

Doctoral Thesis : Research and Development of a Knowledge Management System (KMS) for Embedded Systems Development

Researcher: Simon L Winberg Supervisors: Mike Inggs (UCT) and Steve Schach (Vanderbilt)

1. Objective

Develop a framework for evolving a knowledge management system [Drucker, 1998] for managing Artifact Organization and Adaption (AOA) knowledge, a specialized form of technical knowledge that occurs during the implementation phase [Schach, 2005] of a development project. The methodology is applied and tested in the context of developing embedded systems.

2. Terminology and Background

Knowledge exists in the mind of a person, and gets there through the interpretation of information [Debowski, 2006]. A knowledge management system (KMS) involves people, processes and artifacts of an organization and how these work together to support the creation, capture, storage and dissemination of knowledge in the organization [Holsapple, 2003].

3. Focus: ESAOA Activities

A KMS exists for any form of knowledge work (e.g. Embedded system development). This thesis focuses on moving a group of engineers from using an *ad-hoc* KMS that evolved naturally towards a refined KMS through a process of “directed KMS evolution” (See Figure 1). Knowledge management, like knowledge itself, is highly dependent on the type of knowledge work involved. Therefore, to evolve a KMS, detailed study of the knowledge work is needed, to achieve trade-offs and produce specialized knowledge management methods and tools. This project focuses on a specific form of knowledge work, referred to as embedded system artifact organization and adaptation (ESAOA) activities. These activities are closely associated to an engineer’s knowledge of development tools and product components used to construct an embedded system (see below). The research design (Figure 2) focuses on how developers organize and adapt implementation artifacts to create, capture, store, and share knowledge of product components and the use of development tools to implement a product. The results are used to improve the design of the ESAOA framework for managing embedded systems knowledge.

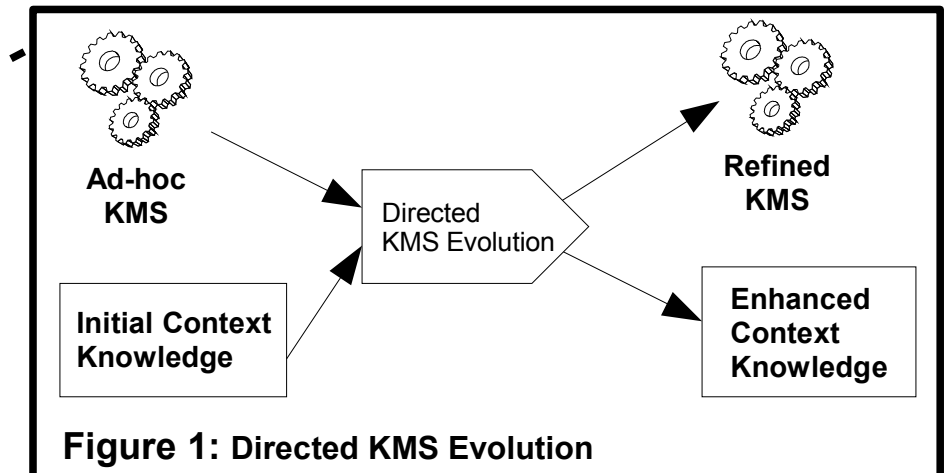
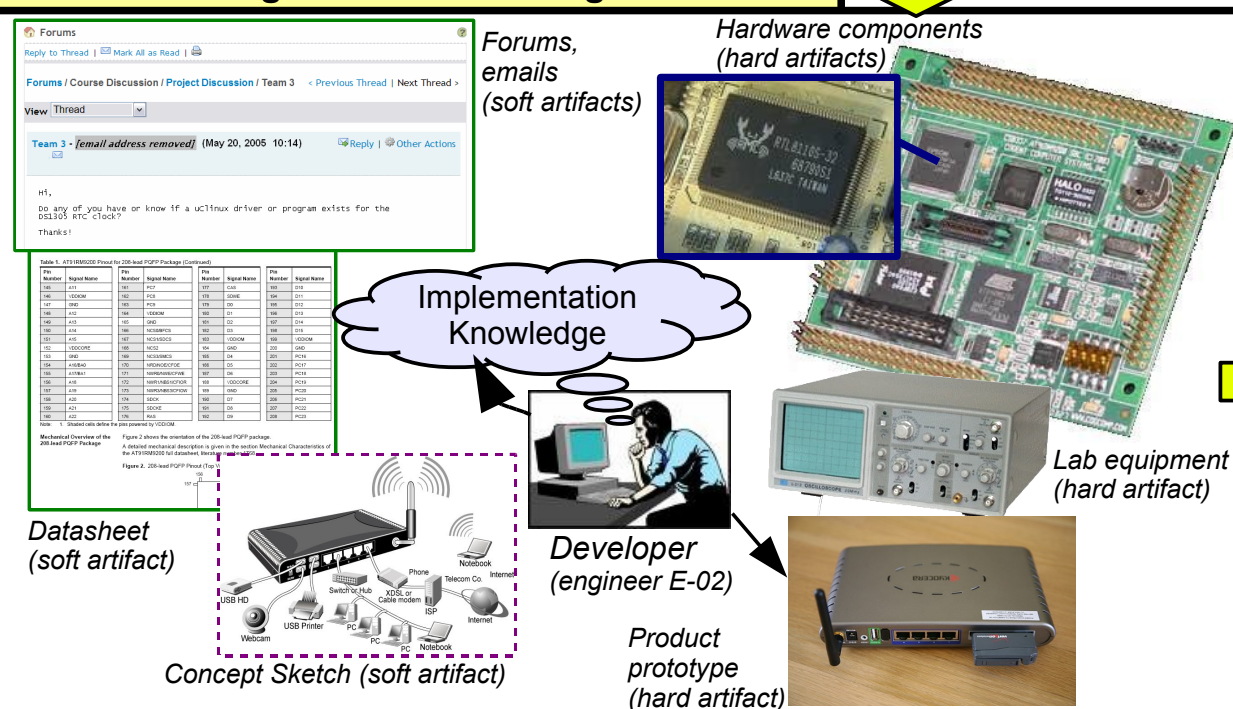
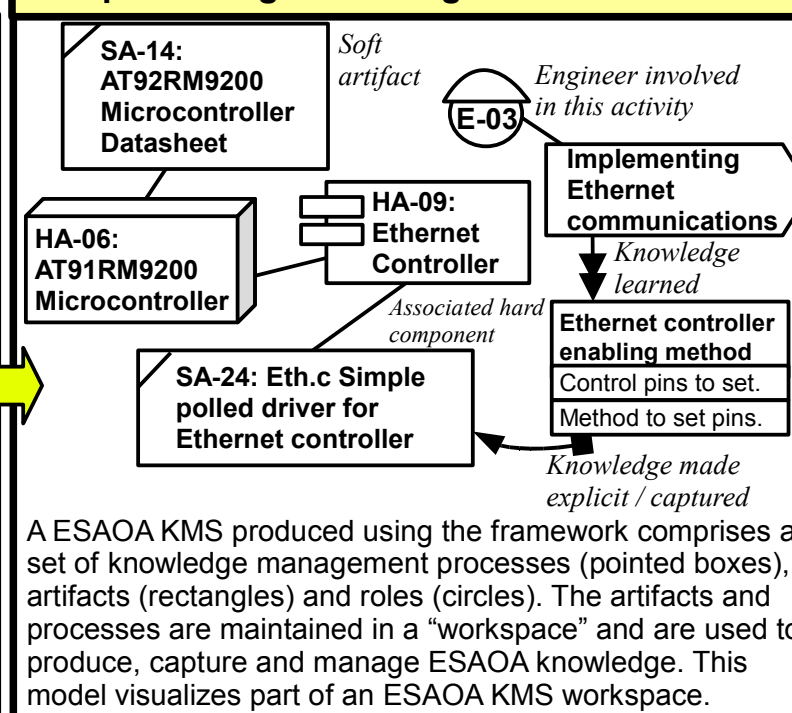


