Wireless Innovation and the Internet of Things

Bob Schutz
Artisan Wireless Solutions, LLC
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Wireless in Everything
The billion unit market for Wireless

Devices	> 45 B
Home Accessories (internet / apps centric devices	> 10 B
Smart Energy (meters and displays)	> 1 B
Home Automation (white goods and HVAC)	> 5 B
Health, Wellness, Sports & Fitness	> 10 B
Assisted Living	> 5 B
Animal Tagging (food assurance)	> 3 B
Intelligent Transport Systems	> 1 B
M2M (Internet connected devices)	> 10 B

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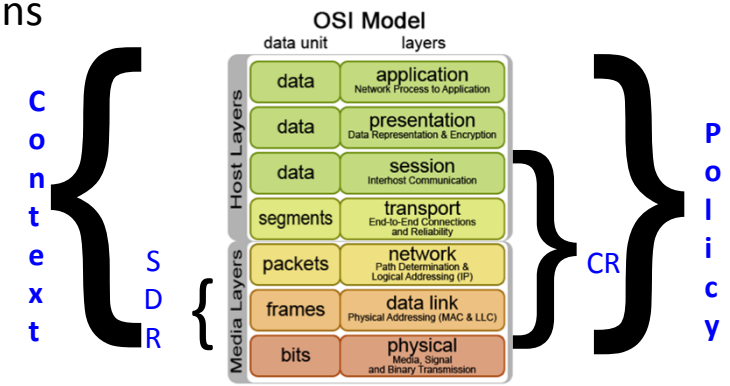
IoT and Wireless Communications

- Wireless communications is the foundation of M2M and IoT communications.
  - Spectrum is the oxygen of wireless communications
  - Mobility and dynamic reconfiguration of assets depend on wireless networks
- Does the rapid growth of M2M and IoT devices present unique challenges for supplier and operators in the wireless communications value chain?
  - Spectrum & Spectrum Sharing – Robustness both in paired and shared technologies
  - Regulatory Compliance Issues
  - Context aware and Policy based communications
  - The massive scale of deployment
  - Big Data Analytics
  - Security & Privacy
  - Distributed Power Generation and Storage
  - Wireless Energy per Network Bit (EpNB)
  - Ease of use – autonomous behavior
  - Cost



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Currently in “Stealth” mode

- Focus:
  - Development of a PIPES (Policy Information Processing Exchange System) architecture and protocol stack for personal sensor networks
  - Leveraging emerging technology in M2M and IoE for development of a personal metadata gateway
  - Development of a secure EvDB (Event Data Base) for lifestyle and behavioral data analytics with forensic and predictive analysis
  - Specify OSI stack modifications for wireless devices to support Policy and Context aware deployment

