13 Enterprise Knowledge Spaces

In Chaps. 1 and 2 we introduced the concept of enterprise knowledge spaces. We will here describe the different spaces in more detail, before discussing in further detail the necessity of theses spaces; are they given or artificial constructs, borders between different parts of human conduct that can be efficiently bridged by Active Knowledge Modeling?

13.1 Enterprise Knowledge Spaces Revisited

A knowledge space is a four-dimensional representation, where the dimensions are mutually reflective, capable of altering each others' meaning. AKM methodologies are built upon a common framework, called the Enterprise Knowledge Architecture (EKA) as described in Chap. 5. The EKA defines the dimensions of four nested knowledge spaces:

- The *personal workspace*, reflecting a user's work and knowledge so that the information system can adapt to it, as information content, roles, tasks and views (IRTV).
- The *innovation space*, reflecting the products, organization, processes and systems (POPS) of an interdisciplinary team collaborating, e.g. in product design.
- The *business networking space*, reflecting how companies come together in value networks and supply chains, their services, networks, projects and platforms (SNPP).
- The *community space*, reflecting how larger industries, sectors, cultures, and societies function, their values, resources, initiatives and infrastructures (VRII).

These knowledge spaces exist in all enterprises from two people collaborating to global value-chains. Main roles and goals of the different spaces are depicted in Fig. 13.1.

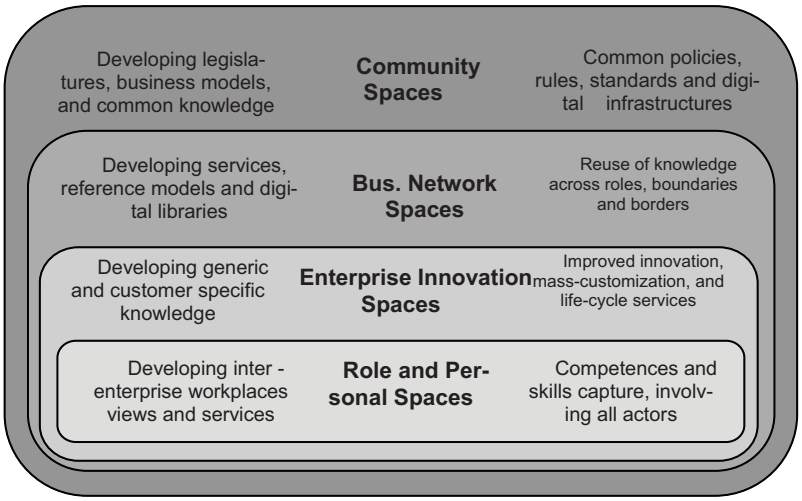

Fig. 13.1. Enterprise knowledge spaces

13.2 Modeling of Enterprise Knowledge Spaces

There are modeling methodologies associated with each of the 4 knowledge spaces. This book introduces the visual solution development methodology for personal workspaces, and the collaborative product design methodology for the innovation space. Below, we first introduce the basic dimensions of each space, and then we outline the principles for how the knowledge spaces are integrated into a holistic knowledge architecture.

13.2.1 Personal Workspace

A personal workspace should contain everything that someone needs for performing their work. In order to reflect this space, we need to model the four dimensions depicted in Fig.13.2 below:

- Information (I), which information is needed to perform the work, which information is produced, etc.
- Roles (R), who are involved in the work, what is their responsibilities, which tasks do they perform, which information do they use, which views should their workplace consist of etc.

- Tasks (T), which tasks are performed, which services are used to achieve the results.
- Views (V), which views should be available in the workplaces, which information and services should they give access to, what should it look like, etc.

