Supporting Mobility via Context in the MobilityFirst Architecture

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Why Context-Aware Networking?
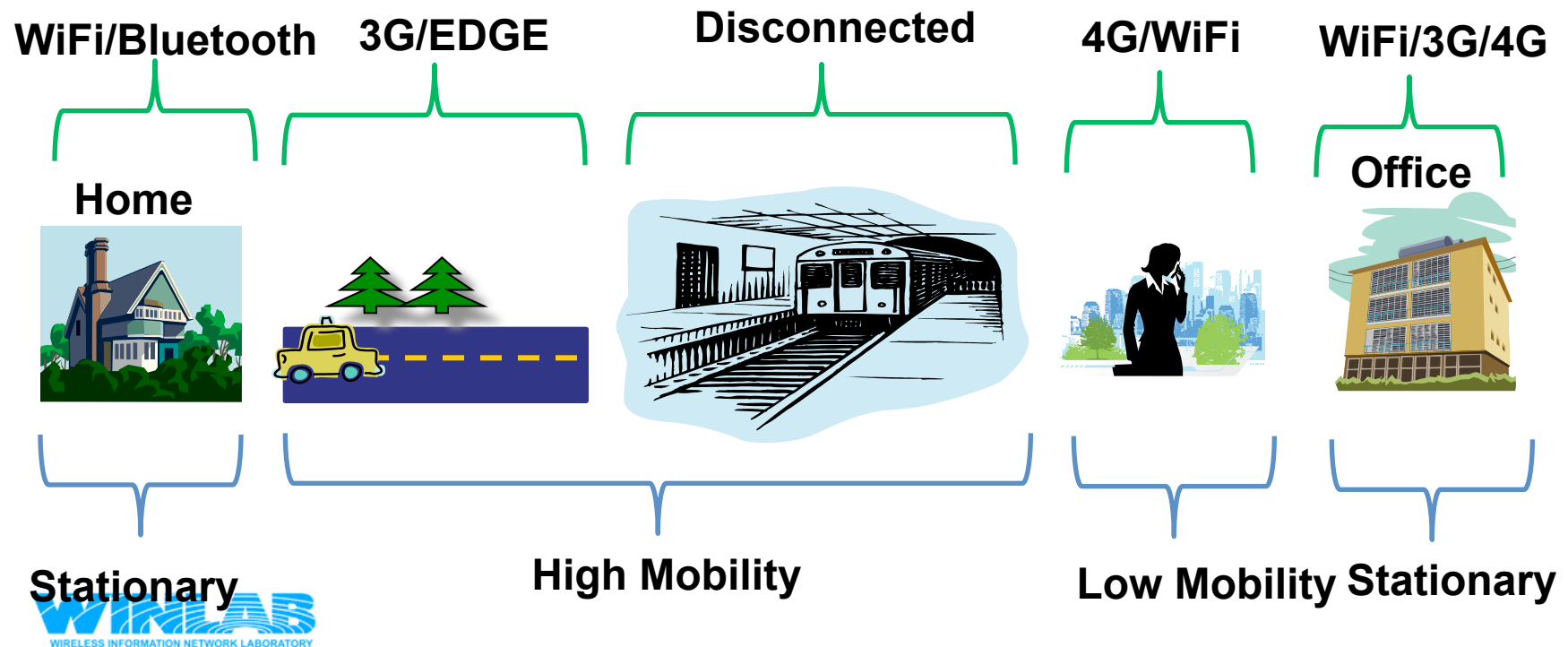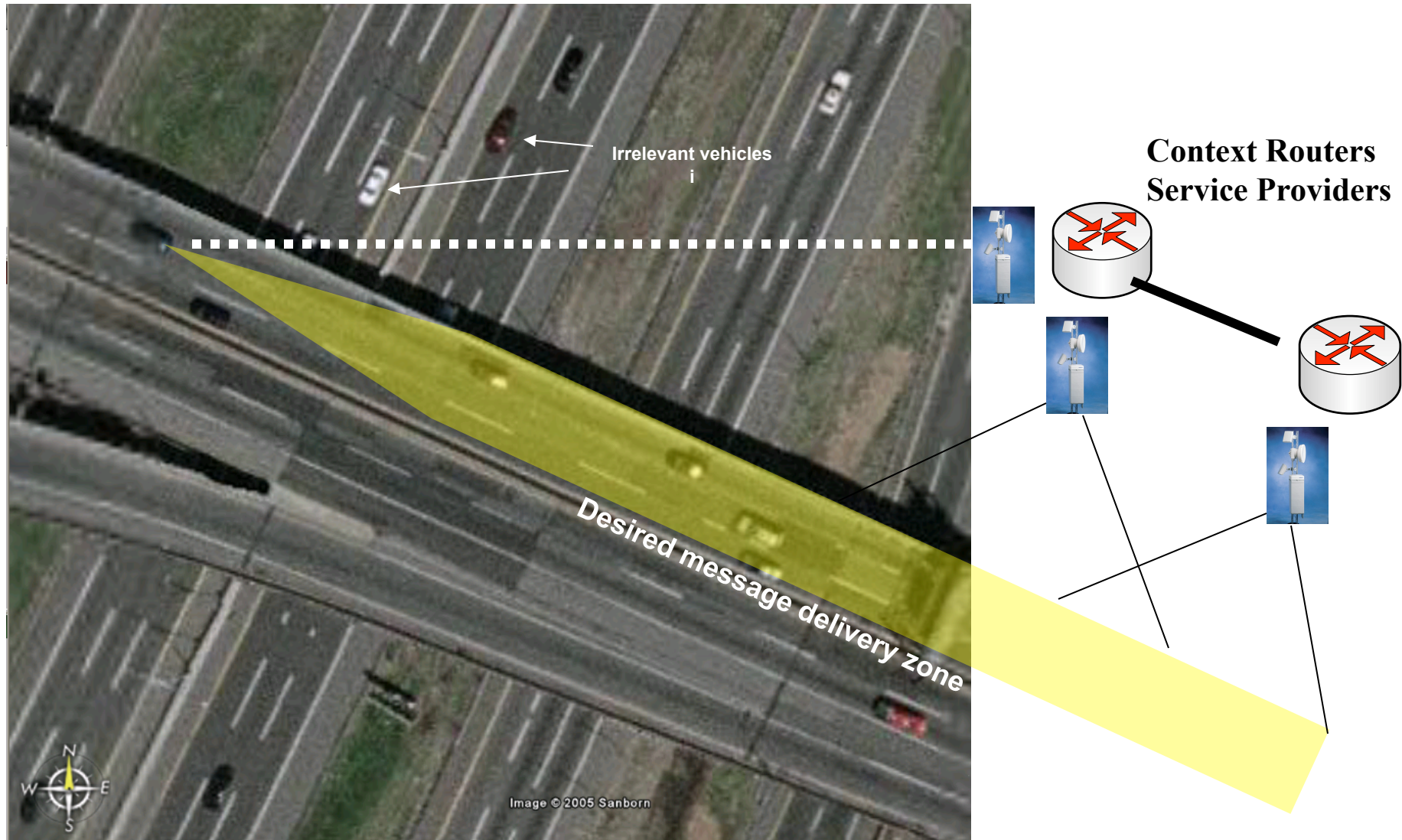
- "The Revenge of Geography"

