NRI: FND: Action-perception loops over 5G millimeter wave wireless for cooperative manipulation

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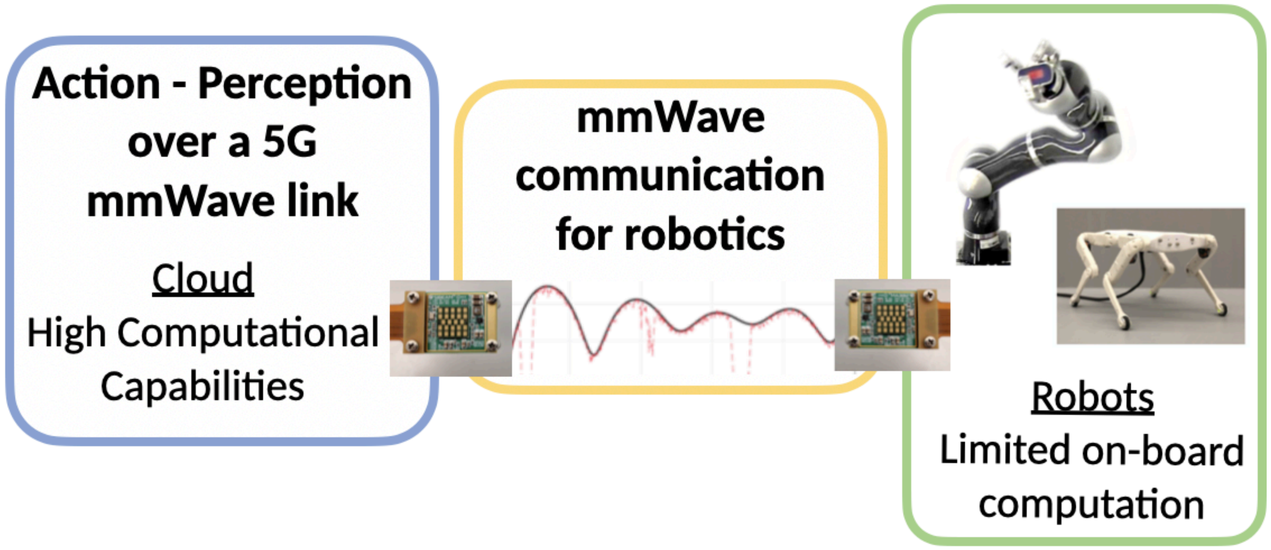
Motivation

Autonomous robots need increasing access to computation but available on-board computing is limited (size, weight, power limits)

=> Use high bandwidth and low latency communication offered by 5th generation wireless technology to **offload real-time action-perception loops to the network edge**

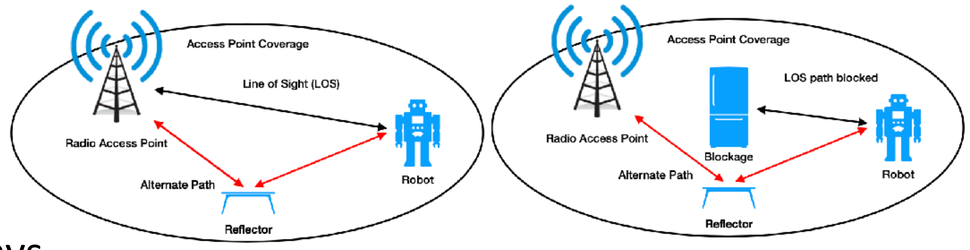
- Split control algorithms robust to communication loss
- Wireless-aware perception
- Planning to anticipate and reduce signal loss
- Robotics-centered models of wireless access



5G Wireless opportunities and issues

Massive data rates (>25Mbps/user loaded > 1Gpbs peak rate)
Low airlink latency (1-2ms)
=> Opportunities for real-time control

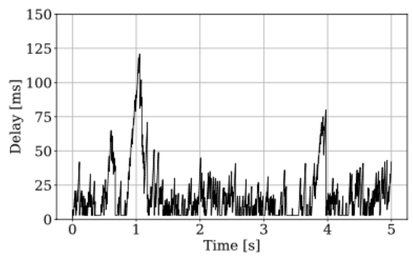
Blockage and difficult to predict delays



(a) No blockage (b) With blockage

Network edge/local split whole-body control

Physics simulation including realistic 5G communication with blockages (various indoor environments)



Idea

1) compute controller + constraint-consistent gains (from KKT conditions)
2) local controller uses linear gains during delays and blockages

=> balance/walking controller robust to blockages and delays with local cost local control

[Zhu et al. IROS 2020]

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