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International Standards for Worldwide Communication

Unless comprehensive standards are adopted before the introduction of new telecommunication services and systems, worldwide communication between all users and uniform operating procedures will not become reality.

The I series of recommendations adopted by the CCITT laid the foundation for compatibility in ISDN. The first ISDN Communication Systems, like the HICOM system, are now appearing on the market, which makes the development of ISDN on the basis of universal compatibility a subject of particular importance.

Efforts toward compatibility and their chances of success

Compatibility between communications equipment (systems, units) and between services (features, procedures) is essential to international communication. Although it is easy to appreciate the need for it, it is often difficult to implement. Numerous parties (users, manufacturers, telecommunications administrations) with different, often conflicting interests are involved in the process. They define compatibility in different terms and have different views of the degree of compatibility desirable or necessary. Added to this is the fact that, owing to the rapid developments in telecommunications engineering, different ideas prevail these days about the degree to which compatibility requirements can be fulfilled at all. Attaining a specific degree of compatibility is no longer merely the result of optimization of technical and economic resources by a select group of experts. Political influences with specific goals are affecting the compatibility issue more and more.

Bearing in mind its long historical background and its present significance, compatibility can be defined as follows: compatibility exists when communications equipment and communication services can be interconnected without additional conversion or adaptation. It is recognized that definitions exist for specific applications which go beyond this basic requirement and can be included within its wider framework.

The trend toward "inner" compatibility

In the past, it was sufficient to draw up specifications for the few interfaces to the international network needed for the relatively small amount of international telephone and telegraph traffic. National networks were only affected to the extent required for handling international traffic. Today, every communications user should, in principle, have the means of communicating with any other user in the world. This assumes a much higher degree of "inner compatibility" than was the case with the interface compatibility previously required at only a few points within the network.

This is not the only reason for stepping up standardization in telecommunications. To an increasing extent, the developing countries are demanding technical standards for equipment for which previously no international specifications except for interface compatibility were required. Since these countries often have neither the experience of the indus-

trialized countries nor sufficient experts to conduct their own studies, they require these standards to guide them in selecting the equipment and services best suited to their needs from the vast range offered by the international communications industry.

Such standards, of course, are also useful to administrations and operating companies in the industrialized countries, which have been developing systems themselves or have enough know-how to make their own selection.

Interest is also growing in a number of countries where deregulation of the telecommunications monopolies is taking place. No longer the reserve of a single authority or operating company, communications in these countries are being run by numerous new organizations with their own networks which eventually have to be interconnected. International standards can be of great advantage in this new area as well.

In short, "inner" compatibility, achieved by standardization of the various network components, is demanded more than ever. This in turn is leading to a rapid increase in standardization work by international bodies to achieve the degree of compatibility desired.

One major factor, however, must not be overlooked here: demands for "inner" compatibility can go too far and inhibit innovation. This is not in the interest of users, administrations or operating companies, who stand to gain from innovations and wish to exploit them. **A** sensible balance of interests must be found, ensuring that all the groups involved can see their justifiable demands met as far as possible, to the advantage of all concerned.

The time factor

The driving force in communications is modern semiconductor technology. It enables industry to produce equipment and systems offering higher and higher performance and economy in innovation cycles of rapid succession. International coordination processes in pursuit of compatibility must adjust to this pace. It is not always possible, however, to launch these processes and draw up the required standards in step with technology.

If the processes start too early, there is a danger of premature specifications being adopted which may restrict or even preclude the application of desirable equipment, systems, or communication services at a later date. If, on the other hand, coordination starts too late, the chances of achieving compatibilitybetween existing, non-standardized equipment or services are reduced – nobody is willing to pay for subsequent adaptation, the cost of which is often exorbitant.

The reason for this dilemma is the considerable financial risk that every manufacturer on the telecommunications market has to bear. Every manufacturer hopes, of course, that his product will make an impact on the international market and that the substantial investments involved will pay off. Usually, however, several manufacturers with the same hopes have similar products appearing on the market at the same time, and it is often a long time before meaningful talks on compatibility standards can be started. Recent examples are the long lasting discussions on facsimile standardization and the ongoing efforts toward compatibility in the different videotex standards (Prestel, Teletel, Bildschirmtext, Telidon, etc.).

Compatibility and politics

The increasing number of communications options is accompanied by a growing interest from political circles. Political forces are influencing communications more and more – this is true of all countries – and, with it, the demand for compatibility. Media policy, i.e. questions relating to user rights in private and public networks and to possible future communication services, is a relevant example. Market policy is a further political issue. The communications market is one of the few growth markets left. It follows that various forces in the political arena will attempt to dictate market policies (regulation, competition, etc.). Such motives also affect defini-

tions of standards and can influence the depth and scope of specifications and standards.

