CHAPTER 7
THE POLITICS OF GROWTH: THE GERMAN TELEPHONE SYSTEM

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1 The telephone as a large technical system

The aim of this paper is to portray the development of the German telephone system as it resulted from the interaction among a set of corporate actors. The course of the development cannot be inferred from the impact of a single variable. On the contrary, system development is seen as the result of decisions (as well as of non-decisions), choices among a number of alternatives made by a definable set of actors. The choices made are constrained by the actual environment of the actors and by the sediment of previous decisions, but they are not determined by any of them.

The telephone system is a technical system because its central function is the transmission of spoken information by electrical waves. It is a large system because of its sheer size in manpower and capital, and because in an advanced state of development it encompasses most of the territory of a society. Finally, the different components that make the telephone work form a system - they are all needed and they interact.

In reconstructing the development of the German telephone system, I shall highlight structural and environmental aspects as well as the temporal and spatial dimensions of the process:

- the embedding of the telephone system in the overall communications and transport system;
- the special weight of political actors and of their political and economic decisions;
- the time-consuming, stepwise integration of separate elements into a single system;
- the importance of an analysis of geographical properties of a

technical system, especially if the technical system has a communications function.

For the purpose of intellectual parsimony, five central phases were selected to represent the development of the German telephone system:

- The introduction of the telephone shows the starting conditions which greatly influenced the further development.
- After a decade of growth, the first difficulties arose that were tackled by two laws and a parallel change of technology.
- During the Weimar Republic, the first steps were taken to give the postal and telecommunications system a certain degree of autonomy.
- After 1933, a reshaping of the actor network and a change of function resulted in a massive geographical spread of the system.
- The reconstruction and expansion after the Second World War implies a change of functions that enormously accelerated the growth of the system.

As space is limited, all references to the interaction with the economic environment, with international actors, and all but the most superficial remarks about the technical development of the system are omitted. Nevertheless, this does not mean that they are unimportant.

2 The introduction of the telephone

The telephone entered into the German postal communications system in a different way than in most other countries. It entered in a two-stage process: In 1877, it was first used as an auxiliary telegraph apparatus. The idea cherished by the German Postmaster General, Heinrich Stephan, to open subscriber telephone networks was not carried out because of a lack of demand by customers. Two years later, the second stage began when private businessmen took the initiative and asked the German administration to get concessions for private telephone networks. Only then the administration felt moved to act. It declared private telephone networks to be unconstitutional and opened state telephone networks with public access.

The setting for the introduction of the telephone in Germany was an economy in a state of full industrialization. Growing societal and spatial differentiation led to an expanding traffic and communications

sector. Urbanization and the clustering of enterprises in the cities made it possible to use the early telephone with its limited transmission range[1]. But most city centers were still small in area, so that personal visits, urban mail, and messenger services were able to compete successfully with the telephone. In the political arena, Germany had been united as a constitutional monarchy only since 1871. Its central government remained weak in comparison to the state governments. For instance, separate postal and telegraph administrations existed in Bavaria and in Württemberg. The finances of the Reich were also weak so that the income derived from the Imperial Posts and Telegraphs (RPTV) was important for the central government. Both agencies were merged only in 1875. They were controlled by the Reich Post Office, the precursor of the later Post Ministry. So the field of communications has always been dominated by political-administrative actors. When later on the telephone was declared to be a part of the telegraph system, no special organization needed to be set up for it.

In the second part of the 1870s, the Post Office modernized and geographically extended its communications networks into rural areas. Its intention was to improve political and economic integration, to strengthen administrative control of the territory and its population and to put an end to the financial losses of the telegraph system. An important obstacle in implementing this policy were the marginal returns from telegram use that were expected in peripheral areas[2].

In Bavaria and in Württemberg, where state railways and the separate postal and telegraph services were administered within the framework of the same ministry, apparently neither a modernization nor an extension of the state communications system was perceived to be as necessary as the Reich Post Office held it to be. Here, industrialization was still at a low level, and the economies of scope that were inherent in this integrated type of state bureaucracy kept the running costs of telegraph stations low. Where the RPTV was interested in network expansion, the southern German telegraph administrations therefore were not. This divergence of goals partly explains the different time of adoption of the telephone in the three areas.

The first stage of telephone introduction began when Heinrich Stephan, head of the RPTV, heard about the invention of a "speaking telegraph" in October, 1876. At first, he did not react to the news because he did not get it from a source he deemed reliable[3], but when the first issue of "Scientific American" arrived at his office that carried

the news, the RPTV instantly reacted and asked Bell to send a pair of telephones. By chance, a pair of telephones did already arrive from an English acquaintance of Stephan on October 24, 1877. After five days of trials to determine the maximum range of transmission, Stephan decided to use the new device as an extension of the existing telegraph network for areas with small telegram income. The arguments in favor of the telephone were convincing: The price of a telephone was 1/80th that of a telegraph set, and its operators needed no lengthy and costly training. By a series of letters and of demonstrations to the Chancellor and the Emperor, the Post Office then initiated a process of consensus building. On November 28, 1877, the telephone was officially adopted as a further type of telegraph apparatus to expand the telegraph system into suburban and rural areas[4].

In Bavaria and Württemberg, the same experiments were run, with entirely different evaluations. In both states, the adoption was retarded for several years. In Bavaria, the telephone was tried as a replacement of the railway service telegraph and as a replacement of the inter-urban telegraph lines. For both purposes, the transmission range was too small. The telephone in its present state was then claimed not to be useful[5].

Besides the noted objective influences, the power of influential personalities in a time of small political elites and of political parties which were only in the process of institutionalization is obviously important. The swift introduction of the telephone into the German state telegraph system can also be attributed to the energetic and prudent personality of Heinrich Stephan, the head of the Post Office.

The second stage, the introduction as a subscriber network, started two years later. Already in October, 1877, after one week of experiments only, Stephan had the idea to make the telephone available to every household or business, an idea he repeated again in early 1878[6]. The idea was not implemented as Stephan found most of the prospective customers not to be interested at all. At the same time, a certain number of private point-to-point lines were built for private in-house conversations and for the internal communication within enterprises, public administrations, etc. even before the inauguration of the first state subscriber networks.

Compared to the introduction of the telephone into the telegraph system, where the telephone satisfied an existing need of a single customer who was also the operator of the system, the situation in

1880 was different. The operator and the customer were no longer the same entities, so that the operating agency had to consider the interests of its customers. For a business customer the existing services such as the mail service and the telegraph were operated at a reasonable speed and at moderate prices. Thus a contemporary would not perceive any "need" that had to be satisfied by a new technology. To make people use the innovation, a need had first to be created. In fact, this need was created by the RPTV, not by some purposeful action, but as an unintended effect of the performance of the telephone: The time-savings for those businesses that were already connected to the system forced commercial non-users to subscribe too in order to neutralize the communications advantage of their competitors.

The situation changed entirely when in 1880 the International Bell Telephone Company entered the scene. Because Bell's invention was not protected by a German patent, in Germany International Bell did not try to become a producer of telephone sets but instead intended to make its profits as a network operator. Thus the strong impetus to act came from outside the German communications administration. The application for private concessions first by Emil Rathenau, then by International Bell - the latter was even supported by the influential private banker of Chancellor Bismarck, Gerson von Bleichröder - and finally by several other private entrepreneurs, forced the Post Office to change its passive mood[7].

After a discussion within the Post Office between supporters of a policy of state concessions, who declared the telephone to be technically immature and therefore incompatible with the technically more sophisticated system of the telegraph, and backers of state intervention, who stressed the threat to the Reich finance and the danger of a loss of political and economic control to a foreign company[8], Stephan decided to interpret the legal situation of the telephone as being part of the existing state monopoly on telegraphy that was fixed by the Constitution. As a consequence of this decision, the RPTV was obliged to run telephone networks itself. After a lengthy search for subscribers, the first trial installation of a RPTV telephone exchange was opened in the capital, Berlin, on January 12, 1881, with eight subscribers only. On January 24, 1881, the first state telephone network was officially opened in Mulhouse (Alsace)[9].

In the meantime, Stephan asked Reich Chancellor von Bismarck to publicly support him. His intention was to produce a *fait accompli* in

terms of legal decisions and technical facts because the legal interpretation of the Constitution by the Post Office was doubted. After Stephan made the Reich Treasurer support his demand, on February 12, 1881, the Chancellor publicly declared the telephone to fall under the provision of the Constitution for the state monopoly of telegraphy[10]. The decision can be interpreted as an example of the growing mood for state intervention in economic affairs among German politicians that started at the end of the 1870s.

