Eight Architecture Lessons from History

Historians are known for their reluctance to use the past to predict the future. It's often possible to predict change a few years forward, but after that new developments start to interact, and even the most informed person can't speculate past these events with any hope of accuracy. However, historians do argue that, while the past can't predict, it does provide an "essential guide" to understanding the future.

It has been about 40 years since the term ‘Architecture’ was introduced in the computer/information technology context. What does 40 years of history offer in terms of lessons learnt and future guidance? More importantly, what lessons can IT architecture learn from some of its peer fields i.e. Military, Civil, Finance, Mathematics, Astronomy, Social and Medical. The answer: quite a bit.

To put in context, Civil, Finance and Military fields command a combined history of more than five millenniums. Knowledge of history is quite essential in fields like finance, military, law and diplomacy. As we will see in this article, knowledge of history can be quite important for the IT as well.

 # 1. Understanding IT architecture complexity

Consider, for example, an analogy that pre-dates emergence of architecture concepts in any field:

According to an old legend, King Shirham of India wanted to reward his grand vizer Sissa Ben Dahir for inventing and presenting to him the game of chess. The desires of the clever vizier seemed very modest. “Majesty”, he said kneeling in front of the king, “give me a grain of wheat to put on the first square of this chessboard, and two grains to put on the second square, and four grains to put on the third, and eight grains to put on the fourth. And so, oh King, doubling the number for each succeeding square, give me enough grains to cover all 64 squares of the board.”

“You do not ask for much, oh my faithful servant,” exclaimed the king, silently enjoying the thought that his liberal proposal of a gift to the inventor of the miraculous game would not cost him much of his treasure. “Your wish will certainly be granted”. And he ordered a bag of wheat to be brought to the throne.

But when the counting began, with 1 grain for the first square, 2 for the second, 4 for the third and so forth, the bag was emptied before the twentieth square was accounted for. Many bags of wheat were brought before the king but the number of grains needed for each succeeding square increased so rapidly that it soon became clear that with all the crop of India the king cold not fulfill his promise to Sisa Ben. To do so would have required 18,446,744,073,709,551,615 grains, an equivalent of world’s wheat production for the period of some two thousand years!

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There is a parallel to an IT architecture problem of the 21st century – business process integration. Throughout the past two decades, enterprises spent time in creating silos of internet applications. Now enterprises are faced with not only needing to create new applications but also face the daunting task of integrating the existing ones. Every time you invest in creating an IT application, it is very likely that the application needs to be integrated with the existing and new applications. If there are 200 existing applications in an enterprise then the number of possible connections among the 200 applications is n(n-1) i.e. 200*(200-1) = 39800 two way connections. Obviously the end result is not a pretty picture.

Lesson 1: Every time you add a new application to your enterprise portfolio, think of the n(n-1) scenario; sooner or later it can assume monstrous proportions and bite you

 # 2. Understanding Technology adoption trend in the past forty years

Counting computer generations is necessarily controversial—machines don't have the same pedigrees as people. But, the five generations that are described below comprise close to a consensus.

Computer Generation	1.Mainframe	2. Mini-computers/WAN	3. PC/LAN	4.Client/Server	5.Internet	6. Pervasive Computing
Period	60's	70's	80's	late 80's – early 90's	Mid-late 90's	2005+
Adoption time	10+	7+	6+	5+	3+	

It is clear that the pace of technology development and adoption has accelerated over the past five computer generations. While old technologies have given way to new technologies, they also have to peacefully co-exist with one another. The internet revolution, the dot com fall out, the outsourcing wave and a critical focus for enterprise to meet regulatory compliance and enterprise security needs have heightened the strategic value of IT architecture. Business process integration has assumed new focus and IT organizations are under constant pressure to integrate disparate data, systems and processes across the enterprise and its extensions outside the enterprise including customers, partners and vendors. Hence IT architecture now requires complex business and technology decisions and a large percentage of the next generation of productivity benefits hinges on current IT architecture decisions.

Note, we do not aim for 'perfect' solution – there is no 'perfect' solution, as there is no black and white in a complex architecture for the large enterprise where we are trying to find an elusive balance and hard compromises between sometimes conflicting goals.

