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Mobile communications – On standards, classifications and generations

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ABSTRACT

The research question addressed in this paper is concerned with the manners in which the general technological progress in mobile communications is characterized and the reasons for the differences in these modes of manifestation. The relevance of this research question is that the different manifestation modes create a degree of confusion in communications and discussions on mobile technologies. At the same time, it should be recognized that different manners of categorizing technologies illustrate the fact that categorizations are based on different purposes of the classification exercises. Also, the paper discusses the role of the International Telecommunication Union (ITU) in the processes of mobile standardization.

In common parlance, progress in mobile technologies is mostly referred to as generations. In ITU, the classification terminology is that of International Mobile Telecommunication (IMT) standards. In the specialized standards body with a central position in the standardization of core mobile technologies, namely 3GPP (3rd Generation Partnership Project), the terminology of 'releases' is used. In order to address the research question, the paper uses an analytical framework based on the differences and relationships between the concepts of standards, classifications and generations.

1. Introduction

Mobile communication is often classified in generations - beginning with 1G or even '0G' (legacy public or private land mobile radio systems) and currently with the processes of 5G standardization. The concept of generations is in a sense fortunate as it indicates that there are ongoing processes with different 'steps' and that each generation includes different solutions. But it is also a vague concept and not always appreciated by technology specialists in the mobile field (ITU, 2013; ITU, nd). They consider the G-concept to be a marketing tool for mobile operators and equipment manufacturers and prefer to talk about 'releases of specifications' from the bodies standardizing mobile technologies and refer to the classification system institutionalized by the International Telecommunication Union (ITU) on the progression of IMTs (International Mobile Telecommunications), from IMT-2000 and IMT-Advanced to IMT-2020.

The coherence between the concept of mobile generations and the ITU classification of IMTs is not complete. The 3G-category and the IMT-2000-category do, for instance, not entirely correspond, and there has been a discussion as to whether the LTE standard (Long Term Evolution) can be called a 4G technology. The Norwegian consumer ombudsman, for instance, in 2010 accused the operator Netcom of false marketing when offering LTE as a 4G-technology (PCWorld, 29 Oct. 2010), and ITU does not consider LTE as an IMT-

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Advanced standard (ITU, 2015).

There are thus different ways of categorizing the advances in mobile communications. In general parlance, the concept of generations is used. In the ITU context, progressing versions of IMTs is the terminology applied. And then, there are the releases from the standardization bodies.

In the paper, we will discuss these concepts – how they are used and how they relate to one another. The framework for this discussion will be the concepts of standards, classifications and generations. Standards are prescriptive norms for 'how things should be', while classifications are descriptive categorizations. There is, obviously, a relationship between the concepts of standards and classifications. There needs to be standards for how to classify, standards are classified, and classifications are necessary tools when standardizing. Furthermore, the concept of generations will be applied. While standards and classifications are often used in a static manner, the concept of generations adds a dynamic perspective to the analysis.

The purpose of the paper is two-fold: On the one hand, we aim at clarifying the relationships between the mobile generations and the consecutive IMTs and the releases from standardization bodies. On the other hand, we wish to examine the concepts of standards, classifications and generations to see how they can be used for analyzing the developments of mobile standards.

First, there is a discussion on the concepts of standards, classifications and generations. Thereafter, the concepts of mobile generations, IMTs and releases are presented. This is followed by a summarizing discussion and conclusion.

2. Standards, classifications and generations

Standards are prescriptive norms for 'how things should be', while classifications are descriptive categorizations. A paper by Bowker and Star (1998) says: "Classifications and standards are two sides of the same coin … classifications are containers for the description of events … whereas standards are procedures for how to do things". And they add: "Every standard imposes a classification system".

In some fields of science, standardization and classification are important active and explicit concepts and tools. This applies primarily to medical science where the classification of diseases and the standardization of procedures for treatment are valuable practical tools – see, for example, a paper by Rullier, Denost, Vendrely, Rullier, and Laurent (2013) entitled 'Low rectal cancer: Classification and standardization of surgery'. One can also find the concepts of standardization and classification used in other contexts, for instance in a paper on technological progress in the bakery industry by Barbiroli and Mazzaracchio (1994) entitled 'Classification and standardization of bakery products and flour confectionary in relation to quality and technological progress'. However, generally, the issue of standardization and classification is dealt with in practical manners as tools and the conceptual relationships are not discussed.

Though it also happens that the concepts of standardization and classification are mixed up, the difference is clear. The same does not entirely apply to the concept of generations. Generations are classifications but in a diachronic manner as opposed to a synchronous classification. At the same time, there is a sense of 'something that has to be lived up to' (standards) and that the new generations are better than the former.

2.1. Standards

Now and then the word 'standard' is also used for how things are mostly done without any prescriptive qualifications. But at a point in time, somebody (a group of people or otherwise) has determined explicitly or implicitly 'how to do things'. The prescriptive character certainly applies to technical standards as in the case of the different generations of mobile communication standards, but standards are found in all aspects of life. Languages are standards, and there are standards for good behavior. Measuring is based on standards, and compatibility specifications are standards.

In a seminal paper, David (1987) differentiates between three basic types (classifications) of standards: Reference standards, quality standards, and compatibility standards. Reference standards are used for measurements; quality standards are used for setting the bounds for acceptable qualities; and, compatibility standards are used for ensuring interoperability between different parts of systems. While there are surely reference standards and quality standards used for the various generations of mobile standards, mobile standards like all other ICT standards are basically compatibility standards. They provide the basis for making certain that devices and infrastructure elements can communicate with one another.

Other useful categorizations of technical standards are concerned with the differentiation between de facto and de jure standards and the differentiation between sponsored and unsponsored standards (David & Greenstein, 1990). De facto standards are also called industry standards and are the standards that are established in the markets either by dominant players or by other selection mechanisms. De jure standards are the standards being negotiated and decided upon in official standardization bodies - national, regional or international. Even if the concept of 'de jure' linguistically implies that the standards have a legal status, this is mostly not the case. Most standards developed in de jure standardization bodies are voluntary. But the organizations in which standardization takes place are recognized by public institutions.

Sponsored standards are standards which are supported (sponsored) by specific market players, and the 'sponsorship' is often based on intellectual property rights (IPRs). Unsponsored standards, on the other hand, are standards where there are no intellectual proprietary rights involved and where the dominant standards arise more spontaneously. Sponsorship is primarily linked to de facto standards, however, sponsored technology solutions may also enter de jure processes, as companies participating in de jure standardization processes will carry their proprietary solutions into the de jure standardization bodies.

All these issues – and many more – are part of standardization processes. The implications are that the developments of standards often constitute very complex processes with many different market players and with many public as well as semi-public and non-public bodies involved. Interests of the different players will often diverge and conflicts of interest can be intense, but, at a point in time,

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