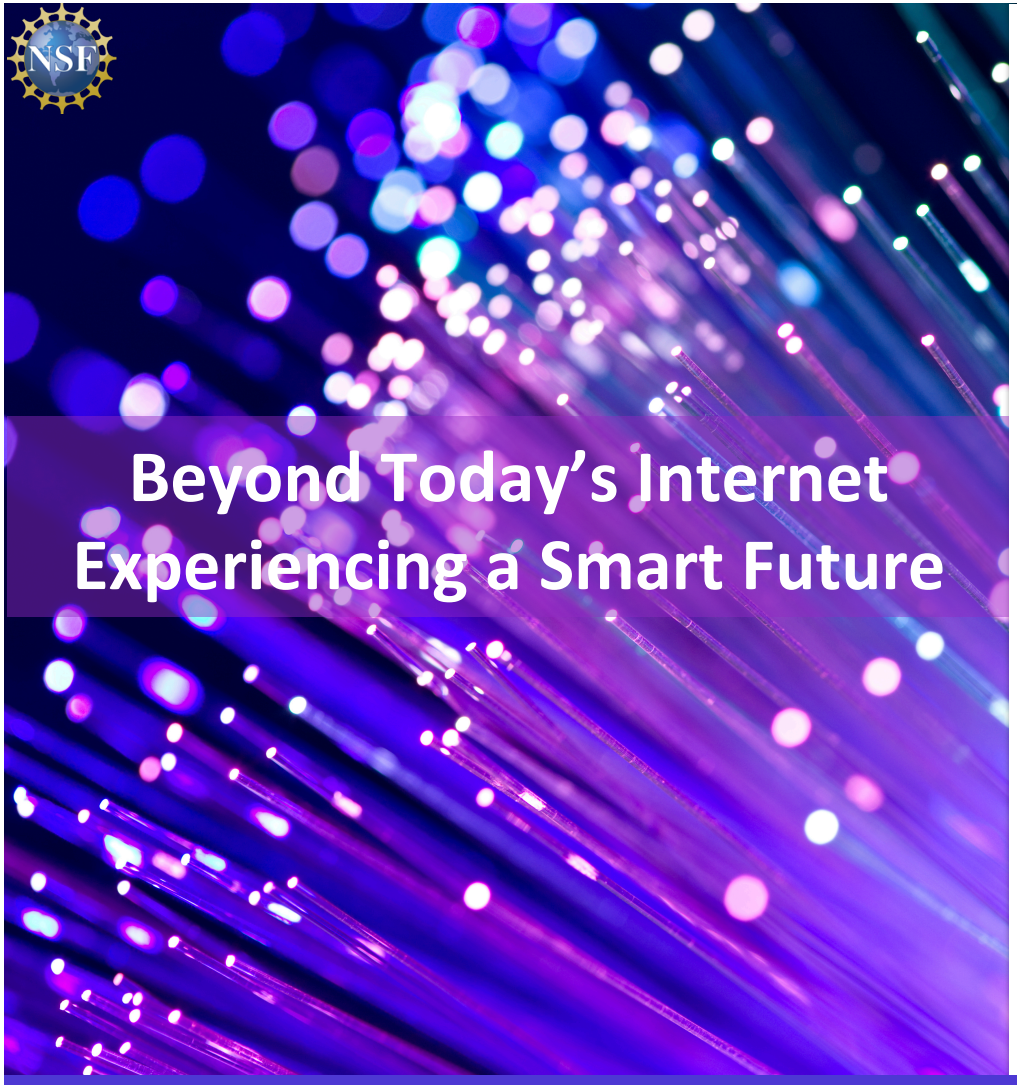
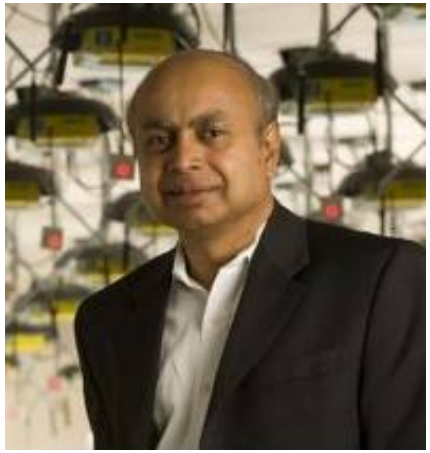


Public Safety in the Smart Future

Suman Banerjee
(suman@cs.wisc.edu)