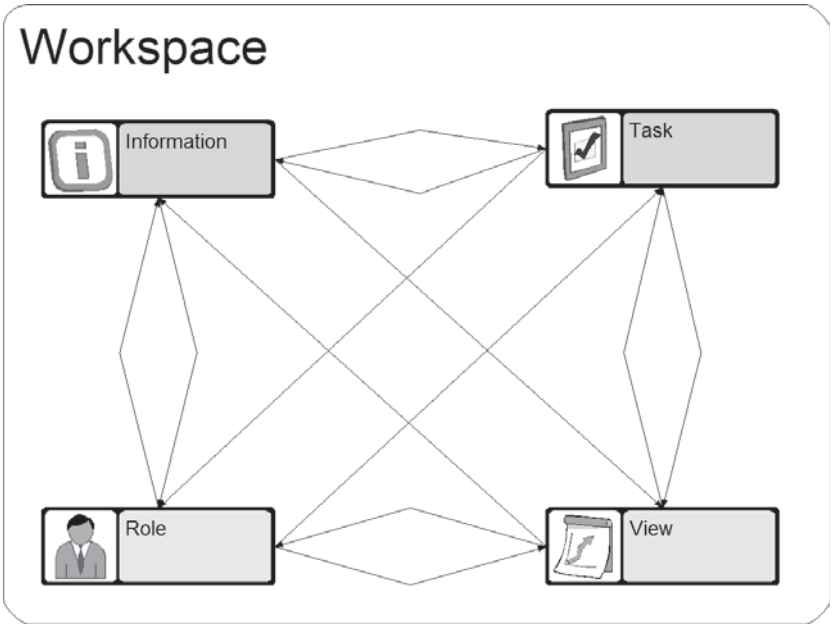

Fig. 13.2. Personal workspace components

As shown, the dimensions are mutually dependent. Tasks require and produce information, tasks are performed by roles, roles are defined by the tasks the role is responsible for, roles need access to information, information is owned by roles, views are applied by roles performing tasks on some information, etc. Understanding and managing these dependencies are crucial for designing the right information, role, task and view models. The four dimensions should thus be designed together. IRTV models typically contain several relationships between the elements in each dimension (information models, task patterns etc.), and as well between the dimensions (e.g. roles and tasks such as a UML use case diagram). Large hierarchies of elements are however less common in this layer. Instead, task are often organized into process hierarchies, information by product structures, roles into organizational structures and views into application systems, in the surrounding innovation space discussed below.

13.2.2 Innovation Space

The innovation space defines the core structures of teamwork, especially in design projects. It contains these dimensions:

- Product (P), the result and content of the work,
- Organization (O), the personnel resources and skills required, available or applied,
- Process (P), the structure of work tasks,
- System (S), the underlying support tools and equipment used.

