

Establishing a Common Vocabulary for Software Organizations Understand Software Processes



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Agenda

- Motivation
- Software Process
- SABiO: A Systematic Approach for Building Ontologies
- Software Process Ontology (SPO)
- Mapping Standards to the SPO
- Related Work
- Conclusions



Motivation

- Several process quality models and standards, such as ISO/IEC 12207 and CMMI, are used to guide software organizations in their software process improvement efforts.
- Vocabulary used by those models and by software organizations is diverse, leading to misunderstanding and problems related to the jointly use of different process quality models .
- Potential solution: Building a software process ontology.



Software Process

- Is a coherent set of policies, organizational structures, technologies, procedures, and artifacts that are needed to conceive, develop, deploy, and maintain a software product.
- Should be defined considering: the activities to be accomplished, the required resources, the input and output artifacts, the adopted procedures (methods, techniques, templates and so on) and the life cycle model to be followed.
- Different projects require processes with specific features.



Software Process

- Although different projects require processes with specific features, it is possible to establish a set of software process assets that should be present in all project processes → The organization's standard software process.
- The organizational standard software process can be specialized to consider some classes of software type (such as information system), paradigms (for example, object-oriented paradigm) etc, giving rise to standard specialized processes.
- The project's defined software process is developed by tailoring the organization's standard software process or one of its specialized standard processes to fit the specific characteristics of the project.



Software Process Standards

- Help software organizations achieve excellence by following the processes and activities adopted by the most successful organizations.
- A software organization can use or implement more than one standard at the same time.
- Vocabulary problems arise.



Software Process Standards

- ISO/IEC 12207: Processes, activities and tasks; Relationship between processes; Software process categories.
- ISO/IEC 15504: Processes, activities, inputs and outputs (work products); Organizational standard processes, tailored process.
- CMMI: Process areas (PAs), practices and goals. Organizational standard processes, project's process.
- RUP: Workers, activities, artifacts and workflows; Guidelines, templates and tools mentors.



Ontology

- A representation vocabulary, often specialized to some domain or subject matter.
- It can be used to describe ontological commitments for a set of agents (humans and software applications), that is, agreements to use a shared vocabulary in a coherent manner, so that they can communicate about a domain of discourse.



SABiO (Systematic Approach for Building Ontologies)

- Purpose identification and requirement specification: competency questions;
- Ontology capture: ontology diagrams (using an UML profile for ontologies), axioms and term dictionaries;
- Ontology formalization: axioms written in a formal language;
- Integration with existing ontologies;
- Ontology evaluation;
- Ontology documentation.



Software Process Ontology (SPO)