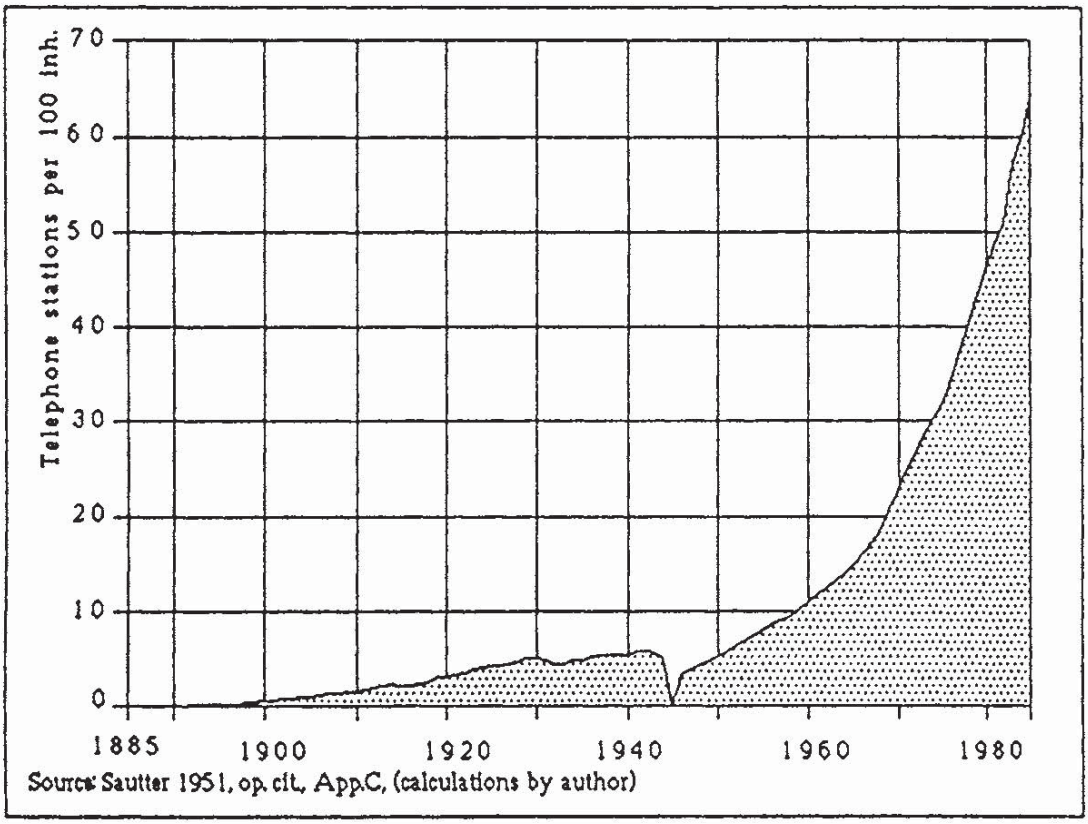
The way the telephone was introduced in Germany heavily influenced its further development. The integration into the existing communication systems, the weak legal base of the integration of the telephone into the state telegraph, the form of tariff regulation and its impact on early spatial growth can be deduced from the starting conditions.

The slow growth of the telephone system in its starting phase can partly be explained by its integration into the state communications system. The financial effects of the advance of the telephone and of the relative retreat of the telegraph had to be adjusted within the same budget. Thus, new local networks were only opened if a threshold level of usually 50 subscribers guaranteed a minimum revenue to the Reich. The same policy of stressing financial safety was applied by the Post Office when interurban lines were constructed. In this case, the new subscribers or the municipal councils of the cities connected not only had to guarantee a minimum income to pay for the running costs but they even had to neutralize the estimated losses in the telegraph service[11]. Smaller communities had difficulties raising the money. The delayed expansion in rural regions was partly a result of this deliberate spatial extension of the actor network (as far as funding was concerned). In a situation which was characterized by uncertainty, the Post Office decided to steer a course of safety at the expense of system growth.

A new division of functions emerged. The telephone replaced the telegraph because it was cheaper and more rapid. The latter was used only if the telephone could not be used because of the initially limited transmission range of the telephone or if a legal document had to be produced[12]. Nevertheless, the telegraph did not "die". "Dying" of a technology because of a low intensity of use is only possible if two conditions are met: Firstly, considerations of profitability must be directly tied to the decision about the survival of the technology. Secondly, the new and the old system have to perform identical func-

tions[13]. Both conditions were not met in the case of the German state telegraph system. The reason for keeping the telegraph system was not an economic one but purely a political one: The German PTT wanted to give every citizen access to a fast communication system even if he or she had no telephone; that the functions were different has already been mentioned.

Figure 1: Development of Telephone Density, 1885 to 1985



The official definition of the telephone as a part of the existing state monopoly of telegraphs allowed the government to regulate the system by administrative decrees as it had done with the telegraph, i.e. without the consent of the Reichstag. This autonomous way of regulating extended the opportunity structure of the organization, though at the same time it became the cause of much trouble with political and economic actors who were left without influence. One of the consequences of this decision was the official definition of the function of the telephone in relation to the telegraph. The telegraph

was perceived by the Post Office as the basic system for long-distance communication whereas the telephone was seen as an urban communications means, supplementing but not replacing the telegraph[14]. Given that strategy, in the first decades the Post Office tried to make the telephone grow with the help of its own revenue only. Only when it became apparent that interurban telephone calls in fact replaced telegrams and that the telephone system became profitable did the Reich Treasury allow the use of public loans for further growth.

The tariff that fitted into the early strategy was the flat tariff. It was the only form of tariff in which the revenue could safely be calculated in advance, and it needed no call-counting equipment. As an unintended consequence, the averaging of the subscriber rate that necessarily goes along with a flat tariff disadvantaged users in smaller networks that were not able to profit by the unlimited usability of the telephone that is part of a flat tariff.

The high flat rates (200 marks annually in 1881, 150 marks from 1884 to 1899) that resulted from that policy of self-financing severely limited the access to the system. Thus the first telephone subscribers were among those that relied on swift communications with only minor regard to costs: the information businesses, public and private administrations, the professions, and the well-to-do[15].

In line with the location and the geographical communication ranges of these first users, suburban, neighboring city and regional networks were established by the RPTV. The first interregional lines were built not as a network but as single lines, on a city-to-city basis, still in the style of the telegraph system. After 1887, with the rapid replacing of the telegraph by the telephone, the larger of the solitary local networks and their point-to-point intercity lines were step by step integrated into a nationwide network. A central reason for the pattern of spatial integration was the already mentioned lack of capital that favored a demand-oriented spatial growth. Therefore the geographical growth was not a development from chaos to structure[16] but a substitution process patterned by the spatial order of the pretelephonic communications space[17]. A second effect of the scarcity of funds was that it slowed down the spatial spreading of new technologies. Here, as well as during the construction of the long-distance cable network after 1921 or during the automation of long-distance switching after the Second World War, these communications technologies that all had the function to overcome distance in fact intensified spatial inequalities.

Due to the long initial phase of the process of spreading, the cities and urban agglomerations at the top of the central-place hierarchy increased their advantageous position.

The motive force of this first wave of spatial integration was an interaction between actors at three distinct levels. At the central state level it was the Post Office. There were regional actors, such as the chambers of commerce. They often cooperated with their political allies at the local level, in the city halls.

3 The legal stabilization of the telephone system

After a decade of unimpeded growth, the telephone system became so large that the casuistic solution of political problems characteristic of the initial phase had to be replaced by a more generalized way of solving conflicts with the political environment.

Up until the 1890s, the German telephone system consisted of scattered local and a few regional networks linked by a certain number of overhead wires. So the system essentially was an urban one. The first real obstacle to growth emerged with the growth of electrical utilities in urban areas. Both infrastructure systems used the ground beneath the city streets instead of building a special return line to save the costs for the return wire. Therefore the high-voltage lines were able to induce currents in the telephone lines that diminished the audibility of the conversations ("noise"). The telegraph administration was therefore interested in making the owners of high-voltage lines pay for the costly so-called "self-protection" of their facilities.

For the first time, the RPTV met with organized resistance to its plans. The municipalities supported the standpoint of the electrical utilities to which many of them were closely linked. Both actor groups were not at all interested in higher construction costs for power lines which would have been the result of the RPTV's policy. The fledgling electrical industry as a supplier of high-voltage equipment became another powerful ally of the utilities in the emerging fight. All of the opponents of the RPTV had strong supporters in the Reichstag, in the press, and in numerous "Electrical Associations" in the country[18].

The two primary intentions of the Post Office were to get a safe investment climate for the expensive cabling of the growing urban

overhead wires and to prevent any competition for its subscriber networks to arise. The legal ground for the Post Office's intentions were not very strong. The municipalities to which the street ground belonged were self-governed (at least in Prussia) so that the RPTV was not able to enforce its view. In this situation the 1881 official definition of telephony as a part of the state monopoly of telegraphy proved to be a disadvantage. Even the highest German court had decided that a legal basis was missing to make the utilities and the municipal administrations comply with the wishes of the RPTV. Against its intentions, the telegraph administration was forced to give up the large freedom of action that until now the management by administrative decrees had given it. It had to accept that the regality of the telegraph and the telephone were to be fixed by a special law. This law could only restrict its range of action[19].

In general, the Telegraph Act of 1892 legally confirmed the status quo. The law legalized the state monopoly of the telephone, and it excluded all types of competition from networks with access for public users. Non-state (i.e. municipal or private) networks were confined to regions that the RPTV thought to be unimportant. In the case of the existing telephone networks of railways and of large enterprises, these private networks continued to be restricted to internal communication so that they could not compete with the state network. The conflict about the costs for the protection of the telephone wires against electrical induction was regulated by a compromise. Before, interactions between the RPTV and its subscribers were more or less regulated by private law. From then on and until today, they are regulated by public law which means a more institutionalized way of behavior on both sides. The Telegraph Act also extended the actor network because from then on, any raising of tariffs had to be passed by the Reichstag. With the entry of the Reichstag into the set of relevant corporate actors, pressure groups that had representatives in the Reichstag were now able to voice their approval or dissent, which they frequently did during the annual readings of the budget[20]. The political environment of the RPTV became more influential with the help of this law.

