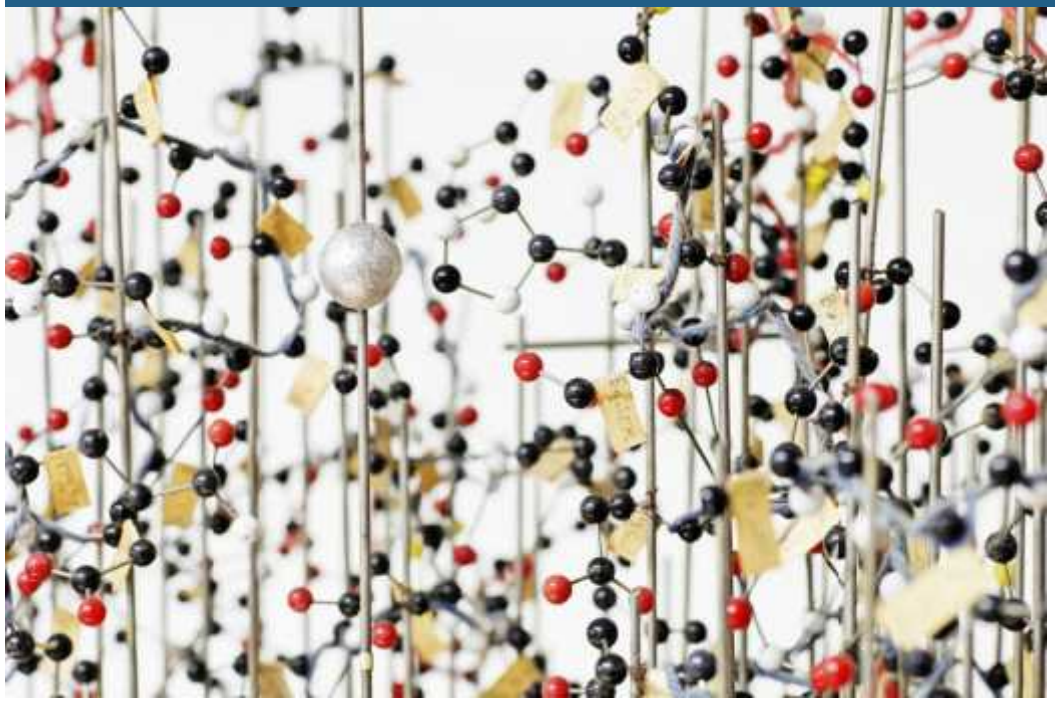
Remote Accessibility to Diabetes Management and Therapy in Operational Healthcare Networks



Continua Alliance

– the Global Perspective

Denmark, November 13, 2013

Malcolm Clarke

REACTION

Outline

- Background
- Overview of the requirements
- Development of requirements
- Approaches
- The standards
- Practical examples
- A research study

Background – we would like

- Sematic interoperability
- Works across several domains
- Technically feasible
- Universal standards
- Inexpensive
- Simple
- Extensible
- Available

Background – advantages

- Components can be re-used
- Devices can be marketed
- We deliver clinical results
- We develop systems of value to the patient
- Variety of interoperable solutions
- Richness of available devices

