Everything is Alive:  
Modeling RFID and Healthcare Logistics in Second Life

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Setting the Context

- Remember when
  - Eniac \( \Rightarrow \) Mainframe \( \Rightarrow \) PC \( \Rightarrow \) cell phone \( \Rightarrow \) ?
  - Cheaper, faster, smaller, more distributed, smarter, more memory, more data, ….

- It's embarrassing
  - You may have a cell phone and HDTV but you also have N remotes \( \Rightarrow \) complexity
  - No electronic receipts & drawer of manuals \( \Rightarrow \) your things are not network objects so how can you call yourself a networked society. Humans now manage 10 network devices and will need to manage 100s to 1000s.
  - Healthcare > 15% & adverse effects & no electronic patient record
  - 30% of the truck tires on the road are underinflated
Everything is Alive

I see a tank!

Any threats?

Need fuel!

orders & subscriptions

observations & recommendations

EiA = a world where everything can sense, act, think, feel, and communicate. This includes equipment, vehicles, robots, toys, clothing, pets, trees and walls.
RFID Research Center @ UAF

Fully student staffed, funded by industry members, the first open test laboratory to be accredited by EPCglobal.
Wal-Mart and Blue Cross Blue Shield funded center aimed at HC Logistics

- Largest U.S. industry at 15% of GDP & rising
  - Growing at 3 times inflation due to aging population, epidemic of chronic disease, advances in powerful but expensive technology
  - Costs impacts every household, industry & level of government
- Up to 30-40% waste, massive under-investment in IT, 90K annual deaths from preventable medical errors, 20% of tests lost & repeated, minimal continuity of care within the provider network, only half receive best-practice care, rampant perverse economic incentives,...

Also mention - RFID-enabled tire management system
- Developed Ubiquity Agent System
- Developed TagCentric RFID application in Java
  - 4 reader types supported: Alien, Symbol, Thingmagic, and “Fake”.
  - 1 Tag printer supported: Zebra
  - 5 databases supported: DB2, Derby, MySQL, Oracle, Postgres
  - TagCentric Open Source Toolkit available on SourceForge
- Developed Low Level Reader Protocol Toolkit
- Developed RFID-based Item-level inventory and point-of-sales system for St Mary’s Hospital
Modeling Healthcare in Second Life

Our hospital on our SL island – patient rooms, ICU, cath lab, storage rooms, loading dock
What we have so far

- University of Arkansas island + Healthcare facility
- Transportation – Vehicles, carts, pallets, wheelchair, elevator, stretcher, restocking robot, way points and some route planning
- Smart devices – pill bottles, smart shelves, e-paper, clipboard, EKG, blood pressure monitor, IV-drip, cot, thermometer
- DBMS plugin, Logging to our own remote server
- RFID reader/tags, sensors
Next Steps

- **Management**
  - Inventory
  - Asset
  - People
  - Process/Service

- **Business Process Modeling**
  - Finding needed equipment or the doctor in an emergency
  - Nurse gives patients the right meds on time
  - Restocking robot
Many Technical Puzzles Remain

- Item level tagging, mobility, cold chain and sensor nets, people and things communicating with things. Precision communication.

- Architecture
  - 4th party broker
  - Standard API - SNMP vs. XML, SOA, semantic interoperability, composability, evolvability, survivability, policy languages, querying collections of agents
  - Security, visibility, digital rights for agents
  - Enclaves, web services, visibility, pedigree/recalls
  - Data mining, info quality, disruption/replanning
  - Open source

- Simulation
- Business use case and value chain for RFID
- Privacy Assurance