



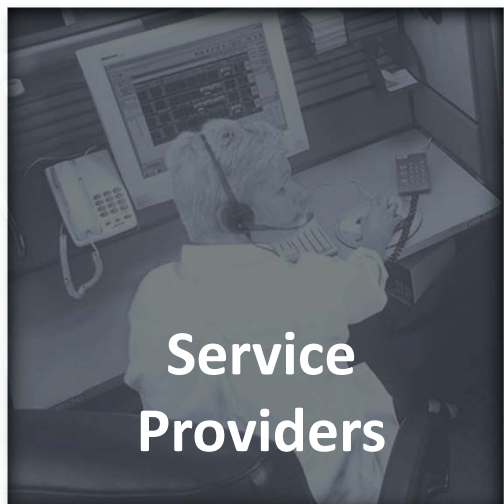
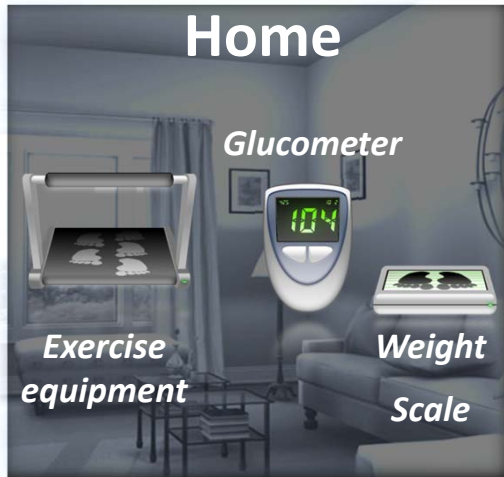
Future Integrated Sensors in Wireless Health

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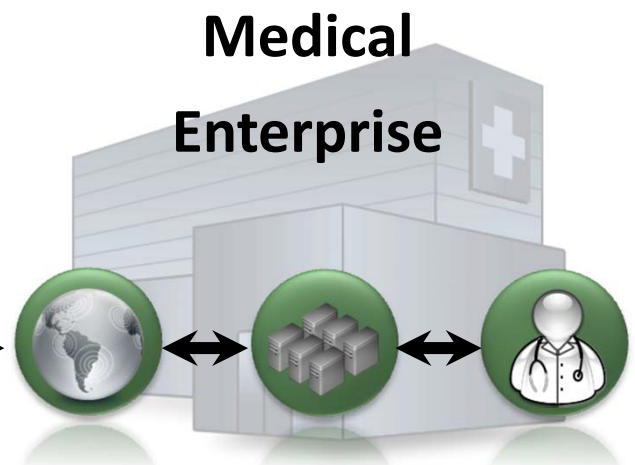
Wireless Health



Body Area and
Local Area
Wireless

Wired/Wireless
WAN
Network

Internet





Wireless Health: Fundamental and Broad-Based Motivations

- Motivation: Healthcare delivery
 - Provides the first means for assuring outcomes in the field
 - Provides the first means for establishing “dosage response curve” for specific subject behaviors (for example, activity)
 - Provides the first in-community advance diagnostics
 - Provides direct method for reducing rate of hospitalization both primary and readmission



Wireless Health: Fundamental and Broad-Based Motivations

- Motivation: Business
 - “World’s largest accessible market” : Robert McCray (WLSA)
- Business sectors
 - Healthcare: Cost of healthcare delivery
 - Telecomm: Platform and service providers
 - Microelectronics: Sensor, embedded through enterprise computing, and communication systems.
 - Information Technology: Data source of unprecedented value



Wireless Health: Integrated Sensor Elements

- Integration
 - Sensors:
 - Physical, environmental, and physiological
 - Sensor Information processing
 - Sensor fusion exploiting *individualized* subject training and classification of subject state
 - Directly addresses sensing uncertainty
 - Embedded computing and body area networks
 - Performance optimized under energy constraints
 - Enterprise computing
 - Signal Search Engine (SSE)
 - Critical inspiration and support
 - Dr. John Cozzens (NSF-CISE)
 - Professor Gregory Pottie
 - Dr. Bruce Dobkin



