



SmartCities

Creating Municipal ICT Architectures

A reference guide from Smart Cities



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1. Introduction

E-government operations require citizens and external organisations to receive appropriate e-services, delivered by an organisation's automated business processes and supported by information and communication technologies (ICT). The delivering organisation must therefore be able to manage these services, typically through business units and officers who are responsible for the development of business processes and ICT. This area of service management can be reinforced and strengthened, however, by using architectures: business architectures, information systems architectures, technology architectures¹ and the processes used to produce them.

Architecture frameworks often are difficult concepts to understand. This publication is a collection of ideas about enterprise architecture which we hope will contribute to people's understanding of this subject. Taking a broad perspective, this publication answers some basic questions: What is an ICT architecture? What is the value of ICT architectures and how are they produced? Why should we bother with them? Using the enterprise architecture approach we hope to show how architectures and the processes followed to produce them can help the development and improvement of e-government.

Would you build a house without drawing up proper layouts, designs and plans? Would it be possible to build this house in a community without detailed plans for land use or transportation links? Typically you would select, develop and design the 'functions' and appearance of the house for many months before hiring a builder. You also need to apply for permits and planning permission from the local authorities who must approve your designs and your processes for carrying out the building works. You cannot just start laying the foundations and begin throwing around bricks and mortar without considering laws, regulations and guidelines in addition to the function and appearance of the building and its place in the local environment.

This analogy helps us to illustrate the issues involved in the development of ICT. Many organisations fail to develop strategies and produce plans with sufficient scope and quality. A lack of strategic planning compromises ICT projects and the efficient use of resource.

But in a modern e-government organisation, which finds itself subject to ever increasing demands for 24x7x365 e-services that seamlessly cross institutional boundaries, there is little room for poor quality. ICT must support the organisation and its business, not introduce new obstacles.

High standards are maintained when organisations make careful preliminary studies, then develop and design their offerings using effective methods, tools and development processes that are controlled by strategies, policies and principles, that cover local, regional, national and European levels.

The contributors to this publication have gone 'all in' for service orientation, designing and planning their operations and processes around the delivery of services, including e-services. This is what it is all about: building an organisation with the capabilities, resources and internal processes to deliver a portfolio of efficient electronic services to citizens, businesses and other organisations throughout the EU. We must leave system-centricity and look at everything from a service perspective.

This is already happening in towns and cities across Europe. The task is not easy – there are many great challenges to overcome – but only by focusing on services will Europe's municipalities really be able to live up to the expectations of their citizens.

Who this publication is for

We have produced this publication primarily for business developers, architects and designers, although many other e-government stakeholders will find it useful if they want to acquire some architectural know-how. The publication will serve as a reference for the developer community, providing a common understanding and a set of common recommendations for the design of ICT architectures and highlighting their importance in service-oriented organisations.

Contributors

This guide brings together lessons and experiences from three Smart Cities partners: Karlstad, Kristiansand, and Groningen. Written by Gunnar Kartman, Arild Sandnes, and Gjill Smit, it brings together local lessons and perspectives from a wide range of local, national and European initiatives. The appendix includes further references to our contributors' work. We have included several illustrations in this publication as examples to support and clarify our points.

2. The concept and value of architecture

Let's begin by thinking about buildings. When you say the word 'architecture' most people immediately think about the construction plans and designs for homes, office blocks, etc. Sometimes they even confuse the building itself with 'architecture'. Consequently, an architect is the professional who designs these buildings.

Throughout this publication, we use the term architecture in a different context. A building is the physical representation of a specific architectural design; architects are responsible for, or participate in, a design process which involves the customer, contractors, suppliers, end users and so on.



Figure 1. The Oslo Opera House in Norway, designed by Norwegian architects Snøhetta AS (www.visitnorway.com; photo by Bjørn Eirik Østbakken)

The objective of the architecture process is to transform a customer's requirements into a series of descriptions that will allow others to realise the customer's requirements in the future (i.e. to understand the processes and materials required to construct the building). The product of the architect is a set of descriptive elements – blueprints, physical models, physical examples of surface textures, colour samples, etc. – that tell others exactly what is needed. The product from the building process is the actual building, constructed according to the architect's design and meeting the customer's expectations.

Not just buildings

Now, let us replace the building with something a little more abstract: an e-service or an e-process. The architecture (i.e. the product of the architectural process) is developed because key people (“stakeholders”, customers in the building example above) have ideas and concerns that need to be addressed within the organisation. The concerns, which may emerge from different parts of the organisation, will be expressed in the architecture process as requirements for a service.

This ICT architecture therefore consists of a set of formal descriptions (like the building architecture’s portfolio of blueprints, models and samples) of an information system’s structural and behavioural properties, together with descriptions of how it may evolve or be adapted in the future.

As is increasingly common among architects in the construction industry, architectures for business processes and information systems can help to plan what happens at the end of the product’s life cycle. The descriptions define the components or building blocks for the required information system and its subsystems, but will also include a plan or roadmap outlining how these components may be procured, evolved and developed over time.

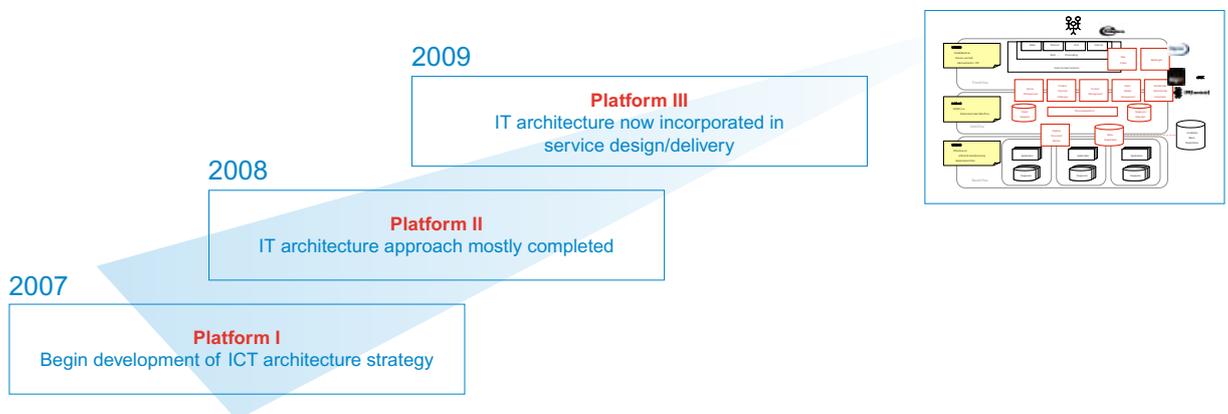


Figure 2. Groningen’s ICT architecture roadmap

The ICT architecture is developed through an architectural process managed by an ICT architect. The architecture work aims to develop a reference architecture for the organisation which is based on a set of rules and principles that are defined by how business processes in the organisation intend to and can actually evolve in a structured, uniform manner over time. From this reference architecture specific architectural solutions are then developed as needed.

