

A Glimpse into 6G Wireless Systems

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The wireless networking landscape is witnessing an unprecedented revolution driven by the emergence of new technologies, applications, and use cases. This revolution recently culminated in the ongoing deployment of the much coveted fifth generation (5G) of wireless cellular systems which is expected to enable a plethora of innovative wireless applications ranging from 4K mobile streaming to intelligent automation. This ongoing deployment of 5G cellular systems is continuously shedding light on the various benefits of this system as well as its inherent limitations compared to its original premise as an enabler for emerging Internet of Everything (IoE) applications. In this talk, we first provide a holistic exposition on the technologies behind 5G wireless systems and their expected potential. In particular, we will discuss the main features of 5G and their impact on technology and society. Then, we shed light on some of the limitations of 5G and contrast them to the original premise of the system.

We then discuss how and why these identified 5G drawbacks are currently spurring worldwide activities focused on defining the next-generation 6G wireless system that can truly integrate far-reaching IoE services ranging from connected autonomous systems to extended reality and haptics. We then identify how such emerging wireless services will challenge the capabilities of 5G. We then expose the fundamental architectural and performance components of tomorrow's 6G wireless systems. In this regard, we present a holistic, forward-looking vision that defines the key technological tenets of a 6G system, as extracted from its potential IoE applications. In particular, we show how 6G will not be a mere exploration of more spectrum at high-frequency bands, as has been commonly portrayed, but instead it will rely on a necessary convergence of emerging technological trends, such as artificial intelligence and human-centric communications, driven by exciting, underlying services. Within this vision, we start by identifying the primary drivers of 6G systems, in terms of emerging services and accompanying technological trends. Then, we shed light on the potential set of service classes that 6G is supposed to meet along with their target wireless performance requirements. For these delineated 6G services, we then identify enabling technologies and provide a comprehensive view on the research efforts needed to meet the needs of 6G. Along the way, we present several preliminary results that motivate the identified research areas and that show some of the main features of 6G systems. We conclude the talk by providing concrete recommendations for the roadmap toward 6G.