Research Building Blocks For Intelligent Infrastructure: Convergent Systems

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AAAS Annual Meeting Panel:
Intelligent Infrastructure
Join us February 18, 2022!

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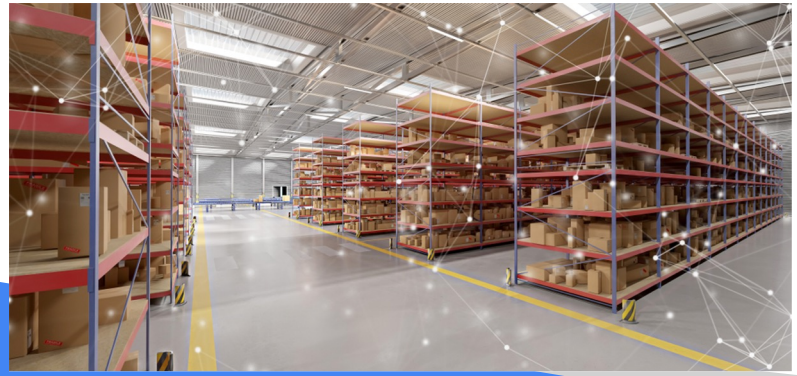
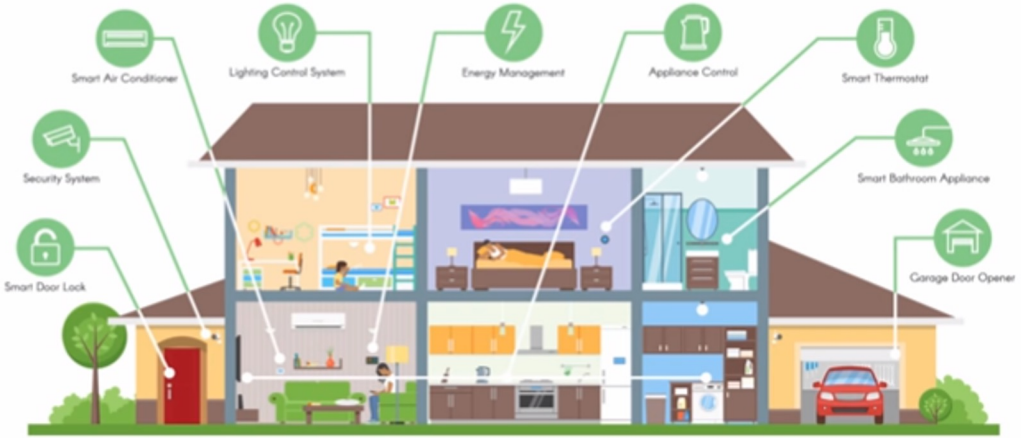
November 2021