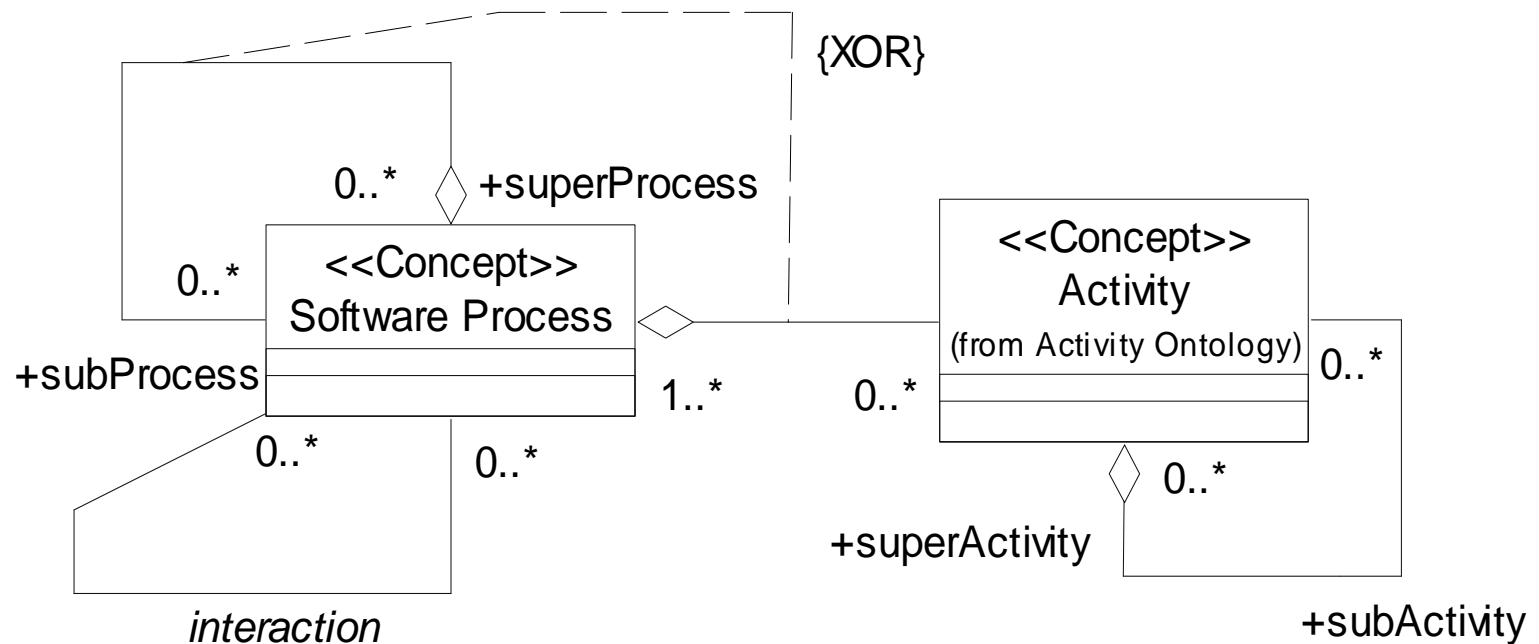
- Software process ontology was originally published in IBERAMIA'98.
- Ontologies for software activities, procedures and resources were not modified.
- Reviewed software process ontology is presented here.