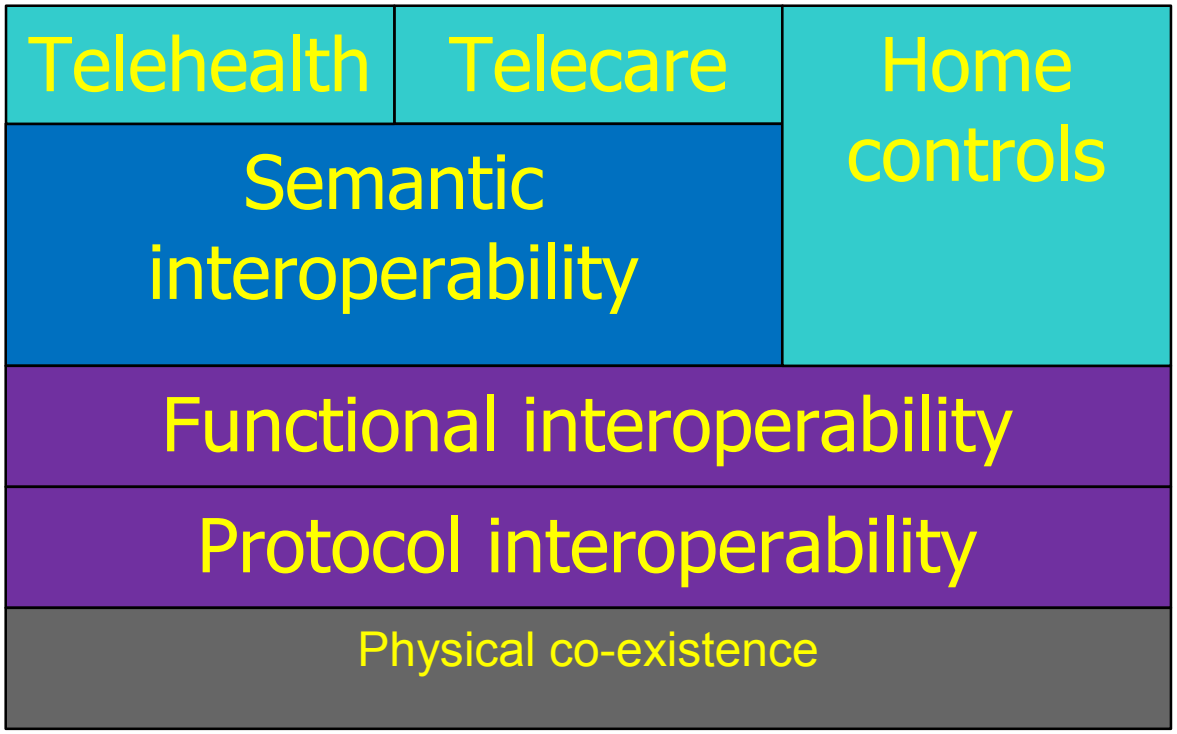
Consider new opportunities

- Telehealth – physiological monitoring
- Telecare (ambient assisted living)
- Other opportunities

Today

Telehealth	Telecare	Home controls
Proprietary	Proprietary	Proprietary
Proprietary	Proprietary	Proprietary
Proprietary	Proprietary	Proprietary
2.4GHz	868MHz	2.4GHz

Inter-related standards



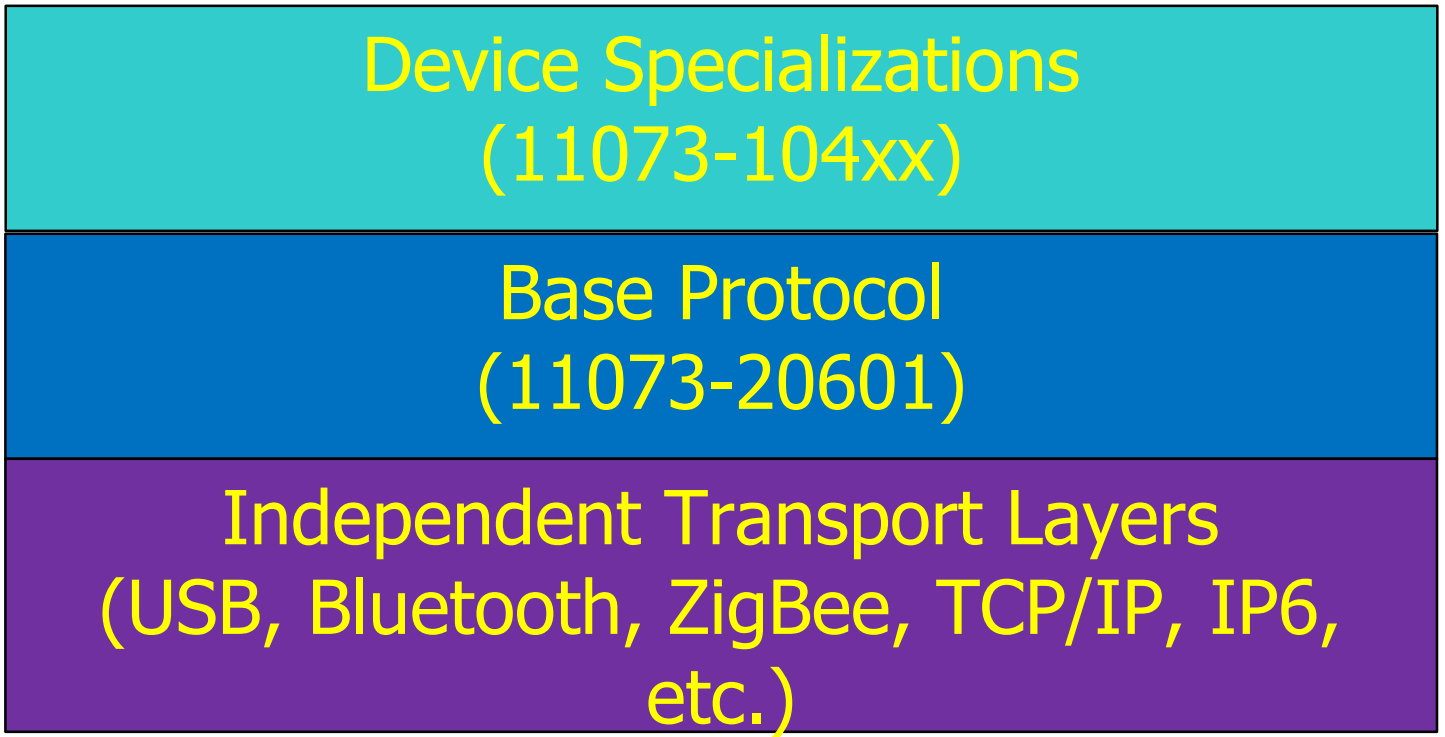
Unified Architecture

- Disease Management
  - Pulse oximeter, Heart rate monitor, Blood pressure monitor, Thermometer, Weighing scale, Glucose meter
- Independent Living (Aging Independently)
  - Independent living activity hub (motion, fall, bed/chair sensor, smoke), Medication monitor

