



# ANNUAL

CONFERENCE & EXPO | 2015

## Ambient Intelligence Applications in Healthcare

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# Ambient Intelligence Applications in Healthcare

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*Collaborative for Research & Education in Aging, Technology & Health*  
*University of South Florida*  
<http://health.usf.edu/publichealth/create>

June 2, 2015  
IIE Annual Conference & Expo  
Nashville, TN

# Outline

- Our Research Group
- Ambient Intelligence
- Ambient Intelligence in Senior Healthcare
- *Always Near*

# CREATE Health

Collaborative for Research & Education  
in Aging, Technology & Health

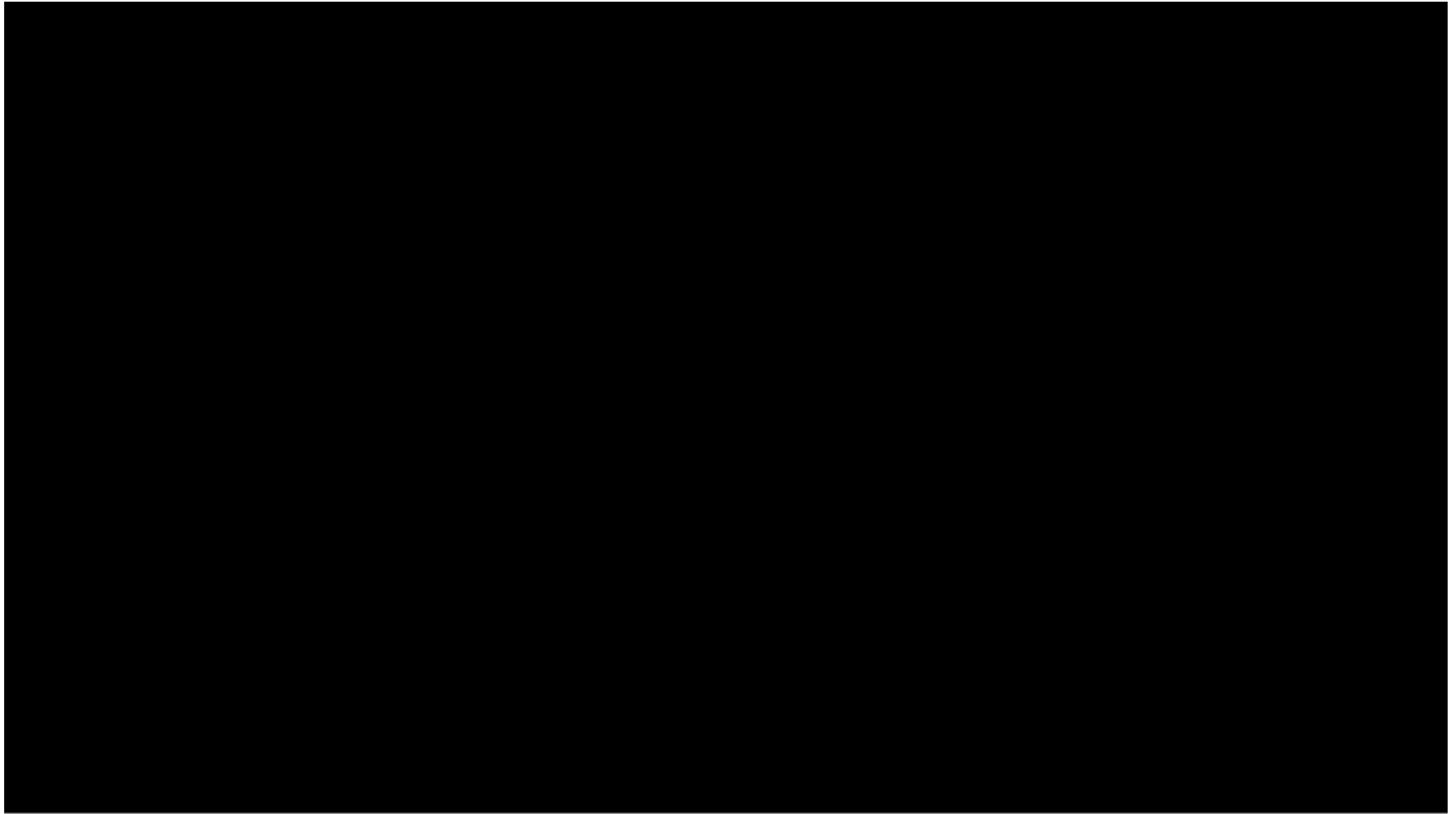


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<http://health.usf.edu/publichealth/create>