The example of ISDN standardization

Let us now look at a practical example of how the problems outlined above can be solved in the search for acceptable compatibility.

Telecommunications has reached new milestones:

- development of digital technology for uniform transmission of voice, text, images and data,
- emergence of software as a powerful instrument for switching, signaling and network management,
- exploitation of VLSI circuitry in advanced hardware,
- application of CAD to design interface architecture.

All these are essential steps in the technical development of the ISDN (Integrated Services Digital Network).

ISDN permits the integration of different communication services in a single transmission network and provides access to them via a single connection (information outlet), under a single directory number and all from the same user terminal. It was obvious from the beginning, however, that this goal could not be achieved without comprehensive standardization – standardization unprecedented in extent – and that it would have to coincide with the introduction of ISDN **(Figure).**

Moving toward ISDN

The CCITT (Comite Consultatif International Telegraphique et Telephonique has been involved with this network since 1972. Progress in digitization of the telephone network proved conducive to materialization of the ISDN concept. No longer the fantasy of a handful of optimists, it began to play an important role in international discussions, among experts and users alike, who became increasingly interested in its potential.

Adoption of the first ISDN recommendations by the 1984 CCITT Plenary Assembly in Malaga-Torremolinos (I series recommendations) was the first visible result of this work.

The new ,recommendations provide guidelines for the development of ISDN. They assume that the ISDN will develop in several phases.

The first phase – the prerequisite for ISDN – is digitization of the analog telephone network. In the second phase, the digital telephone network will develop into a narrowband ISDN for integration of all communication services operating at up to 64 kbit/s. In the third phase, this can be expanded into a wideband ISDN for communication services operating at more than 64 kbit/s. Technical implementation of this phase will not be dealt with here.

Problems on the way

Appreciation of the progress made by CCITT Study Group XVIII in dealing with ISDN standardization calls for a certain familiarity with some of the problems which had to be solved and which ultimately determined the scope and depth of specification of the new I series of recommendations.

The first obstacle here is that the development phases outlined are taking place more or less simultaneously, rather than consecutively. In many countries digital switching and transmission systems are being installed in the analog telephone network. This would correspond to the first phase. But whereas the first phase will go on for decades until the telephone network has been fully digitized, we are involved in planning the 64-kbit/s ISDN now. In this sense we are already in the second phase. And we should not forget that this is not the final goal. Wideband services are already being announced, and the third phase of the wideband ISDN is not far away. The consequence is that ongoing standardization must not only satisfy those requirements which can be realized today,

