WIRELESS COMMUNICATION

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Both wireless communication networks and handheld devices have continued their rapid technical evolution, supporting a growing focus on increased end-user utility and new opportunities for compelling wireless applications in many aspects of people's lives.

The advances in cellular network air interfaces and infrastructure has included increased data rates, spectral efficiency, and wider bandwidths, with more recent focus on the efficient support of various types of network heterogeneity. Wireless operator deployments of wide area network (WAN) macro cells are now being coordinated with planned lower power pico-cells and also allowing for the addition of unplanned but auto-configuring user-deployable indoor femto cells. These varying sized cells are optimized to achieve both high capacity and good coverage, sharing the same licensed spectrum to meet the high bandwidth needs of users who might be vey densely packed at a large sporting event, moderately clustered in an office or mall, or more geographically isolated. Over and above the heterogeneity from varying cell sizes and planned vs. unplanned licensed communications, devices on licensed networks are now also supporting a growing amount of unlicensed radio frequency communications for WiFi, Bluetooth, and other new approaches for short range links at higher frequencies. The growing mix of cell sizes and licensed and unlicensed communications link options has also renewed research efforts on broader cross-systems optimization with new approaches to increase network power efficiency and avoid interference and cognitive radio sensing techniques to make opportunistic use of available spectrum.

In addition to a growing number of available communication link options, devices such as smartphones and wireless tablets now include ever increasing processing power, display capabilities, and the integration of more physical sensors. These increasing device capabilities are opening up new avenues of research into the broader use of smart phones for a wider variety of tasks and applications. The ability of the wireless device to incorporate personal body area networks and additional sensors coupled with the device's processing and real-time communications capability is spawning exciting research into new medical applications. The contextual awareness of wireless devices is also increasing based both on physical sensors and user data enabling new applications and higher utility for existing applications. The growing processing capabilities both within the device and based on the devices' wireless access to very powerful cloud based processing has resulted in new research into algorithms focused on making productive use of the growing amount of data from sensors, users, applications, and other sources.

The four presentations in this session highlight some of the recent advances and research approaches to further enhance the capability and efficiency of wireless communication systems and enable new useful applications.

The first talk by Ali Niknejad gives an overview of wireless circuit and silicon evolution and describes the latest research on how higher radio frequencies can be exploited to achieve very high speed point-to-point communications, demonstrating the design of mm-wave links at 10 Gb/s with very high power efficiency. Wenhui Xiong's

presentation on cognitive radio describes spectrum sensing approaches for single devices as well as cooperation across nodes and then presents techniques to share the spectrum between a primary and secondary network with an overview of a cognitive radio testbed. Urbashi Mitra addresses the need for integrated systems design and describes some of the recent approaches being applied to leverage body area networks and processing of sensor data for new preventative health applications. Concentrating on efforts to improve power efficiency across networks while meeting user data rate needs, Yang Yang presents research results on cross-network cooperation mechanisms to share network infrastructure and energy according to user service requirements.