- Social Networking
  - Location Sharing
- Point-of-Interest Queries
  - Finding nearby hotels, gas stations; travel guides, local entertainment
- Reverse 911
  - Emergency notifications to geographic area
- Fleet management
  - Tracking fleet of company vehicles
  - Determining legal restrictions
- Navigation
  - Traffic-aware travel time optimization
  - Improved information for traffic engineering

Adapting Content Downloads: Context-constraints

Example: The phone should resume download when arriving in office.
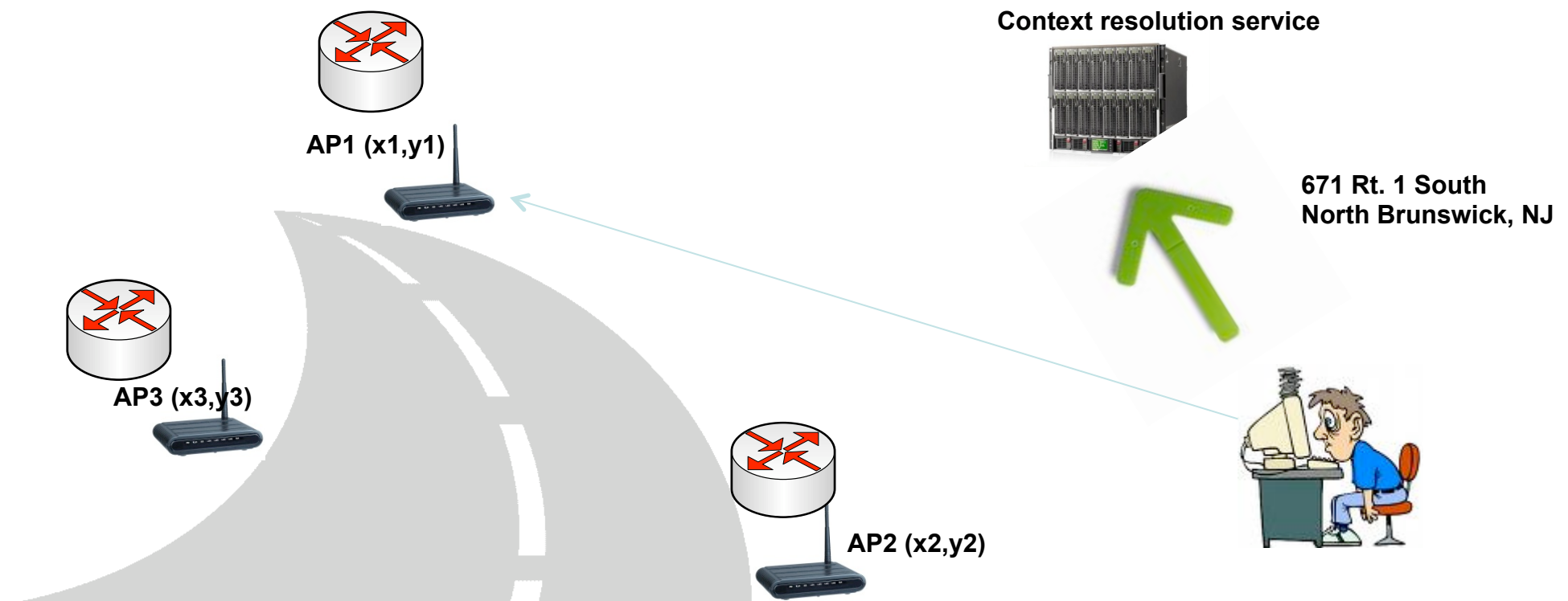
WiFi/Bluetooth **3G/EDGE** **Disconnected** **4G/WiFi** **WiFi/3G/4G**