A comparison with the Prussian Law on Secondary Railways (Nebenbahngesetz) that was voted in the same year shows that the strategies of network control differed greatly between the telephone and the railways. Private secondary railway lines were allowed in areas situated between the great trunk lines of the Prussian State Railways. Their

tracks were allowed to be connected to the state network[21]. The effect was a system of mutually supplementing networks. One reason for this way of regulating was that in Prussia private railway companies had a powerful tradition. Furthermore, investment costs for railway lines were far higher than those for telephone lines so that the Prussian government was not interested in extending its railway network into areas where it expected small returns only. The railway law increased the attractiveness of the state network and, at the same time, retained the state monopoly for the important part of the railway network. In contrast, network expansion in the telecommunications area was retarded until the RPTV itself had the financial power to serve the remote (and financially most unrewarding) rural areas.

A most important effect of the Telegraph Act for the expansion of the telephone system was that it increased the already existing incentive for the RPTV to continue extending its network into previously unserviced (i.e. rural) areas. From then on, its growth policy was split up between a demand-oriented variant as far as the establishment of new local networks was concerned and a supply-oriented strategy in the case of linking small communities to the long-distance network by public telephone stations. The reason for this differentiation of policy was that the RPTV had to operate a local network itself in order to prohibit the establishment of a competing municipal network and that a public telephone station was interpreted as a "network". Large numbers of rural communities had been connected to the telegraph system by the use of simple telephone lines between an auxiliary telegraph station and a full-service telegraph station at the nearby market center as a consequence of the decision of 1877. These internal telephone lines were then opened to the public. The RPTV thus averted criticism by stressing its performance in terms of geographical accessibility of the network.

The differentiated expansion policy was also an effect of the slow speed of expansion in combination with the size the system had then reached. In the initial phase of its geographical spreading the demand-oriented, hierarchical spatial growth of the interurban wire network connected only the larger among the German cities. Businesses in these cities that were enabled to use the telephone achieved a time-advantage in commercial communication over competitors in places that had no access to the interurban telephone lines and were restricted to the use of the slower telegraph. The representatives of these places

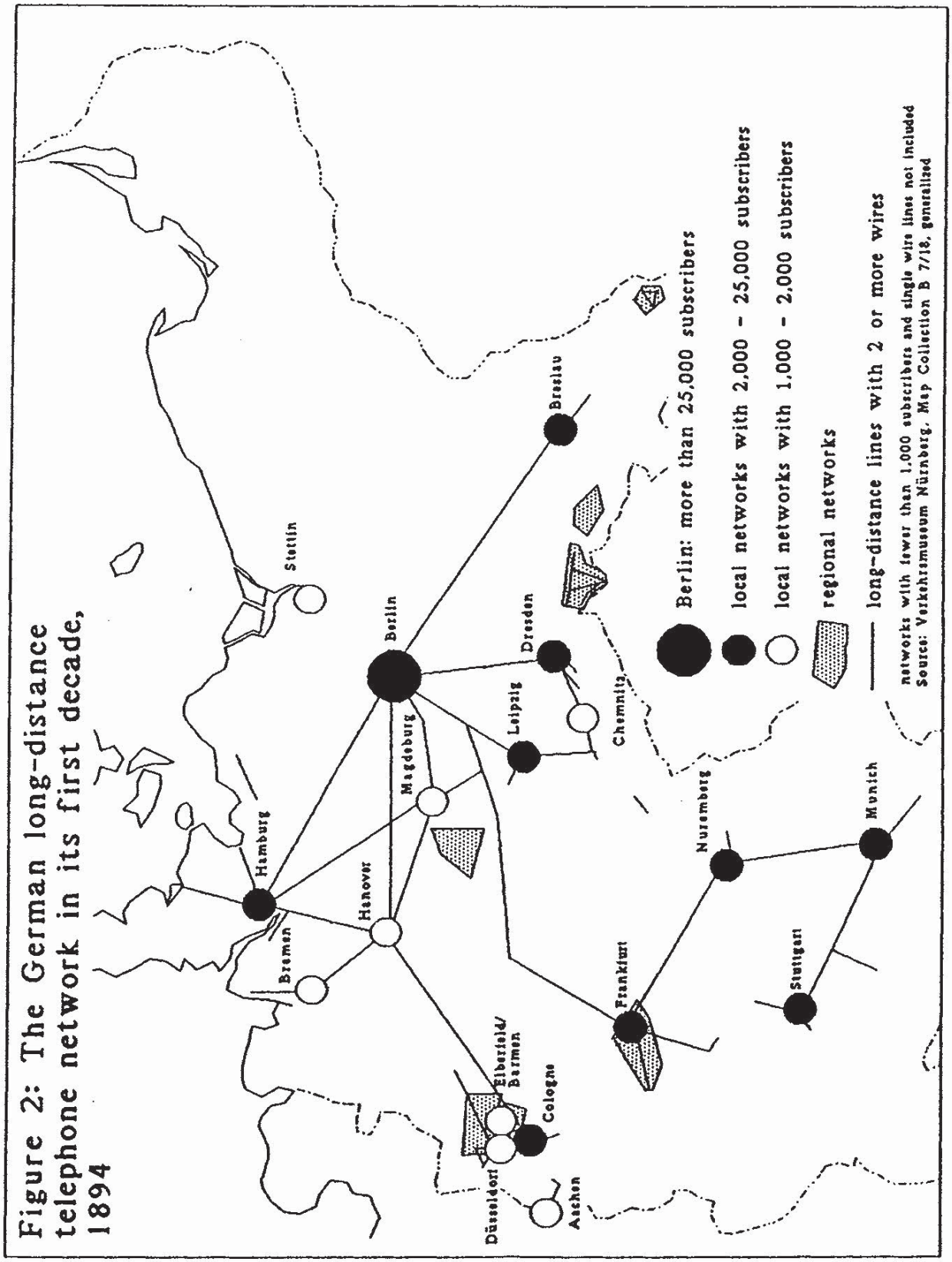


Figure 2: The German long-distance telephone network in its first decade, 1894

began to realize that being connected to the telegraph system only might become a problem and voiced their disapproval of the expansion policy of the RPTV[22]. Public telephone stations were a means to counter discontent; another, and more effective one, was the reduction of tariffs for small networks after 1900.

Within a few years, the solution to the growth problems in urban areas by the Telegraph Act produced new problems. Overhead wires in the cities were doubled to provide for induction-safe loop circuits. This, together with the continuous increase in subscriber stations, made the RPTV replace the overhead wires by expensive underground cables. At the same time, after 1887, the first generation of long-distance lines began to penetrate the countryside. The location of the major conflict shifted from urban to rural regions. The network no longer exclusively linked the large cities but the RPTV began to connect the rural market towns and county seats as well. This policy was impeded by smaller communities that had no interest in accepting the telephone lines along the roads that they had to maintain as long as they were bypassed by the network. In these situations, the RPTV thought it needed an all-German, unitary right-of-way (that did not exist) to assure the security of its investments. Therefore the intention of the RPTV was to harmonize its national action space with a corresponding "legal space".

The Telegraph Lines Act of 1899 extended the opportunity structure of the Post Office. The property rights of the owners of roads and of real estate had to be taken into account, but the institutionalized way in which these interests were now introduced into the planning process channelled their influence. The construction of future long-distance lines could no longer be severely impeded by individual or local interests. Again the public telecommunications system was made more powerful and more rigid.

Compared with the French development, the RPTV speeded up the spatial expansion of the network by centralizing the decision about the establishment of new local networks at the central state level by reducing the influence of local or regional actors on matters of right-of-way. In France, at the same time, the incorporation of local assemblies into the actor structure - as far as funding was concerned - retarded the spatial expansion[23].

The two laws of 1892 and 1899 were fundamental for the technical configuration of the telephone system. Their main provisions regulate

the German telephone system still today. In stabilizing the interaction between RPTV on one side and its political environment and the subscribers on the other, the laws supported a stable growth rate until the First World War. With growing size, and thus, growing usefulness to the user, the system then became profitable[24].

The First World War had two contradictory effects on the development of the telephone system. It retarded the growth of the system, whereas the technological development was spurred. The war demonstrated the importance of a reliable long-distance network for the survival of the political system, and it changed the actor structure again.

The German war preparations foresaw a short war only. Therefore, the German telecommunications administrations went technically unprepared into the long war that finally emerged. In the summer of 1914, the second generation of long-distance equipment consisting of Pupin coils and amplifying valves just started to be put into practice. With the start of the war, a limited number of lines were handed over to the military for their exclusive use. For the first time in the history of the German telephone system, regular mass telephone traffic over distances of up to several thousand kilometers had to be realized. In theory, the problems could be solved, but in practice a war-induced scarcity of maintenance personnel and of imported raw materials decreased long-distance transmission quality. This led to a reappraisal of the more reliable telegraph for long-distance communications. The organizational side of the mobilization of the telecommunications system was the source of an enduring conflict. Because of the organizational autonomy of the RPTV on German territory, the military was not able to control the telephone system as a whole. So it tried to incorporate more and more long-distance lines into its separate network. A hidden struggle over the control of the network emerged. The beginning of the total war in 1916 meant a thorough reorganization of the whole military and civil telecommunications systems. The civil telephone network, although still run by postal personnel, was more or less exclusively used by military and war industry bureaucracies[25].

