



Independent LifeStyle Assistant™ (I.L.S.A.)

A NIST ATP Program

Honeywell Laboratories

University of MN School of Nursing

United Health Group EverCare





In a Nutshell

Program Goal

Develop an intelligent home automation system with situation awareness and decision-making capability based on integration of diverse sensors, devices, and appliances to support caregivers and enable elderly users to live independently at home.

Programmatics:

- Co-sponsored by the National Institute of Standards and Technology Advanced Technology Program

Benefits:

- Support elder independent living
- Provide peace of mind to caregivers
- Support efficient quality care for caregiving organizations
- Cost savings for government and industry



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Quality of life

- Desire to maintain independence
- Limitations
 - ◆ Arthritis (49%)
 - ◆ Hypertension (35%)
 - ◆ Heart Disease (31%)
 - ◆ Hearing (31%)
 - ◆ Activities of daily living
 - ◆ Falling
 - ◆ Fraud



Support systems (Caregivers)

- Institutions are costly
- Remote families
- Decreased availability (aging population)

Technology developments

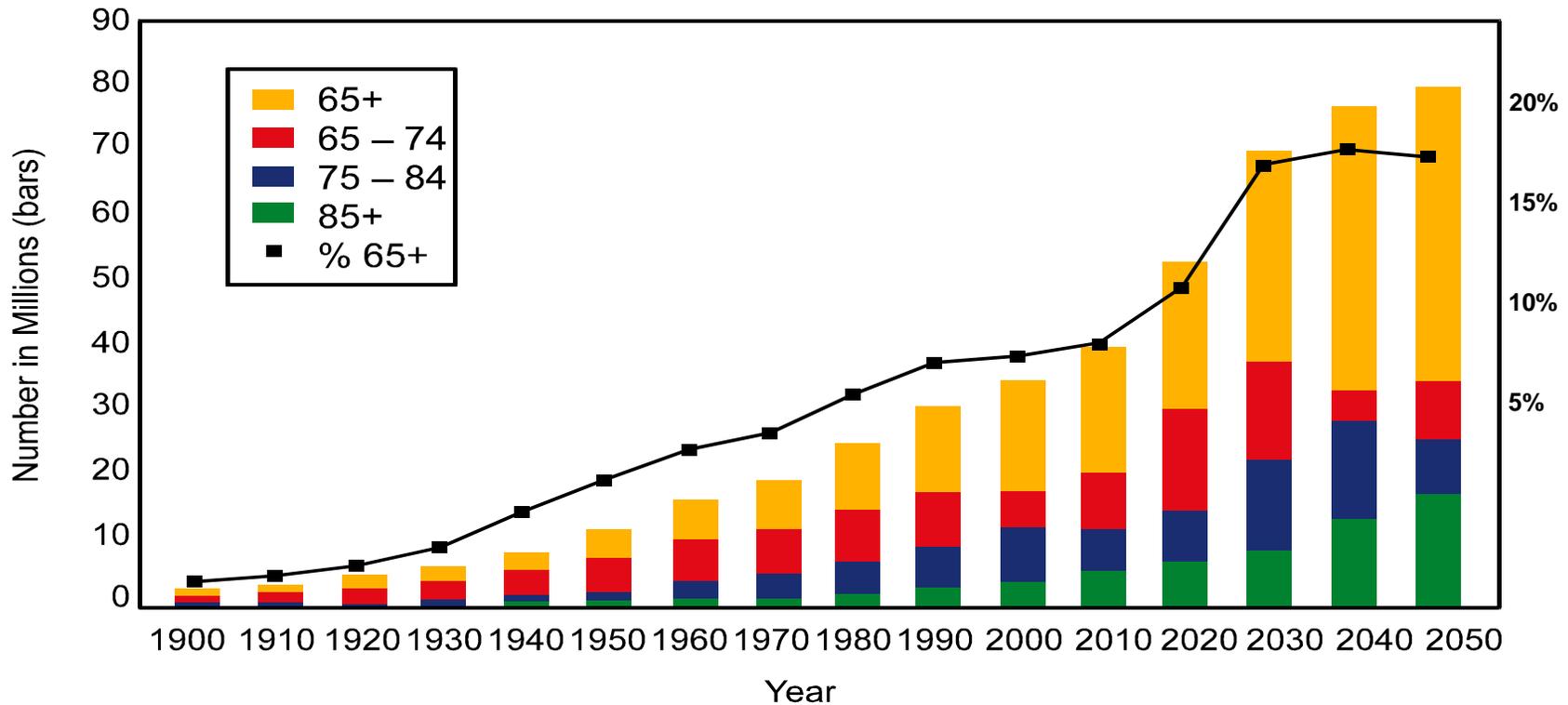
- Widespread, diverse products and services
- Lack overall, integrated infrastructure
- Resistance to new technology



