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# Ontology-Based Competence Management for Team Configuration

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# Outline

Need for Competence Management

Competence Profile Management

Enterprise Competence Profiles

Individual Competence Profiles

Conclusions

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# Need for Competence Management (1 )

The rate of collaboration between manufacturers grows

- Network-like organizations are usually more flexible and robust when compared with hierarchically organized large-scale companies
- This is essential for the build-to-order (BTO) strategy

Networked structures raise a number of problems to solve

- Configuration of a team that is able to carry out a specific task arisen from a production process
  - One example of such a task is collaborative design of a product in dispersed groups of engineers

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# Need for Competence Management (1 )

Finding a member that has suitable competence for a required task can be a laborious, time-consuming process

- Developing and maintaining a competence management system can significantly reduce the time
- Linking such a competence management system to key decision points and frequent problems can further enhance effectiveness of the production network

The proposed approach is to apply ontology engineering to modeling competences of potential team members

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# Competence Profile Management

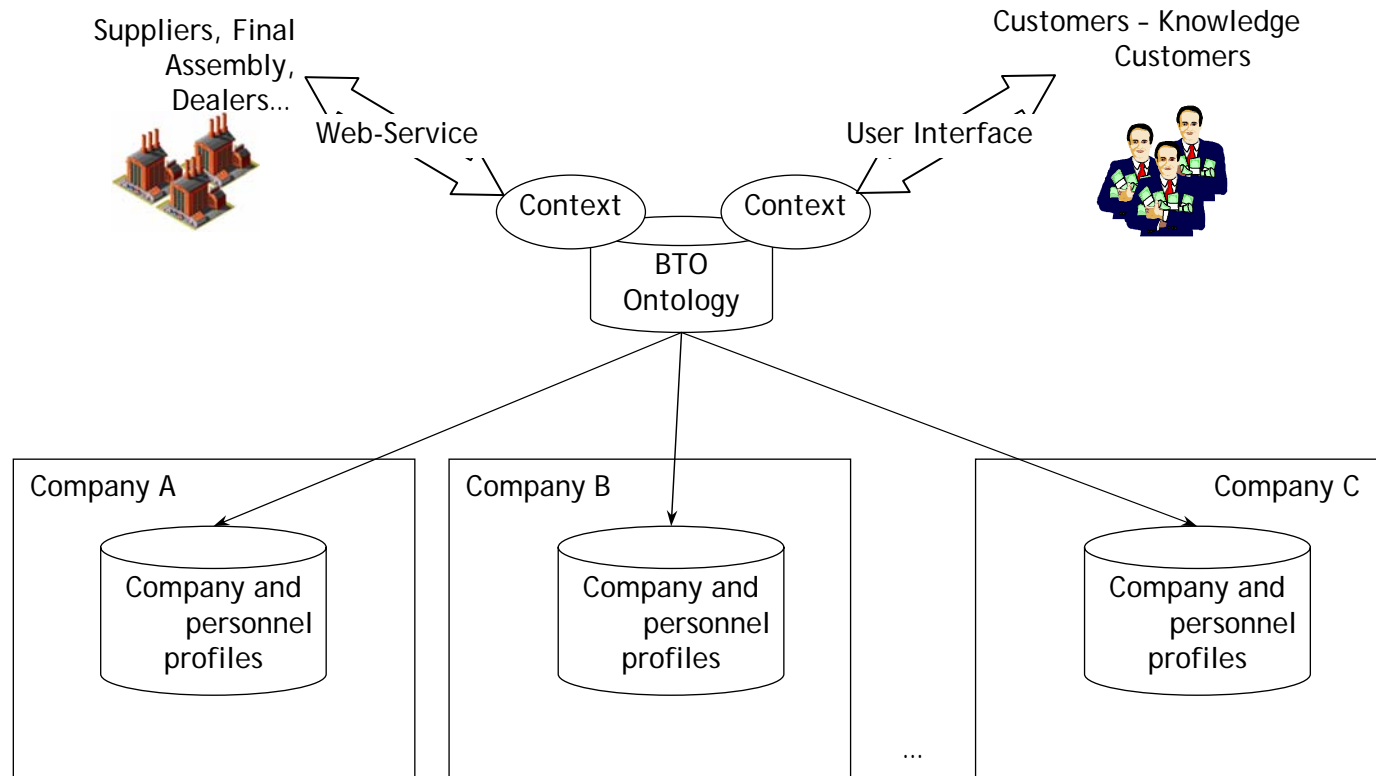
It is very important to share and exchange knowledge on available competences in a production network