Home

Office

Stationary **High Mobility** **Low Mobility** **Stationary**

Automotive Safety Applications: Context-based Multicast
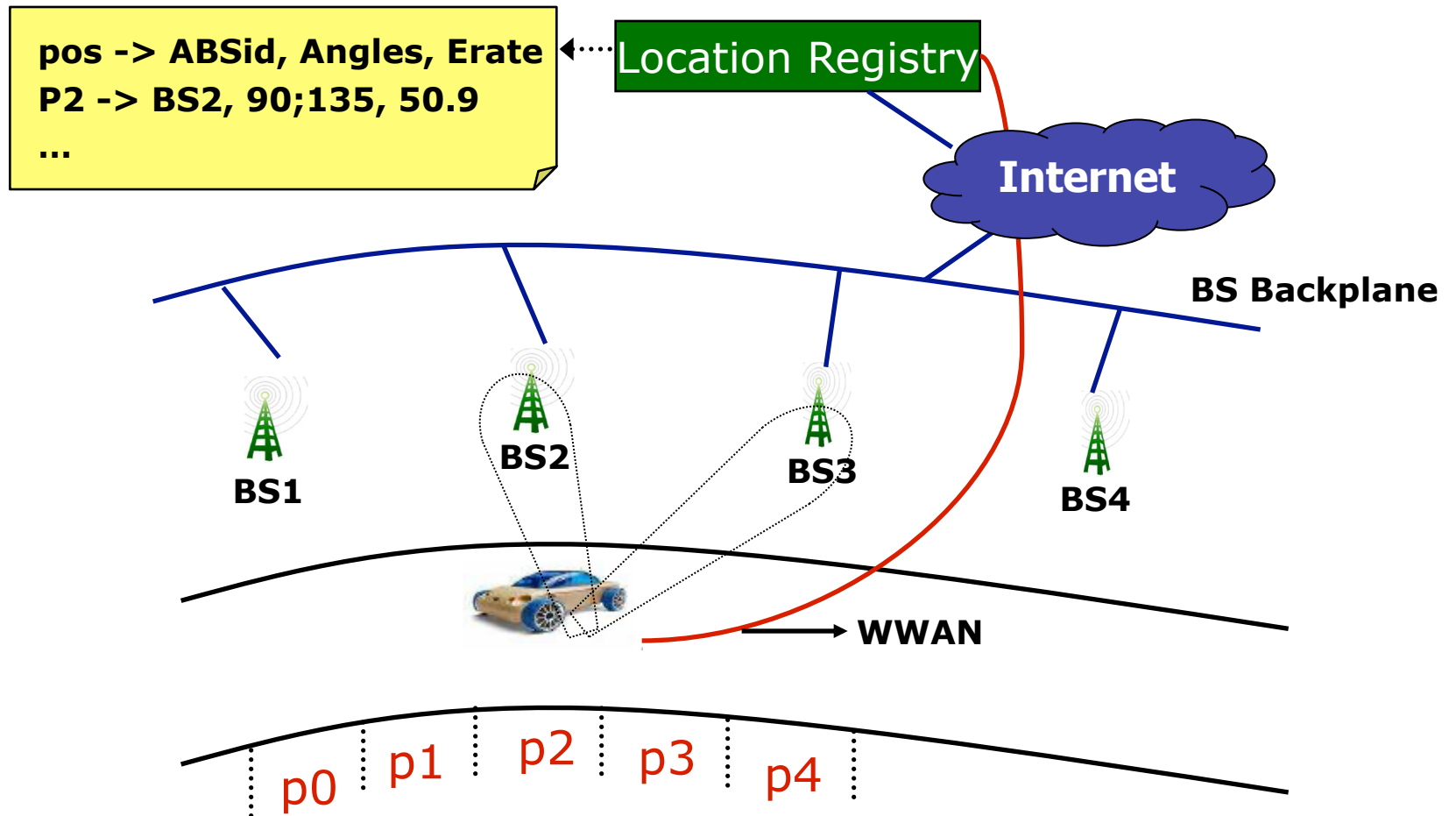
"Real-time Streetview": Context-based anycast

- Queries are directed to AP/Router at corresponding location

Context resolution service

671 Rt. 1 South
North Brunswick, NJ

AP1 (x1,y1)

AP3 (x3,y3)

AP2 (x2,y2)

Beamsteering: Querying Network Context

pos -> ABSid, Angles, Erate
P2 -> BS2, 90;135, 50.9
...