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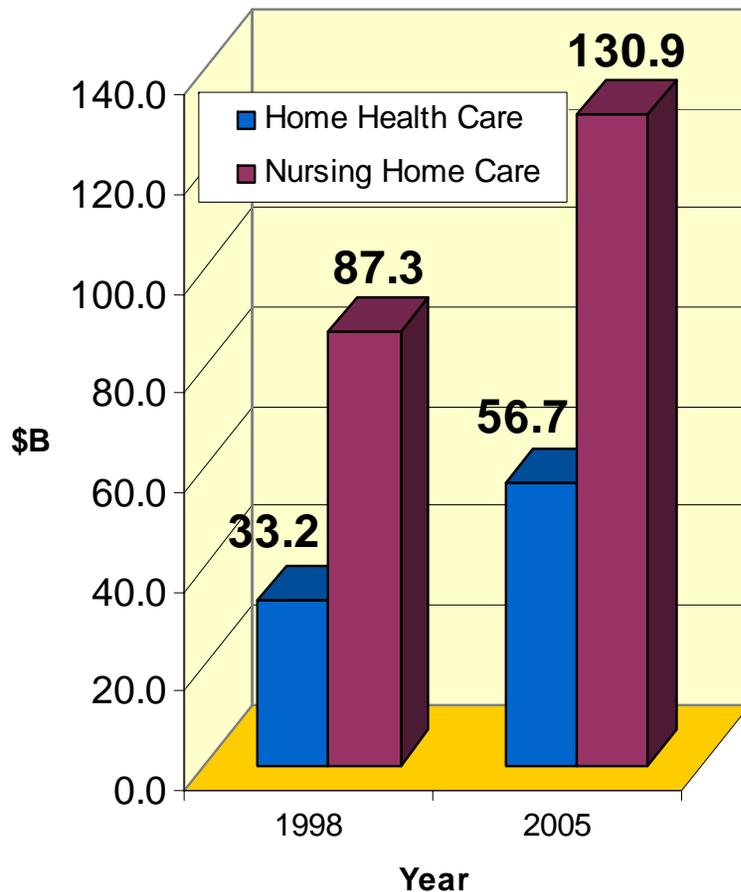
The Elder Boom



Growth of the 65+ Population by Age Group: 1900 to 2050



U.S. Financial Statistics



- Federal government pays 57% of nursing home and home health care costs (primarily Medicaid)
- 43% of those over 65 will enter a nursing home
- Average nursing home cost per patient is \$47K
- 1.6 million home care patients in 1996 will increase to 2.0 million in 2005
- 7 million Americans provide remote care to an elder (12 hours per week or more)



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What will ILSA look like?

