

# Mobile Health (mHealth)

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# mHealth – What is it?

- mHealth:
  - Connected medical and consumer devices (scales, glucometers, etc.) and related tools (Intel's Health Guide) – mainly in the US
    - Bluetooth or cellular network-based
  - Applications on mobile phones – rest of the world
    - SMS (text) or applications

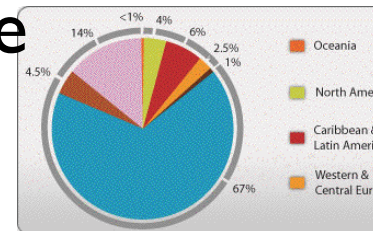


# mHealth – The Opportunity for Mobile Phones

- Chronic Disease Management
  - Social networking (establishing peer networks)
  - Improved communications
  - Advocacy
- 
- Vast scale (95% global penetration by 2013)
  - Low barrier to entry

# mHealth – Chronic Disease Management

- Diabetes – 6.5% global prevalence, 285M worldwide, \$400B USD annually <sup>1</sup>
- HIV/AIDS – 0.5% global prevalence, but 5% in sub-Saharan Africa, and several countries 20-25%, 35M worldwide, children 15% of the new cases and deaths <sup>2</sup>
- Both disease require lifelong therapy, lifestyle modification, and are concomitant with other dz



<sup>1</sup> – International Diabetes Federation (IDF) @ [www.diabetesatlas.org](http://www.diabetesatlas.org)

<sup>2</sup> – AVERT @ [www.avert.org](http://www.avert.org)

# Why focus on mhealth, smart phones, and open?

## mHealth

capacity for impact with access to participants

...all 168 hours of the week...

...all 1440 minutes of the day...

## smartphones

*real time (always on),*

*real place (always carried)*

*real context (always web connected)*

*real powerful (apps, usability)*

## open

broad applicability

heterogeneous users/uses

evolving methodologies

foster innovation ecosystem



# Health & Wellness: observations in daily living/EMAs

Hybrid of time-location trace with media capture and self-report.



Our Actions

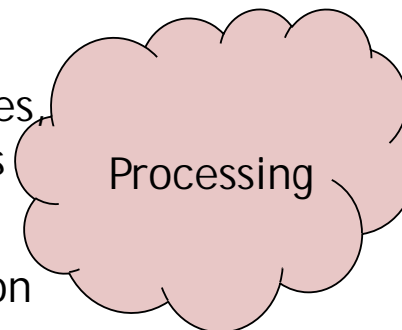


Our Self Report



Geocoded and time-stamped EMAs  
→  
Mobility traces

Private Data Storage



aggregate measures, trends, patterns

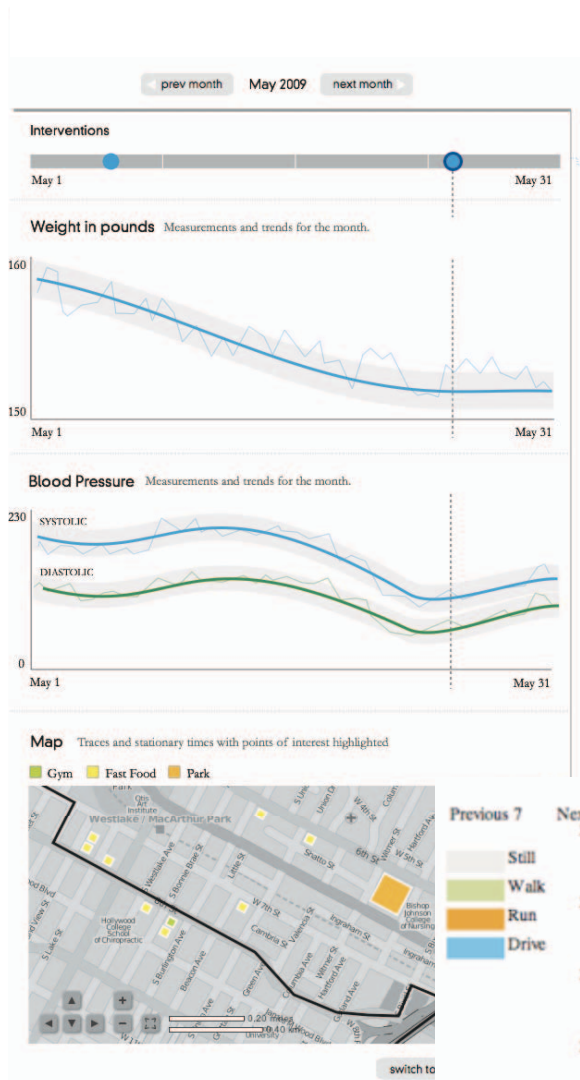
←  
event detection



Visualization

Photo - Marshall Astor

# Integrated personal data stream creates a *Living Record*



Automatically prompted, geocoded, uploaded:

- physiological (BP, glucose...)
- patient reporting (medication, symptoms, stress factors)
- location traces
- contextual, environmental, social factors



And it doesn't require a smartphone to generate telling traces...

