Towards a North Carolina Smart and Connected Communities Hub

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Smart & Connected Communities

- NSF's Smart & Connected Communities Program
  - effectively integrate data sources, networked computing systems, and sensors with people, decision-making, and physical infrastructure and systems to enable more livable, workable, and sustainable communities regardless of place or scale.
  - *support for basic research and education - foundation for smart solutions*
  - *multi- and interdisciplinary collaborations and partnerships - necessary to foster high-impact research, pilot deployments, and education and workforce development that will support S&CC of the future*
  - *foster close collaboration with industry, non-profits, entrepreneurs, local governments, anchor institutions such as schools, libraries, and hospitals, and local residents*

Need for a S&CC Initiatives

- Urbanization
  - *The 21st Century is called the Urban Century as, for the first time in history, over 50% of the world's population lives in urban regions*
  - *Urbanization has placed massive pressure on existing infrastructure, including utilities, mechanisms for safety and security, transportation, housing, law and governance, and various civil services*
- Revolutionary change in information & communication infrastructures
  - *Big Data & Analytics, the Internet of Things, Social Media, …*
- Multiple Dimensionalities & Complex Connectedness
  - *Smart Citizens, Smart Communities*
  - *Smart Environment, Smart Infrastructure*
  - *Smart Analytics, Smart Policies*
- *Currently there are no state-wide S&CC initiatives*

NC S&CC Initiative

- North Carolina-wide initiative - Towards a Smart State
- Pilot Program - Ongoing
  - Funded by UNC Research Opportunity Initiative Grant (2016-17)
  - UNC-CH, UNCC, NCSU, ECU, WCU, NCCU
- Aims
  - *Foster and grow partnerships for transformative impact across rural and urban regions of North Carolina*
  - *Translate Solutions from **Smart Cities** to **Smart State***
  - *Harness emerging IoT, Cloud Services, Mobile Platforms*
  - *Enable Analytics and Sensor Fusion*
  - *Capitalize on the existing strengths of researchers across the UNC system and NC-based industries and government partners*
  - *Leverage regional private-public partnerships such as the NSF South Big Data Hub, National Consortium for Data Science, and the Carolina Population Center at UNC Chapel Hill, and the EPIC, Project Mosaic, and Data Science Initiative at UNC Charlotte, Center for Environmental Farming Systems at NCSU, etc.*
  - *Serve as a national model for Smart State*
- https://smartcities.web.unc.edu/

Towards a Smart State NC

- Promote Sustainable Solutions for Social and Economic Developments across North Carolina
  - Build bridges across Rural and Urban Communities
  - Engage Multiple Stakeholders
- Apply Innovative Smart Technologies
  - Big Data, Data Science & Deep Learning
  - Data Sharing Urban Platforms
  - Social Media Networks
  - Internet of Things & Sensor Networks
  - Cloud Computing & Edge Computing
- North Carolina as an Extreme Living Lab
  - Pilot Deployments across Communities
    - Apply Smart Technologies Specific to Community Problems
  - Fitbit for the State
    - Monitor and Analyze the pulse of the State
  - T2T Networking
    - Connect Governments Across Towns
  - Transparency & Outreach
    - Point-of-Presence & Social Media for Citizen Interactions