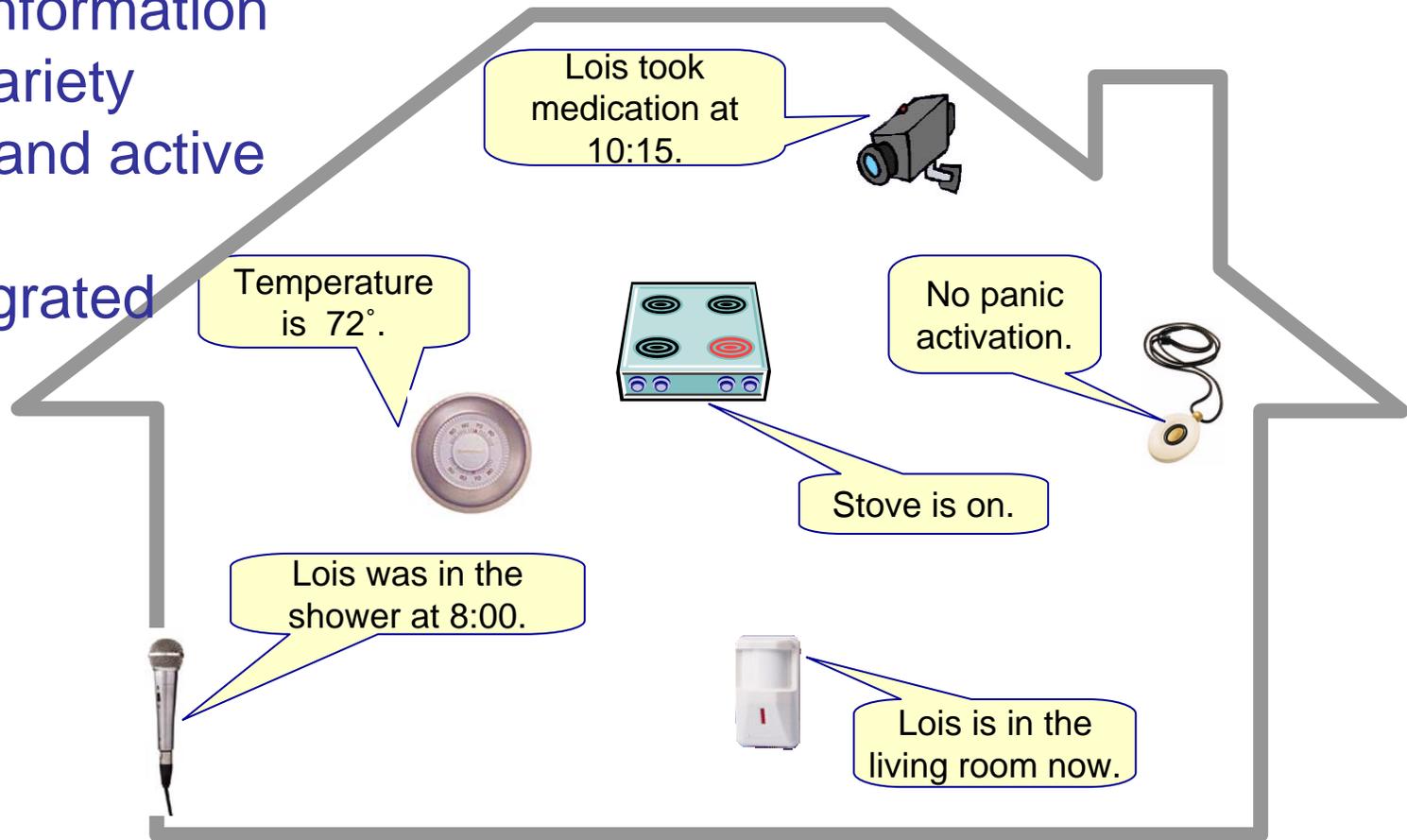
- An invisible **network** of **integrated** sensors, devices, and “smart” appliances
 - Sensors - motion, contact, optical, acoustic, etc.
 - Devices - thermostat, speaker, telephone, medical, etc.
 - Smart Appliances - communicating refrigerators, stoves, etc.
- **No computer** workstation needed. Users interact with the system through familiar devices or simple dedicated devices like:
 - Telephones, Pagers, email, TV
 - Webpad, Digital picture frame, PDAs, speakers/microphones



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i.L.S.A. ILSA Vision Gather Information

