University of Minho
School of Engineering

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Computer Science and
Technology Center

Biomedical Informatics

Interoperability

Background - Interoperability

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- Interoperability is the first step for the so-called Paper Free Hospital;
- Quality of services and quality of the Information
- Better patient treatment (faster and better)
- Cost reduction
- Error reduction
- **Improving Quality of Service in Healthcare with Interoperability**

Interoperability is essential to

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- Healthcare Information Systems
- Paper free hospital
- Electronic Medical Records
- Electronic Nursing Records
- Decision Support Systems (BI)
- Problem Solving in Real World Environment
- Action research and usability

Introduction

What is interoperability

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- "The ability of a system or a product to work with other systems or products without special effort on the part of the customer“

adapted from the Institute of Electrical and Electronics Engineers (IEEE)

- “Interoperability is the ability of independent systems to exchange meaningful information and initiate actions from each other, in order to operate together to mutual benefit. In particular, it envisages the ability for loosely-coupled independent systems to be able to collaborate and communicate.”

adapted from the International Organisation for Standardisation (ISO)

Interoperability

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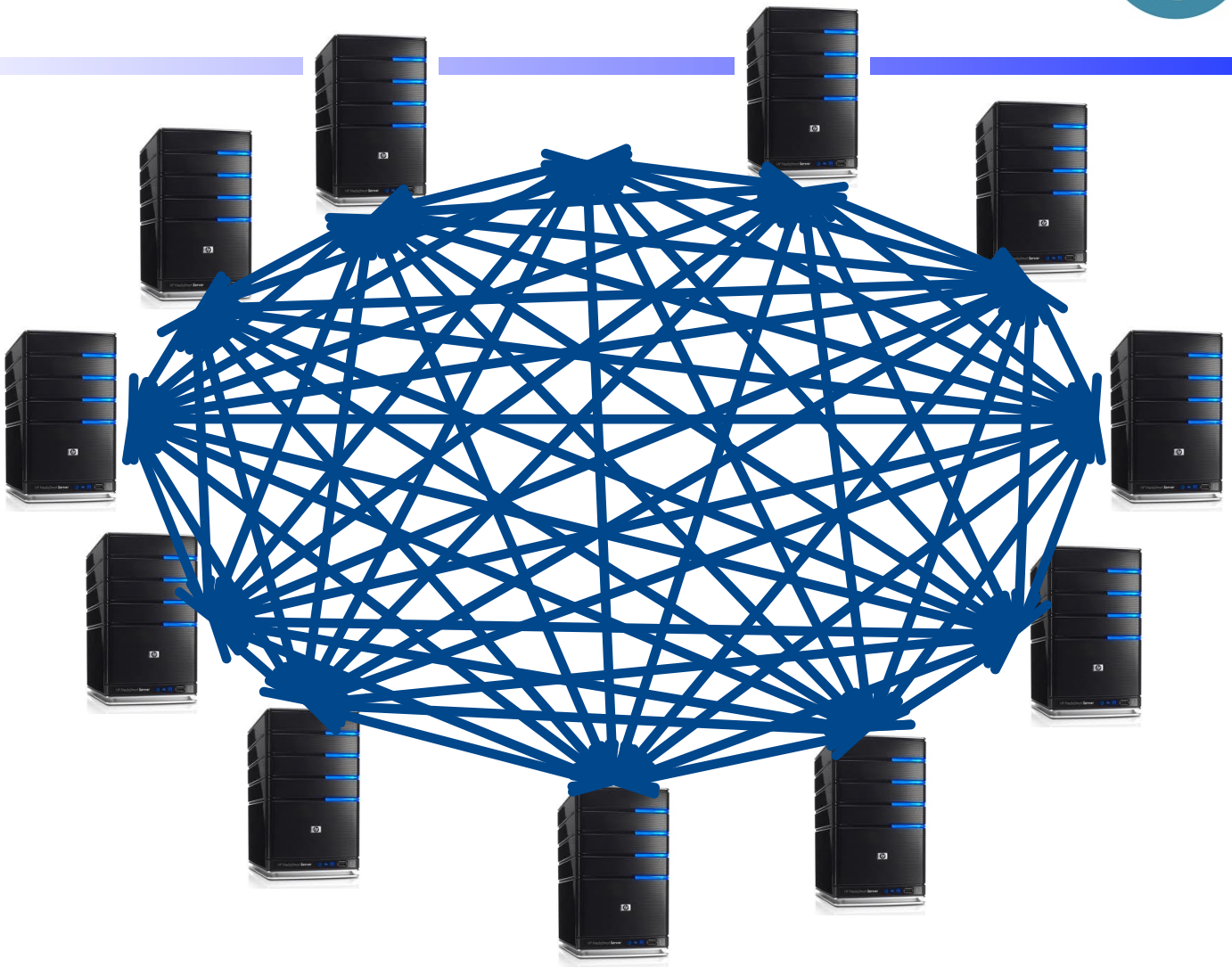

