Smart Gigabit Communities

UT Dallas 2017 Innovation & Technology Summit

May 16, 2017
Welcome

Mike Skelton
Director
Mayor’s Office of International Business
Richardson Economic Development Partnership
PROGRAM AGENDA

• Mike Skelton
  – US Ignite Smart Gigabit Communities Program
  – Richardson US Ignite Initiative

• Gi Vania
  – Richardson GENI Infrastructure

• Mike Skelton
  – Gigabit Application Challenge –”Smart Gigabit Campus”
  – Richardson Community Challenge /Winners

• Dr. Don Hicks,
  – What’s Next?

• Q&A
Mission, Focus, Goals

• **usignite** Launch: January 2011 (NSF project)

• **Mission**: foster the creation of next-generation Internet applications that provide transformative public benefit (that stimulate the deployment of broadband fiber and wireless networks nationwide).

• **Areas of Focus:**
  - Healthcare
  - Education/Workforce
  - Public Safety
  - Transportation
  - Advanced Manufacturing
  - Energy

• **5 year Goals**
  - 60 applications
  - 200 community testbeds participating
This project will assemble and jump-start a growing and sustainable ecosystem of smart gigabit city test-beds and corresponding applications delivering important new advances in healthcare, education, public safety, and other national priority areas. These advances will leverage advanced Internet concepts developed by prior NSF research programs that are not yet available on today’s commercial Internet. In doing so, the project will open up new economic development opportunities in the participating cities.

SUSTAINABLE ECOSYSTEM OF SMART APPLICATIONS

- Common locavore infrastructure
- Applications adapted to the locavore infrastructure
- Organizational and technical capabilities bolstered
- Best practices shared across ecosystems
Richardson Community
usignite Initiative
Richardson Community

usignite Initiative

- Richardson Economic Development & the University of Texas at Dallas partnership
  - Signed MOU in April 2013
  - Became the 12th U.S. city to join US Ignite (20 now)
  - Setting up newly arrive GENI rack to connect to GENI Network (Global Environment for Network Innovations)
  - Three US Ignite grants awarded
  - 5 DFW Area application research projects (4 at UT Dallas)
GIGABIT APPS BEING DEVELOPED LOCALLY

• “Geo-Located Allergen Sensing Platform” – GASP
  PI: Dr. David Lary, UT Dallas
  • Mapping air quality
  • Cooperating with Chattanooga, Tennessee; University of Chicago; Argonne National Labs

• “Industrial Cloud Robotics across SDN”
  PI: Drs. Andreas Fumagalli & Co-PI: Don Hicks, UT Dallas
  • Demonstrated remotely controlled milling machine in Tokyo, Japan, Richardson, Texas and Southwest Research Institute (SwRI) Smart Cities 2016 (Austin, TX) & 2016 IP+Optical Network Conference, Yokohama, Japan

• “Remote Physical Therapy with Haptic Feedback”
  PI: Prof. Prabhakaran Balakrishnan, UT Dallas Test Site: Dallas Veterans Hospital

• Remote Surgery with the Da Vinci Surgical System
  PI: Dr. Prabhakaran Balakrishnan, UT Dallas
  • Institutional Partner: UT Southwestern, Dallas, TX
UTD “SMART CAMPUS”

INFRASTRUCTURE & RESOURCES

Gi Vania
Director, Enterprise Architecture
Office of Information Technology
UT Dallas
UTD “Smart Campus”

Infrastructure & Resources

- Campus Network
- Via West Data Center
- GENI Rack
- GENI Network, Internet2, LEARN Network
- OpenFlow, SDN
- Other items we discussed or you want to add. (Gi-use as many slides as you need)
Almost ready!! Final Testing by GPO BBN/Raytheon

http://instageni.utdallas.edu
50 Gbps per server possible!