Our Layered Approach

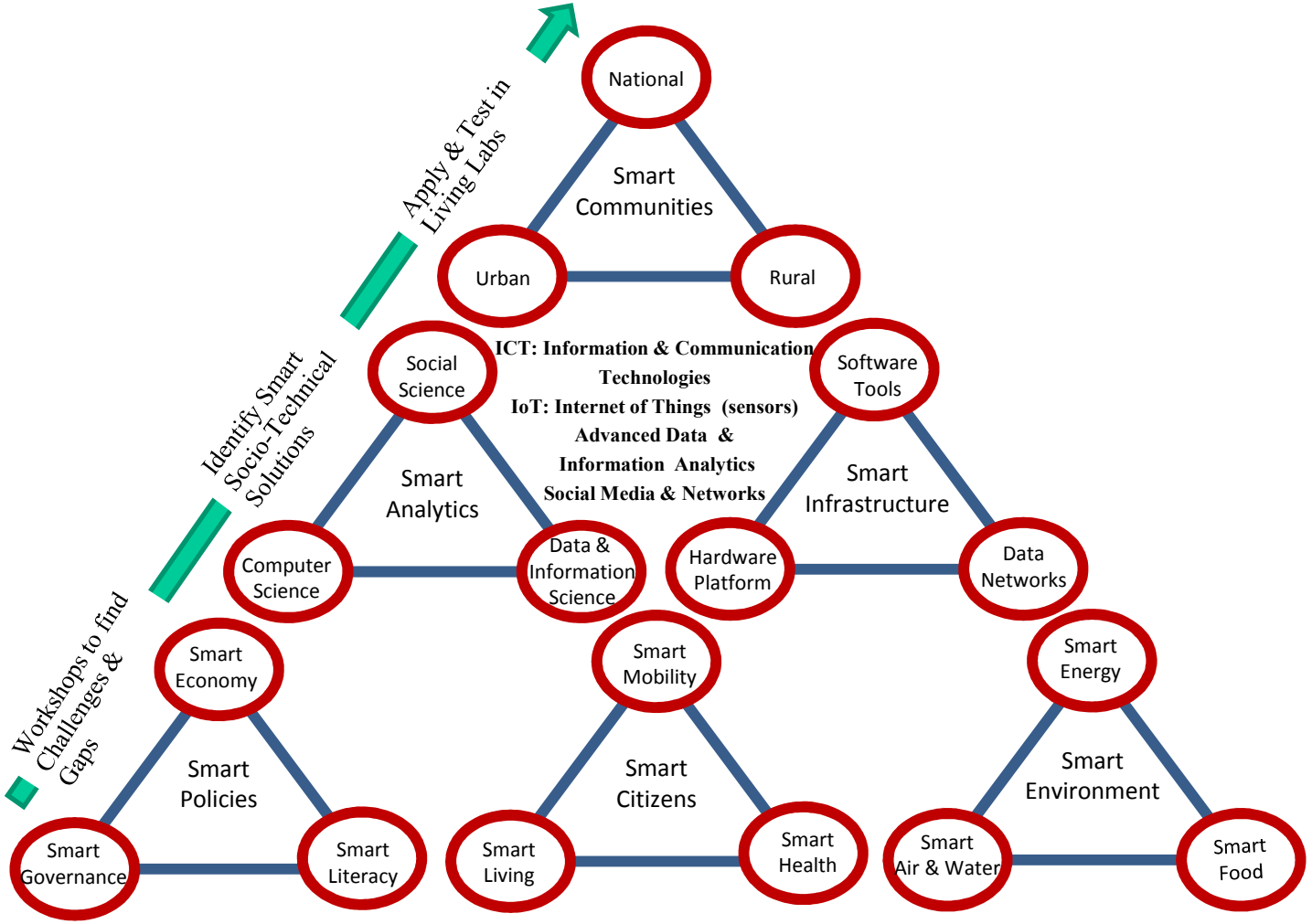


Fig 1: S&CC Model of Connectedness: Multiple Dimensionalities (triangles), Each with Shared Disciplinary Components (circles)

Initiative Pilot

- Workshops : Information Gathering & Collaborations
- Workshop1: Connectedness and Gaps in North Carolina Communities, Kinston, December 2016