- The interoperability at the technical level is addressed in a number of research efforts that usually employ such approaches as SOA and standards as WSDL and SOAP
- The semantic level interoperability in a production network is also paid significant attention in approaches like Semantic Web

The conceptual model of the proposed ontology-based competence management is based on the ideas of knowledge logistics and competence modeling developed earlier

- Ontologies are used to describe competence profiles of enterprises and their employees

# Architecture of the Knowledge Management Platform



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# Contexts

Contexts are important because the dynamic nature of the build-to-order (BTO) production networks requires considering the current situation in order to provide for actual knowledge or information

The context represents additional information

- It helps to identify specifics of the current situation
- It defines a narrow domain the user of the competence management platform works with

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# Competence Profiles

Competence profiles for each company and its specialists are represented as an ontology.

- Competence profiles are subdivided into enterprise and individual ones
- They contain such information as the production network member's capabilities and capacities, preferred ways of interaction, skills of staff members, etc.

Competences required from companies or specialists are described as subparts of the BTO ontology

- The system can search for potential team members by matching the identified parts to ontologies representing competence profiles



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# Enterprise Competence Profiles

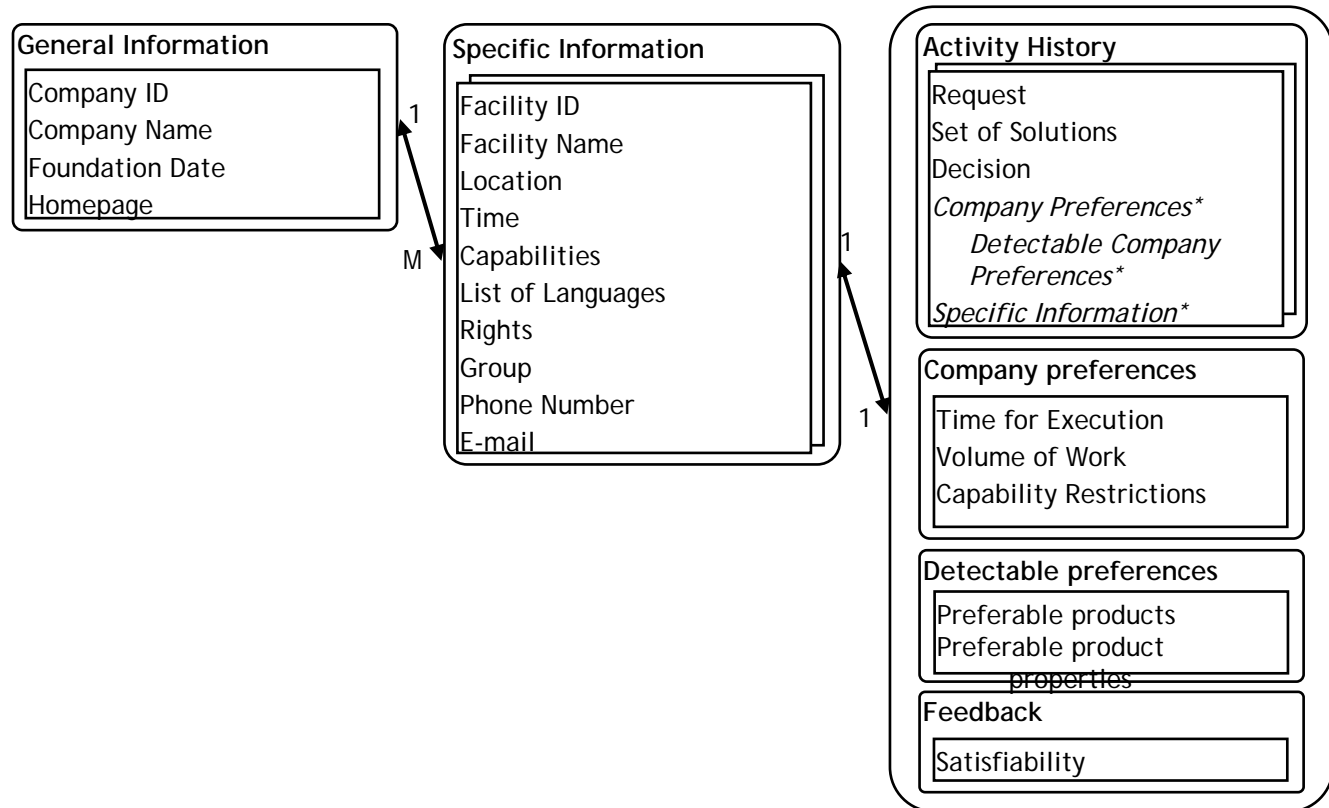
Competences of a company are described in an enterprise competence profile

