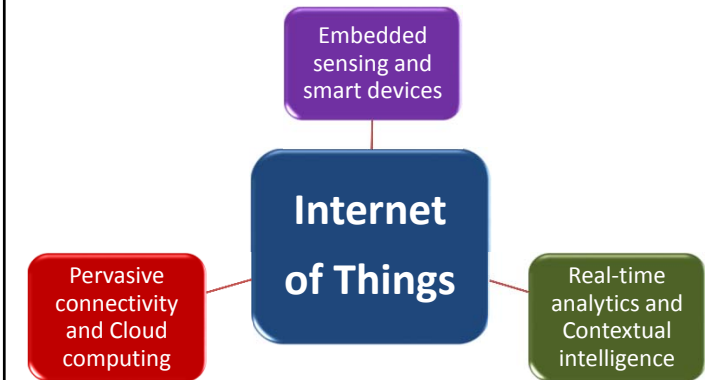# How the Internet of Things will change our world

Dr. Raj Veeramani

Three irreversible, converging technology trends are enabling the Internet of Things

- Embedded sensing and smart devices
- Internet of Things
- Pervasive connectivity and Cloud computing
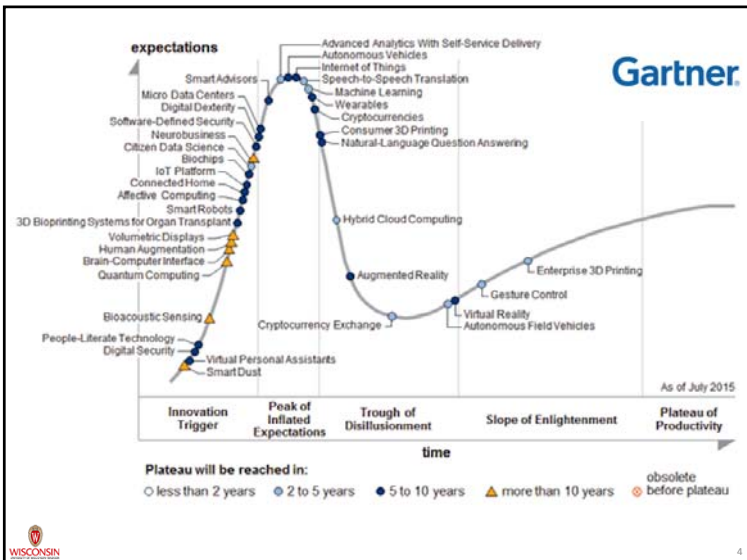- Real-time analytics and Contextual intelligence

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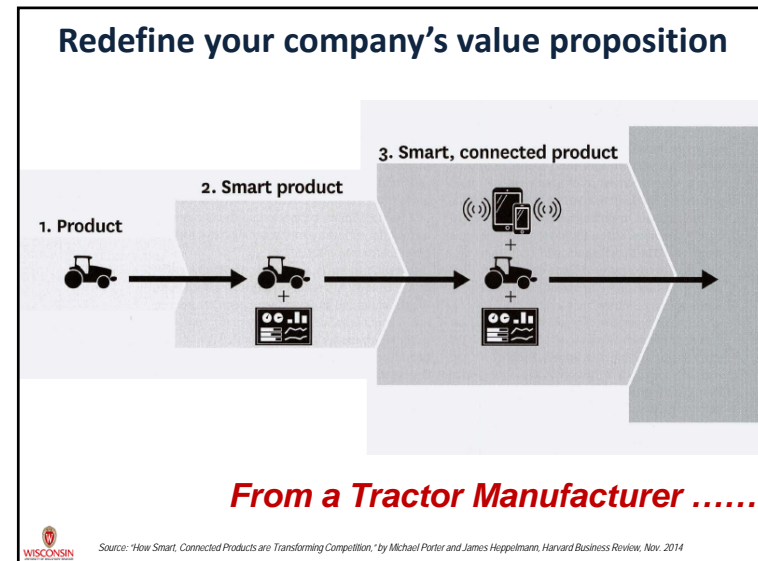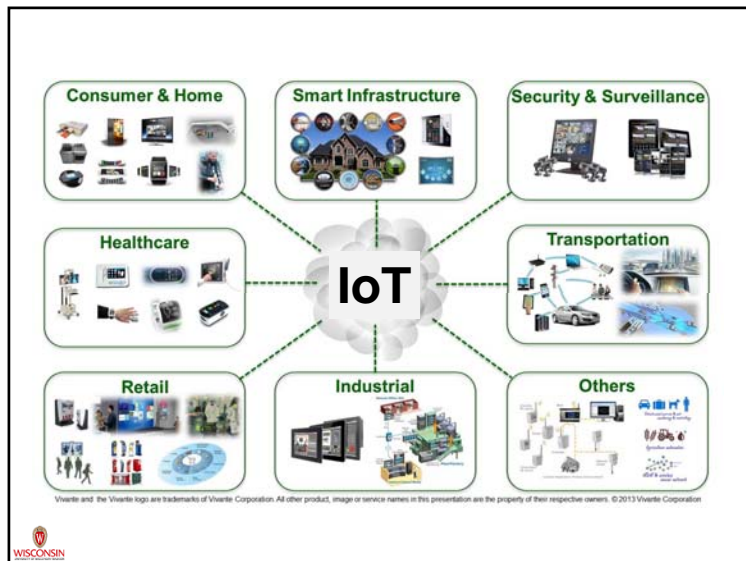## IoT: In the Future

