

How it all began

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This article describes the background for the European Telecom Administrations' decision to start the work on the GSM mobile communication system and the fundamental issues the committee was faced with in the first five years, as well as how they were dealt with.

The basis for the work

The European telecommunications market was for a long time badly fragmented and in many areas lacking universally applied standards despite efforts by i.a. ITU. As a result, economy of scale could frequently not be achieved. In an attempt to remedy that situation, the organisation of 26 Western European Telecom Administrations (CEPT) in 1959 started standardisation activities, but the progress was often hampered by differences in policy in the member countries. As time went by, the fragmentation in the rapidly growing mobile communications field became particularly annoying because the very idea of mobile communication is of course to communicate while on the move, and the incompatibility made this impossible while visiting a foreign country. (One exception was the NMT system.) The spectrum available for new mobile communication systems was very limited in frequency ranges suitable for this purpose, among other things because of the large amount of spectrum reserved for radio and television broadcasting.

At the meeting of the World Administrative Radio Committee (WARC) in June 1979, it was realized that it was desirable to allocate a part of the 900 MHz band for land mobile communication in Zone 1 (which in the terminology of the Radio Regulations means Europe). The reason for this decision was that the 900 MHz band, which up to that time had not been extensively used, now was becoming attractive because of the technical development. A large block of spectrum was therefore reserved for land mobile use, but nothing was said about the character of the systems, whether they should be private or public, automatic or manual, analogue or digital.

CEPT discussed for a while the opportunity thus created. At the CEPT Telecommission meeting in June 1982, the Netherlands and the Nordic Telecom Administrations presented a proposal, stating that because of the rapidly increasing demand for mobile communication, the frequency band allocated by WARC'79 was in danger of being put to use for

national and probably incompatible systems. This would almost certainly remove the only opportunity for the coming decades to achieve a form of harmonisation in Europe in the field of public land mobile services, since frequencies above 1 GHz were not at that time considered suitable.

The Telecommunication Commission decided to entrust its Harmonisation Committee (CCH) with the task of coordinating the activities of CEPT in the field of mobile services. A special study group should be set up, reporting to CCH and working out an action plan with the aim of ensuring that compatible mobile systems could be implemented by the early 1990s. The new study group was given the name *Groupe Spécial Mobile* (GSM). The work was to be completed by 1986, and the Commission accepted an offer from the Swedish Administration to supply the author of this article as Chairman. (I was in a meeting somewhere else and was quite surprised when I heard this, since nobody had asked me in advance.)

The decision made by the Commission was quite vague, and in effect left it to the new group to propose its own terms of reference. Representatives of the Netherlands and the Nordic Administrations therefore met during the summer of 1982 in order to write a proposal for an action plan, which was subsequently approved by CCH in November that year and used (Doc. GSM 2/82) as the basis for the work of GSM for many years.

The decision only mentioned "harmonisation", which indicates that the compatibility aspect was the dominating factor behind the decision, and few delegates at the T-Commission meeting sincerely believed that free circulation of radio users across international borders could be achieved within the foreseeable future, given the serious political and military obstacles that existed at the time. In fact, later comments have indicated that in view of the many failures in European standardisation, many doubted that a common system could be agreed at all.

The start

From the start, it was clear that many more aspects than harmonisation had to be addressed if the goal of a modern Pan-European service was to be reached. Clearly, the goal envisaged by the CEPT Telecommunication and the CCH of completing the work by the end of 1986 could not be met if important new developments were to be taken into consideration. It was therefore decided that by the end of 1986 only an outline specification should be available, comprising the main system parameters for the various parts of the system and their interfaces, including the air interface.

The list of basic requirements for the new system was to a large extent patterned on the corresponding list for NMT, but with a number of modifications due to the fact that there would be a huge number of technological advances that had to be exploited, and of course also the necessity for the new system to satisfy the needs of a far larger community than NMT all over Western Europe. The need for services other than speech was stressed, but since nobody knew exactly what those services would be, the system structure had to be modular and flexible. The same philosophy as for ISDN and OSI should be applied in order to achieve this, and standards for protocols etc. should as far as practicable be compatible with such developments. Furthermore, the system must provide the same facilities as those offered in the public telephone and data networks, and the need for security must be taken into account, all of this without significant modifications of the existing fixed networks.