# Our Research



<http://bit.ly/tech-helps-indep-seniors>

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# Ambient Intelligence

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In Healthcare

# Ambient Intelligence

Integrates

- Ubiquitous (pervasive) computing
- Smart environments
- Artificial intelligence and machine learning

Aarts (2004)

- *Environments that are sensitive and responsive to the presence of people*
- *Improve quality of life [with] intelligent, personalized, interconnected systems and services*
- *Ambient, distributed, ubiquitous, transparent, intelligent*

# 5 Key Features

<b>Embedded</b>	Many networked devices
<b>Context aware</b>	Recognitions of situational context
<b>Personalized</b>	Learns users' needs and habits
<b>Adaptive</b>	Changes in response to user behavior
<b>Anticipatory</b>	Anticipates actions and needs

Aarts (2004)

# Aml System Process



Aztiria, Izaguerre, Augusto (2010)

# Ambient Intelligence

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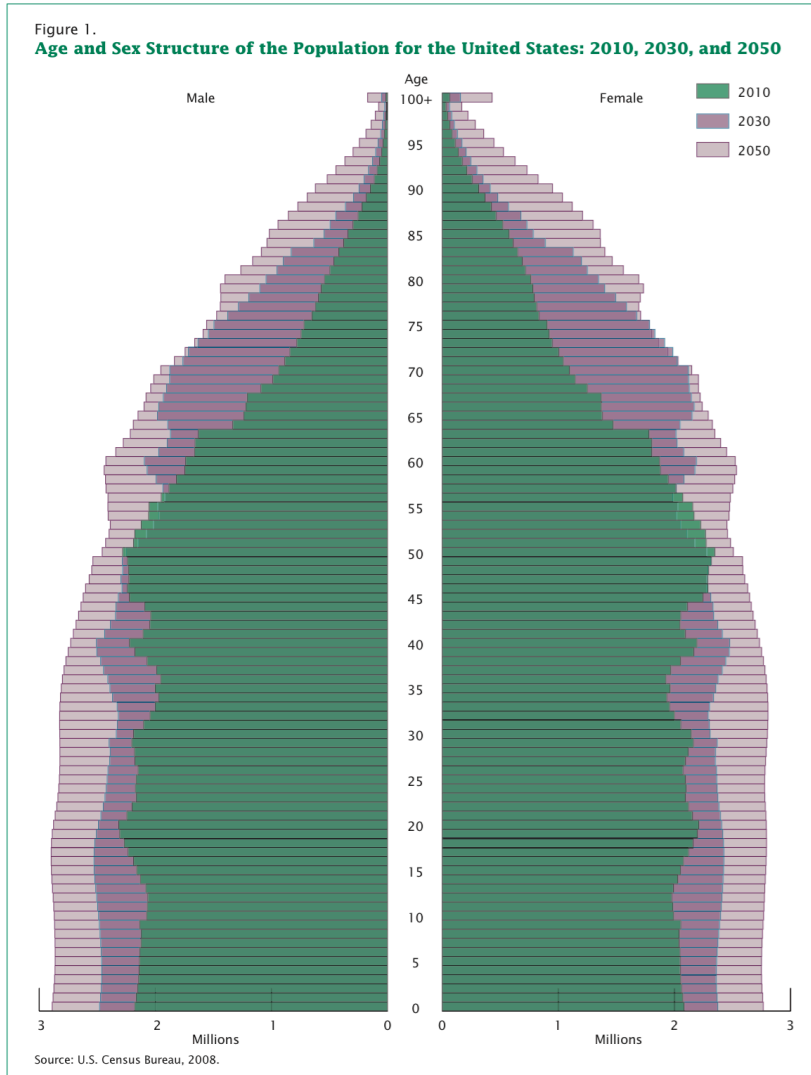
In Senior Healthcare