The architect

The role of the ICT architect is to address the concerns of all stakeholders. First he must draw up a comprehensive list of all these concerns, then refine them into a set of functional requirements. Once these requirements are agreed, the ICT architect can then begin to develop different architectural solutions that show how the requirements (and ultimately all the stakeholders' concerns) are going to be addressed.

This is no easy task. The architect must be able to reconcile the conflicting concerns of different stakeholders, working out priorities and balancing the important elements of cost, consistency and value. Sometimes an architect may first put together a 'project starting architecture' (PSA) – a somewhat rough-and-ready solution that is unlikely to address all stakeholder requirements, but is a good starter for subsequent discussions. Of course, in the end, it is rare that any architecture addresses everyone's concerns and requirements; some may even compromise other aspects of a business or its strategy. The 'good enough rule' is often the one to follow!

An e-service will eventually be implemented within a wider context, just as a building goes up within a city. This context is the complex architecture landscape of the e-service which contains processes, services, data, infrastructure, etc.. All of these elements must be considered during the process of designing or redesigning individual building blocks that make up the ICT architecture.



Figure 3. Map of Piraeus, Greece, in 1908.
Wikimedia Commons (Baedeker's Handbook of Greece, Leipzig)

The roadmap

An architect therefore has to deal with baseline (existing or 'as is') and target (future or 'will be') architectures of the entire landscape, not just the individual building blocks for a single e-service. A strategy must be developed on how to meet the goals of the e-service within the wider organisational landscape, its strategies and its processes. This strategy should be documented and detailed in a roadmap.

Gap analysis may be used to help outline any issues which could prevent this movement and identify tactics to drive the process forward according to the organisation's strategy. It is crucial that you align architectural work and strategies with:

- the organisation's process to develop business strategies;
- the organisation's vision for different architectural domains under development (e.g. ICT, business processes, etc.); and
- the expressed goals and targets that have been set out for the ICT architectural initiatives (see Section 2.1 "The architecture metamodel").

A well executed architecture project adds to the organisation's capabilities of investigation, development and design that are essential for the business to procure and use ICT in a suitable way.

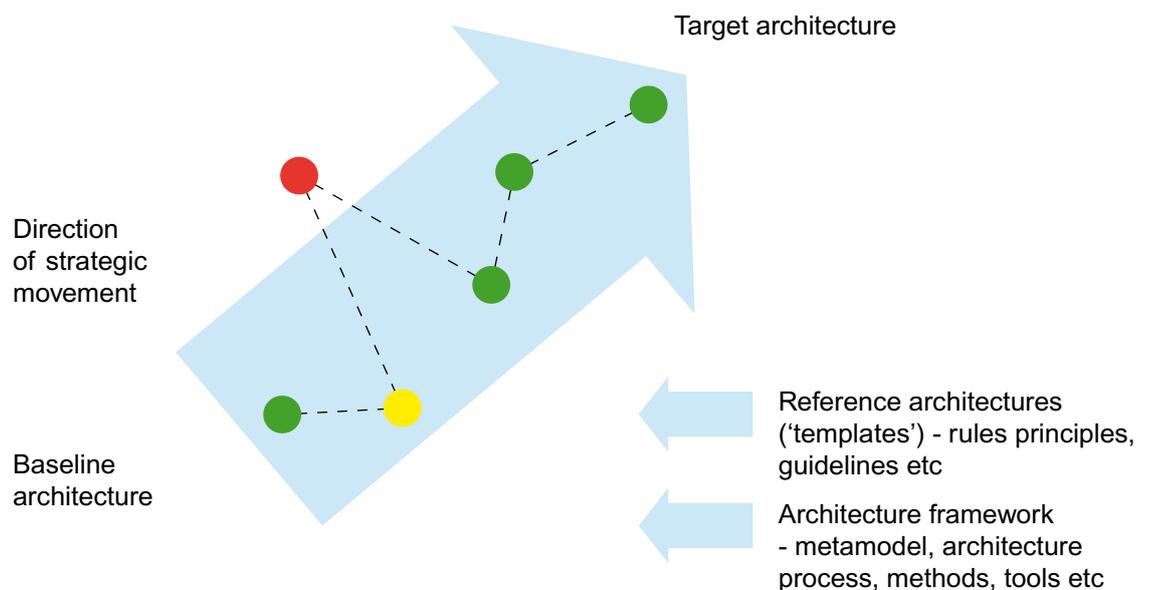


Figure 4. A high-level representation of a roadmap and its environment

An ICT architecture project involves a number of consecutive steps which takes the work from the initial identification of requirements through to the actual implementation of an end product such as an e-service. In the illustration below the first four (coloured) steps typically occur as part of some kind of an ICT architecture process.



Figure 5. A schematic representation of a product development process

2.1 The ICT architecture metamodel

Architecture projects can be run in different ways and focus on a variety of different domains, including, for example, business processes and information systems. Architectures can also possess levels of detail (granularity) and expert knowledge. Consequently it is important to define the architectural landscape, its boundaries and the necessary level of detail that is required for the architectural work to achieve its goals.

Outline

This publication uses a simplified architecture metamodel to support our discussions, based on TOGAF^{®1}, an Open Group standard. The TOGAF standard takes a holistic approach to enterprise architecture. It should be noted that the metamodel used here should not be confused with the TOGAF Architecture Metamodel.