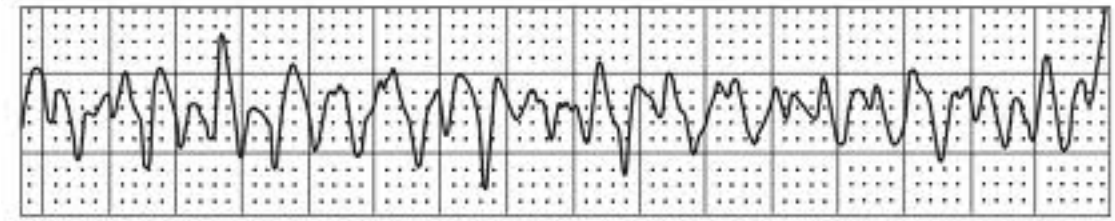
Suman Banerjee



Raychaudhuri Dipankar

Public safety is challenging

Time is THE critical resource

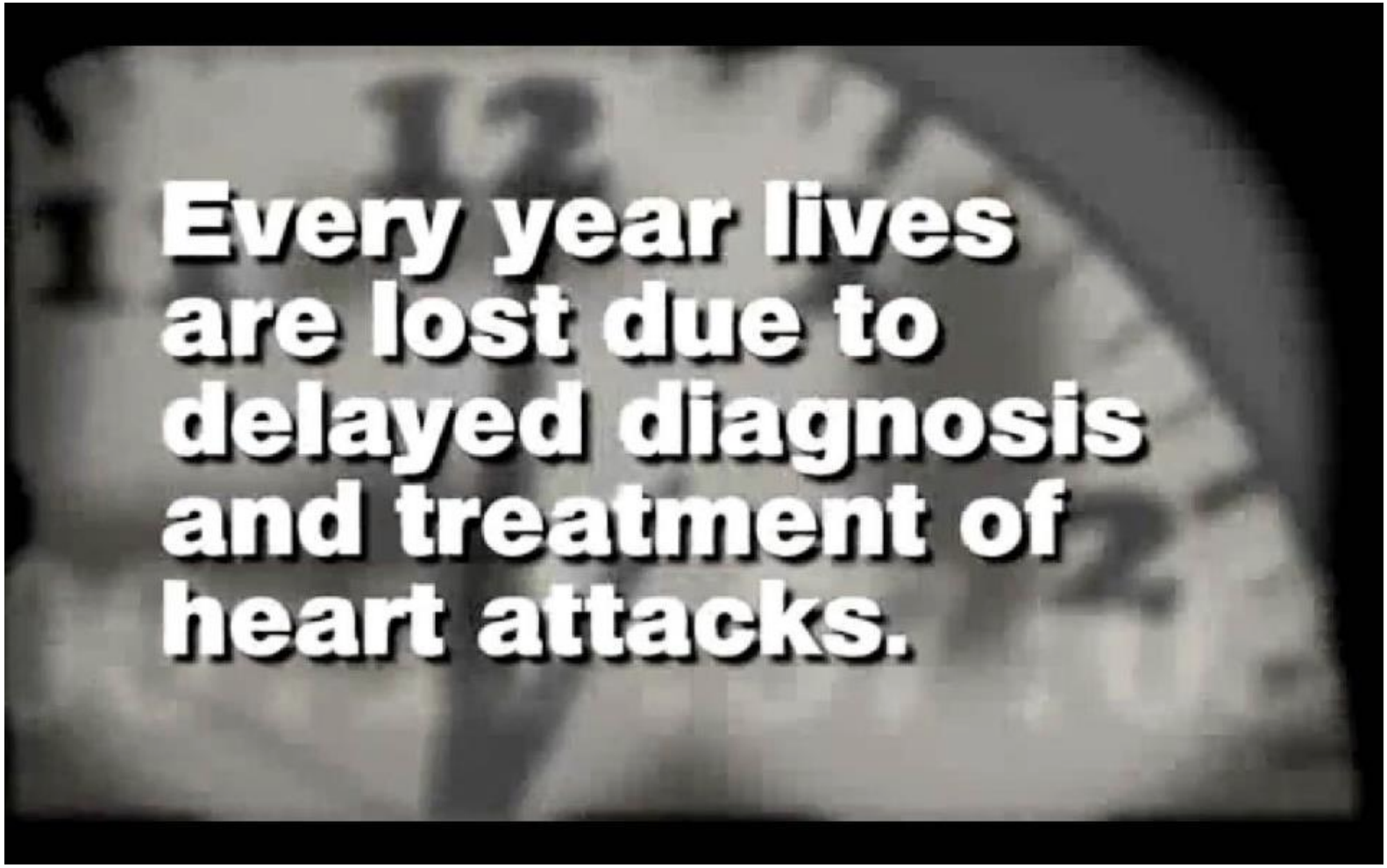


Earlier we know how to handle an incident, the better prepared we can be

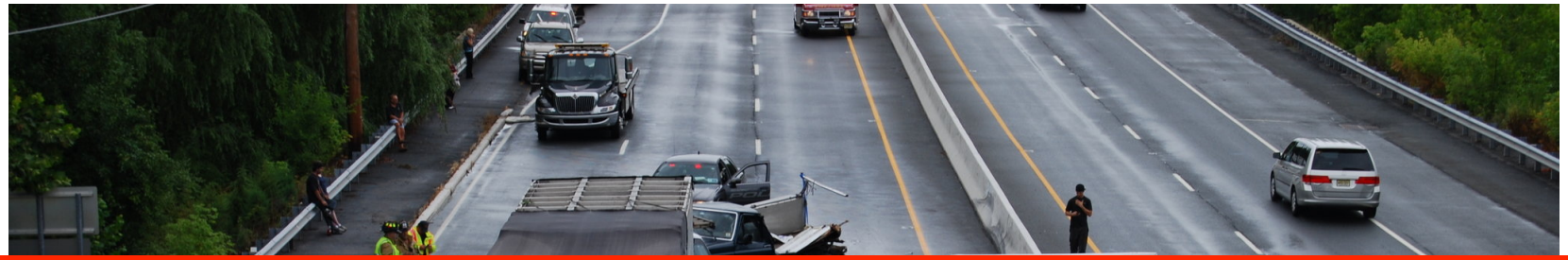
Aware

Aware, Coordinate

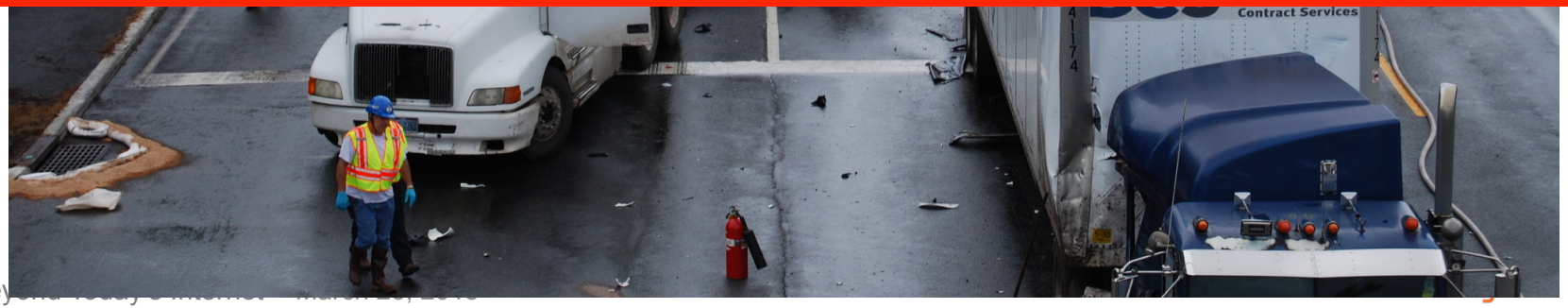
Aware, Coordinate, Responsive


Every year lives
are lost due to
delayed diagnosis
and treatment of
heart attacks.

When an incident occurs …



… how to respond quickly and efficiently,
by combining new computing, networking, and communication technologies



