Introduction: Illuminating Urban Transportation with NDN

Goals
- NDN-based transit state diffusion using Interest / Data exchange
- Apply earlier research (2011-2012) in NDN Lighting Control
- NDN deployed on embedded systems (Raspberry Pi)
- Public deployment of NDN
- Demonstration of NDN within Internet of Things (IOT)
- Aesthetically pleasing
- Can ambient informatics improve transit outcomes, especially, informed travel choice and passenger wait-time experience?

Application Architecture and Namespace Design

- HTTP Archiver
  - HTTP based REST consumer, stores requests in MongoDB every 4 seconds (rate limited by NextBus API
  - Runs on server (borges.metwi.ucla.edu)
- NDN Publisher
  - Accesses MongoDB and publishes NDN Data Object for each sample (FreshnessSeconds=4)
  - Runs on server (memoria.ndn.ucla.edu)
- NDN Controller
  - Expresses interests to NDN testbed for latest transit Data Object
  - Expresses lighting control messages (Signed Interests)
  - Runs on Raspberry Pi, physically inside the bench.

Implementation and Continuous Testbed Publishing

Implementation Milestones
- Summer 2012
  - NextBus Archiver written (python)
  - Basic NDNPublisher written (PyNDN)
  - Camera installed for data verification
- Summer 2013
  - Lighting Control introduced
  - Hardware and assembly prototyping
- Summer 2014
  - Lighting Control and NDNPublisher refined w/ PyNDN2
  - Web Consumer upgraded to use NDN-JS

Testbed Publishing
- June 2012 – Ongoing
  - HTTP Archiver running continuously
  - NDN Publisher also running continuously on NDN testbed
  - Analysis Bus data and arrival timing
  - Web Consumer for simple visualization:
    http://memoria.ndn.ucla.edu/bus/view/

Public Demonstration / Manufacture and Installation

- Summer 2014
  - Physical fabrication (fiberglass)
  - Final NDN Platform (IOT Toolkit / Raspberry Pi)
- Fall 2014
  - Physical installation on campus

Future Work

- Pre-Installation
  - Implement NDN versioning of data instead of merely freshness
  - Aesthetic refinement (explore other mappings of data to lighting patterns)
  - Add humidity and temperature sensor
  - Add almanac data for night/day awareness (see above namespace)
- Post-Installation
  - Monitor temperature and system performance
  - Monitor bench performance and bus synchrony.
  - Program Day/Night modes
  - Aesthetic refinement

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