The purpose of enterprise architecture is to optimize across the enterprise the often fragmented legacy of processes (both manual and automated) into an integrated environment that is responsive to change and supportive of the delivery of the business strategy.

TOGAF²

¹ TOGAF is a registered trademark of The Open Group in the United States and other countries. <http://www.opengroup.org/architecture/togaf9-doc/arch/index.html>

² <http://pubs.opengroup.org/architecture/togaf9-doc/arch/>

TOGAF defines 'enterprise' as "any collection of organizations that has a common set of goals. For example, an enterprise could be a government agency, a whole corporation, a division of a corporation, a single department, or a chain of geographically distant organizations linked together by common ownership."

TOGAF argues that the term 'enterprise' in the context of "enterprise architecture" can be used to "denote both an entire enterprise – encompassing all of its information and technology services, processes, and infrastructure – and a specific domain within the enterprise. In both cases, the architecture crosses multiple systems, and multiple functional groups within the enterprise."³

The architecture metamodel takes an enterprise-wide perspective and focuses on the context and dependencies of architectural elements. Typically the use of the metamodel is delimited by how the enterprise is defined; from this definition you can then analyse whatever level of detail is required, iteratively working towards a complete ICT architecture.

It is also advisable to view the model in two directions – top down and bottom up. The top down analysis starts from the perspective of the whole enterprise, its overall direction, policies, goals and strategies. The bottom up approach starts by looking at individual components (processes, software, etc.) and sees how they fit together to perform the work of the enterprise.

³ <http://pubs.opengroup.org/architecture/togaf9-doc/arch/>

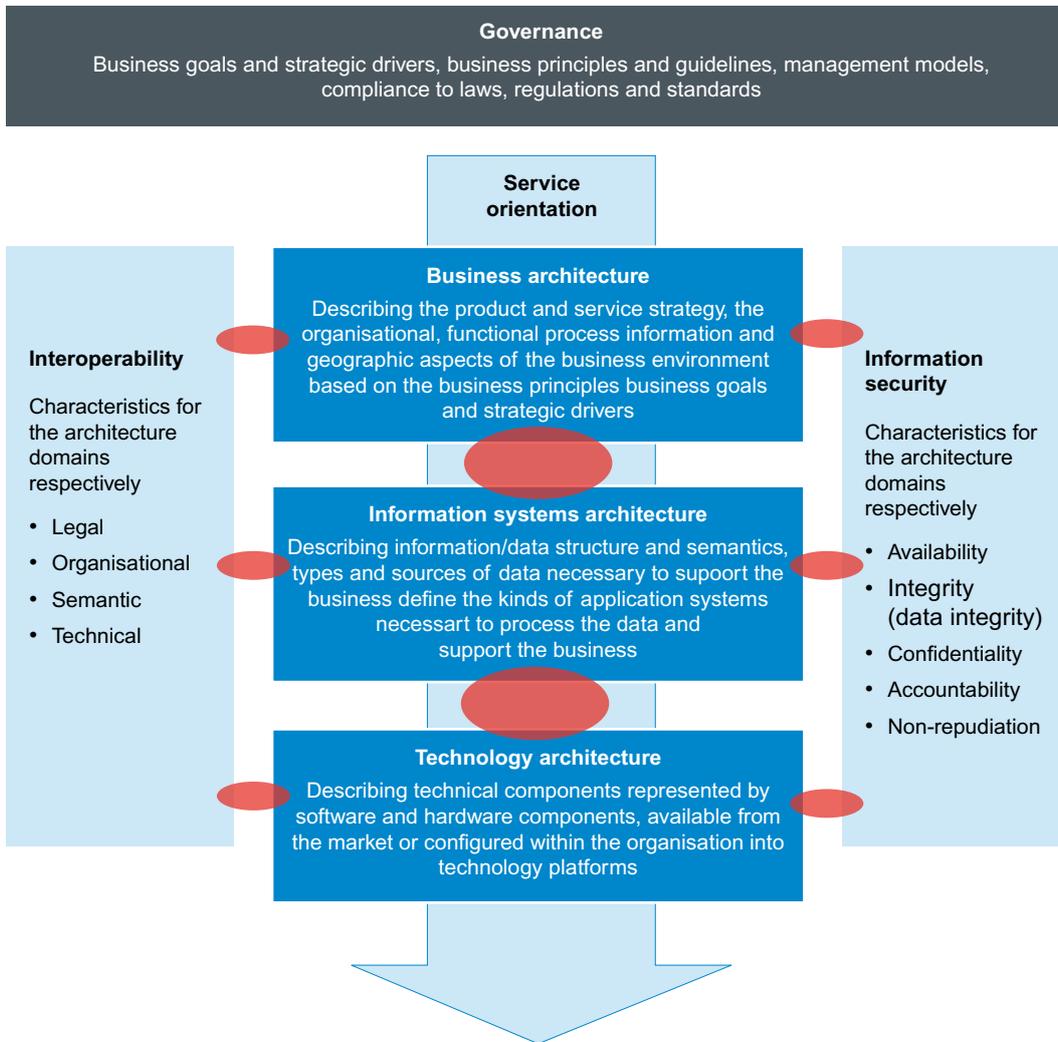


Figure 6. Part 1 of the architecture metamodel used in this publication

Figure Six shows how the architecture metamodel comprises seven domains – one governance domain (dark grey), three architecture domains (dark blue) and three domains which describe three of the most important characteristics of the architecture domains (light blue). The red markers in the diagram represent dependencies between domains where it is important to pay close attention to detail. Failure to manage dependencies between domains will result in deficient designs.

One can argue about why the information security domain is not dark blue. Does this mean that security architectures do not exist? Of course they do, but this discussion is largely philosophical. A key aim of the architecture metamodel is to interweave information security characteristics into the business, information systems and technology architectures; this approach helps to give much greater prominence to these issues and forces ICT architects and stakeholders to have a deeper understanding of the security aspects of their architectures.

The metamodel's inclusion of service orientation characteristics emphasises that components should be designed so that they support the enterprise's vision for service orientation. These characteristics give prominence to reusability and the ability to exchange an architecture component with another without disrupting service.

These domains will be discussed in detail later in this guide.