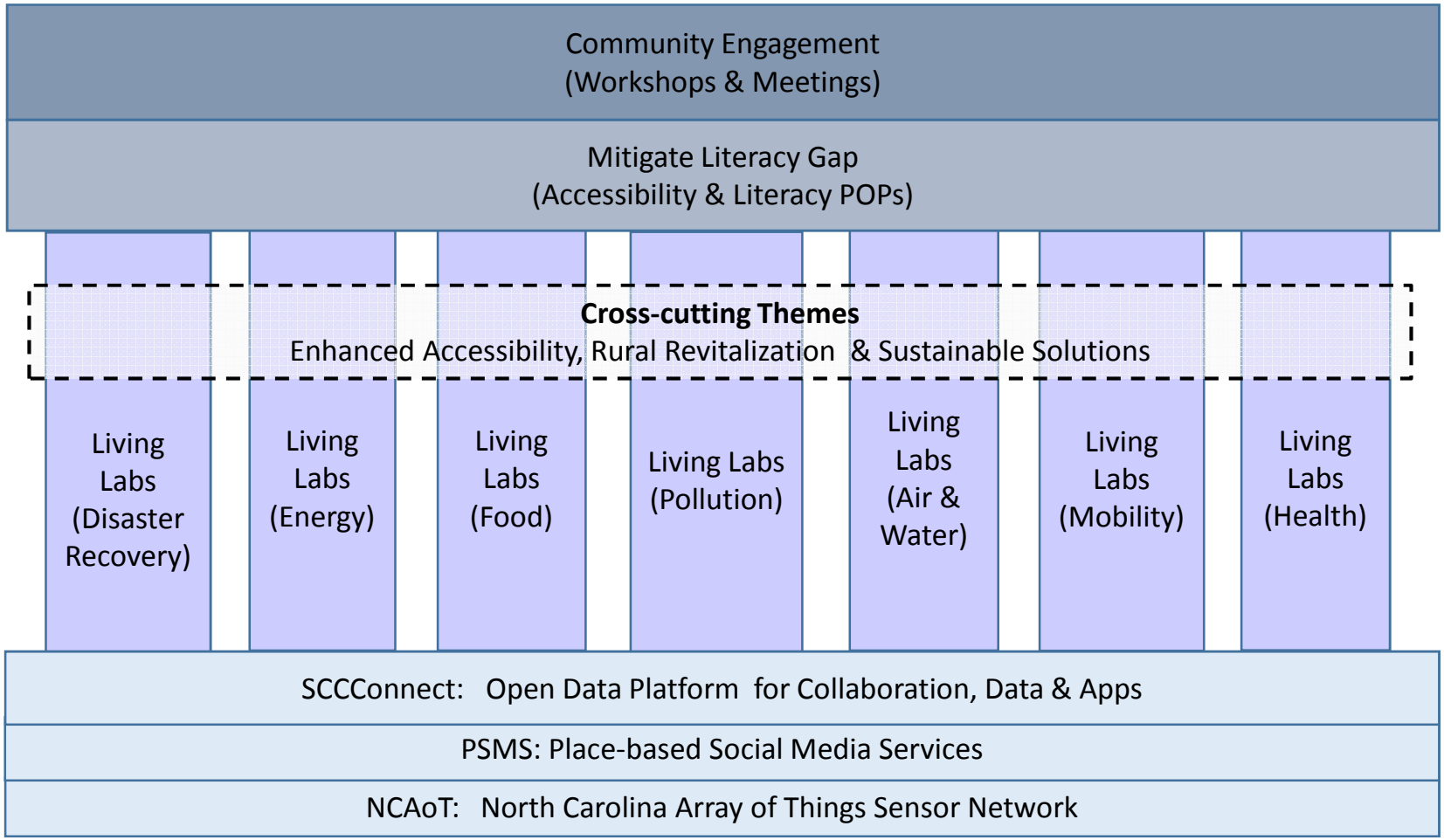
  Explore the needs and gaps in connectedness in Smart Policies, Smart Environment, and Smart Citizens dimensionalities
- Workshop2: Connectedness and Gaps in North Carolina Communities, Asheville, February 2017

  Explore the needs and gaps in connectedness in Smart Policies, Smart Environment, and Smart Citizens dimensionalities
- Workshop 3: Bridging the Connectedness Gap using Technology, Charlotte, April 2017

  Explore the data-intensive nature of S&CC and the challenges in Smart Analytics and Smart Infrastructure dimensionalities
- Workshop 4: Towards a North Carolina Smart and Connected Communities Initiative, Chapel Hill, May 2017