Navigating the myriad of IT architecture decisions requires tremendous expertise. It is here that IT can learn from the great building architects who shaped the evolution of civil architecture to where it stands today. Vitruvius, the great building architect under Julius Caesar described an ideal architect:

"*The ideal architect should be a man [or woman] of letters, a mathematician, familiar with historical studies, a diligent student of philosophy, acquainted with music, not ignorant of medicine, learned in the responses of jurisconsults, familiar with astronomy and astronomical calculations."*

Vitruvius himself has written not just about city planning and building materials but also about astronomy, medicine, music, the arts -- even contract law.

Invest in your best architects with broad and deep skills, keep cool head, take measured and well-informed risks when necessary, and make judgment calls based on experience and professional insight. Diligent analysis, expertise and mature attitude of the IT Architect have no substitute in finding the good workable and feasible solution in the complex architecture.

Lesson 2: There is just no substitute for sound IT architecture skills – plain and simple

 # 3. Parallels from the Paris Architecture:
IT architecture has a lot of parallel to civil architecture – building architects, building trade, building blocks.

When Napoleon III appointed Baron Georges-Eugène Haussmann to create a new plan for parts of Paris in 1853, Haussmann swept away acres of rambling medieval streets and substituted his own concept of a modern city - wide, straight boulevards with imposing façades, converging at major junctions marked by monuments, public buildings and points of importance such as city gates or railway stations. To create adequate traffic circulation, old streets were widened and new ones cut, while the great railway stations were placed in a circle outside the old city and provided with broad approaches. As a result, the Paris of today, with its Beaubourg and La Défense, is a modern and highly efficient but unmistakable patchwork of many eras. Paris became the yardstick by which all European cities were judged. Haussmann tried to preserve and renovate those old assets that are still viable while replacing others and adding new ones in a coherent way.

Haussmann's architecture strategy is largely responsible for the city's present appearance, despite the passage of more than 100 years.

The Paris Architecture Strategy has a number of useful pointers to IT architecture. Ensure you have a blueprint of the IT architecture to address your short-term ad long-term business goals. More importantly, use the blueprint to guide the sequence of roadmap initiatives and IT investment decisions. Use the big picture while adding new

building blocks and integrating business processes or acquisitions. Drive and evolve the architecture evolution along the way as the finer details of the business get to be known.

Lesson 3: Develop the "big picture" IT architecture and use it as the guide to solve your business problems and IT investment decisions.

 # 4. Preparing for the software architecture trends

Software Architecture paradigm have evolved a great deal through the history of IT architecture. We can characterize the trends in software architecture through its inception as below:

a) post-2000 – Internet, Agile Computing
b) 90's –Distributed computing, Y2K
c) 80's – Object oriented Analysis and design
d) 70's - Modular and Structured Programming
e) 60's –Modular and Structured Programming

The software architecture paradigm shift is driven by powerful forces, including the physics of relativity and chaos theory, as well as changing business requirements and relentless technology evolution. Making the shift requires proactive architectural planning, pattern/framework reuse, and proper tools for defining and managing architecture**.**

IT architecture needs to planned and executed according to "the natural laws". Like a machine not driven as its structure demands, IT architecture can break down. You can not go straight from top gear into reverse, nor can you run your engine on sand or water. A proactive forward thinking, preparing the business teams the value proposition of upgrading to a new technology, anticipating causes and managing outcomes are essential to the success of IT architecture.

Lesson 4: About once every decade, there is a paradigm shift in software architecture. If you are unprepared, you are sure to fail.

 # 5: Apply, Develop and Reuse Architecture patterns

Military history is an essential means of retaining the experience of past battles and imparting it to recruits and less experienced soldiers. Military historians incorporate various sources of historical documentation including reference books, interviews with military leaders and planners, and scientific analyses of artifacts recovered from battlefields. A thorough study of past battlefields provides valuable insight into strategies and tactics that can be brought to bear in modern situations. Army leaders, commanders, and soldiers can all benefit from learning from the experience of their predecessors.

Aside military, we can see the applications patterns in civil, finance or even social architectures. Essentially, patterns can be used to disseminate any expertise, not just military, town and building construction.

In the internet world of applying IT solutions to business problems for organizations that plan to lead and gain competitive advantage, patterns are an important tool.