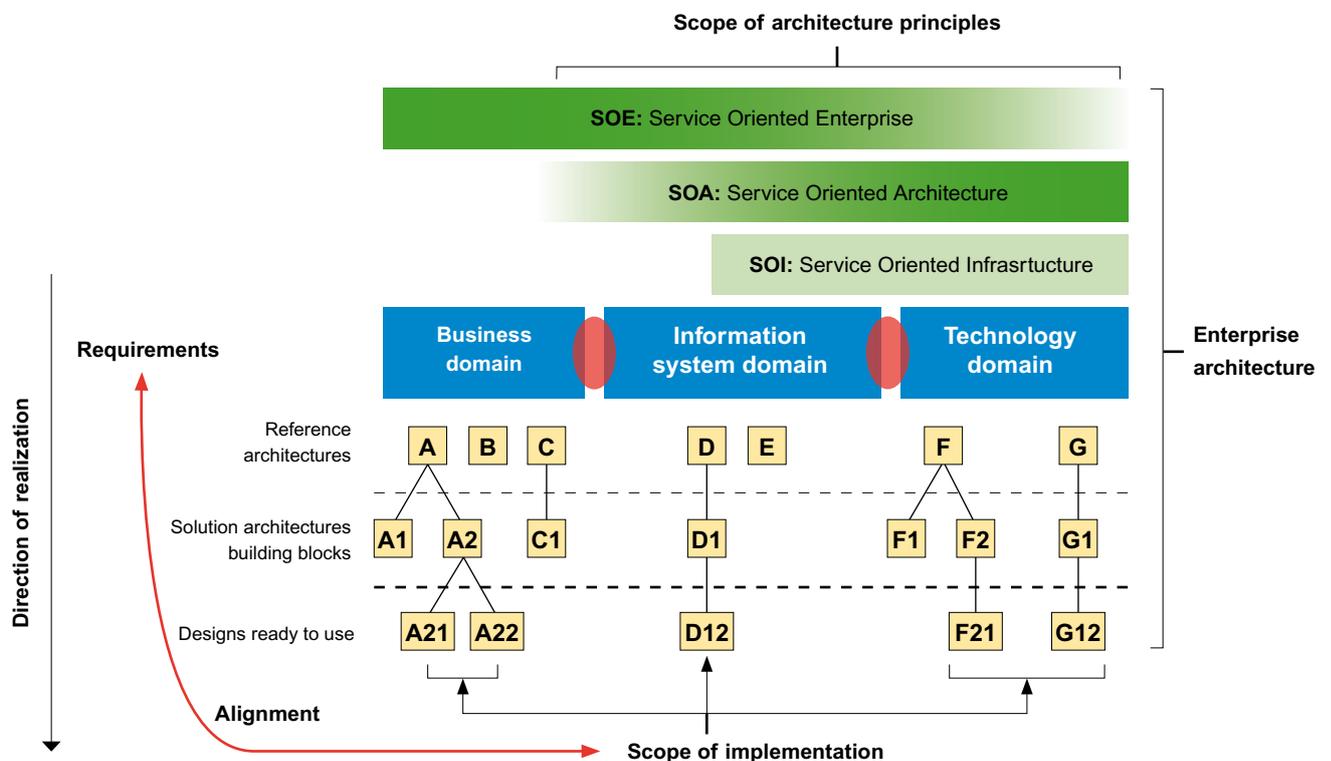


Figure 7. Part 2 of the architecture metamodel used in this publication

When a municipality wishes to offer effective and efficient services – whether they are electronic or not – to its citizens, it is important that it has service management capabilities in place. This requirement is highlighted in Part 2 of the metamodel using the concept of a Service Oriented Enterprise (SOE). Again, a holistic view is essential and must be applied from the highest level of management down through the entire organisation.

Poor interoperability and adaptability are serious issues for many of today's infrastructure components. Replacing or changing these components is often prohibitively expensive or too time consuming. Where it is possible, architecture solutions should use open standards which underpin service orientation. In this metamodel the Service Oriented Infrastructure (SOI) represents an idealised implementation of components which are designed to deliver services with a minimum of overhead and which follow the design principles of Service Oriented Architecture (SOA)⁴. By following this service-oriented approach, interoperability and adaptability are embedded within the ICT architecture.

Governance

Governance is a broad topic so it is important to narrow its definition. In the architecture metamodel the governance domain is relatively simple and covers the control and oversight by management of different levels of the organisation. The overall purpose of governance is to coordinate efforts within the enterprise so they work together towards predetermined goals; governance provides guidance and steers the organisation towards its goals. This may be achieved by:

- working out and monitoring short- and long-term goals and strategies;
- working out and monitoring principles and guidelines;
- providing management models;
- ensuring compliance with laws and regulations;
- ensuring compliance with, and encourage the use of, standards to reach appropriate levels of interoperability;
- encouraging a change in staff to have a service-orientated mindset.

These management tasks will create the appropriate conditions to develop the organisation's service orientation. To be successful, enterprise architecture work should be aligned with, and participate in, strategic management work and corporate governance activities.

⁴ See "SOA Principles, An introduction to the Service orientation Paradigm by Thomas Erl"
<http://www.soaprinciples.com/default.php>

Business, information systems and technology architectures

The architecture metamodel covers three architecture domains based on TOGAF: business, information systems (encompassing the data and application architectures) and technology.

Business architecture

If you do not understand the business architecture it is impossible to work on the architectures of any of the other architecture domains (information systems, technology). The business architecture is the foundation of all architectures, and so it should be the first domain that is tackled in any architecture project.

Having said this, it is possible to ignore the business architecture if it is already the subject of other organisational planning processes. In some cases, key elements of the business architecture may be the focus of other strategic activities; for example, the enterprise mission, vision, strategy and goals may already be documented as part of some wider business strategy or enterprise planning activity. These aspects of the business architecture may already have a lifecycle of their own within the enterprise.

Action in the business architecture domain begins with the execution of process mapping⁵ based on the needs and requirements expressed by citizens, internal users and management. This mapping exercise will help to produce activity models (business process models) and reveal all the data and information which is exchanged internally at each step of a business process, or externally (and therefore outside the scope of the model).