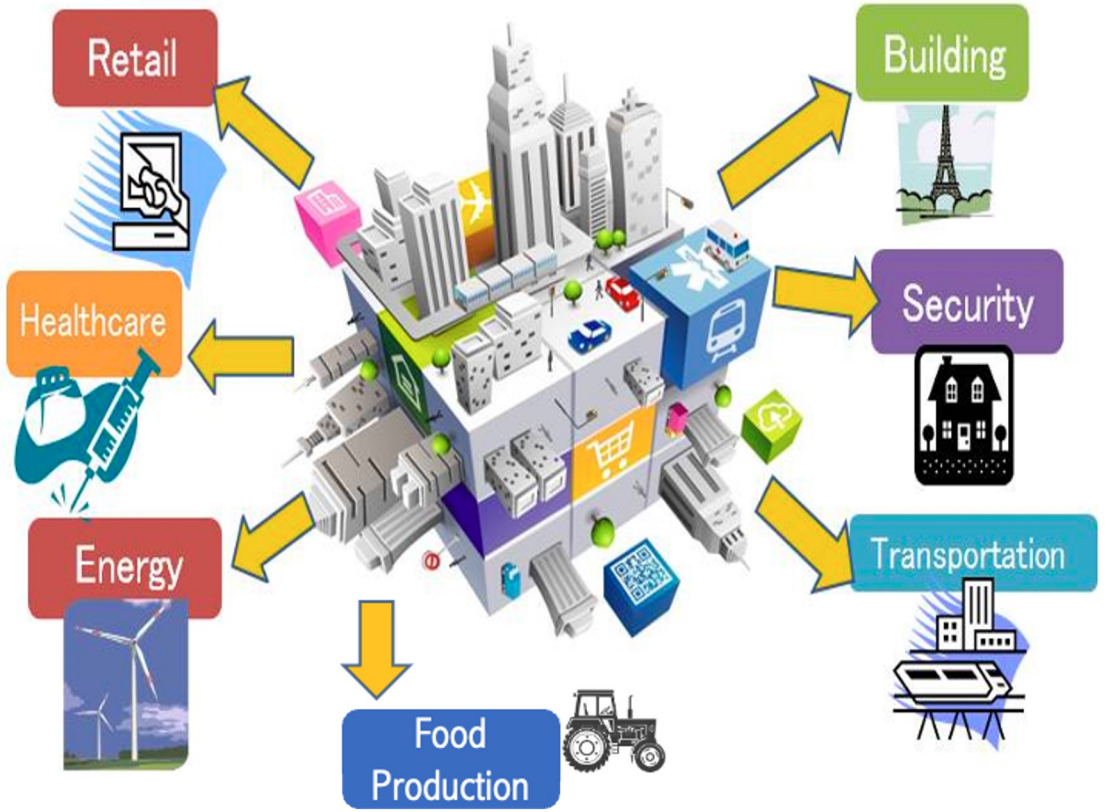
Intelligent Infrastructure

Embedding sensing, computing, and communications into our physical infrastructure





The Promise of Intelligent Infrastructure



- Safety & status monitoring/alerting
- Data-driven decision support & situational awareness
- Recommendations & predictions
- Automation & autonomy

Extending human perception & control of the physical world through digital infrastructure

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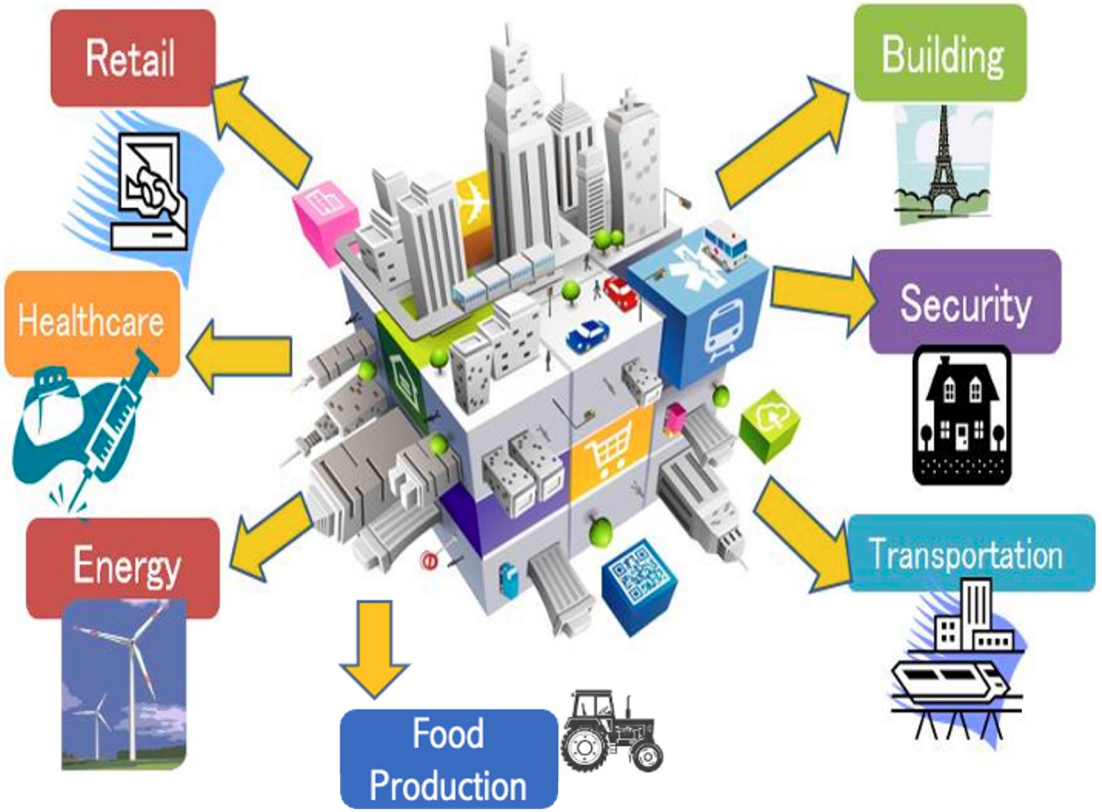