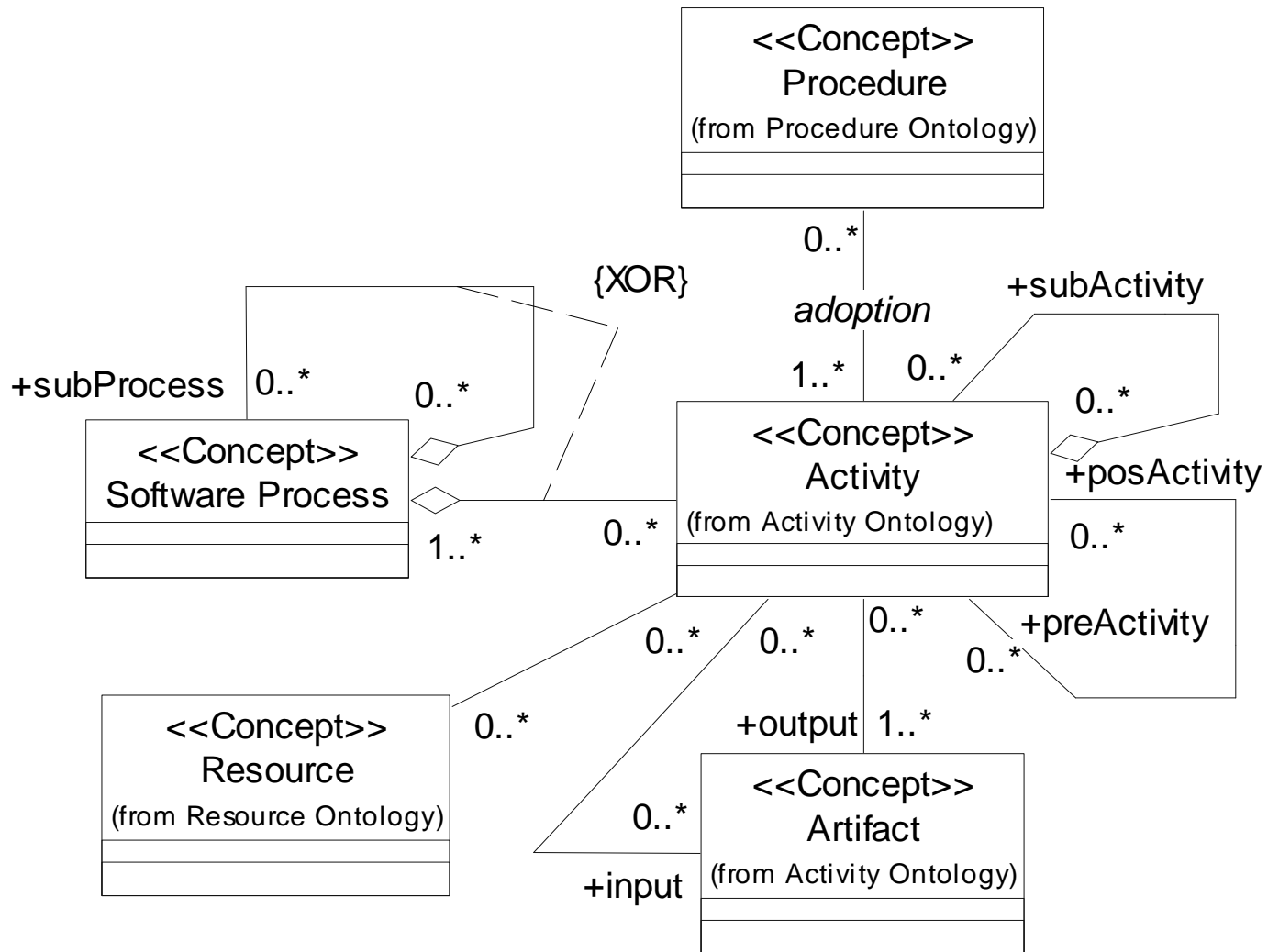
SPO – Competency Questions

- How can a process be decomposed?
- Which are the assets that compose a software process?
- Which are the inputs and outputs of a process?
- How can a process be classified?
- Which is the abstraction level of a process?
- How can a process be tailored?
- How do processes interact?
- How are the activities of a project's software process organized?