The business architecture domain may also produce use-case models to describe either business processes or how system functions are related to actors, depending on the specific focus of the modelling effort.

Business architecture work also produces class models. Class models are similar to logical data models; they describe, with various levels of detail, any static information and the relationships between information. A class model also describes informational behaviours (methods or operations).

Information systems architecture

The information systems architecture identifies and defines the applications and data handling requirements that are necessary to support an enterprise's business architecture. The information architecture will show how information, knowledge, application services, etc. all relate and interconnect with each other.

⁵ See *Improving business processes and delivering better e-services - A guide for municipalities from Smart Cities*
- <http://www.smartcities.info/business-processes>

Data architecture

A data architecture defines the major types and sources of data that are necessary to support the business; the data should be complete, consistent and stable. Furthermore, stakeholders should be able to understand how the enterprise acquires and uses data; visualisations of the data architecture may help them to understand this.

It is important to define which application components in the information architecture will hold the enterprise's master data (the data without which the enterprise would not be able to function) and who owns/manages this data. The key considerations for the data architecture are data management, data migration and data governance.

The data architecture should be clear and accessible to everyone in the enterprise, but in reality it seldom is – this is a big challenge for any architecture initiative. Unfortunately even ICT specialists tend to underemphasise this domain. A poor understanding of the data architecture within an enterprise can be extremely problematic: the poor management of data affects an organisation's ability to provide reliable and accurate data to services and processes.

Application architecture

An enterprise needs to define the major kinds of application systems it requires to process data and support its business. The development of an application architecture is not about the design of application systems but takes a higher level perspective: what kinds of application systems are relevant to the enterprise, and what should those applications be able to do to manage data and to present information to employees and other IT systems/applications in the enterprise?

Applications are grouped together logically by their abilities to manage, the different objects in the data architecture and to support the business functions in the business architecture. Applications and their capabilities are defined without reference to particular technologies. Ideally the enterprise will try to keep these application definitions constant, while the technology that is used to implement these applications may change significantly as the available technology improves.

Technology architecture;

The technology architecture maps application components (defined in the applications architecture) to a set of technology components – software and hardware – that are available on the market or which can be developed or configured within the organisation into a technology platform. This domain is the primary focus of employees in an organisation's IT department.

Interoperability

Interoperability should always be at the front of any architect's mind. In the business, information systems and technology architecture domains, paying attention to interoperability will help an organisation to be effective and efficient. This publication looks at how the European Interoperability Framework (EIF) may be used to tackle interoperability issues to facilitate better interactions between European organisations; we have highlighted some of the recommendations in this publication. The ambition of the EIF is to marry the various National Interoperability Frameworks (NIFs) at a higher European level. This degree of interoperability is absolutely necessary if organisations wish to work together on mutually beneficial and agreed common goals.

*Public administrations should align their interoperability frameworks with the European Interoperability Framework to take into account the European dimension of public service delivery.*⁶

Recommendation 1, European Interoperability Framework

The purpose of the EIF is:

- to promote and support the delivery of European public services by fostering cross-border and cross-sectoral interoperability⁶;
- to guide public administrations in their work to provide European public services to businesses and citizens⁷;
- to complement and tie together the various National Interoperability Frameworks (NIFs) at European level.

Annex 2 of the EIF for Public Services (December 16, 2010)⁸ states:

“Interoperability, within the context of European public service delivery, is the ability of disparate and diverse organisations to interact towards mutually beneficial and agreed common goals, involving the sharing of information and knowledge between the organisations, through the business processes they support, by means of the exchange of data between their respective ICT systems.”

The EIF also outlines the needs and benefits of interoperability. “Interoperability is both a prerequisite for and a facilitator of efficient delivery of European public services. Interoperability addresses the need for:

- cooperation among public administrations with the aim to establish public services;

⁶ Sector is to be understood as a policy area, e.g. customs, police, eHealth, environment, agriculture, etc.

⁷ In the context of the EIF, the concept of businesses includes non-governmental organisations, not-for-profit organisations, etc.

⁸ http://ec.europa.eu/isa/strategy/doc/annex_ii_eif_en.pdf

- exchanging information among public administrations to fulfil legal requirements or political commitments;
- sharing and reusing information among public administrations to increase administrative efficiency and cut red tape for citizens and businesses.

The result is:

- improved public service delivery to citizens and businesses by facilitating the one-stop-shop delivery of public services;
- lower costs for public administrations, businesses and citizens due to the efficient delivery of public services.”

The EIF sets out four levels of interoperability.