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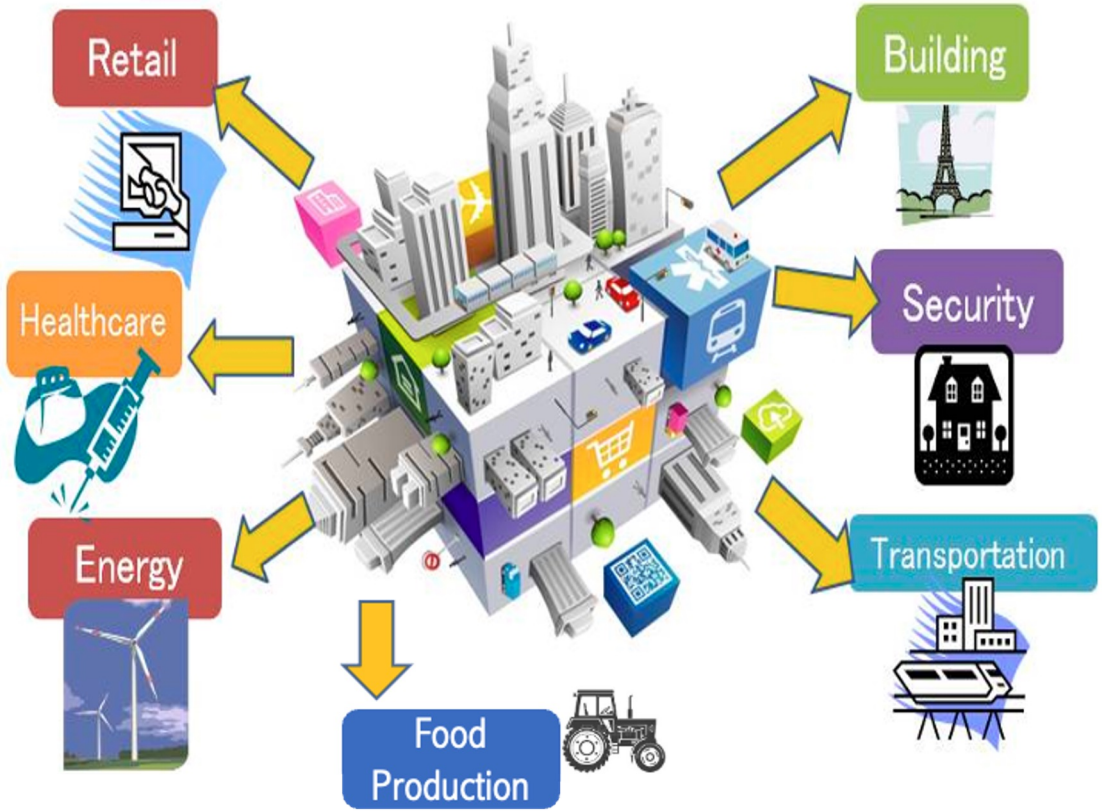