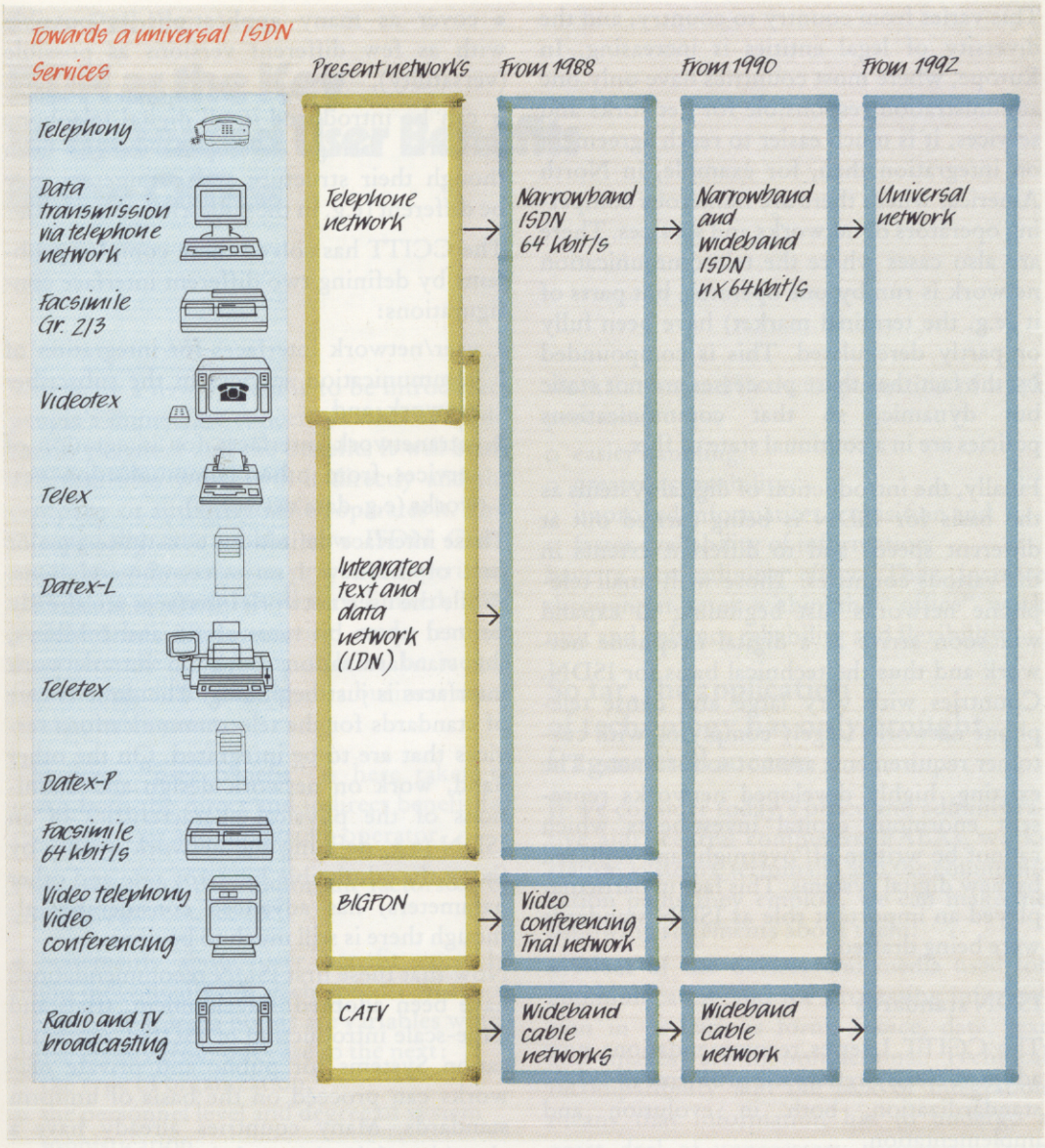

Figure Major steps in the evolution of the analog telephone network into the universal ISDN, marked by a steady progression of technical developments through several successive stages of integration, as anticipated by the Deutsche Bundespost

but also allow for the technological developments of tomorrow and years to come.

- A further obstacle to ISDN is the uncertainty as to the extent to which integration of existing telecommunication services is desirable or feasible. Uncertainty as to the course that new telecommunication services are likely to take is another factor. All this must be taken into account during the standardization process, i.e. standards must be flexible.
- The legal position is another problem, i.e. the question as to who is allowed to operate telecommunication services in a country.

This varies from country to country, and the diversity of legal entities is increasing. In Europe, where most countries have only one administration responsible for networks and services, it is much easier to reach agreement on integration than, for example, in North America, where there are numerous competing operators of networks and services. There are also cases where the telecommunication network is run by one operator, but parts of it (e.g. the terminal market) have been fully or partly deregulated. This is compounded by the fact that these processes are not static but dynamic, so that communications policies are in a continual state of flux.

Finally, the introduction of digital systems as the basis for ISDN is being carried out at different speeds and to different extents in the various countries. Those with small telephone networks just beginning to expand will soon arrive at a digital telephone network and thus the technical basis for ISDN. Countries with very large and dense telephone networks largely complying with customer requirements are not so fortunate. The existing, highly developed networks represent enormous capital investments which cannot be written off overnight and replaced by new digital systems. This fact in particular played an important role as ISDN standards were being drafted.

ISDN standards

The CCITT I series recommendations now adopted clearly reflect the problems of ISDN standardization, both in evolution and implementation.

Under the new recommendations, the basis for this ISDN evolution is the digital telephone network. Suitable access points (interfaces) have been added to this network via which other (non-telephone) services can gain access to, or be integrated into, the digital telephone network, which thus becomes an ISDN. Interface definitions should ensure that interfaces

- are as simple as possible (economy),
- cover as many applications as possible with as few different versions as possible (versatility),
- can be introduced in all digital telephone networks being developed today, even though their structure and parameters may be different (eg. in the subscriber network).

The CCITT has solved these complex problems by defining two different interface configurations:

1. user/network interfaces for integration of communication services in the subscriber network, and
2. intranetwork interfaces for integration of services from other communication networks (e.g. data networks).

These interface definitions constitute a major part of the new I series recommendations. While the user/network interfaces are already defined up to bit rates of 1.5 and 2 Mbit/s, the standardization work on intranetwork interfaces is just beginning. The same is true of standards for the telecommunications services that are to be integrated. On the other hand, work on network design and definitions of the physical characteristics of an ISDN (e.g. defining the network quality by fixing the admissible bit error rate and other parameters) has advanced considerably although there is still much to be done.

Now that these first ISDN recommendations have been adopted, development, trials and large-scale introduction of ISDN Communication Systems for public and private networks can proceed on the basis of uniform standards. Many countries already have a clear idea of the time scale involved.

In the years to come, innovation in the field of communications is expected to surge ahead because of the vast selection of new services and enhancements that ISDN has to offer. The even closer affinity to information processing that ISDN will foster suggests that a totally new communications structure will emerge which will place decision-making and the dissemination of knowledge on a completely different footing.