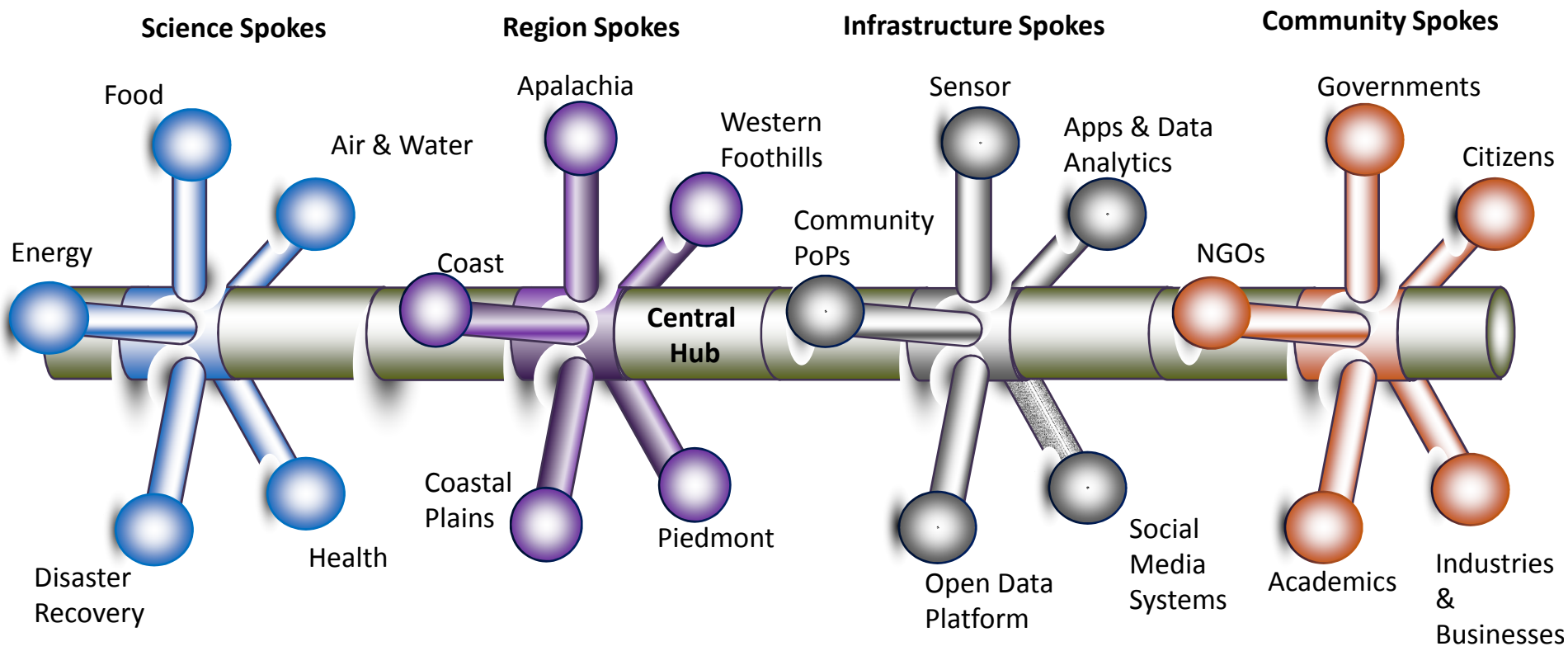
  Explore the Smart Communities dimensionality as applied specifically to the State of North Carolina