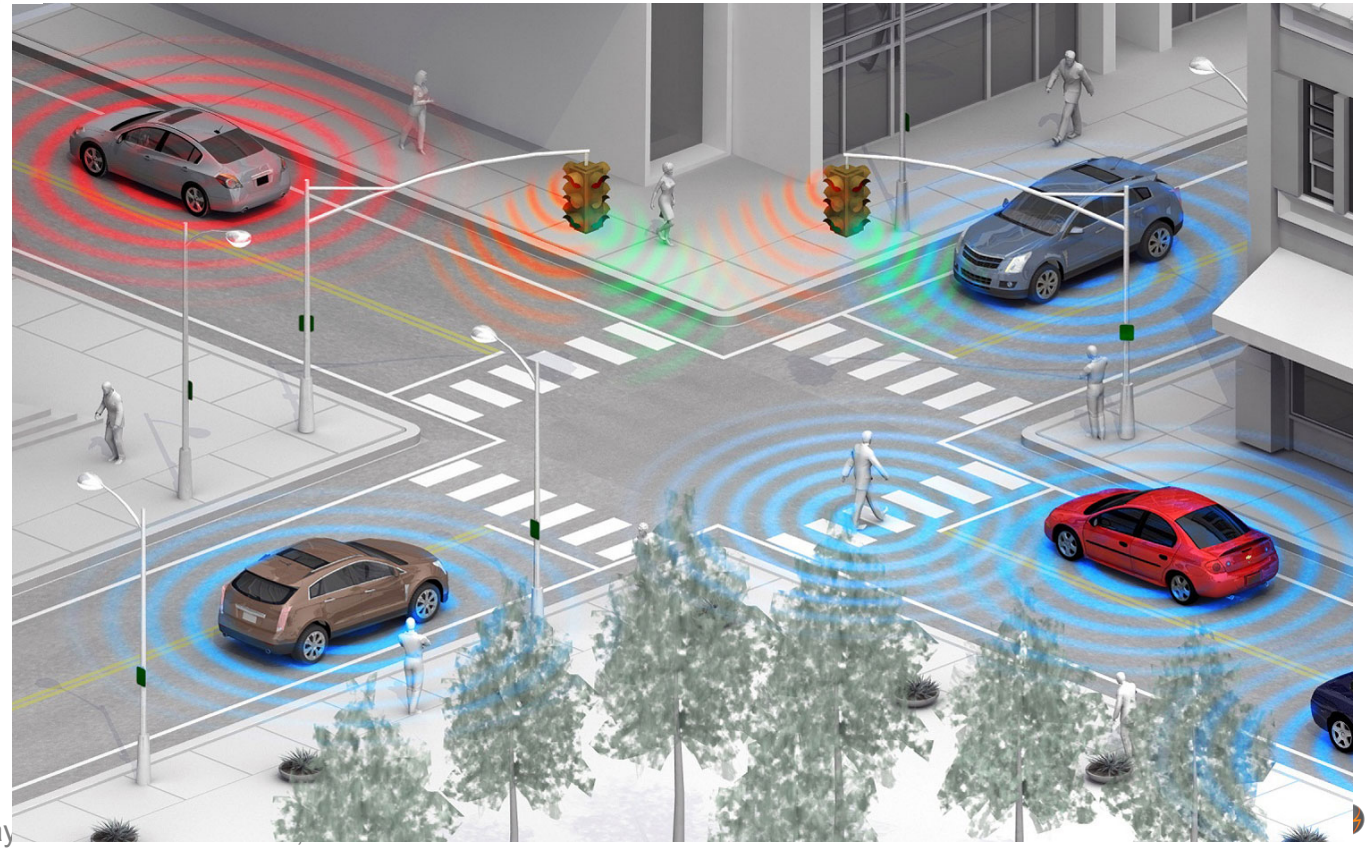
Four key technology ideas

Four key technology ideas

1

Self-reporting vehicles

DSRC

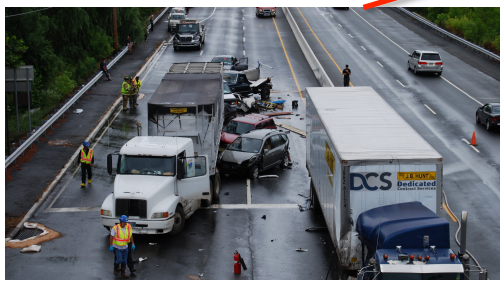


Four key technology ideas

2

Aerial vehicles as first responders

Aerial vehicles as first responders

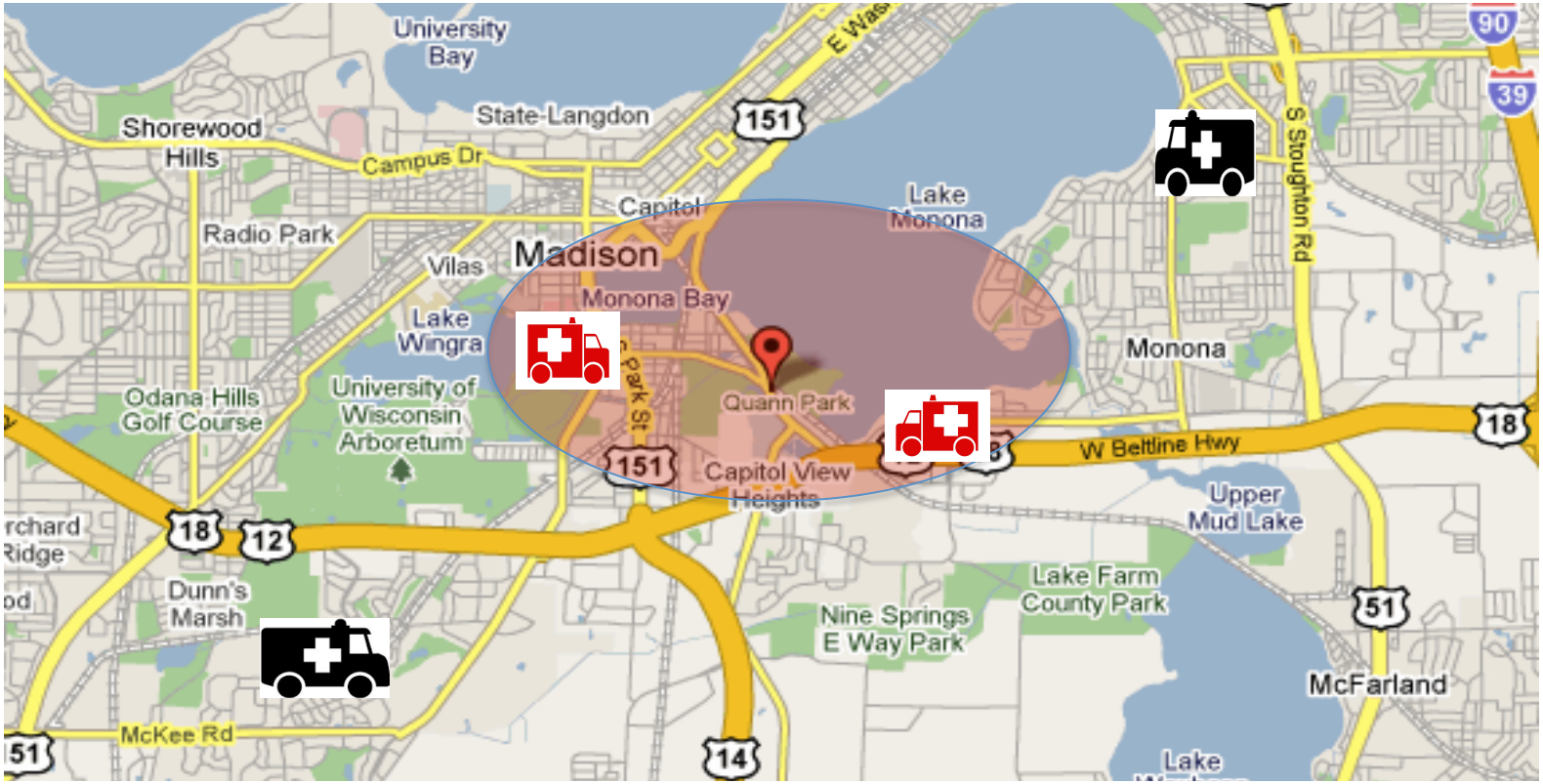


Live video

Four key technology ideas

3

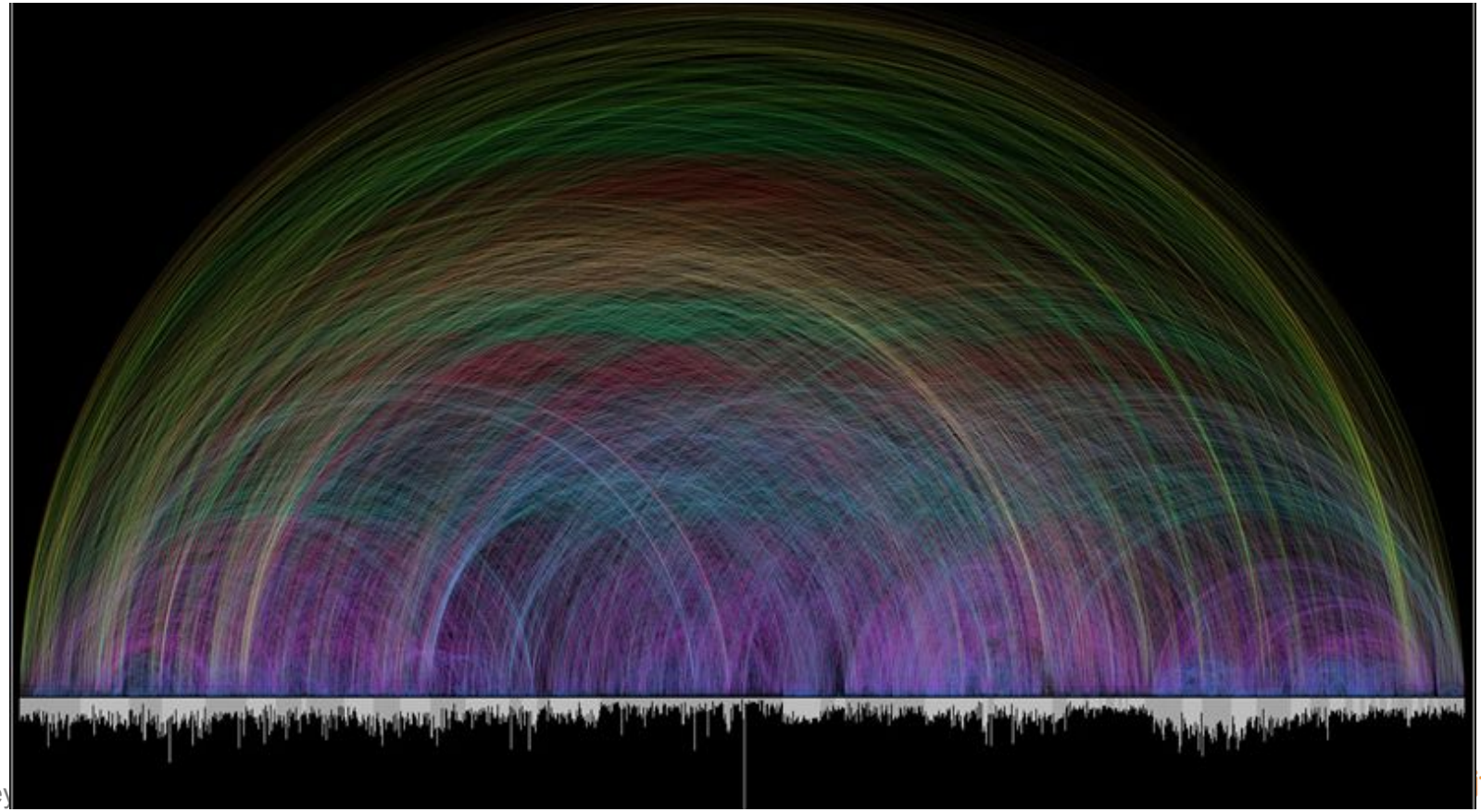