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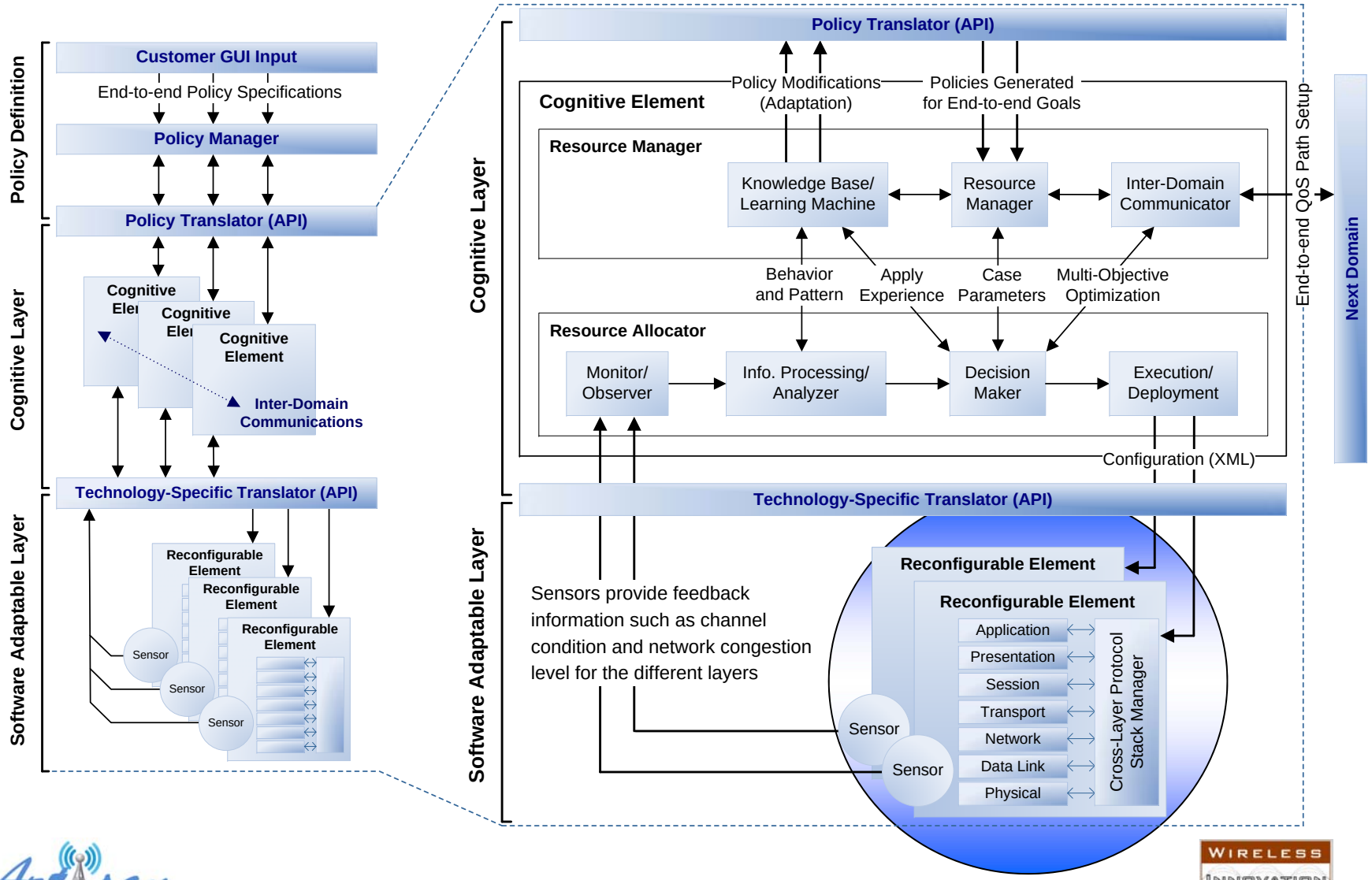
Artisan PIPES Platform



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Internet of Things

Vertical Markets

Energy/Grid

Health & Wellness

Fitness

Environmental

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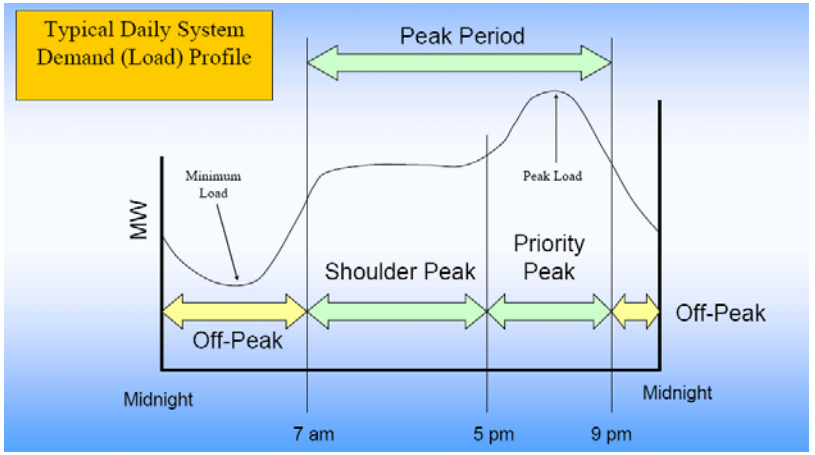
Smart Energy/Grid

eGuage

EV Charger



Smart Power Meters

Raven Zigbee USB

http://www.pecanstreet.org

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Smart
Health & Wellness

Fitness Trackers

Fitbit

Polar Loop

Nike Fuel

Plus 100s of others

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Smart Fitness

Data & Metadata

Summary

Distance:	83.74 mi
Time:	4:37:56
Avg Speed:	18.1 mph
Elevation Gain:	3,720 ft
Calories:	2,689 C
Avg Temperature:	61.4 °F

