

Understanding Architecture Principles as Working Mechanisms and Patterns

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Abstract. In many fields of science like physics, biology, chemistry and astronomy, principles are regarded as working mechanisms and not as general rules or guidelines. Carl Sagan [5], PZ Myers [6], Richard Feynman [7], Isaac Newton [8], Christiaan Huygens [9] and Richard Dawkins [10], all these scientists regard principles as working mechanisms. Principles are about the way things work. With principles we discover and explain how nature, our earth and universe, at macro and micro level, works. With principles predictions are made. However in the field of Enterprise Architecture [14], general rule (or guideline) has become the mainstream notion and definition for principle and architecture principle. This may be only because of one or two articles, like Richardson [1].

This thesis focusses on testing the hypothesis that architecture principles in the field of Enterprise Architecture are much more effective when they are formulated as working mechanisms and visualized as patterns. They are much more effective because they are then used in decision making, the design and realization of enterprise wide solutions.

Keywords: Architecture Principles, Enterprise Architecture, Scientific Method.

1 The Research Question

The research question we are answering in this thesis is: are architecture principles in the field of Enterprise Architecture much more effective if they are formulated as working mechanisms and visualized as patterns, instead of being only formulated as general rules with a rationale [1, 14, 15]? And also: are architecture principles much more effective if grounding literature for the architecture principles is referenced, if the architecture principles have an official status, if architecture principles are visualized, if there is a feedback loop from realization back to design back to architecture and if architecture principles should be selected and proposed based on strategy, goals, objectives and initiatives, stakeholder needs and requirements?

2 The Problem Addressed In The Thesis

Many architects, managers and CIOs that have been interviewed (over 100 architects, in over 10 countries, in the last four years) state that they find architecture principles to be one of the most important building blocks of architecture [2]. However a first problem that we noticed is that they see architecture principles hardly used or having any effect or impact in decision making, in designs and in projects. There often is no feedback loop back to the architect.

Many of the architects we have interviewed agree that if you write down a general rule (or guideline), you are only writing down one third of a principle. The part that says why you should do certain activities and what the outcome is of these activities, is felt as part of the principle (but not always uttered). As current mainstream definitions are falsifiable, we are looking into the definitions for architecture, principle, architecture principle, concept, design principle in this thesis. Because of lack of a trusted and used reference base of architecture principles, we will propose a basic set (database) of 100 architecture principles for 10 basic generic domains for enterprises including the rules and standards that can be used to implement these architecture principles.

Another problem that we address in this thesis is that many architects do not like to theoretically discuss and argue if the current notion and definition for architecture principle is any good or how to improve it. The “why are you doing this” question and “how do you know that this works” question is not appreciated to be asked. Or sometimes architects say: “who cares what the definition is for architecture or principles, does it matter for the architecture principles you create? I do not have the impression that if we redefine architecture and principle suddenly everyone starts using them!”

The final problem that we address in this thesis is that, in many scientific articles in the field of Enterprise Architecture, the scientific claims made are only asserted but not supported with evidence. But what is asserted without evidence, can be dismissed without evidence. Hardly any scientific article in Enterprise Architecture does do experiments or tries to falsify claims. Many scientific paper in Enterprise Architecture only repeat or summarize earlier made assertions. And some papers even tend to be pseudoscience like dowsing or numerology [12, 16]. They do not present any facts or evidence.

3 Research Methodology

This thesis brings back science into the field of Enterprise Architecture. The scientific method [4], with doing experiments to test hypotheses and to falsify hypotheses, is hardly practiced in other Enterprise Architecture researches.

The overall research methodology used in this thesis is Hevner [11].

4 Current Mainstream Practice of Architecture Principles

Currently most architects work with the notion that architecture principles are or should be general rules (or guidelines) and have a rationale. That is maybe only because many architects are educated with TOGAF [3]. If you ask an architect, “should a principle be always true?”, they will say “yes”. But they also say that it is hardly possible to write down a principle that is always true. We think that it can be always true in a certain context, only not when a principle is defined as general rule and is written down as such.