Requirement

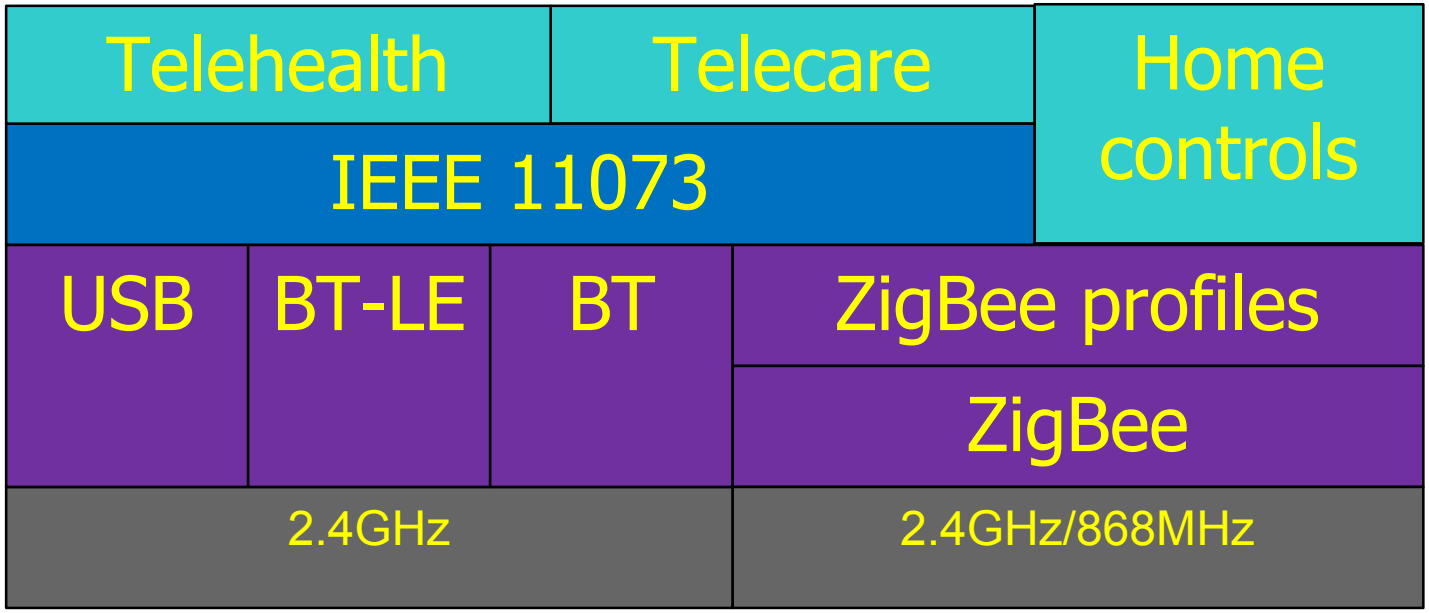
- Base on standards
- Define profiles of standards taken from different domains to create a complete standard (e.g. IEEE and BT or ZigBee)
- Support interoperability beyond immediate environment (in home, out of the home, in the healthcare enterprise)

