

Independent LifeStyle Assistant™



Leveraging Technology for Independent Living

A NIST Advanced Technology Program

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Whillock NAHB 5/2/2002

Independent LifeStyle Assistant™



Agenda

Independent Living Issues
I.L.S.A. Vision
Research Program
System Details
Field Test Plans
Progress to Date



Independent Living Issues



Elder Concerns

- Desire to maintain independence
- Growing population
- Medication Compliance
- Falling
- Costs / Insurance
- Uncomfortable with Technology



Support systems (Caregivers)

- Institutions are Costly
- Remote Families
- Informal Caregiver Productivity
- Caregiver Burnout

Technology developments

- Smarter Sensors and Appliances
- Lower Cost Processors
- Improved Connectivity
- Advanced Reasoning Architectures



The I.L.S.A. Vision & Challenges



Vision:

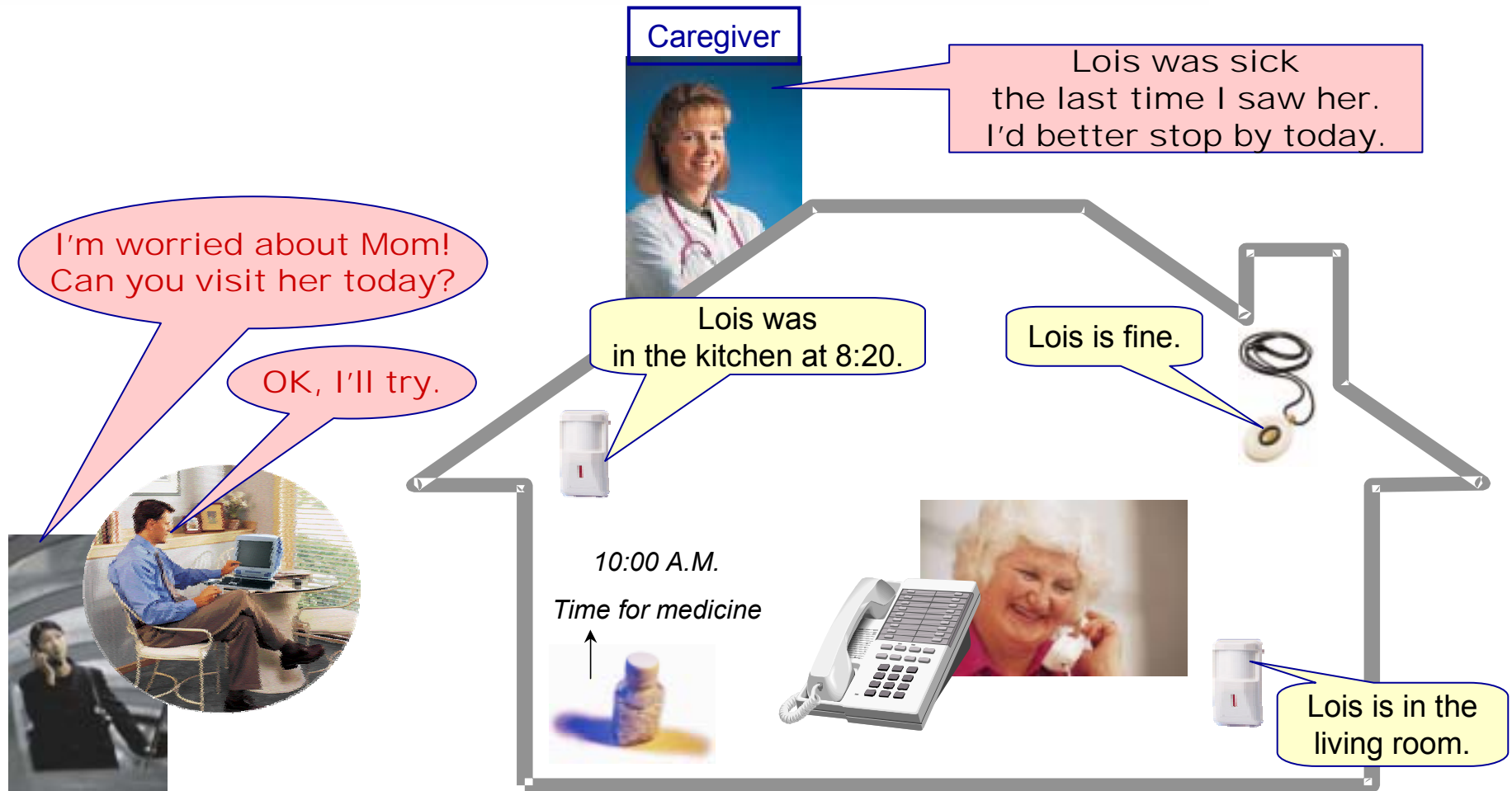
Leverage technology developments to help older people maintain independent living.