Automated geocasting



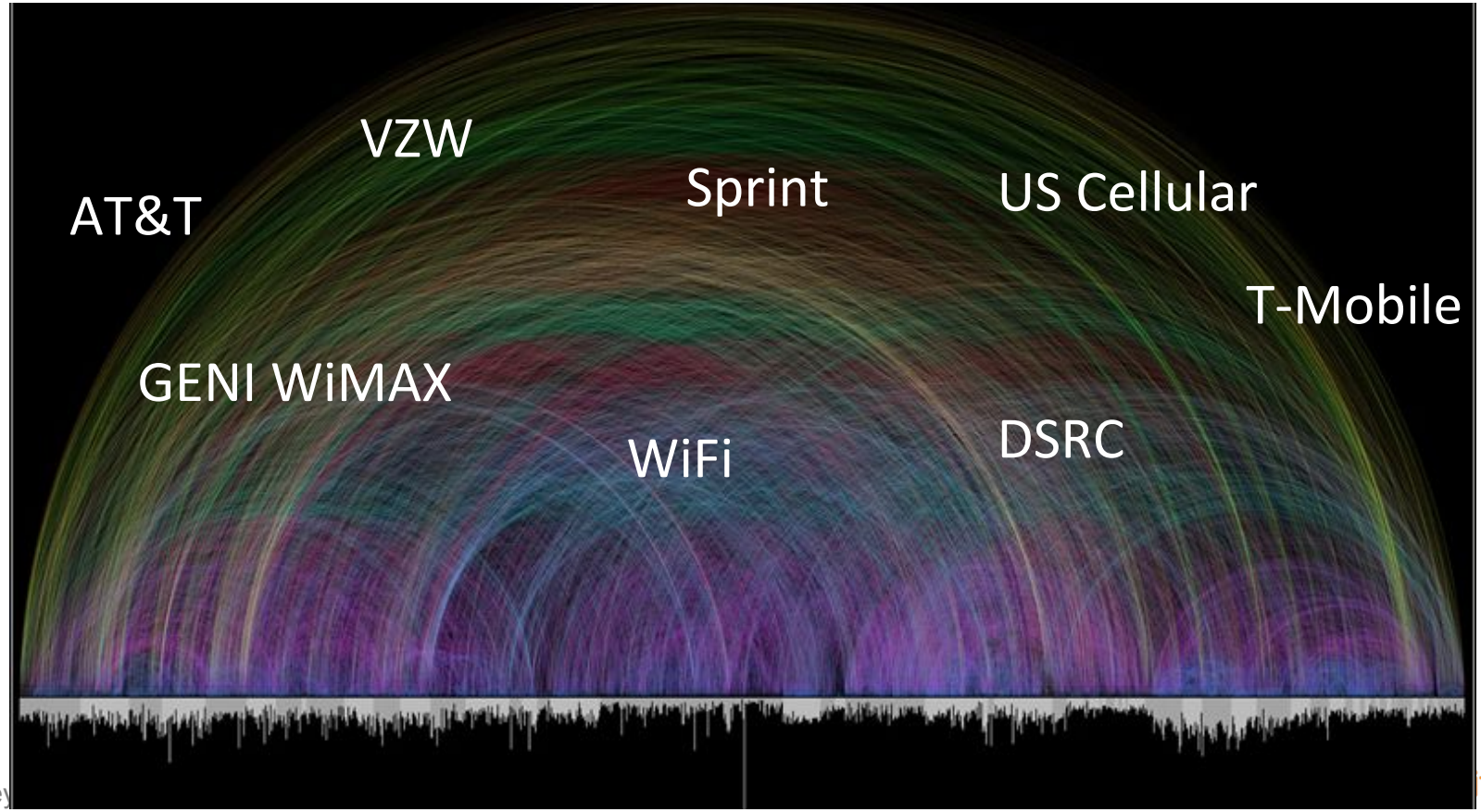
Four key technology ideas

4

Leveraging network diversity

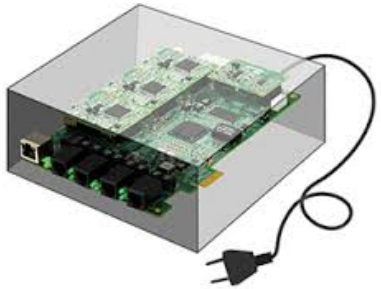


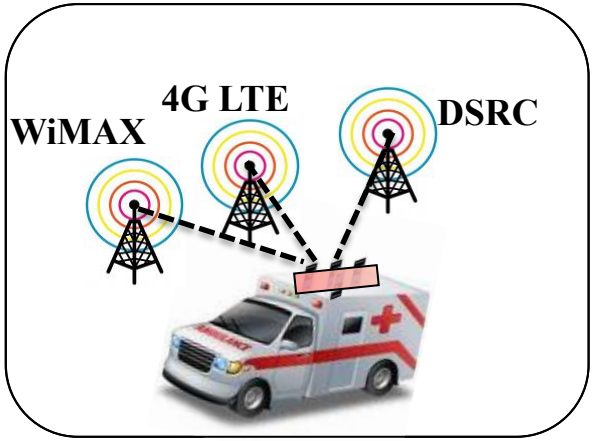
Wireless networks all around us



WiRover

Seamless high bandwidth connectivity on the move





- A small gateway that uses multiple carriers

- Backed through cloud-based services