Personal Health Devices Framework



An interoperable platform

Standards position today

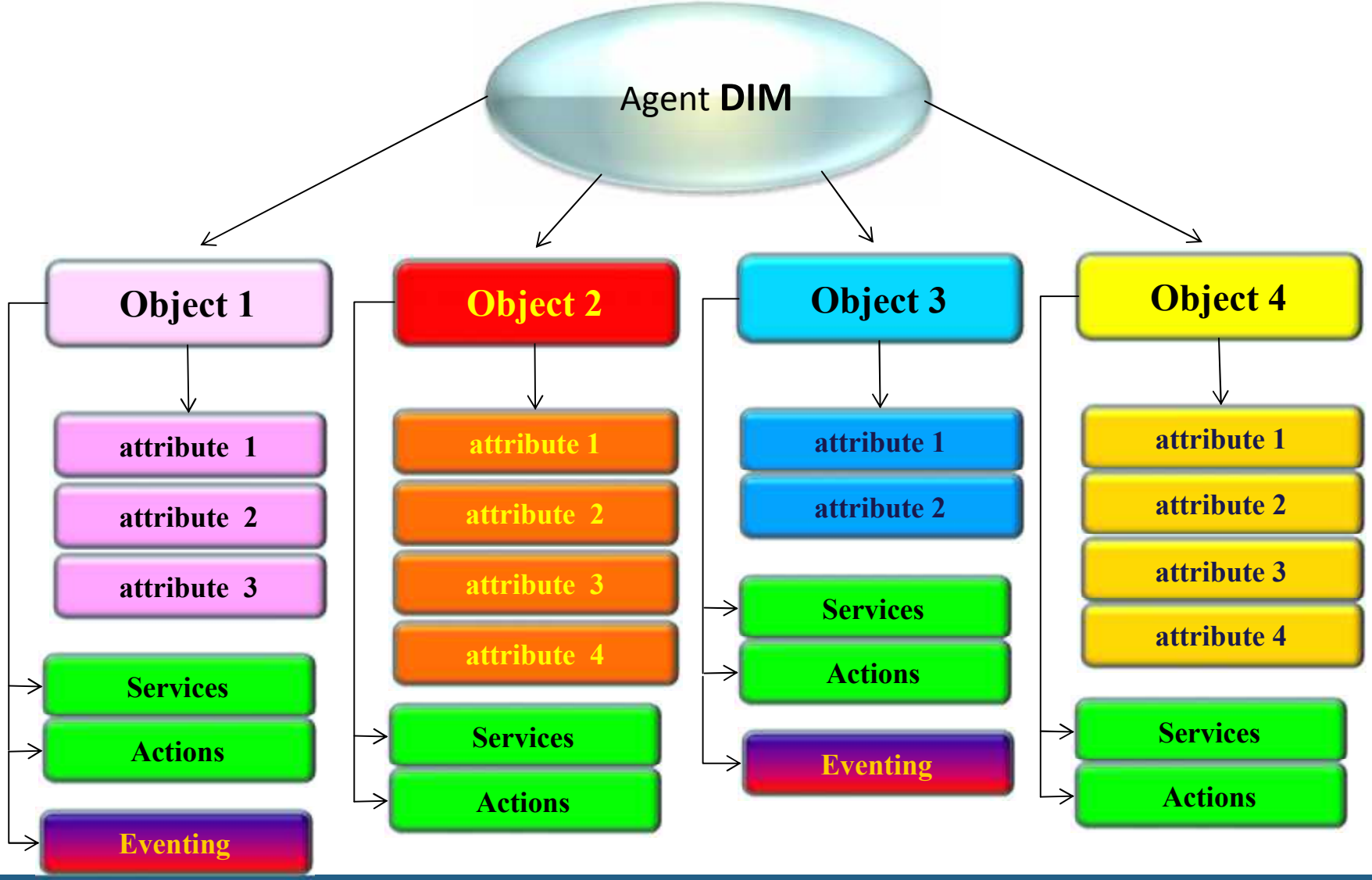


ISO/IEEE 11073 Personal Health Devices

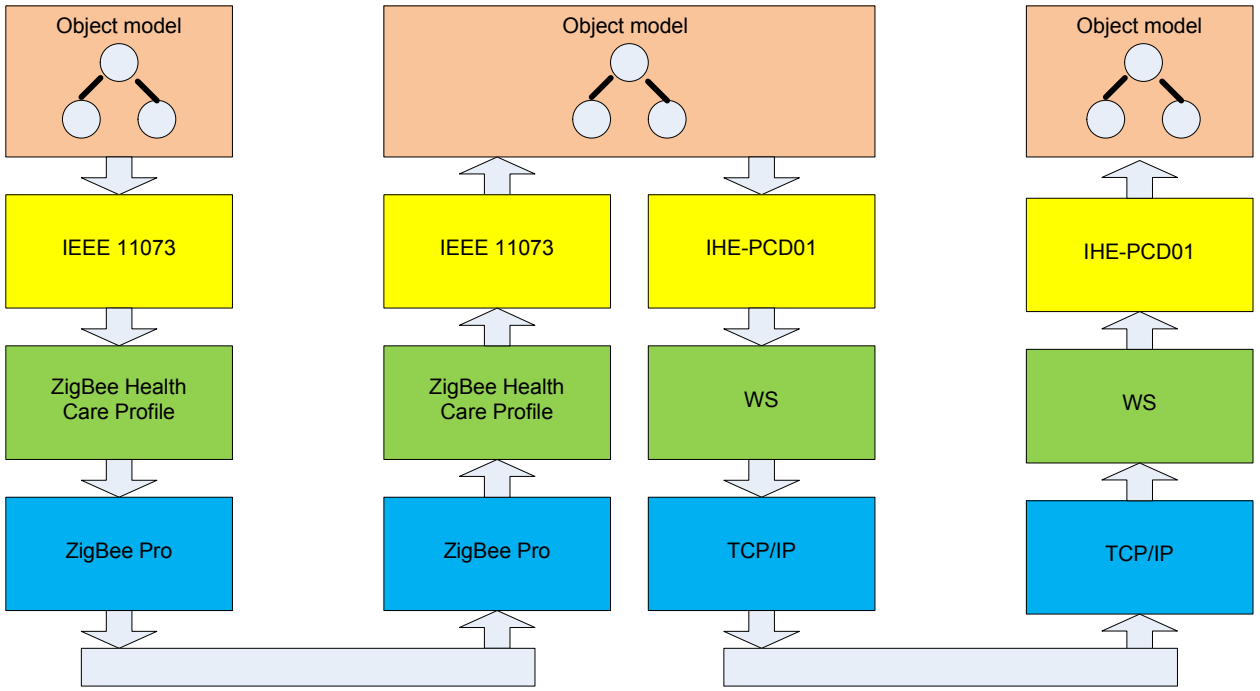
- IEEE 11073-20601™ Optimized exchange protocol
  - IEEE 11073-10404™ Dev specialization – Pulse oximeter
  - IEEE 11073-10406™ Dev specialization – Basic ECG
  - IEEE 11073-10407™ Dev specialization – Blood pressure monitor
  - IEEE 11073-10408™ Dev specialization – Thermometer
  - IEEE 11073-10415™ Dev specialization – Weighing scale
  - IEEE 11073-10417™ Dev specialization – Glucose meter
  - IEEE 11073-10418™ Dev specialization – INR meter
  - IEEE P11073-10419™ Dev specialization – Insulin pump
  - IEEE 11073-10420™ Dev specialization – Body composition analyzer
  - IEEE 11073-10421™ Dev specialization – Peak flow
  - IEEE 11073-10471™ Dev specialization – Independent Living Activity hub
  - IEEE 11073-10472™ Dev specialization – Medication monitor