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

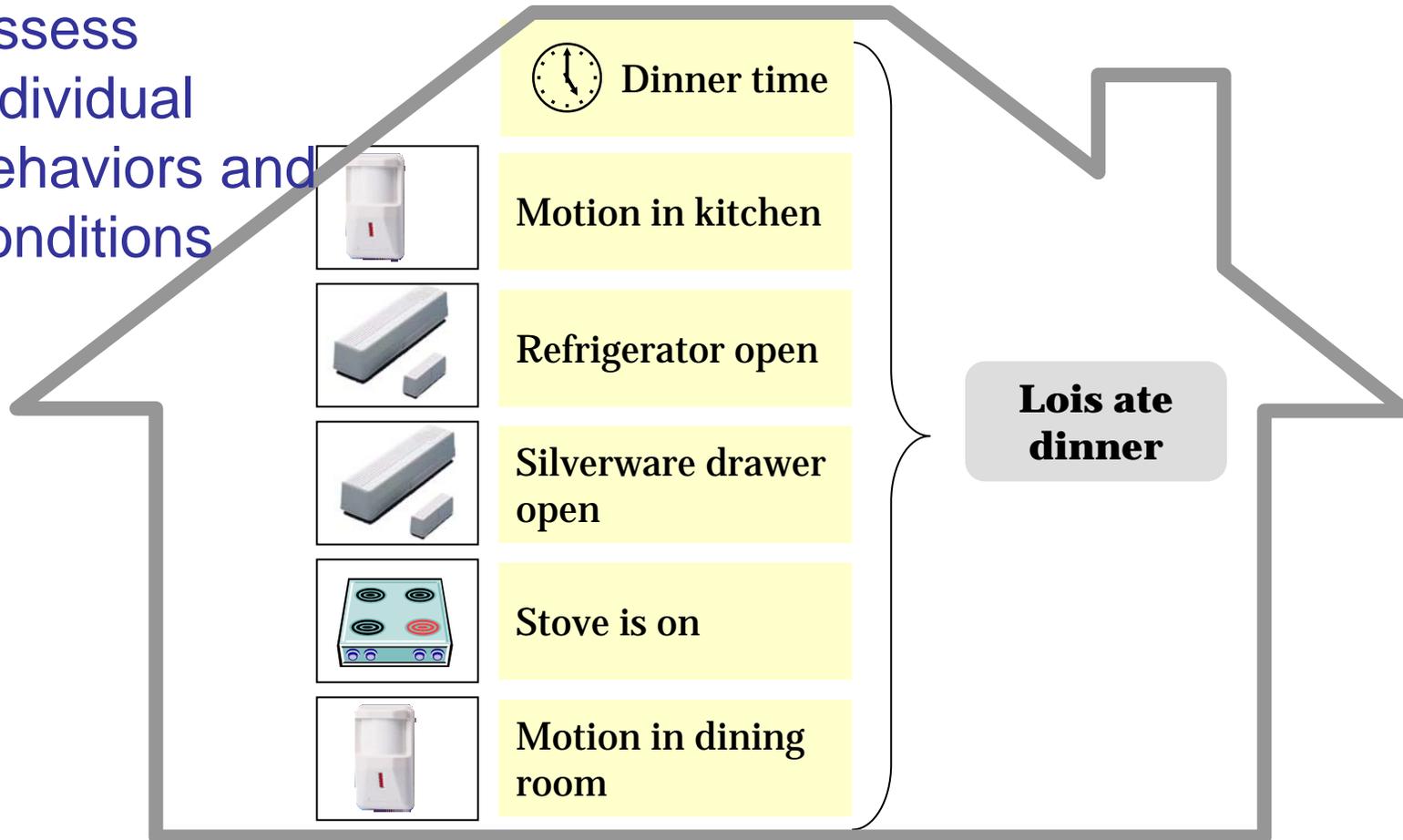


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ILSA Vision Assess Information

Assess individual behaviors and conditions



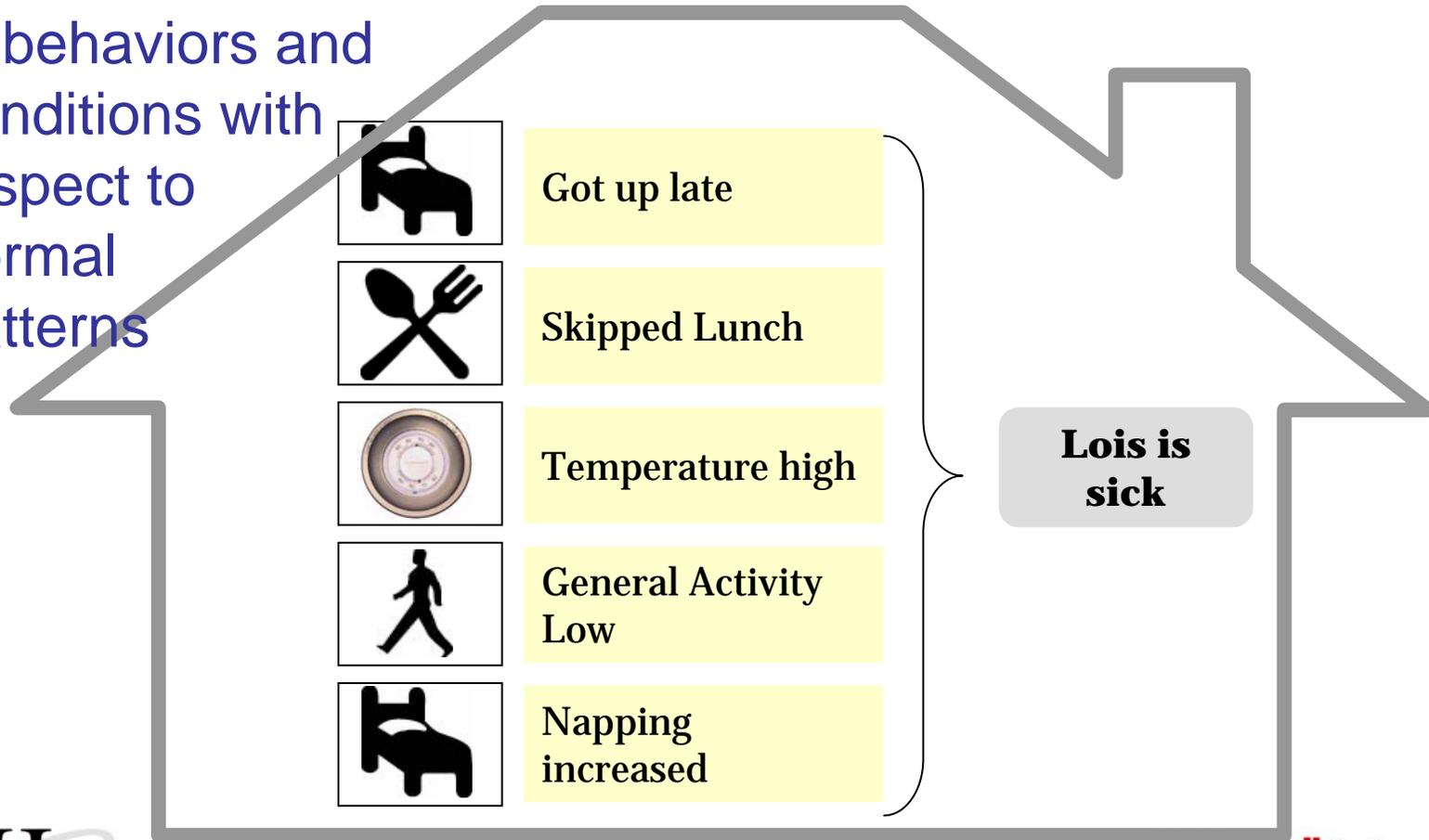
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ILSA Vision

Assess Information

Assess collection of behaviors and conditions with respect to normal patterns



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ILSA Vision 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, and I can't get up!