# Ambient Assisted Living

- Ambient Assisted Living
  - *Ambient Intelligence + Assisted Living*
- Generontechnology
  - *Gerontology + Technology*
- In essence, assisted living technologies for older adults



# A Growing and aging population...

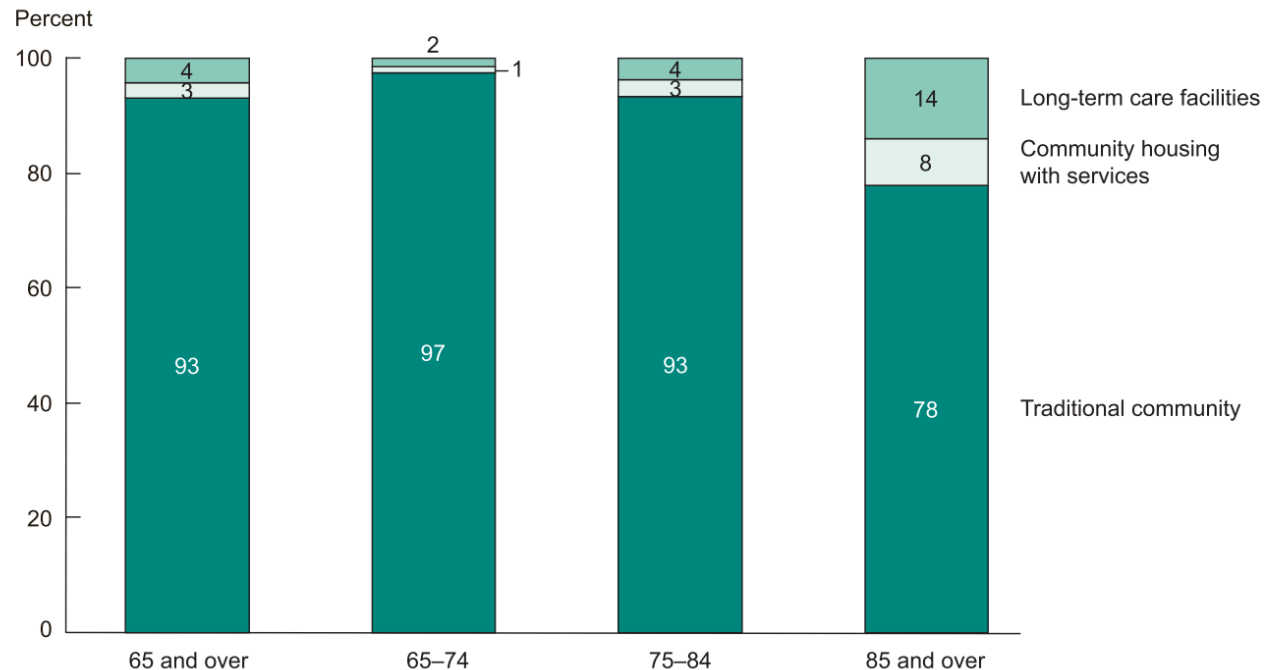


- By 2030
  - 1 in 5 Americans will be 65+
- By 2050
  - 1 in 5 in the world will be 60+
  - 88.5M Americans 65+, double from 2010
- Dependency
  - 22% in 2010 to 36% in 2050

*U.S. Census Bureau, 2010.*

# Living independently...

**Percentage of Medicare enrollees age 65 and over in selected residential settings, by age group, 2009**



NOTE: Community housing with services applies to respondents who reported they lived in retirement communities or apartments, senior citizen housing, continuing care retirement facilities, assisted living facilities, staged living communities, board and care facilities/homes, and similar situations, AND who reported they had access to one or more of the following services through their place of residence: meal preparation; cleaning or housekeeping services; laundry services; help with medications. Respondents were asked about access to these services, but not whether they actually used the services. A residence (or unit) is considered a long-term care facility if it is certified by Medicare or Medicaid; or has 3 or more beds, is licensed as a nursing home or other long-term care facility, and provides at least one personal care service; or provides 24-hour, 7-day-a-week supervision by a non-family, paid caregiver.

