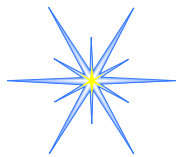# CPS

One Future Application (and Challenges)

Jack Stankovic
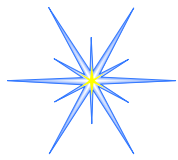University of Virginia

Questions

- *How many sensors?*

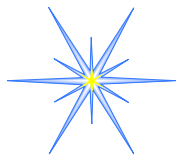 Tens of trillions

- *Where will they be?*

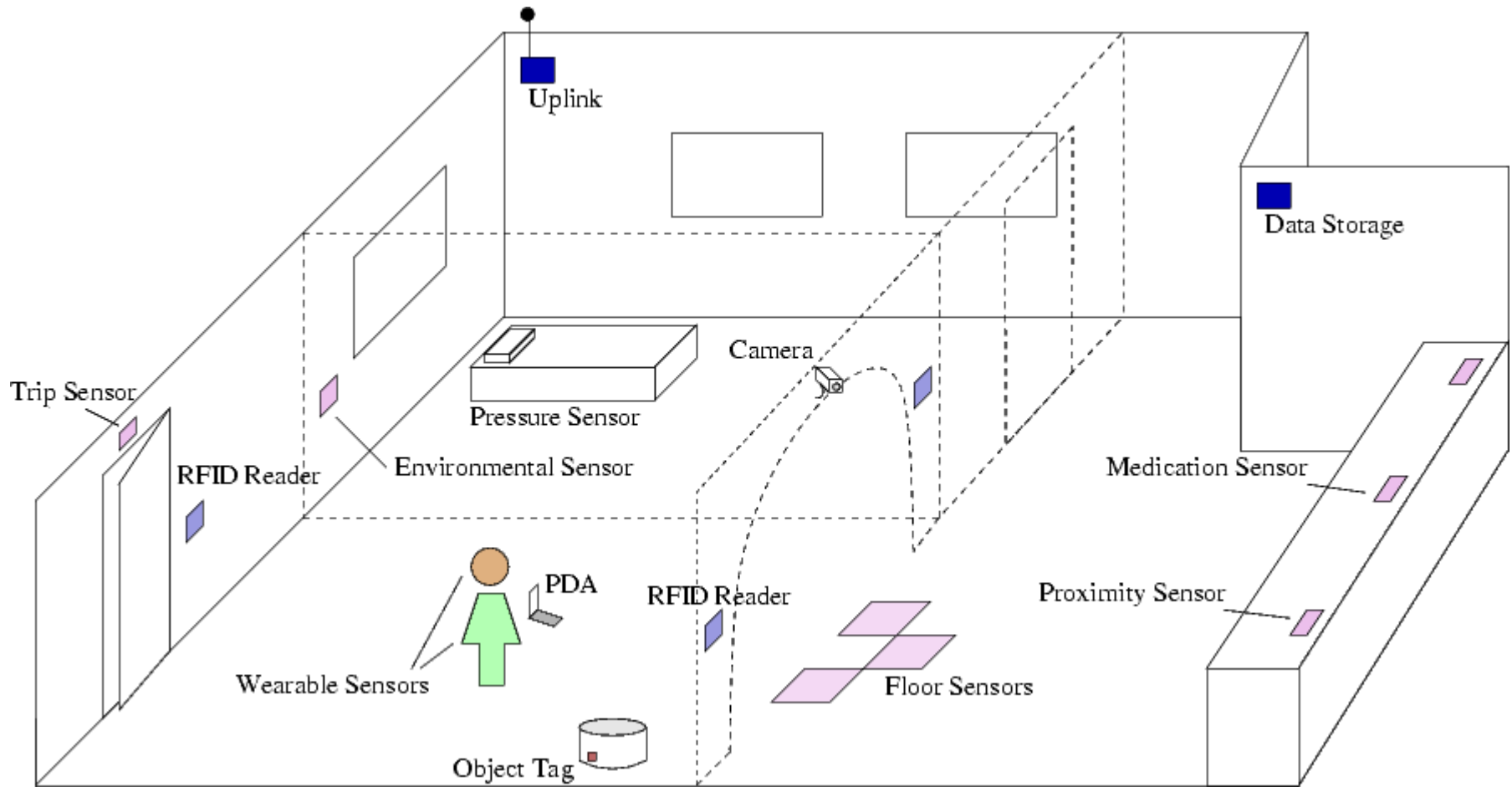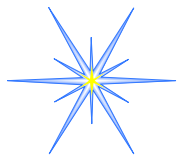 Around the body, on the body
  and in the body