Details

Timing Pace Speed

Time:	4:37:56
Moving Time:	4:35:35
Elapsed Time:	6:05:19
Avg Speed:	18.1 mph
Avg Moving Speed:	18.2 mph
Max Speed:	43.9 mph

Elevation

Elevation Gain:	3,720 ft
Elevation Loss:	3,622 ft
Min Elevation:	-127 ft
Max Elevation:	559 ft

Heart Rate bpm % of Max Zones

Avg HR:	146 bpm
Max HR:	199 bpm

Power Watts Zones

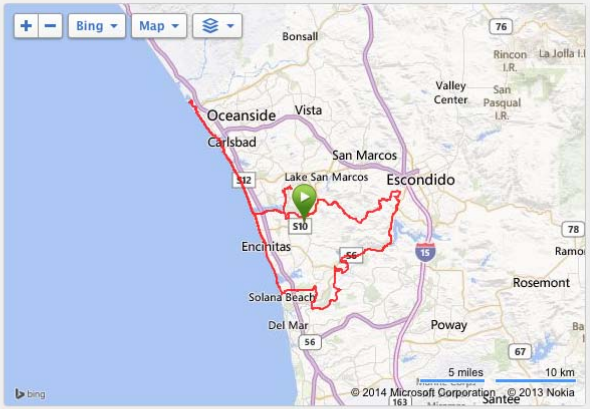
Avg Power:	200 W
Max Power:	1,195 W
Max Avg Power (20 min):	271 W
Normalized Power (NP):	221 W
Intensity Factor (IF):	1.107
Training Stress Score (TSS):	561.1
FTP Setting:	200 W
Work:	2,690 kJ

Cadence

Avg Bike Cadence:	59 rpm
Max Bike Cadence:	130 rpm

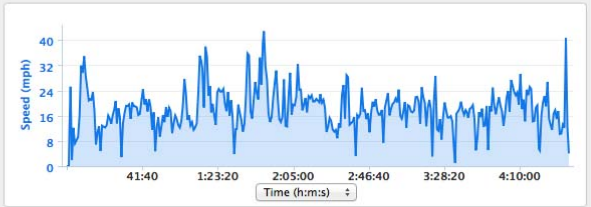
Temperature

Map



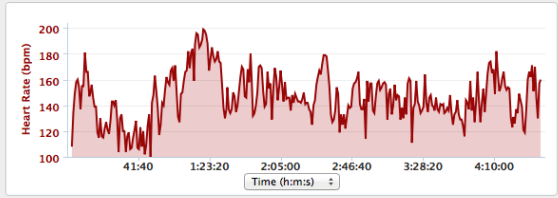
Charts Average

Timing

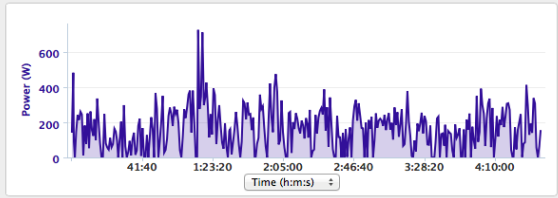


Elevation

Heart Rate



Power Max Avg: None 5 sec 1 min 5 min 20 min



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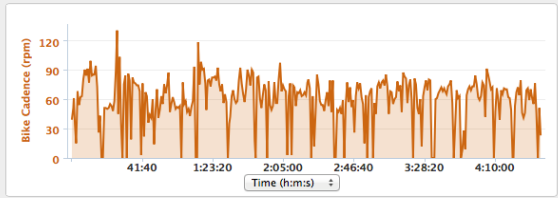

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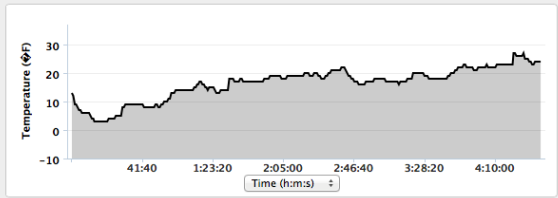