WiRover : A Multi-network gateway

Seamless high bandwidth connectivity on the move

A highly connected ambulance

Bringing it all together: The MobilityFirst Internet Architecture

Trialed and refined by working with …

West Allis Fire Department

Wisconsin State Patrol

… multiple public safety agencies

Vehicles in demo

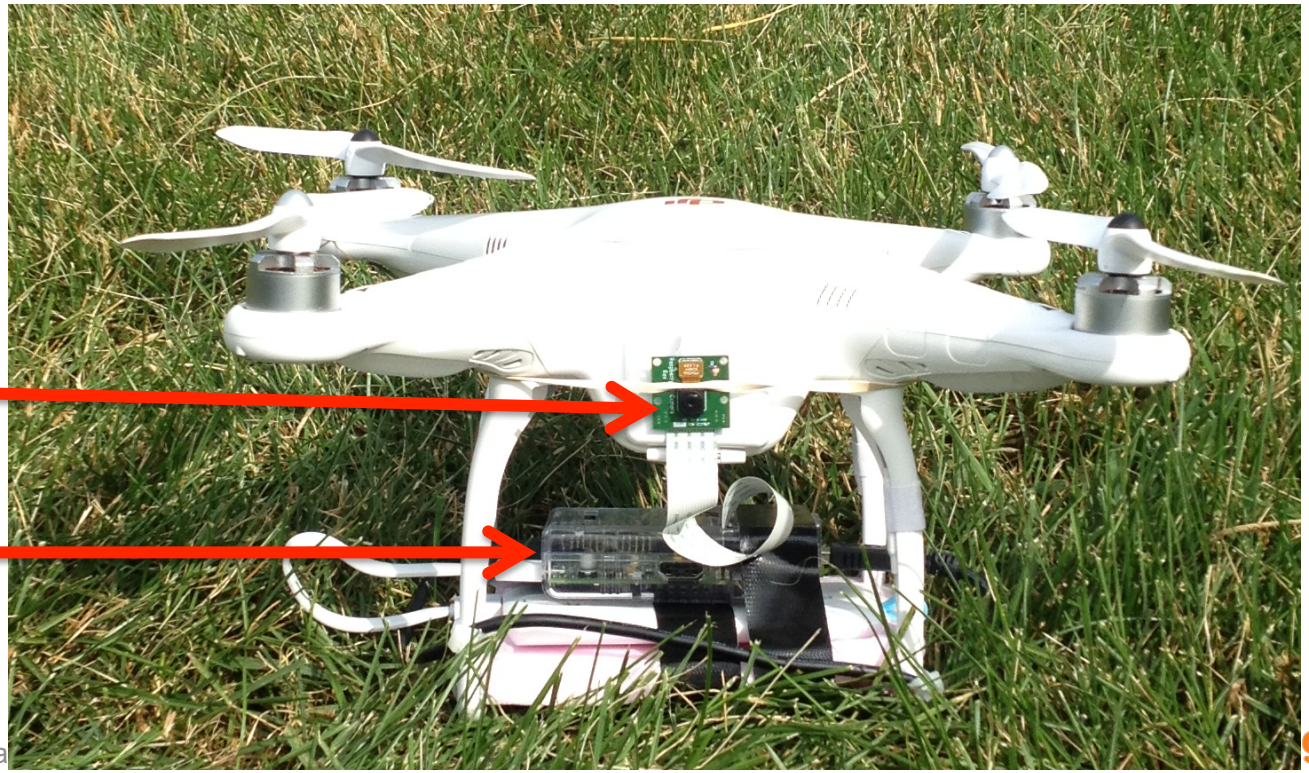
(Innova Dash + Internet2 + UW-Madison)

