Article

The PRISM Architecture Framework –
Was it the Very First Enterprise Architecture Framework?

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Abstract

This article introduces a little known architecture framework and development method called the PRISM Architecture Framework. This framework was published to a very limited research sponsor audience in 1986. The objective of this article is to bring this milestone achievement into the public light, as it not only is likely to be the very first Enterprise Architecture (EA) framework, but the results of the PRISM team research have had a far-reaching influence on how we do architecture work today – and we didn't even know it.

Keywords

INTRODUCTION

Over the years many architecture frameworks have been developed and used. Many gained popularity, many did not. But there is one particular architecture framework that remains relatively unknown, though it has influenced many of the most popular architecture frameworks and methodologies in use today – the PRISM Architecture Framework. The influence is especially strong from many of its key concepts. Moreover, its publication predates all of the Enterprise Architecture (EA) frameworks that today tout themselves as the first, so the PRISM Architecture Framework may well be the very first EA framework.

In this short article I provide some background about how this architecture framework was developed, why it is not well known, the framework itself, and how it has influenced what are still today considered to be best practices in developing IT architectures.

WHAT WAS PRISM?

During 1984, CSC Index Systems and Hammer and Company put together an information systems research think-tank that was led by Dr. Michael Hammer (Davenport 1986). They sought a group of multi-national corporations to sponsor their research into topics that were recommended yearly by the sponsors themselves. The sponsors often served as the primary source of data for the research, and participated in conferences at which results were presented. This multi-client research service was called PRISM (Partnership for Research in Information Systems Management) and among the 50+ sponsors were very well known companies like Texaco,

Digital Equipment Corporation (now Hewlett-Packard), IBM, Xerox, AT&T, Clorox, American Express, Bankers Life, Coca-Cola, Swissair, Upjohn, NCR, Westinghouse, US Internal Revenue Service, Metropolitan Life Insurance, Pacific Gas, Ontario Hydro, Rockwell International, and many others. These companies were all considered leaders at the time (many still are), and they represented many different industries. They served as a good testing ground for surveys and in-depth research.

During 1986, the sponsors had requested PRISM to focus their research on:

- Integrating Information Systems and the Business
- Expert Systems: Prospects and Early Development
- Information Systems Planning in an End-User Environment
- Dispersion and Interconnection: Approaches to Distributed Systems Architecture

It is in the June 1986 final report for this last topic that the research team of Dr. Michael Hammer, Dr. Thomas H. Davenport, and James Champy presented the PRISM Architecture Framework (Hammer, Davenport, Champy 1986). This is the same trio of researchers that later led the Business Process Reengineering (BPR) movement in the late 1980s and early 1990s, which was also based on PRISM research.

Why isn't the PRISM Architecture Framework widely known?

PRISM research was privately funded, and the result of the research was to be solely used by the research firms

themselves and the funding sponsor companies. Copyrights were also held by the research firms (CSC Index and Hammer and Company). The sponsor companies were authorized to use and distribute the results of the research internally. None of the sponsor companies were authorized to publish or share the results of the research externally – so only the handful of 50+ sponsor companies knew about this new architecture framework.

In the case of Digital Equipment Corporation (DEC, now Hewlett-Packard or HP), they added their own research and experience to the PRISM Architecture Framework to develop their own architecture framework and the architecture methodologies that used it. The methodology that they created in 1988 was called DART – Digital Architecture Response Team – which has evolved to what now is called HP Global Method for IT Strategy and Architecture (HPGM for ITSA) (Beijer, de Klerk 2010). DART was actively used and promoted by DEC architecture consultants to create architectures for their clients, as well as their own internal architectures. Although originally intended for the creation of EAs, it was quickly apparent to DEC consultants that the PRISM Architecture Framework could be also used for solution and technology architectures, and they developed additional extensions of their methodology accordingly.

Other sponsors, like Texaco during 1990 (Richardson, Jackson, Dickson 1990), used the PRISM Architecture Framework to create their own internal EA.

In their communications with me, Dr. Hammer and Dr. Davenport were very candid in stating that they did not pursue or actively promote the PRISM Architecture Framework any further as at the time they were focused on the BPR frenzy, which took all of their time (conferences, books, journal articles, consulting, TV appearances, etc.). When BPR took off, PRISM was disbanded (around 1990). Given that sponsors responded more strongly to one concept than to other detailed aspects of the approach, they only added to the PRISM Architecture Framework by publishing an article in the Harvard Business Review that expanded on that key aspect of the framework – the concept of Principles (Davenport, Hammer, Metsisto 1989).