<http://your.floatingdata.com>

# Example: health behavior change through self monitoring

real time  
prompting

real place  
observations

real context  
from mapping, GIS,  
social networking

AndWellness

Friday, March 13 02:12

Touch here to take a photo of who you're with.

Duration: quick (< 10 min)

Were you on plan: Yes

Fullness: too full

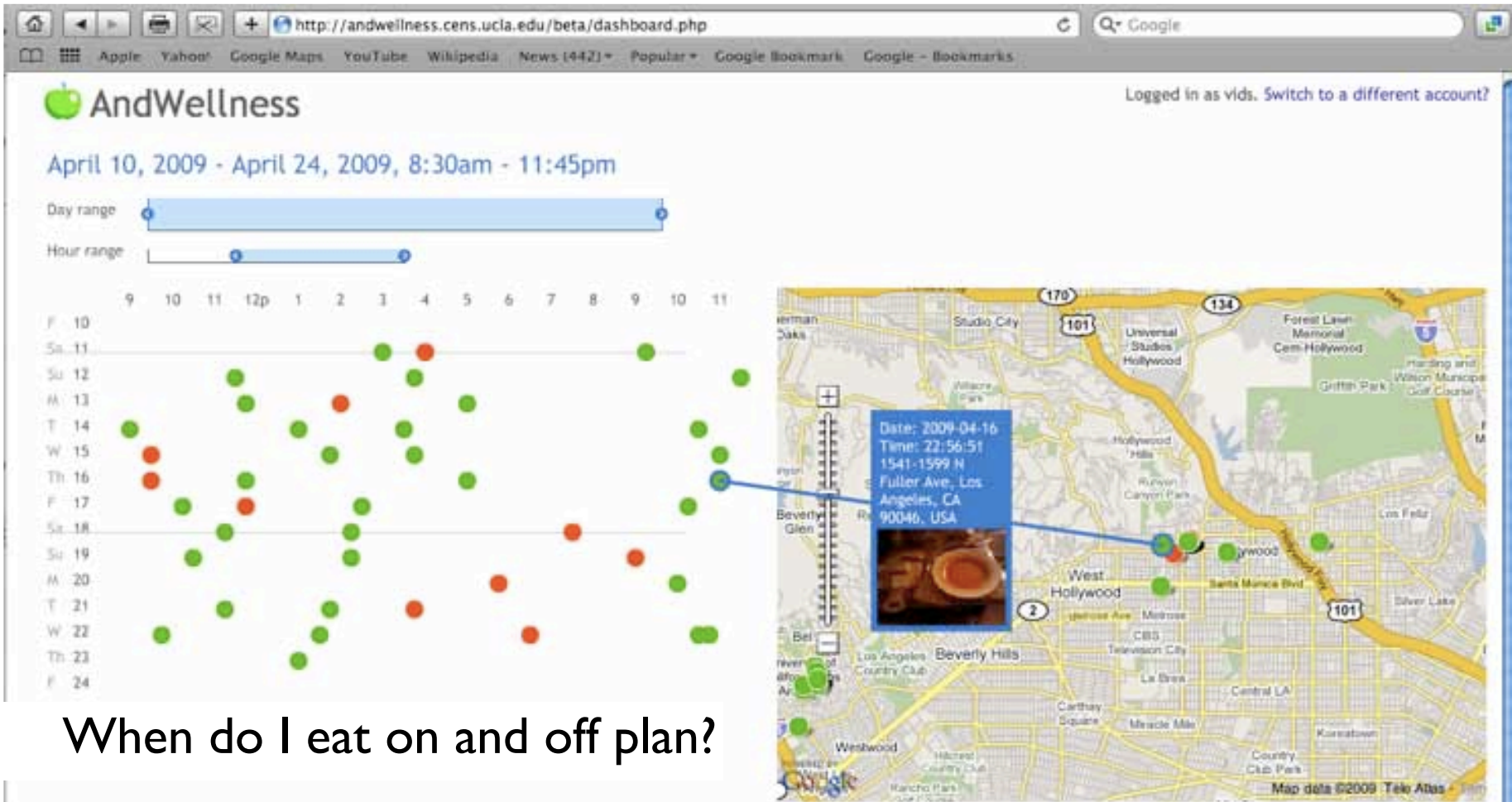
Quality: gold

SNOOZE SUBMIT I haven't Eaten

Slides courtesy of  
Deborah Estrin, PhD



# Web services provide historical, environmental context



When do I eat on and off plan?