Reference population: These data refer to Medicare beneficiaries.

SOURCE: Centers for Medicare and Medicaid Services, Medicare Current Beneficiary Survey.

*U.S. Census Bureau (2010)*

# With chronic & age-related disease

- 8.5 million seniors require some form of assistive care
- 80% of older adults live with at least one chronic disease
- Care for elderly has significant costs
  - Nursing home care costs: \$70,000 to \$80,000 annually
  - Significant costs to informal caregivers: family and relatives
- Insufficient professional caregivers and facilities for the coming “age wave”

# Challenges for Older Adults

- Age-related challenges
  - Physical limitations
  - Perceptual
  - Cognitive
- Chronic age-related diseases
  - Alzheimer's Disease, Dementia
  - Arthritis
  - Hypertension
  - Cardiovascular disease
  - Diabetes

# Role of AAL for Older Adults

- Continuous health monitoring
- Emergency detection
- Cognitive orthotics
- Persuasive applications
- Therapy
- Emotional well-being

# Role of AAL for Older Adults

## **Continuous health monitoring**

- ADL monitoring
- Vital signs
- Sleep monitoring
- Communicate with caregivers, doctors, families
- Guide behavior and compliance
- Early warning

## **Emergency detection**

- Fall detection
- Medical emergency
- Hazard/critical situations

# Role of AAL for Older Adults

## **Cognitive orthotics**

- Daily reminders
- Medication reminders
- Navigation
- Wandering prevention
- Planning