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Smart Environments

Personal Spaces & Public Spaces

Measure

Analyze

Cloud

Control

Davis

Vantage PRO-2

netatmo

SmartThings

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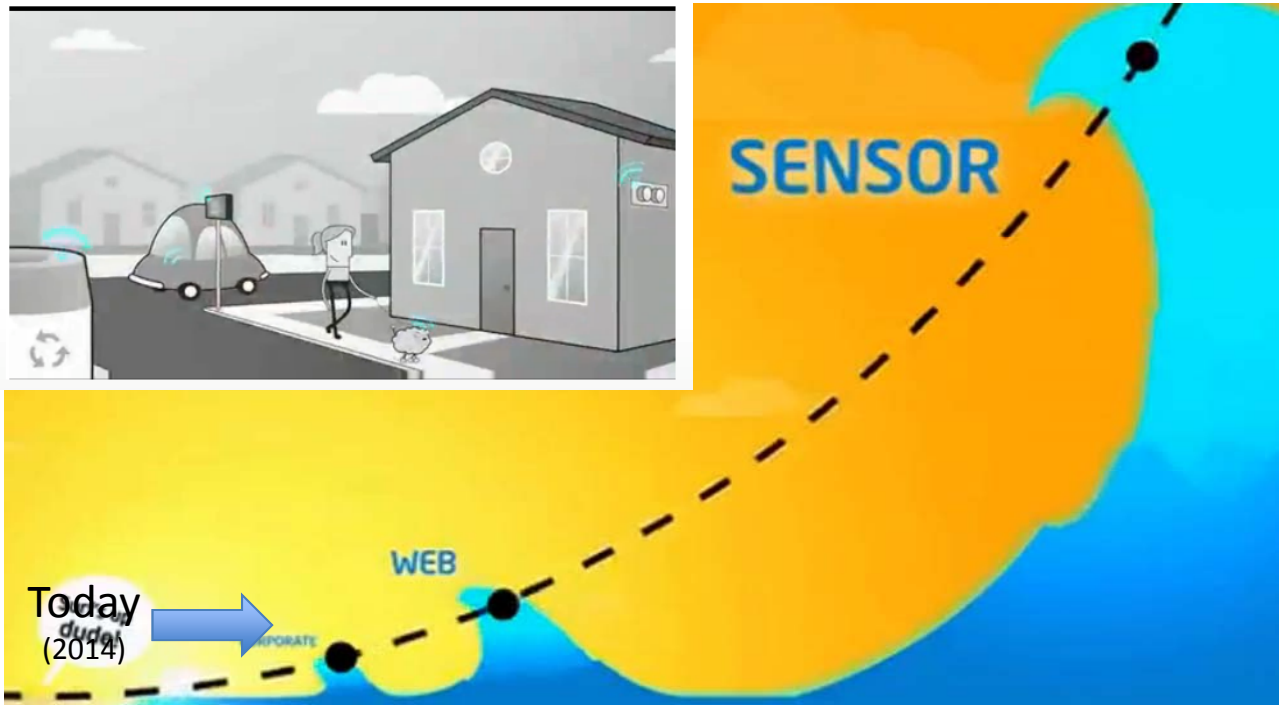
Drivers for Big Data

- Intel's & IBM's view of the Big Data Problem…
  - A shared society requires business to understand and categorize individuals by characterization of behavior.

Home Networks

Today…
- Cellular
- Wi-Fi
- Bluetooth
- Zigbee
- Z-Wave
- …

Tomorrow…
- TVWS
- AM/FMWS
- Opportunistic Spectrum
- …



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Drivers for Big Data

- Governments view of the Big Data Problem…
  - A shared society requires government to understand and categorize individuals by characterization of behavior.