Linda's calling.



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Kathleen Krichbaum. Annual meeting of the National Council on Aging/American Society on Aging, March 2003



ILSA Vision Respond to Situations

Control situation so Lois' immediate needs are met

The Stove's been left on for 46.3 minutes!

iLSA Stove - turn yourself off.

I've fallen, and I can't get up!

Lois, are you all right? **iLSA**

Linda's calling.

It's time to take your medicine!

iLSA Reminders - be quiet for now.



Phone - disconnect Linda and call caregiver. I'll talk when you connect. **iLSA**

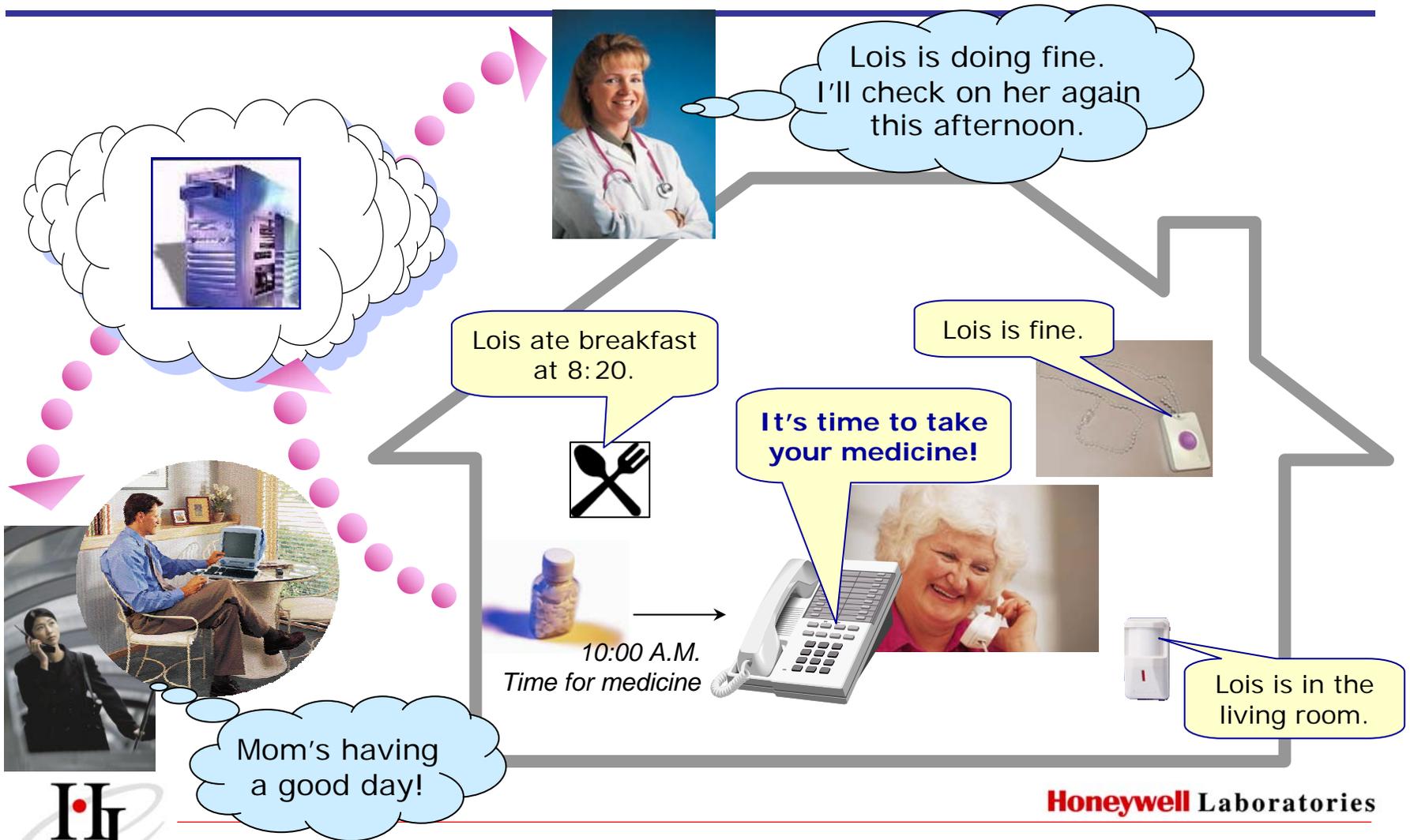


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ILSA Vision

Share Information

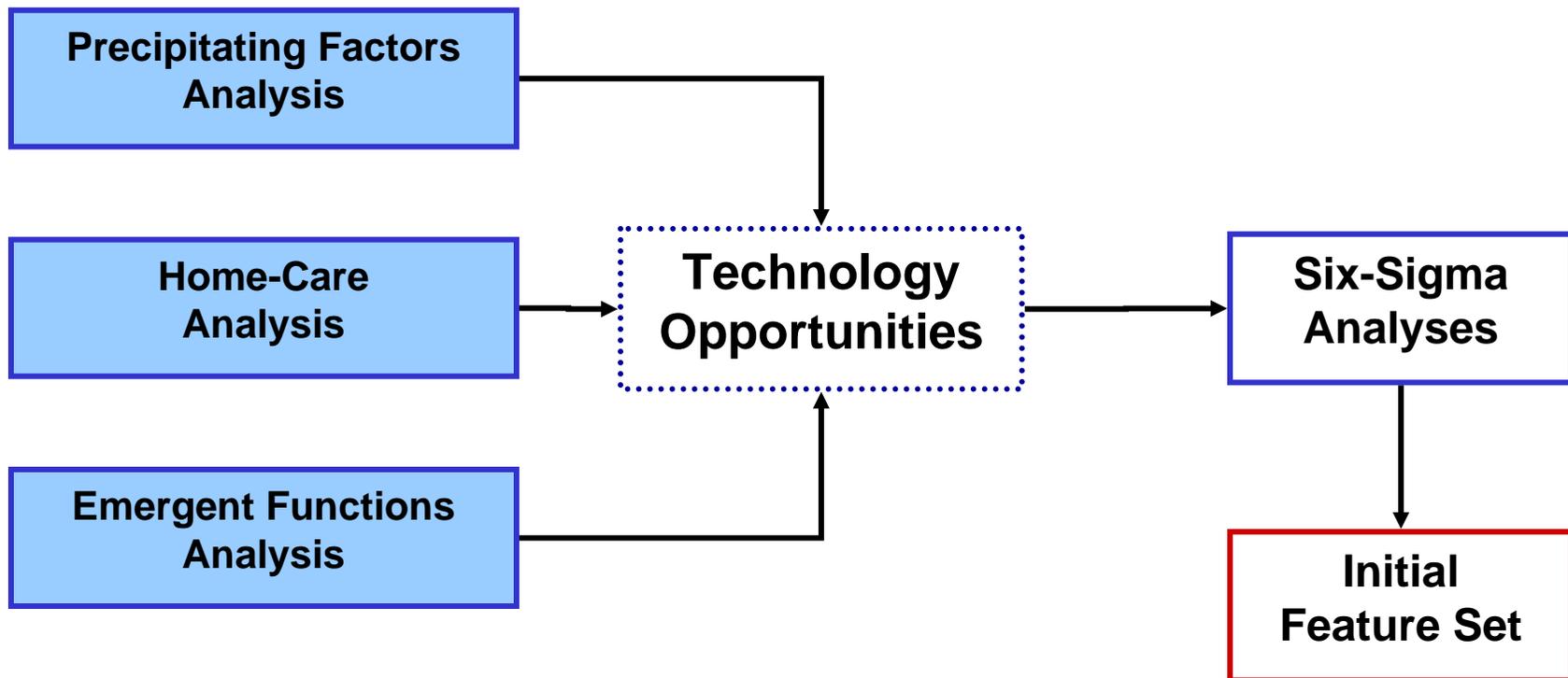


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Background

Focusing on Features





Correlates of Elder Institutionalization

Higher Significance

- Safety
- Medical Monitoring
- Mobility
- Caregiver Burnout
- Medication Management
- Dementia
- Eating
- Transportation
- Isolation
- Managing Money
- Toileting

Lower Significance

- Housework
- Shopping
- Pressure Sores
- Equipment Use
- Alcohol Abuse
- Wandering
- Hallucinations &
Delusions



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Home-Care Analysis

- **Functional Assessment and Monitoring**
 - Medical, as well as physical / mental function
- **Managing Information**
 - Medical history accessible to all caregivers and medical professionals
- **Coordinating Care**
 - Address the disconnect between the medical community, professional caregivers, family caregivers, and elders
- **Educating the Care Community**
 - train informal caregivers to recognize signs of dementia
 - train geriatricians to better recognize environmental factors contributing to dementia, especially in behavior outside the home
 - train physicians to better communicate medication strategies



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Emergent Functions Analysis

Potentially valuable features can be overlooked because they are not represented by specific interactions between the user and the system.