## **Persuasive applications**

- Well-being promotion
- Medical compliance

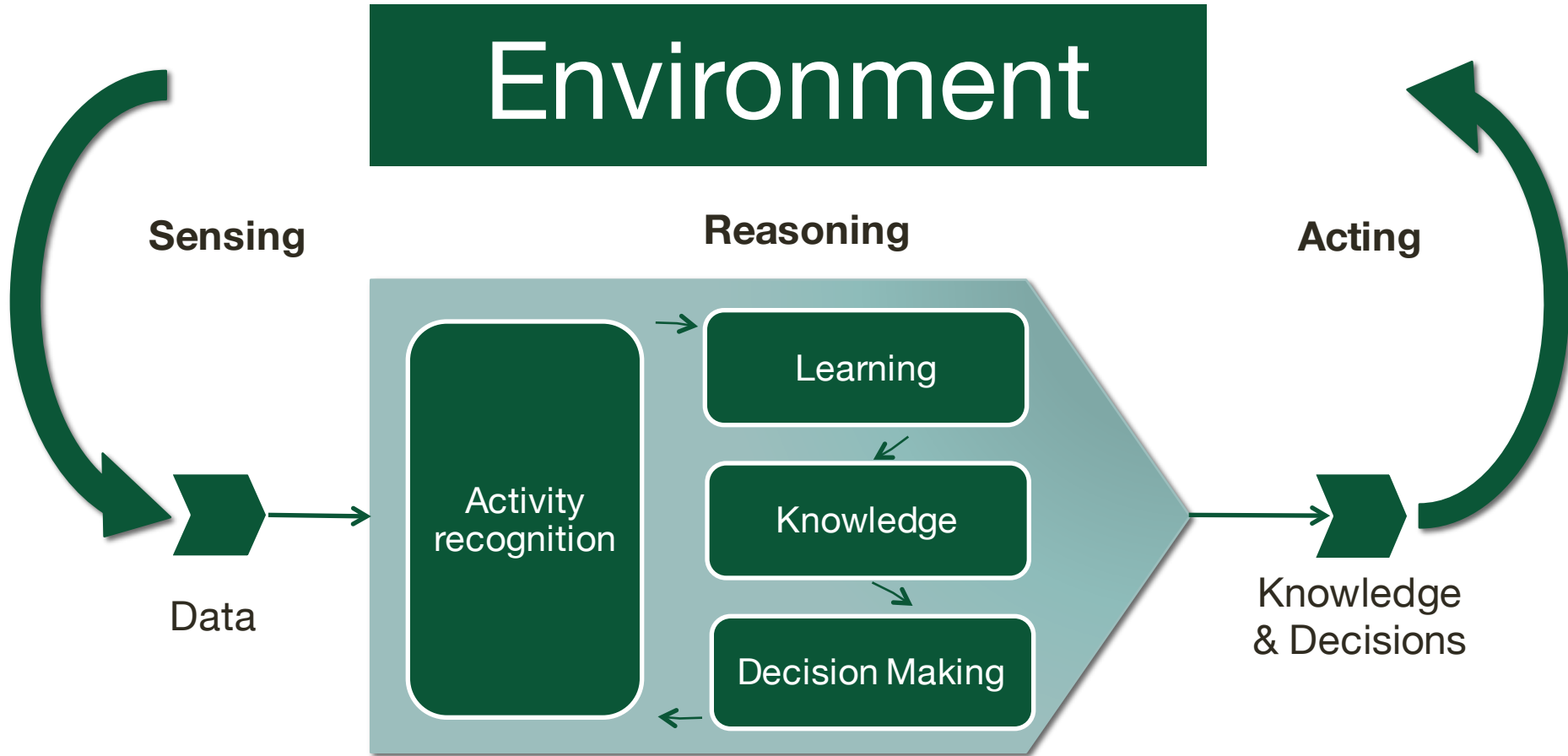
## **Therapy**

- Tele-health/rehabilitation

## **Emotional well-being**

- Social connectedness
- Communication facilitation

# Aml System Process



*Aztiria, Izaguirre, Augusto (2010)*



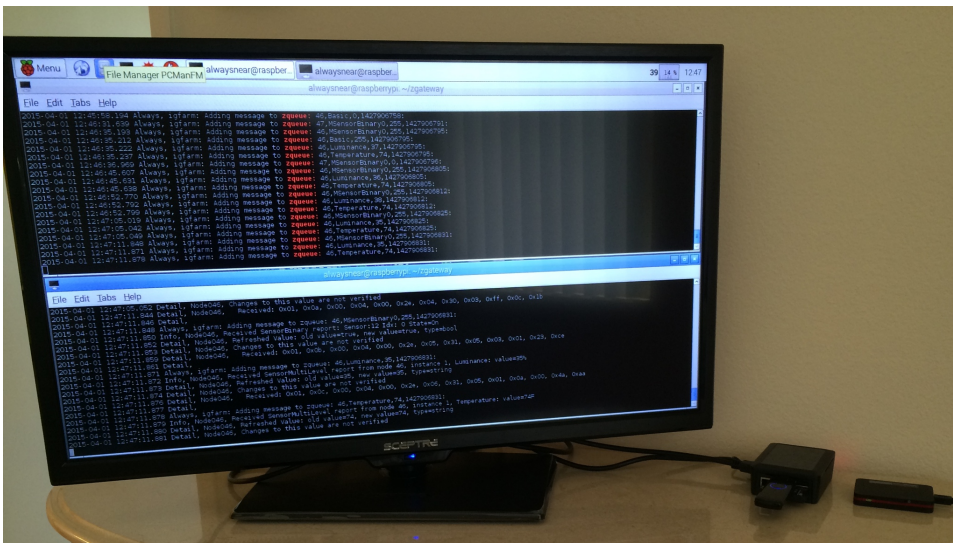
# Always Near

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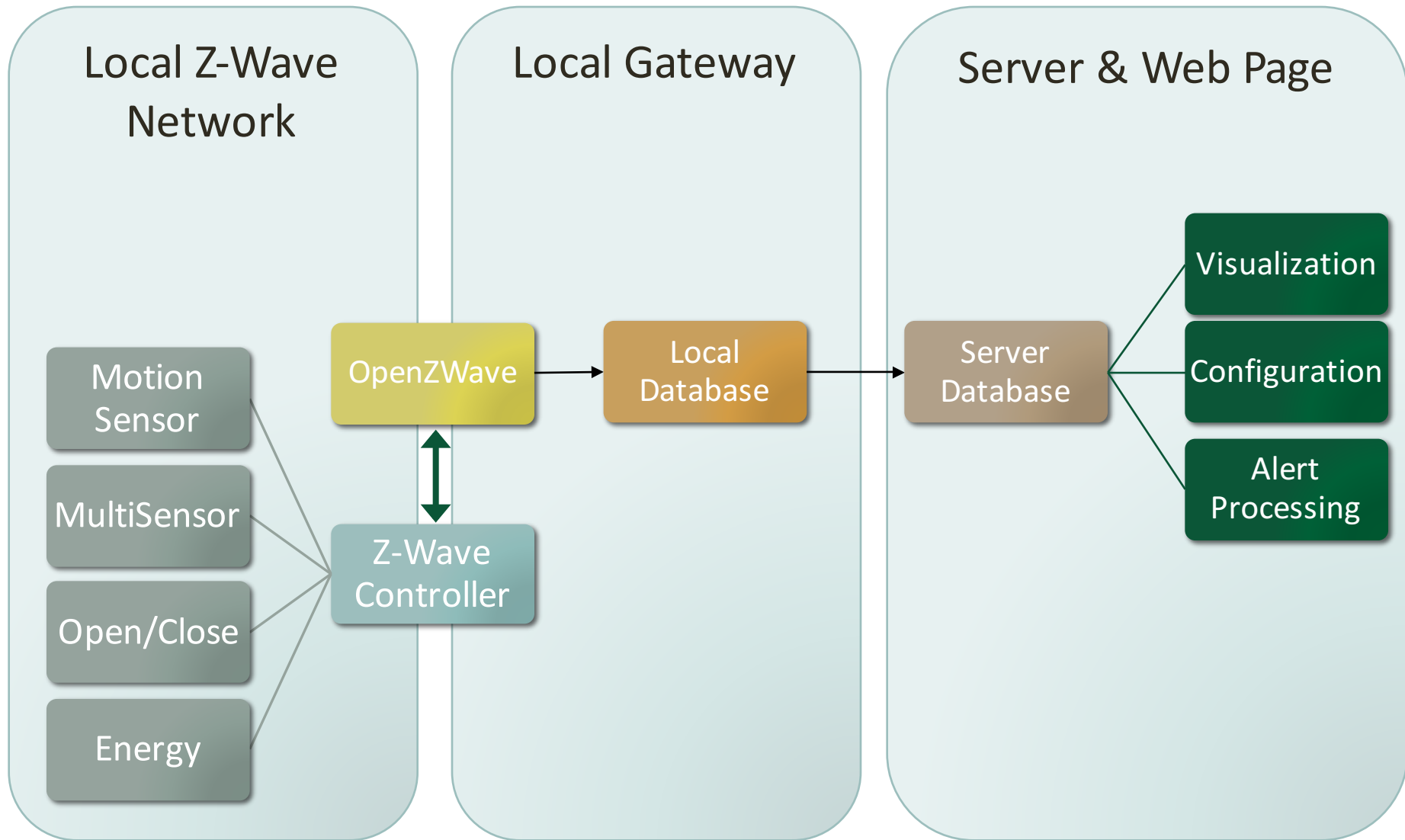
# The Always Near System

- Integrated ambient sensors for in-home monitoring with case management and community-based alert response
- Sensors
  - Presence, motion, contact, pressure, medication usage, panic button
- Web-based dashboard for monitoring by care managers and caregivers

# In-Home Passive Sensing



# System Architecture





# Always Near

[Status](#)[Contacts](#)[Reminders](#)[Notifications](#)[Sensors](#)[Users](#)[Logoff](#)

