Continua Health Alliance: Architectural Overview & Comparison with 2009 Phoenix Architecture

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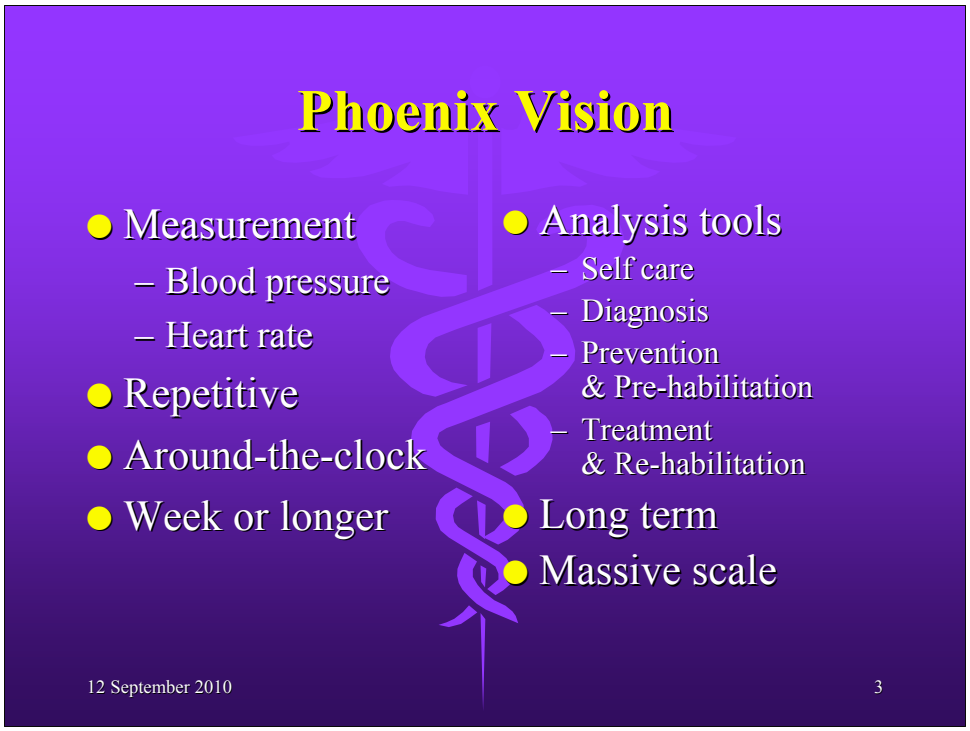


Repetitive -- automatic, periodic measurement

Around-the-clock -- regardless of person's activity

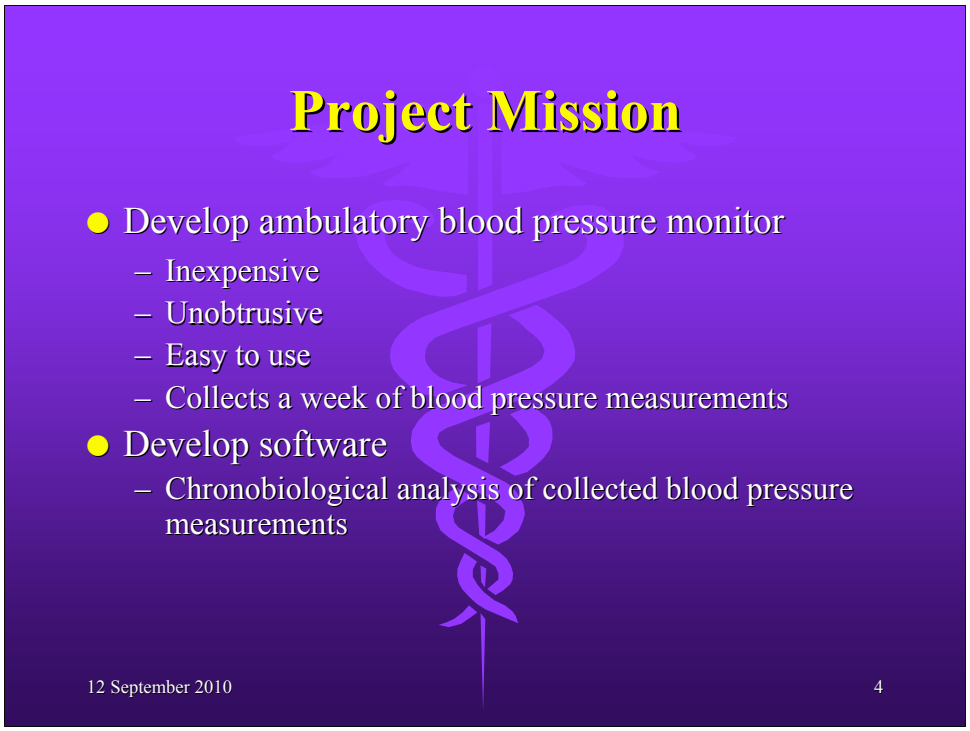
Week or longer -- initially, collect at least one week of data per session

Long term -- data for an individual may span the individual's life

Massive scale

From current load of hundreds of sessions per year

To millions of sessions per year



Inexpensive

•Price not a barrier to use
•Less expensive than blood pressure cuff
•Comparably priced to other personal accessories (less expensive than wrist watch; < US$50)
•Globally affordable (less expensive than "two bushels of yams"; < US$10)

Unobstrusive

•When wearing monitor, patient can
    •Forget about, be unaware of device
    •No more encumbering than wrist watch, Band-aid™, piece of jewelry
•Usable wherever the patient is
    •At home, at work
    •Not only in clinical setting

Easy to use

•Easier to use than current BP cuffs, home BP monitors
•Patient can:
    •Ignore device
    •Determine that device is functioning normally
    •Observe a blood pressure and heart rate measurement
•Device is automatic -- takes measurements regardless of patient behavior
•Allows manually initiated measurements

Architectural Requirements

- Inexpensive
  - Open source
  - Free intellectual property, volunteer labor
- Highly decomposed
  - Consequence of open source
  - Each component quickly engineered by very small team (usually one person)
- Extensible -- highly recomposable
  - Consequence of multiple actors, vaguely organized
  - Evolving user classes, usage scenarios, environments
  - Highly re-usable components