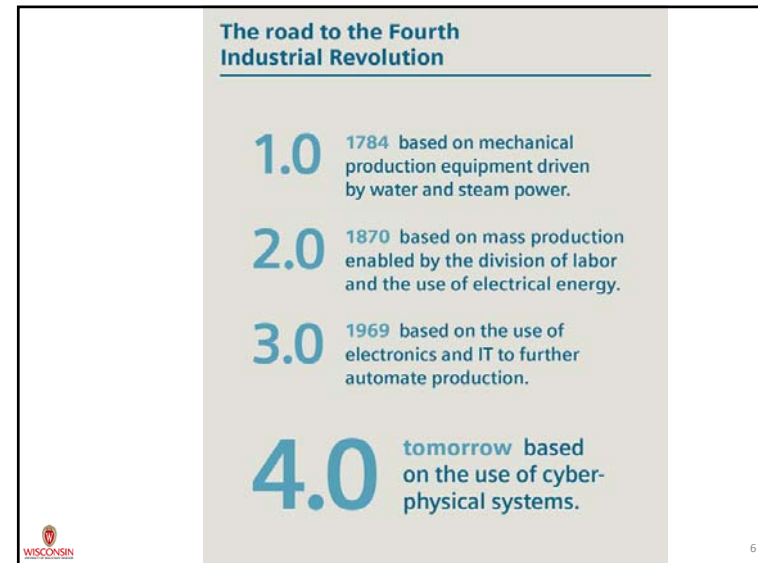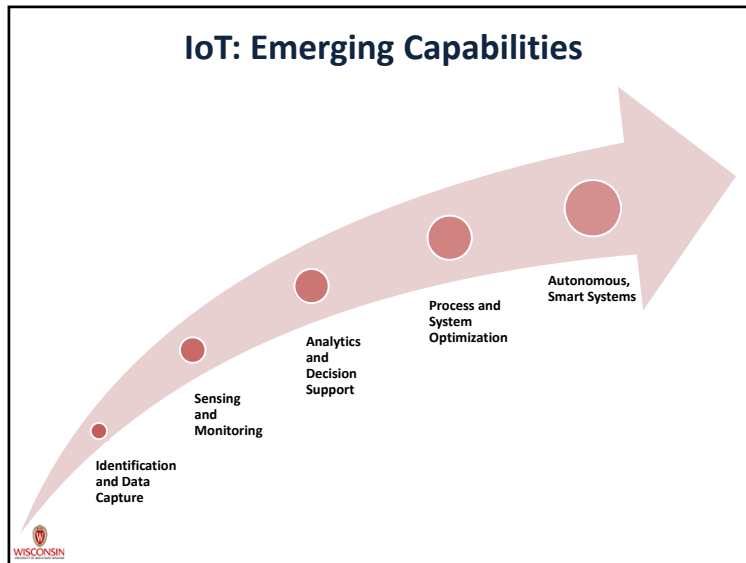By **2020** there will be **30-50 billion** devices connected to the Internet.

Source: Gartner, Cisco, IDC

IoT: Emerging Capabilities

- Identification and Data Capture
- Sensing and Monitoring
- Analytics and Decision Support
- Process and System Optimization
- Autonomous, Smart Systems

The road to the Fourth Industrial Revolution

1.0 1784 based on mechanical production equipment driven by water and steam power.

2.0 1870 based on mass production enabled by the division of labor and the use of electrical energy.

