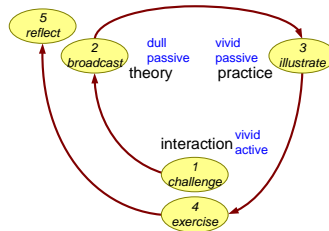


Systems Architecting: a Business Perspective Instructor's Manual

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Abstract

Systems Architecting: A Business Perspective is written as text book. This paper provides practical information for teachers, such as didactic style, background information and exercise answers.

All Gaudf documents are available at:
<http://www.gaudisite.nl/>

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Introduction

Systems Architecting is more skills based than knowledge based. The course provides methods and techniques as knowledge. However, the didactic objective is to train the architecting skills. The teacher should strive for continuous linking of theory and practice.

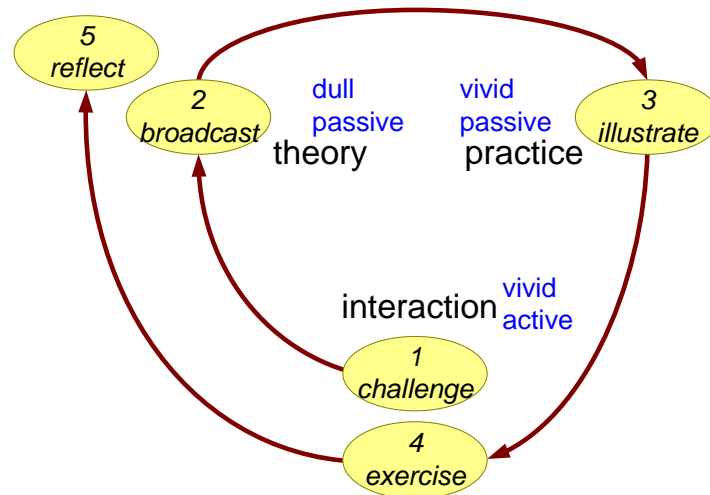


Figure 1: Alternating Theory and Practice, and Active and Passive

The proposed didactic model is shown in Figure 1. Theory and practice are alternating, and active and passive learning modes alternate.

We recommend to start with challenging the students to think about the topic of interest, by asking some engaging questions. This questioning can be done as brain storm: the teacher writes the answers of the students on a flip chart, without discussion. Then the list of answers can be discussed.

The discussion can evolve into broadcasting some methods and techniques (theory) and illustrative examples(practice). Broadcasting is passive; students will reach saturation after half to one hour.

Before students get saturated an exercise is started as group work. Ideal group size is 4 students per group. Working as member of a group is part of the architecting training. One of the red threads of the course is the capability to interact with group members. Teams with less than 3 members are too small to train this interaction. Teams with more than 5 members tend to create too much space for lean-back behavior of more introverted members.

The group work results in a brief presentation on flip charts. Another red thread in the course is the ability to present results brief and to the point. During the course

all students should get a turn in presenting. Typical such presentation should be 5 minutes or less. The teacher acts here as facilitator and time keeper. When presentations exceed the time limit then the presenter must be urged to finish the presentation quickly.

At the end of the presentation some plenary discussion should take place about the content of the presentation, followed by feedback from the teacher on the presentation itself. Note that the teacher again should act as coach. The teacher might also start with asking for reflection by the presenter self.

1 Process and Organization

1.1 Engaging Question

The starting question to engage students is *What are the most important processes in your company?*

The purpose of this question is to let participants think from a broader company perspective. The idea is to let them discover the processes as present in Figure 1.1. Note that the notion *process* has not yet been defined and that *most important* is slightly misleading. The answers can be screened when they are listed on a flip chart. A first screening should be used to eliminate answers that are no process, or to transform them into a process. A second screening is used to agree upon the importance. During this second screening different kinds of importance can be distinguished especially urgent versus middle or long term importance. This classification helps to explain the tensions between the processes in Figure 1.1.

1.2 Learning Objectives

- To get an organizational perspective of the company as a whole.
- To understand the urgency of all customer related aspects.
- To understand the tension with medium term (product creation) and long term (people, technology and process management).
- To understand the difference between a process view and a (hierarchical) organizational view.
- To offer a framework for product creation.
- To position the Systems Architecting Process.
- To explain the relation with operational or project management.

1.3 Exercise

1.3.1 Exercise in classroom for students with working experience

Make a map of the operational organization for your product group. Use Figure 2 as starting point. Note that organizations in practice might look quite different; please show the actual situation, not the theoretical diagram. Identify who is fulfilling the roles in this organization diagram and put their names in the map. Take one horizontal layer of this diagram and annotate that layer with the relations between the people:

- How do they interact?