Many architects write down or copy statements (pieces of text in documents) that are labeled as architecture principles that assert what is very wise to do (in fact these are then rules, not principles), but their documents lack of references to proof, literature or practices. So, even though many of the statements written down in the architecture principles documents are very sensible, they often are not followed or done, because it costs a lot of time, money, resources or cause resistance. And as these statements are optional general rules (or guidelines) they are crushed under the pressure of time, budget and resources.

The field of Enterprise Architecture lacks regrettably of proven practices and working reference architectures for principles that everyone can rely on and build on. With this thesis and the new way of formulating and visualizing architecture principles (our new theory), we try to inspire and to stimulate people creating and documenting proven practices of actual and present architecture principles. In many organizations things are done in a good or great way, but what they actually do, is not documented and certainly not in the form of architecture principles as working mechanisms. So let’s start to do that as enterprise architecture community.

Many governments and organizations created reference architectures in the 2000s-2005s that initially were used a lot by architects, but now updates are skipped and architects don’t use them anymore. We think that this is not a good situation, and it should be that these reference architectures are updated yearly and used frequently.

The current way of working with architecture principles is, according to many architects, an ineffective and untrusted way of working. So here we have a lot of support to come up with a new approach and try to improve impact and effectiveness of architecture principles.

5 The Solution Proposed

This thesis will introduce a new set of definitions for key terms related to architecture principles, introduce four criteria for correct definitions and introduce a framework and process model for working with architecture principles. Also this thesis will introduce a set of symbols and diagram types for visualizing principles and introduce a syntax for formulating architecture principles in an effective way. Meaning: the architecture principles are used to support decision making and can be tracked and traced in designs and realization of enterprise wide solutions.

The definition for architecture we are introducing is: The architecture of a structure is the total concept of that structure, consisting of a coherent set of constructive, decorative and operative concepts. This definition is applicable in all sciences.

A structure is a system with a constructive, decorative and operative dimension.

The definition for principle we are introducing is: A principle is the enforced way an entity or a system works, producing results. In short: a principle is a working mechanism.

A concept is an idea, approach, abstraction or reference of/to a way of working.

A concept principle is the way a concept works, producing results.

An architecture principle is the way a concept (that is made part of the total concept/architecture) works, producing results.

The four criteria we introduce for good definitions are:

- 1) Every word used in the term definition must be predefined, else we do not know what someone means with that word.
- 2) There may not be counter examples.
- 3) The definition must qualify and quantify the term.
- 4) Definitions may not be circular in itself or with two or three other terms as a group.

An example syntax for architecture principles we introduce is:

Single Source of Truth (SSOT) – “By always storing data only in its official data source and only retrieving that type of data from this official data source, **it is ensured** that never an inconsistent or outdated (other) version of that data can exist or be used as part of the operational data set **and with that** the overall quality of the data is increased significantly for the organization and its stakeholders.”

This SSOT principle is always true, so if an organization take this truth into account in every business process and information system, they will make less mistakes, such as in sending sensitive data and mailing to the wrong persons or addresses.

If you formulate principles as working mechanisms, you can do predictions with them, and much better, than if principles are only formulated as general rules or guidelines. A working mechanism is always true within a certain context, general rules are not always true within a certain context, because for one: rules are optional.

So for these things alone architecture principles are much better and much more effective formulated as working mechanism than as general rules (or guidelines).

6 Relation to existing work

When you read books of building architecture, landscape architecture, molecular biology, physics and astronomy, you see that principles are regarded as working mechanisms. They describe a way of working that is always true in a certain context. For instance, design principles for landscape architecture, like rhythm, unity and symmetry, are about the way our eyes work, what our eyes find pleasing to look at.

Some scientific articles of architecture principles in the field of Enterprise Architecture address that there are construction principles next to principles in the sense of

a general rule. We say that all principles are working mechanisms and not that these are only construction principles.

Most articles about architecture principles regard them to be general rules (or guidelines), without falsifying that theory or proving it with actual experiments.

