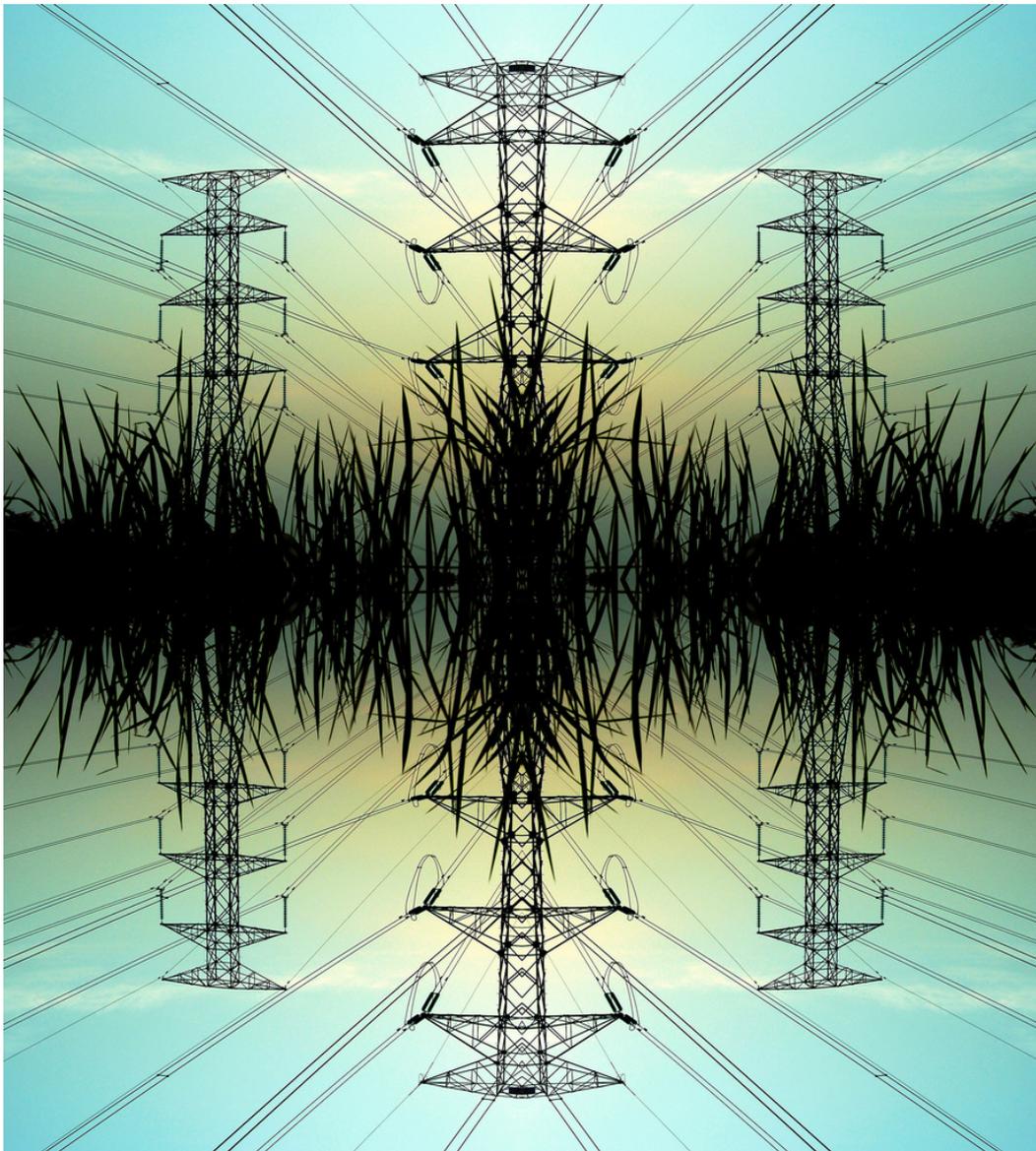


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# Organic Enterprise GIS Architecture: Laying foundations for more sustainable environments

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# Organic Enterprise GIS Architecture:

Laying foundations for more sustainable environments

## ABSTRACT

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Current IT architectural trends actively promote the benefits of integrated, normalized and service oriented enterprise designs.

As a natural consequence, the Enterprise GIS systems design practice has embraced this approach, introducing a new set of variables, layers and flows, into traditionally isolated, controlled and rather stable systems.

Unfortunately, these new pieces also have an unexpected potential to degrade and limit the proposed solutions, minimizing most of the anticipated gains of such novel approaches.