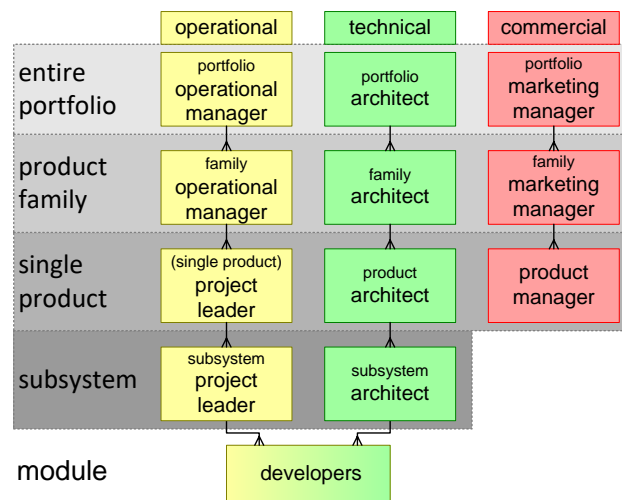


Figure 2: The simplified hierarchy of operational entities in the Product Creation Process form the core of this process (originally Figure 1.14).

- Where are they located (same room, floor, building, etc.)?

Purpose of the exercise

The main purpose of this exercise is to make students aware of the *actual* process and organization in their own organization. A typical escape is that participants show the *formal* process and organization.

Role of teacher during the exercise

The challenge for the teacher is to keep the students close to the intend of the exercise; to understand and show the actual organization. By asking for actual names of people in Figure 1.14 participants need to think about the actual role and contributions of specific individuals. It is quite probable that people fulfil multiple roles; it also quite probable that some boxes stay empty or are covered by several individuals.

Another frequent pitfall is that people show the line organization. The question here is to name the people who have the actual *operational*, *technical* and *commercial* responsibility. This might be close to the line organization, but in many cases the actual roles deviate from the line organization structure.

Outcome of the exercise in the classroom

People working in one and the same organization may well have different perceptions on their organization and hence may show different answers. The “right” answer does not exist, both participants might have given valid answers.

Exercise in classroom for students without working experience

The exercise for not experienced students is quite different than the exercise for experienced students, since the not experienced students miss the frame of reference to reflect on process and organization. The exercise is used to create a starting point for the later exercises. The not experienced students will be working on an imaginary company and product that they define in this exercise.

1. Discuss your product and market.
2. Propose process and organization for your company: What does your company do in-house, what does your company outsource?
3. Determine staffing for your company.
4. Consolidate the outcome in one organization diagram.

Purpose of the exercise

The main purpose of the exercise for students without experience is to emerge them in company wide thinking.

Role of teacher during the exercise

The teacher needs to act as coach: ask more questions to the students that help them to evolve their answers.

Outcome of the exercise in the classroom

The initial answers to these questions may not be realistic. The outcome of this exercise, however, is the starting point for the later exercises. The teacher has to give sufficient specific feedback to shape a usable starting point of the rest of the course. In view of available time and the progress in the course some of the feedback can be more directive. The teacher may take the perspective of the supervisory board of the imaginary company to make the directives more realistic.

Outcome of the exercise as home work

During the remainder of the course, the students should also evolve their thinking about the process and organization questions. The final report should show such evolution. In the final report the consistency of the answers and the clarity of the visualization and description are criteria for grading.

2 Role and Task

2.1 Engaging Question

The starting questions to engage students are

1. What are the *deliverables* of a systems architect?
2. What are the *responsibilities* of a systems architect?
3. What does a systems architect *do*?

The purpose of asking these questions in this order is to let the students discover that they spend a relative small amount of their time on their most visible deliverables. They will also discover that the responsibilities of systems architects are not very sharp and overlapping with many other project members.

2.2 Learning Objectives

- to understand the role of the systems architect in the organization context
- to be aware of inherent overlapping nature of architecting responsibilities
- to have insight in the balance between (technical) depth and breadth

2.3 Exercise

Perform a role play in teams of three to four students. In every team we need the roles of *project leader*, *marketing manager*, and *systems architect*. The other team members are observers. In the ideal situation, we have one observer per team.

The teacher provides one actual system. The team has to discuss a very early definition and feasibility. Every team has to create the following deliverables:

Product definition: a very brief summary of the essentials of the specification.

Business relevance: a very brief overview why this investment makes sense from the business perspective

Technical feasibility: the core ideas for realization

Initial plan: a very rough plan of when, what, who

Typically, the group will go through the following phases:

1. Use a few minutes to allocate the roles.

2. Spend 5 minutes individually to think about one's own role in relation to the product. For example, the marketing manager will have to think about customer needs, timing, and prices. The architect will explore technologies and potential solutions, and will prepare questions to ask the marketing manager. The project leader will explore required budget, resources, and time.
3. Have a group meeting of about 30 minutes about the deliverables.
4. Use 5 to 10 minutes to make a flipchart-based presentation in the classroom.
5. The observer also makes one flipchart to explain the observations. Note that it is wise if the team discusses these observations before these are presented plenary.
6. The teams report their deliverables and observations plenary, 5 minutes per team.