Figure 1: Directed KMS Evolution

4. Researching ESAOA knowledge



5. Representing & evolving an ESAOA KMS



A ESAOA KMS produced using the framework comprises a set of knowledge management processes (pointed boxes), artifacts (rectangles) and roles (circles). The artifacts and processes are maintained in a “workspace” and are used to produce, capture and manage ESAOA knowledge. This model visualizes part of an ESAOA KMS workspace.

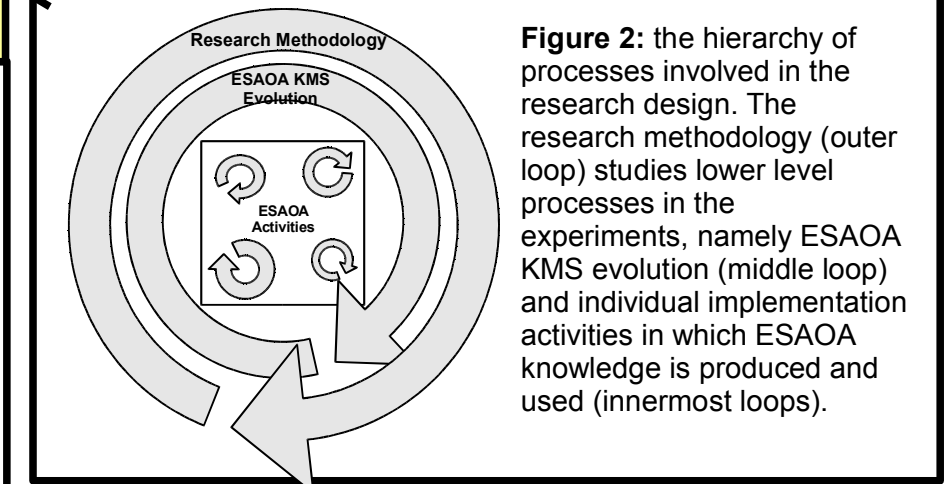


Figure 2: the hierarchy of processes involved in the research design. The research methodology (outer loop) studies lower level processes in the experiments, namely ESAOA KMS evolution (middle loop) and individual implementation activities in which ESAOA knowledge is produced and used (innermost loops).

References

Drucker, P., et. al (1998) *Harvard business review on KM*, HBS Press.
Holsapple, C. (2003) *Handbook of KM*, Springer, New York, NY.
Schach, S. (2005) *Object-oriented and classical software engineering*, McGraw-Hill, Boston, MA.
Winberg, S. (2007) *Productive vs non-productive knowledge acquisition in embedded software development*. In *International journal of Software engineering and knowledge engineering*, 17(4), New Jersey.