Architecture Competence

Literature

[Bass et al., 2008a]

– Bass, L., Clements, P., Kazman, R., Klein, M. (2008). Evaluating the Software Architecture Competence of Organizations. In *Proceedings of WICSA 2008, pp 249-252*

[Bass et al., 2008b]

– Bass, L., Clements, P., Kazman, R., Klein, M. (2008). *Models for Evaluating and Improving Architecture Competence.* Technical Report CMU/SEI-2008-TR-006

Perspectives on Architectural Competence

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Competent input/process

The architecture competence of an organization is the ability of that organization to grow, use, and sustain the skills and knowledge necessary to effectively carry out architecture-centric practices at the individual, team, and organizational levels to produce architectures with acceptable cost that lead to systems aligned with the organization's business goals.

Competent output

Models of Competence

Duties, Skills, and Knowledge (DSK) model of competence

- Architects are competent practitioners, understand what they do

Human Performance model of competence

- Competence can be measured on quality of output of individuals

Organizational Coordination model of competence

- Competent coordination is in concert with module structure of architecture

Organizational Learning model of competence

- Organizations and not just individuals can learn

Duties, Skills, and Knowledge

Architects perform many activities other than producing an architecture

- Architect has a set of *duties* such as architecting and leadership

Performing duties requires *skills*

- E.g., communication skills or interpersonal skills

This is backed by *knowledge* (including experience)

- E.g., knowledge of architecture concepts or domain knowledge

Questionnaire…

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B. About your organization's architectural practices

B1. How important are the following activities for a software development organization to achieve high competence in software architecture? B2. How well does your organization carry out these activities now?	**How important are these activities to architecture competence?** **1 = Unimportant** **2 = Not very important** **3 = Fairly important** **4 = Very important** **? = Not sure**	**How well are these currently practiced by your organization?** **0 = not done at all** **1 = done poorly** **2 = done moderately well** **3 = done very well** **? = I don't know**
a. Hire talented architects.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
b. Establish a career track for architects.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
c. Make the position of architect highly regarded through visibility, reward, and prestige.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
d. Establish a clear statement of responsibilities and authority for architects.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
e. Establish a mentoring program for architects.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
f. Establish an architecture training and education program.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
g. Track how architects spend their time.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
h. Establish an architect certification program.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
i. Have architects receive external architect certifications.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
j. Measure architects' performance.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
k. Establish a forum for architects to communicate, and share information and experience.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
l. Establish a repository of reusable architectures and architecture-based artifacts.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
m. Develop reusable reference architectures.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
n. Establish organization-wide architecture practices.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐
o. Establish an architecture review board.	1☐ 2☐ 3☐ 4☐ ?☐	0☐ 1☐ 2☐ 3☐ ?☐

The Trouble with of Surveys

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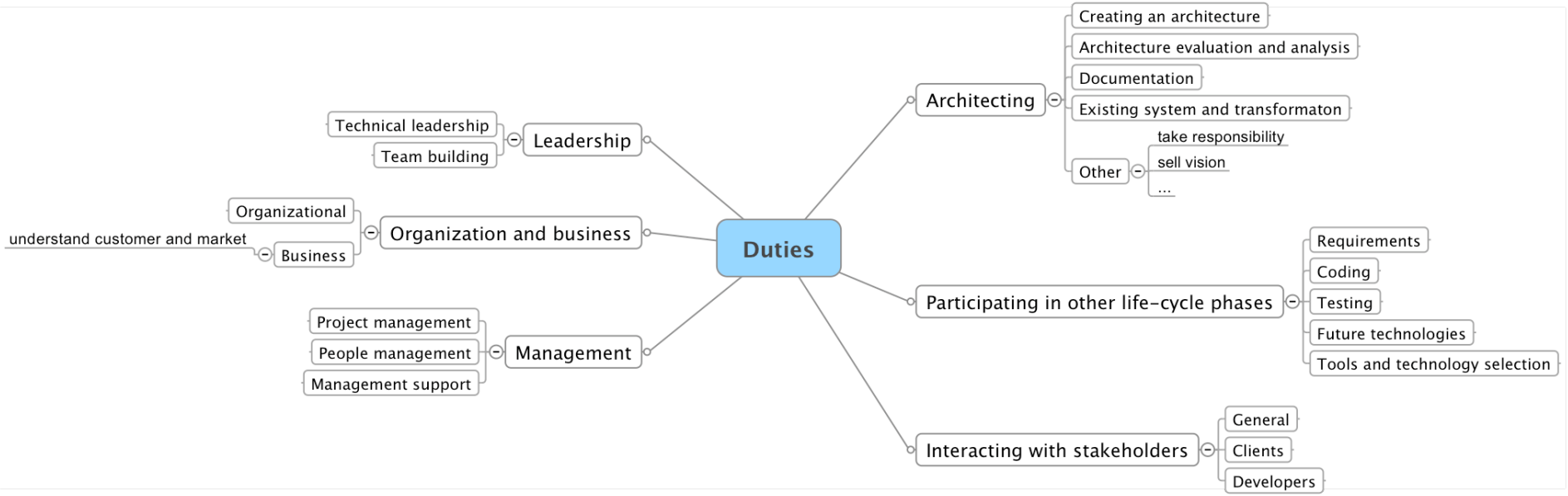
Self-reporting may be inaccurate