Another major effect of the war was the emergence of the trade unions as a new, important actor. Postal trade unions had already been founded at the turn of the century, but only when German labor was thoroughly reorganized for warfare, beginning in 1916, the unions got an accepted voice. For a short time, the telephone personnel exerted considerable influence through political strikes during the riots of

1919. The strike of leftists among the exchange personnel that cut the central state authorities in Berlin off from the entire nation could only be bypassed by changing from telephonic to telegraphic message transfer with the help of a loyal military telegraph unit[26].

4 Financial autonomy and modernization

The German defeat in the First World War changed the political environment of the RPTV. A new parliamentarian constitution made the Reichstag a core political actor. To compensate the loss of political power in foreign affairs, the Constitution favored further political centralization. In this connection also, the two southern German communications administrations were merged with the RPTV.

Civil war, demobilization, and inflation laid heavy burdens on the communications system. The whole interlocking communications system nearly stalled when the railway mail system broke down in 1919/1920 while the necessities to communicate quickly were higher than ever before (cf. Figure 5). Attempts were made to solve the problem of overload by expanding the supply of lines through a new underground long-distance cable network, through the temporary use of carrier frequencies on overhead wires and by rearranging the transmission capacity by new queuing rules. Replacing the unreliable overhead wire long-distance network by a cable network was a technical step towards national integration, paralleled in the transport sector by the merger of *Länder* railways into a nationalized Deutsche Reichsbahn and the planning towards a nationalized high-voltage power network spanning the whole of Germany. These movements, however, were not unique to Germany[27].

As a result of the new Constitution, every important change in the statutory structure of the telecommunications system now had to be regulated by law. Through the involvement of the Reichstag and the Reichsrat and of a special Traffic Advisory Council, the amendment of ordinances that now had to be passed by Parliament became too slow to cope with the quickly changing situation, especially in tariff matters[28]. The lack of maintenance during the war, overstaffing, and the large sums of money needed for the modernization of the system made the situation even worse. For the first time the RPTV needed

to be subsidized. To support the German currency reform and to relieve the Reich budget of the burdens, the Reichspost Budget Law (Reichspostfinanzgesetz) was passed in 1924. This law changed the statutory structure of the German PTT in a fundamental way. It separated the property of the former RPTV from the Reich property while preserving the legal status of the Deutsche Reichspost (DRP), as it was now called, as part of the national administration. For the first time, DRP expenditures had to be balanced by revenues. To achieve this, the office heads were allowed to act in a businesslike manner, although still within the framework of the Reich Budget Law and the Civil Service Law. The Post Minister was charged both with the political control and the operational management of the system. A move of the Reichsrat (Chamber of *Länder*) to separate management and political control in the same way as it had been done in the Law on the Deutsche Reichsbahn one month before, failed.

Next to the Constitution, the Reichspost Budget Law is the basic *statutory* law of the whole postal and telecommunications history in Germany. It added economic interest organizations and the Reich Finance Minister to the relevant actor network by instituting a special Administrative Council. The power of the Council was centered on the control of the financial behavior of the DRP; it consisted of representatives of the Reichstag, of the Reichsrat, of the Reich Finance Minister, of the postal personnel, and of the organized business community. Regality matters continued to be regulated by the legislative.

Successive attempts to change the law or to abolish it altogether failed. The SPD and the Hansa-Bund[29], a business organization, which tried to reintegrate the DRP fully into the body of state administration, were as unsuccessful as the German Association of Chambers of Commerce and Industry and a transport business organization which both tried to convert the DRP into a stockholding company[30]. A structural change was not possible because all of the actors mentioned that were interested in such a change were able to obstruct one another. For the same reason, the most important organizational change within the German telephone system that was ever attempted by an outside actor, a lease by I.T.T. in 1931, did not have the slightest chance[31].

The management of the DRP was least interested in any change. The law of 1924 gave it sufficient scope for action. Interference by economic actors could be blocked by stressing the public function of the DRP. If on the other hand pressure from political actors became

too strong, the DRP called attention to the necessity to manage its affairs in a businesslike manner[32].

In 1927, the Telegraph Law of 1892 was amended and given the new name of Telecommunications Installations Act (Fernmeldeanlagengesetz). Parliament further consolidated the state monopoly on telephony: it abolished the last legal basis for non-DRP networks *with public access* to be operated. For the first time, the military was explicitly named as an owner of monopoly rights. From then on, the German telephone system was split up into a network owned and run by the PTT with access to and for everyone, and a limited number of mutually unconnected smaller networks usually owned and run by large enterprises or public authorities for their own internal communications. The Telecommunications Installations Act is the basic law of German telecommunications in force until now.

A problematic effect of the Budget Law on the telephone system was that it sharply limited the financial maneuverability of the DRP at the very time when the telephone system needed large amounts of capital to expand (new telephone stations) and to modernize its technical facilities (automation of local exchanges, laying of the great underground long-distance cable network). The imposed financial constraints were subsequently eased by:

- cost accounting,
- lowering the running costs through rationalization,
- increasing both the accessibility and the usefulness of the system for the user,
- changing the structure of the telephone tariff and
- raising credits.

Cost accounting was very much needed because nobody really knew how profitable different ways of running the system were[33]. As there were no comparative data, thresholds of economic feasibility were fixed quite arbitrarily and tended to maximize economic safety. To rationalize, changes in the allocation of the personnel manning the exchanges according to test averages were introduced. Besides, personnel needs were reduced through the automation of local telephone exchanges. In rural areas this had a double effect: the number of operators was reduced and, at the same time, the service hours and thus accessibility for the user were extended. In fact, automating urban as well as rural exchanges had started before the war, but the speed of conversion

was highest in the years before the world economic crisis of 1929[34]. The automation of long-distance switching was tested in that period in Bavaria for the same reason[35]. Replacing overhead wires by more reliable long-distance cables and enabling interregional and international calls by amplifying those calls increased the incentive to use those lines which were most profitable to the Reichspost. The unusually large number of five tariff reforms between 1923 and 1933 reflected the amount of outside pressure within the Administrative Council. Thus the tariff structure oscillated between a structure favoring large users and one encouraging households and other small users to subscribe. The Post Ministry closely cooperated with the representatives of trade and commerce to orient the telephone tariffs according to prime costs, i.e. it discriminated against the small user. The adversaries of this policy were those among the political parties that supported rural, private or small business users[36]. Load considerations became effective with the introduction of nighttime tariff reductions. Finally, the use of public loans was made easier, so that investments like the automation of exchanges or the construction of the cable network could now be financed by credits[38].

A contradictory effect of the new financial autonomy of the DRP was that it helped to modernize the existing system, but at the same time it impeded the growth of the number of private lines. The Reichspost was not interested in an unlimited growth of the system: Most of the newly connected subscribers in private households or small businesses did not use the telephone enough to make the extension profitable for the operator. In 1931, during the world economic crisis, the Ministry tried to remedy the situation by deliberately prohibiting its regional offices to advertise for new subscribers[39]. Another important and negative effect of the autonomy was that it induced the Reichspost to concentrate its efforts on the long-distance service in regions where return on investment was highest. During that period, long-distance cables connected only the larger local networks, whereas smaller networks were still linked by the less reliable overhead wires. Thus, the advantage of location which the cities of highest centrality already enjoyed was reinforced.

The Reichspost Budget Law stabilized the public communications system. It established a certain degree of financial and managerial autonomy. Because of the lack of competition the DRP was able to concentrate its efforts on the technical improvement of the existing

system and neglect the existing demand. The idea that the usefulness of the system was increased if everyone had access to it and that usefulness to the user meant more revenue to its owner was never embraced by the DRP in that period.

5 The telephone system under military control

The period of Nazi reign between 1933 and 1945 shows the most dramatic change in the function and the actor configuration of the German telecommunications system before its expansion after the Second World War. More than ever before, the function of the system became a political one. The NSDAP, following its strategy to establish "the unity of party and state", used the telecommunications system as a means for the control of the German population and, after a period of preparation, for the war that was intended to create a Greater Germany. The German military, in implementing this policy, expanded the long-distance telephone and telex system at a speed that had never before been attained. It is this aspect of the political function of the telephone system which this section aims to elaborate.

The period of Nazi control can be divided into three consecutive stages: In the beginning, the telephone system was brought under the exclusive control of the political system. After 1935, it was prepared for war. Finally, it was used for that purpose.

The NSDAP seized power within the DRP early in 1933. First the function of the communications system was changed. Before this time, the DRP had defined itself as "a servant to communications", i.e. as an infrastructure system for both the economy and the government. Now the major function of the communications system was shifted to make it into a means for political power, to serve as a command-and-control system. For the growth of the system it meant that cost considerations were replaced by an infrastructure approach.

In 1934, a move to abolish entirely the organizational autonomy of the DRP failed[40]. The organizational "momentum" of the Reichspost had become too large to be dissolved without resistance. On the contrary, what remained of this initiative meant a centralization of decision-making by excluding pressure coming both from the environment (economic and regional political actors) and from within the organization

(personnel). The Administrative Council was abolished as well as the last remnants of separate regional organizations in Bavaria and in Württemberg[40].