Guaranteed Bandwidth and Latency between GENI sites!
Experiment like never before, making more research possible!
Control Plane, Data Plane all 10 Gbps

About 40 10 Gbps ports!, Uplinked at layer-2 to I2 AL2S GENI Net!
UTD Campus and Research Networks

Commodity Internet

UTD Cisco Nexus 9000

LEARN Adva Optical Distribution

Router/Switch Access Layer Switch

802.11 A, B, N, AC WiFi

I2 AL2S Research Network

I2 GENI Research Network

Ganymede

GENI

UTD Cisco NCS-2006 ProNet

UTD Cisco NCS-2006

UTD Cisco NCS-2006

UTD Cisco NCS-2006

UTD Firewall

Access Layer Switch

Distribution Router/Switch

100 GB Fiber

1 GB Ethernet

802.11 RF
GENI RESEARCH NETWORKS

http://www.geni.net
UTD HPC Resources

- **Ganymede** – 400 core, ½ PB, 100GB IB, DDN GPFS high performance parallel filesystem
- **GENI Rack 1.0** – Get a Slice, 5 rack mount HP computers + VMs + Software Defined Network + Docker Container capability
- **Ol’ Stampede 1.0** – 10 racks of Old Stampede 1.0, Dell C8000 Series Computers, 400 computers at 16 cores = 6400 cores (we shall see)
- (Fast growing and fast changing environment!)
US Ignite Community Resource

- The GENI rack / GENI Network is a shared resource
  - Internal UT Dallas research and development platform
  - Available to Richardson/DFW community
What is a Gigabit Community?

100% coverage. Every rooftop, household and business, connected. Every entity within the City of Any Town footprint, including businesses, schools, medical facilities, engineering labs, libraries, commercial enterprises, and residents, will have access.

End to end connectivity. Connectivity from backbone to last mile to last 100 feet which enables symmetrical performance; users can send information at the same speed at which they receive it.

Affordable to residents, business and municipality.
Gigabit Community Update

• Gigabit access to every home, every business is a vision
• Few communities in the U.S. are truly a gigabit community
  – Chattanooga, Tennessee one of the first
  – Google Fiber initiative halted
  – AT&T GigaPower - selective markets
• US Ignite funding challenges to create applications to stimulate gigabit access
Richardson Community

Gigabit Application Challenge

• Goal of the challenge:
  – Create two (2) application that take advantage of
    • Gigabit internet bandwidth and/or
    • Low latency
    • Advanced Software Defined Networks - SDN
  – Two winners, $10,000 each
Challenge Sponsors

iWire365
Redefining Communication Infrastructure

ANIXTER
SMART GIGABIT COMMUNITY CHALLENGE
Richardson Smart Gigabit Community

Application Challenge #1

- UT Dallas Smart Gigabit Campus Testbed
  - Set up equipment in selected areas of campus to test capabilities
  - Applications created only need to utilize gigabit bandwidth or low latency at critical (peak) times (emergencies, large spike users, unusually large data, etc.)

- Application ideas utilizing available equipment and infrastructure:
  - Public Safety Video Surveillance*
  - License Plate Recognition*
  - Facial Recognition*
  - Traffic monitoring – suggested ingress and egress routes during peak traffic*
  - Emergency communications network with streaming video*
  - Parking space availability apps

*(UT Dallas campus police approval needed to implement)
Equipment & Applications available to use:

- LED Street Lights
- Smart Grid
- HD Cameras
- WiFi
- Small Cell
- Sensors
- Development Kits
- Arkhos Analyst by IBM i2
- OpenFlow SDN software
Richardson Smart Gigabit Community

Application Challenge #2

• Application ideas that fall into any of the six usignite focus categories:
  Healthcare     Education/Workforce     Public Safety
  Transportation Advanced Manufacturing Energy

• Meet the criteria of:
  – Requires gigabit internet bandwidth, or
  – Requires low latency, or
  – Utilizes advanced Software Defined Network (SDN)
  – For examples of these types of applications visit:
    https://www.us-ignite.org/apps/
Smart Gigabit Communities

Application Challenge

• Timeline:
  • February 24, 2017 Pitched the “Challenge” to North Texas entrepreneurs, students, university researchers, SMEs
  • March 31, 2017 14 Proposals submitted
  • April 21, 2017 Judges selected Top Five proposals-invited them to pitch their ideas to judges on or before this date
  • May 11, 2017 Finalists had 30 minutes to pitch their application idea and development plan to a panel of judges.
  • May 16, 2017 Winners announced TODAY!
  • October 31, 2017 Working prototype / demonstration due
APPLICATION CHALLENGE WINNERS