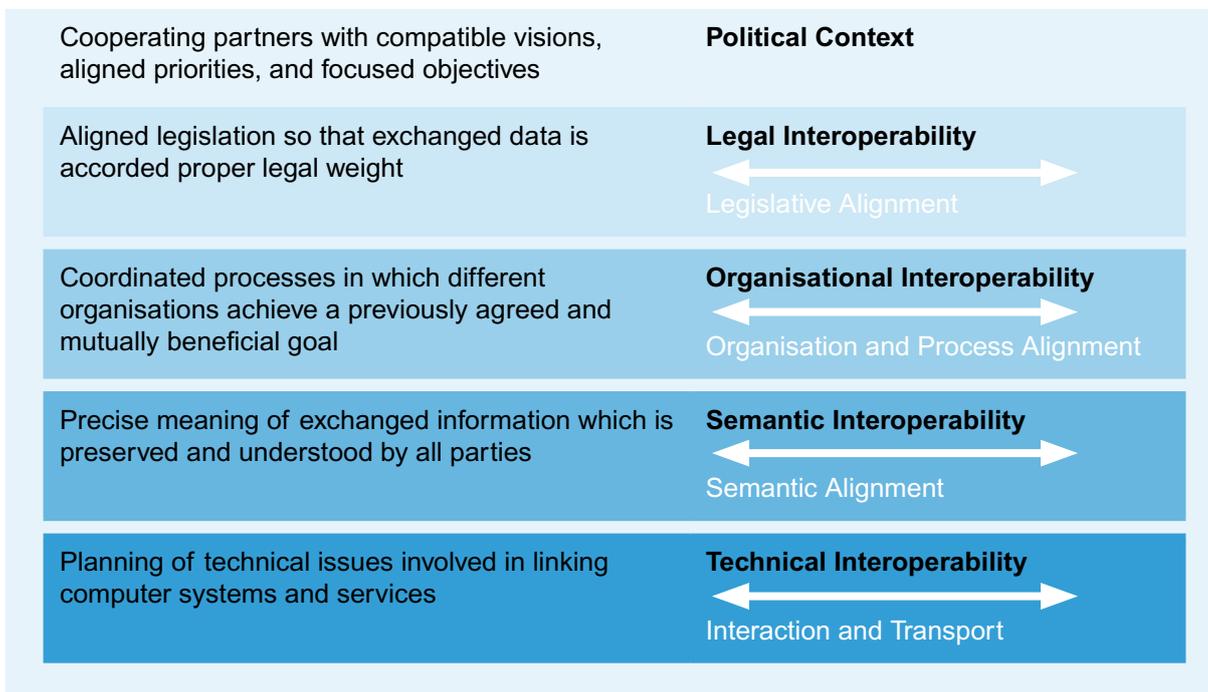


Figure 8. The four levels of interoperability in the European Interoperability Framework (EIF)

The EIF recommendations on these four levels of interoperability are discussed in more detail below.

Legal interoperability

Public administrations should carefully consider all relevant legislation relating to data exchange, including data protection legislation, when seeking to establish a European public service.

EIF Recommendation 14

This recommendation highlights the fragmented nature in the legal status of data and its processing across Europe. It is essential that any information exchanged between Member States is legally valid for them to provide public services. Legal interoperability is also an important issue within Member States as the legal framework often prevents public organisations exchanging information.

Organisational interoperability

Public administrations should document their business processes and agree on how these processes will interact to deliver a European public service.

EIF Recommendation 15

From a business perspective this sometimes can be a new experience calling for new capabilities to be developed and for political decisions to be made. It is a challenge to execute this within the administration, and an even bigger one to make this happen for administrations in different co-operating organisations.

Public administrations should clarify their organisational relationships as part of the establishment of a European public service.

EIF Recommendation 16

The EIF explains that “service orientation, on which the conceptual model for public services is built, means that the relationship between service providers and service consumers must be clearly structured”.

“This involves finding instruments to formalise mutual assistance, joint action and interconnected business processes in connection with cross-border service provision. Examples of such instruments are Memoranda of Understanding (MoUs) on joint actions and cooperation and/or Service Level Agreements (SLAs) signed between participating public administrations. For cross-border action, they should preferably be multilateral agreements.”

Public administrations working together to provide European public services should agree on change management processes to ensure continuous service delivery.

EIF Recommendation 17

The EIF states that “Since delivering a European public service is the result of collective work parties that produce or consume parts of the service, change management processes are critical to ensure the accuracy, reliability and continuity of the service delivered to other public administrations, businesses and citizens.”

This implies service management capabilities.

Semantic interoperability

Public administrations should support the establishment of sector-specific and cross-sectoral communities that aim to facilitate semantic interoperability and should encourage the communities to share results on national and European platforms.

EIF Recommendation 18

The EIF sets out the scope for semantic interoperability:

- **Semantic interoperability** is about the meaning of data elements and the relationship between them. It includes developing vocabulary to describe data exchanges, and ensures that data elements are understood in the same way by communicating parties;
- **Syntactic interoperability** is about describing the exact format of the information to be exchanged in terms of grammar, format and schemas“.

The EIF states that “achieving semantic interoperability at European level requires at least:

- agreed processes and methodologies for developing semantic interoperability assets;
- agreement by sector-specific and cross-sectoral communities on the use of semantic interoperability assets at EU level.

“Due to the complexity of the task and the large number of interested parties, it will take a concerted effort to harmonise processes and methodologies”.

Technical interoperability

Public administrations should agree on the formalised specifications to ensure technical interoperability when establishing European public services.

EIF Recommendation 19

This recommendation “covers the technical aspects of linking information systems. It includes aspects such as interface specifications, interconnection services, data integration services, data presentation and exchange, etc.”

Information security

Information security is included within the architecture metamodel to ensure that aspects of information security are fully embedded in business, information systems and technology architectures; these enterprise architectures will therefore be developed from a high level of understanding of information security.

This particular approach to the metamodel does not mean that security architectures do not exist, however. The information security domain covers:

- availability
- data integrity
- confidentiality
- accountability
- non-repudiation.

These characteristics of information security are derived largely from the requirements for legal interoperability and the need for personal integrity. More information about security architecture can be found at <http://www.opensecurityarchitecture.org/cms/>.

Service orientation

The reason for including the service orientation architectural (SOA) domain in the architecture metamodel is to ensure that the characteristics of service orientation (derived from SOA principles) are fully embedded into business, information and technology architectures; the enterprise architectures will be developed from a high level of understanding of service orientation. Guidance on the integration of service orientation into architectures is also available in the EIF.

Public administrations are encouraged to reuse and share solutions and to cooperate on the development of joint solutions when implementing European public services.

EIF Recommendation 7

According to EIF Underlying Principle 10 – Reusability – the term ‘reuse’ means “that public administrations confronted with a specific problem seek to benefit from the work of others by looking at what is available, assessing its usefulness or relevance to the problem at hand, and deciding to use solutions that have proven their value elsewhere.”

“This implies that public administrations must be willing to share with others their solutions, concepts, frameworks, specifications, tools and components. This can be facilitated by applying the principle of openness.”

“Reuse and sharing naturally lead to cooperation using collaborative platforms⁹, towards mutually beneficial and agreed common goals.”

“Reuse is consequently key to the efficient development of European public services.”

This will call for standardisation efforts and a way to publish reusable components and services within administrations as well as between administrations nationwide and at the European level. It also calls for development structures to be established and operational.

⁹ At EU level, various platforms have been set up to share open source software components (<http://www.osor.eu/>), semantic assets (<http://www.semic.eu/>) and best practices (<http://www.epracice.eu/>). The European Commission has also created the European Union Public Licence (<http://www.osor.eu/eupl/>) to facilitate the sharing of software components.

Public administrations should not impose any specific technological solution on citizens, businesses and other administrations when establishing European public services.