Location Registry

Internet

BS Backplane

BS1

BS2

BS3

BS4

WWAN

p0   p1   p2   p3   p4

Traffic Monitoring: Querying Aggregate Context

Anonymization / Aggregation

GPS Satellite

Cellular Service Provider

Context Proxy

Traffic Estimation
Data mining and logging

In-vehicle phones

Vehicle ID | timestamp | Lon | Lat | Speed | Heading

254,18-oct-2006 10:11:12,-85.3452,42.4928,42.18,135
372,18-oct-2006 10:11:12,-85.3427,42.4898,63.72,100
182,18-oct-2006 10:11:12,-85.4092,42.4726,50.15,75
254,18-oct-2006 10:12:12,-85.3462,42.4998,45.18,135
372,18-oct-2006 10:12:12,-85.3512,42.4944,60.01,185
182,18-oct-2006 10:12:12,-85.4102,42.4753,45.88,235
…
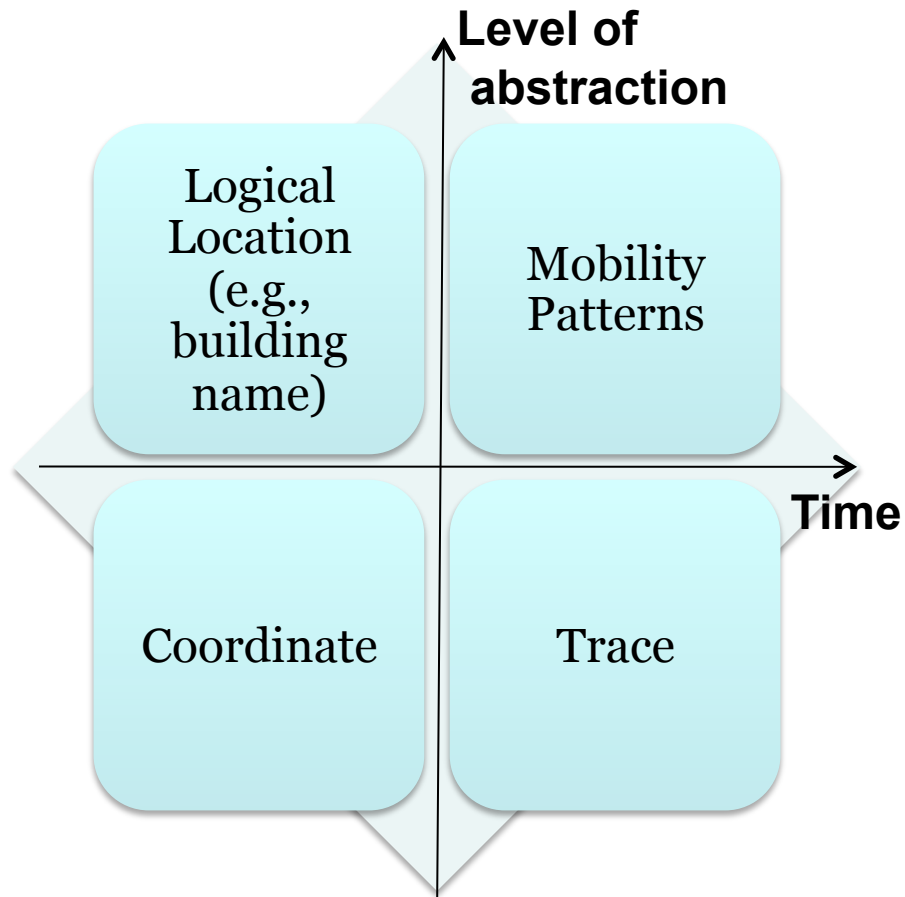254,18-oct-2006 10:21:12,-85.3856,42.5129,45.67,135

Context as a First-class Object

- Context-constraints
  - send(guid, constraint)
  - get(guid, constraint)
- Context-Addressing
  - multicast-send(context, data)
  - anycast-send(context, data/query)
- Context-Queries
  - getcontext-localdevice(attribute)
  - getcontext-device(guid) // subject to permission
  - getcontext-network(network descriptor)

Context Descriptor

Level of abstraction

| Logical Location (e.g., building name) | Mobility Patterns |
| Coordinate | Trace |

Time

- Geolocation
- Network attachment points
  - Network addresses, could be none
- Time
- 1-hop neighbors
- Energy left

Approach

- Naming service maps context to network addr or device IDs
  - Routing largely based on addr and GUID
  - Computation layer allows some in-network context operations
- Focus on lower-level context
- Allow higher-level services to be built using the lower layer primitives

Thank you