7 The State of the Thesis

The state of the thesis is that we have a raw 200 page document with a lot of data and results from working experience. We have material for more than 5 scientific articles to be written the coming two years. Also we have a small textbook for the academic world, containing this new theory of architecture principles.

What Has Been Done So Far?

So far, the past 7 years, a lot of architecture books and scientific articles from different fields have been read, interviews have been held with many types of architects and the new theory of working architecture principles has been applied in practice with great results.

Any architecture principle that was first only formulated as general rule with a rationale was reformulated by us easily as working mechanism and visualized as pattern. This had as benefit that the people who should decide for the architecture principle or should use it to create or to improve a design, knew much better what the essential point of the architecture principle was. The usage or lack of usage of architecture principles in processes and documents can be tracked and traced much better using the new theory. Architecture principles in this new way, will have significant more impact on the design and realization of enterprise wide solutions. Especially when people are faced with conflicting, seemingly incompatible requirements, architecture principles in the form of working mechanisms help significantly to find, design and build a new concept or solution.

The new theory of architecture principles has been made available via a textbook and is taught in a couple of different countries.

At the conference we will present a library of 100 architecture principles that are formulated and visualized using our new theory.

8 Future Plans

The future plans are to engage many universities inside and outside Europe having them include this new theory for architecture principles into their curriculum. With this trying to replace the other notion of architecture principles being defined and formulated as general rules (or guidelines).

Many organizations, like US Government, banks, hospitals and nuclear plants, are very much interested in using this new theory for architecture principles and have been asking to do proofs of concepts and pilots with it: reselecting, reformulating and visualizing architecture principles.

The Agile manifesto [13], that many of us know, contains principles that are mostly rules. But these rules are not supported with evidence and the so-called principles

they are suggesting are often just not true in any context or not the best things to do (as in best practice). Many people have requested to apply this new theory of architecture principles onto the Agile manifesto, so in the near future we are going to rewrite the Agile manifesto principles.

We have various students at universities being interested to research architecture principles for Business Architecture and Security Architecture using the new theory.

Also by many request we are going to reselect, propose, reformulate and visualize principles in reference architectures for governments and hospitals.

Furthermore the concepts of Zero Waste and Interoperability will be researched for real principles and a manifesto for them will be created using the new theory of architecture principles.

References

1. Richardson, A Principles-Based Enterprise Architecture: Lessons from Texaco and Star Enterprise (1990)
2. Paauwe, Mark, <https://www.dragon1.com/blogs/markpaauwe/views-on-architecture-principles> (2018)
3. The Open Group. Open group standard - togaf version 9.1. Web: <http://pubs.opengroup.org/architecture/togaf9-doc/arch/>
4. Francis Bacon, Novum Organum (1620)
5. Sagan, Carl, Physical Studies of the Planets (1960).
6. PZ Myers, Lithium perturbation and gooseoid expression identify a dorsal specification pathway in the pregastrula zebrafish - Development, 1993 - dev.biologists.org
7. Richard Feynman, R. Feynman, Quantum Mechanics, And Path Integrals, McGraw-Hill Companies , ISBN 0070206503 (1965)
8. Newton, Isaac [1726 (3rd ed.)]. Philosophiæ Naturalis Principia Mathematica [Mathematical Principles of Natural Philosophy] (1726, 1999)
9. Christiaan Huygens, Traité de la lumiere (1690)
10. Richard Dawkins, Hierarchical organisation: a candidate principle for ethology, (1976)
11. Hevner, A, - Design research in information systems, Springer (2010)
12. Popper, Karl, The demarcation between science and metaphysics - Conjectures and Refutations, (2014)
13. Agile Manifesto, <http://agilemanifesto.org/principles.html>, last accessed 2018/7/7.
14. D Stelzer - Enterprise architecture principles: literature review and research directions, , Service-oriented computing. ICSOC/ServiceWave (2009)
15. S Aier, C Fischer, R Winter, Construction and evaluation of a meta-model for enterprise architecture design principles (2011)
16. T Tamm, PB Seddon, GG Shanks, P Reynolds - How Does Enterprise Architecture Add Value to Organisations? CAIS, (2011)