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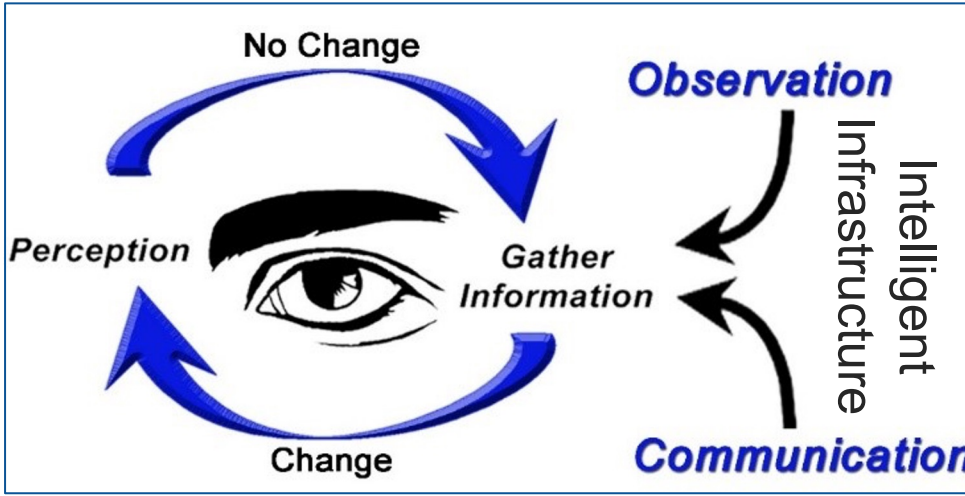

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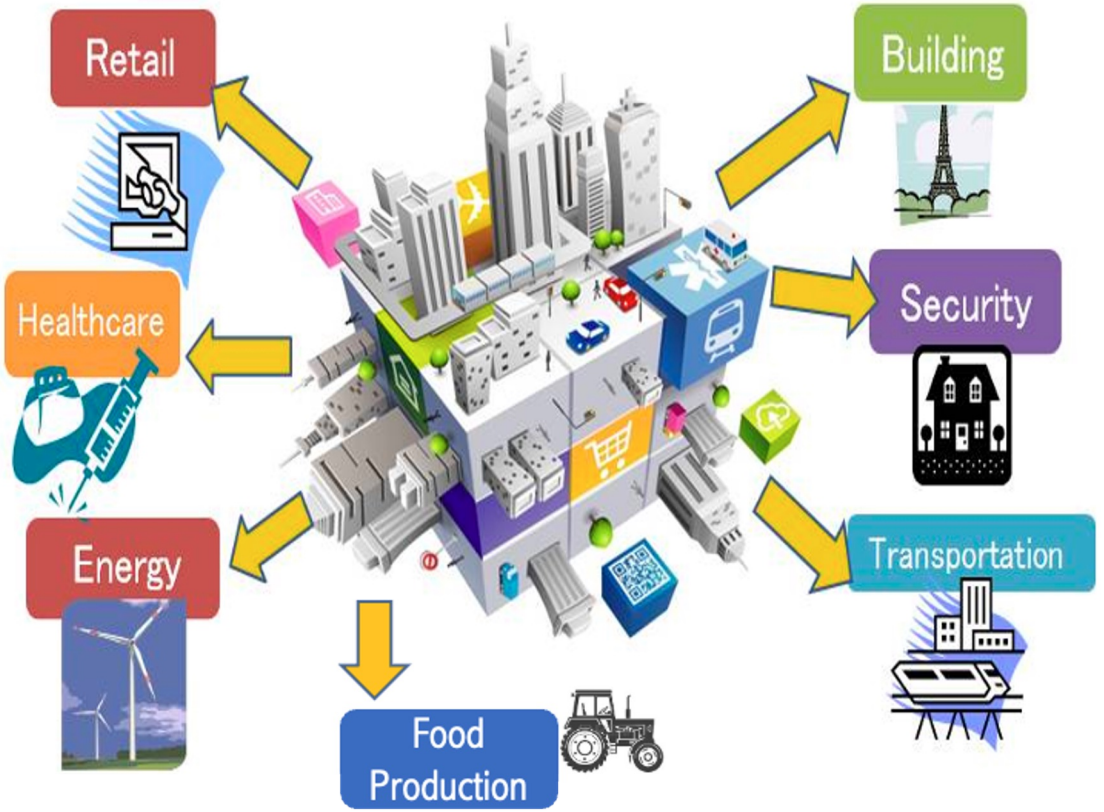

