System Thinking in IT
model driven solutions

How ‘Enterprise Architect’ and the ‘Pro Cloud Server’ helped staff and students successfully complete their projects

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Authors: Roman Kazička

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1 Introduction

Common understanding among stakeholders is critical success factor in all IT solutions (CSF), This is one of the most important experiences of my practice. I worked as a solution architect in the production of consumer electronics (SAGEM, PHILIPS VIENNA), automotive components manufacturing (Wabash Technologies, Magneti Marrelli), developer of a specialized application for the International Personnel Agency (Trenkwalder Technologies), CTO during IT outsourcing in a large car (Volkswagen Bratislava) - ITIL, TOGAF. Everywhere was the communication and common understanding the most common problem.

Currently, the ‘common understanding’ is largely based on the principle that we could call 'Document driven Solutions'. Documents are of great importance, and it will be in the future as well, but they should not be primary sources of information. They contain thousand of Terms with their own lifecycle. It is impossible to keep documentation up to date in this way.

Primary source of information should be the 'Trusted sources' of truth about our solutions. Model with repositories, based on SQL and NoSQL databases. From these sources (contain necessary metadata about all term) will be generated secondary carriers of information in different formats (docx, pdf, html). This approach is called 'Model Driven Solutions'. 'Model Driven Documentation'.

Because each document is valid only at the moment of generation, this article is obsolete in the moment of publishing as well. We have the chance to keep actual information in the model only.

With Sparxsystems technology I have experience since r. 2000. I chose it because it provides the best price-performance ratio for supporting 'Model Driven Solutions'.

This article discusses how the Sparxsystems technology supports this concept in practice and how we have tried to transfer our experience to young people at the prominent Slovak University ‘Faculty of Informatics and Information Technologies, Slovak University of Technology in Bratislava’ (FIIT STU) in the subject of System Thinking in IT solutions and Digital fabrication.

Model driven solutions, Basic principles of self-learning organization, individual visions, team visions, personal mastery.
The course was based on cooperation many individuals, enthusiasts and institutions in the winter 2017-2018.

The basic pillars of the course are:

- Long term experiences of the teachers from different types of solutions, environments in IT a digital fabrication
- Original methodologies and process standardization (7D-seven disciplines for successful solutions, APV-Assets-Perspectives-Views, Q12-12 quadrants for building business)
- Enthusiasm of individuals, non-profit institutions and educational institutions
The topic is quite extensive, and its comprehensive description goes beyond the purpose of this article. If interested in more details, please, contact me.

**Figure 2: PCG_1453_Story board**
2 Demonstrating how students at the University were able to use Enterprise Architect to solve real world problems

Students had to find the customer with his specific problem from real life. Every student was using the ‘Enterprise Architect’ client. All students shared the common repository via Cloud Sparx Services and WebAE. Every student had own place in the repository. The structure of this place corresponded to the methodology 7D, which is implemented into ‘Enterprise Architect’ via specific MDG. It contained following packages- 01. Management, 02. Motivation, 03. Analysis, 04. Design, 05. Implementation, 06. Verification, 07. Lesson learned. All disciplines are very well supported by SparxSystems technologies (‘Enterprise Architect’ client, Sparx cloud services, Pro Cloud Server).

Students generated the content into model’s repository during the whole semester from September till February. Continuously they could generate the current output documents via ‘Master Document’ feature and ‘Virtual Documents’ elements. In this way, the students were focused on the matter not the form. Output documentation was created as a side effect of their regular work on the project tasks almost automatically. The outputs are not perfect, but for technical documentation and common understanding are ‘good enough’.

![Figure 2: PCG_1454_‘Enterprise Architect’ Client with Home page separated for each student, for each Project](image-url)
Figure: 3: PCG_1470_Time Planning/Scheduling
3 The simple tutorial based on some of the Course Work presented

All project activities were supported by original methodologies 7D, APV which are implemented in 'Enterprise Architect' client via MDG extension. There is 'Model Driven Book' about methodology itself and about the process – how to automatically generate documentation from 'Enterprise Architect' repository (https://leanpub.com/7D)

Methodology 7D-Seven Disciplines for Successful Solutions

Here is short presentation what is 7D methodology. 7D is focused on the journey to the goal. The experiences from the journey itself, is the goal. 7D methodology covers the specific task of Project management and Knowledge management systems. It is specific chronicle of the Solution and team members.