Challenges:

- Open Sensor Communications
- Advanced Reasoning
- Elder User Interfaces



Smart Devices





Program Objective

Develop an intelligent home automation system with situation awareness and decision-making capability that can be easily integrated with a diverse set of sensors, medical devices and "smart" appliances to enable elderly and infirm users to live and function safely at home.

Programmatics:

- ILSA is NIST ATP Program
 - ñ ATP programs are high risk research
 - ñ Honeywell 60%; NIST 40%
- November 2000 through April 2003

Activities:

- Year 1: infrastructure and architecture development
- Year 2: Prototype & Field Tests
- Year 3: Usability evaluation and tuning



I.L.S.A. Program



What will ILSA look like?

- **Sensors** - A network of integrated sensors, devices, and “smart” appliances
 - Sensors - motion, contact, optical, etc.
 - Devices - thermostat, speaker, telephone, medical, etc.
 - Smart Appliances - communicating refrigerators, stoves, etc.
- **User Interface** - Users interact with the system through familiar devices or simple dedicated devices like:
 - Telephones, Pagers, email, TV
 - Webpad, Digital picture frame, PDAs, speakers/microphones



I.L.S.A. System



What will I.L.S.A. do?

- **Gather** information about elder, activity, and home status from devices and sensors
- **Assess** the need for assistance based on the elder's condition and what activities are going on inside the home
- **Respond** to a situation by providing assistance to the elder and getting help when necessary
- **Share** health and status information with authorized caregivers