- Interactions between the client and the environment
 - Example: Using temperature data and door sensors to alert if an elder leaves the home without adequate clothing for the weather.
- Interactions between different aspects of the environment
 - Example: Locking windows in the home in response to the front door being locked.

This analysis produced 85 potential functions, either to generate alerts to caregivers, or provide direct assistance to the client. No emergent functions are in the initial features because environmental factors were rated low in priority.





What I.L.S.A. Looks Like

Control Boxes

- **Home & Away** - Hidden in closet, talks to sensors and devices

Devices to communicate with I.L.S.A.

- **Telephone** - I.L.S.A can call you with a message
- **WebPad** - You can get information from I.L.S.A.

Sensors

- **Motion Sensors** - Sense motion in a room
- **Call Button** - Same as your current call button
- **Medicine Caddy** - To tell I.L.S.A. when you take your medications





Caregiver Web Introduction

The web site was designed with professional and family caregivers in mind, since many people may eventually share in the maintenance of your parent's independence.

The screenshot displays a web browser window titled "Status - The Independent LifeStyle Assistant (TM) monitoring system (I.L.S.A.) - Microsoft Internet Explorer". The interface features a blue sidebar with navigation links: Notices, Status, Profile, Set Up, and Help. The main content area shows a profile picture of Lois Anderson and a status summary report. The report includes a table with the following data:

Time Period	Description	Status
12:01PM - 6:00PM	No Medication Information	low

Additional elements include three circular icons at the top (a book, footprints, and a pill) and a status bar at the bottom showing "Done" and "Local intranet".



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What I.L.S.A. Will Do

Functions¹

- **Reminders:** Notes to help you remember what you should do today
- **Mobility²:** Summary of your activity level for each time period of the day
- **Medicine²:** List of the medications you should take and whether you opened the caddy at the correct time
- **Controls:** The status of I.L.S.A. for your home
- **Help:** What to do in an emergency and who to call if you require assistance

Support

- **Caregiver/family member, user guides, and technical support**

¹*Critical to have accurate information*

²*Thresholds have been established to issue alerts for these functions*



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Kathleen Krichbaum. Annual meeting of the National Council on Aging/American Society on Aging,
March 2003



Messages

Alerts

An **alert** suggests that you may want to check on your parent at your convenience. You will be called with alerts, and will see them in your web browser.

- No Mobility for more than 4 hours during normal wakeful times
- A 50% increase or decrease in mobility (activity) from normal levels over the course of three days.
- Missed medications for a period of at least 24 hours.





Managing Prescription Information

As the designated caregiver for your parent, you will have access through your web browser to change medication schedules. If you are uncomfortable with this, you may call the support number we will provide and we can manage this data for you.

The screenshot shows a web browser window titled "Profile New - The Independent LifeStyle Assistant (TM) monitoring system (i.L.S.A.) - Microsoft Internet Explorer". The page has a blue sidebar with navigation links: Notices, Status, Profile (highlighted), Set Up, and Help. The main content area is titled "Profile" and includes a "Save" and "Cancel" button. Below this is a "New medication information" section with a dropdown menu for "Lois Anderson". The form fields include: Condition, Medication, Form (set to "Pill"), Dosage, and six Dose No. fields (all set to "N/A"). The Prescribing Physician is "Dr. Jeff Morgan", the Starting date is "07/11/2002", and there are fields for Ending and Comments. The browser status bar shows "Done" and "Local intranet".



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Field Test Aims

- **Gather information** about elder, activity, and home status by listening to the home and communicating with devices
- **Assess the need for assistance** based on the system's understanding the elder's condition and what activities are going on inside the home
- **Respond to a given situation** by providing assistance to the elder and getting help when necessary
- **Share health and status information with authorized caregivers** to help improve the quality and timely delivery of care





Field Test Methods

Design

- **Longitudinal, repeated measures**
- **Sample: 9 elders**
 - Takes one or more medications**
 - Needs assistance with IADLs**
 - Has family or formal caregiver who provides regular assistance**
 - Caregiver willing to participate in study**

• Sites

MN & FL: ALFs, Apts, private homes

• Data Analyses

- **Frequencies**
- **Correlations**
- **Chi square**
- **T-tests**
- **Friedman's ANOVA**





Field Test Measures

Evaluation Scope

- **Interface & Interaction design**
 - Ease of use, access to information, intuitiveness, match with expectations
- **Attitudes and perceptions**
 - Trust, levels of monitoring, privacy
- **Patterns of behavior**
 - Accuracy of identification, inferences, and learning
- **System operation**
 - Quality of data from devices, appropriateness of behavior
- **System effects**
 - Elder health, cognition, caregiver effectiveness and burden, elder sense of independence
- **6-10 month duration**



