WICHE meeting
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Private, Not for profit

- Established in 1980 as Microelectronics Center of North Carolina; Became MCNC in 1990
  - Founded by NC General Assembly as non-profit, state-funded resource for technology-led economic development
- Expanded in 1985 to include NC Networking
  - Provide high-speed network linking NC universities
  - Provide common platform for statewide research for academic institutions
- Operated NC Supercomputing Center 1988 - 2003
- Independent, not for profit organization
- Technology-focused economic development
Fiber footprint

NCREN

LEGEND

- BTOP Fiber
- NCREN Fiber pre-BTOP
- Co-location Facility
The future is here,
it’s just not evenly distributed
- William Gibson
What is IoT?

• Sensors and effectors
  – Detect a state in the environment around them
  – Take and action in response to inputs from sensors, humans, or computer which has performed some analysis

• Directly or indirectly connected to the Internet
The Price of PCs

Personal computers are now 99.9% cheaper today than in 1980.
IOT – $11T by 2025

IOT will connect billions of devices, generate large volumes of data, and need a secure network

- Today there are over 13B IOT devices, by 2020 25B to 200B “things” could be connected
  - IOT projected to represent 2x economic value of IT
    - 2014 IT 5% of global GDP ($3.7T/$71T)
    - 2025 IOT 10% of global GDP ($11.1T/$103T)

- The amount of IOT data will be ENORMOUS
  - Zettabytes \((10^{21})\) by 2020
  - Then Yottabytes \((10^{24})\)
  - Then Brontobytes \((10^{27})\)

Device ecosystem
enabled by standards
Personal medical devices

Continuous glucose monitor (CGM)
  *sensor + specialized display*

Bone conduction hearing aids
  *sensor + specialized device for integrating other inputs*

Glucose pumps
  *actuator + control device*
RFID: passive - no power required
now can store some info as well as report a serial number
data rate 40-640kbps
Evolution of maintenance

Time-based
Condition-based
Performance-based
AI?
Three rules of robotics

- In 'Laws of Robotics' by Asimov, there were three rules those were established.
  - First Law: A robot may not injure a human being or, through inaction, allow a human being to come to harm.
  - Second Law: A robot must obey any orders given to it by human beings, except where such orders would conflict with the First Law.
  - Third Law: A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.
AI is:

• A system that perceives its environment and takes actions which maximizes its chances of success.

• Programming computers for certain traits such as:
  – Knowledge
  – Reasoning
  – Problem solving
  – Perception
  – Learning
  – Planning
  – Ability to manipulate and move objects
IBM Watson

*Cognitive computing* is the simulation of human thought processes in a computerized model. Cognitive computing involves self-learning systems that use data mining, pattern recognition and natural language processing to mimic the way the human brain works.
Google Translate
• Google open sources sentence parsing – parsey mcparseface
  – http://googleresearch.blogspot.com/2016/05/announcing-syntaxnet-worlds-most.html
Opportunities

Personal instrumentation (fitness, medicine)
Home instrumentation and control
  HVAC, appliances, security
Community instrumentation and control
  Smart grid, utility management (water, waste collection, lighting, etc)
Business instrumentation and control
  Sensors for field moisture, GPS controlled planting, maintenance, harvesting, market tracking and analysis
Operations
  Maintenance and performance of mechanical systems
Challenges

Lack of relevant standards and APIs
Business models work against IoT implementation
Potential security risks
**Lack of quality connectivity**, especially in rural areas
Policy and Ethical Questions

• How should legal responsibility for actions of cognitive systems be assigned?

• What does ownership mean in an IoT / AI world?
• Questions?
A little background on AI

• https://www.techopedia.com/definition/190/artificial-intelligence-ai
• https://www.sciencedaily.com/terms/artificial_intelligence.htm
• http://homepage.cs.uiowa.edu/~hzhang/c145/notes/chap1.pdf