Integration of IT-system in hospital environment

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Agenda

- Why do we want integration in IT systems?
- What are the driving forces?
- Important conditions
- Examples of integration between systems
- Pitfalls and problems - and how to avoid them
  - Standardizing
  - Interface
  - Organizational aspects
  - Risk and vulnerability
- Conclusions

Introduction

- A large hospital has up to hundreds of different systems and applications installed, falling into various categories:
  - Hospital information systems
  - Specialist (clinical) systems
  - Medical-technical systems
  - Technical support systems
  - Administrative systems
  - Management systems
- A coordination between many of these systems is necessary and requires some kind of interaction/integration of various extent and complexity
- Digital information is a necessity for effective integration

Digital information – why?

- "Paper free" hospitals
- Easy storage/retrieval of information
- Saving space – digital information needs much less space than saving information on paper
- Problems with "missing" information will be reduced
- Reduces possibilities of various kind of errors due to manual handling
- Easy transfer of information between systems - makes integration easier
- Reduce time for information transfer between the various parts involved in the patient treatment process

Driving forces for integration (1)

- Need for increased effectiveness (operate at lower costs without compromising on the quality of treatment and care)
  - More people needs treatment in hospitals
  - Lowered budgets
- The number of systems/applications in a hospital is increasing (typically several hundreds in a large hospital), both for use in the patient treatment processes and other work processes and for other are increasing
- Increased need for information distribution between systems (clinical-administrative-technical)
- Too complex, time consuming and costly to handle manually

Driving forces for integration (2)

- The majority of building infrastructure systems are traditionally monitored, operated, and managed separately.
- In addition, many systems have their own company- or industry-specific standards and protocols, resulting in high costs of installation and operation.
- The drives for greater efficiency have lead to an increasing number of hospitals focusing on integrated systems to achieve efficiencies.
- Integration between building infrastructure system provides the means to achieve sustained energy optimization and to reduce operating costs throughout the entire building life cycle.

Computer network (1)

- The computer network in a modern hospital is the glue of integration for many systems, and is the most important system in the integration process
- All kind of signals are being integrated in wired and wireless IP-based computer networks
- The whole archive is digitally stored on servers.
- Doctors, nurses and patients are getting access to data through workstations, PDAs and other kind of terminals
- The above requires a well designed computer network

Computer network (2)

- A shared high quality computer network is the most important communication system in a modern hospital
- The computer network is the main carrier for data, audio and video – including technical systems , medical-technical systems, clinical specialist systems, administrative system, etc.
- Relevant applications/systems must be available for the user from any available data outlet, or via wireless access – within the framework of network security regime of the hospital
- The network management system (NMS) monitors servers and equipment connected to the computer network

Computer network - requirements (3)

- A well designed network supports should:
  - Facilitate interaction for users, applications and services
  - Robustness and stability
  - Flexibility towards changes
  - Scalable
  - User friendly
  - Satisfy strict requirements to redundancy, availability and reliability

Message Server Service System

- The Message Server Service system, when installed, plays an important role in integration between several systems
- The MSS is an IT platform especially designed to assist health professionals focus on safety, quality and efficiency. The platform includes solutions for connectivity, healthcare messaging and storage service.
- The solution must support mail messages, phones, pagers, communication whiteboards, nurse station and facility integration, as well as a set of integrations with clinical systems, fire alarms, elevators, air tubing systems and ERP systems

Example - resource management system(s)

- There may be one or more resource management system in a hospital – administrating requisitions for various resources and services
- Integration with other systems:
  - Message server – distributes receipts/accepts/denied information when requiring various resources, e.g. help for moving a patient from radiology back to his/her bed
  - Typically using the computer network and/or telephone/pager for distribution of messages
- If the hospital has a top system for message distribution (a Message Server System) the MSS will control the information flow and subsystem being used
- If the resource is outside the coverage area for local receiving of information, external notification may be relevant (e.g. mobile phone system)

Example - AGV(automated guided vehicle)

- Information about delivery status distributed to message receivers according to a predefined rule base
- AGV – delivers information about alarms and operation status to the BAS
- Fire alarm sends information to AGV regarding fire alarm for stop of container transport
- Security system – opening of doors according to information from AGV
- Elevators - the elevator control receives a signal from the AGV system and sends a car to the floor
- The elevator is in a special AGV mode throughout the vertical trip until the vehicle leaves the car

Example - PAS/EPJ

- PAS/EPJ is the source for patient information being presented in a clinical portal presentation system – makes it possible to view different patient information
- Ordering of transportation resources from e.g. RIS/PAX
- Ordering message is sent via wireless technology
- If the personnel is outside the coverage area of the hospital communication system – external notification is possible via e.g. SMS

Example - Building Automation System (BAS)

- Medical alert system: Delivers alarms/operational state to BAS
- Message server: Critical operational alarms distributed to message receivers according to a predefined rule base
- Operating state and technical alarms sent to BAS via computer network
- Fire alarm: Alarm via OPC/ESPA 4.4.4
- Security systems: Alarm via OPC/ESPA 4.4.4
- Pneumatic tube: Alarm via OPC/ESPA 4.4.4
- AGV: Alarm via OPC/ESPA 4.4.4

Example - pneumatic tube

- Delivery state in the pneumatic tube system is distributed to message receivers according to a predefined rule base via the MSS, or directly via telephone/pager and/or computer network
- Alarms and operational state are delivered to the BAS system – OPC/ESPA 4.4.4
- Access to pneumatic tube stations may be controlled by the access control systems (AAC)