EIF Recommendation 8

According to EIF Underlying Principle 11 – Technological neutrality and adaptability – when establishing European services “public administrations should focus on functional needs and defer decisions on technology as long as possible in order to avoid imposing specific technologies or products on their partners and to be able to adapt to the rapidly evolving technological environment.”

“Public administrations should render access to public services independent of any specific technology or product.”

Public administrations should develop a component-based service model, allowing the establishment of European public services by reusing, as much as possible, existing service components.

EIF Recommendation 9

The EIF conceptual model “promotes the reuse of information, concepts, patterns, solutions, and specifications in Member States and at European level, recognising that European public services:

- are based on information from various sources located at different levels of administration, in different Member States, and
- combine basic public services constructed independently by public administrations in different Member States.”

“Therefore, the model highlights the need for modular, loosely coupled service components¹⁰ interconnected through infrastructure and for working together to deliver European public services.

¹⁰ *Service Oriented Architecture (SOA) is an implementation of this concept.*

“It explicitly calls for EU-wide adoption of a service orientation to designing and developing systems, and an ICT ecosystem comprising consistent, and in some cases jointly developed, service components. Its particular service orientation is a specific way of creating and using business processes, packaged as services, throughout their lifecycle.”

Public administrations should agree on a common scheme to interconnect loosely coupled service components and put in place the necessary infrastructure when establishing European public services.

EIF Recommendation 10

Public administrations “will need to agree a common scheme on how to interconnect service components. There are well-known and widely used technical solutions, e.g. web services, to do this, but implementing them at EU level will require concerted efforts by public administrations, including investment in common infrastructure.”

When services are loosely coupled their system components are separated, thus preventing potentially hazardous domino-effects when a system component breaks down or malfunctions. The use of a service contract expresses the purpose and capabilities of the service; it is a key component in a service-oriented architecture. A service contract has an owner who is responsible for maintaining and monitoring that all services comply with their contract. Loosely coupled services also make it easier for system components to be replaced with minimum disruption.

Conclusion

Most of these EIF recommendations can be met by applying SOA principles, thanks to the close link between interoperability and service orientation. It is important to note that the EIF recommendations encompass a long-term vision. We are still very much in the process of migrating from old to modern and compliant technologies and this process will still take some time. Encapsulation of legacy-systems can be a way to “bridge” different generations of technologies to make the transition to a service oriented infrastructure smoother. Encapsulation provides old systems with an SOA interface making them easier to integrate with the modern infrastructure.

More information on service-oriented architectures is available from the following websites:

<http://www.whatissoa.com/p10.php>

<http://www.soamethodology.com/>

<http://www.soapatterns.org/>

2.2 Closing the gap between business and ICT

The problem

All too often there is a gap in the alignment between what a business does and its ICT. Businesses tend to make inadequate analyses of their processes and the concerns of their stakeholders. Once they have identified their requirements, businesses often jump straight to technical solutions without any consideration of business processes and the information systems requirements of these processes. In addition, organisations often have trouble bringing together their many different activities and services to come up with a coherent ICT design to support business processes.

The barriers to enterprise-wide solutions may could include:

- having several uncoordinated information domains and information owners in the organisation;
- the absence of an organisation-wide information security management process and information classification framework;
- infrastructure not supporting service delivery;
- the absence of design capabilities and organisation-wide governance.