A staunch follower of Hitler, Wilhelm Ohnesorge, was made Secretary of State of the Postal Ministry[41]. The personnel was purged at once; 10% of all senior officials had to leave the Reichspost. In the lower ranks nearly three thousand new employees entered the service in the first year, most of them formerly unemployed SA- and SS-men. The party influence was increased by selectively promoting party members[42] and, at least after 1937, by compulsory NSDAP membership of newly appointed senior officials[43]. Since 1933, every chief official of each of the regional administrations was controlled by a special official who directly reported to the Minister[44]. A Post Militia (Postschutz) was established to protect telecommunications and radio facilities in times of political unrest or war. Its peacetime function was to intimidate the non-party members among the DRP personnel.

Very soon, the Gestapo widely controlled telephone conversations, with the necessary technical help of DRP experts[45]. The policy of the NSDAP thus openly showed the *double function of support and control* that the state monopoly of telecommunications had: to enable people to exchange their ideas and, at the same time, to control that exchange if it becomes a threat to the political system. So the same Janus-faced function the mail system always had was ascribed to the telecommunications system.

The legal and organizational preparations for war began in 1935. In that year, an amendment of the Telegraph Lines Act helped to keep secret the extension of the cable network that the Wehrmacht was to finance. The law strengthened the position of the DRP in matters of rights-of-way so much that today, when the reason for its existence has since long disappeared, the law is still in use[46].

In this period, the Nazi government used a double strategy. The DRP was led by senior officials who were party members, if not convinced NS-followers, but who were also DRP-men. So the interests of both sides, the build-up of military strength and the traditional interests of the DRP to run a nationwide system that is technically up-to-date and performs well, were pursued at the same time.

In 1937, a special Communications Department within the Supreme Military Command was established, with branch offices at every regional Reichspost administration, to control the functional integration of

the civil telecommunications organization into the military in the event of war. In 1938, the (unpublished) Reich Defense Act placed the Reichspost in time of war under the direct command of the Supreme Military Command as it did the two state traffic organizations of the Deutsche Reichsbahn and the Autobahn[48]. The military did everything to avoid repeating the bad experience of the First World War. Its behavior shows the pattern of indirect rule exercised during the following years. The core interest of the DRP, its survival as an organization of its own, was safeguarded, but political indoctrination by the Nazi party and military control of the access to the scarcest of the resources, expert manpower and raw materials, enabled the military to use the DRP to the fullest.

The technical preparations for war began in 1936. If the Wehrmacht wanted its control-and-command communications to survive a future air war and still fight a mobile war, a communications network with a high amount of redundancy and invulnerability against aerial attacks was needed. The already existing public telephone and telegraph cable network was one of the most extended ones in Europe. Therefore the most economical way to improve military strength in the communications sector was to divert its use in time of war to the military and not to build a separate network. The first Four-Year-Plan issued in 1936 gave the Reichspost the necessary financial resources, so it did not find it too difficult to comply with this scheme[49].

The Reichspost was made to expand and to modernize its network. The existing star-shaped underground cable network had to be changed into mesh form and to be extended into rural areas in western and southern Germany. These areas had been bypassed by the first cable network because of the demand-oriented and cost-sensitive expansion policy of the DRP at that time but after 1935, army garrisons or air stations were located in these regions, especially in western Germany (Westwall). Long-distance cables had to be laid along secondary roads to reduce the chance of being hit. The most important network nodes Berlin, Frankfurt, Munich and the Ruhr got bypass cables. Repeater facilities were moved to sites outside the city centers, mobile repeater units constructed and emergency long-distance exchanges were built under the cover of air-raid shelters[50]. After the war, sheltered exchanges often were the only ones that remained intact to reestablish telecommunication links[51].

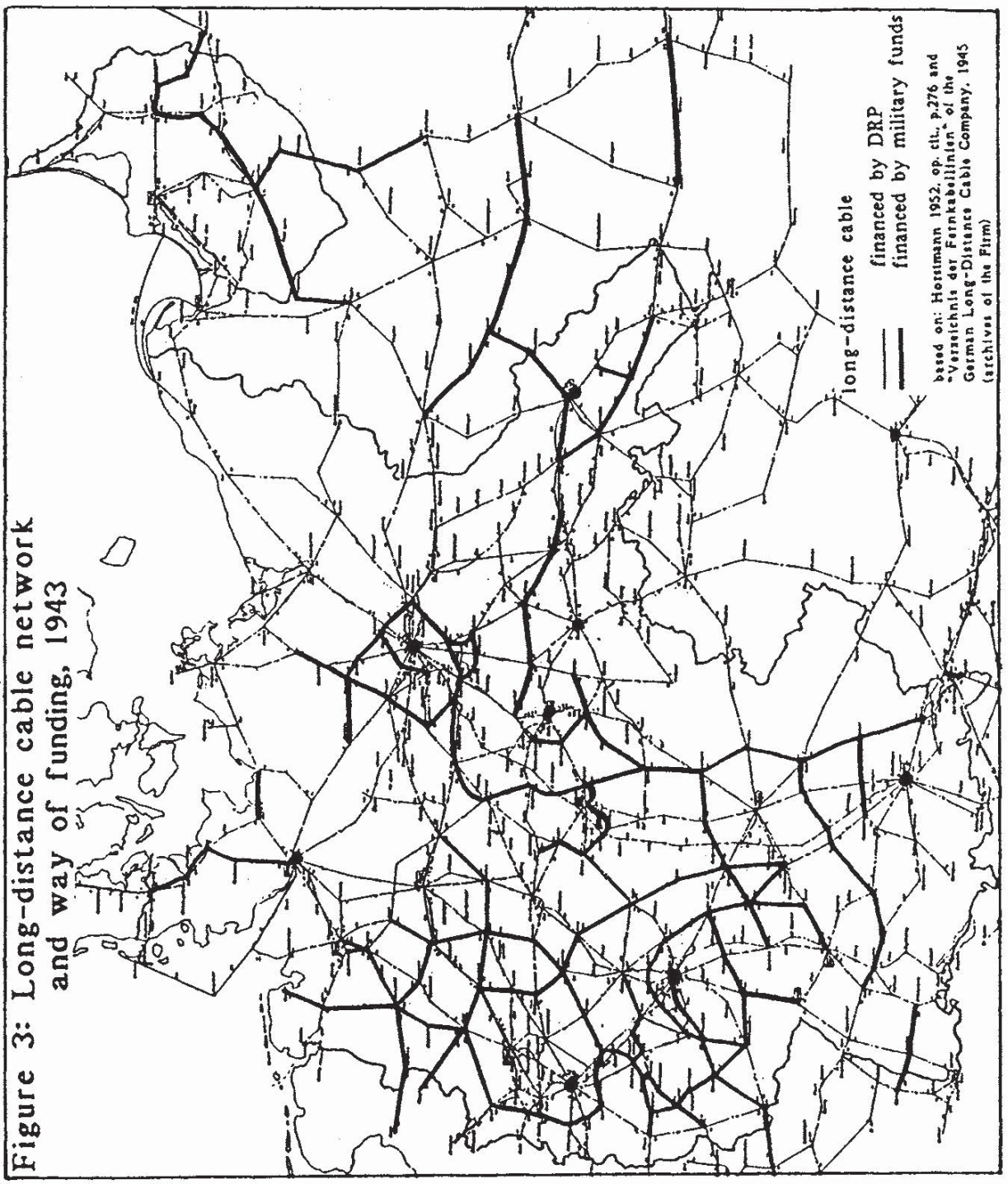


Figure 3: Long-distance cable network and way of funding, 1943

Modernization was a second feature of strengthening the telephone system. Coaxial cables connected the centers of political and military power (Berlin, Nuremberg, Munich, Hamburg, Frankfurt, Vienna, Hanover). In peacetime, the coaxial lines permitted economies of scope superior to the old standard telephone and telegraph cables: The technical function of the lines was to carry the centrally produced TV pictures to the first TV transmitters, to enlarge the number of circuits in telephone and telex transmission by enabling the use of carrier frequencies on cables and to transmit videophone calls. The star-shaped pattern resulting from the location of the TV production center in Berlin reinforced the locational advantage of the capital. In local networks, the new service of high-frequency wire broadcasting on telephone lines enabled a higher quality of broadcasting than on radio waves and, after 1939, to curb listening to enemy radio stations and to transmit detailed air-raid warnings without being monitored by Allied forces[51].

After the start of the Second World War, the military exploitation of the telephone system proved to be well planned. The Supreme Military Command became the core actor and controlled the telecommunications system with the help of the DRP experts. The military took full advantage of the system: On some cables more than 50% of the circuits were handed over to the military[52].

As the war went on and Hitler subjugated the majority of European countries, a genuine telecommunications *Geopolitik* emerged step by step. All of the networks in German-occupied countries were incorporated into the German one to serve as a unified Wehrmacht command-and-control system[53]. In October, 1942, the convention of the European Postal and Telecommunications Union was signed in Vienna, integrating the respective administrations of the German-dominated countries[54]. Special telecommunications attachés at the German embassies were to reinforce organizational links.

