

## PROJECT SUMMARY

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### NeTS-ProWin: Flexible MAC Protocols for Configurable Radios

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There is an ever-larger number of portable wireless devices ranging from cellular phones and portable computers, to cordless phones and wireless sensors. However, many of them cannot communicate with each other due to the differences in their physical (PHY) layer and medium access (MAC) protocols. Furthermore, some of them share the same unlicensed spectrum and cause interference to each other.

The major reason for the proliferation of PHY/MAC protocols is that different classes of devices have dramatically different data rate, communication range, and transmission power requirements. As a result, different PHY/MAC combinations are introduced as point solutions to specific problems. One can argue that no single PHY/MAC combination can suit the needs of every device. However, if a family of MAC protocols that can be designed to accommodate the needs of a wide variety of devices and yet share the same physical layer, one can foresee a future in which many wireless devices will interoperate with each other and enable many novel applications.

**Intellectual Merit:** We propose to study the design of a new family of MAC protocols that has two innovative features. First, it allows any devices with vastly different data rate, communication range, and transmission power requirements to communicate with each other as long as their MAC protocol belongs to this family. This family of MAC protocols use a common physical layer framework based on OFDM to provide connectivity among a wide variety of devices. Second, this new family of MAC protocols will allow applications to make explicit tradeoffs among data rate, communication range, and transmission power when communicating to their neighbors.

Although programmable radios are not strictly required for implementing this family of MAC protocols, they can potentially reduce the complexity of the implementation because of their ability to change modulation and channel coding on the fly easily. The proposed new MAC protocols will take advantage of the state of the art modulation schemes and programmable radio technologies.

**Broader Impact:** If the project is successful, one would expect future mobile devices to choose a MAC protocol from our proposed family instead of creating a new one. This new protocol will share the same physical layer structure as others in the family, thereby achieving the following objectives:

1. Realize the dream of universal connectivity instead of creating islands of connected devices;
2. Eliminate the complexity of managing devices using many different wireless PHY/MAC standards that interfere with each other;
3. Eliminate the need to introduce new wireless standards that are not backward-compatible whenever a section of the spectrum is available or when a new modulation scheme is invented;
4. Spark the development of new applications that exploit the communication between nodes from different classes that was not feasible before.