- These competencies are important for determining which company is capable of carrying out a specified task and, hence, can be chosen as a team member
- Company competence is determined by available production facilities and previous experience of carrying out tasks

The enterprise competence profile consists of the following parts

- General Information
- Specific Information
- Activity History
- Company Preferences
- Detectable Company Preferences
- Feedback

# Structure of the Developed Profile for Companies in a BTO Production Network



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# Specific Information

Capabilities are production capabilities of a facility

- This property stores several options from a list of all the options for the domain

Rights determine knowledge area, which a facility can access

- For example a facility that produces 'tires' should not be able to access information about glass production

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# Activity History

Set of Solutions, Decision are used

- To analyze performance of a company
  - Other companies can see solutions generated in particular situations
- To identify detectable company preferences
  - Via analyzing differences of selected decisions from other offered alternative solutions

Company Preferences\* contain a snapshot of all the properties of the category “Company Preferences”;

Detectable Company Preferences\* contain a snapshot of all the properties of the category “Detectable Company Preferences”;

Specific Information\* contains a snapshot of all the properties of the category “Specific Information”.

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# Individual Competence Profiles

It is as important to know competence of the company's human resources in order to choose a qualified member for a team

- The individual competence profile aims at representing abilities and skills of a specialist who could take part in carrying out the defined task

An individual competence profile consists of

- General and special abilities
- Cultural competence
- Educational background
- Work experience

# Overview to Competence Perspectives for Collaborative Design Tasks

Competence	Represented by perspective	Based on work from
Problem solving competence	General Competences	Bjurklo and Kardemark [3], Pahl and Beitz [10]
Planning and designing competences	General Competences	Bjurklo and Kardemark [3], Pahl and Beitz [10]
Competences in the field of engineering in question	Occupational Competences	FOET-99 [1] and ISCO-88 [7]
Different technical competences in this engineering area	Occupational Competences	FOET-99 [1] and ISCO-88 [7]
Competence for team work and different roles	General Competences	Bjurklo and Kardemark [3], Ullman [17], Grudin [4]
Language competences, competences in integrating different social backgrounds	Cultural Competences	Hammer et al. [5]

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# Using Ontologies

We utilize ontologies to represent competence profiles

- This method allows for capturing the rich semantics of competence and accommodation of the results obtained in the areas of human resource management and statistics

An individual competence profile is divided into three parts according to the perspective

- General competence part
- Cultural competence part
- Occupational competence part