Others in development

An Object Oriented Approach



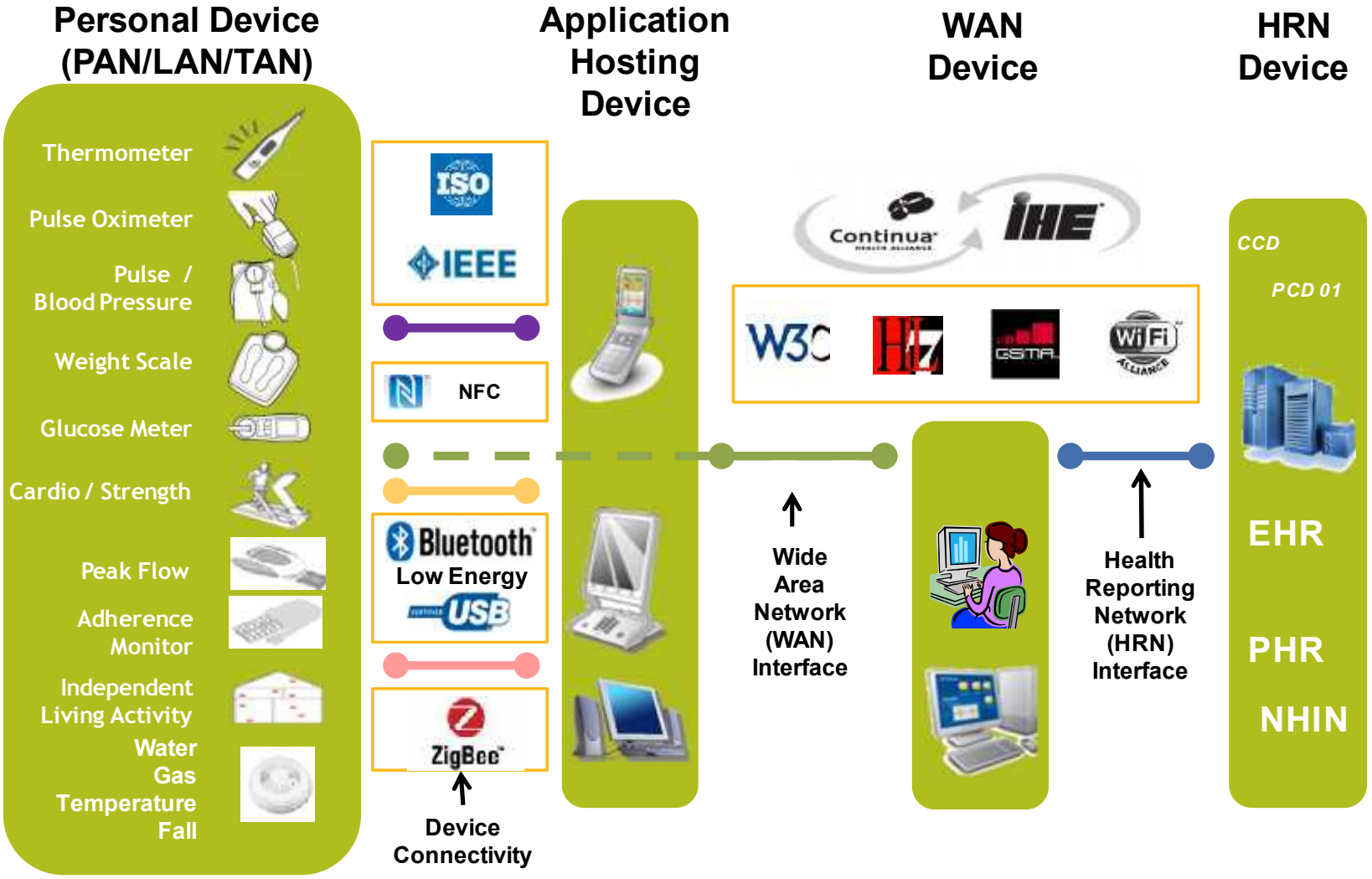
Link to the other standards



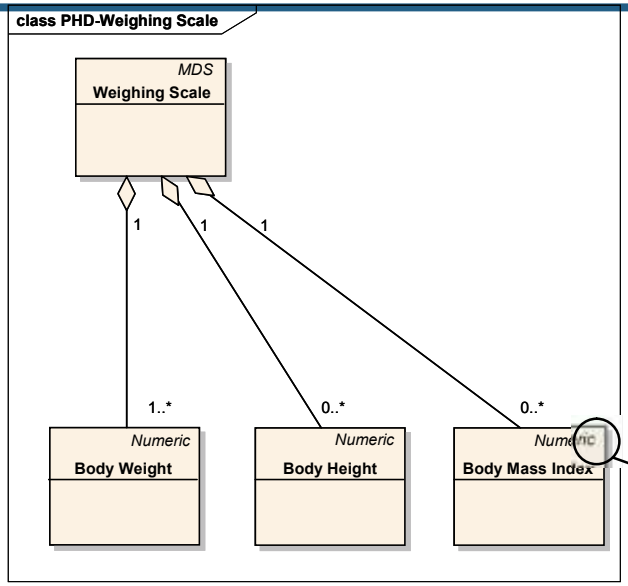
DEVICE	
Object Model	11073-10102
Nomenclature	11073-10101
Presentation	11073-20601
Convergence layer	ZHCP/BT HCP USB HC Class
Transport	ZigBee/BT/USB