It is not until recently that I obtained authorization to release the details of this milestone research to the general public from the copyright owners of the report. So now begins the journey to bring the framework into the spotlight.

THE PRISM ARCHITECTURE FRAMEWORK

The 1986 PRISM report presents a framework for architecture development. The framework defines four

domains (or aspects of information systems) to which architectural processes can be applied:

- Infrastructure: The underlying technological platform which supports data and applications, including hardware, systems software, and communication networks.
- Application software: The code which processes data for the organization, including acquired as well as internally developed programs.
- Data: The information assets of the organization.
- Organization: The people and structures that make it all work.

For each of these domains, the framework also specified four general types of architecture or processes that can be exercised on these domains:

- Inventory: A snapshot of the current state showing the architectural items in place today and their relationships.
- Principles: A statement of the organization's philosophy of information systems expressed in terms of objectives and goals in each domain area.
- Models: Pictures of the desired state, with emphasis on what goes where, and how it is all connected.
- Standards: Specific rules or guidelines for implementing the models.

The cross-relationship between these domains and types of architecture or processes were represented in the simple model shown in Figure 1.

Figure 1: PRISM Architecture Framework

In their research, the authors stated that the relationship among these types of architecture was not static; there was a natural flow and sequence of activities which proceeded from an articulation of technology values to the development of principles, and on to models and standards. Inventory serves as an input to the development of models as the current state influences the practicality of various desired states. Figure 2 depicts these relationships.
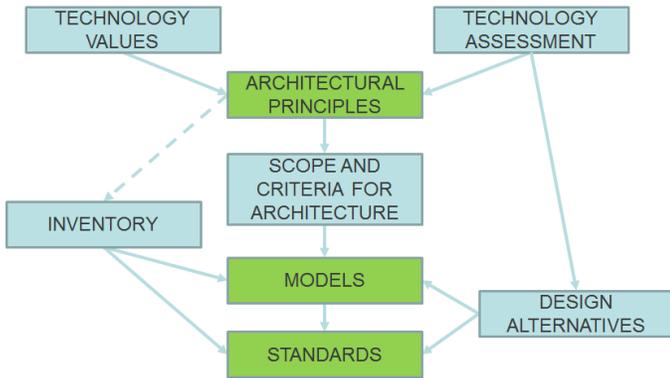
Figure 2: PRISM Framework Architectural Development Relationships

Principles are the key aspect of this framework. In the subsequent publication about the framework, the researchers provided much more detail about what principles meant and how they should be used (Davenport, Hammer, Metsisto 1989). They refined their earlier definition of principles to "simple, direct statements of an organization's basic beliefs about how the company wants to use IT over the long term". By their very definition, principles were long-lived – they were created to provide long-term guidance to the decisions/choices to be made while defining the architecture. This is in contrast to the frequently used process of creating an architecture using requirements as the foundation. Requirements, different from principles, change more frequently and can be seen as decisions about how to implement principles. Principles would then precede requirements and can be used to check their validity (Rivera 2007).

The researchers also highlighted that to establish good principles consensus among the primary stakeholders was needed. They went as far as to say that if there was significant disagreement about a given principle, it likely was not valid for the organization. In a few of the sponsored organizations they identified that those using technology more effectively were also those who had articulated principles that summarized how the company would use IT to achieve their goals. In other words, they identified the use of principles as a best practice for successful architectures – something that is still believed today.

Principles as defined in the framework had three key elements – the principle statement itself, its rationale (why it was important, what was its business value), and its implication (what had to happen in order to achieve the principle). The framework itself would force architectural thinking to occur in terms of people, processes, and technology, as principles were needed for all three.

In the 1986 report, many examples of key areas where principles would need to be developed were presented for each domain of the framework. They can be viewed in Table 1. Subdividing the work of creating the architecture into these domains helped break down the complexity of creating architectural descriptions for each. Subdividing them further into smaller key areas focused work even more and consensus could be achieved amongst stakeholders.

Table 1: Key Topics for Principles

Domain	Key Areas for Principles
Infrastructure	Extent and Access, Vendor Stance, Degree of Interconnection
Data	Ownership, Responsibilities of Stewardship, Location, Access
Application	Location of Processing, Extent of Interfacing and Integration Demanded, Responsibilities for development and Maintenance
Organization	Focus of System Responsibilities, Definition of Roles, Career Paths
Cross and Inter-Domain	Cost Sensitivity, Time Horizons, Degree and Extent of Standardization, Simplicity/Complexity, Generality/Optimality, Sharing, Organizing Theme

The above is just a short overview of the framework. The research report and other cited documents go into much more detail, including examples and proposed process steps to successfully create architectural descriptions with it.