Example - Trauma/crisis team notification

- Alarms sent to members of trauma/crisis team etc.
- Members of t/c team receives information from message server according to a defined rule base
- Receipt for received messages back to sender
- Message receiver (telephone/pager): Notify team (cardiac arrest, sectio caesareae, fire)

Example – fire alarm

- For hospital with MSS. The MSS is the hub and sends directly to message receivers according to a predefined rule base
- Message receiver (telephone/pager):Information with early warning and fire alarm distributed to message receivers according to a predefined rule base
- Delivering information of alarms/operational status to the BAS system
- Security systems (ESPA 4.4.4 /OPC – protocols)
- Pneumatic tube - ESPA 4.4.4/OPC
- AGV – ESPA 4.4.4/OPC

Pitfalls – and how to avoid them (1)
Protocols and interfaces

- Old/outgoing/proprietary protocols
- Large number of protocols
- SW revision upgrade – possible problem area
  - Need for upgrade to new versions in SW for one IT-system may force other systems to upgrade as well to operate properly
  - Who shall pay for this "forced" upgrade?
- Identify interfaces between systems
  - Are other systems/applications involved?
- Ensure to choose protocols that is supported by all systems/equipment involved

Pitfalls and how to avoid them (2)
Planning

- Detailed planning of the complete process is a must
- Important questions raised in the planning process:
  - Why integrate?
  - What are the advantages? (functionality, increased efficiency, improved treatment, etc.)
  - What are the disadvantages? (costs, technical problems, etc.)
  - Which systems are involved and which interfaces are included?
  - Which requirements/assumptions are basis for the planned integration?
  - Are the resources available (budget, competence, personell, …)?

Pitfalls and how to avoid them (3)
Organization aspects

- Information to the employees involved is VERY important to make a smoothest possible process
- Relevant information at correct times during the process
- User involvement is important to create positivity and stimulated employees.
- Focus on the possibilities - not the problems
- Training
- Educate and stimulate
- New roles – work flow development process

Delay and large cost increase – typical common problem in large IT projects (1)

- Not necessarily due to bad planning and bad project control
- Expectations may be too high
- Users are demanding functionality and user friendliness that can not be met
- Can "off the shelf" systems be easily adapted, or is expensive time consuming SW/HW development required to be able to meet the requirements?
- Each country has its own health legislation – adaption of the IT-systems may be required
- Some countries allow IT-systems from different manufacturers, e.g. patient journal systems, to be used.

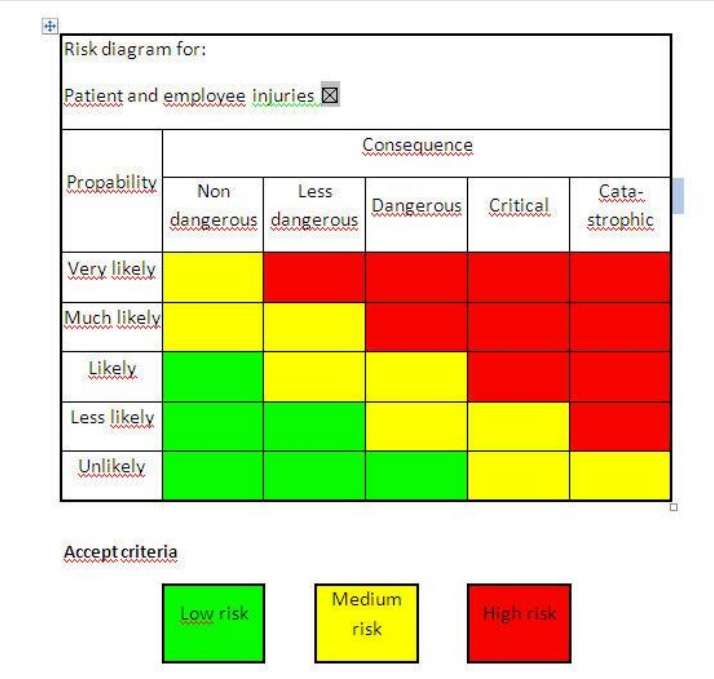
Delay and large cost increase – typical common problem with large IT projects (2)

- Many IT-consultants and manufacturers do not "understand" the health sector.
- Employees need to have a certain level of IT competence to understand how "things" work, and the possibilities/limitations with the systems, and last but not least, to be able to communicate with the IT-experts.
- Some employees needs in fact to have depth competence in IT, but the majority just need some basic understanding.

Risk and vulnerability analysis - method(1)

- Risk and vulnerability analysis may be relevant prior to purchasing new systems, equipment and/or new functionality
- Identify events (what can go wrong)
- Each event is evaluated with respect to some kind of class/criteria. For a hospital, it might me relevant to focus upon:
  - Threats regarding life and health for patients and employees
  - Possible malfunctions - irregular operation conditions - delays in patient treatment
  - Possible economic losses (compensation, substitutions etc.)
  - Possible reduced goodwill

Risk and vulnerability analysis – risk diagram(2)



- Low risk: Accepted
- Medium risk: Accepted, but actions should be evaluated. Actions implemented based on cost-benefit evaluation
- High risk: Not accepted. New actions leading to lowered risk must be identified and implemented

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Risk and vulnerability analysis – risk criteria(3)

- The risk and vulnerability analysis is both a method to avoid unforeseen costs and delays in a project, and at the same time a method to prevent unwanted events to take place – events that in worst case can cause death of patients or employees.

Conclusion
Success criteria – integration of IT-systems

- Detailed planning
- Aim for
  - Open system architecture
  - Standard and open protocols
  - Limit the number of protocols
- Verify that the assumptions can be met
- Organizational aspects must not be ignored
- Risk evaluation?
- Employee involvement – create positivity

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