The goal we want to achieve.

- The journey to the goal. In 7D methodology this is our real goal.
- The journey provide us the huge experience to be better in the bext projects.
- The first way is full of unforeseen circumstances, our inexperience. If we understand what we can do better, each subsequent path will be faster and easier to manage.

Initial status. We have a intention, we have a goal, maybe we lack experience.

Figure 4: PCG_1455_Methodology 7D-Seved Disciplines for Successful Solutions
System Thinking in IT - Model driven solutions

7D Structure

Figure 5: PCG_1474_7D Structure
Methodology APV serves for describing the AS-IS and TO-BE status of current and future situation.

In the APV methodology, we focus on how to describe the outcome.

APV describes the baseline. From it, we want to reach the goal with the 7D methodology.

APV describes static properties of the solution not the path to it.
4 Some students Projects

During the course were realized 9 small projects in the team of 1-3 team members. Here is the list of all projects. 2 of them are described in details.

| 01. | Smart sensors for Intelligent House |
| 02. | Security system for Houses - NFC Protect |
| 03. | Automated entry of vehicles into a logistics center |
| 04. | YPASS-Facility access management system |
| 05. | GSM gate for opening the gate using your phone |
| 06. | Robotic Car |
| 07. | Car driver sleep detection during driving |
| 08. | Dirty hands multimedia system control |
| 09. | Intelligent Garden |

06. Robotics Car

Description

- The goal of the project is to create a remote-controlled car that can be controlled without visual contact, thanks to real-time image transfer. To simplify control, increase user awareness and reduce the risk of collision, the user will be helped by various sensors such as distance sensor, gyroscope, accelerometer, temperature sensor.

Results

- Educational Functional prototype of the robotic car controlled via smart phone application and with many sensors.
Figure 8: PCG_1460_How Sees the word the robotic Car. The can be controlled via Web page as well
04.YPASS-Facility Access management system

**Description**
- Customer:
  - Ynet is civic association and its members entering the reserved area
  - Documentation of an existing card reader when entering the room access control system. Also documented will be previous versions.

**Results**
- Relatively detailed model in 'Enterprise Architect' on existing HW solution. Used methodology APV-Assets-Perspectives-Views for describing existing status of the real system. This type of ‘documentation’ has the chance to be close the status 'up to date'.

In this project was used methodology APV. It was more suitable for describing existing solution. Here are some samples from documentation.

![Figure 9: PCG_1464_Assets-Perspectives-Views](image-url)
Figure 10: PCG_1495_Stakeholder Analysis

Figure 11: PCG_1496_Sequence Diagram - Open Door
Figure 12: PCG_1497_Design - version 03
04. How did you use the Pro Cloud Server/Cloud Services within your course material?

‘Sparx cloud services’ allow easy access to a shared repository without the need to install ODBC drivers and it provides another useful feature, which promote synergistic effects in the whole team of the course. Within the principles of self-learning organization (Peter Senge), we try to connect individual visions, needs and expectations with the visions of the project groups and the whole course. Important is, that Visions have to be transformed during the course into real solutions and expectation of the real customer.

‘Pro Cloud Server’ (WebEA) was used for easy access to model content without installing any special software components on the end devices (nor ‘Enterprise Architect’ client nor OBDC driver). The web browser is enough. In this way the repository contents could be consumed by persons, who don’t need to work with so sophisticated tools like UML modeler (e.g. course supervisor from university site, university representatives, friends of team members, etc). All these individuals, who had access to repository could see and review the solutions. On the background were running the scripts, which provided different reports about the project’s status.

The team members communicated to each other via chat, internal e-mails, and reviews.

Figure. 13: PCG_1467_Number of elements per team member in time
Figure 14: PCG_1468_Internal Communication
Figure 15: PCG_1469_Web EA-Team member presentation
Presenting content of model via standard CMS tool like Joomla! seems to me very interesting. Full text search, browsing through the model via ‘Project Browser’ feature is very useful for sharing model with persons, who needs to consume the content of model. I can imagine to manage in this way internal directives. Maybe we will use this feature in presenting results of student’s projects on the web in the future. We have used this way just for illustration this year.