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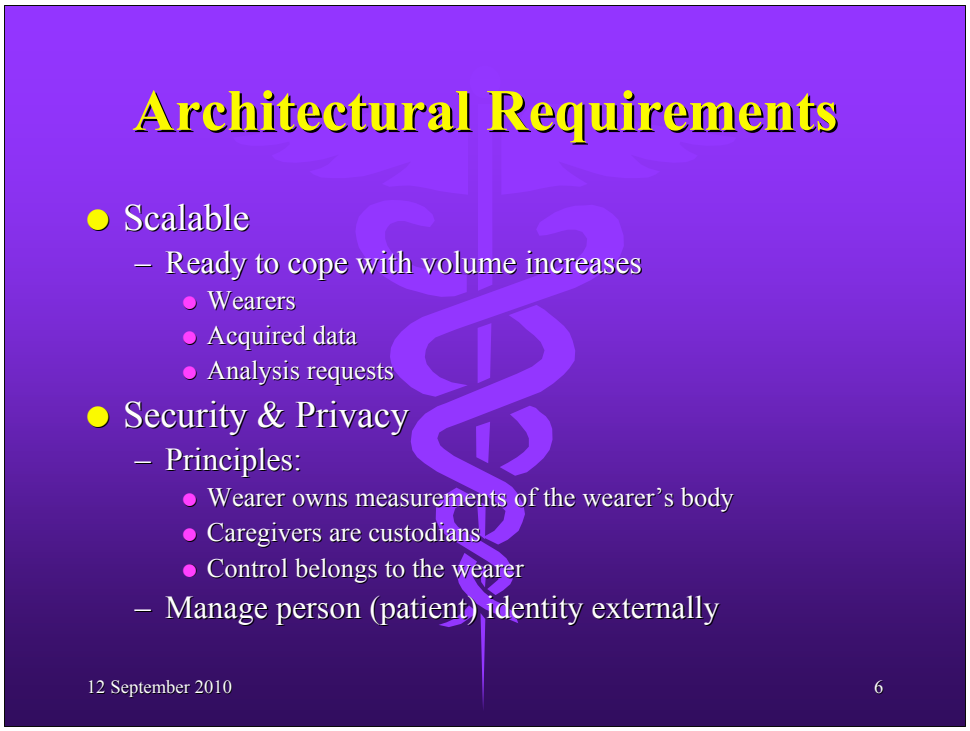
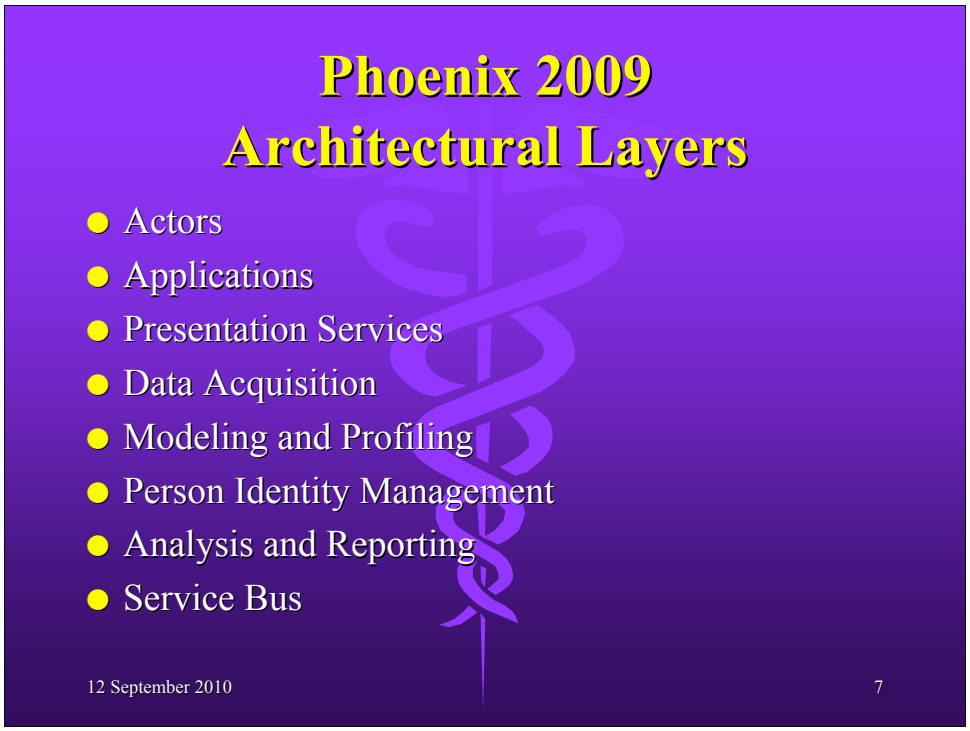