After the start of the Allied combined bomber offensive in mid-1943, the telecommunications system gradually broke down. The action pattern of the DRP changed from planned behavior to mere improvisation as the accumulating amount of destruction became overwhelming. But the way in which the DRP coped with the losses which the Allied attacks inflicted on its system highlights once more the political function of the telephone system. To counter the effects of Allied

bombings, a choice of alternatives existed for the DRP. These alternatives were related to:

- the technology of transmission (radio or wire),
- the transmission range (local or long-distance),
- the organization of maintenance (centralized or decentralized),
- the time sequence of usage (private, business, official or military).

As the primary function of the telecommunications system was the survival of the political system, the repair work emphasized the maintenance of the long-distance cable network that was necessary as a means for political integration. A special maintenance organization for the areas hardest hit was set up in July, 1943. It was assisted by maintenance teams of the special mixed private-public enterprise that had laid the cable network and later even by military signals units. An official radio telecommunications overlay network was planned to increase redundancy that was lost due to the bombings[56]. Private and business users had to use the telegraph or the mail service. Overload was curbed by increasingly tight queuing rules for long-distance telephoning, by the possibility of shutting down entire regions and by disconnecting private users[57].

In this time of utmost pressure Wehrmacht and DRP cooperated closely. Both sides urgently needed more lines than those that were left in operation. Cooperation in technical maintenance was extended to cooperation in utilization: The military allowed official civilian users to use their lines in closely specified situations[58]. As a result of Allied bombing and German countermeasures, the spatial structure of the telephone network changed. After 1944, the physical existence of the technical infrastructure and its usability started increasingly to diverge. Nevertheless, up to the very end of combat, a telecommunications system at the strategic level, reduced as it was, continued to work[59].

6 Reconstruction and expansion of the system

When the Allied forces occupied all of Germany, all forms of telecommunication were forbidden by Allied Proclamation No. 76. By military decrees of local military governments and by the initiative of DRP personnel a slow reconstruction and a very limited service began in

the summer of 1945. By this period, the integrating power of the DRP's organizational culture became clearly evident.

The war had destroyed neither the personnel nor the organization and the procedures. But the technical system had to be reconstructed, even if there were large parts that had survived intact. In the larger towns the technical infrastructure was most heavily destroyed so that the most modern equipment was most in need of repair. Also, the telecommunications industry was badly hit. Before the war, the largest telecommunications suppliers were all located in Berlin. Now, nearly all of them were bombed to the ground, and what remained was dismantled. Slowly, the enterprises began to reorganize in Western Germany. Though the material structures had mostly vanished, and initially German patents were no longer respected, the social structures of the firms, their relations with the telecommunications administration, and the personnel with its accumulated experience and expertise had not.

The Allied occupation did not alter the organizational structure of the telecommunications system too much, at least not in the long run. The local and regional level of the postal and telecommunications administration remained structurally unchanged, whereas the top ministerial level was reorganized according to the intentions of the different political powers. For a few years, there was a scarcity of experienced senior personnel because of the high numbers of former NSDAP party members among the experts that were temporarily ousted during denazification.

One of the earliest intentions of the Allied powers was to reconstruct the telephone network for their own needs. In all of the occupied zones, the reconstruction of technical and administrative structures of the telephone system was therefore among the first steps taken by the Allied postal and telecommunication officers. The very early establishment in September 1945 of an organization at the ministerial level for the British Zone, the Reichspost-Oberdirektorium, and of a consulting agency consisting of German officials for the whole of the French zone, can be traced back to the same purpose. At this time, the political control function of the telephone system remained active, but its economic function, including physical survival of the population, became more and more important[59].

Even before the currency reform of 1948 and the passing of a new constitution one year later, the combined postal and telecommunications

administration for the British and U.S. occupied zones reestablished contact with the telecommunications industry. An Advisory Committee for Communications Technology was founded to coordinate the future construction of German telecommunications. The function of this committee was to develop technical norms. In the spring of 1948, it was decided to automate long-distance switching, to change the switching technology and, as a prerequisite, to lay a new carrier frequency long-distance cable network. The geographical structure of the network had to be adapted to the new political and economic geography as well[60].

One reason for making such far-reaching decisions was surely that the war had only interrupted a development that had already begun. Full-scale planning to adopt automated switching (although limited to regional districts) had already started during the 1930s[61], and in 1938, Siemens & Halske had built a forerunner of the rotary switching technology that was used after 1955. With the internal telephone system of the Deutsche Reichsbahn, a decade-long experience with a nationwide dialing system - if again of limited complexity - existed[62]. Another reason is probably the continuity among technical experts and senior officials. Dr. Steidle, for instance, who was responsible for the first large-scale experiments made in Bavaria in the 1920s, reinitiated planning measures already in 1946[63] and later headed the central research and development agency of the German PTT. Moreover, the heavy destruction of the telephone system was perceived by the industry as a chance to construct an advanced system. This accorded well with its traditional export strategy. The German telecommunications industry welcomed state commissions as an opportunity to demonstrate its regained technological modernity to potential buyers abroad[64]. In any case, the decision to modernize was a deliberate step towards an infrastructure approach in network policy: The telecommunications administration intended to take its part in the reconstruction of the devastated country.

The technical norms for the new network were set at the 1946 and 1949 conferences of the CCIF, the International Consultive Committee on Telephony, a suborganization of the International Telecommunications Organization, without German participation. The Committee agreed on a network of carrier frequency lines as the new backbone of European international communication[65]. If the German PTT wanted to exploit the geographic advantage of Germany's position in the center of Europe and to attract transit traffic again, its long-distance network

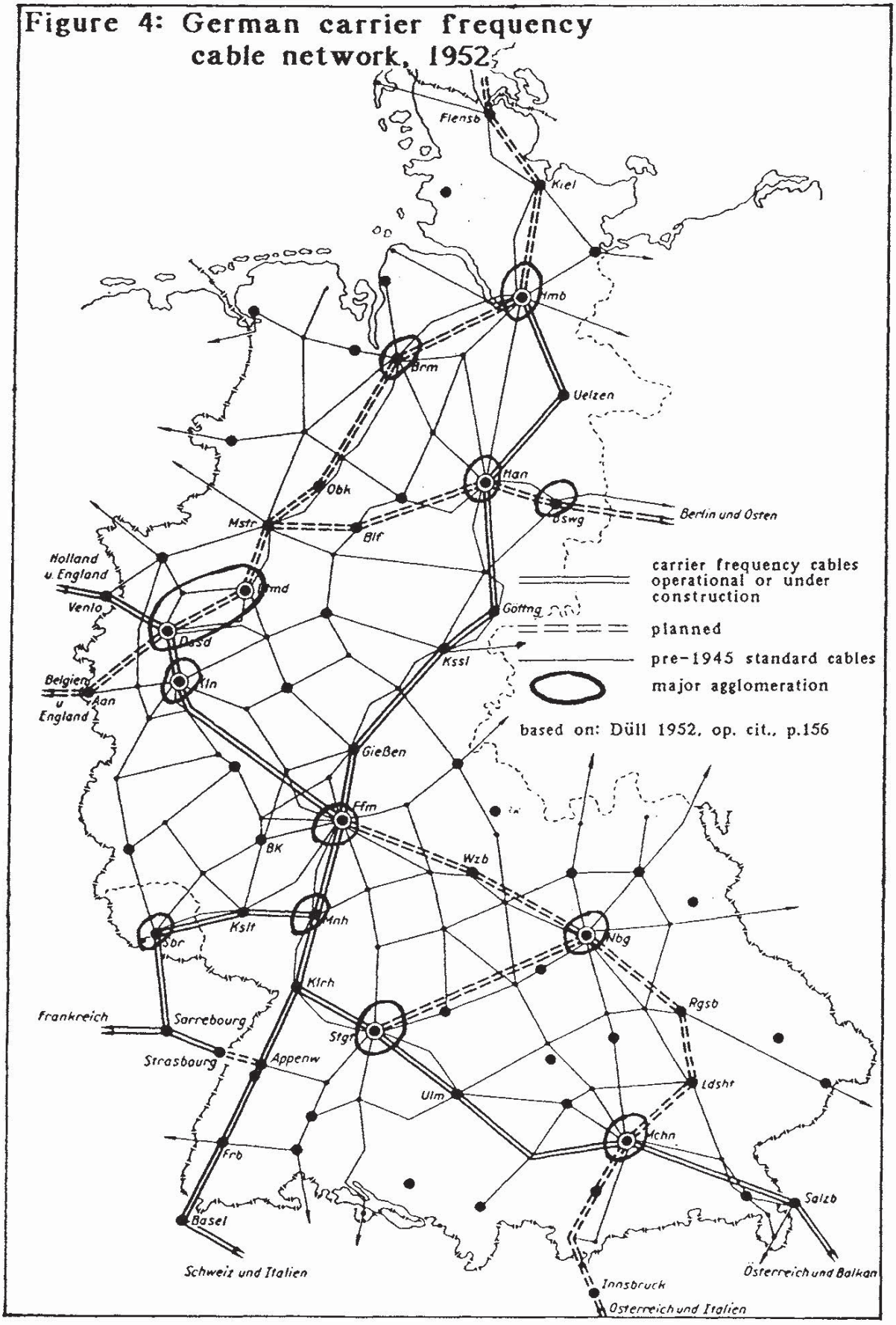
had to meet the aforementioned international standards. The main lines for the new network in Germany were then laid between 1949 and 1956.

