization activities in different settings, is needed. With the approval of the Open Systems Interconnection (OSI) frame by the most relevant international standardization organizations in telecommunications and information technology, such a solution was already established in the early 1980s. Even IBM after some controversies partly complies with OSI.

After the abdication of national hierarchies the rather smooth internal political control of telecommunications has been erased in national contexts and more so in international telecommunications. In the old international regime, however, political intervention was mainly directed towards protecting national domains. Now that coordination is practically reduced to standardization, the absence of international political control has become evident. Political intervention, if it occurs at all, tends to be nationally motivated and designed

to improve the competitive position of the respective national telecommunications industry. A more comprehensive approach to recover transnationally what has already been lost in some national domains in order to secure open networks, universal service, data protection or privacy on a global level, has not found an institutional basis yet. Is, as some developments in the European Community seem to suggest, a transnational hierarchy that politically controls telecommunications unavoidable? Or will the network of international and regional standardization organizations be complemented by a network of political control agents?

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