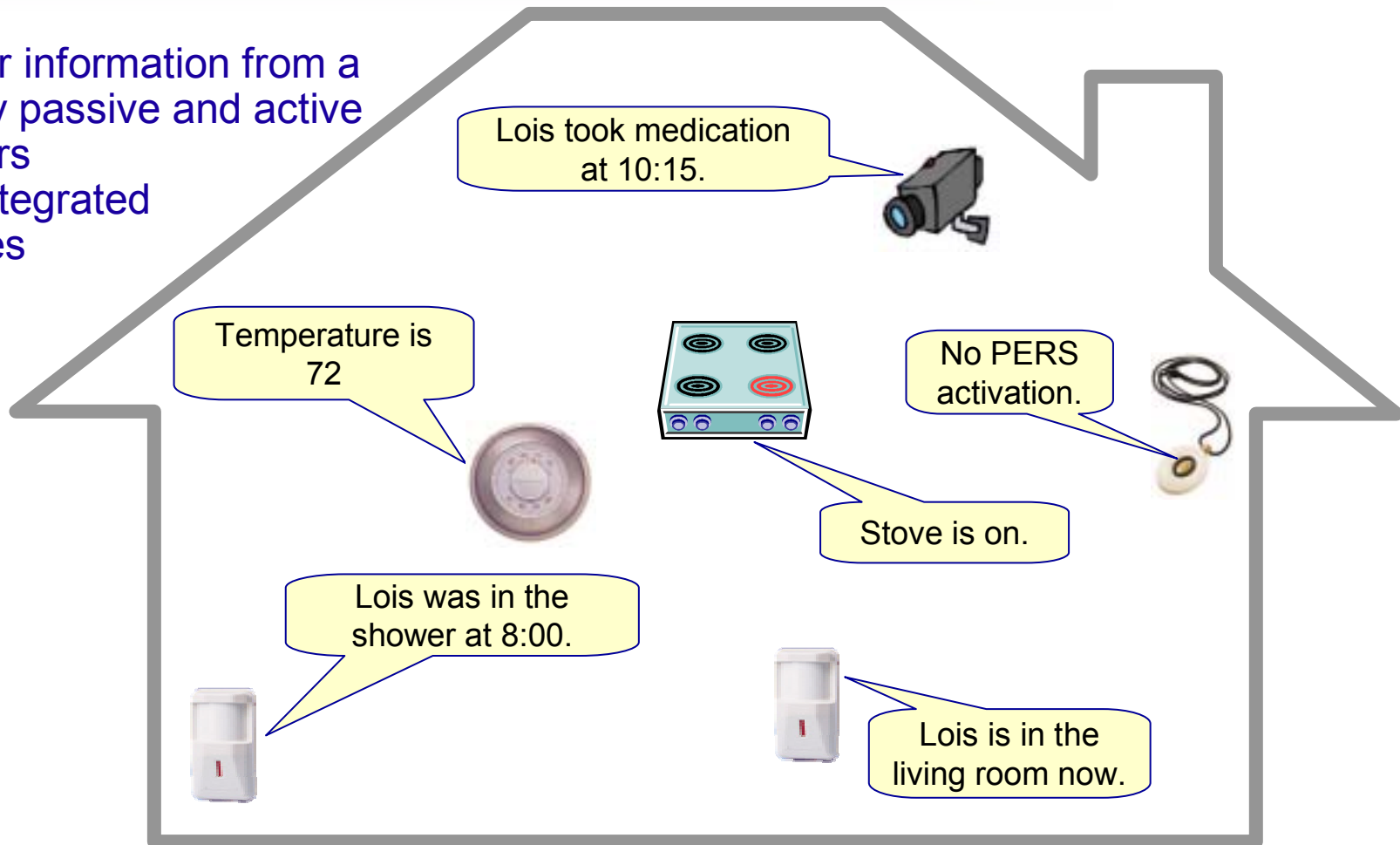


I.L.S.A. System

Gather Information



Gather information from a variety passive and active sensors and integrated devices

