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Motivation

Untethered robots require an **increasing access to computation** while available on-board computing power remains limited due to robot size/weight constraints and **power autonomy** requirements

=> Leverage unprecedented access to high bandwidth and low latency communication offered by fifth generation wireless communication to **offload real-time action-perception loops to the network edge**
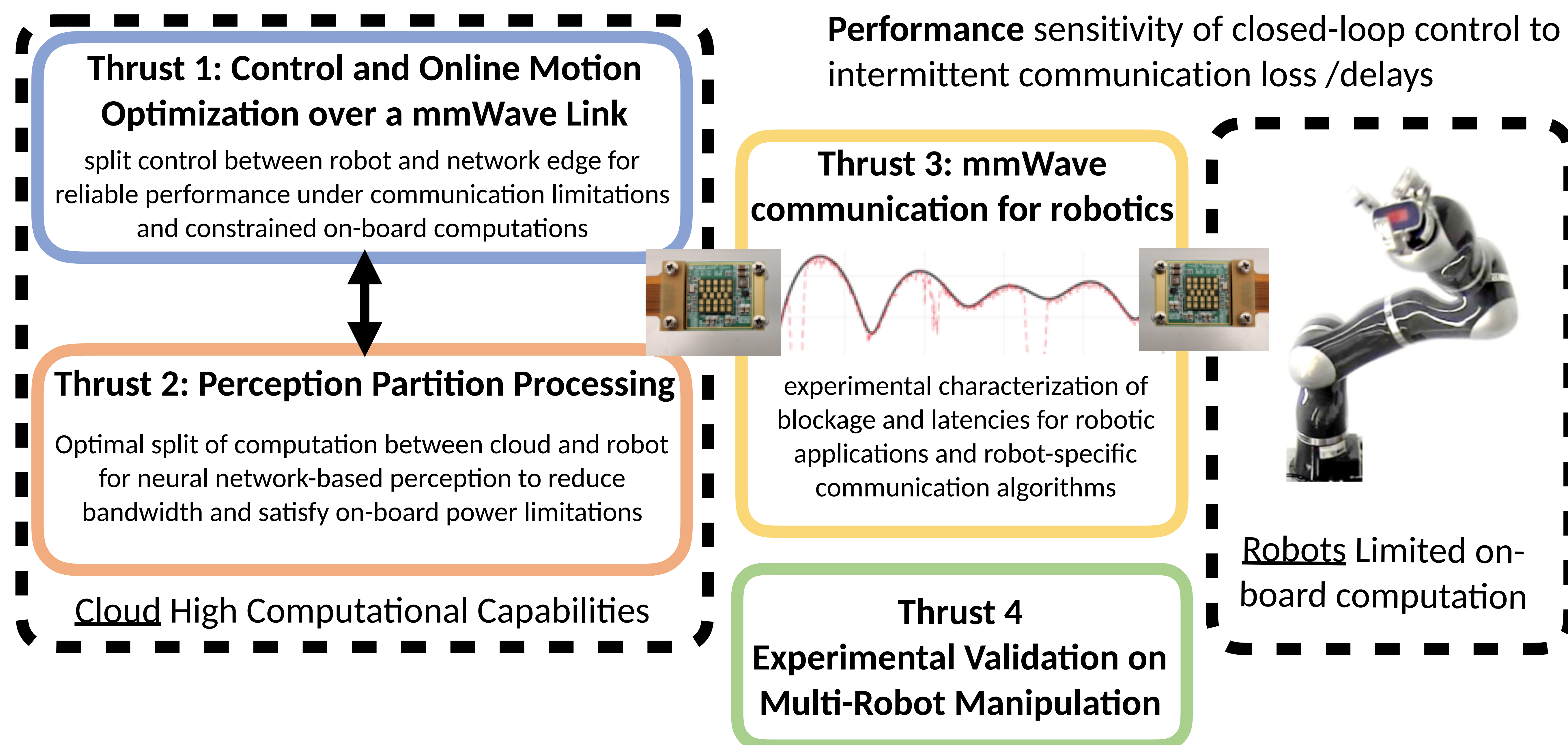
Scientific Objectives

Novel perception, control and planning algorithms for **reliable remote real-time computation of action-perception loops** using 5G mmWave wireless communication.

Challenges

Communication reliability mmWave signals are vulnerable to blockage from common materials

Scalability Bandwidth/latency requirements push the limits of wireless communication

Performance sensitivity of closed-loop control to intermittent communication loss /delays

Thrust 1: Control and Online Motion Optimization over a mmWave Link

split control between robot and network edge for reliable performance under communication limitations and constrained on-board computations

Thrust 2: Perception Partition Processing

Optimal split of computation between cloud and robot for neural network-based perception to reduce bandwidth and satisfy on-board power limitations

<u>Cloud</u> High Computational Capabilities

Thrust 3: mmWave communication for robotics

experimental characterization of blockage and latencies for robotic applications and robot-specific communication algorithms

Thrust 4 Experimental Validation on Multi-Robot Manipulation

<u>Robots</u> Limited on-board computation

Broader Impact

Lowering barriers to entry for industry/academia for 5G-enabled robotics

Dissemination, technology transfer and industrial cooperation via NYU WIRELESS

Curriculum development for graduate and undergraduate students including projects at the intersection of wireless communication and robotics with state of the art platforms