• Security on the Poles
  – Dr. Prasad Golla, Director/Founder AGGICORP
  – Narender Ramireddy, CTO, SWENSA

• Emotive Virtual Reality Patient System
  – Dr. Marge Zielke, UT Dallas, Director, Center for Modeling and Simulation/Virtual Humans & Synthetic Societies Lab (“Center”) 
  – Gary Hardee, Associate Director of the Center
  – Djakhangir Zakhidov, research scientist at the Center
  – Lenny Evans, solutions architect at the Center
  – Gautham Suriay Mathialagan, UT Dallas Graduate student
  – Jithin Pradeep, UT Dallas Masters student
What’s Next?

Dr. Donald Hicks
Professor
Political Economy and Public Policy
University of Texas
North Texas: Fertile Ground to Incubate A Wireless Ecosystem Revolution

Today DFW Metroplex Hosts Major Global Multinational ICT Producer & User Domains

2017 – DFW #2 in Data Centers (#1 Northern Virginia)

1999- DFW #2 High-Tech Sector (#1 Silicon Valley)

1988- 1st Toll Tag (Amtech – David Cook)

1988 - 1st Supply chain management software i2 – Sanju Sidhu / Ken Sharma)

Late 1980s - Telecom Corridor Richardson leads the world into the “Wireless Era”

1985 –1st Video store (Blockbuster Video – Bob Wooley)

1983 - DSP & DLP Sensors (Analog & Digital) TI

1979 – Launched 1-800-FLOWERS) (Jerry Wescott)

1972 – Launched Distance-learning Industry (Wescott Communications – J. Wescott)

1968 FCC Carterfone Decision (approved 2-radio connection to AT&T network)

1962 Systems Integration industry launched – EDS – Ross Perot

1968 Microelectronics Integrated circuit invented here by Texas Instruments

1954 Collins Radio Builds production facility in Richardson, TX

1950 Collins Radio Builds production facility in Richardson, TX

1950s

1960s

1970s

1980s

1990s

2000s

2010s

2020

1995 - 1st Streaming multimedia over Internet Broadcast.com - Mark Cuban & Todd Wagner

Early 1990s - Richardson recognized as “RFID Hub”

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Industry Cluster

An industry cluster consists of large and small firms in a single industry. Firms in industry clusters benefit from synergies of association related to shared labor, sources of innovation, suppliers, markets, technology, and infrastructure.

- **Large/Anchor Firms**
- **Medium Firms**
- **Small Businesses**
- **Start-ups**
- **Suppliers**
- **Support Sectors**

**LAbOR**
Includes transportation, utilities, broadband, etc.

**INNOVATION AND TECHNOLOGY**
Includes access to university and federal lab research and development.

**SUPPLY CHAINS**
Includes education and training systems graduating jobseekers with skills for entry-level, mid-level, and advanced-level occupations.
TELECOMMUNICATIONS

Dallas-Fort Worth is a crucial U.S. center for telecommunications firms. The bulk of them are located along the "Telecom Corridor" that stretches north of downtown Dallas through its suburbs of Richardson and Plano. The industry's biggest names call the DFW region home, among them the global headquarters for the Fortune 100 ranked AT&T Inc., and the North American headquarters for Ericsson Inc., Alcatel-Lucent and Samsung Telecommunications America. New York-based Verizon Communications maintains a major business unit here employing some 8,000 workers in the area.

CROSSES OF COMMUNICATIONS

THE DFW AREA IS A CRUCIAL U.S. CENTER FOR TELECOMMUNICATIONS FIRMS

THE TELECOM CORRIDOR

Located 15 miles north of downtown Dallas, the Telecom Corridor encompasses approximately 30 square miles and includes the city of Richardson along with the Texas Instruments campus and the west side of Waranch Parkway near the University of Texas at Dallas campus.

The Telecom Corridor area is one of the most significant and unique high-tech business concentrations in the United States. Various telecommunications industries are represented in the area, including:

- Carriers/service providers
- Telecom equipment manufacturers
- Consulting firms
- Wireless communications companies
- Photonics/optics networking firms

Companies located here include AT&T, Fujitsu, Cisco Systems, Verizon, Samsung Mobile and MetroPCS.