## Daily Activity For Thursday April 2, 2015

[← Previous Day](#)[→ Next Day](#)[Today](#)[Back to Weekly Activity Summary](#)

Monitor	AM											PM											Summary				
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11		
Bathroom																										1.6 hours	
Bathroom: Toilet Flushed																										8 events	
Bedroom																										0.6 hours	
Bedroom: In Bed																									7.0 hours		
Bedroom: Light Levels																										[1 , 60]	
Front Door Opened																										8 events	
Kitchen																											2.0 hours
Kitchen: Dining Table																										0.7 hours	
Living Room																											7.2 hours
Living Room: On Couch																											5.7 hours
Living Room: Watching TV																										5.2 hours	
Office																										2.1 hours	



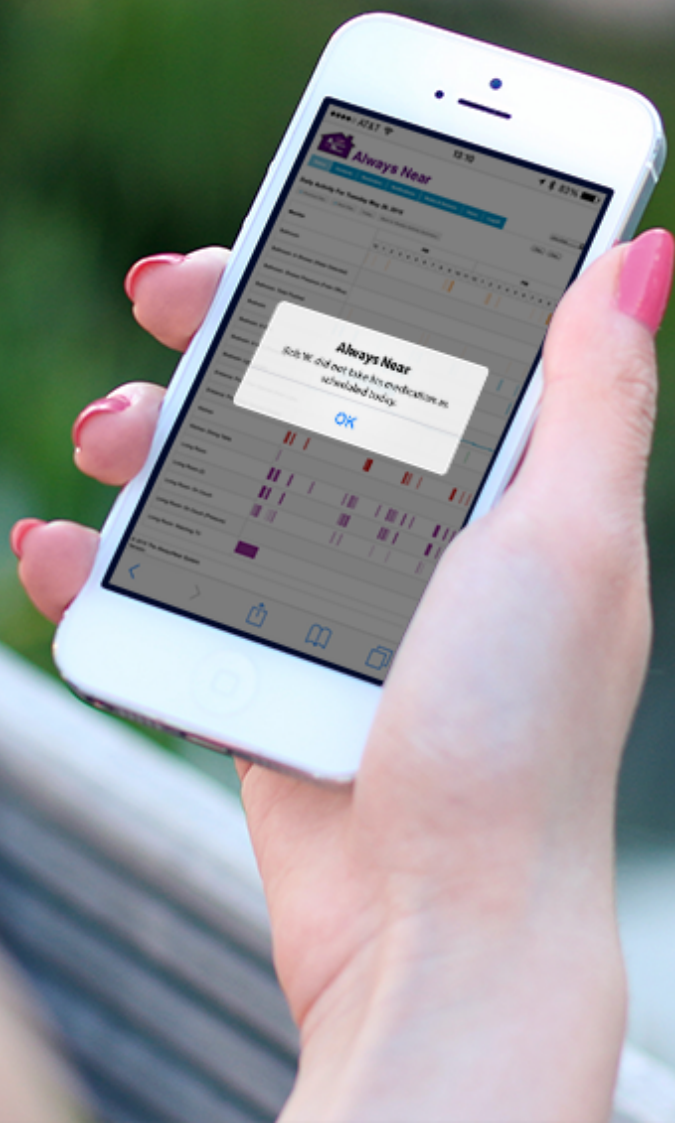
[Back to Weekly Activity Summary](#)

Monitor	AM											PM											Summary			
	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9		10	11	
Bathroom																										2.0 hours
Bathroom: Toilet Flushed																										4 events
Bedroom																										