Home Networks

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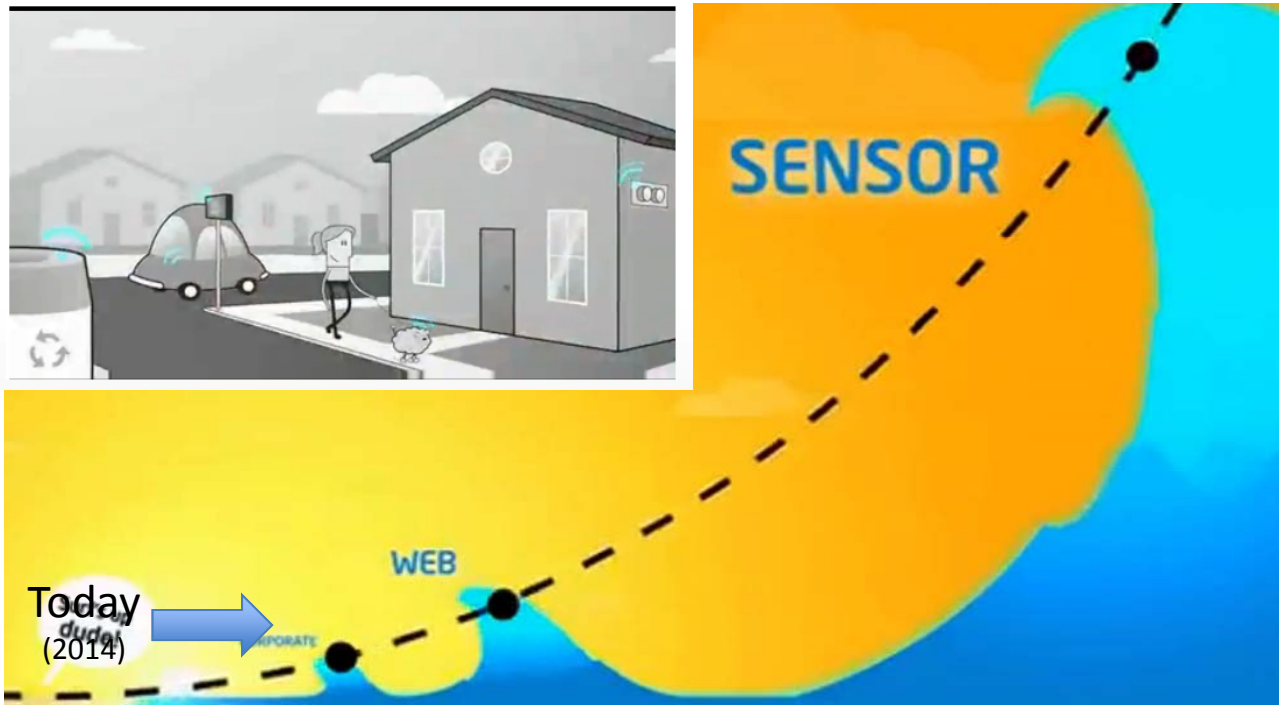

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Big Government and Big Data

- Federal Government "Big Data" Investment: In 2012 over 100 of separate programs funded ($1.5B+ "on budget funding") by:
  - Department of Defense (DOD)
  - Defense Advanced Research Projects (DARPA)
  - Department of Homeland Security (DHS)
  - Office of Basic Energy Science (BES)
  - Biological & Environmental Research Program (BER)
  - Fusion Energy Science (FES)
  - Office of Nuclear Physics (NP)
  - Office of Science & Technology Information (OSTI)
  - Department of Veterans Administration (VA)
  - Department of Health & Human Services (HHS)
  - Food & Drug Administration (FDA)
  - National Archives & Records Administration (NARA)
  - National Aeronautic * Space Administration (NASA)
  - National Endowment for the Humanities (NEH)
  - National Institutes of Health (NIH)
  - Office of Behavioral & Social Sciences (OBSSR)
  - National Science Foundation (NSF)
  - National Security Agency (NSA)
  - …
- See publication: "Big Data Across the Federal Government" March 29, 2012
  - Most of these organizations use Big Data Analytic SW platforms based on Hadoop

- FCC Blog on Big Data
  - http://www.fcc.gov/blog/big-data
  - 2010 – 0 comments?

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The future of IoT

Important Questions

- Who determines what is measured?
- Who owns the data?
- Who controls the metadata?
- What is the context of the analysis?
- Who controls the context?
- What is the relationship between a shared society and your personal behavior?
- What are you willing to sacrifice and for wha benefit?
- Who is in control of your life?
- Who defines the value proposition?

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Silicon Valley View of IoT Metadata

"IoT, IoE and M2M is ONLY about control, not about Free Will"

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Questions?

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