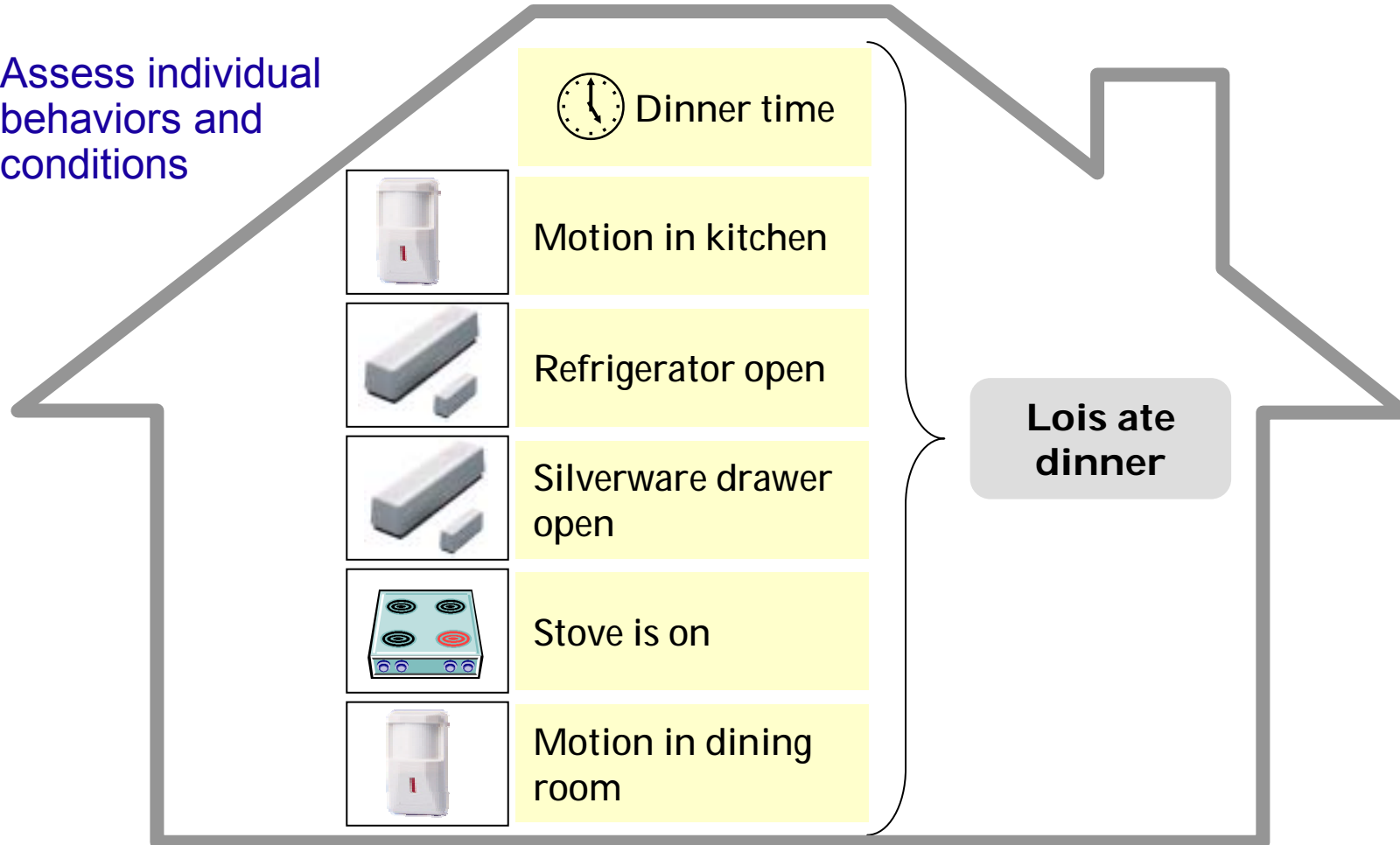


I.L.S.A. System

Assess Information



Assess individual behaviors and conditions

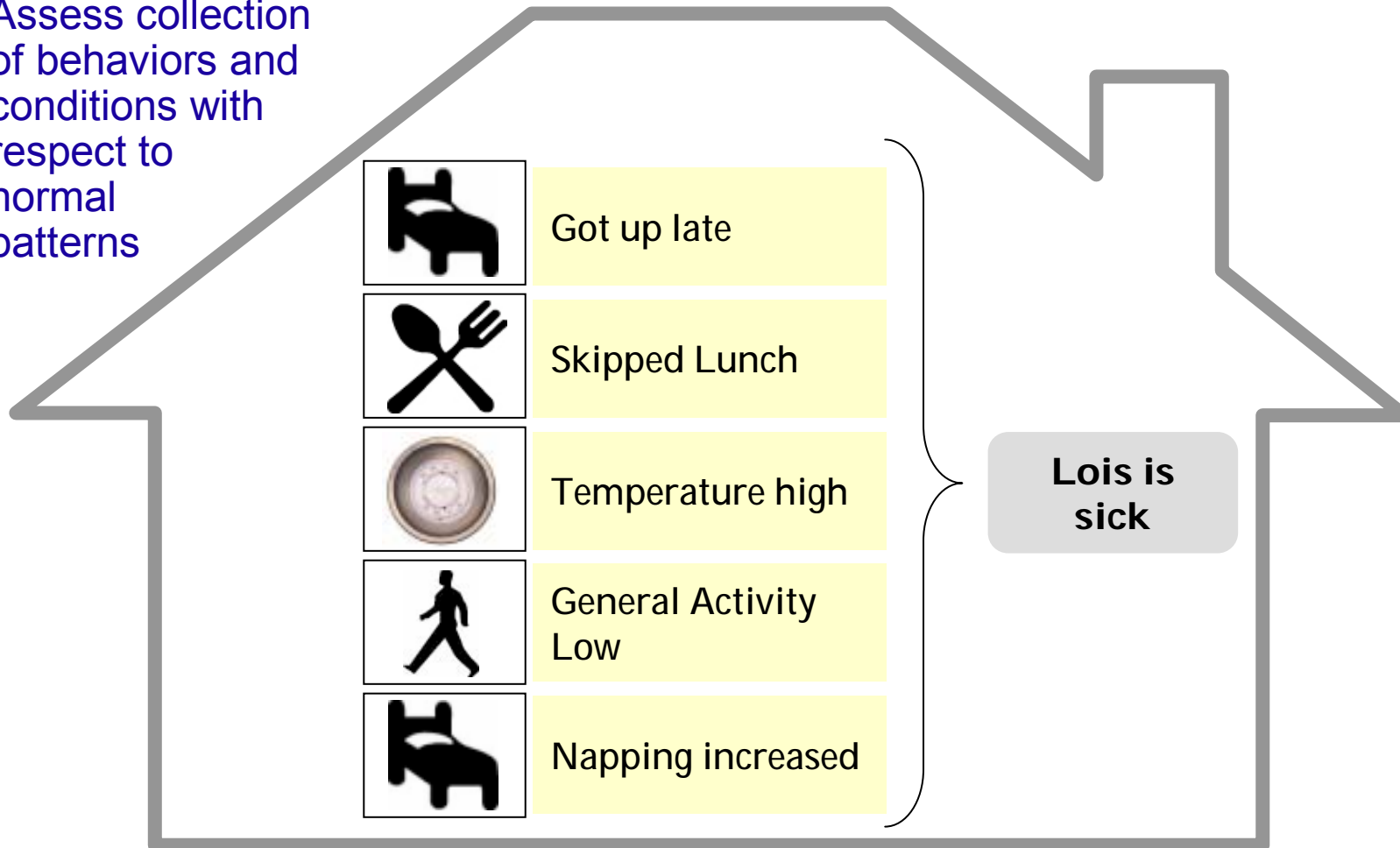


I.L.S.A. System

Assess Information



Assess collection of behaviors and conditions with respect to normal patterns



I.L.S.A. System

Respond to Situations



Prioritize conditions and formulate an appropriate response plan

The Stove's been left on for 46.3 minutes!

It's time to take your medicine!



I've fallen!

Linda's calling.



ILSA System

Respond to Situations



Control situation so Loisí immediate needs are met

The Stove's been left on for 46.3 minutes!

Stove - turn yourself off.

It's time to take your medicine!

Reminders - be quiet for now.



I've fallen!

Lois, are you all right?

Linda's calling.

Phone - disconnect Linda and call caregiver.