- May not remember correctly
- May not have sufficient knowledge
- May misrepresent on purpose

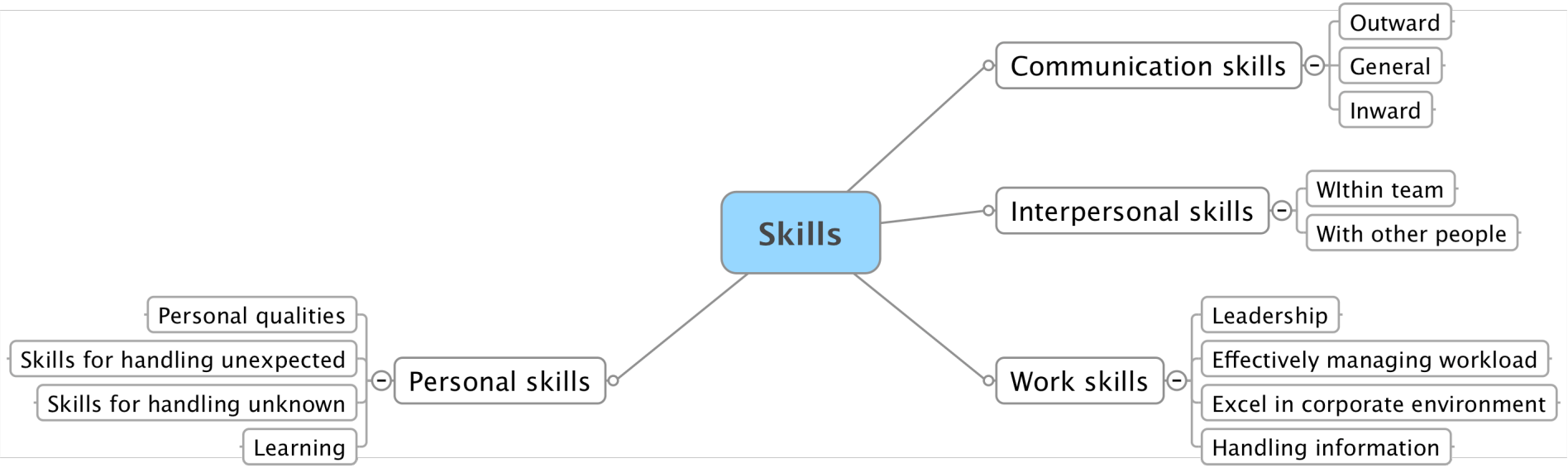
Field studies as an alternative

- The SA@Work project does this
- Complements survey-type studies with rich, concrete details