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Introduction

Research Opportunities

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- The most common models use end-to-end architectures even when applying standards
- The use of standard protocols are not forcibly standard as an high level of favouring exists
- Higher levels of interoperability such as semantic, are rarely achieved
- Existing frameworks are not adaptable to all interoperability cases and are usually of low level interoperability

Background: Multi-Agent Systems

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Research Methodology

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Action research

- Knowledge and technological transference
- Intervention over the object of study
- Evaluation of the impact of this intervention based on inductive and deductive analysis of captured feedback

Methodology Analysis

- Oriented towards a development and a production purpose
- Derives mainly from important synergies with several healthcare institutions
- Existing limitations leave a large margin of improvement regarding existing paradigms of the multi-agent based interoperation
- Validate the research results in a large production environment.

Case Study

- Each of the implemented interoperation services can be considered a case study
- Important considering that the evaluation of each implementation and prototype must be contextualized
- Validate proposed theories

Interoperability

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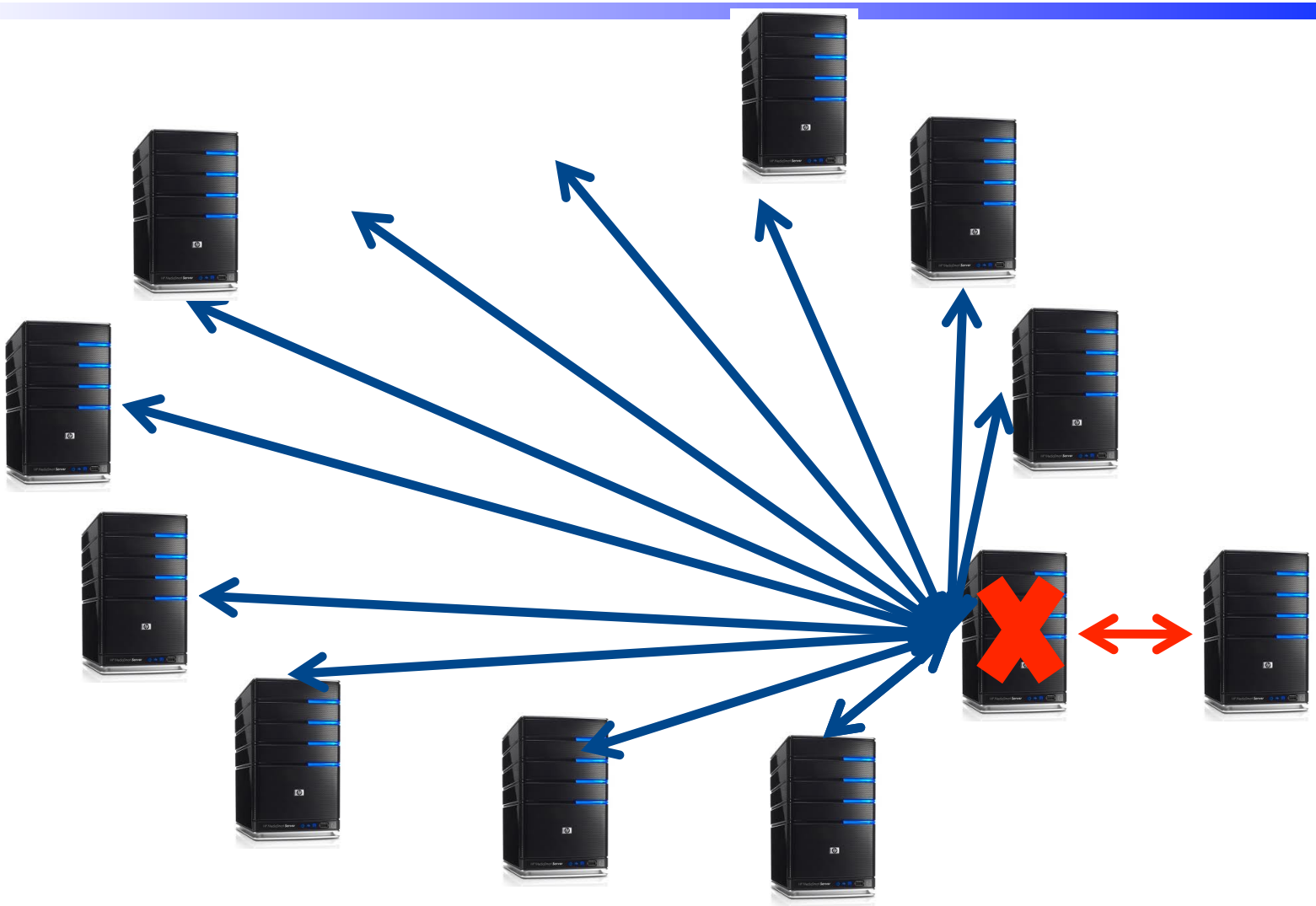