Hardly anyone among us expected that an analogue system would be preferable since the technology was clearly moving toward digitalisation. It had to be proved, however, that a digital system would meet the needs better than an analogue system. The digital technology had never before been tried in terrestrial public mobile communications, and it was necessary to convince the operators and manufacturers that a digital system was a realistic goal. Obviously, if "harmonisation" had been the only goal, an analogue system could be based on well established techniques and could therefore be specified and built in a short time. This may have been in the minds of some of the CEPT T-com delegates, whose main concern was to make sure that the allocated spectrum would be used for a harmonised system without paying much attention to the technical solution. The choice of analogue techniques would mean, however, that many desirable objectives could not be met, such as ease of introducing modern services, compatibility with the emerging digital fixed networks, etc., and it was clear that the digital technique had a far greater potential than the analogue one for mass manufacturing pro-

cesses. To establish the feasibility of digital technique in the mobile network was therefore among the first steps of the work in order to establish a truly modern system. The greatest problem would be caused by the need to achieve a satisfactory speech quality and at the same time conserve spectrum.

The first meeting of GSM was held in Stockholm in December, 1982. One of the most important issues at that meeting was the spectrum situation in the CEPT countries, and there was great concern that it might prove impossible to keep the 900 MHz band "on ice" for GSM for such a long time as envisaged in the work plan for GSM. The feasibility of a standardised system was thus in great danger, since it was unrealistic to expect the manufacturers to invest in a system with a very uncertain market potential. This point was a constant concern for several years until the EU Directive reserved the band for GSM.

Another important issue was the question of free circulation of users. The existing regulations in many European countries regarding the use of radio equipment by foreign visitors would clearly be a serious obstacle to the system since free circulation would be one of the great advantages in a common system. To eliminate such obstacles would therefore be among the most important tasks of the committee, but it would be a very difficult task since those obstacles were usually outside the authority of the national telecom administrations.

Some assumptions had to be made for testing the solution, regardless of the choice of analogue or digital techniques, and one such assumption must be a traffic model. This was a very important issue during the first year of the group. In retrospect, of course, those traffic figures look almost ridiculous today.

Mode of operation

The written and unwritten rules of CEPT were in many ways very different from those generally used in purely national bodies. As usual in CEPT, we had to work on the basis of consensus, so there would be no voting. Earlier experience in CEPT and other standards bodies had shown that making recommendations by majority decision could easily lead to a situation where some countries chose to disregard the recommendations, and the compatibility was then lost. (It is correct to say that the possibility of voting in a few special cases was introduced towards the end of the 1980s, but it was never used by CEPT/GSM.) Consensus is not the quickest way to reach a decision, but on the other hand, a consensus makes it almost certain that everybody is going to stick to the decision made.

The choice of working language was of great importance for the efficiency of the work. In CEPT, both English, French and German were established as working languages, and the committees and many large working groups therefore worked through translators. In GSM, we agreed that it would be far better to work in English only, since just about everybody in the technical field had a sufficient command of the English language, and since working through translators in such a highly specialised field would actually hamper the work. Furthermore, making arrangements for translators and interpreters for every meeting would involve practical problems and major costs. The language question turned out to be a politically sensitive issue in certain countries, however, and the respective delegations had to do some arguing at home in order to convince their managements. They succeeded, and English was accepted somewhat reluctantly as the only working language. The issue resurfaced after a few years but the rules were then firmly established and nothing happened. Without this decision, we would never have been able to reach consensus within the time frame agreed.