3.0 1969 based on the use of electronics and IT to further automate production.

4.0 tomorrow based on the use of cyber-physical systems.

Consumer & Home · Smart Infrastructure · Security & Surveillance · Healthcare · **IoT** · Transportation · Retail · Industrial · Others

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Redefine your company's value proposition

1. Product
2. Smart product
3. Smart, connected product

From a Tractor Manufacturer ......

Source: "How Smart, Connected Products are Transforming Competition," by Michael Porter and James Heppelmann, Harvard Business Review, Nov. 2014

5. System of systems

4. Product system

...... *to a Farm Automation company.*

IT → **IoT** ← OT
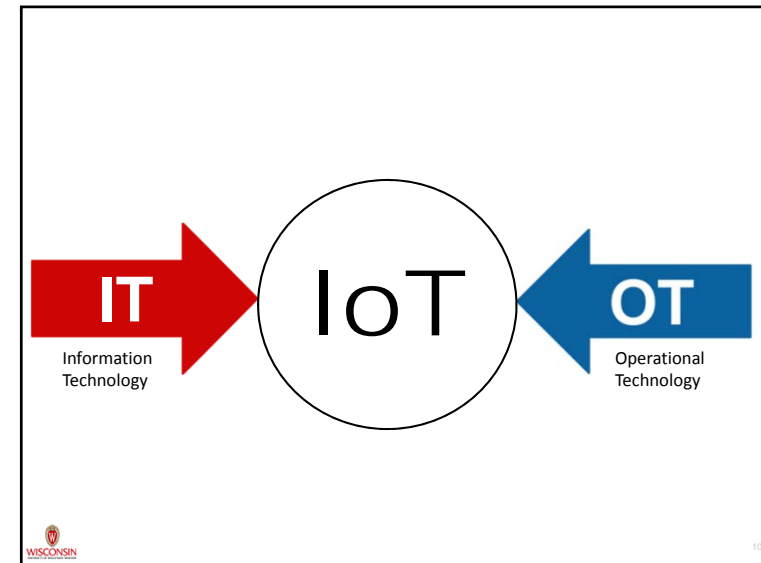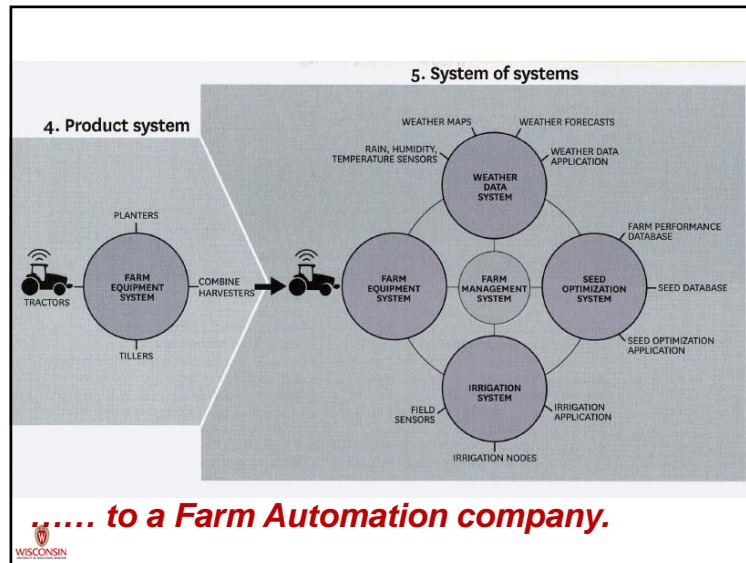
Information Technology

Operational Technology

IoT value is fundamentally centered around
data-driven insights

Information as asset –
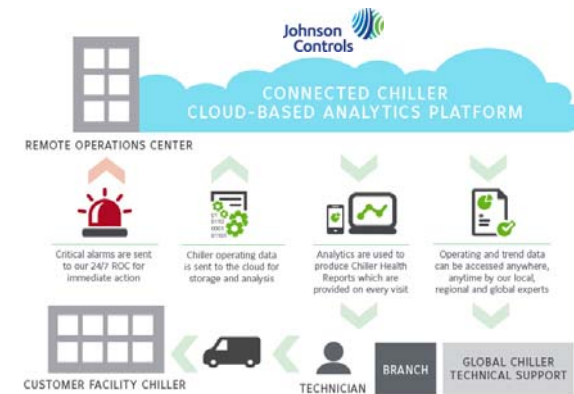**Moving from product manufacturer**
to information-based service provider