This issue is particularly sensitive for enterprise architectures where GIS is a core piece of the puzzle like in the utility Industry. If core components are not properly padded with sufficient logic and flow controls, the impact can be significant to the business as a whole.

In this paper we discuss issues and options to avoid these shortfalls, designing more sustainable enterprise GIS systems architectures, and their projection in time, as programmes of work.

Keywords: Enterprise GIS, Architecture, Organic Design, Sustainable architecture. GIS programmes.

## Introduction

Over the past few years, Geographic Information Systems have evolved to become formally recognized as an essential resource of any large utility operation.

Typically sprouting out of old AM/FM or drawing systems, and initially deployed at a desktop or workgroup levels, GIS have now migrated to the Information Technology land of servers and databases.

During roughly the same period, Enterprise IT environments (typical of medium and large utilities) have also changed and embraced new values and models. Concepts like “best practices”, “COTS/bespoke ratios” and “service level agreements” have now become a part of every day life for IT specialists.

In this context, GIS projects can run into trouble when a company embarks into this new technology landscape without a clear roadmap for the projected business role(s) GIS will have in the overall business systems environment, potentially lessening its fitness to deliver the expected outcomes.

In other words, deploying or redeploying an Enterprise GIS with disregard to the basic enterprise IT architecture, business logic or processes it will affect, will very likely setback most of its anticipated benefits.

To help mitigate these potential shortfalls, we propose to use the case of Utilities Enterprise GIS to illustrate some of the challenges we face, and some of the responses we have devised in the past years.

To draw a reference plane first, we'll have a quick look at current trends in Enterprise IT and GIS in the utilities space, with some notes of implementation issues raised in some of these frequent scenarios.

We will then, based on these reflections, look at potential design methodologies applicable to these projects, and their projection in time as programmes of work for enterprise GIS.

Act 1: The Buzzword; what's happening?

What is happening to GIS in the utilities world?

- ☑ Wider use within the organization (up to 80 application areas last year)
- ☑ More Integration with other enterprise systems ( ERP, EAM, CIS, OMS)
- ☑ Becoming a key component in Organizational workflows (Service request, dispatch, Customer requests)
- ☑ Has a greater need to utilize internal and external information sources (Land, Imagery, Network, Weather)

What 's happening in the Enterprise IT arena

- ☑ Scalable, distributed and virtualized environments.
- ☑ Use Loose coupling over stacking or hardwired components
- ☑ Ride the Enterprise Service Bus

What is happening in the GIS arena?

- ☑ Tiered components (Desktop, Server, Services, Web apps, objects)
- ☑ Scalable server side deployments ( Multi nodes and N-tier architecture)
- ☑ Use standard interfaces and formats (SOAP,REST, XML,JSON)

*The problem*

Now implementing these technologies is not as straightforward as it looks. You will come across a few roadblocks, dead ends, very edgy paths and the usual Pandora's box type of problem. Here is a sample of some of the type of issues you should be mindful of, specifically for Enterprise GIS in electricity utilities.

*Some lessons: Warning - Men at Work Ahead.*

If you are Integrating/Interfacing your GIS to other systems, or ESBs, be mindful of:

- Planning for an error management sub system.
- Don't Underestimate traffic volumes.
- Implementing flow control mechanisms.
- Defining most of your business logic in the Bus, and data mappings at the receiving ends.
- Minimizing hardwired replicas, favor extractions where possible.
- Defining tight logic for managing native and foreign keys.

Or, if you plan on using your GIS as a Network Asset Management System (or sub-system), or as a building tool or design system, make sure you:

- Expect complexity in resolving geometric networks reconciliations (deciding which GN junction goes with which conflicting line segment?)
- Prepare to produce a thick layer of business specific logic on top of already industry specific functionality.
- Manage users expectations WRT performance in handling complex network datasets, especially in large multi-editors scenarios.
- Tackle performance issues quickly and systemically in large replication or synchronization processes.
- Do not underestimate maintenance & admin requirements.

Of course, If you are using GIS for map production and viewing, be sure you;

- Do not underestimate growth of demand in all client footprints (thick, thin, web, services)
- Diversify your corporate mapping products, but consolidate it's management.
- Design and distribute basic business focused analysis tools (GP models) in maps.
- Add fat to Map and GP services instances (N+1).
- Do not underestimate maintenance & admin requirements.

Finally, If you are using GIS for any or all of the above, remember to:

- ☑ Model geodatabases as standard as possible and as simple as possible.
- ☑ Make sure you capture and manage only what you need, not what “used to be” or “nice to have”.
- ☑ Take full advantage of industry specific logic tools, like auto field calculators, validation tools, and customizable behaviors.
- ☑ Don’t try to do everything with your GIS, just make sure you exploit all of what it is good at.