Wireless Health: Diverse Impact Today

- Stroke Rehabilitation
 - Predicted 1T annual cost
 - Critical need to *guide* activity as primary intervention
- Solution **today**
 - 15 countries and 300 subjects
 - Low cost sensing
 - High performance computing supporting sensor fusion
 - Individual subject models

USB Logging Accelerometer



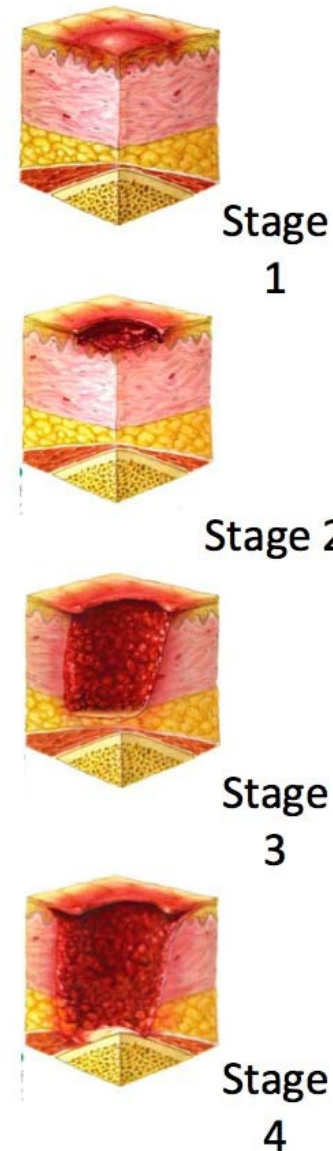
Wireless Accelerometer





Wireless Health: Diverse Impact Today

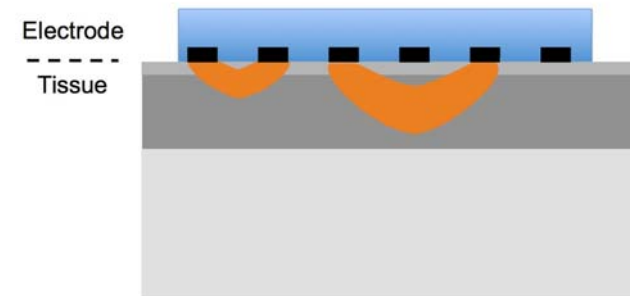
- Acute international need
 - Pressure Ulcers
 - Result from excessive, extended application of pressure to tissue
 - Appear in nursing home, clinic, or residential life
 - National Cost
 - Over 50,000 mortalities in US
 - Over 2M Medicare hospital days annually
 - **New regulatory impact**





Wireless Health: Diverse Impact Today

- Wireless Health Solution: SEM Scanner:
 - First evidence based pressure ulcer detection system
 - Measures subepidermal moisture (SEM)
 - Sensing of tissue dielectric properties
 - Now serving nursing home and clinic communities
 - Wireless guidance and compliance assurance