New cables were developed that were adapted to carrier frequency use, and the use of styroflex plastics instead of copper for cable production reduced capital needs for transmission lines. Automated switching - although capital-intensive - and the incorporation and extension of former military multiplex microwave lines further reduced running costs. As in France, international military funds helped to finance some of the major lines[66].

After the foundation of the Federal Republic, a Federal Ministry of Posts and Telecommunications was established and the organization changed its name into Deutsche Bundespost. In 1953, the Bundestag passed a new PTT Administrations Act that, in most of its fundamental provisions, resembles the Reichspost Budget Law of 1924. Financial autonomy was confirmed, though the links of the Bundespost to the national bureaucracy were strengthened.

The second major characteristic of the post-war period was the start of mass distribution. Already in 1951, the telephone density (telephone stations per 100 inhabitants) for West Germany surpassed the all-German level of 1938 (cf. Figure 1). The system changed its character from a business tool and a luxury for the few to a *mass system*. It is not this orientation of the German PTT in 1948 and 1949 that was surprising, but its timing in the face of the poor conditions of the economy. In fact, the Bundespost merely followed the infrastructure approach with respect to subscriber growth of its predecessor. Already in the 1930s, the DRP had induced a growth of telephone stations by tariff reduction and promoted the development of a low-cost dial party-line technology to meet the low revenue expected from future small users[67]. What remains astonishing is that after the war, in an economic situation worse than ever before, the technological standard of the telephone station technology was even higher. The close integration of the PTT into national administration that the Basic Law as well as the PTT Administrations Act confirmed might be one reason. As a consequence, the right of every applicant to a telephone with the same operational quality and an infrastructure approach were stressed. Aside from this, the reasons already pointed out in connection with long-distance automation may have played a role.

Figure 4: German carrier frequency cable network, 1952



Economically, the expansion of the telephone system was made possible by a mutual reinforcement of supply and demand. The supply of telephone services was increased at low prices. The charge for a local call was viewed by politicians as a so-called "political price": Any increase herein was thought of by the federal government as an indicator of what the public might understand as inflation[68]. Therefore the federal government let the tariffs stay at the same level from 1954 to 1964. The demand for new private lines was made possible by the continuous increase in the purchasing power of the average household. System growth accelerated after the mid-1960s when wages went up and the majority of households had satisfied their immediate needs of housing, clothing and better eating. Today only residual household groups do not have a telephone at home, but compared with countries of comparable GNP per capita that started earlier with their telephone mass distribution (such as Denmark or Sweden), the West German system in 1985 still lags approximately one decade behind[69].

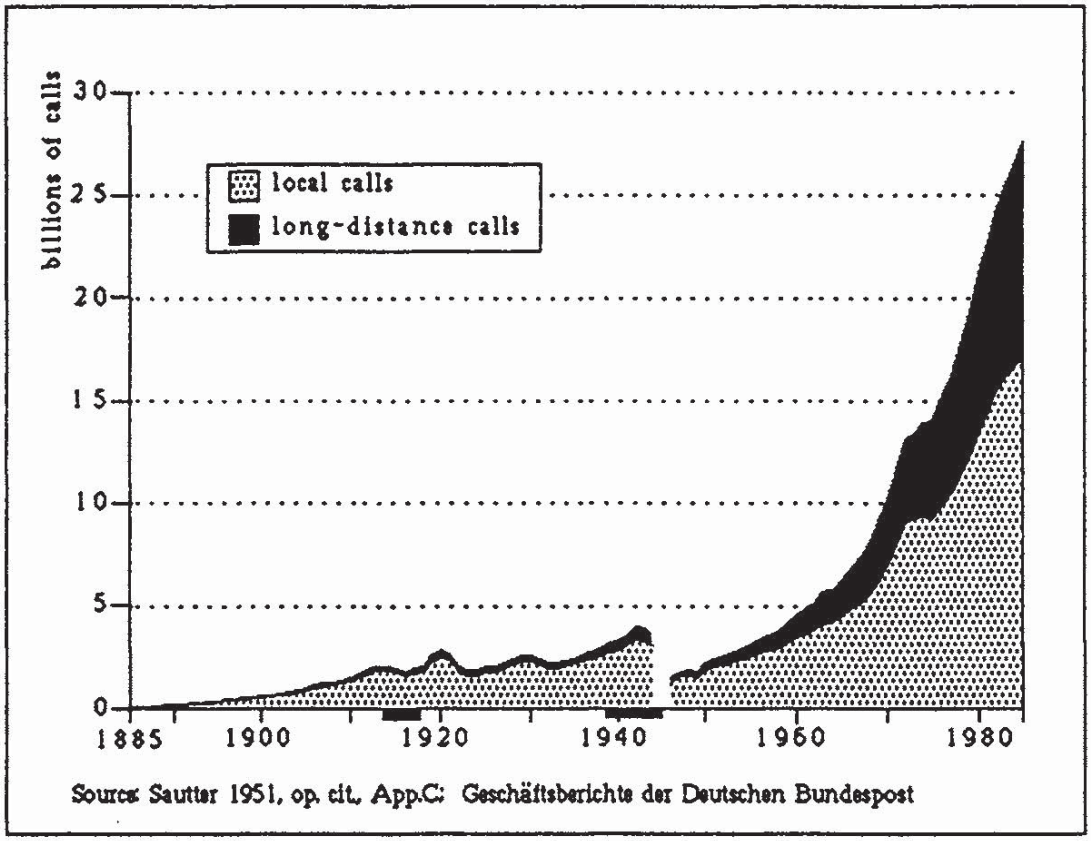
The geographical structure of the new network reflects the new political and economic space structure as the old one before 1945 mirrored previous spatial hierarchies. The new political system lacks the strong central position Berlin once had. A new spatial dispersion of economic activities further favored the regional centers. The high capacity carrier frequency network combined a star-shaped network that was generated in the dispersed local networks with a ring network that channelled interregional traffic. At the same time, the network structure stresses the north-south axis of all traffic in Western Germany (cf. Figure 4). The prewar cable network and its former military extensions now served as regional feeder lines.

With the automation of long-distance switching, the use of the long-distance lines increased enormously. Three reasons can account for this. First, for the first time the long-distance network became really attractive to the user as it enabled virtually instant communication with distant partners. Secondly, the German "Wirtschaftswunder" propelled the economy into previously unknown heights. Lastly, by calculating the call charge on the basis of the time used instead of on a minimum time of three minutes as in the era of manual operation before, automated long-distance calls were cheaper than manually switched ones[70].

The heavy use of the long-distance network was not expected by

the Bundespost. The spatial structure had been planned according to the use intensity and distribution of the operator-controlled era. After some time, the high use intensity made it necessary to link not only the highest levels, but even lower levels of the switching hierarchy with a mesh-form network.

Figure 5: Use of the telephone system: Local and long-distance calls, 1885-1985



Source: Sautter 1951, op. cit., App.C; Geschäftsberichte der Deutschen Bundespost

7 Conclusion

A number of lessons concerning the development of large technical systems can be learned from the history of the German telephone network.

First and above all: The development of the system is driven by decisions of a limited number of actors. If a certain amount of momentum developed, this was not a result of forces inherent in an autono-

mous technology but of purposive action constrained by the sediment of previous decisions about technological alternatives.

Second: The decisions made at the start heavily influenced the course of development of the system in the long run.

Third: Because of the integration of the telephone into the state communication system, in Germany political actors had the say also on economic questions. Such integration often makes it difficult to distinguish between the telephone system and other state communication systems.

Fourth: Political, economic, social, technical and geographic aspects of system development became tightly interwoven.

Fifth: In the case of a large-scale communications system which aims at overcoming geographical distance it is worthwhile to stress the geographic differentiation of the actor system and of the geographic properties of the system itself.

8 Notes

BA	content of a file in the Bundesarchiv, Koblenz
RGBl.	Reichsgesetzblatt

1 Up to 75 km of operational range in the early years. Ernst Feyerabend, 50 Jahre Fernsprecher in Deutschland 1887-1927. ed. by Reichspostministerium, Berlin, 1927, p. 31.
2 Feyerabend 1927, op. cit., p. 27.
3 Paul Henseler, "Aus der Frühzeit des Telefons", Archiv für deutsche Postgeschichte, (1975)2, pp. 164-166.
4 Feyerabend 1927, op. cit., pp. 25-28.
5 Willy Feudel, "Zum 100jährigen Jubiläum des Telefons in Bayern", Archiv für Postgeschichte in Bayern (1983)1, pp. 3-4. At this time of research, no apparent reason can be given for the non-adoption in Württemberg.
6 Conrad Matschoß, Werner Siemens, Vol. 2. Berlin: Springer, 1916, p. 535.
7 Jürgen Schliewert, "100 Jahre Fernsprechen in Frankfurt am Main". Hessische Postgeschichte 26(1981), pp. 32-33; Heinz Wernick, Die Anfänge des Telefons. 100 Jahre Telefon im Wuppertal, ed. by Fernmeldeamt Wuppertal, Wuppertal 1982, p. 5.
8 According to the autobiography of one of the participants: Paul David Fischer, Erinnerungen aus meinem Leben. Berlin: Springer, 1916, pp. 230-231.