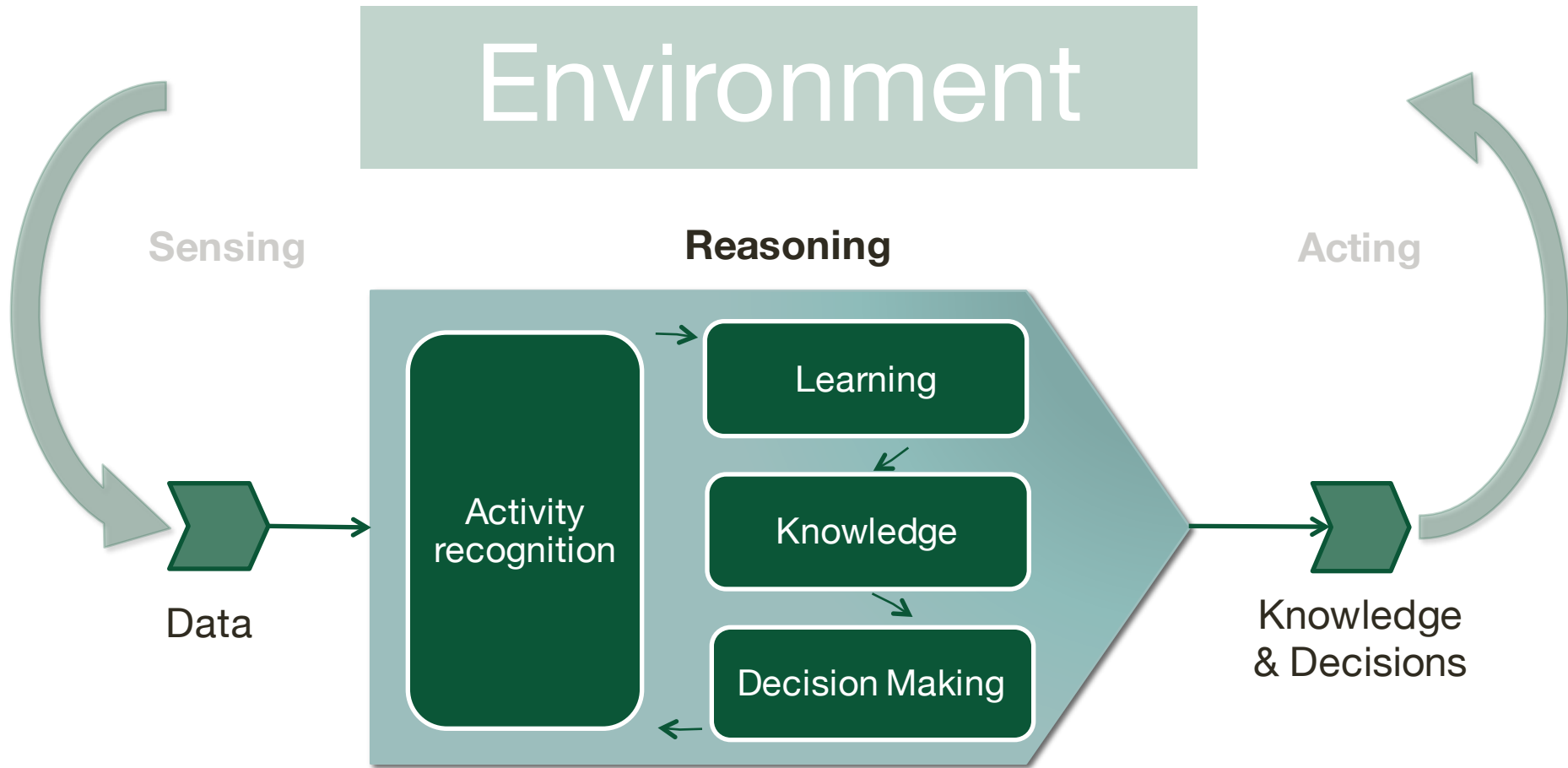




# The Always Near Project

- **Phase 1:** Living Lab Validation
- **Phase 2:** Community Validation & Data Collection
  - Anticipated 60 older adults
  - 6 month participation period
- **Goal:** develop predictive and pattern mining models to detect changes in activity, sleep and medication compliance for early detection of adverse health conditions
- *Sensor-Based, Response-Oriented Technology for In-Home Monitoring of Senior Health & Well Being*

# Future work: data-driven decision making



*Aztiria, Izaguirre, Augusto (2010)*

# Thank you Questions?

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Always Near  
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