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# General Competence Part

The General Competence part includes general competences as proposed by Bjurklo and Kardemark

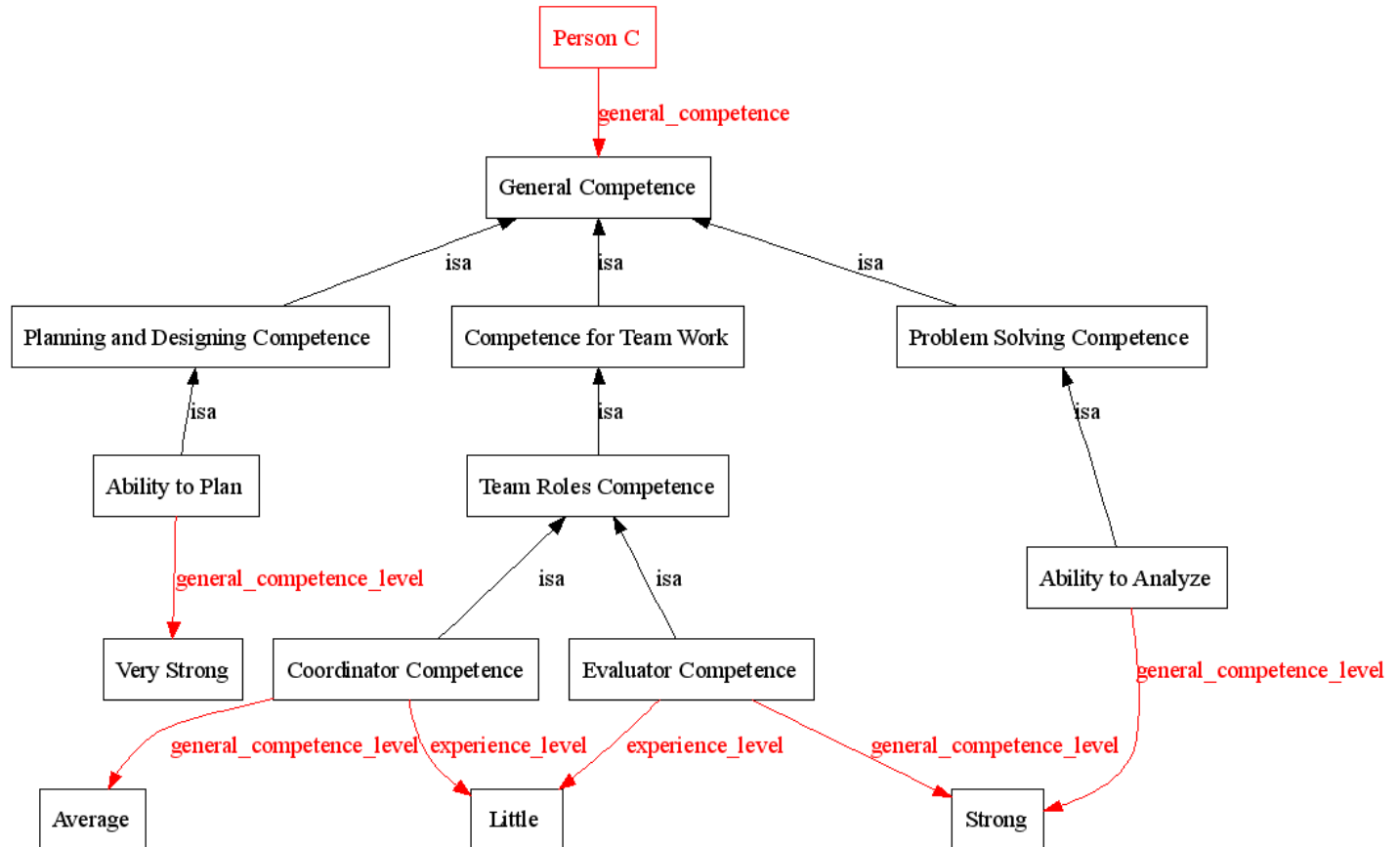
- They represent abilities general in nature and applicable to any task
- The more specific abilities, which are needed for performing tasks related to collaborative design, encompass design skills and teamwork abilities