Interoperability in HIS

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SONHO
SAM
SAPE

Emergency

AIDA-HL7 SOA

Others Systems

Lab

PACS/RIS

Requirements and analysis

Summary of discovered requirements

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- Ability to interact with information systems as loosely coupled services
- Adaptability to non-standard systems
- Independence from legacy systems
- Consolidation of information
- Intelligence
- Embedded load balancing end redundancy of services

Interoperability

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INTEROPERABILITY DIMENSIONS:

- Syntactic and semantic
- Application
- Human
- Business Process
- Geographic

RESULTS

- Cost and integration complexity reduction
- Security improvement
- Availability, performance and security in information access
- Reliability
- Quality of service
- More transparency and simplicity for users
- Interoperability enhancement through the use of ontologies

→ Paper free Hospital

Conclusions

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- The proposed system **addressed difficulties** drawn from literature review and the Portuguese healthcare HIS
- The **challenges** and feedback from the **real healthcare production** environment was essential to improve and devise adaptive models towards a **better understanding on how implement interoperability**
- The usage of a modular approach and the **agent paradigm** allow to overcome many of the limitations of information consolidation models
- The resulting system and its implementation served to solve **practical issues in real environments with a pragmatic paradigm** and **real world difficulties**
- The **distributed consolidation model allows** to store information within the institution as well as important stepping stone for a more complete and **structured electronic health record centered in the patient**.

Conclusions

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- The system proposed in this project takes in consideration a solid model for **ethical reasoning**, validated by international publications
- The use of **continuous logic programming** expresses characteristics that overcome the main shortcomings of other techniques such as black-box techniques or probabilistic algorithms
- the principle and exception modelling demonstrated is a clear and perceivable manner to be understandable by human experts as well as being **traceable** through proof trees and which **processing is clearly identifiable, predictable and updatable**

Future Work

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- Several MsC and PhD students are pursuing in my research group in particular:
  - improving the interoperability platform
  - improving the usability of the EHR
  - automatic system auditing
  - Business and clinical intelligence
  - Group decision support
  - Ethical, social and emotional reasoning