Radio Spectrum Management and Regulation
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Along with energy, radio spectrum is the most basic resource used by wireless communication systems. Yet, the spectrum regulatory framework fundamentally dates to the 1920s --- before Shannon's information theory and the idea of bits as a universal currency for information, before transistors, before VLSI and Moore's law, before universal programmable computers, before the Internet, before cloud computing, and before the near-ubiquitous availability of cellular connectivity. The regulatory framework was based on the idea of static non-programmable non-interactive devices that were essentially isolated from each other and were by nature locked to a narrow range of radio frequencies. It was also implicitly defined by an "endless frontier" mentality wherein there was always another completely unused block of spectrum around the corner to accommodate any emerging demand for spectrum. At this point, commercially available systems like LTE are very different technologically from what was imaginable back when this regulatory framework was adopted. Just as every other aspect of wireless has undergone a revolution since the '20s, it's time for change at the regulatory layer as well.

Recent steps taken by the FCC in the TV Whitespaces demonstrate that the US government is serious about change, and similar developments have occurred in the UK and are being considered seriously around the world. What's driving the change is that it is clear that the days of the "endless frontier" are over as far as long-range capable radio spectrum is considered --- it's all been allocated in principle. So last summer, the President's Council of Advisers on Science and Technology (PCAST) released a report that advocated expanding this approach beyond the TV bands and having shared access to essentially all spectrum. In June of this year, the White House released a memorandum that essentially officially endorsed the PCAST report. What's different now is that it is possible to see the broad outline of a new architecture for spectrum access.

In this talk, I will try to elucidate the new paradigm from my point of view, and point out selected questions within it that should be of interest. The key is that the traditional laws-regulations-and-footnotes-based regulatory layer is going to become largely technological. What is less obvious is that although a part of this will behave like a traditional "layer" in networking, much of it will not. It will be more like a service than a layer, and will be able to leverage the developments in cloud computing, etc. I'll use some simulations based on real FCC data in the TV bands to give a quantitative sense of the technical tradeoffs involved. I will then elucidate how to think about the key issue of "trust" in this regulatory architecture and the overhead involved in maintaining it. In particular, I'll argue that it is possible to establish trust first, and then let technological developments continue to improve spectrum sharing performance.