Purpose of the exercise

The main purpose of this exercise is to let the students experience the differences in responsibilities of the three roles, and as a consequence the differences in behavior and contribution. Secondly, this exercise serves as a warming-up for the next chapters, where some methods are provided to approach the question more structured.

Role of teacher during the exercise

The teacher monitors the groups and intervenes if the group gets stuck. About half way during the exercise, the teacher reminds the groups of their deliverables at the end of the exercise.

After the presentation of the results and the observations, the teacher asks the group once more for their own reflection on the exercise.

Outcome of the exercise in the classroom

The outcome of this exercise is not “right” or “wrong”. However, the teacher looks for coverage (are business, product, and project aspects covered?), balance (between these subjects), consistency, and credibility.

3 Requirements

3.1 Engaging Question

The starting question to engage students is: *What is the definition of a requirement?*
Write this down as sentence or as few keywords on a yellow note sticker

The purpose of this question is to clarify the difference between (not committed) needs and agreed upon specifications. In practice, the word requirements is used for both; this may cause misunderstandings in an organization.

Later during the lecture, when presenting the requirements for requirements, engaging questions are:

- Why do we write requirement specifications?
- Who is using the requirement specifications?

These two questions help the students to understand the requirements for requirements. Especially the tension between the need for formality and the need for understandability. Formality is needed for the contractual aspects; requirements must be SMART to make them useful for qualification and acceptance. Understandability by human stakeholders is important, since all users of requirements are diverse human stakeholders with different backgrounds.

3.2 Learning Objectives

- to understand the logical flow down from needs to realizations
- to understand the objectives of requirements and the related challenge of writing requirements both sufficient formal as well as sufficient understandable.
- to know a number of techniques to identify, collect, and select requirements.
- to understand that a system specification describes the system as a black box; it prescribes what the system has to do and how well (fast, reliable, etc.), but it does not prescribe how the system will do that, or what technologies or components to use.

3.3 Exercise

In classroom for students with working experience

Make a key-driver graph for a product you are currently working on. Follow the method and the recommendations. Work in small teams. Start with listing the most important requirements and then work to application drivers and customer key-drivers. The use of yellow note stickers and flipchart pens is recommended: yellow note stickers can easily be moved or removed during the discussion, while

flipchart pens force you to limit the label to a few words and numbers. Present the results in one flipchart.

In classroom for students without working experience

The teacher will provide a case for this exercise. Use yellow note stickers and flipchart pens during the exercise.

1. Identify the most important requirements of the product. Try to make the requirements as specific as possible; especially quantification helps.
2. Describe what the customer does when using the product. Do this by taking every requirement and answering the *why* question: Why is this requirement needed?
3. Identify the customer key-drivers by repeating the *why* questions.
4. Discuss and improve the entire graph.

The final result

A good graph can be presented “left-to-right,” starting with customer key-drivers and explaining the requirements with a few application stepping stones in between. The graph will, by definition, be far from mature, given the limited time and the classroom setting. In real life, several more iterations with the involvement of external stakeholders will ripen the graph. However, the group now has a much better understanding already of the customer world and, hopefully, is also more aware of their unknowns in that world.

Purpose of the exercise

The purpose of this exercise is to stretch the students. Most students “live” in the technical world in the design of the system. In this exercise, the students are stretched a few times:

- the requirements at the righthand side must be at black box level; the students have to abstract from the realization to a specification.
- the requirements are linked to the use of the system; the students have to step from the system-of-interest into the usage context.
- the use of the system has to be linked to the customer key drivers; the students have to discover what the main objectives of the customers are.

Role of teacher during the exercise

The teacher has to stretch the groups during the exercise., preferably by asking questions. Sometimes, the teacher will have to help by giving examples. The risk of providing examples is that the students get biased.

Outcome of the exercise in the classroom

The exercise usually takes 30 to 40 minutes. That is enough time to make a first graph, but much more time is needed to make a well founded graph. During the feedback on the presentation, the teacher indicates a number of potential future improvements; this feedback helps the students to realize where they currently stand.

Outcome of the exercise as home work

The home work should result in a key driver graph to be assessed against the following criteria:

- between 3 and 6 customer key drivers
- there is a natural tension between the customer key drivers
- there is a logical connection from key drivers to requirements
- there are in the order of 10 requirements
- the key drivers and the explanation how to relate to the requirements shows sufficient customer thinking and understanding

Main pitfall is that the key drivers are introverted (what will we as company gain), or the key drivers are too technical.

