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Leadership with 5G in Europe: Two contrasting images of the future, with policy and regulatory implications

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ABSTRACT

European policy makers have shown a keen interest in the success of 5G because ubiquitous and high capacity electronic communication infrastructure is recognized as a cornerstone of economic development and productivity growth. The second generation, GSM, is considered the leading example, reaching its peak of deployment in 2015 with 3.83 billion subscribers served by over 700 operators in 219 countries and territories.

With 5G rapidly shaping up in the R&D and standardization environments, and a call for leadership with 5G in Europe by policy makers, it is timely to investigate what lessons can be learned from the success of 2G that can be applied to 5G. More broadly, this calls for research into the commonalities and differences between successive generations of mobile technology, their introduction and the market adoption that followed. This also calls for an investigation into the possibility of multiple futures of 5G and how that impacts the opportunity for leadership. As one future may be more desirable than the other, depending on the perspective of the actor involved, a policy debate will be required to determine the most desirable future. As well as a discussion of the policy and regulatory actions required to enable a particular future.

Hence, the two-part research question being addressed in this paper is: *What explains the success of 2G-GSM and how can it be applied to create success with 5G in the European Union*?

To respond to the research question this paper first identifies the leadership lessons to be drawn from the success of 2G-GSM in relation to its successors 3G and 4G. Secondly, the contribution describes two stylized images of possible futures of 5G, called "Evolution" and "Revolution", as input to the policy debate on the options for leadership with 5G. These images reflect two extremes in terms of possible futures of 5G. "Evolution" follows the pattern of previous generations and current trends. "Revolution" represents a clear break with these trends and a path towards leadership with 5G, as it exploits the opportunities of standardized APIs for service creation, being enabled by network virtualization as an architectural foundation of 5G. These open and uniformly applied APIs allow the market entry of a multitude of virtual mobile network operators (VMNOs) serving particular industry verticals or economic sectors with tailored feature sets and qualities of services. They allow a market momentum to be built that constitutes leadership with 5G in Europe.

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1. Introduction

With the introduction of each new generation of mobile communications technology comes a new opportunity for leadership. With the success of 2G-GSM in mind, European politicians would like to see an EU leadership role with 5G, which is scheduled to be introduced in 2020. However, since the introduction of GSM in 1991 much has changed. An assessment of the factors that have enabled the GSM market momentum to build and be maintained shows that most of these factors are not applicable anymore. The industry has moved from regional standards to a global one. The mobile services market has been liberalized and the role of government has changed from being in the lead to acting as a facilitator of industry development. Nonetheless, a leadership opportunity with 5G remains feasible, enabled by the virtualization of the 5G architecture and the focus of 5G on serving so-called vertical industries, such as automotive, public transport, media and entertainment, financial services, energy utilities, manufacturing, health and public safety.

With the success of GSM, introduced in 1991, reaching its peak in deployment in 2015 with 3.83 billion subscribers and 700 operators in 219 countries and territories, it should not come as a surprise that the call for European Union leadership in the development and deployment of mobile communications is raised with each successive generation. European Union policy makers have a keen interest in the success of the next generation because ubiquitous and high capacity electronic communication infrastructure is recognized as a cornerstone of economic development (EC, 2010). This also applies to 5G.

The economic interest can be illustrated by the anticipated revenues globally. While the current mobile operator service revenues are expected to grow 1.5% on an annual basis – from US$1.5 billion in 2016 to 1.7 billion in 2026, the digitalization revenues for ICT players are expected to grow by 13.3% annually – from US$939 million in 2026 to $3.2 billion in 2026. Out of the latter US$1.2 billion is expected to be 5G enabled revenues for ICT players. Energy utilities and manufacturing are expected to assume a major share with 20% and 19% respectively. The addressable market for mobile operators in 2026 is expected to consists of US$193 billion as network developer, $507 billion as service enabler and $582 billion as service creator. (Ericsson, 2017).

Hence, the two-part research question being addressed in this paper is: *What explains the success of 2G-GSM and how can it be applied to create success with 5G in the European Union?*

To answer the research question the first part of the paper investigates the concept of leadership and success. Subsequently it identifies the conditions that have led to the success of GSM using historical analysis. The findings are compared with the developments around 3G and 4G and with the steps in the development of 5G undertaken so far.

The second part of the paper is aimed at creating the basis for the policy debate to create success with 5G in the European Union. For that purpose two contrasting stylized future images are constructed. Taking a more conservative perspective, the market trends can be interpreted as an evolutionary development in mobile technology. 4G – true to its name Long Term Evolution – is giving way to a gradual introduction of 5G, as the needs of the mass market consumer are well served by 4G and the demand for new features of 5G is remaining modest. Hence, operators prefer expanding the current 4G infrastructure and are prudent with investment in 5G. This leads to the construction of the "Evolution" scenario as the base line. Such an evolution scenario is also described in the "5G myth" by Webb (2016). The use of the terms 'evolution' and 'revolution' in the context of scenarios or images of the future in general or in the context of 5G in particular is not new. Examples of earlier use related to mobile respectively 5G are De Vriendt, Laine, Lerouge & Xu (2002) and Kachhavay and Thakar (2014).

The "Revolution" scenario represents a clear break with the trends underpinning the "Evolution" scenario. It shows how a new industry momentum can be created that constitutes a leadership role with 5G for Europe. For that purpose it exploits the opportunities provided by APIs for service creation, which are enabled by network virtualization as part of the 5G architecture. These APIs, when standardized, open and universally deployed, allow the market entry of a multitude of so-called virtual mobile network operators (VMNOs), dedicated to serve particular industry verticals or economic sectors with tailored feature sets and dedicated qualities of service.

These VMNOs may have different origins, they may evolve from (Lemstra, Cave & Bourreau, 2017):

a) the IT/CT departments of the firms in the vertical industries;
b) from specialized providers of ICT services to these vertical industries;
c) from the service divisions of fixed and mobile incumbent operators;
d) from the service divisions of mobile virtual network operators (MVNOs); and
e) from start-ulistaps that recognize the new opportunities for developing services and applications.

By unlocking the knowledge on the needs of the verticals that resides within these organizations across all verticals simultaneously, the market momentum can be created that leads to a high demand for 5G across Europe. And as firms within the verticals compete for end-users, they will compete for providing the best virtual mobile services as well. This is expected to result in a very dynamic retail market for mobile communication services.

The tailored mobile communication services, being bundled with IT-services, will unlock a higher willingness to pay compared to the mass market consumer services, the main stay of the "Evolution" scenario. This extra margin will flow from the retail market through the wholesale market to incentivize 5G network investments by the mobile infrastructure operators. This provides for a virtuous circle of demand and supply that is expected to lead to a leadership role for Europe in the development, deployment and exploitation of 5G services. Such a development is in-line with the European Union objective of creating a vibrant Digital Single Market (DSM).

The possibility of different 5G futures calls for a policy debate of which future is most desirable. The "Evolution" scenario is likely to evolve under the proposed Electronic Communications Code. (EC, 2016b). Enabling the "Revolution" scenario will require additional policy and regulatory measures to achieve leadership with 5G in Europe. Hence, there is a fork in the road ahead that needs to be