Where do I eat on and off plan?

Slides courtesy of  
Deborah Estrin, PhD



<http://andwellness.cens.ucla.edu/beta/demo.php>

# Basic technology/systems are ready to use ...but there are barriers/limitations

## •Technological

- Activity classification: continuous full-day (low-power), accurate
- Usability: interface design, cross-age and multi-layered usability, engagement, adaptive interfaces
- Data visualizations, modeling: beyond maps, calendars and piecharts...
- Data integrity and spam detection
- Interoperability across heterogeneous smartphone clients and health records

## Methodological

- Incentivizing sustained engagement: from participant-feedback and challenges to micro-payments
- Validity and comparability of new mechanisms
- Privacy practices that satisfy needs of individual, researcher, and IRB; and can be supported by technical practice
- Open systems to foster rapid innovation in infrastructure, methodology and evidence based research

# Opportunity to promote new privacy infrastructure and best practices

Slides courtesy of  
Deborah Estrin, PhD  

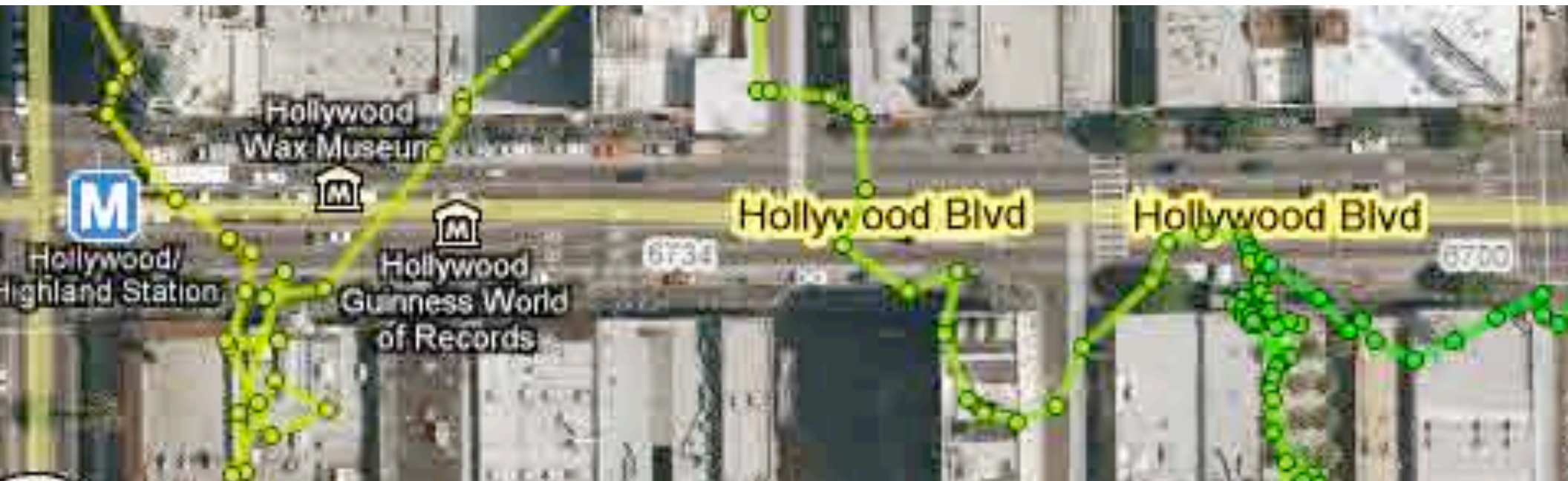

Personal data streams quantify habits, routines, associations

Easy to share and mine; difficult to anonymize

Data handling by mobile carriers, credit card companies, is regulated;  
individual is *free* to capture and share her own data:

*“Everything is free to you, except for the data we collect about you”*

Calls for new privacy practices...*personal data vaults*



# General mobile to web architecture supports scalable, affordable, quickly-deployable use-cases

## General flow

## Meaningful use-cases

**APPLICATIONS**  
web, researchers/  
health providers/community

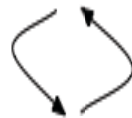


**PROCESSING**  
mobile device and  
web Services



**DATA CAPTURE**  
mobile device  
and individual

Chronic disease  
monitoring/mngmt



Activity, mobility  
trends



Location  
traces

Health behavior  
change/adherence



Health behavior  
diaries

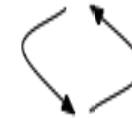


Geo-coded,  
prompted  
entries

Health worker/  
Caregiver support



Environmental  
assessments, Client  
dashboards:  
followups, triggers



Geo-coded  
entries, image,  
annotation