Reasoning

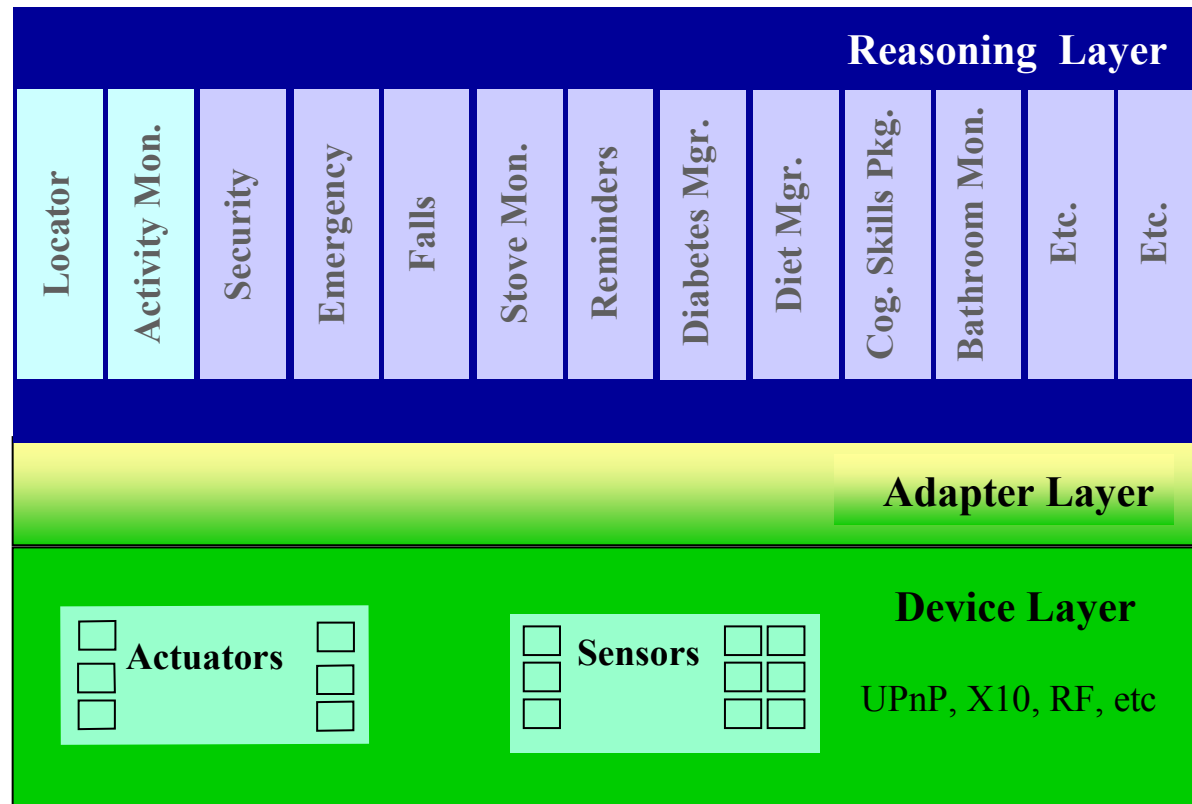
Example Assistance Scenarios



- Safety
 - PERS Call button is activated
 - » Query elder about status and need for assistance
 - » Notify caregivers
- Functional Assessment
 - Activity monitoring - task completion, duration, and consistency
 - » Provide cognitive support for elder by offering reminders or task instructions
 - » Notify caregivers of changes in performance over time
- Health Monitoring
 - Track data to detect and prevent health crises
 - » Query elders about how they are feeling daily
 - » Communicate with 3rd-party medical devices
 - » Share health data with caregivers to improve diagnosis and treatment



Communication Architecture



Sensors



Near Term Prototype

- ï **Standard Security System Sensors**
 - ï **Motion Detectors, Call Buttons, Door Switches**
- ï **Other Easily Integrated COTS Sensors**
 - ï **X10, Fall Sensors, Pressure Mats, etc**

Future Sensors

- ï **Medical Sensors**
- ï **Medicine Dispensers**
- ï **ID / Location**
- ï **Video - Face ID**



Field Tests



- Field Testing - June 02
- Prototype System
- About 20 Sites
- 3 Month Evaluation
- Single Homes
- Independent Living Facilities
- High Priority Functions



Field Test Functions



Detect mobility / lack of
Detect falls
Give Reminders
Verify medication taken
Monitor environment
PERS Call button

To-do lists
Coordinate multiple caregivers
Remote Access
Alerts to clients/caregivers
Reports to clients/caregivers
Intrusion detection



Technology Innovations



- **Home automation** - Automate, and integrate control of home functions like security, comfort, lighting, entertainment, etc.
- **Situation Assessment** - Identify and infer specific behaviors and patterns of activity
- **Machine Learning** - Recognize changes in patterns of behavior over time
- **Adaptive Interaction Design** - Dynamically format content and presentation style for different devices, users, tasks, etc.
- **Human-Centered Systems Design** - Design automated systems that match elder abilities & expectations



Program Progress to Date



Accomplishments

- Studied users to understand what leads to institutionalization
- Identified most important assistance needs and opportunities for technology
- Developed infrastructure to support hardware-software communications
- Developed system architecture, situation assessment capabilities, and initial learning capabilities
- Built and tested prototype systems in lab and home settings

Ongoing

- Expand system functionality
- Refine and enhance machine learning capabilities
- Expand system's ability to communicate with various types of sensors and devices
- Evaluate user interface and interaction designs
- Evaluate overall system in field settings over extended period of time
- Address configuration and set-up issues