4 Toolbox

4.1 Engaging Question

The starting question to engage students is *What means and tools do systems architects use?*

The purpose of the question is let the students discover that:

- Architects use a wide variety of tools
- Ranging from low-tech, such as paper and pencil, to advanced simulations
- Many tools are borrowed from other expertise and adapted to the architect's use

4.2 Learning Objectives

- to get insight of the mental processes of architects; for example, zooming in and zooming out and viewpoint hopping
- to get an overview of available means and tools
- to get exposure to story telling and use cases as tool

4.3 Exercise

In classroom for students with working experience

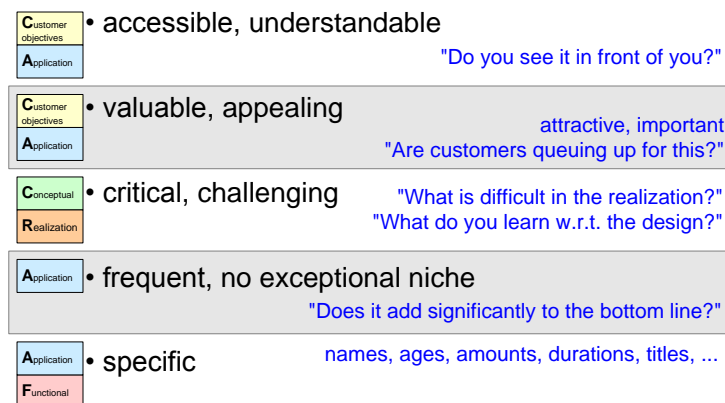


Figure 3: Criteria for a good story(Figure 4.29 in the book)

Create a story for the product you are working on. The story must fulfill the criteria in Figure 3. Make a presentation of the story on a flipchart.

In classroom for students without working experience

Create a story for the product provided by the teacher. The story must fulfill the criteria in Figure 3. Make a presentation of the story on a flipchart.

Plenary presentation and discussion

Ask the audience to assess the criteria of Figure 3. Teachers provide their own feedback based on the criteria.

Purpose of the exercise

Again this exercise is stretching the student from their technical background into the user's world. The stretching in this case needs to include human factors and the physical environment. The exercise must make the student aware of the multitude of human and environmental factors that play a role.

Outcome of the exercise in the classroom

The outcome should be a story that scores well on the five criteria. Special attention should be paid to the specifics of the story. Are human factors, such as emotions and social behavior, and environmental factors, such as climate and weather, sufficiently present? Is the story sufficiently appealing by showing the to be situation? A common pitfall is that an as-is story is presented that shows a problem (and hence opportunity) but not yet the proposed future situation. Is the story told in user terms? Are there no implementation details?

Outcome of the exercise as homework

The final story is an improved version of the classroom version. The same criteria are used and the same questions as above can be used.

5 Strategy

5.1 Engaging Question

The starting question to engage students with experience is *Have you seen roadmaps in your company? If yes, what did you see in these roadmaps?*

For less experienced students the following questions can be used, after given a brief explanation that a roadmap is a map towards the future for an organization:

- What are the objectives of making roadmaps?
- What information should be present in a roadmap?
- What time axis to use?

5.2 Learning Objectives

- To understand the strategy process
- To know roadmapping as tool
- To understand the role of roadmaps in the organization

5.3 Exercise

In classroom for students with working experience

Create a roadmap for the business where you are working.

In classroom for students without working experience

Create a roadmap for the business provided by the teacher.

Hints to do the exercise

The working order is

1. Market: trends and needs in the outside world
2. Technology: trends and developments outside and inside the company
3. Products: how technology can be packaged to deliver solutions to the market

Use yellow note stickers to populate a roadmap on a flipchart. Make sure that team members write stickers during the discussion.

Purpose of the exercise

The purpose of this exercise is to make the students aware of the broader scope both in time as well as in product portfolio. The “normal” time horizon for engineers is weeks to months; in this exercise we want to extend the horizon to years or decades. Normally, engineers work on one product or one subsystem of the portfolio; in this exercise, we want to extend the scope to portfolio level.

Role of teacher during the exercise

In this exercise, the students are stretched again. They often need to be stimulated and challenged to fill in some market trends. The key drivers from the exercise in Chapter 3 can be used as triggers to find market trends. The main role of the teacher is to keep the students going; one of the risks in this exercise is to fall in “circular” discussions. an effective way forward is to write trends (market, product, and technology) on yellow note stickers.

Outcome of the exercise in the classroom

The time to do such exercise in the classroom is quite limited. The main criteria to assess the results are:

- Are there relevant market, product, and technology trends identified?
- Does the time scale make sense?
- Have the students a realistic insight in what they know and do not know?

Outcome of the exercise as home work

During home work, students must use external sources, such as Internet and colleagues, to identify trends. The main challenge is to select a limited set of the relevant trends and to visualize these on one slide.