Wireless Health: Diverse Impact Today

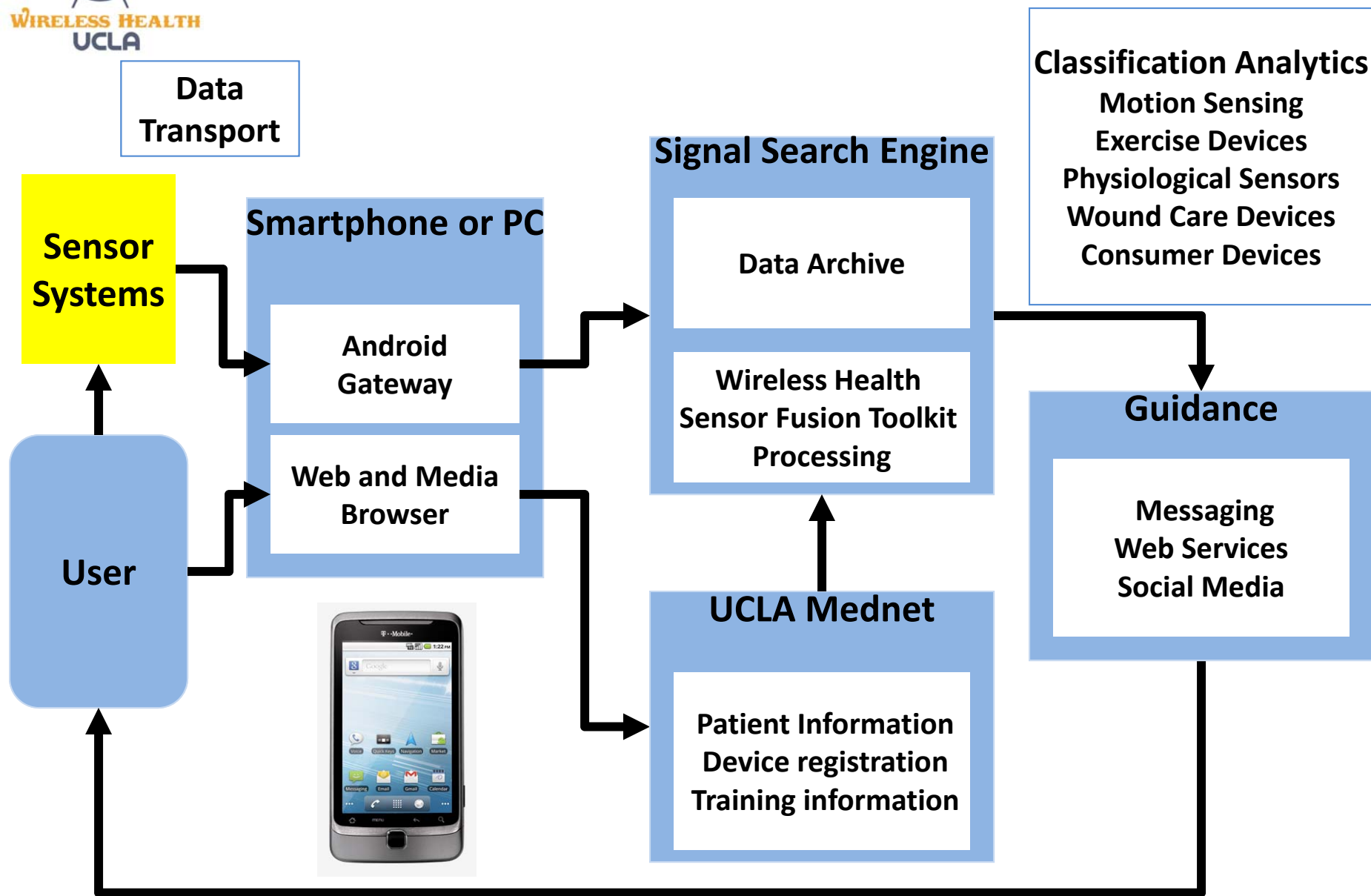
- Human Performance
 - First in-field measurement of biomechanical *efficiency* metrics
 - Wireless *foot* motion sensing
 - Real time data processing and delivery
- **New Vision**
 - *Worldwide, real-time television broadcast*
 - **2012 Los Angeles Marathon**
 - **Race winner: Simon Njoroge**
- Broad Impact
 - Commercial introduction soon
 - Many disciplines





WIRELESS HEALTH
UCLA

New Human Monitoring and Guidance Loop





Wireless Health: Future Integrated Sensors

- New technology world
 - Perhaps our largest and most valuable ever
 - Dedicated to advancing human condition and performance
- Unprecedented system engineering challenges:
 - System integrity at global scale
 - Compliance with usage and guidance
 - Assurance of many requirements of sensor fusion
 - Massive and diverse data return
 - Signal Search Engine
 - *Prediction* of outcomes
 - Resource efficiency
 - Cost, energy, usage
 - Optimization objectives vary with each application