9 René Muller, "Mulhouse, premier réseau téléphonique d'Alsace ... et d'Allemagne (1881)". Cents ans de téléphone en Alsace = Diligence d'Alsace (1976)16, pp. 21-22.
10 Oskar Grosse, 40 Jahre Fernsprecher. Stephan - Siemens - Rathenau, Berlin: Springer, 1917, p. 31.
11 Billig, "Die Entwickelung des Fernsprechwesens im rheinisch-westfälischen Industriegebiete 1881 bis 1886". Archiv für Post und Telegraphie (1887)14, p. 429; (1887)15, p. 454.
12 After the break-through in the development of long-distance communication equipment in 1887, the share of the telegraph service on national, long-distance messages dropped by 50% within 13 years. Derived from data compiled by Karl Sautter, Geschichte der Deutschen Reichspost 1871 bis 1945. Geschichte der deutschen Post, Teil 3. Frankfurt/M: 1951, Appendix C.
13 Colin Cherry, World Communication: Threat or Promise. A Socio-Technical Approach. London, New York, Sydney, Toronto: Wiley-Interscience, 1978, p. 46.
14 Reply of the Post Office to several Chambers of Commerce that had complained about its prohibitive conditions on behalf of opening new inter-city lines. R. van der Borght, "Die Thätigkeit der deutschen Handelskammern in Bezug auf das Fernsprechwesen im Jahre 1889". Jahrbücher für Nationalökonomie und Statistik 56(1891), p. 423.
15 No overall historical sociology of telephone usage for Germany exists until now, though identical local examples are given by Elfriede Meurer, "100 Jahre Telefon in Köln 1881-1981", Mitteilungen der Gesellschaft für deutsche Postgeschichte Bezirksgruppe Köln, (1982)7, p. 34; and Heinrich Walters, "100 Jahre Fernsprechnetze in Minden und Münster", Postgeschichte in Westfalen (1987)4, pp. 88-89.
16 Heinze/Kill, this volume.
17 Borght 1891, op. cit., p. 422.
18 Author unknown, "Die Berathung des Entwurfs eines Gesetzes über das Telegraphenwesen des Deutschen Reichs im Reichstag". Archiv für Post und Telegraphie (1892)7, pp. 222, 232-233.
19 Hermann Wiltz, Das Gesetz über das Telegraphenwesen des Deutschen Reichs (Telegraphengesetz) vom 6. April 1892 nebst dem Gesetze, betr. Abänderung dieses Gesetzes (Telefunkennovelle) vom 7.März 1908, Frankfurt/M.: Wolstein & Teilhaber, 1908, p. 1.
20 As it was evident in the reports published year after year in the Archiv für Post und Telegraphie, a supplement of the post office's administrative bulletin.
21 Heinze/Kill, this volume.
22 Annual report of the Chamber of Commerce of Halle (Saxony) for 1889, cited by: Borght 1891, op. cit., p. 422.
23 Jacques Attali and Yves Stourdze, "The Birth of the Telephone System and Economic Crisis: The Slow Death of the Monologue in French Society" in Ithiel de Sola Pool (ed.), The Social Impact of the Telephone, Cambridge/Mass.: MIT Press, 1977, pp. 97-111, and Jean-Paul Martin, "Les premiers développements du téléphone en Lorraine (1885-1914)", Revue Géographique de l'Est (1982)3-4, pp. 215-234.
24 Kurt Schubel, "Zur Geschichte der Finanzwirtschaft der Deutschen Reichspost- und Telegraphenverwaltung von 1871 bis 1918", Archiv für das Post- und Fernmeldewesen (1968)4, p. 422-423.
25 Grallert, "Das Telegraphen- und Fernsprechwesen vor, in und nach dem Kriege", Archiv für Post und Telegraphie (1921)1, pp. 13-14, 23-24.

26 Letter from the Postal Ministry to the Reich Chancellery re.: list of line break downs due to the Spartakist riots in March and April, 1919, dated May 28, 1919, BA R 43 I/1993 Bl. 9-15; and letter from the Office Workers Council of the Special Telegraph to the Under Secretary of State of the Reich Chancellery, dated January 3, 1921, BA R 43 I/2006, Bl. 39-42.
27 Cf. the volumes of "Europäischer Fernsprechdienst" that chronicle the growth of national long-distance cable networks in the 1920s all over the industrialized countries.
28 As a result of the galloping inflation, the telephone tariffs had to be altered once in 1919, in 1920, and in 1921 each, four times in 1922, 16 times in 1923, according to: Gottfried North, "Die Entwicklung der Fernsprechgebühren, in Deutschland", Archiv für deutsche Postgeschichte (1977)1, (Special issue: Hundert Jahre Fernsprecher in Deutschland), pp. 210-213.
29 Application of the Hansa Federation for Commerce, Trade, and Industry to the Reich government and the Reichstag re.: amendment of the Reichspost Budget Law, dated December 17, 1927, BA R 43 I/2006.
30 Post und Eisenbahn. Tatsachen und Gedanken zur Vereinheitlichung der deutschen Verkehrspolitik. Memorandum, Berlin: DIHT, 1932; Saliger, "Reichsverkehrsreform". Magazin der Wirtschaft 6(1930), pp. 1675-1676.
31 Correspondence between the representative of the Morgan Trust, Prince Löwenstein, the Reich Chancellery, the Reich Finance Ministry and the Postal Ministry, all dated between October 6, and November 9, 1931. BA R 43 I/1998 Bl. 361-374
32 Karl Sautter, "Organisationsfragen des deutschen Verkehrswesens", Archiv für Post und Telegraphie, (1932)6, pp. 145-149.
33 Schubel 1968, op. cit., p. 385.
34 Feyerabend 1927, op. cit., pp. 171-172.
35 Willy Feudel, "Die Entwicklung der Netzgruppentechnik in Bayern". Archiv für Postgeschichte in Bayern (1978)2, pp. 326-340.
36 Cf. minutes of the session of the Working Committee of the DRP Administrative Council on January 28 and 29 and February 2, 1927, BA R 48/207, pp. 2, 4.
37 Gebbe, "Aufbringung der Geldmittel für den Ausbau des deutschen Fernsprechnetzes". Europäischer Fernsprechdienst (1928)7, p. 60.
38 Ernst Feyerabend, Der Einfluß der Tarifpolitik auf die Entwicklung des Fernsprechwesens in Deutschland. Jahrbuch für Post und Telegraphie (1928/29) pp. 19-20,27; circular of Postal Ministry to all Reichspost regional administrations re.: advertisement in official telephone directories, dated May 15, 1930, BA R 48/312.
39 Letter from the Reich Ministry of the Interior to the Reich Chancellery dated February 15, 1934, BA R 43 II/1147, Bl. 13.
40 Law on the Simplification and Cost Reduction of the National Administration, issued February 27, 1934 (RGBl. I S.130).
41 He became Minister in 1937 and remained in office up to the very end of the war.
42 Minutes of the annual conference of DRP regional directors in the Postal Ministry at Berlin, on June 6, 1934, App. 2, BA R 48/238, pp. 3, 8-9.
43 Testimonial by Hans Schuberth, Director of Posts and Telecommunications for the American and British Zones of Occupation, dated October 20, 1947, printed in: Kurt Wiesemeyer, Das Personalwesen der Deutschen Post vom Zusammenbruch des Nationalsozialismus bis zu den Anfängen der Bundesrepublik, ed. by Bundesministerium für das Post- und Fernmeldewesen. Frankfurt, 1954, App. 1, pp. 156-160.

44 Appendix to the letter of the complaint of the retired DRP regional director Ringel to Hitler, dated December 8, 1937, BA R 43 II/1147 b Bl. 23, 36, 41.
45 Tapping devices were installed by the DRP, in some cases the DRP owned or even operated them, cf.: circular Reichsführer SS and Head of the German Police to all Gestapo-offices, dated August 28, 1937, BA R 58/242, Bl. 174.
46 Letter of the Reichspost Minister to the Head of the Reich Chancellery dated July 9, 1935, BA R 43 II/267.
47 Gerhard Meinck, "Der Reichsverteidigungsrat". Wehrwissenschaftliche Rundschau, 6(1956)8, pp. 420-422.
48 Hensger, Die Nutzung der Fernmeldenetze der Deutschen Reichspost durch die Wehrmacht im Zweiten Weltkrieg. Typescript, Feldafing, 1984, p. 4.
49 Walter Surén, "Erfahrungen von 1914 wurden im Zweiten Weltkrieg voll genutzt". Fernmelde-Impulse 6(1965)2, p. 55.
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52 Circular of Reichs Post Minister to all supreme Reich administrations re.: to employment situation and work distribution in the DRP, dated February 19, 1944, BA R 2/21203, p. 2.
53 Hensger 1984, op. cit., pp. 6-9.
54 Werner Zschiesche, "Der Europäische Postkongreß Wien 1942", Europäischer Fernsprechdienst (1942)61, pp. 92-93.
55 Letter of the Secretary of State of the Postal Ministry, Nagel, to Reich Minister Goebbels, Plenipotentiary for Total Warfare, dated January 3, 1945, BA R 43 II/638 Bl. 196r, 197.
56 Erwin Horstmann, 75 Jahre Fernsprecher in Deutschland 1877-1952, ed. by Bundesministerium für das Post- und Fernmeldewesen. [Frankfurt/M.] 1952, pp. 165-166.
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