NOTE: Project has not yet investigated security issues


Phoenix 2009
Architectural Layers
Actors
Applications
Presentation Services
Data Acquisition
Modeling and Profiling
Person Identity Management
Analysis and Reporting
Service Bus
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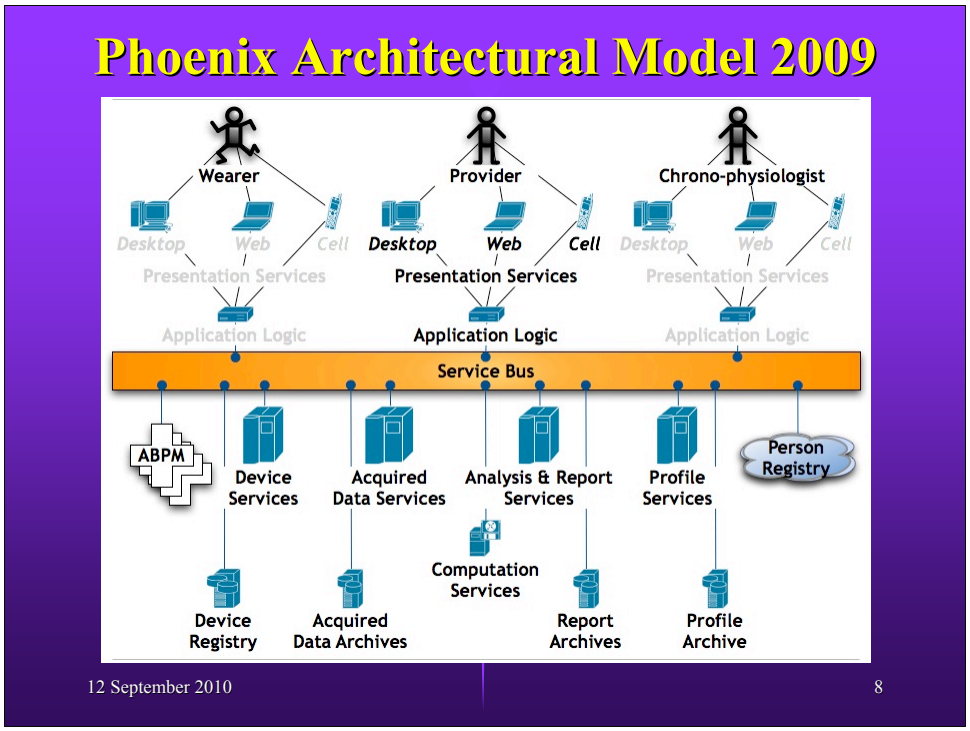
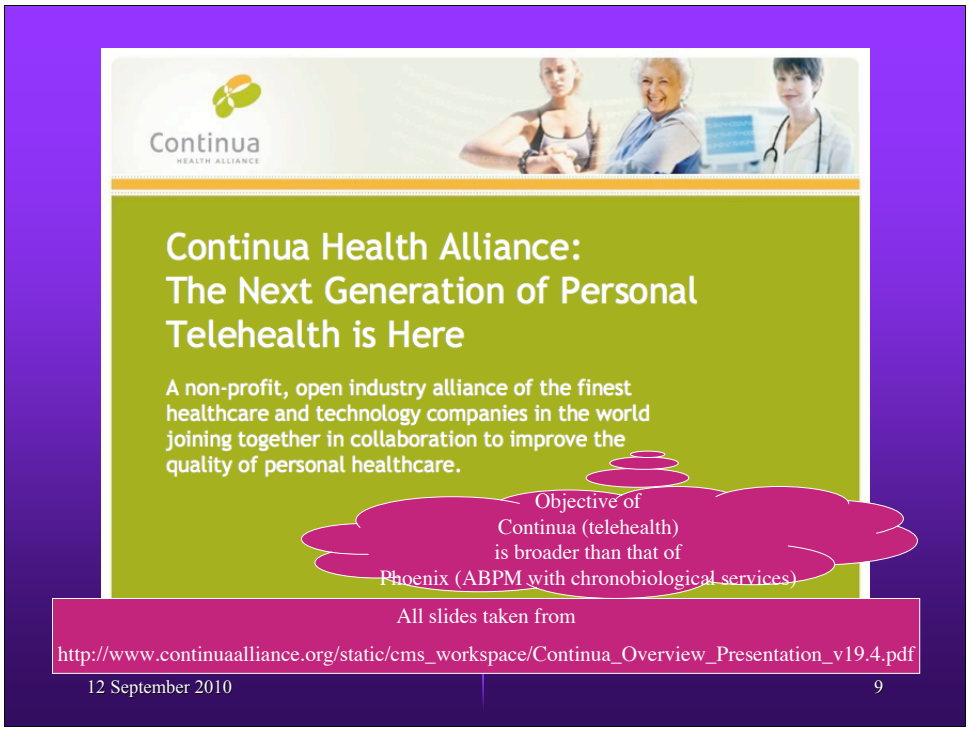


Two compatible architectural styles:

1. Service Oriented Architecture (SOA) -- loosely coupled, distributed computing
2. Cloud computing -- internet-based computing, with shared resources available on-demand

Advantage: promotes decomposition and recomposition

Disadvantage: ABPM as a service seems a stretch


Continua
HEALTH ALLIANCE
Continua Health Alliance:
The Next Generation of Personal Telehealth is Here
A non-profit, open industry alliance of the finest healthcare and technology companies in the world joining together in collaboration to improve the quality of personal healthcare.
Objective of Continua (telehealth) is broader than that of Phoenix (ABPM with chronobiological services)
All slides taken from
http://www.continuaalliance.org/static/cms_workspace/Continua_Overview_Presentation_v19.4.pdf
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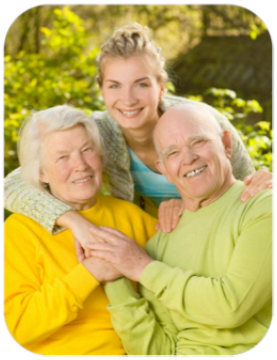
Continua Health Alliance



"Our Mission is to establish an eco-system of interoperable personal health systems that empower people & organizations to better manage their health and wellness"

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Continua
The Continuum of Care
Infant
Amateur Athlete
Diet/Fitness Focused
Worried Well
Chronic Patient
Acute Recovery
Elderly Living Independently
CONTINUUM of LIFE
Continua Health Alliance enables a personal health eco-system that empowers individuals & families to better manage their own health and wellness across the continuum of life and care methods.
CONTINUUM of CARE GIVERS
New Parents
Fitness Wellness Coach
The Family
Home Nursing Professional
Doctor/NP/Nurse
7/19/2010
3
High degree of alignment with Phoenix
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Additional Phoenix challenge: broaden chronomedicine beyond its current scope of sleep therapy

