Internet-of-Things and Internet-of-Space
A Unique and Necessary Combination

The Internet of Things Meets The Internet of Space

Orlando, Florida
February 20th, 2019

Adam T. Drobot
Wayne, PA 19087
Outline

• Internet of Things and the Internet of Space

• A bit about:
  • IoT
  • IoS
  • Applications
• Summary and Discussion
A bit about: The Internet of Things

Digitization is the Driver

Services
- Business Consumer
- Public Sector

Processes
- Consumer Facing
  - Management - Functional
    - Internal
      - Administrative
      - Manufacturing
      - Functional

Products
- Consumer Enterprise
  - Internal - External
  - Public Sector
A bit about: The Internet of Things

A Very Complex Eco-System
With Many Stakeholders
A bit about: The Internet of Things

- Extract Information
- Model Situation
- Aggregate Data
- Make Decision
- Sense Condition
- Take Action

IoT Control Loop
A bit about: The Internet of Things

- Domain Knowhow
- System Design
- Cloud/Fog/Edge
- Integration
- Mobility
- Artificial Intelligence
- Communications
- Sensors
- Big Data
- Computing
- Actuators
- ......
- Digital Storage
- Human Interfaces
- Exponential Technologies
- Software
- Exponential Technologies
- Orlando, Florida
- January 20th, 2019
- IEEE Vertical and Topical Summit at RWW2019
Compute Storage, Sensing and Communications are increasingly tightly coupled in our Networks.
A bit about: The Internet of Things

Sensors                   Vehicles            Factories                                                        Buildings     Turbines                 Cities

"Things And Endpoints"

Network Edge

Compute Edge

Device Edge

Public and Private Cloud

The Impact of Convergence On Network Architectures

Real Time       Decision Making      Deep Learning

IEEE Vertical and Topical Summit at RWW2019
A bit about: The Internet of Things
A bit about: The Internet of Things

Growth in Data Traffic

Source: Cisco

Source: Data Age 2025 Study - IDC
A bit about: The Internet of Things

Exponential growth of the number of connected devices; industrial sector is the leading driver of the IoT market development.

Growth and market capitalization of the IIoT market

Source: statista.com, bcg.com
A bit about: The Internet of Things

**Trends for 2019:** Gartner defines a strategic technology trend as one with substantial disruptive potential that is beginning to break out of an emerging state into broader impact and use; or as a trend that is rapidly growing with a high degree of volatility, and that will reach a tipping point over the next five years.

- Trend No. 1: Artificial Intelligence (AI)
- Trend No. 2: Social, Legal and Ethical IoT
- Trend No. 3: Infonomics and Data Broking
- Trend No. 4: The Shift from Intelligent Edge to Intelligent Mesh
- Trend No. 5: IoT Governance
- Trend No. 6: Sensor Innovation
- Trend No. 7: Trusted Hardware and Operating System
- Trend No. 8: Novel IoT User Experiences
- Trend No. 9: Silicon Chip Innovation
- Trend No. 10: New Wireless Networking Technologies for IoT
Important Issues

1. For economic viability IoT is highly dependent on infrastructure – the use of common services available for multiple purposes – power, computing, connectivity, etc. This includes connectivity and now “sensing”.

2. The pattern for wireless connectivity has been built out to maximize population coverage. There are many IoT Application Verticals that require both mobility and Area Coverage. Examples are Agriculture, Mining, Natural Resource Management, Connected Vehicles, Emergency Services, Healthcare, etc.

3. Digitizing the Planet – as a source of knowledge and as a critical resource for responsibly managing what we have.
A bit about: The Internet of Space
A bit about: The Internet of Space

Source: Sanjay Raman, Robert Weigel and Tim Lee
Three Important Functions

- Unique source of sensor data and information
- A Component of the Communications Infrastructure
- An important service for space based assets
A bit about: The Internet of Space

Why now, and what has changed to make this possible:

- Cost of access to space
- Miniaturization of building block components for space based systems – from mechanical to electronic
- Renaissance in underlying engineering disciplines and sciences and marked improvements in performance
A bit about: The Internet of Space

Communications

- LEO, MEO, GEO
- Cross-Links
- Ground Infrastructure
- High Bandwidth
- Low Latency
- Precise Footprint
A bit about: The Internet of Space

Sensors

- Position
- Imagery
- Radar
- Lidar
- Hyper-spectral
- ........
- ........
A bit about: The Internet of Space

Questions and Discussion