Virtual Life Partner

– Continuous Birth-to-Death Health Care
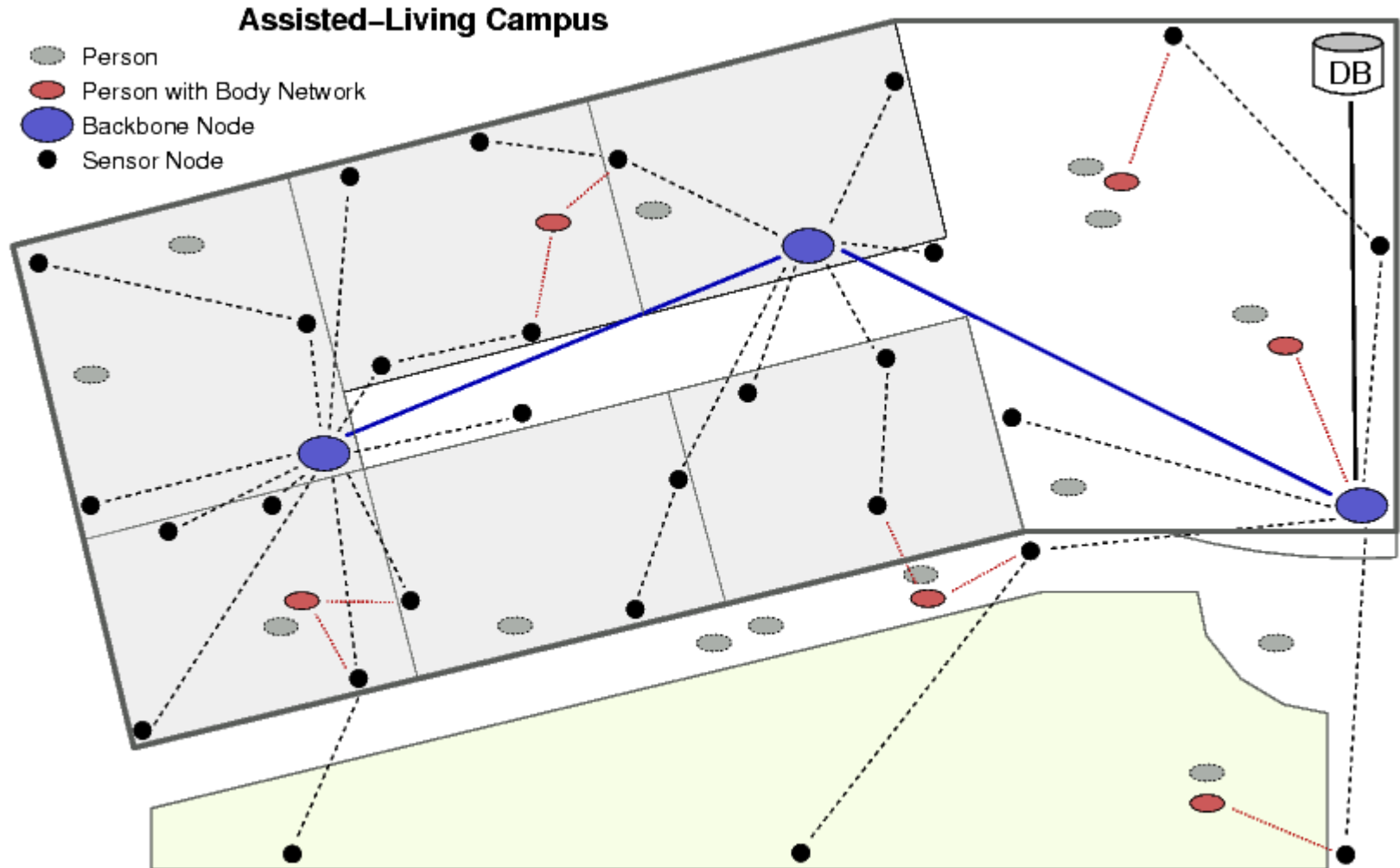
– Personal Safety

– Happiness

Smart Health Aware Spaces

Large Scale Deployments

Assisted-Living Campus

Legend:
- Person
- Person with Body Network
- Backbone Node
- Sensor Node

DB

University of Virginia
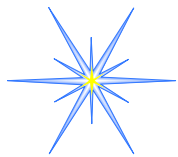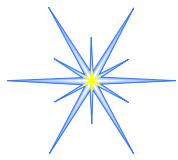
Global Scale

- Across "all" people, homes and health care facilities

- Preliminary diagnoses without doctor's visit

- Lifelong medical records (HealthVault)

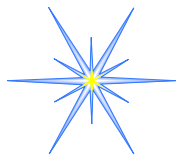- Holistic health care and quality of life

Research Challenges

- From Raw Data to Knowledge
  - Finding the knowledge
  - Trust the data
- Robust System Operation
- Privacy
- Security
- Certification and Runtime Validation
- Openness
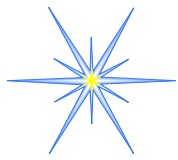
Openness Challenges

- Account for openness in
  - Dynamic Compositional Theory
  - Analysis Techniques
  - Tools
  - Communication
  - Security
  - Privacy

Example - Openness

- ## Current Feedback Control
  - Model "closed" system and derive controller to meet stability, overshoot, settling time

- ## Open System
  - Model keeps changing
  - Human behavior models
  - Errors, noise, missing data is the norm
  - Interactions of control loops (within and across systems)