Continua Use Cases

http://www.continuaalliance.org/connected-health-vision/aging-independently.html

http://www.continuaalliance.org/connected-health-vision/health-and-wellness.html

http://www.continuaalliance.org/connected-health-vision/disease-management.html

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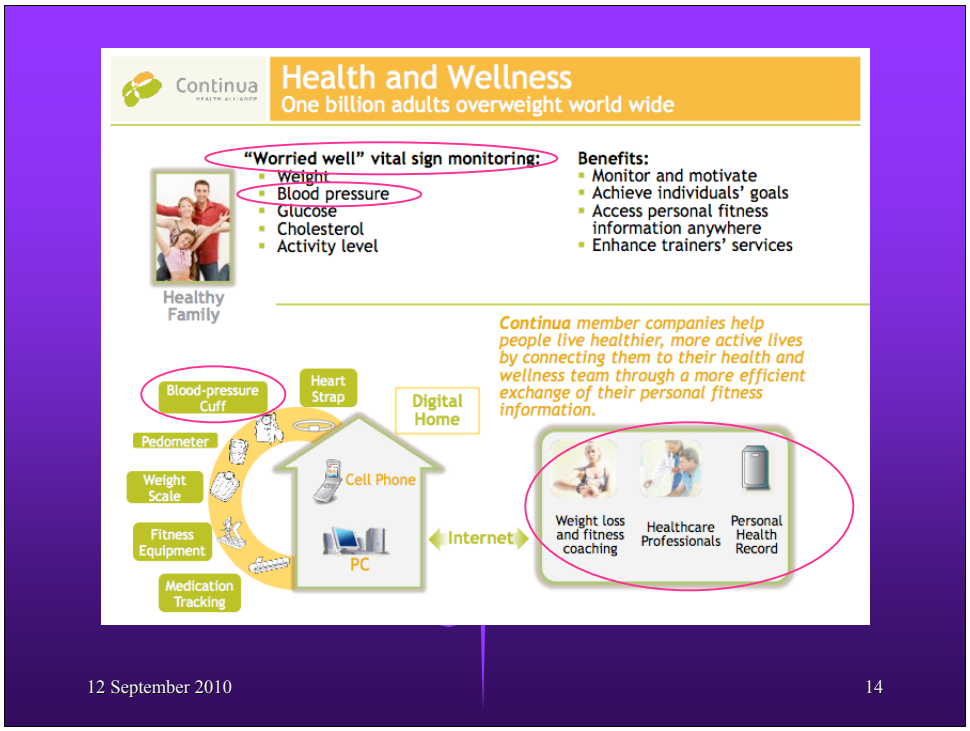
Continua
Health and Wellness
One billion adults overweight world wide
"Worried well" vital sign monitoring:
Weight
Blood pressure
Glucose
Cholesterol
Activity level
Benefits:
Monitor and motivate
Achieve individuals' goals
Access personal fitness information anywhere
Enhance trainers' services
Healthy Family
Continua member companies help people live healthier, more active lives by connecting them to their health and wellness team through a more efficient exchange of their personal fitness information.
Blood-pressure Cuff
Heart Strap
Digital Home
Pedometer
Weight Scale
Fitness Equipment
Medication Tracking
Cell Phone
PC
Internet
Weight loss and fitness coaching
Healthcare Professionals
Personal Health Record
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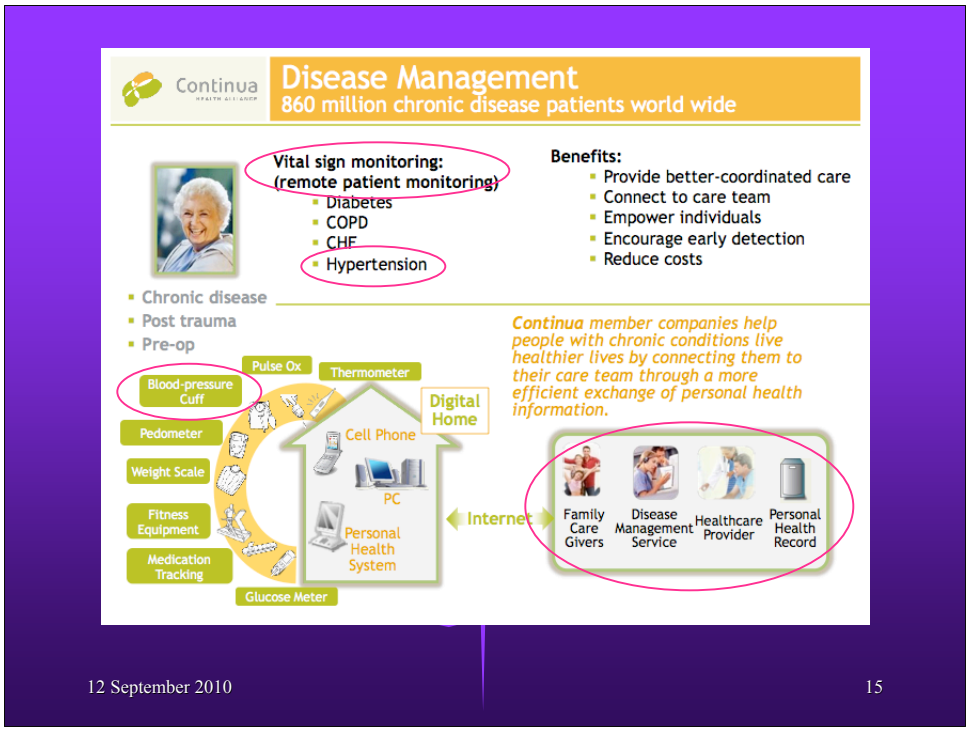
Continua
Disease Management
860 million chronic disease patients world wide
Vital sign monitoring:
(remote patient monitoring)
Diabetes
COPD
CHF
Hypertension
Benefits:
Provide better-coordinated care
Connect to care team
Empower individuals
Encourage early detection
Reduce costs
Chronic disease
Post trauma
Pre-op
Continua member companies help people with chronic conditions live healthier lives by connecting them to their care team through a more efficient exchange of personal health information.
Pulse Ox
Thermometer
Blood-pressure Cuff
Pedometer
Weight Scale
Fitness Equipment
Medication Tracking
Glucose Meter
Digital Home
Cell Phone
PC
Personal Health System
Internet
Family Care Givers
Disease Management Service
Healthcare Provider
Personal Health Record
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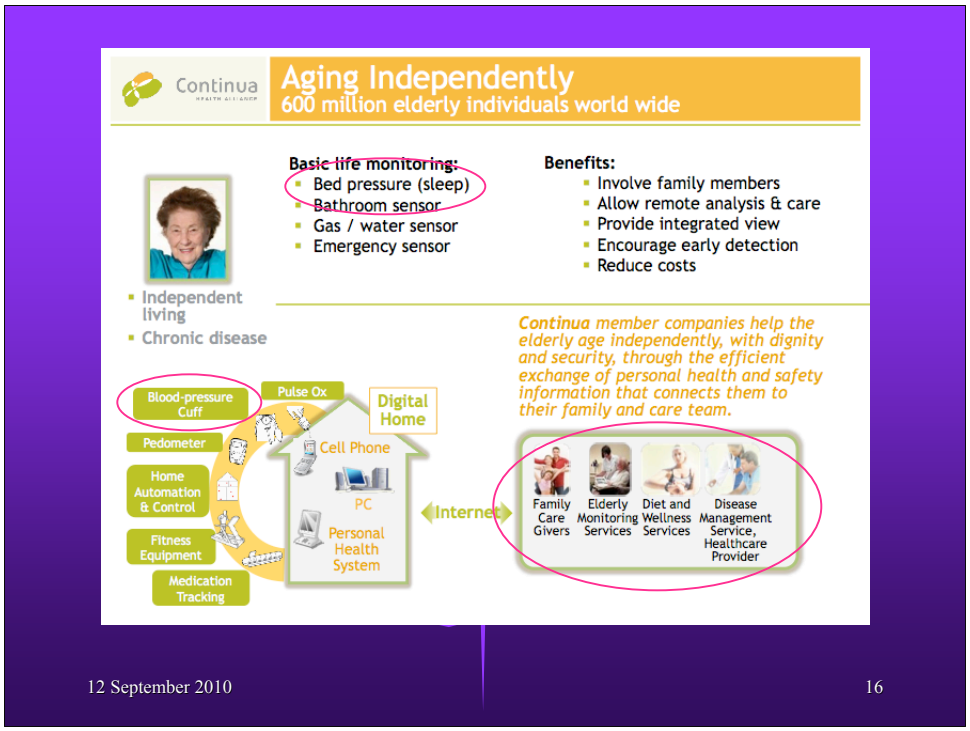
Continua
Aging Independently
600 million elderly individuals world wide
Basic life monitoring:
Bed pressure (sleep)
Bathroom sensor
Gas / water sensor
Emergency sensor
Benefits:
Involve family members
Allow remote analysis & care
Provide integrated view
Encourage early detection
Reduce costs
Independent living
Chronic disease
Continua member companies help the elderly age independently, with dignity and security, through the efficient exchange of personal health and safety information that connects them to their family and care team.
Blood-pressure Cuff
Pulse Ox
Digital Home
Pedometer
Cell Phone
Home Automation & Control
PC
Fitness Equipment
Personal Health System
Medication Tracking
Internet
Family Care Givers
Elderly Monitoring Services
Diet and Wellness Services
Disease Management Service, Healthcare Provider
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Continua