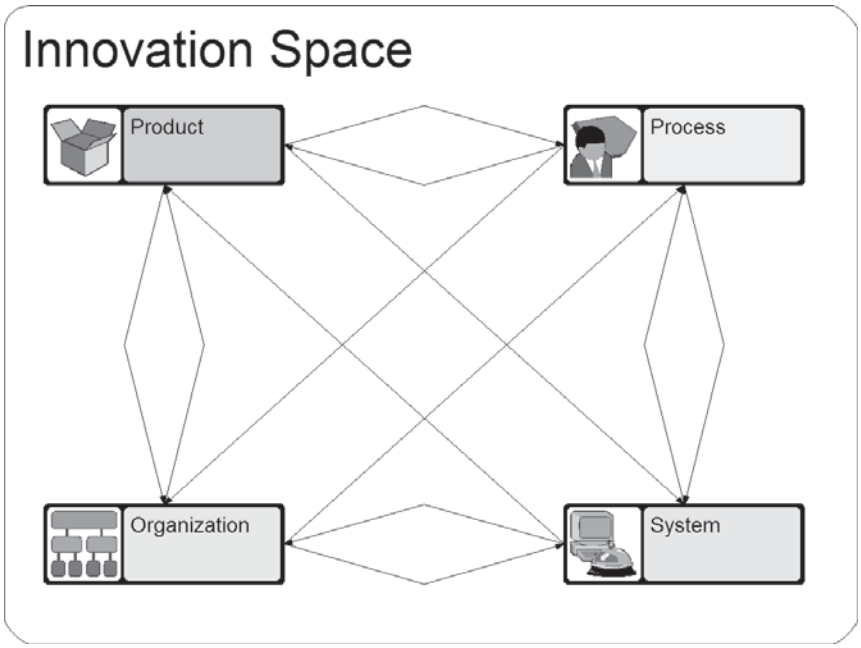

Fig. 13.3. Innovation space components

In a design project, a process is followed by an organization, using a system to develop a product. Again, the dimensions are mutually dependent on each other, and should be designed together, using the Collaborative Product Design methodology. The innovation space typically will contain hierarchical and aspect-oriented structures for each of the dimensions, such as work-breakdown structures for processes, component hierarchies for products, and of course organization hierarchies.

13.2.3 Business Networking Space

Behind the creative work performed in innovation spaces, we find strategic management and business transactions, establishing networks of groups and companies working together in value and supply networks, markets, and consortia. The dimensions of this space are:

- Services (S) required and provided by the different companies and groups,
- Network organization (N) structures of established collaborations,
- Projects (P) where multiple partners cooperate to create new services, and
- Platforms (P) providing interoperable IT support for the networks.

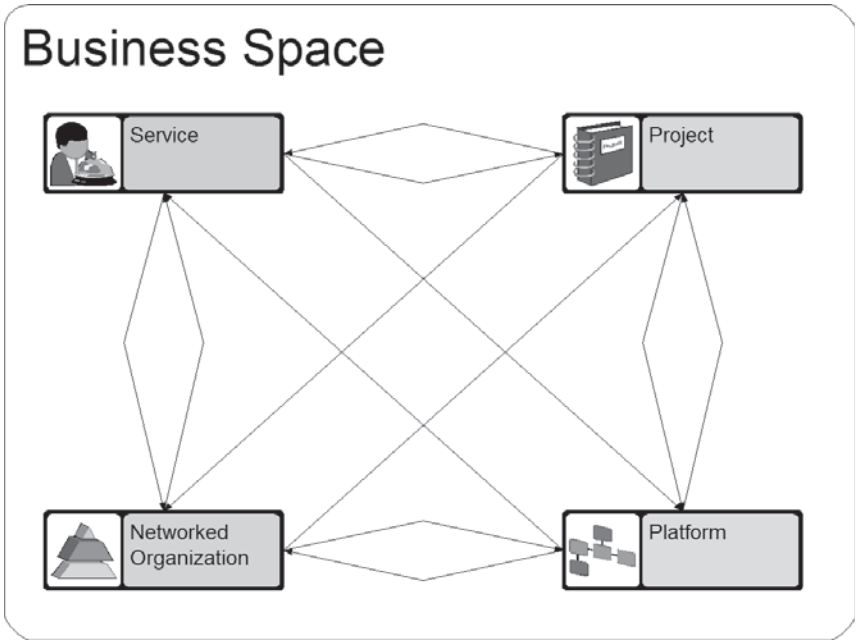

Fig. 13.4. Business space components

13.2.4 Community Space

Finally, the backbone of personal knowledge spaces, innovative teams, businesses and networks, is the society, culture, industrial setting etc. where the businesses operate. Though not under the control of the business, they influence the operation of most businesses profoundly, in a number of dimensions:

- Values (V) represent the worth of commodities, services, assets, or work, and the principles, standards, or quality which guides human actions.
- Resources (R) are the personnel and material applied to create value.
- Initiatives (I) to apply resources and infrastructure to create new values.
- Infrastructure (I) is the overall set of tools and mechanisms for communication, logistics, and value creation in general.