Urban electric vehicles

Highly instrumented for research in mobility, IoT, vehicular systems, …

Vehicles in demo

DJI Phantom Quadcopter



Camera

Raspberry Pi

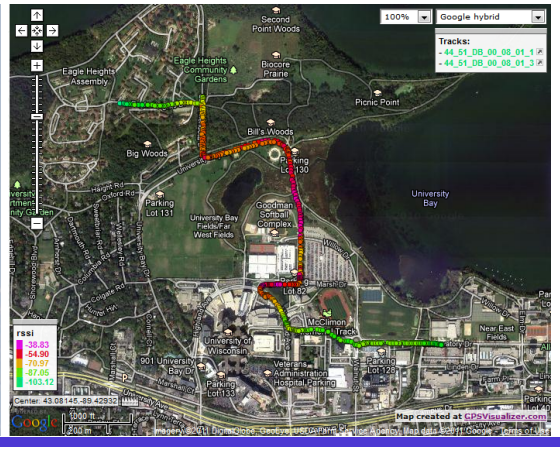
Experimentation in geni

Exploring Networks of the Future

- GENI racks & L2 networks

- Transcoding
- Geocasting
- Non IP path

- GENI WiMAX

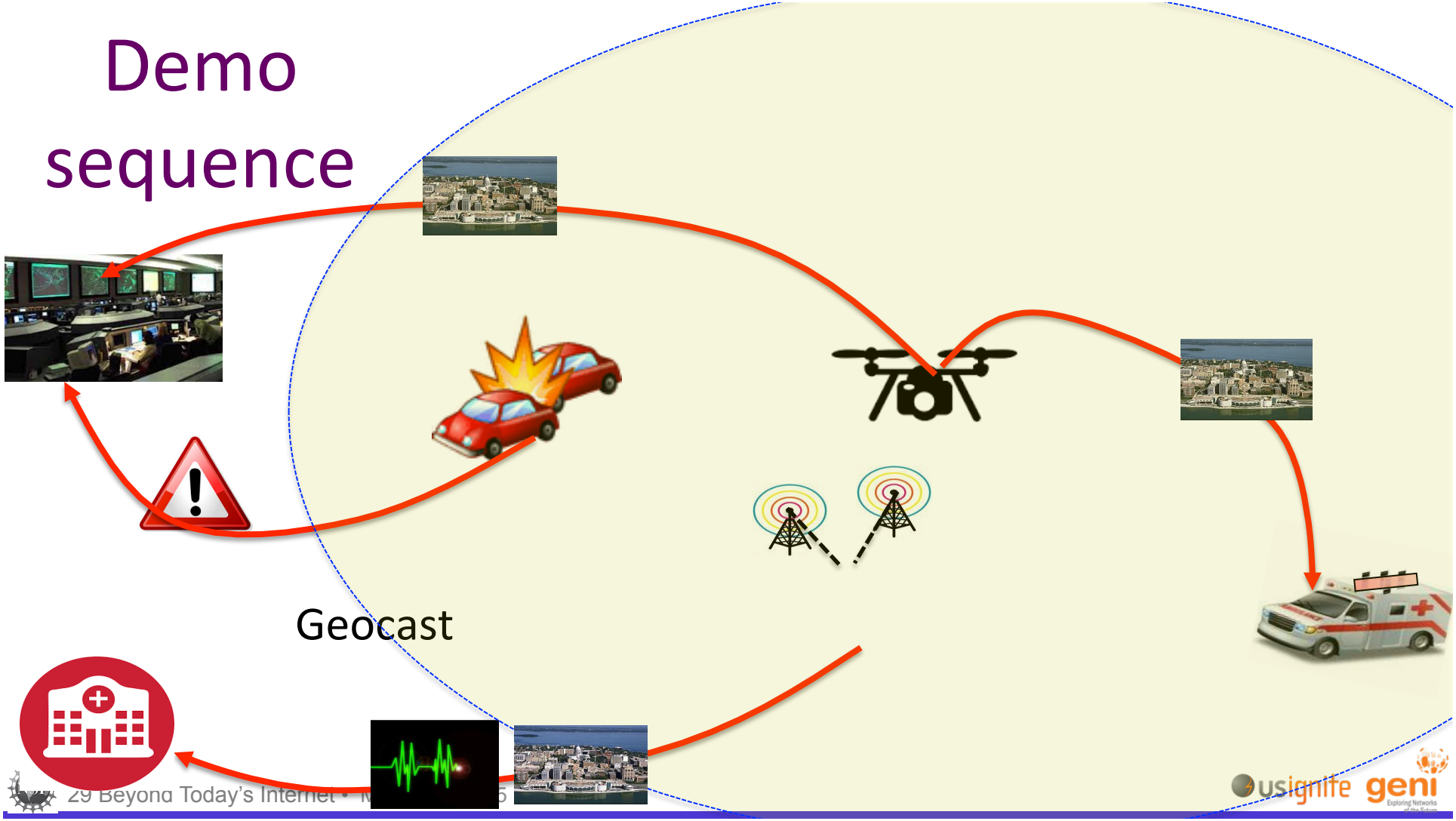


- Wide-area connectivity
- Mobility

usignite geni

Demo sequence

Demo sequence



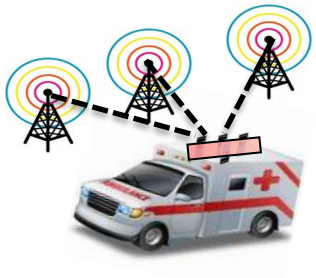
The cast of characters

- Cliff Buchanan
- Peter den Hartog
- Lance Hartung
- Greyson Hensley

- Lance Johnson
- Peng Liu
- Derek Meyer
- Alex Sherman

- Manu Gosain
- Niky Riga

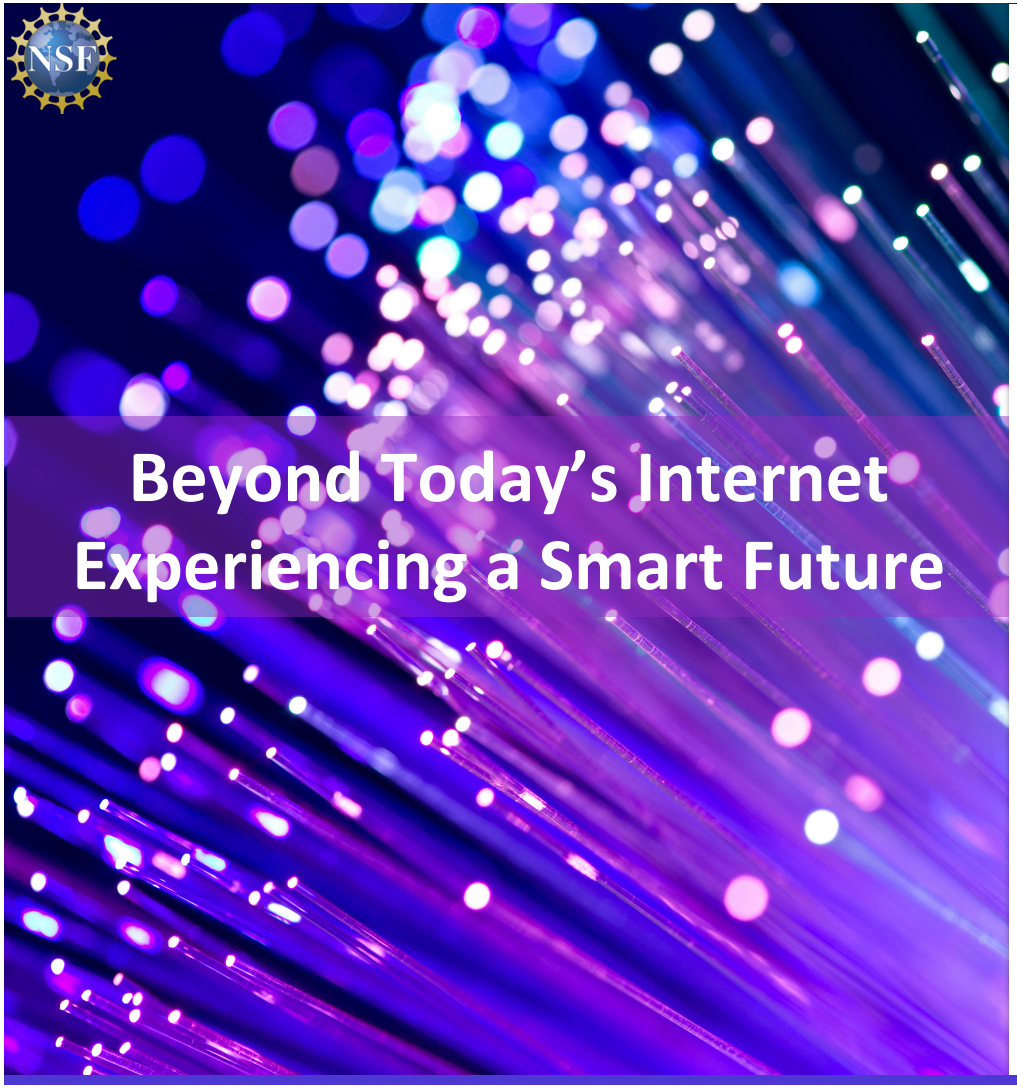
- Ivan Seskar



Public Safety in the Smart Future

We are always looking for more pilot sites, please contact us

Suman Banerjee
(suman@cs.wisc.edu)



Evaluation of MobilityFirst Future Internet Architecture Using GENI

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WINLAB, Rutgers University
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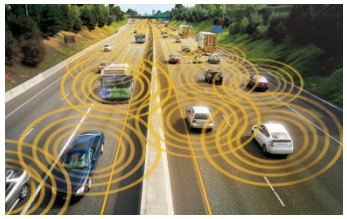
WINLAB

MobilityFirst Project Background

- Started in 2010 under NSF FIA, continuing under FIA-NP
- Project team: Rutgers, UMass, Michigan, Wisconsin, Duke, MIT, Nebraska
- Clean-slate architecture motivated by fundamental shift of Internet services to mobile platforms → ~10B in 2020!
- Use cases:

Mobile Data
("5G", WiFi First, …)