SPO Ontology Diagram – Process Decomposition



SPO Ontology Diagram – Process Definition

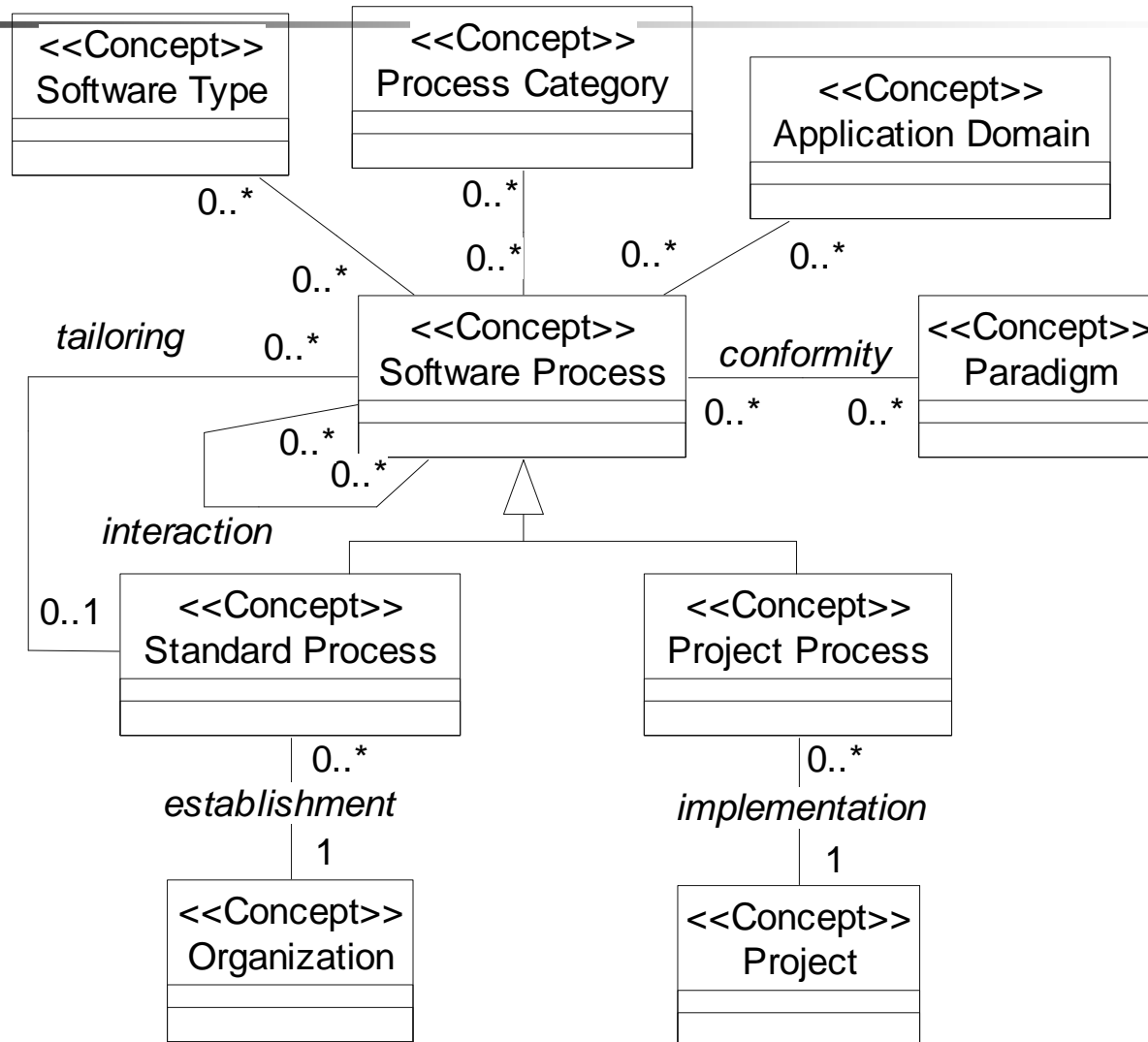


SPO Axiom (Example) – Process Definition

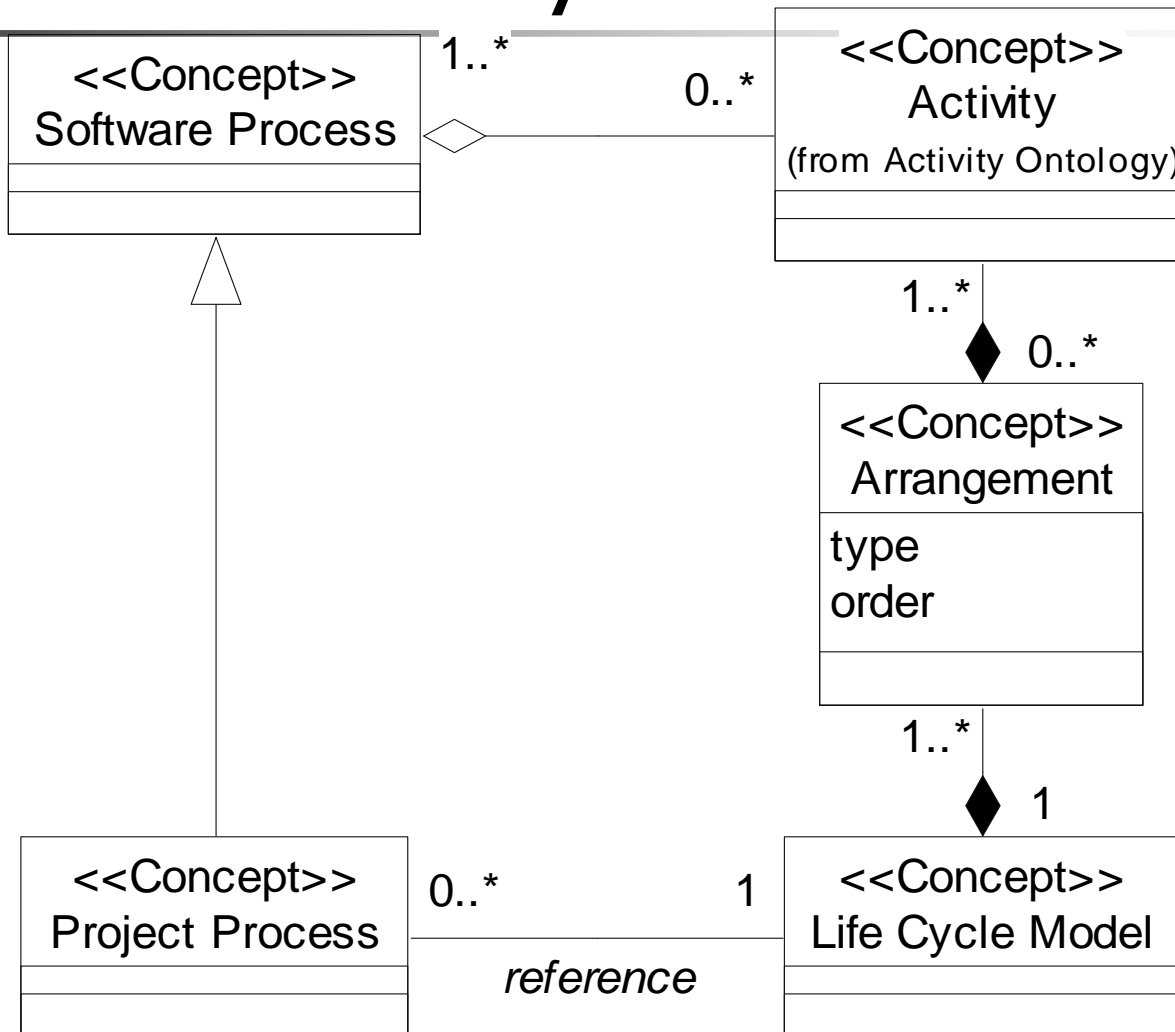
- If an activity $a1$, part of a software process p , requires as input an artifact s , and there isn't another activity $a2$, part of the same process p , that produces this artifact, then s is said an input of p .