Guidelines → Certification → Recognizable Logo

Guidelines

Continua member companies will select connectivity standards and publish Guidelines for strict interoperability.

Certification and Logo

Continua is establishing a test and certification program with a recognizable logo signifying the promise of interoperability with other certified products.

Electronic Media / Software

Product Packaging

Product Applications

Product Substrates

Continua CERTIFIED

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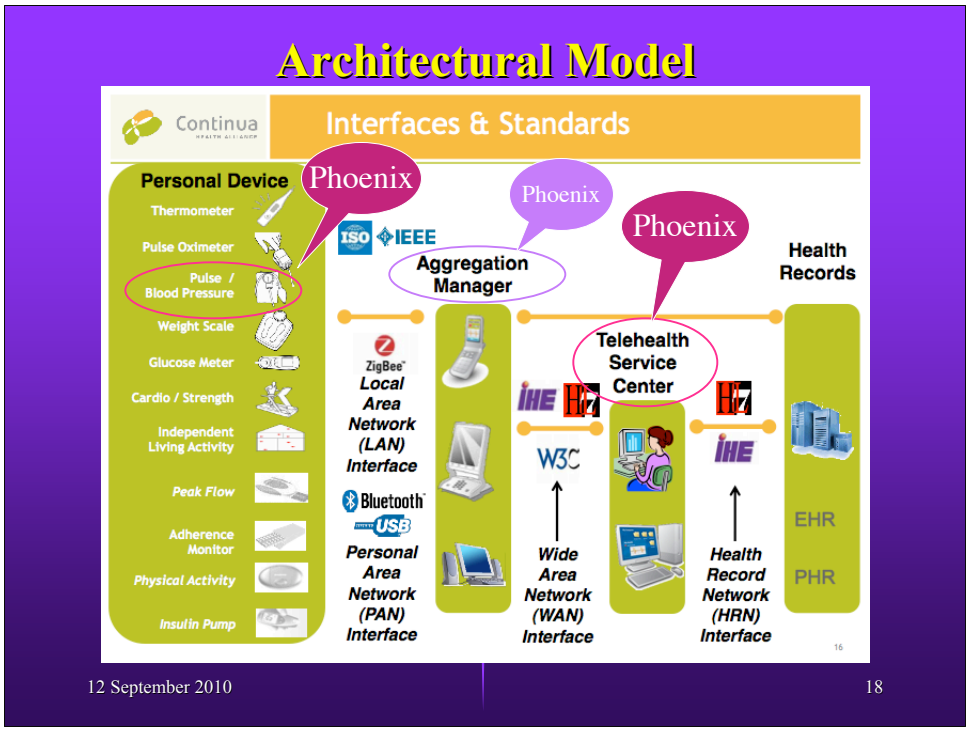
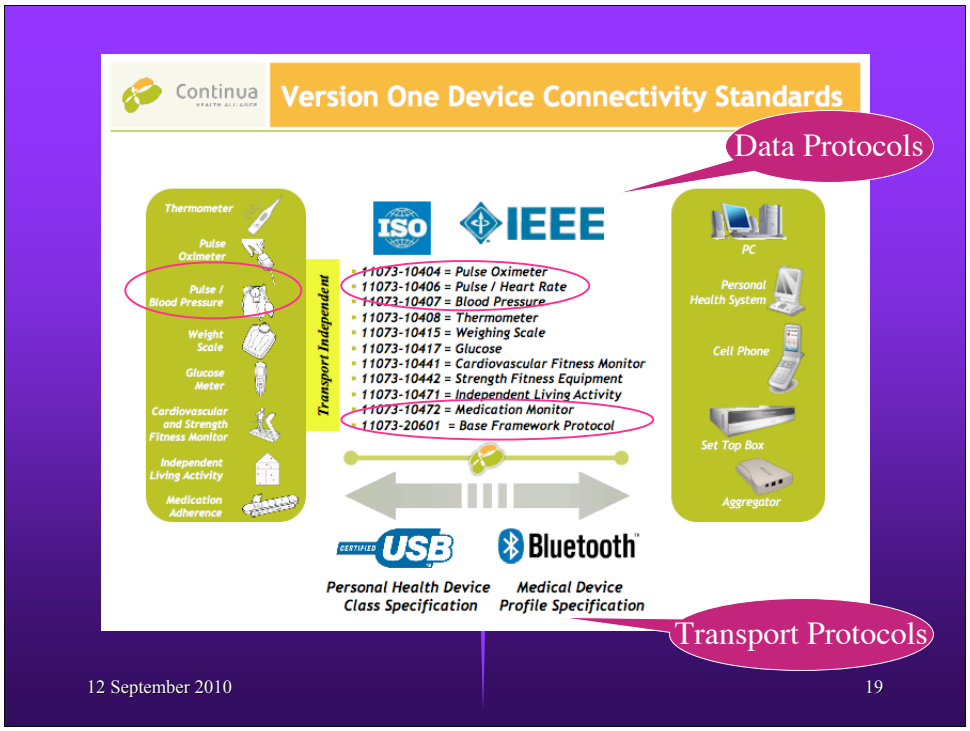