Vehicular Networks

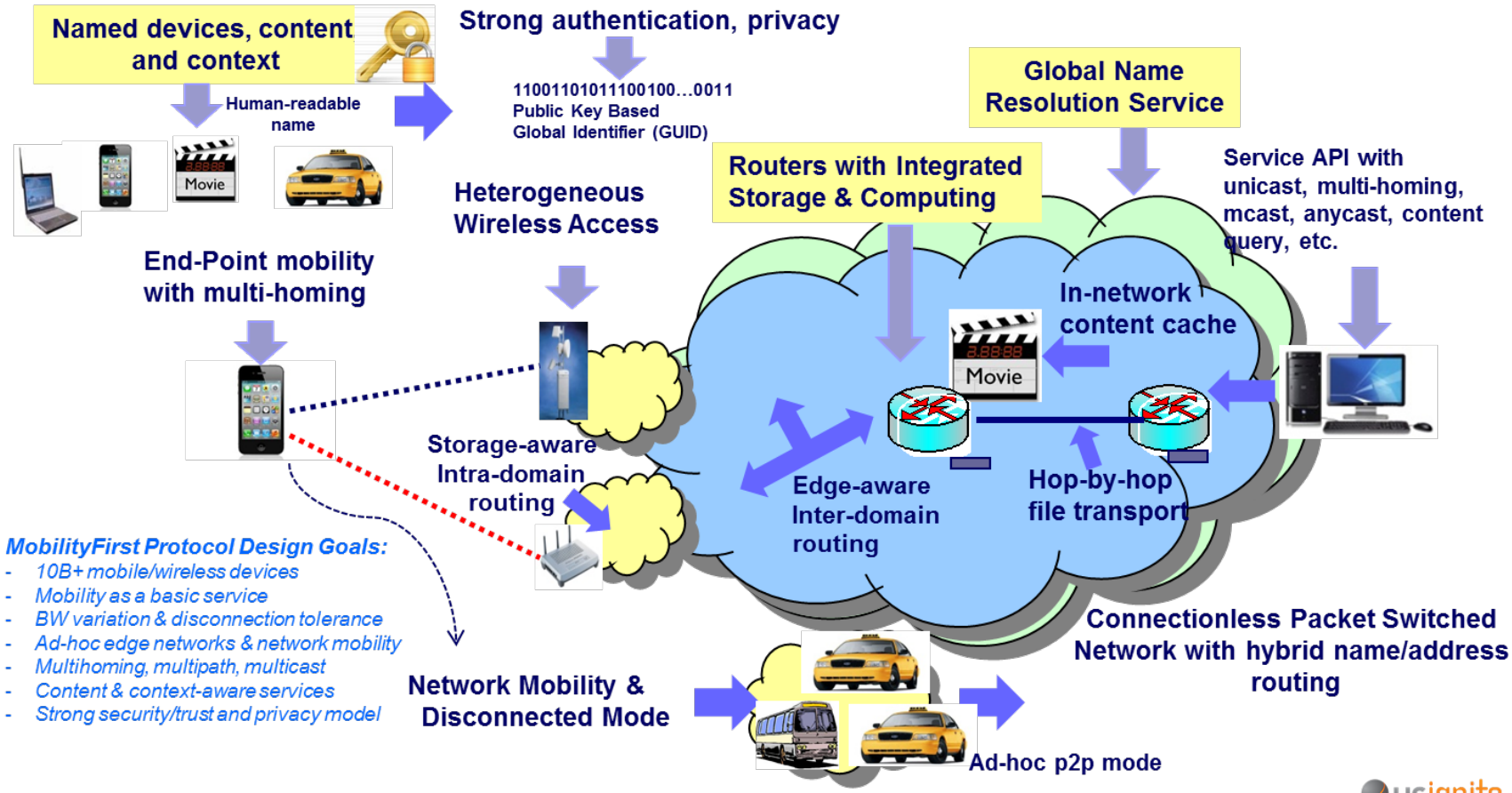
Content Delivery

Cloud Services

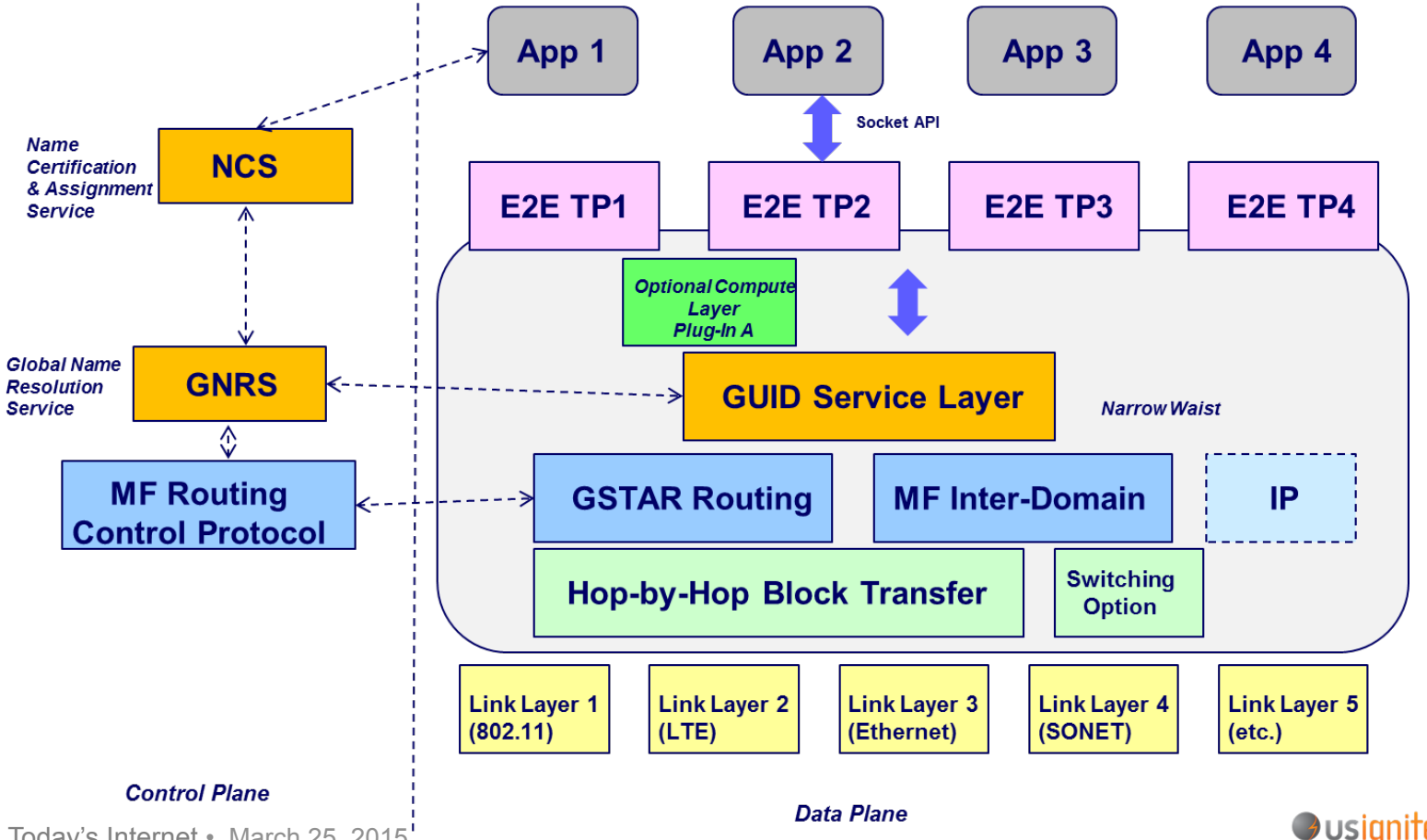
Emergency Networks

Internet-of-Things

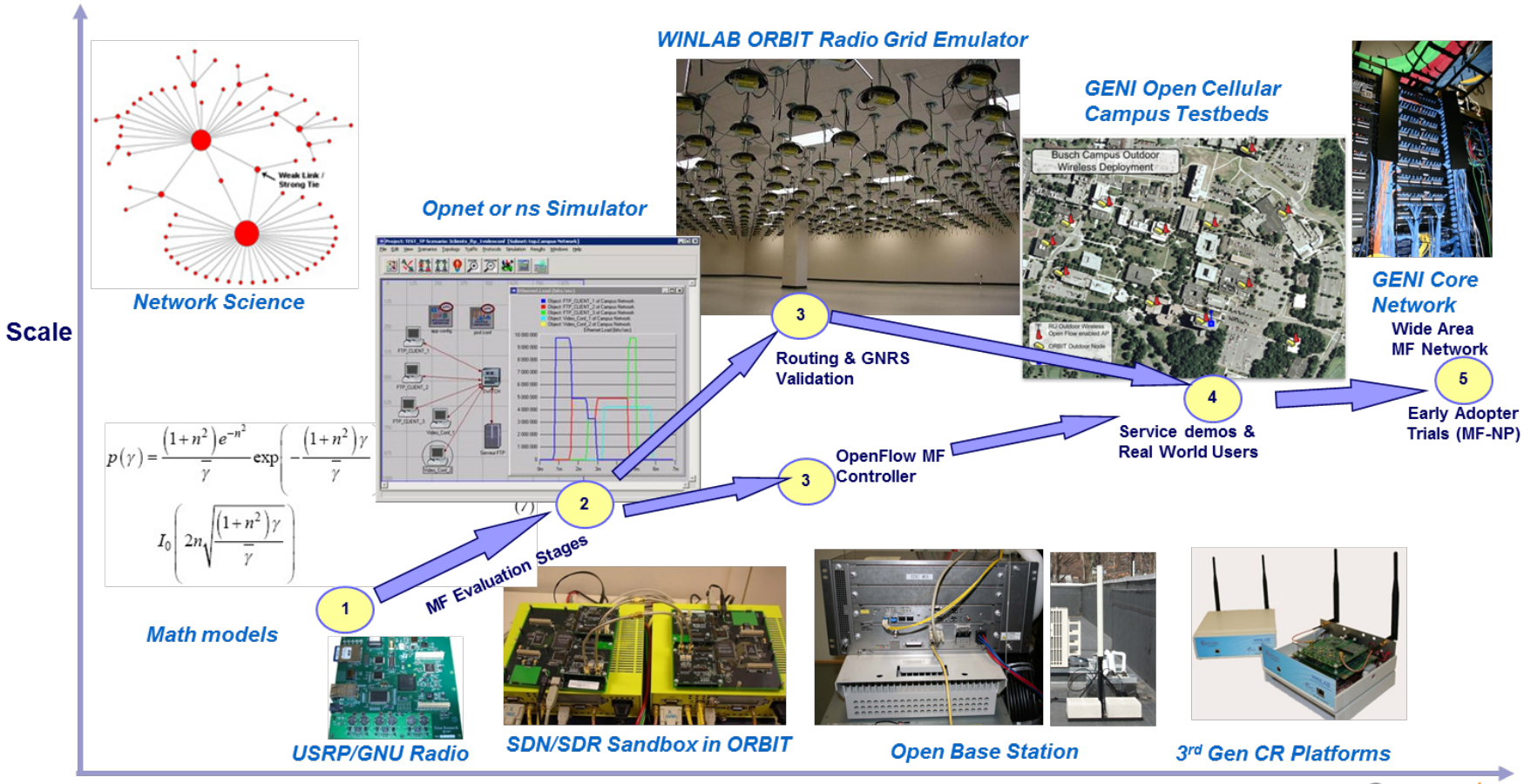
MobilityFirst Architecture Summary



MobilityFirst Protocol Stack



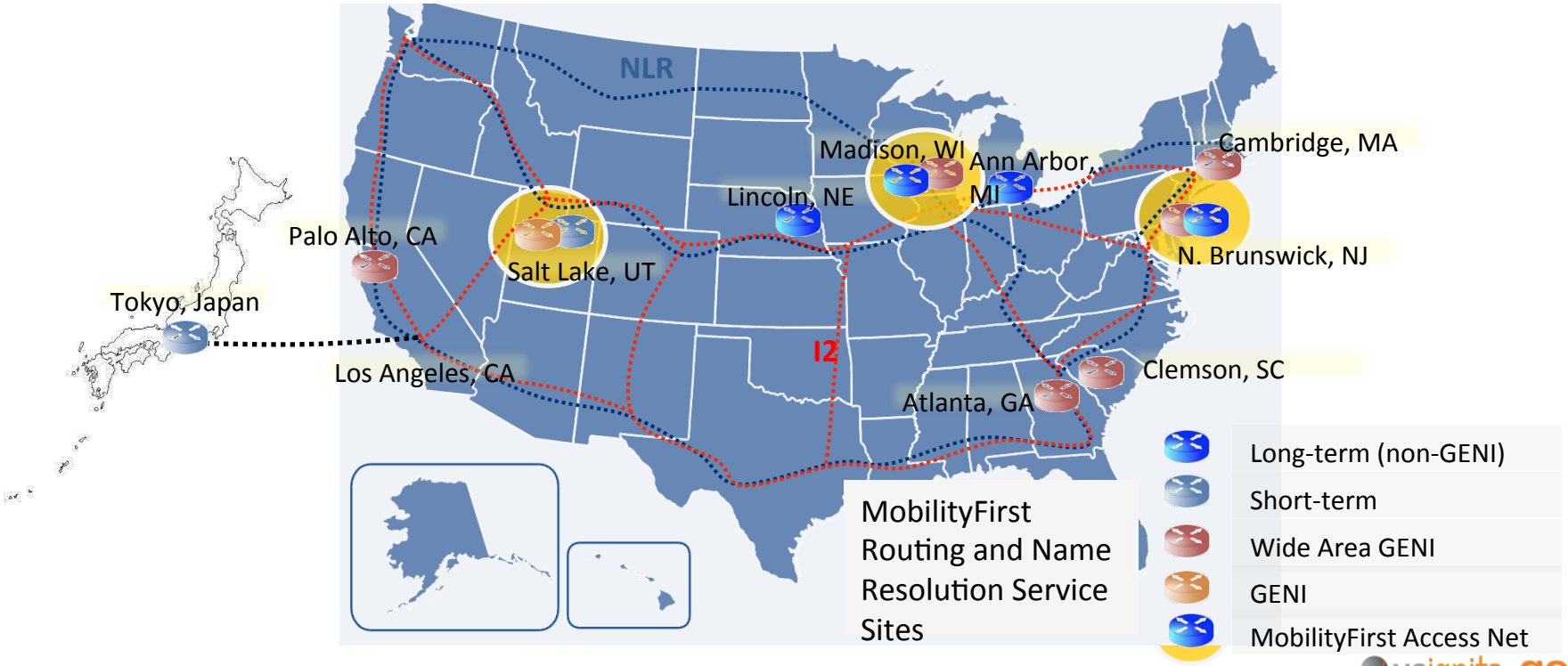
Evaluation Strategy for MobilityFirst Architecture



$$p(\gamma) = \frac{(1+n^2)e^{-n^2}}{\bar{\gamma}} \exp\left(-\frac{(1+n^2)\gamma}{\bar{\gamma}}\right) I_0\left(2n\sqrt{\frac{(1+n^2)\gamma}{\bar{\gamma}}}\right)$$

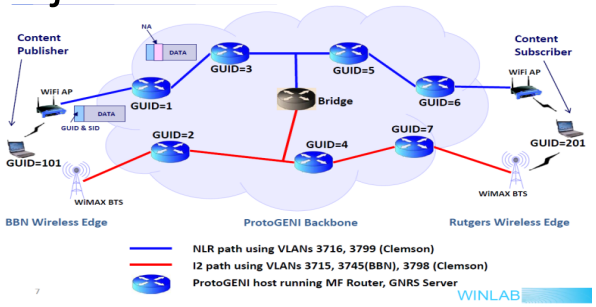
MobilityFirst Deployment on GENI

