Internet of Things for healthcare applications

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Internet of Things for healthcare applications

- Scope of opportunities in production?
- Challenges to privacy?

Robustness of the solutions?
Is the timing right?
Do we have the underlying technology?
Is there expertise available on the service side?
What is actually delivered?
What are the implementation challenges?
Do we dare?

After Gartner Group, 2011
What is IoT?

"Tomorrow's Internet, where networks can be conceptually defined as a dynamic global network infrastructure with self-configuring capabilities based on the standard and interoperable communication protocols.

Physical and virtual "things" have identity, physical attributes, and virtual personalities, using intelligent interfaces, and is seamlessly integrated into the information network."

THE GIANT STEP IS THE CHANG FROM ASKING QUESTION TO DATA TO “BE TOLD” BY ANALYTICS!
Major challenges and opportunities

Internet of Things sends huge amount of data through the global infrastructure

No one today with 100% confidence know where

Internet of Things provides faster access to wisdom through the machines and systems talking together

No delay by user interactions

We are told by analytics, less needs for asking the right questions

We need to decide on some important questions
- **Who** should have access to “our” information?
- **How** can information be secured while it is available for those who need it?
What are the challenges in the health care in Norway?

In Norway, we are 2.5 million workers, 500,000 of us are working in health- and care services.

In 10 years it’s a need for further 100 000 in this sector.

This is the challenge in the health care system, everything else is details!

(freely rendered from Paul Chaffey, director Abelia, October 2011)
What initiatives has the owner decided?

National priority areas

- National message system
- Core Journal
- Health records and health databases
- Standardization and Certification
- Electronic patient records
- Privacy and information security
- Secured Health Network
- E-presentation
- Health portal
- Welfare technology
- Collaboration architecture
What is and where is our "market" in 2022?

- We need to have a more intelligent health care, healthcare centers
- The waiting list is gone
- No busy tone or “you progress steadily forward in the queue”
- Journals "flies" back to the GP before the patient leave through the door
- Small specialized treatment places are in favor “big is not always beauty”.
- Clinical pathways covers the entire "value chain" from home residence to the clinic
- The patient is "online" with his/her health data
- Patient data flows safely through the national Health Network
Can IOT help us to close the gaps for tomorrow and meet expectations in a +10 perspective?

*Maturity*, will IoT supports the current strategies for ICT investment in the health regions (RHF’s) and the 429 municipalities?

- National strategy for electronic cooperation in health-care sector (2008 to 2013)
- The regional health authorities' joint ICT strategy

*Survivability*, is IoT a contribution in the long-term agenda?

- Close the resource gaps
- Increase quality
- Cut operation costs
Key areas where IoT probably will help by supporting the strategies

- The Norwegian coordination reform
- Clinical decision support (quality improvement)
Key areas where IoT probably will help by supporting the strategies

The Norwegian coordination reform
- Self-service and welfare technology
Clinical decision support
The Norwegian coordination reform
4 important challenges

The bill
The municipalities will have a co-financing responsibility, i.e. take over parts of the bill for the hospitals

Local services
The Government will invest more in the municipal health services - medical clinics, nursing homes, school and health clinics

GP more involved
GPs will undertake more public health services, work more closely with the patients

Cooperation
Small municipalities should join together to develop "health centers"

Provide selfservice
Intensively exchange knowledge without moving data
Monitor patient and processes, implement welfare technology
Detect risk and calculate early warning
The classical approach to «Selfservice» - the users ask the data for information
Welfare technology – “selfservice” actively enabled for the patient

Morning and evening care, nursing and specialist roles, telemedicine

Transfer - detect case

Supervision of daily activities - activity profiles

House robot - task robot

Risk score and alarm processing

Sampling and diagnosis

Digital companion

Reporting and intelligent dialogue

Medication and dosage

Social activities “friend and butler”
Welfare technology – “selfservice” actively enabled for the patient

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- The Norwegian coordination reform
  - Self-service and welfare technology

- Clinical decision support (quality improvement)
  - Innovation from other industries
  - RTD based on SNAP
Clinical decision support

**SCREENING**

**PATIENT**
- Diagnosis
- In treatment

**ANALYSIS**
- Forecasting expected progress
- Current situation
- Patient's track record

**SURVEY EXPECTED LIFE CYCLE FOR THE PATIENT**

**CLASSIFICATION**
- Peer grouping
  - Relevant clinical pathways (M2M)

**PLAN FOR PATIENT – INDIVIDUAL BASED ACTIVITY PLANNING**

**MEDICAL DECISION**
- Score life cycle
  - Decisions

**INDIVIDUAL-BASED**
- Timeline and activities
- Resources needed

**ABC ANALYSIS**
- Activities
- Resources needed

**RESOURCES – ACTIVITIES DATA** (standardized data)

**OPTIMIZING AND RE PLANNING**

- Optimizing and re-planning
  - Treatment plan for patient
  - Process redesign implementation of treatment

**KNOWLEDGE BASE** (group data)

**DIALOG**

**PATIENT DATA** (individual data)
Clinical decision support

**PLAN FOR PATIENT – INDIVIDUAL BASED ACTIVITY PLANNING**

**MEDICAL DECISION**
- MEASURES
- INDIVIDUAL-BASED

**SCORE LIFE CYCLE**
- DECISIONS
  - TREATMENT PLAN FOR PATIENT
  - OPTIMIZING AND RE PLANNING
    - PROCESS REDESIGN IMPLEMENTATION PLAN