PRISM ARCHITECTURE FRAMEWORK INFLUENCE

The most salient and long-lasting influence this research had was the concept of principles. We find the same concept of principles in architectural methodologies and in standards related to architecture that are still in use.

TOGAF®, an Open Group Standard, uses a concept of principle similar to that of the PRISM research. In TOGAF 9, principles are defined as "general rules and guidelines, intended to be enduring and seldom amended, that inform and support the way in which an organization sets about fulfilling its mission". They are defined with a name, statement, rationale, and implication – exactly as in the PRISM Architecture Framework, and with the express intent of being long-lived.

The ISO/IEC/IEEE 42010:2011 standard – Systems and Software Engineering – Architecture Description (the current revision of IEEE standard 1471-2000, and later ISO/IEC/IEEE 42010:2007) – contains the concept of

principles as a key part of the definition for IS architecture:

"… fundamental concepts or properties of a system in its environment embodied in its elements, relationships, and in the principles of its design and evolution."

TOGAF 9 also uses this definition of architecture:

1. A formal description of a system, or a detailed plan of the system at component level, to guide its implementation (source: ISO/IEC/IEEE 42010:2007).
2. The structure of components, their inter-relationships, and the principles and guidelines governing their design and evolution over time.

Both the ISO/IEC standard and the TOGAF standard define principle in a manner similar to the PRISM definition of principle. The TOGAF standard has also influenced many other architecture methodologies with the concept of principle to provide longer-term guidance.

Many architecture methodologies and frameworks in use today seek to conform to the ISO/IEC/IEEE 42010:2011 standard as well as to the TOGAF standard. Today, the use of principles in architectural descriptions is found in most of the recognized IS architecture frameworks, methodologies, and related processes – the Gartner Enterprise Architecture Framework, TOGAF, RUP, and many others.

Another area that the PRISM Architecture Framework may have influenced is the TOGAF domains definitions or architecture layers. I have not found definitive proof of this, so this is a topic for future research. Yet it is interesting to notice that the TOGAF standard defines four key architecture domains – Business, Data, Application, and Technology – and PRISM also defines four that directly map to them. The PRISM definition of the Organization domain maps to Business in the TOGAF standard, Data to Data, Application to Application, and Infrastructure to Technology.

Hewlett-Packard's (HP) definition of principles, used in its methodologies HPGM for ITSA and RightStep™, have evolved from the PRISM work as follows:

"A principle is a fundamental approach or means for achieving a goal."

HP's definition of architecture also follows the ISO/IEC/IEEE 42010:2007 standard, and has principles as a main component of the definition:

"… architecture: is a formal description of a system, defining its purpose, functions, externally visible properties, and interfaces. It also includes the description of the system's internal components and their relationships, along with the principles governing its design, operation, and evolution."

In HPs methodology, principles are formulated in a timeless fashion to express how the system is meant to work. This is achieved by expressing them in the present tense – that is, as if they were true today, so that it maintains their guiding quality as the architecture evolves over time. To the elements that PRISM created for principles (rationale and implication) HP has added the elements of obstacles and actions. The architectural domains of PRISM have evolved into four views focused on the stakeholders: the Business View, Functional View, Technical View, and Implementation View. And there have been many other evolutionary improvements over the years since Digital's original 1988 DART methodology (Beijer, de Klerk 2010).

This kind of long-term thinking and architectural descriptions based on principles is one of the key differences between doing architecture work *versus* engineering or detailed design work (Rivera 2007). The use of principles in architectural descriptions is still thought of as a best practice in the architecture profession. It is interesting to note that in the mid-1990s the PRISM Architecture Framework and its principles-based architectures had already been recognized as the best model to integrate business and information technology (Dietrich 1995).

CONCLUSION

The Zachman Enterprise Architecture Framework, usually considered as the first EA framework, was first published in 1987 (Zachman 1987), almost a year after the publication of the PRISM Architecture Framework. There is concrete evidence that by 1988 the PRISM Architecture Framework had been used by Digital to develop an architecture methodology that was used by consultants to actively deliver architecture services to clients, and that by 1999 it already had been used at Texaco to create their internal EA. It is safe to say that the PRISM Architecture Framework was the first architecture framework.

And curiously, even though it was not distributed widely, its influence has withstood the test of time, and has been widespread. It's just that we never knew, until now, where this influential architectural process and thinking had originated.

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