- **Long running MF "slice" in GENI to validate routing and name resolution and to run real-world applications on mobile devices (in wireless coverage areas)**

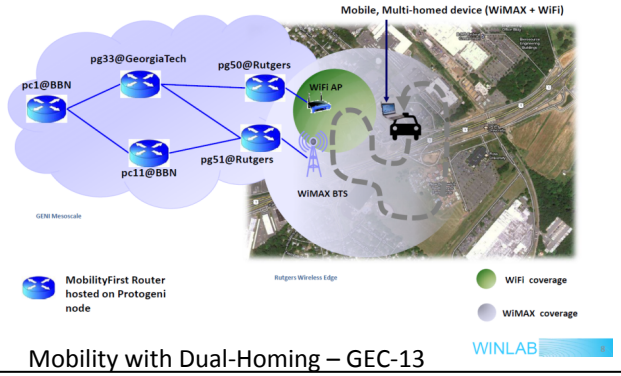


MobilityFirst on GENI: Selected Experiments

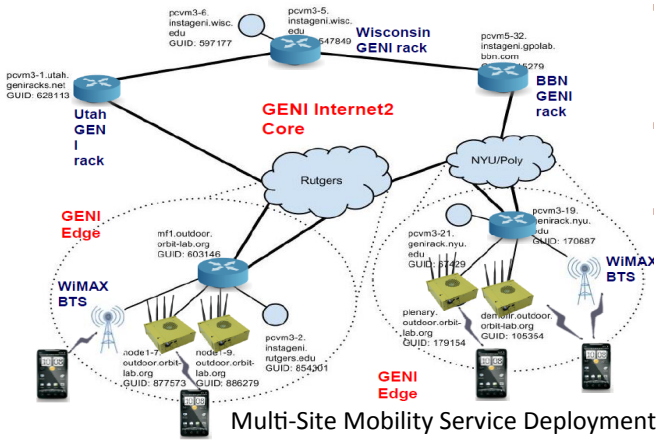
- GENI has been an integral part of MF evaluation methodology since the project started in 2010 ….



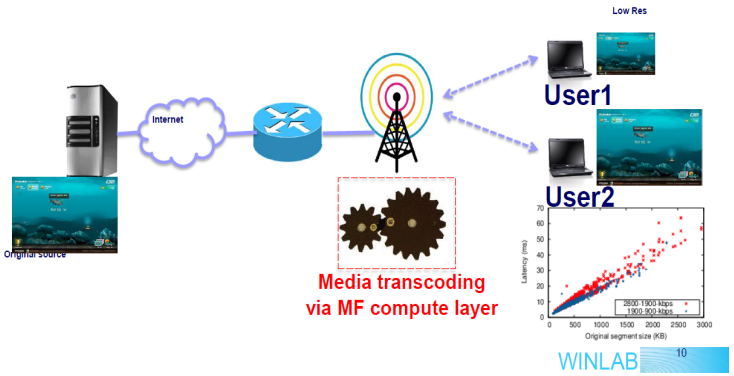
Content Delivery Scenario – GEC-12



Mobility with Dual-Homing – GEC-13



Multi-Site Mobility Service Deployment – GEC-19



Video Delivery with In-Network Transcoding– GEC-21