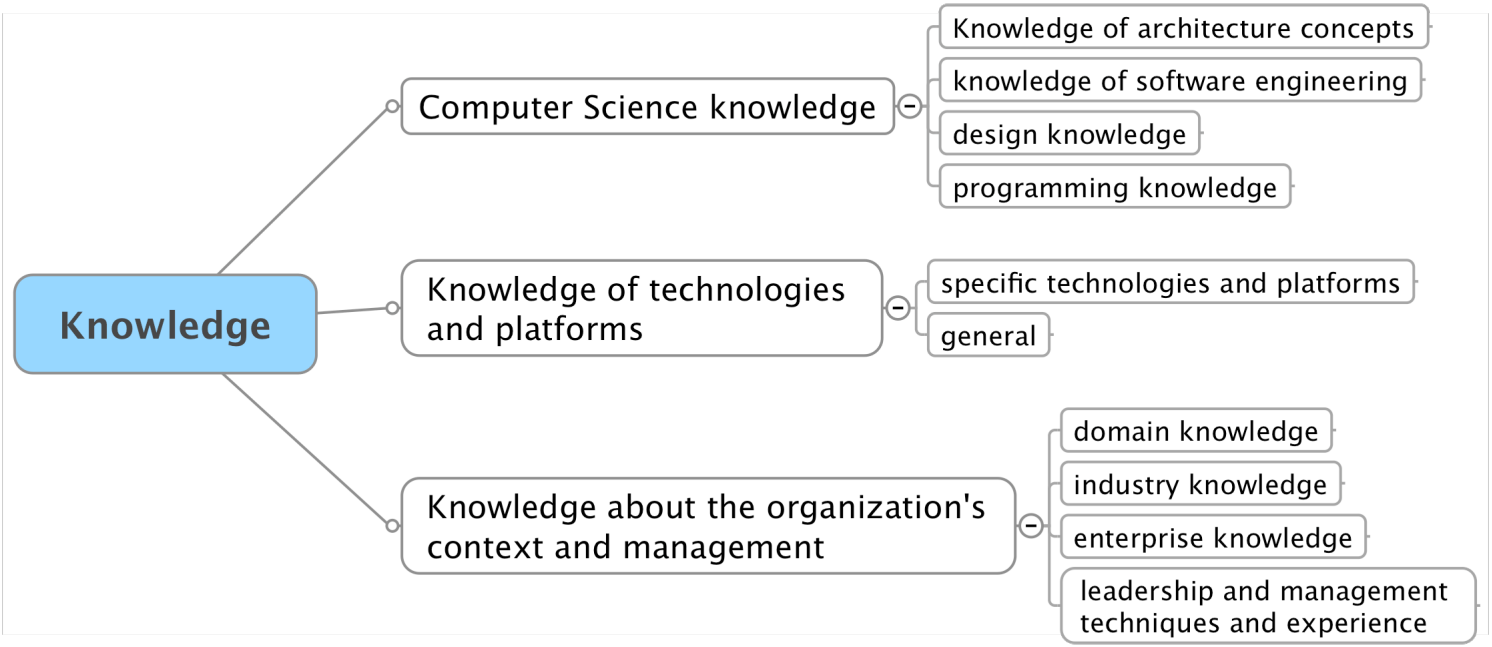
Architect Duties



Architect Skills



Architect Knowledge



Is Architecture Competence Important?

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> *The architecture competence of an organization is the ability of that organization to grow, use, and sustain the skills and knowledge necessary to effectively carry out architecture-centric practices at the individual, team, and organizational levels to produce architectures with acceptable cost that lead to systems aligned with the organization's business goals.*

Axioms/beliefs

- The software architecture of a system is the fundamental artifact that guides development
- Design of software architecture is based on architecturally significant requirements
- Alignment of software architecture and organizational and business context has a large impact

Implications for business goals, requirements, architecture, and implementation

Assessing Architecture Competence

[Bass et al., 2008a] proposes an assessment instrument based on questioning

- Top-down generation of questions: based on axioms/ beliefs
- Bottom-up generation of questions: based on the DSK, human performance, organizational coordination, and organizational learning models

Typical assessment situation will then involve

- An element of self-assessment in an organization
- An assessor probing an organization

Each questions accompanied by

- Asking for supporting evidence
- Asking for general validity/sustainability of answer

Examples: Questions Based on Duties

Duty: Architecture evaluation and analysis

Question: How do you evaluate and analyze an architecture?

- Are evaluations part of the normal software development life-cycle or are they done when problems are encountered?
- Is the evaluation incremental or "big bang"? How is the timing determined?
- Does the evaluation include an explicit activity relating architecture to business goals?
- What are the inputs to the evaluation? How are they validated?
- What are the outputs from an evaluation? How are the outputs of the evaluation used? Are the outputs differentiated according to impact or importance? How are the outputs validated? To whom are the various outputs communicated?

Exercise

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Consider Questions Based on Duties for your own organization

Examples: Questions Based on Organizational Learning

Questions based on the Organizational Learning Model

Question: How do you capture and share experiences, lessons learned, technological decisions, techniques and methods, and knowledge about available tooling?

- Do you use any knowledge management tools?
- Is architectural knowledge embedded in your processes?
- Where is the information about "who knows what" captured and how is this information maintained?
- How complete and up to date is your architecture documentation? How widely disseminated is it?

Exercise

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Consider Questions Based on Organizational Learning for your own organization

Summary

Two perspectives on competence

- Qualification perspective: possession of required skill, knowledge etc. to manage software architectures
- Output perspective: ability to actually manage software architectures
- Architecture competence definition combines these

Several levels of competence

- Individual
- Team
- Organization

To assess, each perspective and level should be considered

Architecture Compentence Exercise

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Perform a “mock assessment” of an organization of a group member using the questions in [Bass et al., 2008a]

How would you measure architectural competence to give a level of 1 to 10 (as in the questionnaire)?