# Demo Abstract: CODA + PSFQ + Virtual Sinks = Enabling Technologies for Resilient Sensor Networking

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## Categories and Subject Descriptors

C.2.1 [**Computer-Communications Networks**]: Network Protocols, Wireless Communications.

## General Terms

Algorithms, Design, Performance.

## Keywords

Reliable transport, congestion avoidance.

## 1. OVERVIEW AND MOTIVATION

Data impulses, congestion, packet loss, and component failure are likely to undermine the performance of sensor networks, if left unchecked. In the Armstrong Project [4], we are developing a set of transport control algorithms that make sensor networks more resilient to these effects. We demonstrate how a mote sensor network running a number of applications can be made resilient by deploying a set of resilient transport algorithms that include congestion control (CODA [2]), a reliable transport (PSFQ [1]), and virtual sinks [3]. PSFQ (Pump Slowly, Fetch Quickly) is an energy-efficient reliable transport protocol that supports reliable multicast between a sink and groups of sensors. CODA (COngestion Detection and Avoidance) comprises a set of congestion avoidance mechanisms that support an energy-efficient congestion detection component, and open-loop and closed-loop congestion control mechanisms. The final component of our resilient transport system relies on the availability of dual-radio virtual sinks, which are capable of steering overload or impulse traffic away from congested regions in the sensor field toward one or more physical sinks.

## 2. WHAT WILL BE DEMONSTRATED?

We show how PSFQ, CODA, and virtual sink services can be integrated with each other to support resilient sensor networking.

### 2.1 Testbed Setup

We deploy a 20 node multi-hop network using Mica motes running TinyOS. The transmission radii of these motes is configured so that the network can be deployed on a reasonably sized table. Stargates are used as virtual sinks that support both IEEE 802.11 and Mica radio networks. Power outlets are needed for powering a laptop and the Stargate nodes.

### 2.2 Demo Content

First, to demo the reliable transport service, three sensors (sources) in the testbed run environmental monitoring applications that periodically report ambient conditions (light or temperatures) back to a sink connected to a laptop. This kind of application generates low rate data traffic so the network runs smoothly. We use PSFQ to reprogram these sources with an application that detects impulse data traffic. The audience observes from our console (laptop) the process of the reliable delivery of the code segments from the sink that is multiple hops away from the sources, and when the transfer is complete, sees how the 3 sources reprogram themselves and run the second application. Second, to demo the congestion control service, we model an impulse event by sending a signal that triggers the sources to generate high data rate traffic. Congestion ensues and a console plot shows the rising energy tax and degraded fidelity [2]. A subsequent signal is sent from the sink to enable CODA causing an immediate positive observable difference. Finally, to demo the virtual sink service, we place a number of Stargate-based virtual sinks in the network. Once the virtual sinks are enabled, improved fidelity can be observed at the console. We can add and remove virtual sinks to observe the plug-and-play nature of the infrastructure, and the incremental benefit of deploying virtual sinks. The source code for these technologies is freely available from the web [4] for experimentation.

## 3. REFERENCES

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