# Programmable Wireless Networks for Smart Cities

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Over 54% of the population live in cities today, and the number is expected to keep increasing significantly in the coming years (e.g., exceeding 66% by 2020). In supporting seamless, pervasive information flow among people, organizations, as well as the physical environment, wireless networks will be foundational infrastructures of future cities. Unlike existing cellular networks, WiFi networks, and wireless sensor networks, future smart city wireless networks need to support applications with drastically different communication requirements, ranging from low-power, low-rate, and delay-insensitive environmental monitoring applications to high-power, high-rate, and time-sensitive control of connected vehicles or micro energy grids where wireless networks have only started to be deployed in recent years.

To support efficient, controllable sharing of wireless access resources among applications, especially safety-critical applications such as the control of connected and automated vehicles as well as micro energy grids, it is important to ensure *predictable control of wireless resource management in the presence of complex dynamics and uncertainties* within the system and environment. Ensuring predictability in wireless communication is challenging, for instance, with the very basic issue of predicable control of interference for per-packet transmission reliability and timeliness guarantee remaining open today. Given the time-varying communication requirements of individual applications, different priorities for different applications, and the need for networking and application (e.g., networked control) co-design, it is important for wireless networks to be *programmable, configurable, and controllable for predictable exploration of network capacity regions*.

Given that we are still at the beginning of developing and deploying wireless networks for mission-critical cyber-physical systems (CPS) such as connected and automated vehicles, it is expected that wireless network solutions will keep evolving in the coming years. In fact, many new algorithms for CPS wireless networking have been developed. One challenge of wireless CPS networking research today, however, is the difficulty in experimenting with real-world CPS systems at-scale. For instance, it is difficult for a regular wireless networking researcher to orchestrate hundreds or thousands of road vehicles to evaluate his/her vehicular wireless networking alone. Thus, it will greatly facilitate research, experiments, as well as pilot deployment and adoption of innovative CPS wireless solutions if wireless networking platforms in real-world deployment can be partitioned so that *programmable research experiments and real-world applications can co-exist in the same platform, thus calling for a software-defined wireless infrastructure of innovation at different layers of the network stack*.

With programmable wireless networking algorithms and real-world research experimental infrastructures, it is expected that innovative wireless networking solutions can be rolled out and adopted at much faster rate than what is traditionally possible, thus laying a solid wireless networking foundation for the envisioned smart cities.

**Travel support**. Travel support, if feasible, will be very helpful and much appreciated.