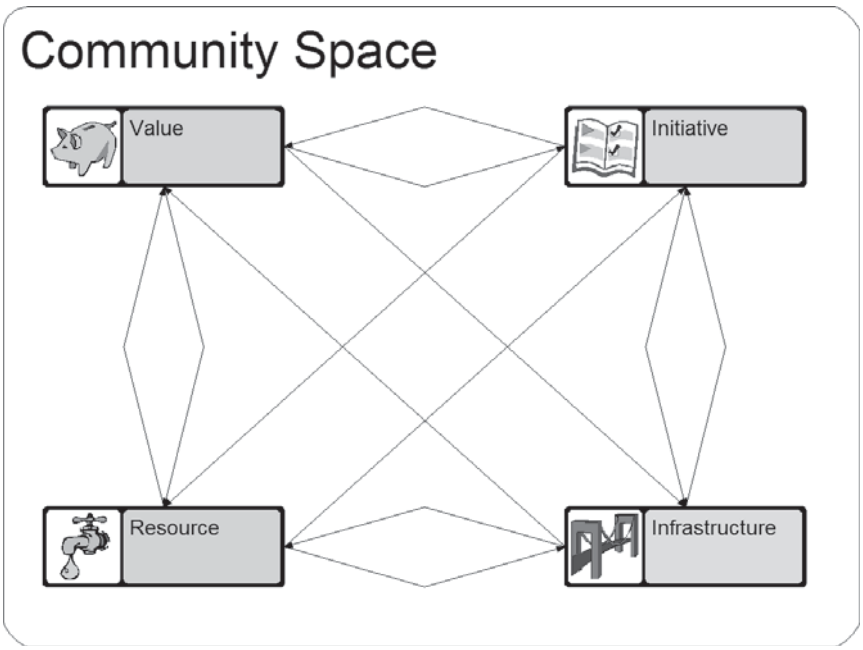

Fig. 13.5. Community space components

Future AKM-based corporate governance and community building methodologies need to assess value propositions, resource development and management, initiative portfolio management, infrastructure extension and maintenance.

13.2.5 Overview

Table 13.1 summarizes the main knowledge spaces discussed above, illustrating as well how the dimensions reflect what to produce, who should do the work, how they should go about, and the tools applied. The last line, refers back to the dimensions described in Fig. 5.6.

Table 13.1. Roles vs. knowledge spaces

	What/Why	Who	How	Enabler
Community and network	Value	Resource	Initiative	Infrastructure
Business	Service	Network	Project	Platform
Team innovation	Product	Organization	Process	System
Individual	Information	Role	Task	View
Software	Data	User	Code	Programming

13.2.6 Knowledge Architectures

Knowledge architectures provide the structure that integrates the various knowledge spaces described above, and define the services for developing and customizing the knowledge spaces. Crucial challenges include:

- How the four dimensions of a knowledge space relate to each other and interact.
- How different knowledge spaces interact, e.g. how elements are reflected across the knowledge spaces.

Reflective Views

The dimensions of a knowledge space are interdependent. When you work on one dimension, you should take the others into account. For instance, in

Fig. 13.6, we see how the products, organization, and system elements appear as input, output and mechanism roles in IDEF process models.