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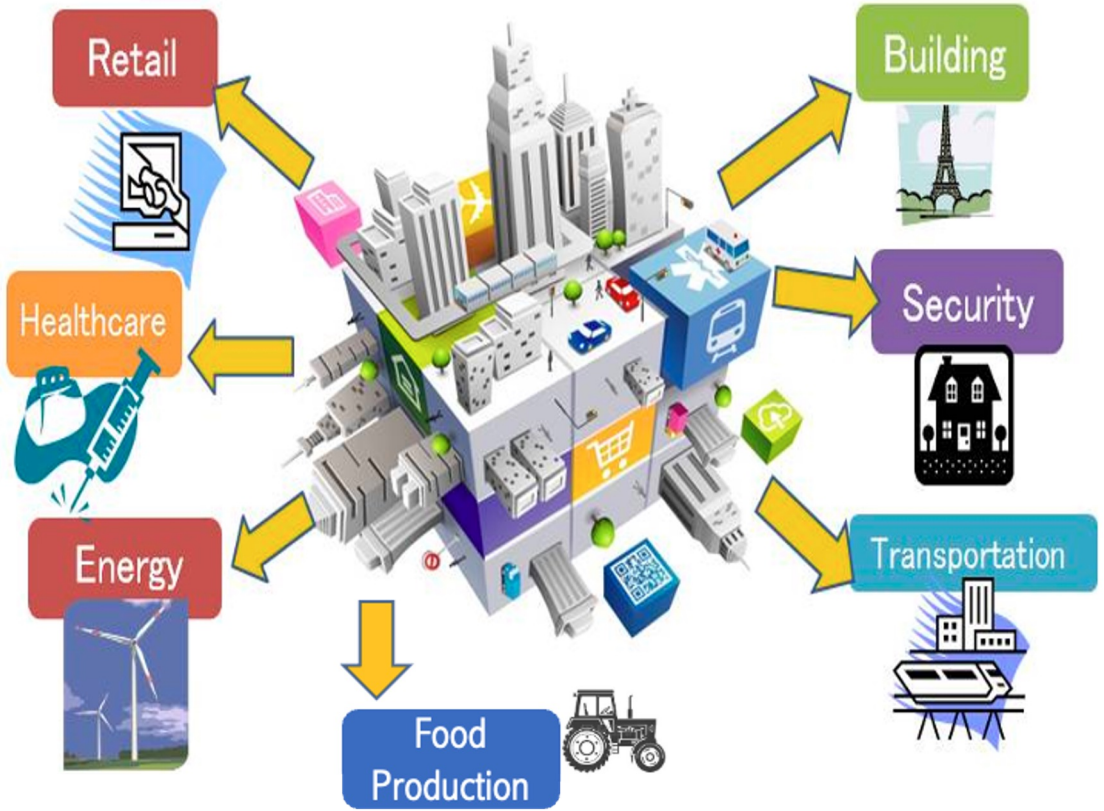

