Sustainability, Environment, Management

Research Seminar in the Module 10-202-2309
for Master Computer Science

Prof. Dr. Hans-Gert Gräbe
http://www.informatik.uni-leipzig.de/~graebe

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Omnipresence of the System Concept

The concept of a *system* plays a prominent role in computer science when it comes to database systems, software systems, hardware systems, accounting systems, access systems, etc.

In general, computer science is regarded by a majority as the

> *"science of the systematic representation, storage, processing and transmission of information, especially their automatic processing using digital computers" (German Wikipedia).*

Also certain relevant professions such as the *system architect* are in high esteem by IT users.

Omnipresence of the System Concept

However, the significance of the concept of system extends far beyond the field of computer science – it is fundamental for all engineering sciences and as *Systems Engineering* with the ISO/IEC/IEEE-15288 standard "Systems and Software Engineering", it is also the subject of international standardisation processes.

Even more, the concept of systems also plays an important role in the description of complex natural and cultural processes – for instance in the concept of an *ecosystem*.

Omnipresence of the System Concept

While classical TRIZ focuses strongly on instrumentally feasible engineering solutions, Systems Engineering

> *is an interdisciplinary field of engineering and engineering management that focuses on how to design, integrate, and manage complex systems over their life cycles. At its core, systems engineering utilizes systems thinking principles to organize this body of knowledge. The individual outcome of such efforts, an engineered system, can be defined as a combination of components that work in synergy to collectively perform a useful function. (English Wikipedia)*

Sustainability, Environment, Management

The issue of sustainability faces us with enormous challenges. One of the clearest findings claims that there can be no more "business as usual". Our industrial mode of production has to be influenced more clearly. Qualified management of socio-technical, socio-economic and socio-ecological processes is on the agenda.

In the past semester, we have been interested in various management theories that are prevalent today. We observed two types of theoretical approaches. One kind of management theory (management by incentive, management by objective, Taylor's principles of management, Minzberg on management) starts from an individual manager with sufficient rights and appropriate authority and reduces management to the question of which organisational, charismatic and psychological means he or she can use to achieve externally set goals.

Sustainability, Environment, Management

The other kind of management theory (Toyota system, SMART approach, i* goal, Business Process Definitions) focuses on various aspects of planning and executing business processes. Russell Ackoff links systemic thinking and management and thus embeds such modelling approaches of business processes deeper into basic development processes of systems.

The practical implementation of a shift to a sustainable mode of production requires both aspects – charismatic leadership and planning built on solid foundations. In our theory seminar, however, we will mainly focus on the second point and **explore different foundations and approaches of a systemic-based business process modelling** in more detail.

On the Notion of a System

"Systemic-based" refers to a system concept that describes **the purpose-oriented interaction of viable components in a delimited context for the provision of emergent functions**. Such functions are not inherent to any of the components, but result from their interaction within the context of a defined throughput of energy, material and information, which is provided by an – in systemic terms – "external world".

The connection between external throughput – and thus access to available resources – and internal formation of structure is not only a technical design principle in component-based architectures, but also frequently found in nature. The examples range from the Bénard cell to complex metabolisms of complicated living systems. It therefore makes a lot of sense to base descriptions and modelling of real-world processes on such a system concept.

Systems and Contradictions

The WUMM project (WUMM stands in German for "Widersprüche und Managementmethoden" – contradictions and management methods) aims at a better understanding of such systemic development processes.

Our starting point is TRIZ as a systematic innovation methodology derived from engineering experience in contradictory requirement situations.

Today, similar demands for an experience-based *systematic* approach are also addressed in the field of management, which means that engineering approaches and admissions are also there on the agenda.

With the field of "Business TRIZ", which has been unfolding for about 20 years, this transfer of experience is being actively promoted, embedded in older management cultures and approaches.

Systems and Contradictions

In recent years, co-operative action by differently specialised experts has become increasingly important.

In such interdisciplinary work contexts, the development of *common conceptual systems* of sufficient performance proves to be a difficult problem that can be supported by digital semantic technologies.

Parallel to these challenges *agile approaches* play a major role in recent years, not only in the field of management, but also increasingly in the solution of socio-technical and engineering problems concerning ongoing co-operative actions in multi-stakeholder contexts – for example with the concept of *technical ecosystems*.