AHD	
Object Model	IHE-PCD01/11073-10102
Nomenclature	11073-10101
Presentation	IHE-PCD01 (HL7)
Convergence layer	Web Services
Transport	TCP/IP

Continua Architecture



IEEE 11073 -> IHE-PCD01



Object number

Device

IEEE unique device ID

OBX|1|528399^MDC_DEV_SPEC_PROFILE_SCALE^MDC|1.1.1.1|||||X|||||0123456789ABCDEF^EUI-64

OBX|2|NM|188736^MDC_MASS_BODY_ACTUAL^MDC|1.0.0.2.80|263875^MDC_DIM_KILO_G^MDC||||
|R|||20090715070707+0000

OBX|3|NM|188740^MDC_LEN_BODY_ACTUAL^MDC|1.0.0.2.173|263441^MDC_DIM_CENTI_M^MDC|||
||R|||20090715070707+0000

OBX|4|NM|188752^MDC_RATIO_MASS_BODY_LEN_SQ^MDC|1.0.0.3.80|264096^MDC_DIM_KG_PER_
M_SQ^MDC|||||R|||20090715070707+0000|188736^MDC_MASS_BODY_ACTUAL^MDC

Time-stamped

IEEE nomenclature code

IEEE nomenclature term

REACTION Platform

Telehealth and telecare

What have we shown

1. Extensible range of devices – telehealth and telecare – grows with needs of user
2. Single system for telehealth and telecare
3. Protect investment – devices compatible and re-usable – lower cost

4. Modularise the system (common interfaces)
   a) Niche sensors
   b) Specialist providers of system components
   c) Extend range of devices available
   d) Improved system functionality
   e) Lower cost

5. Can be built into existing devices in the home (smart meter, Sky box, cable TV)
   a) Ubiquitous
   b) Utilities can provide the infrastructure
   c) Utilities can install the equipment
   d) Commodity item
   e) Simpler installation
   f) Lower cost

6. Increased scale
   a) Can be used on patients with more prevalent diseases
   b) System cost spread over more users
   c) Lower cost

Innovative applications

1. In CHF the patient may sleep in the chair
   - Monitor weight, BP and chair sensor
2. In hypertension patient may not take medication as prescribed
   - Monitor BP and medication taken
3. In COPD the patient will be less active
   - Monitor SpO_2 and chair

Innovative applications

4. Instant install (by the patient)
   - Early discharge
   - Pre-eclampsia
   - Falls
5. System grows with need
6. Commodity item
   - Routine monitoring of all chronic disease
   - Recycle between patients

REACTION

1. Primary care based in UK
2. All patients registered with single GP
3. Stable population for management
4. Management of diabetic patients mandated by UK government (QOF)
   - 6 month check of HbA1c and BP
   - 12 month check of neurological