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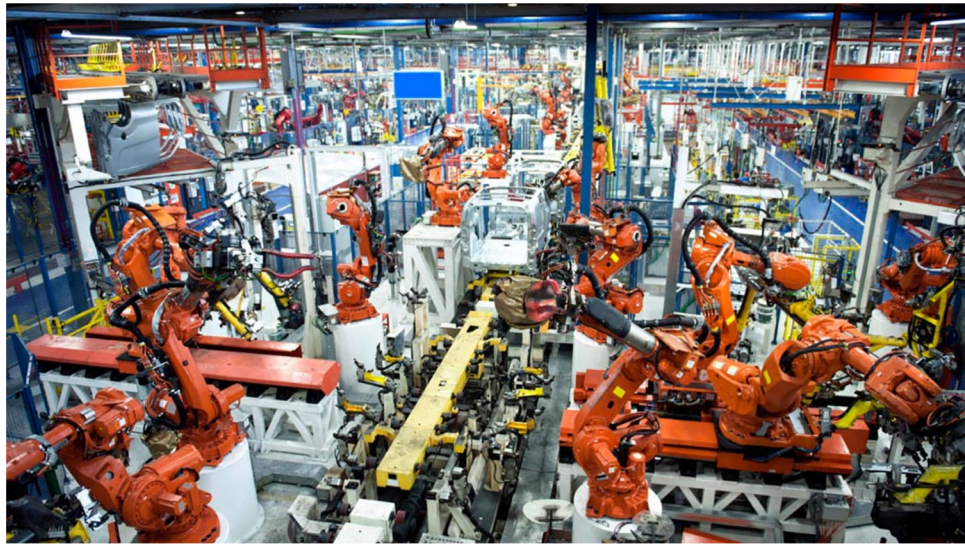

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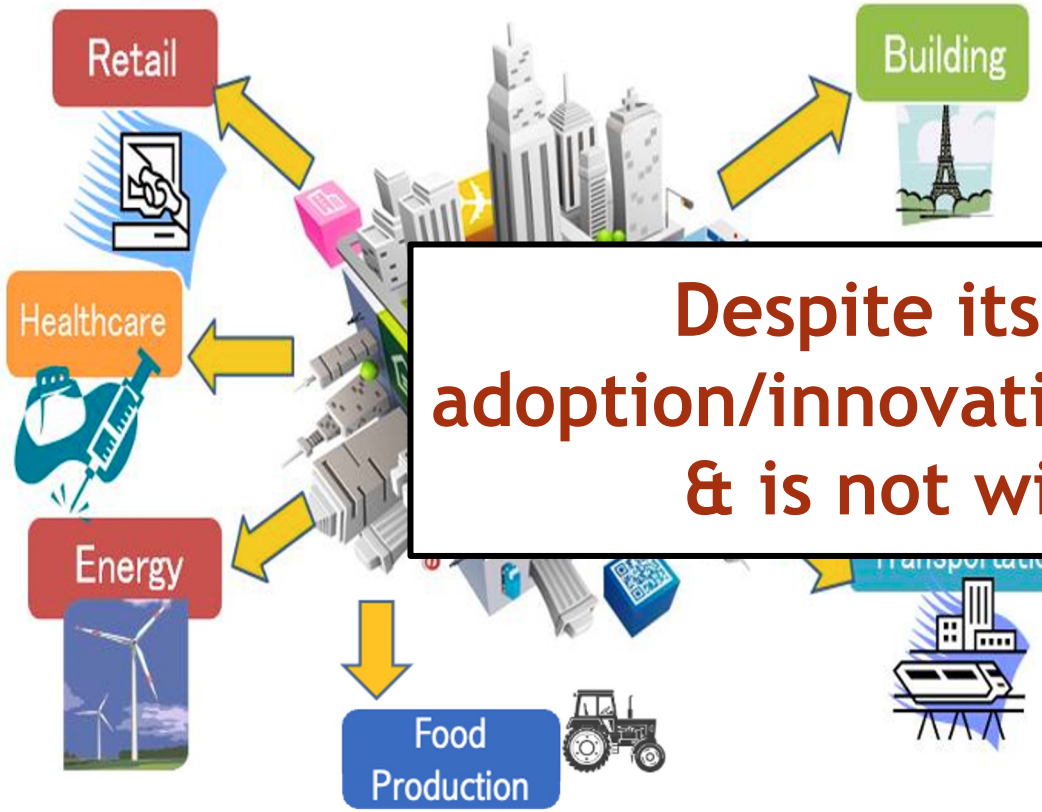

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- awareness
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- Automation & autonomy

Despite its potential, adoption/innovation has been slow & is not wide spread

Extending human perception & control of the physical world through digital infrastructure

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Key Barrier to Adoption - Deployment Complexity

- Traditional infrastructure not designed to integrate digital systems
- Require/assume **continuously** available electricity
- **Interdependent** (& widely varied) infrastructure

