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Demo

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A module for the XDense architecture in ns-3

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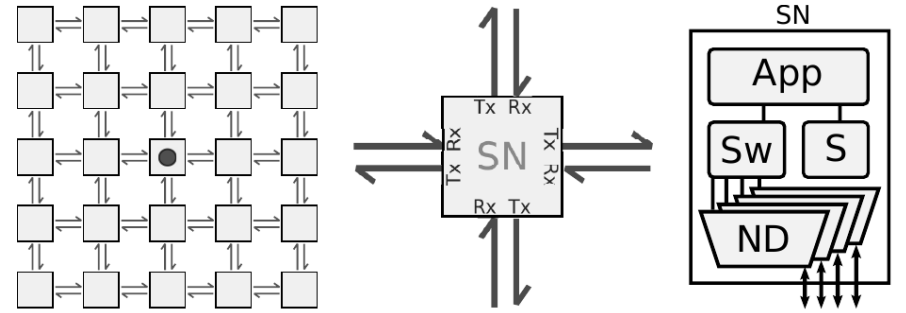
EXTENDED ABSTRACT

The acquisition of data regarding some dynamic phenomena can require extremely dense deployments of sensors and high sampling rates. We propose XDense [1], a wired mesh grid sensor network architecture (see Figure 1a) tailored for scenarios that benefit from thousands of sensors per square meter. XDense has scalable network topology and it enables complex feature extraction in real-time from the observed phenomena, by exploiting distributed processing capabilities and inter-node communication, the latter being represented in Figure 1b.

We implemented a simulation framework on top of NS-3 by developing a module for Network-on-Chip-like (NoC) grid networks, which is complemented by communication protocols and application layers. The architecture of a node in our topology is represented in Figure 1c. The application layer (App) runs the network protocols and application specific algorithms for data processing. It samples the sensing units (S), and communicates with the node's neighbors in the four directions (Figure 1b) using the net-devices (ND) through the switch internal to the node (Sw). Acquisition and preprocessing of data are done in real-time in an ns-3 application layer.

We integrated the XDense architecture with a physical simulation engine, which provides XDense with data regarding an experiment on computational fluid dynamics (CFD). That is, we ``feed" each sensor (S) of our network with spatial and temporal data extracted from a reliable representation of a real CFD phenomenon (a free-air-jet).

To demonstrate our module on Dense Network & Network on Chip for sensing, we will consider a sensor network of N x N sensors with a sink in the center, for example 100 x 100 sensors. In the demo, we will show a video of a physical CFD event (air jet getting into a room), an overview code of the simulator, and a Python application built on the simulation framework that shows the signal as reconstructed by our sensor network. We also demonstrate the post-processing tools for packet and flow tracing, statistical survey and qualitative analysis of the sensed and processed data.



(a) 5×5 network with one sink in center (b) Node pinout (c) Node architecture

Figure 1 Overview of the XDense network architecture

The code of the simulator module will be delivered for the NS-3 review by the end of the summer. By the end of April 2015, the current state of the code will be available on:

https://bitbucket.org/joaofl/usn

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