Slide 13

"*Every industrial company in the coming age is also going to have to be a software and analytics company*"

Jeff Immelt

Slide 14

"Killer App" for IoT

Remote monitoring & predictive maintenance

Slide 15
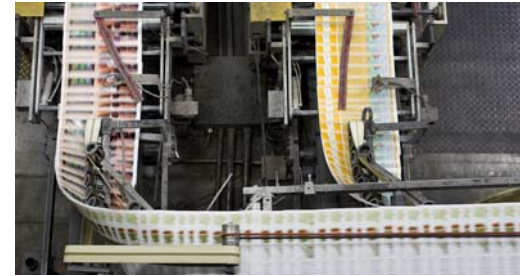

Slide 16

**Arandell Corporation
Menomonee Falls**

high-end, premier catalog printer

Cooling critical to 24/7 printing operation

Smart Connected Chiller Services ensure uptime

"When a production line goes down unexpectedly it can cost a company as much as **$20,000 per minute**." -- FANUC

The Opportunity for Manufacturing

$4.7T Between 2013 - 2022

Fueled By:

| Asset Utilization $1.0 Trillion | Employee Productivity $0.8 Trillion | Supply Chain/Logistics $1.0 Trillion | Customer Experience $0.9 Trillion | Innovation $1.0 Trillion |

Source: McKinsey Global Institute

The Internet of Things represents an opportunity to grow aggregate global corporate profits approximately 21% by 2022

An era of IoT-enabled Digital Disruption

Changing competitive landscape in the auto industry

~~**Ford is an auto manufacturer.**~~

Ford is in the mobility business!

Ford Smart Mobility is about people.

It's about helping people stay connected to their lives.

We are building a safer driver for everyone

WAYMO

Waymo Chrysler Pacifica Hybrid minivan

Why insurance companies are worried

IoT Challenges & Research Questions

❑ Information security

❑ Data privacy

❑ Interoperability, standards

❑ Data management

❑ Analytics

❑ User experience

❑ New business models

❑ *and many more!*

The UW IoT Lab's Mission

A hub for university-industry partnership for

research, innovation & collaborative learning

to discover, advance and attain the promise of IoT.

UW IoT Lab Objectives

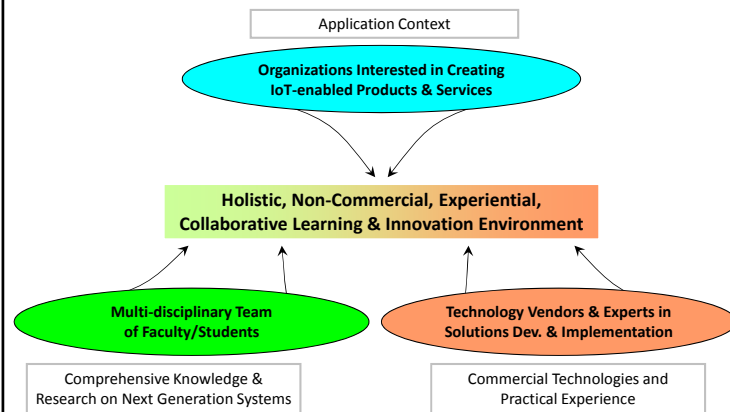**Three primary objectives**

1. **Foster IoT-based breakthrough research and entrepreneurship by faculty/students**

2. **Provide students experiential learning and interdisciplinary exploration and innovation opportunities with IoT technologies**