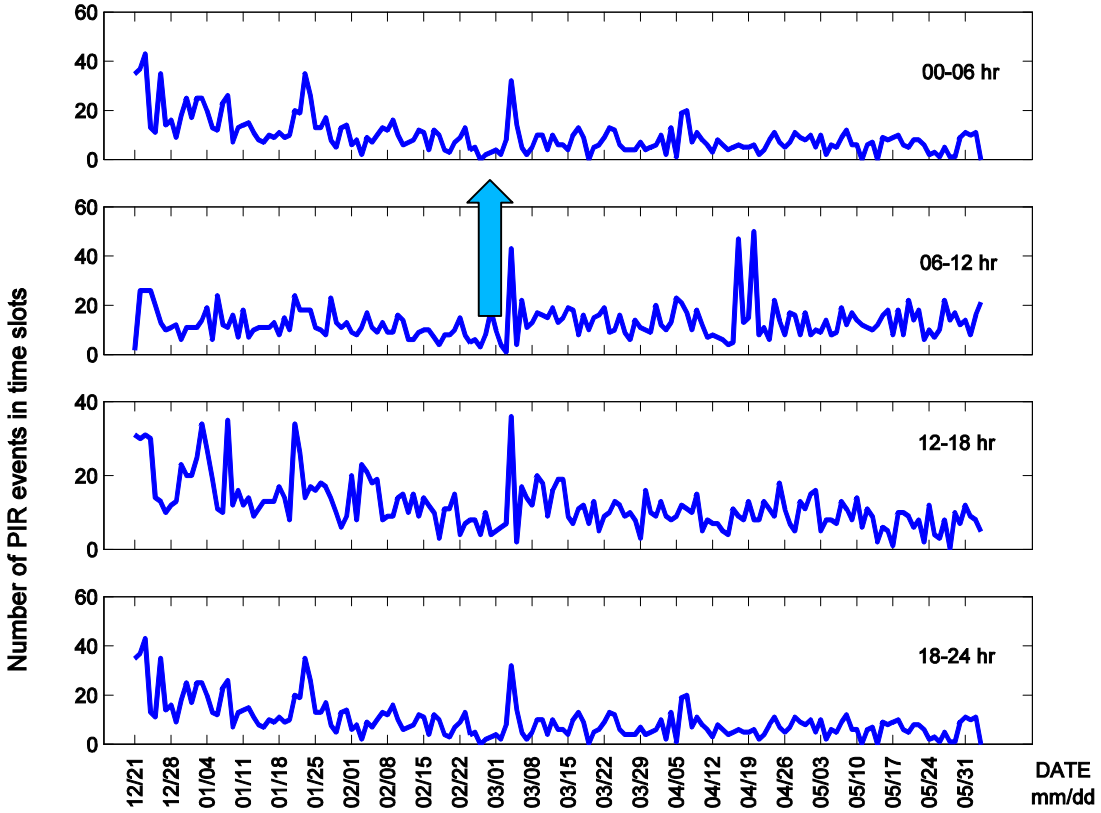
The Patient Journey

Age	Event	REACTION Component	Sensor
		Diabetes risk	
45	Type II Diabetes	Lifestyle advice Intelligent personalised feedback	Blood glucose (spot)
55	Hypertension	Risk score for complication Data mining	Blood pressure
65	Angina		ECG
67	CHF		Weight, BPM
70	Dementia		Medication monitor Environmental sensor
72	Insulin dependent		Continuous BG
74	Valve disease		INR
75	Peripheral vascular (leg ulcer)		
76	Incontinence		Incontinence monitor
78	Fall		Fall alert
80	Vision		
82	Death		

Is the concept viable

	Today	Next Generation
Equipment	£500	£50
Installation	£250	£0
Total per install	£750	£10 (Recycle)

PIR Motion Activity – Patient 1 - Intervention

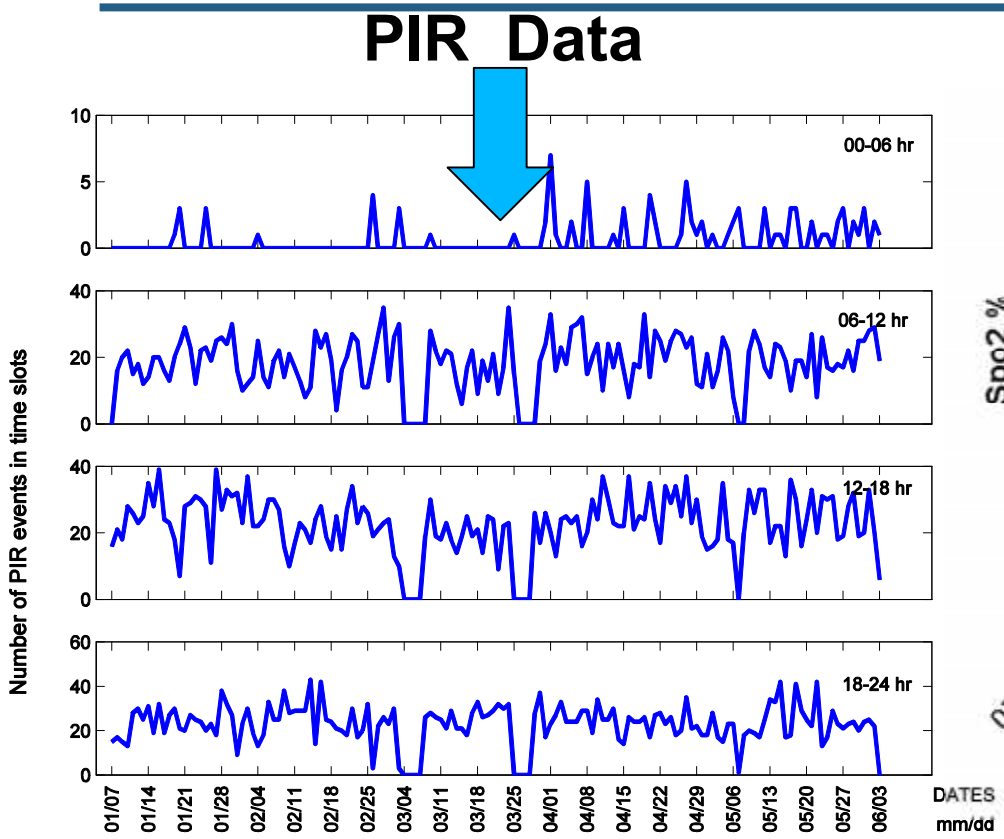


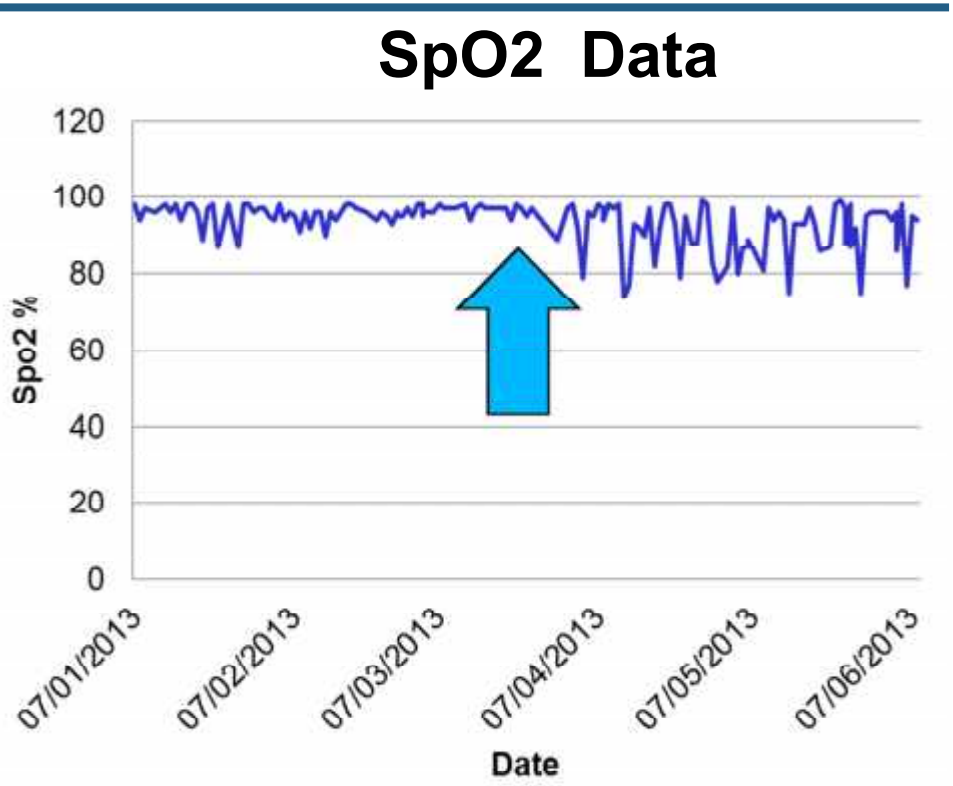
Under activity alert 2-3 March in all time slots, patient contacted and found to have fallen