**ABC ANALYSIS**
- ACTIVITIES
- RESOURCES NEEDED

**RESOURCES – ACTIVITIES**
- DATA (standardized data)

**CLASIFICATION**
- PEER GROUPING
  - RELEVANT CLINICAL PATHWAYS (M2M)

**DIAGNOSIS**

**IN TREATMENT**

**FORECASTING**
- EXPECTED PROGRESS
- CURRENT SITUATION
- PATIENT'S TRACK RECORD

**SURVEY EXPECTED LIFE CYCLE FOR THE PATIENT**

**PATIENT DATA**
- (individual data)

**KNOWLEDGE BASE**
- (group data)

**SCREENING**
Clinical decision support – from “weekly planning” to RTD based on SNAP technology
Clinical decision support – innovation from other industries

New data carriers **discard** old solutions in the dominant value chains
Cognitive processes increase **competitive ability** and lower the transaction costs
New technologies are generating better **utilization** of network capacities
The amounts of data will require processing and analysis is **organized and conducted** in a completely new way

**TECHNICAL LEAPS ALREADY TESTED**
- Distributed platform for Big Data
- In memory analytics scales to very large systems
- Extreme parallelism (read/write/crunch)
- Hybrid computing model
- Automated processes
- Adapters integrate physical objects and non physical agencies and share information

**IMPACT AREAS IN BUSINESS PROCESSES**
- Purchasing
- Maintenance
- Expert availability
- Service Centre / User contact and user interactions

**BUSINESS IMPACT**
The rewards depend strongly of the ability and will to **redesign** the business processes (**business challenge**)
Classic and well-established information architecture needs to be **replaced** in order to reap the benefits (**ICT challenge**)
From asking the data to "be told by analytics"

- Quality can only be measured after recovery
- Exceeding the limits (tolerances) provides unacceptable risk level
- Numerous donors on input factors, assigned to the ports and sub-processes are captured
- Analysis of real-time

- Where are we on the risk curve?
- How will the risk exposure be next?
- What contribute to the expected exposure?
- What is the scenarios?
- What changes is needed?
From asking the data to "be told by analytics"

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IOT application in healthcare, privacy versus efficiency?

**Opportunities in the Production**
- Structuring the classification of the data (semantic patient data)
- Real-time analysis of data streams
- Increased automation of processes
- Network-based resource scaling of inputs
- Expert Decisions
- Monitoring and real-time communication of health status
- Materials and supplies with built-in SIM card supplier
- Services for notification with embedded SIM card for alarms

**Challenges to Privacy**
- Frequent updates and re logistics planning
- Real-time decision
- Formalization of learning
- Dynamic allocation planning in the course of treatment processes
- Globalized automatic emergency communication
- Mobile self-configuring apparatus (from tow bare to the breast pocket)
**IOT application in healthcare, privacy versus efficiency?**

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IOT will support the long term agenda in Norwegian healthcare

### CHALLENGES

**POPULATION MORE CHRONICALLY ILL**
Chronic diseases such as diabetes, substance abuse and mental illness is growing strongly.

**INVESTMENT “EARLY” IN PREVENTION**
The government will invest more in prevention of diseases in the municipalities.

**AN OLDER POPULATION**
In 2040, the proportion of the population over 80 years be doubled compared to today.

**ACCELERATING EXPENSES**
The cost of health care has grown enormously. Growth in spending on hospitals must be relieved by adding more tasks to the municipalities.

**OUT LAYERS**
A significant groups of patients is suffering from poor cooperation (complex disorders).

### AN IOT APPROACH SUPPORTS SOME KEY PROCESSES

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<td>“Everything” can go mobile</td>
<td>Internet will connect together devices where the patient can be followed by endogenous sensors and devices</td>
<td>New technology and solutions will reduce some of the pressure needs for additional resources (+ 100 000 in 2022)</td>
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<td>Real-time information can be available on patients</td>
<td>The underlying infrastructure and analytic capacity can create effective interaction between all parties</td>
<td>Municipality can focus more on decentralized smart buildings</td>
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<td>New information about treatment and medication is available for all parties and to the individual patient “need to know”</td>
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«Only the sky is the limit»
But there are some challenges!

How to create wisdom from knowledge?

The most important contribution of the IoT is not the technology, but that organized processes to extract knowledge faster through the machines and systems talking together. Less manual intervention for faster cycles and shorter processes.

How is information architecture for "Big Data" and RTM?

Mobility, machine-to-machine communication, the combination of integrating physical objects and physical bodies contribute together to the BIG DATA phenomenon. Forces profound change of architectures, delivery models and technologies. The focus will be "to be told by the system" - ie "not to ask the data"

How to build a hybrid data capture?

How to "classical" data captured in the value chains within specialist services and primary health services play along with automated processes? Automation alone will not solve this. Automation of data capture creates huge amounts of data for processing and analysis must be organized and conducted in a different way.

What is the needs for semantics, formalization and standardization?

Service providers and data processing must be put in place the necessary classification and categorization of information. Health data contain enormous amounts of text information? Much of this data contents is almost worthless without a systemic classification and categorization.
«Only the sky is the limit»

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Evaluate reap models

Analyze benefits and risk

Business focus, find the Δ

Standardization and data collection