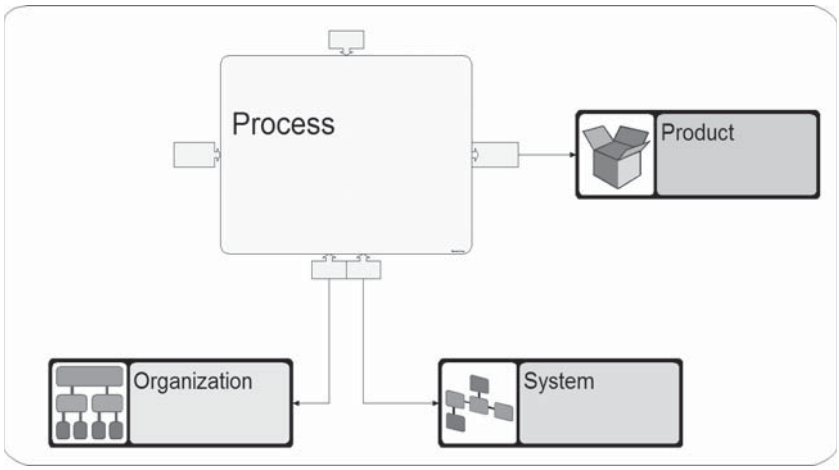

Fig. 13.6. Example of reflective views

Table 13.2 gives more examples for the innovation space, showing that each of the dimensions may appear as "foreign" but integral elements (vertical) of models that primarily deal with another dimension (horizontal). As indicated, there is also inherent reflection within one dimension, e.g. planning processes that define other processes, production equipment being designed alongside the product they are to produce, etc. Examples from other spaces include data and metadata in the information dimension, and learning how to learn.

Table 13.2. Reflections in the innovation space

Dimension → / Foreign element ↓	Product	Organization	Process	System
Product	Design of production equipment	Organize by system, component or discipline	Input/output roles, flows as product states	Identification and coding schemes across systems
Organization	Responsibility for product components; The effects of e.g. manufacturing org. on design	Management and organizational design units	Resource roles, control roles	Infrastructure provisioning organization
Process	Product lifecycle, multiple parameter value sets in different phases	Organize by phase, relationships (e.g. reporting) entail tasks	Planning processes and business process engineering and improvement methodologies	System usage processes
System	Engineering tools manage different product aspects	Deployment architecture	Mechanism roles	Systems for systems development

This mutual reflection between the dimensions in a space implies that all views and representations can be kept consistent. For instance, when someone adds a flow between two steps in a design process, that flow implicitly denotes a state in the product lifecycle as well, e.g. “as designed”, “as built”. When a new product component is added, the process model should immediately include steps for designing, testing, producing etc. the newly added component as well, organizational roles that are responsible for these tasks should be defined, alongside the information system elements needed for managing the information about the component and services for performing the tasks.

13.2.7 Reflection across Knowledge Spaces

Perhaps even more important than the reflection inherent in a knowledge space, is reflection between the knowledge spaces, e.g.:

- How the IRTV models are reflected into software services to create customized IT solutions, with parameterized services and information content available through role-specific workplaces.
- How innovation space models, such as the collaborative product design methodology, map to IRTV models for configurable IT support
- How IRTV models capture bottom-up tasks, information content and targeted roles that need to be managed through the hierarchical process, product, organization and system structures.

As depicted below, the dominant relationships for managing lower layer structures typically follow the main dimensions. For instance, tasks are aggregated into processes, roles into organizations, views into systems, and the primary information elements reflect product structures.

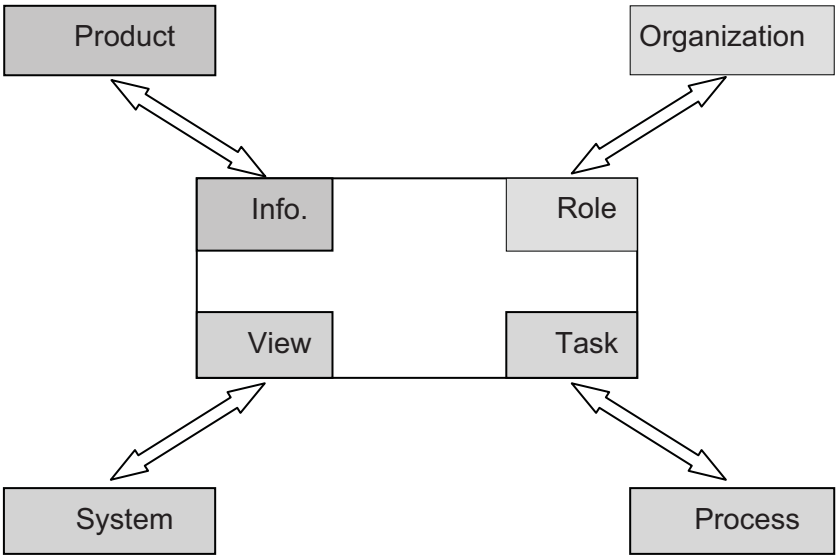

Fig. 13.7. Dominant reflections across knowledge spaces

This simplistic view is held by most modeling methodologies, such a business process management, information and data modeling, organization hierarchy charts etc. It does however violate one of the core principles of knowledge spaces, that the dimensional views are all mutually reflective