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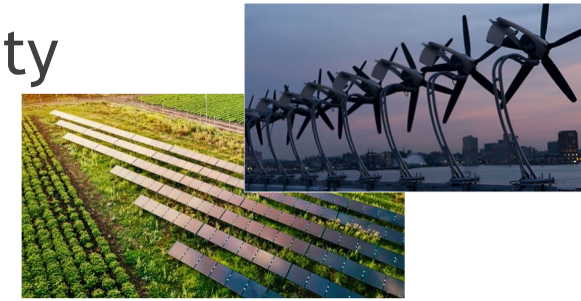

Energy harvesting?

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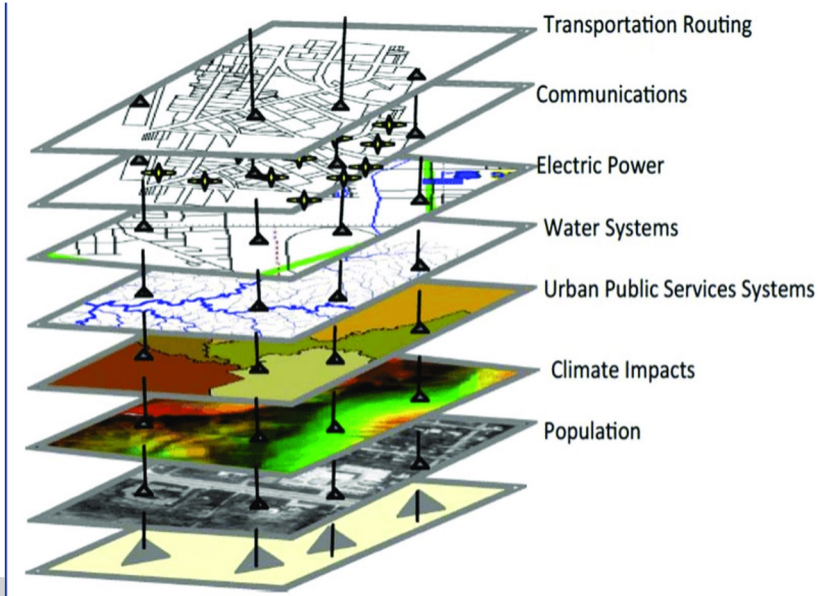
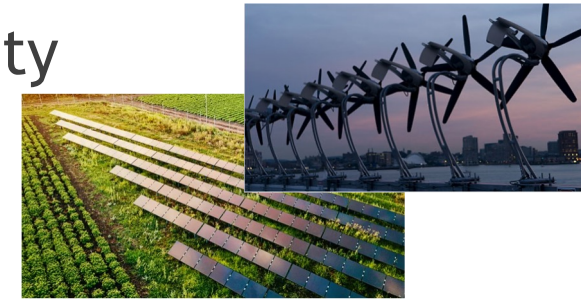


Source: Wilbanks, Fernandez, et al., 2014[8]



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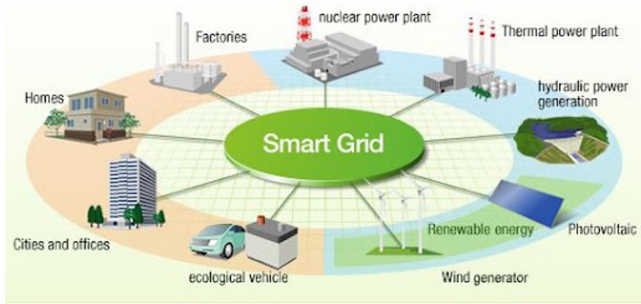
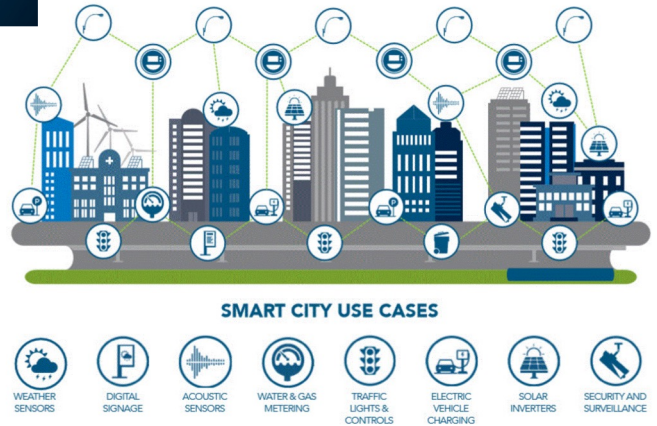
- **Interdependent** (& widely varied) infrastructure
- Very **different** use cases