The main criteria to assess the results are:

- Are the market, product, and technology trends relevant?
- Are there obvious trends missing?
- Is the customer/market world sufficiently understood?
- Has the technology been explored broad enough? Have competing technologies been identified?
- Does the time scale make sense, are the market, product and technology related in time?

- Have the students a realistic insight in what they know and do not know?

6 Synergy

6.1 Engaging Question

The starting question to engage experienced students is *What are your experiences with re-use, common components, generic designs, etc.?*

The starting questions to engage students without experience is *What do you see as benefits of re-use, common components, generic designs, etc.?*

6.2 Learning Objectives

- To be aware of the strategic necessity to harvest commonality between deliverables.
- To be aware of the complexity and associated risks of harvesting commonalities.
- To learn an approach to identify commonalities and differences between products, and to come to decisions about the degree of re-use.

6.3 Exercise

In classroom for students with working experience

Make an inventory in your business where synergy is harvested, where an attempt is made to harvest synergy, and where opportunities for synergy are not harvested.

Assess the success of harvesting synergy and identify success factors and blocking factors for harvesting synergy.

Present the results in one flipchart.

Purpose of the exercise for experienced students

To understand the current situation in their own company and to see the positive and negative consequences of the current degree of harvesting synergy.

Outcome of the exercise in the classroom for experienced students

In classroom for students without working experience

Answer the following questions for the business provided by the teacher:

1. Identify opportunities of harvesting synergy.
2. Propose a technical implementation to support the synergy.
3. Identify process and organizational issues that need to be solved to make the synergy harvesting successful.

4. Present the results in one flipchart.

Purpose of the exercise for students without working experience

To go once through the process of identifying options to harvest synergy. To think about the consequences of the synergy proposal on the processes and organization

Role of teacher during the exercise

The main risks of this exercise are that students take extreme positions that block a more detailed understanding of benefits and concerns. This may happen in two directions: a dogmatic preaching of standardization, or a total focus on dedicated customer value. The challenge is to let them look for a sweet spot, satisfying both objectives sufficiently. The teacher may have to “unfreeze” students with extreme positions.

Outcome of the exercise as homework

The homework exercise is a re-iteration of the exercise with more access to people and literature. The homework should be more factual and specific.

7 Supporting Processes

7.1 Engaging Question

The starting question to engage experienced students is *What are your experiences with the development documentation?*

The mood answers tend to be influenced by the first few answers. If negative experiences pop-up first, then often more problems pop-up. If the answers start with positive experiences then often more positive experiences follow. The teacher can intervene after some time to explore the opposite side.

Later during the lecture the experienced students can be asked to estimate the average document size and the average size of the meta-information in pages.

The starting question to engage less experienced students is *Estimate how much documentation has to be made to support development of the system.*

7.2 Learning Objectives

- To be aware that a systems architect is a customer/user of company processes.
- To be demanding towards process owners to get efficient and effective processes
- To leave the ownership of the processes at the process owner, and to communicate with the process owners in terms of needs and concerns rather than solutions.
- To understand that development documentation is a system that needs to be designed using “normal” design principles.
- To understand the consequences of modularity and granularity of documentation
- To be aware that the main target of the documentation is formed by the human readers

7.3 Exercise

In classroom for students with working experience

Create an overview of the process and the structure of the Product Creation documentation. Annotate strong aspects of process and structure and identify improvement opportunities. Present the results in one flip chart.

Purpose of the exercise for experienced students

To make the students aware of the status quo and to let them compare this current situation with the theory provided in this chapter.

Outcome of the exercise in the classroom

The students should make a clear selection of the main issues, preferably illustrated with a few examples.

In classroom for students without working experience

Create a proposal for the structure of the Product Creation documentation, especially at the systems level. Pay special attention to the decomposition directions, such as construction, functional, and qualities. Provide the rationale for the chosen structure. Present the results in one flip chart.

Purpose of the exercise for students without working experience

To make them aware of the multi-dimensional nature of the information that needs to be documented. To let them experience the trade-offs in modularity and granularity of the documentation.

Outcome of the exercise in the classroom

Typically the outcome will be a hierarchy. Main challenge is how to document cross cutting aspects. At least a number of cross cutting documents are expected, probably along the lines of customer key drivers and key performance parameters.

Role of teacher during the exercise

This exercise normally runs quite smoothly. The only pitfall is that some students keep the discussion too superficial. The teacher has to stimulate them to be specific and concrete, for example by asking for examples.

Outcome of the exercise as homework

The homework is typically a re-iteration of the classroom exercise with more access to people and information. The homework should be more factual and concrete.

8 Role of Software in Systems

8.1 Engaging Question

The starting question to engage students is *How much software does your system contain, expressed in person years or lines of code*. Many engineers do not know how much software is involved. The outcome of this number can be discussed. In zero order the number of source lines of code is proportional to the effort in person years. Very roughly 4000 lines of code corresponds to 1 person year.