Lesson 5: In a rapidly changing business climate, express your IT architecture using proven patterns and evolve patterns from today's experiences for tomorrow's needs

 # 6: Timing of technology investments matters

Financial history provides invaluable wisdom about the nature of the capital markets and of returns on securities. While the historical wisdom does not allow even the brilliant economists to precisely predict the future, it allows them to identify the risks so they can be controlled. In fact, some of the great Nobel Prize-winning economic theories have been the result of financial history analysis. Through the historical exercise from Renaissance Europe to the modern world, economists have established an important concept in finance, that risk and return are inextricably connected. If we desire the opportunity to achieve high returns, we have to shoulder high risks. And if we desire safety, we will of necessity have to content ourselves with meager rewards.

In the IT architecture world, risk and return are also connected in how we apply the technologies to solve business problems and gain competitive advantage. Even if IT architecture does not boast of the long history that Finance has, it has been established in the past forty years that first movers in the technology have almost invariably gained the competitive advantage as compared to the late-starters. The first movers, by definition, involve more risks.

Lesson 6: As in Finance, risks in technology investments and return are inextricably connected.

 # 7: **Importance of Architecture Theory**

Amongst its peers, perhaps IT architecture can learn a lot more from the long and rich history of Civil Architecture. Through its evolution from 30 B.C.E to the twentieth century Civil Architects have looked to historical architecture for the guiding principles, aesthetic inspiration and critical control.

About 30 B.C.E, Vitruvius wrote a systematic and comprehensive theory of architecture, composed in ten parts or "books". It covers diverse topics such as education and professional scope of the architect, practical considerations such as siting of new cities, the handling of building materials, detailed prescription related to the design of the different types of buildings. Civil Architecture theory and practice have continued to evolve through the centuries and millenniums as great architects like Alberti, Francois

Blondel, John Ruskin, Frank Lloyd Wright, Venturi continued the footsteps of Vitruvius and evolved the theory to produce culturally relevant designs. But the importance of Vitruvius work lies in the fact that even after the passage of two millenniums, about one-third of his books touches upon still-relevant issues of architecture theory. It is laudable considering the influence of computers in the modern design methods and design formulation.

The overarching message that IT architecture can get from Vitruvius and other pioneering civil architects is that proper knowledge and application of architecture theory is as much essential as the expertise in practice that makes it possible to translate ideas to reality. In fact, such awareness may be a prerequisite to creative freedom and innovation. In this context, it is encouraging to see the emergence of IT architecture frameworks such as The Zachman Framework, TOGAF (The Open Group Architecture Framework) in the last two decades.

Lesson 7: A fluent knowledge of architecture theory as well as practice leads to effective architectures.

 # 8: **The importance of ilities and disaster planning**

Astronomers have long studied the impact of comets for thousands of years, right from the Shakespeare days. Over the thousands of years of recorded history, comet study has been free of superstition for only the last two centuries. Comets can indeed bring calamity – but as we now know, only if they actually strike the earth. For most of human history however, comets portended major disasters, such as the demise of a head of a state as the Roman Empress Calpurnia reminded her husband in Shakespeare's Julius Casear.

Over the past centuries, astronomers have discovered a whole population of periodic comets, which include Halley, Swift-Tuttle and Levy. Astronomers have concluded that each century there is about a 1 in 1000 chance that there will be an impact on Earth of an asteroid 1km or larger; over 10,000 years the chance increases to 1 in 10. And when a comet or asteroid hits us in the next quarter-century, astronomers have identified things to do to mitigate the disaster to earth.

While a comet impact is potentially the most extreme case of risk versus consequence, the takeaway for IT architecture is that risk analysis, disaster planning and business continuity have to be thought of up front and not after the fact.

Lesson 8: Document the risk factors of IT components to your business; develop a risk mitigation strategy in place and reason it out as part of your IT architecture strategy.

Summary:

As we can see, most of the lessons mentioned in this article were realized through centuries of historical events, painful in many cases. IT architecture can head to the next stage of its maturity by documenting and using the patterns through its own history and its peers. As George Santayana, the great American Philosopher put it: *"Progress, far from consisting in change, depends on retentiveness. Those who can not remember the past are condemned to repeat it"*

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