and interdependent. It's single-dimensional, top-down perspective also violates common sense: Of course, processes, organizations and systems are described as information as well, not just products. In the design, the product structures capture the critical dependencies between tasks, and the product structures are also used for managing and coordinating tasks, e.g. monitoring the progress of product component design rather than the progress of sub-processes and subtasks. Similarly, administrative tasks such as reporting emerge from relationships in the organization structure, and low level tasks are associated to the usage of information systems. Likewise, roles deal with responsibilities towards processes, products, and systems, not just the simple organizational structures. The figure below thus gives a more accurate, albeit complex representation of how the innovation space is reflected into personal workspaces, and vice versa.

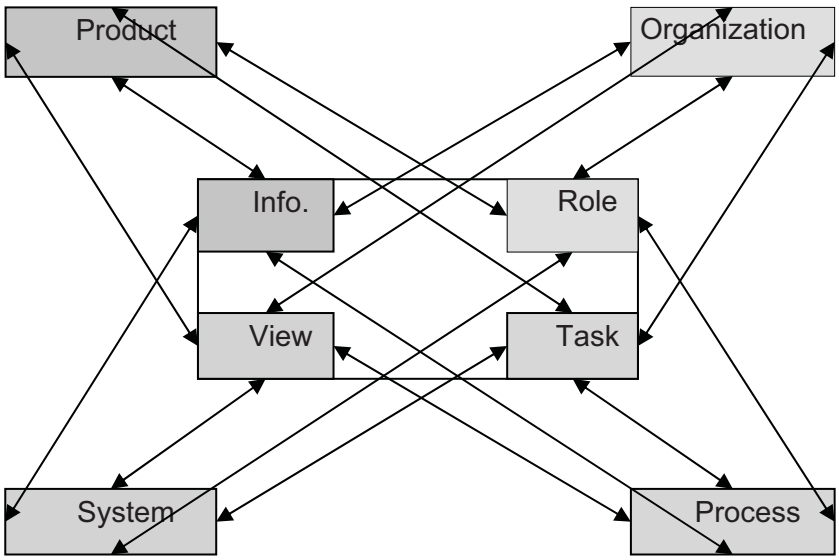

Fig. 13.8. Totality of reflections across knowledge spaces

The figure above also shows that each of the POPS elements can be seen from four different workspace perspectives (sides), as information, role/responsibility, task, and view, respectively. When these spaces are brought together, we thus define derived concepts illustrated by the above relationships, such as

- product role, process role, organization role, and system roles
- product, organization, process, and system information
- product lifecycle, organizational, process, and system tasks

- product, organization role, process phase, and system (aspect) view.

Similar arguments can be made for the surrounding business and community knowledge spaces.

13.3 Chapter Summary

We have in this chapter described of four nested knowledge spaces in more detail:

- The *personal workspace*, reflecting a user's work and knowledge so that the information system can adapt to it, as information content, roles, tasks and views (IRTV).
- The *innovation space*, reflecting the products, organization, processes and systems (POPS) of an interdisciplinary team collaborating, e.g. in product design.
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The enterprise knowledge spaces are bounded by identifiable but fuzzy borders. Whether the borders are a result of pragmatic boundaries, such as gateways between project phases and the isolated roles of engineering disciplines and so forth, or whether they are caused by limitations inherent in the mental models of our brains remains a research issue.