The teacher can challenge the students by asking how much of the software a single designers can know and oversee.

8.2 Learning Objectives

- To understand that software plays an integrating role in the system
- To understand that most functionality at system level is captured in software
- To understand that software determines many system characteristics, such as performance and reliability; hardware determines the inherent capabilities of a system, the software determines what actual performance is achieved.
- To be aware of the many different kinds of software technology that is required in a system.

8.3 Exercise

In classroom for students with working experience

Create a simple functional model of the software in your system. Identify the key software technologies in your system, including operating systems and programming languages. Make a presentation with functional model and key technologies on a flipchart where potential problem areas are annotated.

In classroom for students without working experience

Perform the following tasks for the product provided by your teacher:

1. Create a simple functional model of the software in your system.
2. Identify the potential key software technologies in your system, including operating systems and programming languages.
3. Identify the most critical software design decisions.

Purpose of the exercise

To make the students aware of the role that software plays in their system, and to make them aware of the software technologies used in their system.

Role of teacher during the exercise

Software is a jargon rich expertise that is difficult to enter without software background. Students with software background must be encouraged to translate software jargon in language that can be understood by other engineers. At the same time software is a very powerful, but complex, technology. Hardware engineers have to be challenged to really understand what software in their systems does.

Outcome of the exercise in the classroom

The presentation should contain a number of clear technical models and explanations.

Outcome of the exercise as homework

The homework is a re-iteration of the classroom work. However, now software designers and software documentation is available. The homework should be a better founded set of diagrams and explanations.

9 Boardroom Presentation

This subject offers only a quite limited amount of theory. Most of the available lecture time can be used by the students to prepare the Board of management presentation.

9.1 Learning Objectives

- To understand the managerial perspective on the system and its architecture.
- To get means to bring a message to higher managers.
- To be aware of the transformation that is required from technical perspective to managerial perspective
- To be aware of the need to understand the audience and to shape the presentation for that audience.
- To be aware of the need for interaction with managers and the need to be visible at managerial level.
- To present to-the-point in a small amount of time; the presenters are forced to think about the message and to select what limited evidence to present.

9.2 Exercise

In classroom for students with working experience

Bring a clear *architecture message* to a *Management team* at least two hierarchical levels higher than your supervisor, with *10 minutes* for *presentation, including discussion* (there is no limit to the number of slides).

An *architecture message* = *technology* options in relation to *market* and *product*. Address the *concerns* of the *management stakeholders*: translation is required from *technology* issues into *business consequences* (months, effort in person years, turnover, profit, investments).

Take an actual and hot subject from today's practice. This is an ideal opportunity to conduct the presentation of an issue where you need management attention. Do pick an issue in the core of architecting, avoiding subjects that are clearly allocated to others, such as project management and marketing issues.

Figure 4 shows an example of the typical timeline for this in class exercise.

“Home” work for students with working experience

Improve the presentation made in the classroom by adding facts and analysis. Present the improved version to your supervisor(s), and ask them feedback.

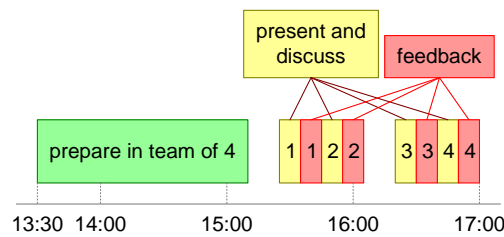


Figure 4: Example timeline of Management Presentation Exercise (original Figure 4.12).

In classroom for students without working experience

Bring a clear *architecture message* to the *Board of Management*, with *10 minutes* for *presentation, including discussion* (there is no limit to the number of slides).

An *architecture message* = *technology options* in relation with *market* and *product*. Address the *concerns* of the *management stakeholders*: translation is required from *technology issues* into *business consequences* (months, effort in person years, turnover, profit, investments).

Purpose of the exercise

To experience an interaction with higher level management. To be confronted with people who disrupt, have a much broader context understanding, who are busy, etc. To experience how easy it is to present *too technical, too open-ended, and too little factual*.

Role of teacher during the exercise

The teacher has to act during the presentation itself as CEO. The teacher will have to adapt the degree of playing this role to the ripeness and confidence level of the presenting students. Towards ripe and confident students, the CEO (teacher) may behave as a rude and interrupting person; re-acting immediately on shortcoming in the presentation. Before and after the presentation, the teacher should clearly be in the coaching role.

The presentation itself, including the interaction with the management, should be limited to 10 minutes strictly. Make an explicit switch from classroom setting to boardroom setting and back. The classroom should be reorganized such that it looks like a board-room, for instance by creating an U-shaped setting.