ZigBee -- wireless protocol based on IEEE 802.15.4, which is longer range the Bluetooth. Low power consumption. Designed for device interconnection.

"ZigBee was created to address the market need for a cost-effective, standards-based wireless networking solution that supports low data-rates, low-power consumption, security, and reliability.

"ZigBee is the only standards-based technology that addresses the unique needs of most remote monitoring and control and sensory network applications."


Continua
Version One Device Connectivity Standards
Data Protocols
Thermometer
Pulse Oximeter
Pulse / Blood Pressure
Weight Scale
Glucose Meter
Cardiovascular and Strength Fitness Monitor
Independent Living Activity
Medication Adherence
Transport Independent
ISO
IEEE
11073-10404 = Pulse Oximeter
11073-10406 = Pulse / Heart Rate
11073-10407 = Blood Pressure
11073-10408 = Thermometer
11073-10415 = Weighing Scale
11073-10417 = Glucose
11073-10441 = Cardiovascular Fitness Monitor
11073-10442 = Strength Fitness Equipment
11073-10471 = Independent Living Activity
11073-10472 = Medication Monitor
11073-20601 = Base Framework Protocol
PC
Personal Health System
Cell Phone
Set Top Box
Aggregator
USB
Bluetooth
Personal Health Device Class Specification
Medical Device Profile Specification
Transport Protocols
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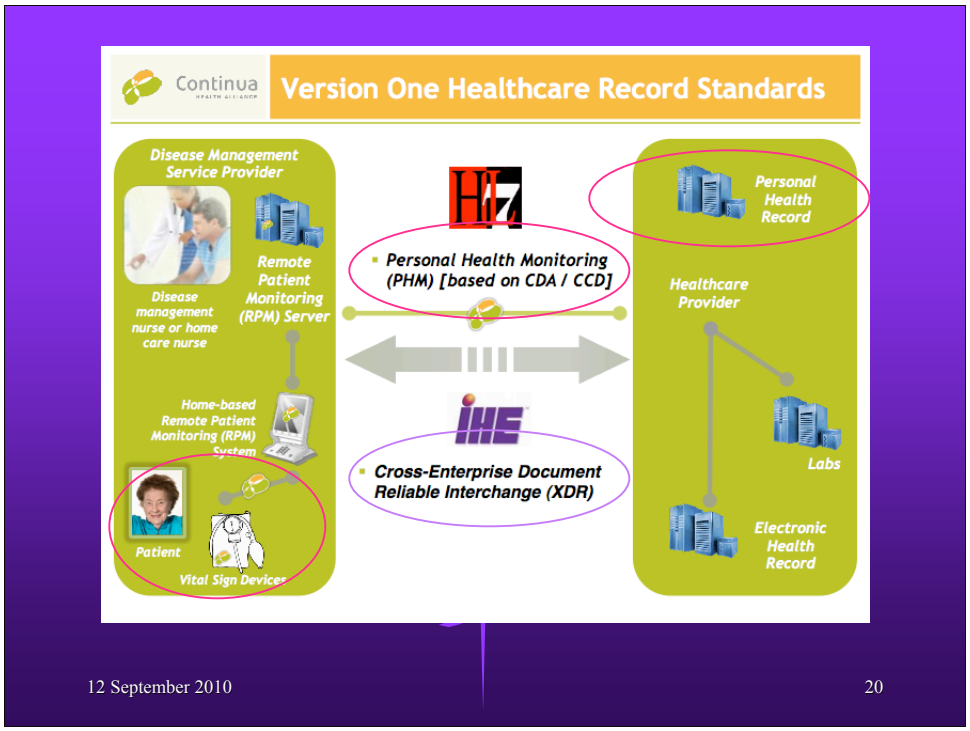
Continua
Version One Healthcare Record Standards
Disease Management Service Provider
Disease management nurse or home care nurse
Remote Patient Monitoring (RPM) Server
Home-based Remote Patient Monitoring (RPM) System
Patient
Vital Sign Devices
HL7
Personal Health Monitoring (PHM) [based on CDA / CCD]
IHE
Cross-Enterprise Document Reliable Interchange (XDR)
Personal Health Record
Healthcare Provider
Labs
Electronic Health Record
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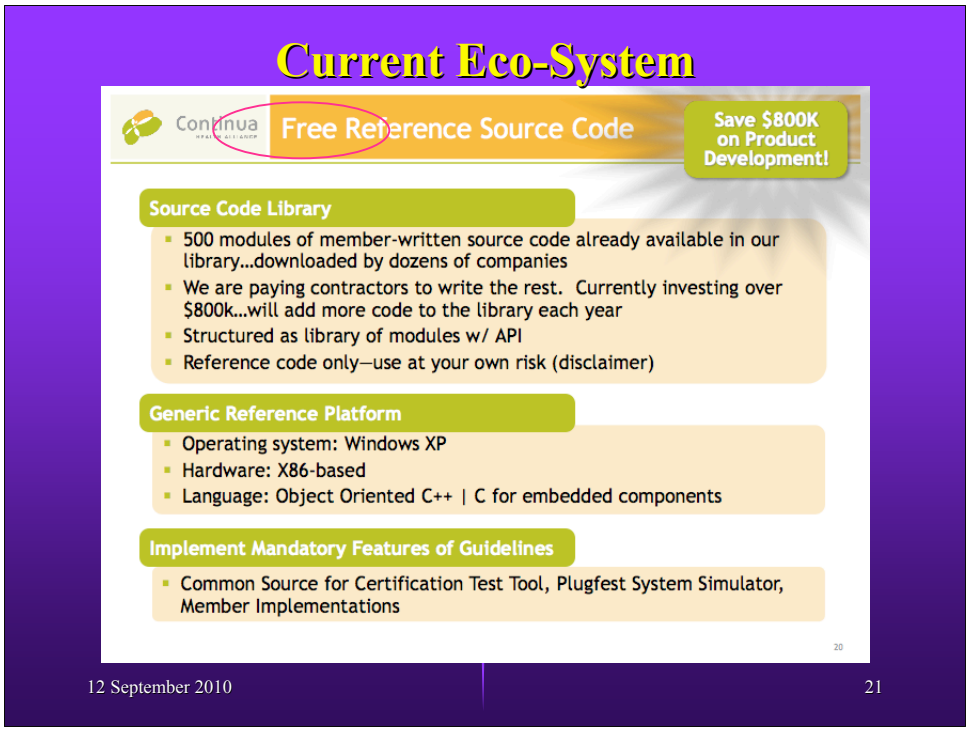
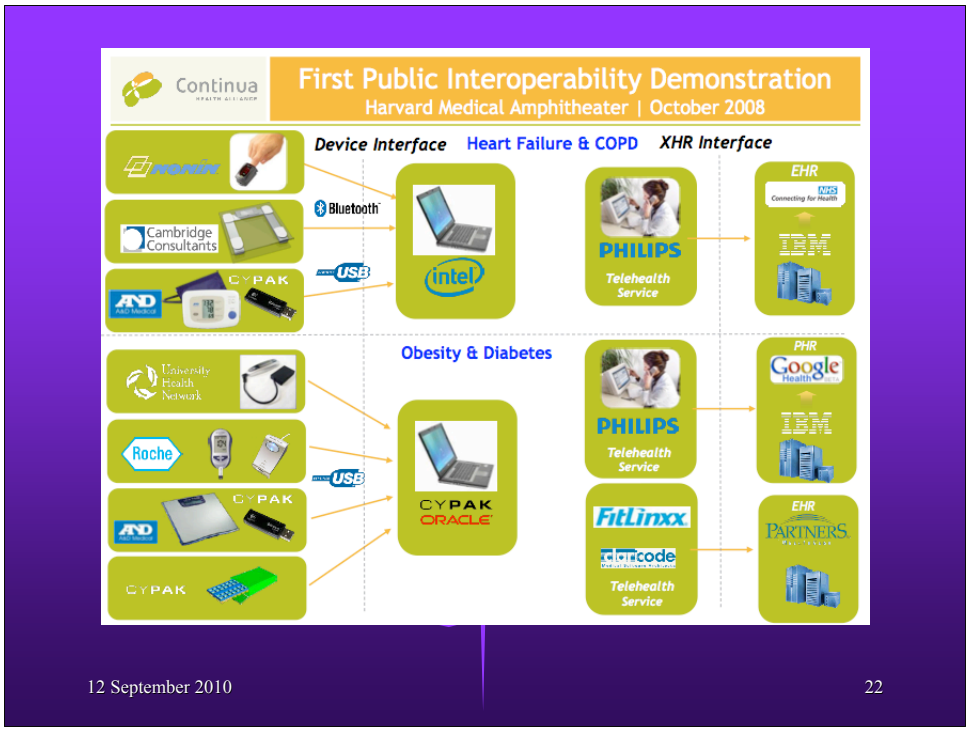
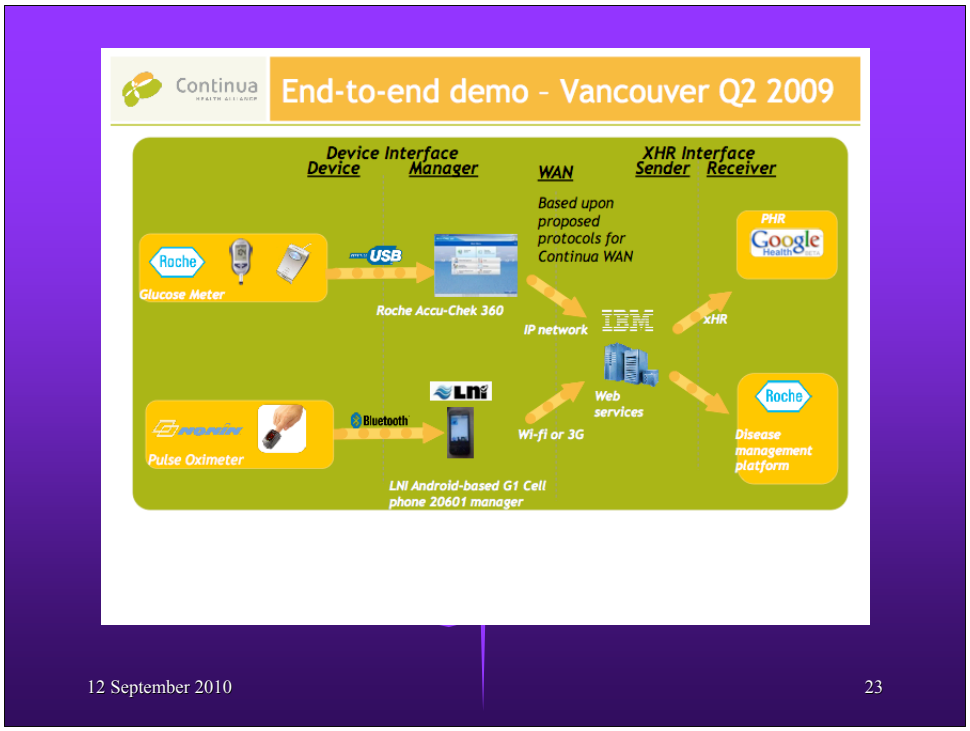


