Title: Wireless Communications for the Industrial Internet of Things

Abstract: The Industrial Internet of Things (IIoT) is ushering in a fourth wave of the industrial revolution, and will have the power to transform energy, manufacturing and healthcare. While traditional wired communication technologies have played a crucial role in industrial monitoring and control networks over the past few decades, they are inadequate to meet the highly dynamic and stringent demands of emerging IIoT applications, primarily due to the rigidity of access to wired infrastructure. Wireless technology, through its increased pervasiveness, has the potential to revolutionise the industry by introducing a completely new class of applications .While present day wireless technologies made some preliminary inroads in the metering and monitoring domains, they still have severe limitations especially when real-time, reliable distributed control and protection operations are concerned, due to their high latencies and insufficient reliability. For current high performance networked control, fiber-optic wired networks are exclusively used as their latencies are significantly lower than those in wireless networks. Wireless systems, however, provide flexible access, are easy and cost-effective to deploy, extend and maintain.

In order to facilitate wireless connectivity in emerging mission critical applications, it is imperative to develop new theories, mechanisms and technologies for wireless networks with consistently ultralow latencies and ultrahigh reliability.

In this talk I will present the state-of-the art wireless technologies for industrial internet use cases and outline the gap between their current and required performance. I will describe the main standardisation activities to overcome this gap and recent results in wireless communications research at Sydney University Centre of Excellence in Telecommunications.

Biography:

Professor Branka Vucetic's work aims to develop theoretical framework and design principles for wireless communication systems. She is an internationally recognised expert in coding theory and its applications in wireless engineering. Professor Vucetic has held various research and academic positions in the UK, Yugoslavia and Australia, and since 1986 she has been with the School of Electrical and Information Engineering at Sydney University, where she is currently Laureate Professor and Director of the Centre of Excellence in Telecommunications.

Her research interests include wireless communications, digital communication theory, error control coding and multi-user detection. Prof Vucetic published four books and more than three hundred papers in telecommunications journals and conference proceedings.
She is a Fellow of Australian Academy of Technological Sciences and Engineering (ATSE), a Chinese Government Friendship Award recipient, an IEEE Fellow and a former Editor for the IEEE Transactions on Communications. In the last several years she has managed several projects related to wireless communications networks development, addressing the issues like interference cancellation, multiple antenna signal processing and coding as well as multiple access technologies.

Her current research activities are focused on advances in wireless networks and internet of things. With the rapidly growing mobile services, there has been an ever increasing demand for very high wireless transmission data rates up to tens-of-Gigabits/second. The conventional microwave bands below 6 GHz have already been heavily utilized and cannot meet this demand. However, the higher millimeter wave (mmWave) frequency band, ranging from 30GHz to 300GHz, offers large bands of unused spectrum and can potentially form the basis for the next revolution in wireless communications. The availability of tens GHz bandwidth in the mmWave band brings the possibility of developing hundreds Gbps data-rate wireless networks. She is working with her team on developing a fundamental theoretical framework and advanced signal processing and network protocols for mmWave systems.

In the area of internet of things, her focus has been on providing wireless connectivity for mission critical applications, where ultralow latency and ultrahigh reliability are essential. Examples are automated power grids, information exchange between vehicles and supporting cloud infrastructure for detecting safety-critical situations, such as black ice, vehicle accident minimisation and adaptation to road conditions, remotely controlled and self-driven vehicles and remote robot-assisted surgeries. She is developing with her team analytical limits and criteria, and applying them to develop novel wireless communication methods and protocols at multiple layers of communication networks that will meet the stringent technical requirements for ultralow latency and ultrahigh reliability of mission-critical applications. A further issue that she is addressing is developing wireless power transfer systems for delivering energy to communication devices by micro and mmWave radiation. This provides communication nodes practically unlimited battery lives and eliminates the need for power cables and chargers. The focus is on creating sharp radio beams, which will have powers high enough to withstand propagation losses and deliver a considerable power to the communication devices and sensor receivers. The applications will be in large scale deployment of wireless sensor networks and commercial IoT applications, currently limited by short lifetime of batteries powering sensors and communication devices.