Intelligent Infrastructure Requires New Research in *Convergent Systems*

- Intelligent automation
  - communications
  - compute/data
  - physical setting
  - target sensing/analysis
  - electrical energy

Co-design: specialized cyber-infrastructure that provides the necessary deployment and management **building blocks** for II innovation

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Co-design: specialized cyber-infrastructure that provides the necessary deployment and management **building blocks** for II innovation

- Deployment automation
- Low cost sensing/actuation
- Lights-out disconnected operation
- AI control, autonomy, safety response
- Energy use **without** continuous availability
- Software to simplify solutions/apps
  - Open source, freely available

Thanks!

UCSB RACELab

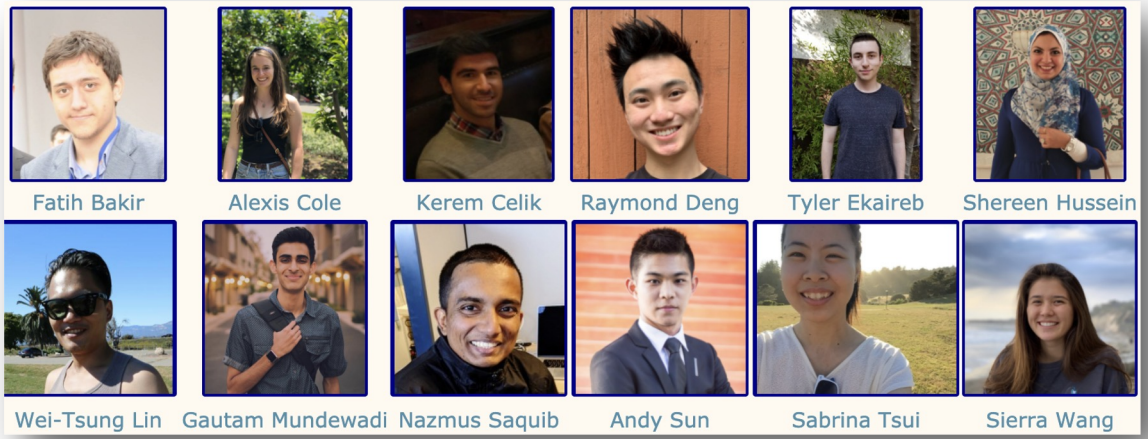
The Lab for Research on Adaptive Computing Environments
Computer Science Department, UC Santa Barbara

Co-Lead: Dr. Rich Wolski

Collaborators: UCSB, LREC, AgMonitor, Sedgwick Reserve, Private Growers

Support: NSF, NIH, Google, UCSB, UCSB IEE, California Energy Commission

Students:



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ckrintz@cs.ucsb.edu
http://www.cs.ucsb.edu/~ckrintz/racelab.html

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In addition, intelligent infrastructure must be

- Robust to harsh operating environments
- Deployable across vast areas
- Safe and self-managing
- Secure & privacy preserving
- Low cost & easy to use
- Amenable to innovation

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DDoS Attack Trends Reveal Stronger Shift to IoT, Mobile

Kelly Sheridan
Senior Editor

March 13, 2020

LILY HAY NEWMAN SECURITY NEWS 08.17.2021 08:00 AM

Millions of Web Camera and Baby Monitor Feeds Are Exposed

A vulnerability in the Kalay platform leaves countless IoT devices susceptible to hackers.

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