The source code is “free” with annual membership: $6500

External design guidelines alone: “free” with membership, $500 without



COPD = chronic obstructive pulmonary disease (e.g., asthma, chronic bronchitis, pulmonary emphasema)


Continua
End-to-end demo - Vancouver Q2 2009
Device Interface
Device
Manager
WAN
XHR Interface
Sender
Receiver
Based upon proposed protocols for Continua WAN
PHR
Google Health
Roche
Glucose Meter
USB
Roche Accu-Chek 360
IP network
IBM
xHR
Web services
Roche
Disease management platform
LNI
Bluetooth
Wi-fi or 3G
Pulse Oximeter
LNI Android-based G1 Cell phone 20601 manager
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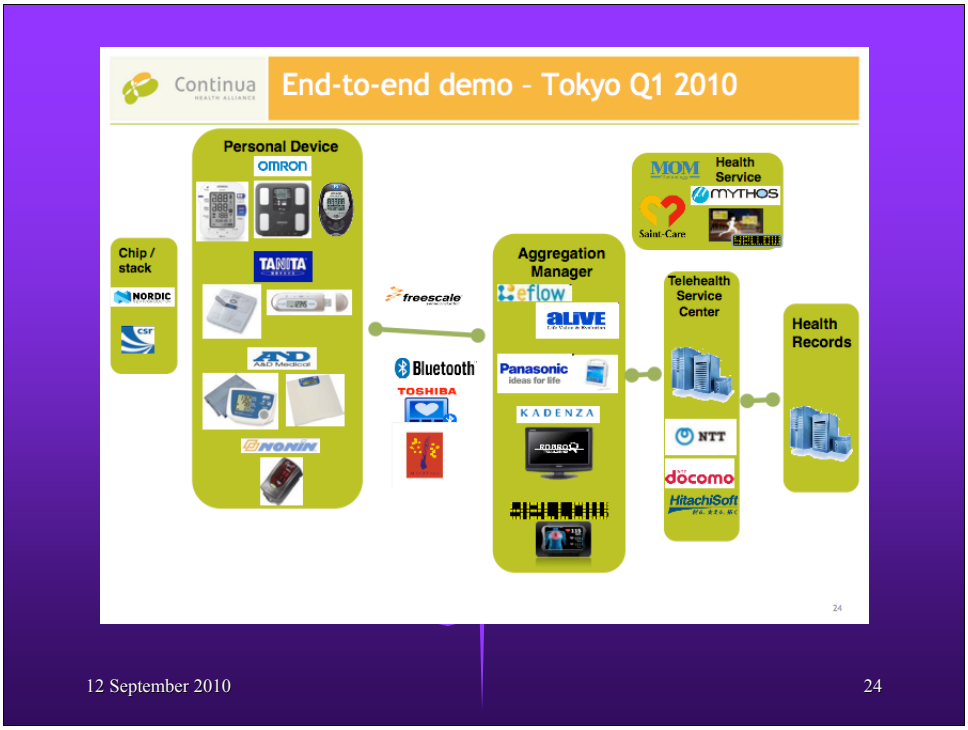
Continua
End-to-end demo - Tokyo Q1 2010
Personal Device
Chip / stack
NORDIC
csr
OMRON
TANITA
A&D MEDICAL
NONIN
freescale
Bluetooth
TOSHIBA
Aggregation Manager
eflow
ALIVE
Panasonic
Ideas for life
KADENZA
Telehealth Service Center
NTT
docomo
HitachiSoft
Health Service
MOM
MYTHOS
Saint-Care
Health Records
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Continua
Latest Continua Certified™ Products
Panasonic
ideas for life
Panasonic TOUGHBOOK H1 with Blood Pressure Monitor, Cardiovascular and Weighing Scale device specializations by Bluetooth
Texas Instruments
Texas Instruments MSP430 USB Agent Platform
A&D Blood Pressure Monitor w/ CPX186 Converter Cable
A&D Weight Scale w/ CYPAK Converter Cable
A&D Medical
A&D Medical Blood Pressure Monitor
A&D Medical Weight Scale
TOSHIBA
Continua Bluetooth Manager Stack for Windows, manufactured by Toshiba
Continua
CERTIFIED
Roche
Roche Accu-Chek® Smart Pix Device Reader
OMRON
Omron Pedometer
Omron Continua Certified Weighing Scale with a Body Composition Monitor
Omron Blood Pressure Monitor
Nonin Pulse Oximeter
Nonin Wireless Fingertip Pulse Oximeter
NONIN
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Conclusions

- Con
  - Cost of Continua membership is prohibitive to Phoenix
  - Concerned that Continua license would infringe on Phoenix mission and license
    - Further investigation needed
- Pro
  - Continua sufficiently supported by industry to justify Phoenix's adoption of Continua standards
    - Would improve chance of industry adoption of Phoenix

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Recommendations

- Retrofit architecture model with layers for
  - Personal device
  - Aggregation manager
  - Telehealth service center
  - Health records
- Investigate ISO/IEEE 11073 Personal Health Data Standards
  - Consider wrappers for 11073 protocol stack
  - Consider adoption of standards outright
    - May be issue of when to adopt

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