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Field Test Data: Baseline

Demographics

- Age: 83.42 (range 76-96)
- Gender : 1 male, 6 females
- Marital Status: 6 widowed; 1 married female
- Level of Education: 4 high school; 2 college grads; 1 masters'





Field Test Data Baseline

Health (SF-36)

- General Health: mean=61.5
- Physical Function: mean=65.38
- Mental Health: mean=75.88

Cognition

- MMSE: mean=27.85 (range 23-30)



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March 2003



Field Test Data Baseline

Mobility:

- One uses wheelchair for long distances, walker in apt.
- Others very active; all but two still drive

Med Adherence:

- One has meds set up;
- Others set up own weekly
- Number of meds range from 1-16 per day





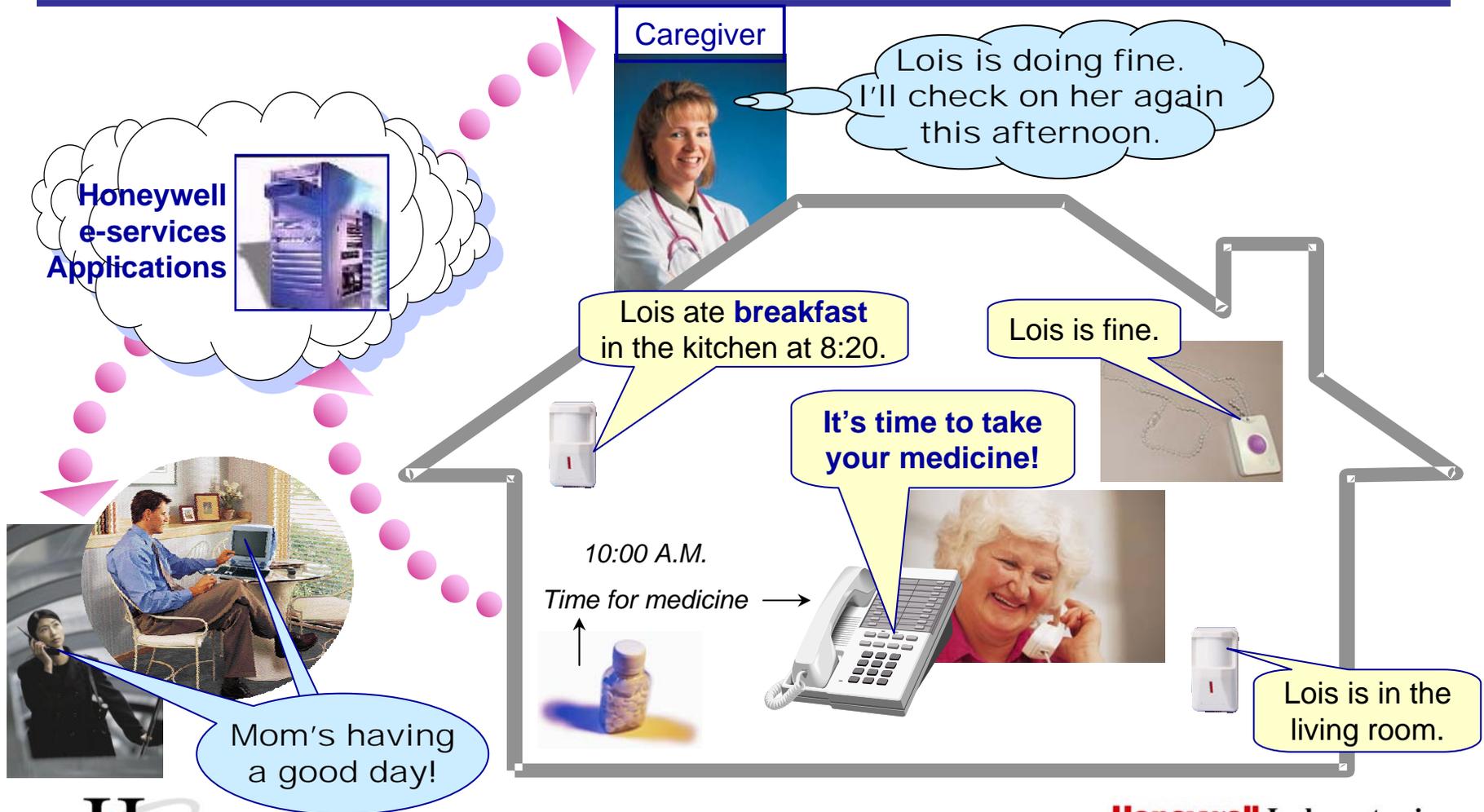
Field Test Preliminary Findings

- Elders are living independently; one in ALF
- All are physically active, mobility is high
- All are “healthy” with at least one chronic illness
- All are comfortable with remotes, programmable appliances
- Five have some computer literacy—wide variation in abilities





Example: Integrated Assistive System



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