Outcome of the exercise in the classroom

The presentation is discussed directly after the switch back from boardroom to classroom. The first step is to let the presenter briefly reflect on the presentation: how did it feel, how did it go, how did management react? Next the audience, the colleague students are asked to give balanced feedback: first what did they like in the presentation, what can be improved in the presentation. The teacher is the last to give balanced feedback. Balanced feedback is even more crucial in this exercise, since we want to encourage students to seek this managerial interaction; we do not want to frighten them away.

The presentation means in the classroom will be limited, e.g. flipcharts and straight forward Powerpoint. Normally appearance is important in management interaction. However, in this case the focus has to be more on the content, the presentation, and the interaction.

Outcome of the exercise as homework

The preparation for the classroom presentation probably is hampered by a lack of fact finding opportunities. The homework should improve the facts and figures in the presentation. The homework can also improve the presentation graphics and cosmetics. Students who actually have the opportunity to present the presentation to their management are encouraged to give that presentation and to get feedback from the real managerial audience.

10 Human Side

10.1 Engaging Question

The starting question to engage students is *What human factors impact the work of the systems architect?*

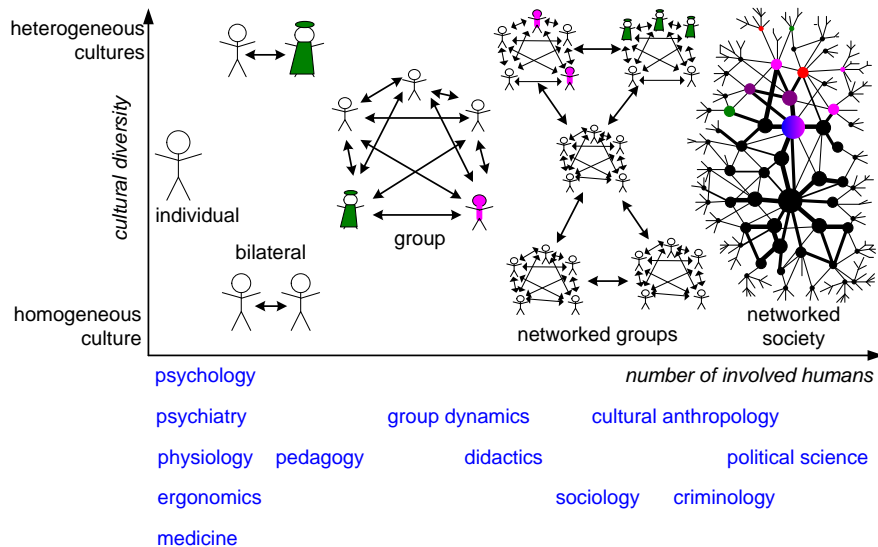


Figure 5: Overview of Human Aspects (original Figure 10.1)

The brainstorm and related discussion should result in examples that populate Figure 5.

10.2 Learning Objectives

- To be aware of the large impact of human factors on the architecting work.
- To be aware of the breadth of human sciences
- To stimulate students to develop themselves further in the human side.

10.3 Exercise

In classroom for students with working experience

Make a lightweight self-assessment using the characteristics discussed in Section 10.3, using in Figure 6; rank yourself on every characteristic on a scale from 1 to 9.

	communication		
	teamwork		
	documentation		
	multitasking		
	flexible, open		
	authority by expertise		
	specialist		
	generalist		
	conceptual		
	pragmatic		
	constructive critical		
	fast absorption of knowledge		
	creativity		
	manual skills		
	process insight		
	political insight		
	improvement		
	completeness		
	schedule		
	monitor progress		
	initial cost		
	decision making		
	customer value		
	sales features		
	commercial insight		
	coaching		
	selection		
	appraisal		
	motivation		

Figure 6: Table with Characteristics

Reflect on the following questions:

- What characteristics do you find difficult to rank?
- Are there characteristics where your own assessment is likely to be quite different from the assessment of others?
- What characteristics would you like to improve?

Make also a lightweight assessment of one of your managers, using the same characteristics and scale.

Purpose of the exercise for experienced students

The purpose is to let the students think actively about a diverse set of human characteristics in relation to their daily work.

Role of teacher during the exercise for experienced students

Most teachers do not have formal education in human sciences. Be aware that some subjects can be sensitive. The teacher acts mostly as reflector, not as therapist. Invite students to talk and explain, refrain from judgements or personal recommendations.

Outcome of the exercise in the classroom

This exercise is highly individual.

Outcome of the exercise as homework for experienced students

The final homework has to take a broader look at human factors in the company. Assess the result on breadth and practicality. One risk is that the result focuses entirely on one aspect. Another risk is that the result is very high level, e.g. the four company values. Four company values might be a good starting point, but these values need some elaboration to make them practical.