Patient visited 3rd March

Found to have cellulitis – intervention occurred

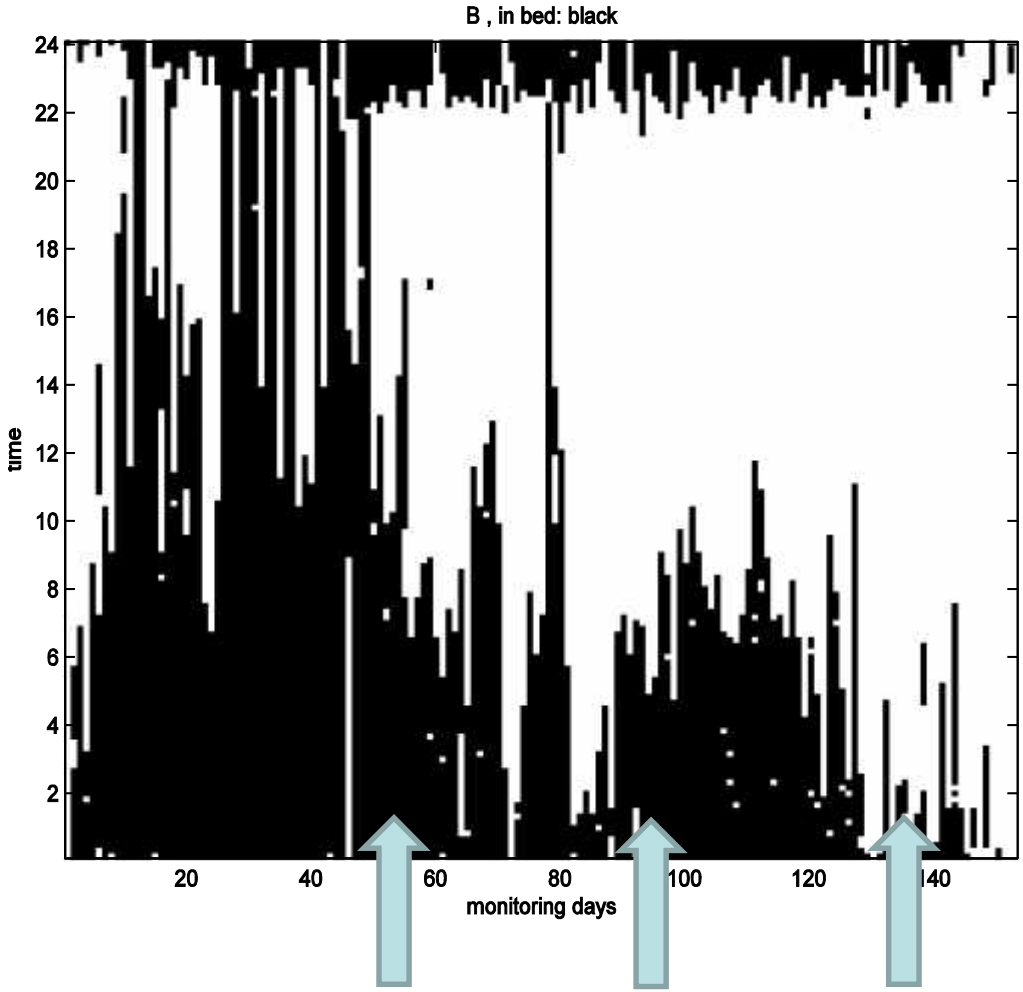
PIR Motion Activity vs SpO_2





#events in 00-06 hr	mean	std
1st 20 days	0.36	**0.96**
Apr 1 onwards	**1.13**	**1.5**

Patient 2 – Retrospective Data Analysis



- Patient enrolled in Feb 2013
- 8 Apr referred to Pulmonary rehab
- Monitoring day 60 (14 Apr) onwards there is:
- an increase in the number of bed events – getting up more frequently
- bed occupancy decreases, Apr 24 onwards;
- Total occupancy < 3 hours after day 143 (6 Jul)
- starts to get up earlier, but does go to bed ~ usual time
- Patient died at home 16 July 2013