The Seminar

In the seminar, we want to learn more about modelling approaches of business processes, especially with regard to contradictory requirement situations that cannot be solved by compromises, but require a dialectical resolution in the sense of the TRIZ methodology and the emergence of common conceptual and notational worlds.

It turns out that such modelling needs are particularly clear **when formalised applying suitable Semantic Web technologies**.

A special emphasis will be put on the work of the *Methodological School of Management* and the Moscow Methodological Circle around G.P. Shchedrovitsky.

The Seminar

The seminar is a **research seminar** in which we jointly explore different aspects of co-operative action in Business Process Modelling contexts.

With this seminar, we are approaching a topic that is new to us, which offers the opportunity to participate in a joint academic explorative process on a basis of equals.

This bears opportunities, but also challenges. The students are expected to actively participate in the seminar through seminar discussions, presentations and last but not least by reading the relevant materials.

For the successful completion of the seminar, a topic has to be presented in the seminar as discussion leader and a handout of 2–3 pages on the topic has to be submitted in advance.

The Seminar

The seminar will be held weekly on Tuesdays 9-11 a.m. synchronously online.

Prior to each appointment participants have to study the assigned reading to be in a position to discuss the problems in the seminar.

The seminar is moderated by a *discussion leader*, who prepares a short handout of 2–3 pages and makes it available to the participants in advance *before the seminar* (by Sunday evening).

Students of Leipzig University find more about the seminar in the Saxonian e-learning platform OPAL – Course W21.BIS.SIM. The platform will be used for organisational purposes only.

The **primary source for the seminar plan** is the (actual version of the) file `Seminarplan.md` in the github repository *Seminar-S21*.

Course Structure

The course includes

- A lecture "Modelling Sustainable Systems and Semantic Web"
- A seminar "Sustainability, Environment, Management"
- A TRIZ practical course.

Note that the access to the e-learning system used in the TRIZ practical course is subject to a fee. Details can be found in the forum of the OPAL course.

Course Structure

In the **lecture** *Modelling Sustainable Systems and Semantic Web* (Thursdays 11-13 a.m.) important concepts of our previous interdisciplinary course programme such as

- technology as a unity of socially available procedural knowledge, institutionalised procedures and private procedural skills,
- sustainability requirements in systemic concepts,
- digital changes and concepts of semantic web technologies,
- concept and knowledge formation processes,
- cooperative action, network economies and open culture

will be developed in more detail.

The lecture and the seminar are not directly related to each other, but conceptual frameworks developed in the lecture will be heavily present in the seminar.

Organisational Matters

These course parts can be taken for credit in various combinations

1) All three parts as In-depth Module 10-202-2309 (10 CP) "Modelling sustainable systems and semantic web".
   - **Prerequisites for examination:** Successfully completed seminar and practical course.
   - **Examination:** Oral examination (30 min)
2) Lecture and seminar as Seminar Module 10-202-2312(5 CP) "Applied Computer Science".
   - **Prerequisite for examination:** Successfully completed seminar.
   - **Examination:** Seminar paper.

Organisational Matters

3) The practical course alone as Module 10-202-2012 (5 CP) "Current Trends in Computer Science".
   - **Prerequisite for examination:** Successfully completed practical course.
   - **Examination:** Oral examination (30 min)

More about this in OPAL
`https://bildungsportal.sachsen.de/opal` in the course W21.BIS.SIM. There, please enrol first in the course and then in the corresponding group.

You can access OPAL with the data of your studserv account.

Organisational Matters

You will find a more detailed lecture concept in the github repo `https://github.com/wumm-project/Seminar-S21`.

Data protection

We follow an Open Culture approach not only theoretically but also practically and make course materials publicly available. This also applies to the course materials you have to produce (presentations, seminar papers) as well as to (annotated) chat sessions of the seminar discussions, in which your names are also mentioned. **We assume your consent to this procedure if you do not explicitly object**. The discussions themselves are not recorded.

Organisational Matters

- Lecture: Thursdays 11:15-12:45, synchronous digital
- Continuously updated lecture plan and list of references in the `Lecture/README.md` file in the github Repo.
- Further (mainly organisational) information also in the forum of the OPAL course.
- Seminar: Tuesdays 9:15-10:45, synchronous digital
- All events online in the BBB room BIS.SIM, `https://meet.uni-leipzig.de/b/gra-w2c-fhz-qnp`

Questions ?

See also `2021-10-12/README.md` for additional information about the goal of the course.