3. **Provide a collaborative forum for IoT knowledge and innovation transfer to industry**
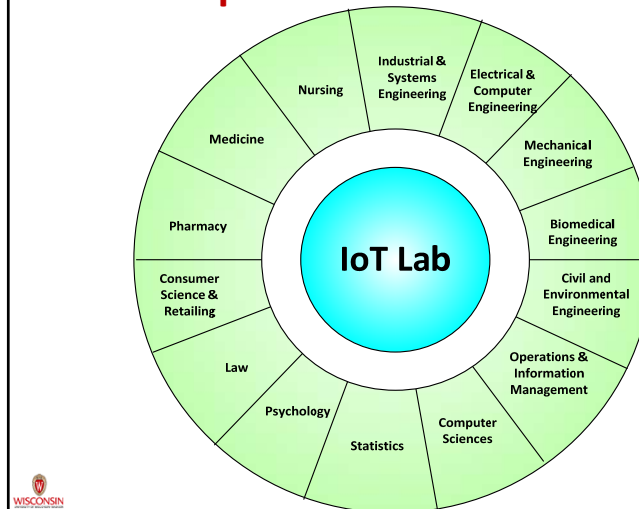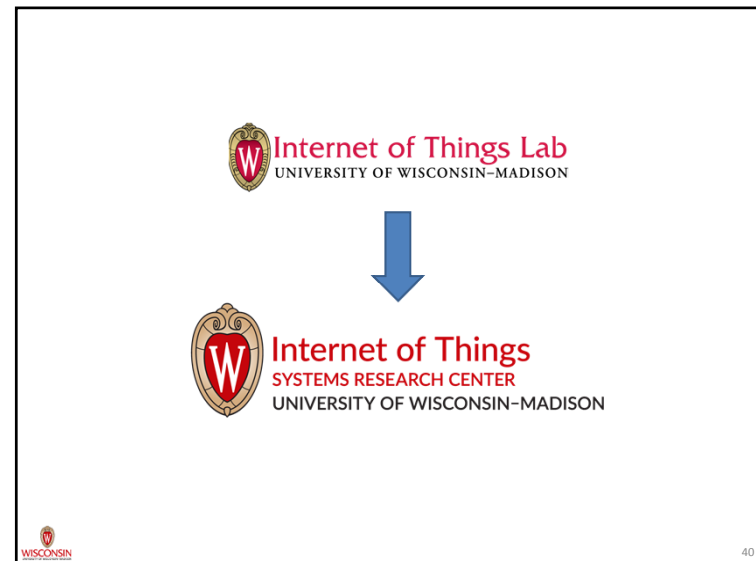

UW IoT Lab Ecosystem

Campus-Wide Involvement

Operating Model: Industry Work Groups
-- *for Collaborative Learning & Innovation* --

| Smart & Connected **Home** | Smart & Connected **Consumer** | Smart & Connected **Enterprise** | Smart & Connected **Building** | etc. ... |

Industry Partners from various vertical sectors

Faculty expertise:
- Sensors
- Communication
- Cloud & Mobile
- Security
- Analytics & AI
- Decision systems
- UX & Interfaces
- HF & Ergonomics
- System/process design & optimization
- Business model
- Privacy, ethics and regulatory issues

Use-case   Use-case   Use-case   Use-case

Remarkable level of student interest

More than 260 students interested in Fall 2015

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Internet of Things Lab
UNIVERSITY OF WISCONSIN–MADISON

Internet of Things
SYSTEMS RESEARCH CENTER
UNIVERSITY OF WISCONSIN–MADISON

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Slide 41

makerspace

UNIVERSITY OF WISCONSIN - MADISON

Over 25,000 sq. ft., run by 10 professional full-time staff members and ~50 student workers

Slide 42

Group Discussion

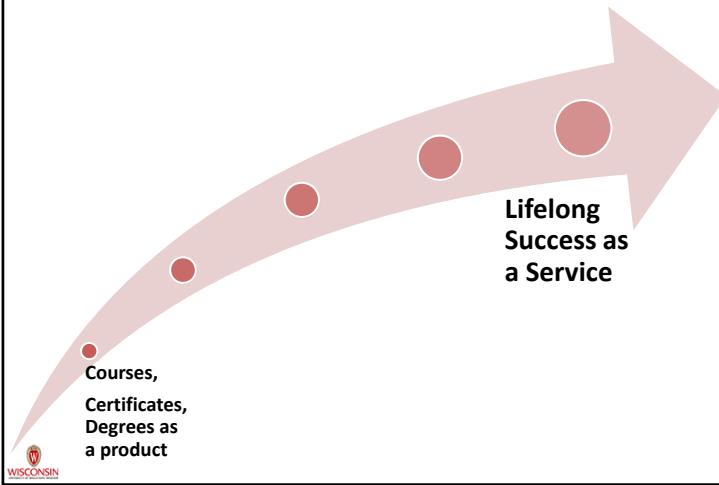## What are your key takeaways from this morning's session?

(e.g., How can we best provide students with transdisciplinary design and innovation experiences?

How can we best prepare students to build the smart and connected future?)

Slide (bottom left)

Redefining Higher Ed Value Proposition

Lifelong Success as a Service

Courses, Certificates, Degrees as a product

Slide (bottom right)

Internet of Things
SYSTEMS RESEARCH CENTER
UNIVERSITY OF WISCONSIN–MADISON

For more information:

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