The GSM committee had to utilise other bodies in- and outside CEPT as much as possible. Within CEPT, there were many working groups with experts in the fields of radio issues, signalling, data transmission, commercial issues, etc. In addition, the GSM committee liaised with several bodies outside CEPT, such as various COST groups and industrial bodies like EUCATEL. The expertise in those groups was very useful for the work on the new system. Another body with which we had frequent contacts was the European Commission, which on the political level proved to be very helpful. Above all, through their activities, the GSM frequency bands (890–915 and 935–960 MHz) were reserved for the coming Pan-European system.

It soon became clear that it would not be possible to deal with all issues in the Plenary, so GSM decided to set up three ad-hoc sub-working parties, reporting to the plenary, to deal with the three major areas of services and facilities, radio aspects and network. As is usually the case in most organisations, the increasing workload made it necessary to increase the number of working parties and to make them more independent, and in 1986 we had to set up a Permanent Nucleus in Paris in order to support the work, both in the Plenary and in the working parties.

The question of IPRs, often a difficult issue in standardisation bodies, arose early in the work. In line with the usual CEPT strategy, it was decided to avoid patented inventions unless they could be made available royalty-free for the CEPT standards, and we suc-

ceeded in acquiring solutions along those lines for two areas, i.e. speech encoding and voice activity detector. After 1988, the question of IPRs was taken over by the MoU and it assumed a much greater importance.

Crucial and controversial Issues

Two crucial issues during the first years of the GSM work, i.e. analogue versus digital techniques and the access and modulation method in a digital system required a lot of work. Proposals were invited and no less than eight were submitted for testing, which was done in Paris in late 1986 by CNET assisted by the GSM Permanent Nucleus. The results were discussed in a meeting in Funchal, Madeira in February 1987. The group found unanimously that the digital technique offered great advantages over the analogue one, and the measurements showed that the requirement for speech quality could be met with a good spectrum economy. Controversy arose around the second question, however, since France and Germany had proposals which did not agree with those of the other CEPT countries. This was due to political decisions made in France and Germany, not to any disagreement on the part of the delegates present, who were privately in agreement with the rest of CEPT/GSM, but they had to follow the line taken on the highest political level at home. Despite endless discussions, the issue could not be resolved in the meeting, so on this fundamental question there was a serious risk of failure of the entire GSM effort. During the following months, however, a considerable amount of pressure was put on the governments in the two countries, above all by the European Commission, which was very anxious to get a Pan-European system. As a result, in the next meeting in June 1987, France and Germany informed us that they had agreed to the solution accepted by the others. Thus ended the only really serious controversy that we had in CEPT/GSM, and we were now certain that there would be just one European system. Without agreement on that point, the Pan-European system of today would not exist.

Conclusion of the first phase

The 1987 decision was a milestone in the work on the system, since it eliminated the only major controversial issues and the road towards the final goal now lay open. There were many changes to our work arrangements, such as the joining of ETSI in 1989, but basically the established organisation with working parties, Permanent Nucleus, etc. stayed although the names were changed. As examples of those changes one should note the signing of the Memorandum of Understanding in September, the opening of CEPT groups to the manufacturing industry and later the

creation of ETSI. Without the commitment of those bodies, hardly any manufacturer would have dared to invest the huge sums required for the development of the system. Still, five years of detailed work remained to be done. There is no doubt that in terms of man-years, they represent a far greater part of the work than Phase 1 and was basically a detailed design project, which cannot be said of Phase 1. The support by the operators, national regulating authorities and manufacturers grew, and a huge number of people were gradually enlisted. However, that part of the work is well known and it would lead too far to go into it here.

The interested reader will find it in [1].

Reference

- 1 Hillebrand, F et al. *GSM and UMTS, The creation of Global Mobile Communications*. London, John Wiley, 2002.

Thomas Haug (77) was employed by the Swedish Telecommunications Administration (now Telia) from 1966 until his retirement in 1992. He was Chairman of Groupe Spécial Mobile in CEPT, later ETSI TC/GSM, from its inception in 1982 until the start of the system in 1992, and in that capacity he led the work on the specifications for the GSM system. From 1970 to 1978 he was Secretary of the joint Nordic NMT committee which worked out the specifications for the NMT system, and from 1978 until 1982 he was Chairman of the NMT committee.

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