In classroom for students without working experience

Write an one-page essay on the desired human interaction model in your company. Elaborate briefly on the following aspects:

- Relation between function and profile
- The culture, values, and attitudes that you would like to stimulate
- The rationale behind these choices

Purpose of the exercise for students without working experience

The purpose is to let the students think actively about a diverse set of human characteristics in relation to the enterprise.

Role of teacher during the exercise for students without working experience

Students without working experience lack insight in the actual human side of an enterprise. The teacher has to stimulate the imagination of the students to make them aware of the relation ship between human factors and enterprise operation.

Outcome of the exercise in the classroom for students without working experience

Assess the result on breadth and practicality. One risk is that the result focuses entirely on one aspect. Another risk is that the result is very high level, e.g. the four company values. Four company values might be a good starting point, but these values need some elaboration to make them practical.

Outcome of the exercise as homework for students without working experience

The homework will give a similar result as the classroom work. However, it should be better articulated and more coherent.

11 Wrap Up

11.1 Engaging Question

The starting question to engage students is *What can you do with the course content in Practice? What will you do on the next working day with this new knowledge?*

The students have seen and exercised lots of methods and techniques, and have gotten many new insights and ideas. However, the colleagues in their working environment do not have the same knowledge and insights. What can you practically do to make the company benefit from Systems Architecting?

Next question is to review individually the learning material and the exercise results. This as preparation for the exercise.

11.2 Learning Objectives

- To refresh all aspects that have been taught during the entire course.
- To understand reflection as method for self-development.
- To determine a personal plan, short term and long term.

11.3 Exercise

In classroom for students with working experience

Individual work: Make a short-term and long-term plan, both as single-page documents.

The short-term plan focuses on practical steps: what can you do in your company to improve systems architecting? For example, “For this project, I will make a key driver graph next month.”

The long-term plan follows the ideas of roadmapping applied on your personal development in the context of your company. Personal development steps should be related to needs of your company and trends in the domain.

Teamwork: Make a plan for the “home” work.

“Home” work for students with working experience

Teamwork: Integrate all exercises into one presentation, showing the current state of systems architecting from all chapter viewpoints. Show and discuss this presentation with your company supervisor. Transform the presentation into a report. The report format allows you to provide a written explanation. The report should contain less than 20 pages.

Individual work: Finish the short- and long-term plan that you started to make in the classroom.

Write a reflection paper, one to two pages, about the course in relation to your working experience.

Purpose of the exercise for experienced students

The purpose of the exercise is to help students in digesting all taught subjects, and to work actively on using architecting in daily practice.

Role of teacher during the exercise for experienced students

Help the students to see the big picture of architecting again. The students have seen many subjects from many viewpoints. Challenge the students to think about the practical application of the material. Help students to think about their personal interests in relation to the company's interests.

Outcome of the exercise in the classroom for experienced students

The result is mostly an inventory of subjects. A discussion where the students compare their ideas for the future helps to cross fertilize ideas.

Outcome of the exercise as homework for experienced students

The homework for each chapter is discussed in the sections per chapter. In addition, the students have produced three short documents covering short term plan, longer term personal roadmap, and reflection report. The short term plan has to be practical and feasible; the motto is start where the company has a clear need. The longer term roadmap should show both long term company needs and long term personal needs and development steps.

In classroom for students without working experience

Individual work: Iterate once more over all material and exercises. Make a personal list of highlights and main lessons learned.

Team work: Prepare an outline for a business report to be made as homework.

“Home” work for students without working experience

Team work: Integrate all answers into one business report. The business report should help convince outside investors that you know your business, customers, processes, technology, and people, and that it is therefore a good investment.

Individual work: Write a one- to two-page reflection report about the course and homework.

Purpose of the exercise

The purpose of the homework is to re-iterate all subjects and to integrate them into a single coherent and consistent report. The exercise in the classroom is a practical preparation. Many students might not see each other regularly after the course; they should use this opportunity to determine a homework approach.

Role of teacher during the exercise

Help the students to take a project management approach to their homework.

Outcome of the exercise in the classroom

A brief discussion about individual learning points helps to refresh the material. The team work should result in an executable plan, with clear dates, deliverables, meetings, and locations.

Outcome of the exercise as homework

The final report should be consistent over the views. For example, the organization size should be consistent with investment levels. Sketches made during the course on flip-overs, should be neat block diagrams or drawings in the report.

References

- [1] Gerrit Muller. The system architecture homepage. <http://www.gaudisite.nl/index.html>, 1999.

History

Version: 1.1, date: July 15, 2011 changed by: Gerrit Muller

- added Figure 1.14
- applied copy-edit changes
- removed standard Gaudi distribution statement

Version: 1.0, date: May 20, 2011 changed by: Gerrit Muller

- Populated all sections
- changed status to concept

Version: 0, date: April 5, 2011 changed by: Gerrit Muller

- Created, no changelog yet