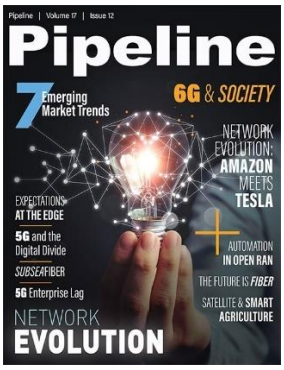

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The Fundamental Drivers of 6G

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We believe that the continuing evolution of the mobile industry and the underlying technologies, namely the development of 6G, must be guided by the imperative to satisfy three fundamental needs facing society at large and the telecommunication industry specifically. These are societal goals, market expectations, and operational necessities.

The need to address societal objectives at large is also expressed in the United Nations (UN) Sustainable Development Goals (SDG). To meet market expectations, new end-user requirements must be satisfied by offering new services and capabilities, supported by evolving technologies in a cost-effective manner. Operational necessities include the need to make the planning, deployment, operations, management, and performance of the mobile operator's networks increasingly more efficient.

Therefore, any future technology development should be contextualized in terms of how it supports the society, the end users, and the operator's value creation and delivery and a healthy ecosystem. The main attributes required to address the expectation of society, the marketplace, and the mobile network operators are the drivers of 6G.

Meeting societal needs

The UN Member States have adopted the SDGs. NGMN's standpoint is that future technologies need to contribute to the success of SDG goals such as: environmental sustainability, efficient

delivery of healthcare, reduction in poverty and inequality, improvements in public safety and privacy, support for aging populations, and managing expanding urbanization.

Network infrastructure is essential to societal needs, and it is expected to become more critical, as the role of communication networks expands in every aspect of society. Therefore, factors such as the following will be central in considering future technologies: cybersecurity, resilience to climatic events as well as to cyberattacks, equipment failures, software bugs, and human errors as well as the end-to-end environmental impact of the ICT industry and digital inclusion.

These are only some examples where advancements in communications technologies can help address societal needs. We at NGMN expect that they play an important role in addressing and mitigating global societal challenges.

The actual impact of future communication technologies would be far broader in scope and larger in scale, limited only by our imagination and creativity in applying these technologies for the benefit of all.

Expanding the scope

In the continued journey toward digital transformation and automated industries, the existing and emerging 5G technologies do and will offer new types of services based on very high capacity, throughput, reliability, and very low latency—thus significantly expanding the scope of mobile applications and broadening human and machine communications. It is to be expected that over the next decade, tens of billions of devices will be connected using wireless technologies.

The telecommunications industry needs to identify a quantifiable and differentiated role for any new technology that is justified by market and commercial needs. To achieve this, new technologies should enable significant and novel capabilities, supporting radically new and differentiated services, opening greater market opportunities than the current technologies.

Novel and differentiated services

New applications and services based on future technologies should be sufficiently differentiated from existing services to minimize overlap of functionalities. These new services should be end-user focused and driven by specific new use cases, which are not supported by existing technologies.

Expanded market opportunity

New applications and services based on future technologies should be driven by their scope and scale for applications and the associated market opportunity. Thedevelopment of a new technology should consider the law of diminishing returns, among others, quantifying demand for it in terms of market value and comparing it against the cost and environmental impact of implementation. From a business model perspective, new paradigms need to emerge to ensure

value to society as well as sustainable return on investment for mobile network operators and the various partners and players of the value chain.

Fulfillment of service expectations

Any future technology should make practical, significant, and cost-effective gains in meeting fundamental service expectations such as ease of accessibility, service experience, security, and privacy.

In addition, any new communication technology needs to have sufficient flexibility in its design to be able to adapt to needs that were not anticipated at the time it was designed. Also, it must have sufficient potential to enable innovation beyond the imagination of today.

Managing complexity

Historically, wireless standards and technology development efforts have rightfully focused on radio and transport and core technology innovations. Since the first generation of wireless networks, significant advancements in these technologies have been made, leading to a fundamental change in the way people communicate with each other and to a significant impact on societies.

However, with the implementation of multiple generations of technology, deployment of greater amounts of spectrum bandwidth, and the demand for greater service reliability, while catering to an increasing velocity of change, the task of deploying, operating, monitoring, and managing networks and services has become increasingly complex and difficult. In short, the need to manage complexity, drive efficiency, and reduce costs is now paramount, in the 5G roadmap and on the path toward 6G.

Making 6G a success

By addressing the expectations of society, the marketplace, and the industry at large, great progress toward a healthier society will be made. Advancements toward superior customer experience and more autonomous and efficient networks, operations and services will follow. NGMN's vision is to significantly contribute to make this a reality.

To be successful, it is imperative to not only establish the details of the next generation of standards and technologies but also to reevaluate how the standards and technologies are developed.

The way future wireless standards and technologies are developed will be crucial. There is a need to broaden, align, and rationalize the scope of standards and the technology development process to support a healthier and more vibrant ecosystem. To date, the development of generations of mobile technology has been piecemeal based on proposals that cover specific

aspects of the system. For the next generation, the industry needs to ensure that technologies are developed holistically across different standards development organizations. NGMN will continue to take an active role to provide impactful guidance in this regard.

Considering the landscape for 6G

The industry and its ecosystem are rapidly changing and NGMN's work is exposed to technology cycles with regards to content and relevance. So, the alliance's new strategic focus topics address the industry's main opportunities and challenges in the next years. While still supporting 5G's full potential through several 5G projects, the three main focus topics are: Mastering the Route to Disaggregation, with a focus on the End-to-End Operating Model, including network automation and cloud native; Green Future Networks; and 6G. All three are equally important and interlinked with different time horizons.

It can be assumed that 6G will be built on disaggregated network principles. And, of course, it needs to be made sure that 6G reflects green and sustainability priorities. Moving forward, all three are very closely coupled and linked; this is the landscape to consider for 6G.