Source: Dallas Regional Chamber (DRC)
**BIG DATA** Enables the “Adjacent Possible”

UT Dallas Anchors North Texas’ Regional Innovation Infrastructure

- **New Venture Startups**
- **US Ignite Network Innovation**
- **Supply Chain Vitality Planning**
- **Demonstration Center**
- **Workforce Vitality Planning**
- **UT-D Venture Development Center**
- **Supply Chain Vitality Planning**
- **Development Innovation Summits**
- **Technology Demonstration & Rapid Prototyping**
- **Customization Consultation**
- **Networked Video Endpoints**
- **Economic Development Presentations**
- **Cisco Video Collaboration Platform**
- **Community College Alliances**
- **AT&T Foundries & Global Headquarters**

**UT Design**
- Accelerates SME Innovation

**State of Texas**
- (Office of the Governor)

**UT System**
- Inter-Institutional Collaboration

**UT-Dallas**
- Rapid High-Speed Application Design & Development Institute

**Rapid Application Development**
- Promote networked product & process innovation & implementation
- Promote supplier base & workforce vitality
- Promote innovative business model development
- Promote advanced development linkages with university R&D labs
- Promote “skill pipeline” development & career opportunities for students

**Pioneer Natural Resources**
- AT&T
- Verizon, Fujitsu, etc.
- TexasOne
- Texas Governor’s Office
- Richardson Economic Development Partnership (REDP)
- UTDesign Applied Research Center (ARC)
- ADVANCED NETWORK INITIATIVES

- Learner U.S. Ignite
- National Science Foundation
- University of Texas System
- Strategic Initiative in Manufacturing, Logistics & Sustainment
- Texas Research Alliance/AHE
Nationwide Ecosystem for Shared Smart Applications

★ NSF: “Sustainable Ecosystem of Smart Applications” (SESA) [Partnership with Richardson REDP] [White House Announcement 9-14-15]

Advanced Manufacturing, Logistics & Sustainment

★ NSF: "CC*DNI Integration: PROnet: A Programmable Optical Network Prototype Serving the Campus," [Awarded]


• NASA: “Rapid Prototyping & Delivery of New Data Products Using Big Data, Machine Learning, Aerial Vehicles, Distributed Clouds and Software-Defined Networks”

• NSF: “Digital Subcarrier Optical Networks (DSOns) for Campus Layer-1 Circuit Connectivity”

Health, Wellness, Workforce Training & Environmental Quality

• NSF/US Ignite: “High-Speed Cyber-Learning Platform for First-Responder Institutional Readiness & Response to Infectious Disease”

★ NSF: “Asthma & Allergy City for Health Observation & Optimization” [Awarded]
Enterprise-to-Ecosystem
Managed Integrated Copper, Fiber & Wireless Applications

AGILE PLATFORMS FOR DELIVERING...
- Programmable Infrastructure as a Service
- Process Control as a Service
- Cyber Security as a Service
- Logistics & Sustainment as a Service
- IoT & IIoT as Service
- Mass Customization as a Service
Co-Location ➔ Collaboration

Managed Net-Centric & IoT Applications

Data Access via High-Speed Low-Latency Networks

Data Analytics & Benchmarking for Performance Evaluation

Industry-led Application Design & Development “Sandbox”

Academic S&T Research Institutes

Public-Purpose Community Service Development

Application Demonstration via Emerging Media

“Sandbox” Data Analytics & Benchmarking for Performance Evaluation
Advanced Wireless Research Consortium of North Texas

Platforms for Advanced Wireless Research (PAWR)
NSF Proposal – In Progress

The PAWR program aims to support advanced wireless research platforms conceived by the U.S. academic and industrial wireless research community. PAWR will enable experimental exploration of robust new wireless devices, communication techniques, networks, systems, and services that will revolutionize the nation’s wireless ecosystem, thereby enhancing broadband connectivity, leveraging the emerging Internet of Things (IoT), and sustaining US leadership and economic competitiveness for decades to come.

(NSF Program Solicitation NSF 16585)
Thank you!

Smart Gigabit Communities