$$\forall (p, a1, s) \text{ partOf}(a1, p) \wedge \text{input}(s, a1) \wedge ((\neg \exists a2) \text{ partOf}(a2, p) \wedge \text{output}(s, a2)) \rightarrow \text{input}(s, p)$$

SPO Ontology Diagram – Process Type and Abstraction Level



SPO Ontology Diagram – Project Process Life Cycle Model



Mapping ISO 12207, ISO 15504 and ISO 9000:2000 to the SPO

ISO	SPO
Process	Software Process
Standard Process	Standard Process
Tailored Process	Project Process
Work Product	Artifact
Activity / Task	Activity
Process Category	Process Category
Life Cycle Model	Life Cycle Model
Project	Project

Mapping CMMI to the SPO

CMMI	SPO
Process	Software Process
Standard Process	Standard Process
Defined Process	Project Process
Work Product	Artifact
Practice	Activity
Process Area	Software Process
Project	Project
Life Cycle Model	Life Cycle Model

Mapping RUP to the SPO

RUP	SPO
Process / Workflow	Software Process
Process Framework	Standard Process
Worker	Human Resource
Artifact	Artifact
Activity / Step	Activity
Guideline / Tool Mentor / Template	Procedure



Related Work

- OMG's Software Process Engineering Metamodel (SPEM).
- SPEM intends to define the minimal set of process modeling elements necessary to describe any software development process.
- SPEM follows an object-oriented approach for modeling a family of related software processes, and its specification is structured as a UML profile, and provides a complete MOF-based metamodel



Related Work - SPEM

- In our point of view, the main problem of SPEM is that several non intuitive (abstract) concepts are used to define concepts related to software process, such as Model Element, Package, Work Definition and so on.

Mapping SPEM to the SPO

SPEM	SPO
Process	Software Process
<i>Categorizes</i> Dependency	Process Category
Work Product	Artifact
Activity / Step	Activity
Process Role	Human Resource / Team
Guidance	Procedure
Life Cycle	Life Cycle Model



Conclusion

- Systematic process improvement is achieved only if it is done guided by process quality standards.
- It is important to use more than one standard, so that the strengths of one can be used to offset the weaknesses of the other, and vice versa. But in this case, we face problems related to the vocabularies used by the different standards.
- To overcome this problem, we established a common conceptualization about software processes, building a software process ontology.



Future Work

- We need to do a more complete mapping between the standards, using our ontology as an interlingua.
- A mapping considering the contents of the standards is also useful.



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Future Work

- We are using the SPO in the development of ODE, a Process-Centered Software Engineering Environment.
- The idea is that it can be configurable for using the most adequate vocabulary, given by the choice of a standard that a software organization is committing to.



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