Extended Approach



NC Smart & Connected Communities Hub: A Socio-Technical System Approach

Building the NC S&CC Hub



Some S&CC Projects at UNC

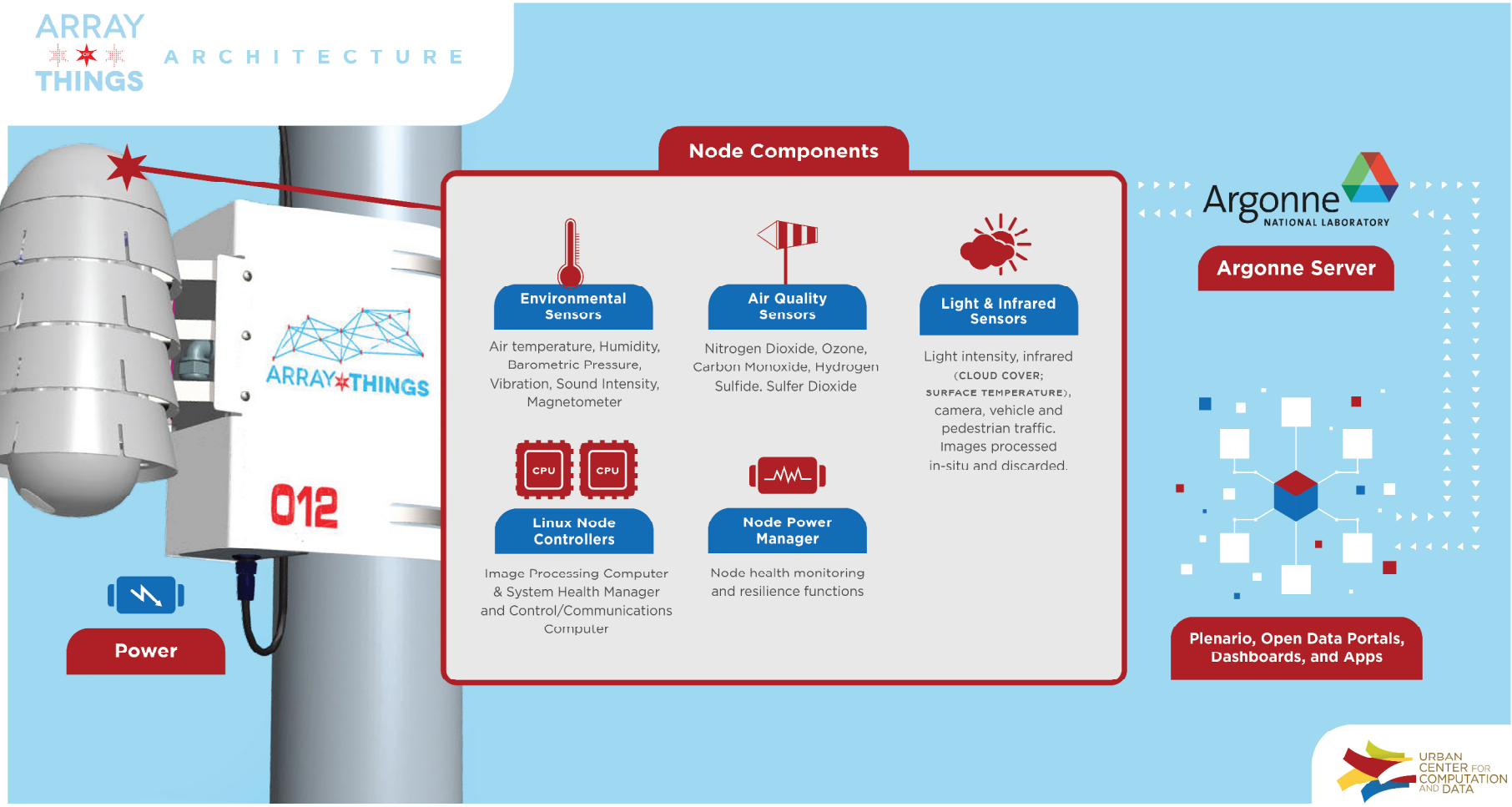
Current Initiatives

- Array of Things
  - Fitbit for UNC Campus – Four Nodes to be deployed
  - https://arrayofthings.github.io/
- SILS Smart Campus
  - Internet of Things and Machine Learning
  - http://cytilife.com/
- Carolina Exposome Hub (internal proposal)
  - Smart Health
  - Study evidence-based exposure and its effect on bio-markers in personalized healthcare
  - AirCharlotte
    - Smart Inhalers
    - https://www.airlouisville.com/
- NC Smart & Connected Communities Hub (proposal)
  - Looking at Rural Problems
  - Urban to Rural Technology Transfer

Smart Sensor Systems

- Chicago - Array of Things
  - https://arrayofthings.github.io/
- Sensor Node
  - Physical, Chemical, Video, Audio
- http://www.computerworld.com/article/3165403/emerging-technology/montreal-sees-its-future-in-smart-sensors-artificial-intelligence-with-video.html
- We have bought four sensor nodes
  - Deploy across campus
  - Get a sense of the campusenvironment
  - Allow students to perform data analytics on real-time data

Array Of Things Node



Cytilife

- Smart Campus
  - Smart Assistant – Time Management
  - Group Management
    - Study Groups, Hobbies, Friends
  - Space & Equipement Management
    - Room Allocation & Usage
    - Loaners (laptops, cameras, VR, bikes, …)
- http://cytilife.com/
- We have contracted them for a pilot project
  - Sensors & Student Apps

CytiLife Apps