Figure 16: PCG_1494_Joomla!EA - Model snapshot presenting
5 How did student groups use the technology to collaborate and discuss models, architectures or class

All team members, all students and teachers are sharing common repository. Information in the repository are available for different roles in different way:

- for active content creators (project team members):
  - ODBC connection
  - Sparx cloud Services connection
- for passive recipients (friends, university representatives, colleagues):
  - Pro Cloud Server – Web EA
  - Joomla!EA
  - Exported content in different formats (rtf, docx, pdf, html)

The Students presented their work progress on weekly basis to the class. They were inspired by each other, they communicated (internal e-mail, chat, review, discussions), shared experiences and common topics (How to?) They presented the interim results of their work. They could plan their work according to the available capacity, and record the efforts of the project. If it is necessary to report time stamps for estimate the effort and evaluate spent time.

Knowledge Sharing

![Image of Knowledge Sharing](image_url)

Figure 17: PCG_1471_Knowledge Sharing
RTF Templates Sharing for automated generated Documents

Figure. 18: PCG_1472_RTF Templates Sharing for automated generated Documents
6 Summary

Experiences from the course:
This course was created on the basis of cooperation between FABLAB CVTI Bratislava, Comenius University Science Park and FIIT STU. The main objective of the course was to bring students closer to digital manufacturing. This course was focus on integration 2 approaches. Rapid prototyping in the field of 3D printing, IoT, Laser cutter, CNC cutter and system approach. Students received the basic information about technology presented in FABLAB CVTI and general overview about holistic approaches in IT (TOGAF, ITIL). During the whole course we have used the client UML modeler 'Enterprise Architect' (SparxSystems) and server background Sparx Cloud Services, Pro Cloud Server with WebEA access. Licenses for 'Enterprise Architect' clients were provided by FIIT, licenses for Pro Cloud Server (WebEA) were provided by SparxSystems company with close cooperation with SparxSystems central Europe.

Teachers experience
- From digital fabrication point of view. Many of students were excited by the ‘maker space’ with 3D printers and Laser cutter. As students of informatics, they had no opportunity to touch such devices yet. Some of them had experiences with Arduino, or Raspberry yet.
- From System Thinking point of view.
  - 7D- Seven disciplines for successful solutions’ was presented to students. There is simple implementation in ‘Enterprise Architect’ client – so called MDG. In spite of that, this methodology can be used independent of the technology. It saves time for users and provide place in model structure for any piece of information which comes to ‘makers’ during realization of their project. It supports the awareness of team cooperation, knowledge sharing, and systematic approach.
  - Many students knew ‘Enterprise Architect’ client just as schema builder. They were pleasantly surprised by many interesting features for keeping all information about their daily work on one place.
- 2 different approaches ‘System Thinking’ and ‘Rapid prototyping’. Is it possible to use both approaches on the same course? Yes. We can combine the strengths of both approaches – Focus on results and keep track on the journey to the goal

Students experience:
- Positive reactions
  - Approximately 30-40 % appreciate the 'Enterprise architect' tool as a collaboration and knowledge management tool for managing processes in lifecycle of the solution. They can imagine to use it in the future. But they are aware of complexity of the tool.
- Negative reaction
  - Non-traditional approach to the making documentation and totally new approach - 'Model Driven Project' from the beginning of the course
  - Very complex tool for daily work, more visual 'how to?' tutorial would be appreciated.

- Almost all students prepared the initial documentation in 'Enterprise Architect' client. Approximately 50% finished their documentation in established tools (google drive, google docs) due to different reasons (problem with Mac, Linux, Licenses, complexity)

Improvements for the next Year
- inspiration from the previous course
  - more practical examples how to use SparxSystems technology for routine work
  - stable and runnning infrastructure with higher availability is crucial for operating such a course

Conclusion at the end
SparxSystem technology is very suitable platform for the building ‘trusted sources of truth’ about our solution in the whole lifecycle of Solutions. Based on this we can try to approach the vision:
Right Information – to Right Role – In the Right Time
And in this way to increase the common understanding among key stakeholders