How can we avoid some of these problems? How do we plan for the best possible GIS your company can afford?

As with every major object or space you intent to use or inhabit, designing and planning on how, what, where who and why you are intending on using it is the best way to get a closer match to your requirements.

This is where that old beaten and bushed, and most definitively misused term called architecture comes into play.

What follows, is a set of “design guidelines”, drawn from the guts of current architectural values that we think are easily transposable, and most important, relevant to modern GIS design practices.

### Basic Design guidelines

What we are trying to address here is setting clear and identifiable architectural principles to govern the way we design these systems, and the way they interact with their environment.

The problem as we see it, is that very often we use the term architecture when we are presented with a set of nice pictures of servers, applications and databases, all tied together with very impressive and complex arrows. These “Visio based” diagrams are often branded as the architecture of the solution.

Now, according to an ANSI/IEEE Standard definition: Architecture ( in the IT context) can be defined as “ the fundamental organization of a system, embodied in its

components, their relationships to each other and the environment, and the principles governing its design and evolution”

What is often missing in these pictures is the architecture itself; i.e the principles, and the fundamental organization cited in the ANSI definition. What abounds are those nice components icons, and the intertwining relationship arrows.

So, instead of proposing you to look at nicely arranged collections of icons, I will try to hold back and look at a higher level, look at the type of solutions we want, and not the solutions themselves.

As the title of this paper suggests, we consider that there two qualifications that can define adequate architectures for enterprise GIS: organic and sustainable.

Let’s have a quick look at these two design traits, and their translation in terms of GIS architecture.

*Organic.*

What is an Organic Architecture?

According to a classic definition, Organic architecture is a design approach which promotes harmony between the built and the natural world through design approaches so sympathetic and well integrated with its site, that buildings, furnishings, and surroundings become part of a unified, interrelated composition.

In the IT context, Organic Enterprise Architecture should then be a design approach which promotes alignment between systems and their environment through solutions so supportive and well integrated with the organizational model, that applications, data, and processes become part of a unified, interrelated composition.

Visualize your “to be” GIS in its specific context, seating next to the old legacy billing system, the recent top of the line financial engine and the manual reconciliation processes. The design has to take into consideration this pre existent environment, as it will accommodate a new set of components.

But as well as the context, the design also needs to pivot around the intrinsic characteristics of the GIS technology itself, trying to draw the best of its features.

Bottom line, an organic design should be based on both, the intrinsic character of the chosen GIS technology, and its nurtured role in the organizational context, by articulating the structural interactions occurring within business processes conveyed across the system.

The design fitness should be assessed from both, its internal logic and flows, as usually assumed, but also from its external interactions and its suitability or aggressiveness with regards to the enterprise environment and the shaping or reshaping it generates in business processes, data flows and functions.

The other term we like to associate to healthy GIS developments is Sustainable

Sustainable

*What is sustainable?*

Sustainable architecture, is a general term that describes environmentally-conscious design techniques ... [that]. seek to minimize the negative environmental impact of buildings by enhancing efficiency and moderation in the use of materials, energy, and development space.

Sustainable Enterprise architecture, is a term that describes context and time conscious system design approach ... [that]seek to minimize the negative organizational impact of systems by enhancing efficiency and moderation in the use of resources, effort, and components.

Deploying a sustainable GIS Design should :

- Not generate continuous strains on your existing IT and business resources.
- Efficiently use all its components as well as taking advantages of existing untapped resources.
- Achieving greater Effectiveness by means of continual efficiency gains.

Finally, try to organize and develop your overall architecture in a tangible and communicable manner. Use Architectural frameworks where possible ((Zachman, TOGAF, DOD, etc)

## *Building the big picture.*

If an organization engages into following these basic guidelines, it soon becomes apparent that no single implementation or upgrade project will be able to cover all the expected benefits of such architecture in a brief period of time. Deploying organic and sustainable GIS architectures requires a projection in time of actions, which become de facto programmes of work. These programmes will have at least one of the following characteristics:

- ☑ They should be, in essence, outcome driven, delivering both tangible (solutions, processes, information) and intangible (governance, technical frameworks, benchmarks) products.
- ☑ They should aim at delivering combined expansions of functionality along with incremental gains in existing ones.
- ☑ They should seek continuous optimization of existing resources and services.
- ☑ Wrap operational and planning activities with proper consolidated governance.

In conclusion, designing these organic and sustainable environments, where GIS will live and evolve, will become more like a journey rather than a project pause. But this change will also very likely deliver far more fruits, and far less pain than most traditional practices.