Motivation

Explore NDN-based Sensor Networks:
- Naming scheme & discovery
- Communication paradigm
- Routing & forwarding

Need a testbed to experiment with
How to build a “testbed”

- **Real devices**
  - Approach: **Real** application + **Real** network
  - Challenge: building a real network is hard

- **Simulation**
  - Approach: **Virtual** application + **Virtual** network
  - Challenge: application code cannot be deployed

- **Emulation**
  - Approach: **Real** application + **Virtual** network
Basic idea

Real-world scenario

Emulated scenario

NDN Network

Forwarder

APP

Forwarder

APP

Forwarder

APP

NDN Emulator

Emulated forwarder node

APP

APP

APP
Design approach

Use adjacency matrix to describe connectivity

NDN app

CSMA/CA
net device

Node

Link

Unix Domain
Socket

NDN app
Features

- Abstract physical link behavior with tx delay and packet loss
- Emulate basic 802.15.4 protocol
- Compatible with the latest version of NFD & NDN-TLV packet format
How to use

1. Specify your testbed deployment as a configuration file
2. Run the emulator program with the configuration file
3. Connect your applications to the emulated NDN nodes and start testing
Test app: sensor data distribution

Diagram showing nodes and repositories connected as follows:

- Node n0 connects to nodes n1, n2, and sensor.
- Node n1 connects to repo1 and node n2.
- Node n2 connects to node n3.
- Node n3 connects to repo2, node n4, and wpan0.
- Node n4 connects to repo2 and user.
- Node n5 connects to wpan1.

Repositories: repo1, repo2.
Tested communication models

- **POLL:**
  - Repo sends Interest to sensor and gets Data back

- **PUSH:**
  - Sensor sends Interest (encoding raw data) to repo

- **NOTIFY:**
  - Sensor sends Interest as notification; repo sends Interest back and pulls data out of sensor
Future work

- Enhancing the emulator
  - Support of more wired/wireless protocols
  - Validation of correctness
- Exploring application design space
  - Additional communication models
  - Routing & forwarding for sensor mesh networks
  - Security in constrained environments