This profile part are subdivided into

- Problem solving competences
- Planning and designing competences
- Competences for team work



# Example of the General Competence Part



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# Cultural Competence Part

The Cultural Competence part considers cultural competences, which are described based on intercultural sensitivity

- Hammer et al. [5] describe the concept of intercultural sensitivity, which shows how people can perceive cultural differences and act in multicultural environments

The intercultural sensitivity is subdivided into

- Ethnocentric orientations – denial, defense (reversal), minimization
- Ethnorelative ones – acceptance, adaptation, integration

This profile part also contains language competence

- It includes languages, spoken by a person,
- They can be related to a language level

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# Occupational Competence Part

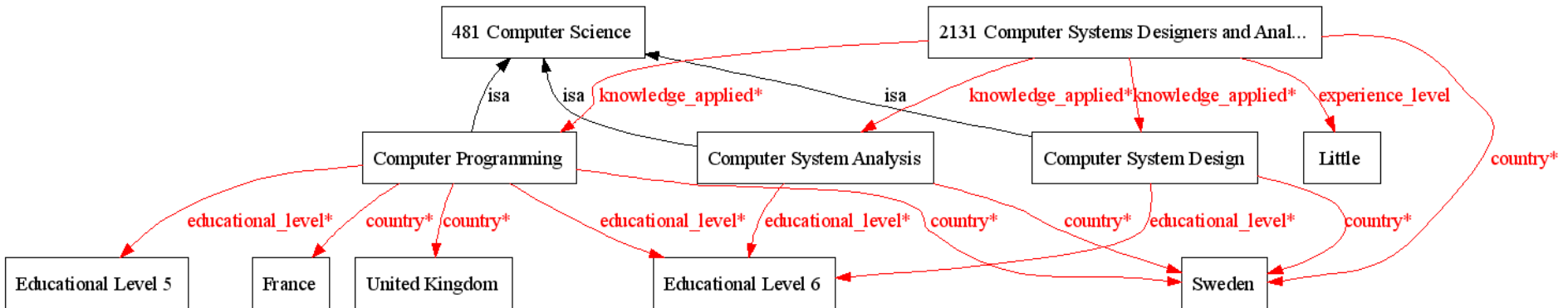
The Occupational Competence part shows what knowledge and skills the person has acquired during his/her work and education

- These skills reflect competences in the field of expertise in question and different technical competences in this area.

This profile part is based on statistical classifications:

- The Classification of fields of education and training, 1999
  - It is used to represent educational areas studied by an individual and relevant for engineering design
- International Standard Classification of Occupations, 1988
  - The person's present and past jobs are represented with the occupational groups from this classification

# Example of the Occupational Competence Part



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# Conclusions (1)

The paper proposes an approach to building a competence management platform that could be used for team configuration

- Competence profiles describe network members and provide for such information as their capabilities and capacities, preferred ways of interaction, skills of specialists, etc.
  - Competence profiles can be used to search for suitable team members
- Context management allows the competence management platform to take into account specific information about the current situation that is usually highly dynamic for BTO production networks

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# Conclusions (2)

Profiles can represent enterprise as well as individual competences

- The former describes production facilities of a company and experience of carrying out particular tasks
- The latter takes into account skills and abilities of a person that could be required for a defined task

As soon as ontologies are used as the representation technique for competence profiles, it is possible to identify potential candidates for a required team by ontology matching

- One can compare their competence profiles to a specific production task represented by parts of the BTO ontology
  - Here, by ontology matching, we rather mean matching of different subparts of the same ontology
- Research into different ontology matching techniques is one of the next logical steps in our future work