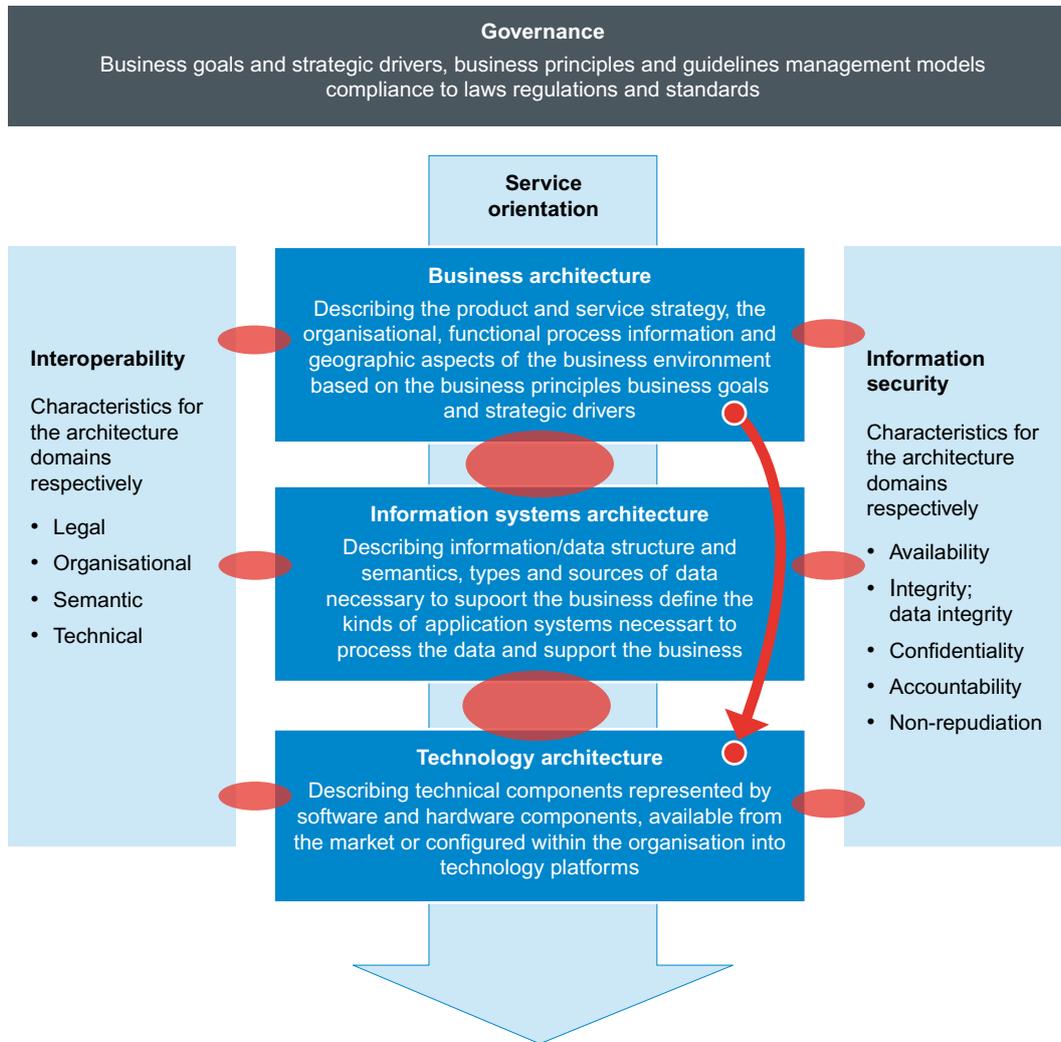


Figure 9. The jump from business requirements to a technical solution



Figure 10. A schematic representation of a product development process

What often ends up happening is that an enterprise will take a top-down approach to solving a problem (or executing an architecture project), but a bottom-up technical approach to deliver the solution, often without any satisfactory interaction between the two. This will produce an implementation project based on a weak design (see diagram above).

One of the most significant challenges for any enterprise is working out how to provide correct information/data to the processes (information systems) involved. From an ICT architect's point of view the case above does not handle this in a satisfactory manner. It is impossible to get good results when you ignore information systems architecture activities.

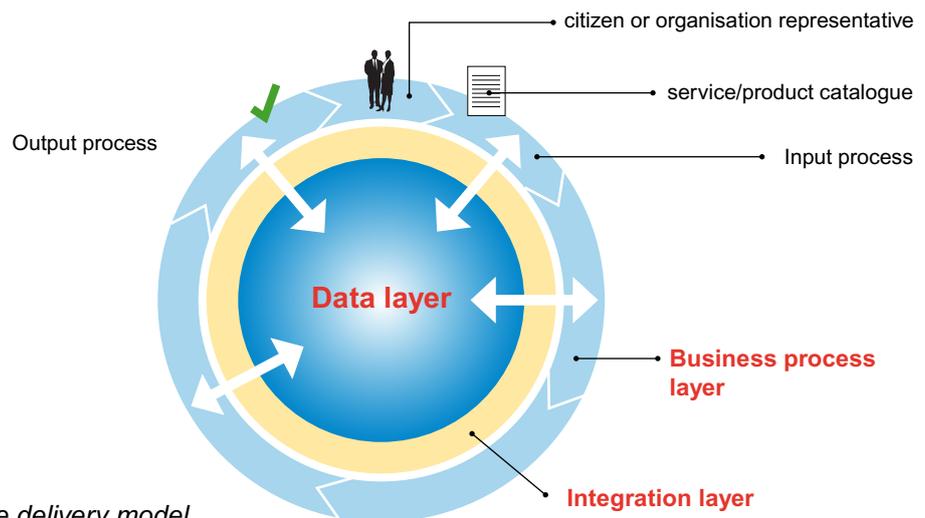


Figure 11. E-service delivery model

It is essential to get the data architecture correct. To achieve this we have to address the following questions:

- Who is the owner/manager of the required information/data?
- Do we require information/data from several sources? Do they fall under the same governance structures?
- Is information/data shareable, or are restrictions present?
- Which information system/database hosts master data?
- Is information/data available and presented in a usable structure? How is it available?
- Are information/data models available?
- Is information/data under the control of a security classification framework?
- Is the quality of information/data adequate?

In situations where information and data are being exchanged across borders the complexity increases dramatically. In such a scenario we have to consider a multitude of additional issues, some of which are already important internally, but which become critical when cooperation between organisations is required.

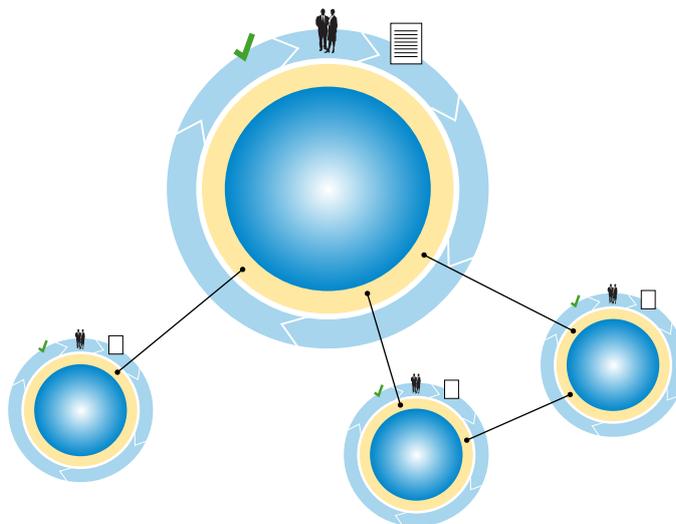


Figure 12. E-service delivery mode (cross-border transactions)

Some of the issues that are critical to organisational cooperation and cross-border information transactions include:

- Interoperability aspects:
 - legal;
 - organisational;
 - semantic;
 - technical.
- Cross-border aspects:
 - cross-border processes;
 - cross-border publishing, addressing and use of electronic services (between administrations, not end-users);
 - cross-border identity and access management.

Key factors in the alignment of business and ICT

Before there is any chance of closing the gap between business operations and the ICT of an organisation, it is first important to take time to describe – qualitatively and quantitatively – all the costs and benefits which would arise if the business were to address and eventually realise the concerns and requirements of its stakeholders. This is something that has to be done for each and every architecture project undertaken. This is a process that repeats itself again and again.

Alignment (and therefore any architecture project) begins with dialogue – business representatives, stakeholders and anyone sponsoring this alignment initiative.

Any changes to the business must fall within the architecture's specification, and should also be supported with a convincing and financially viable business case (in most cases no profitable business case means no change!). Change must come with controls: policies, principles and guidelines together with agreements and goals on how to meet the overriding objectives that are steering the change programme. These objectives will drive the architecture work and be embedded fully in the architecture.

By adopting an enterprise architecture and using the simple architecture metamodel, it is possible to close the gap between business and its ICT. But this can only begin with a change in mindset of all parties involved.

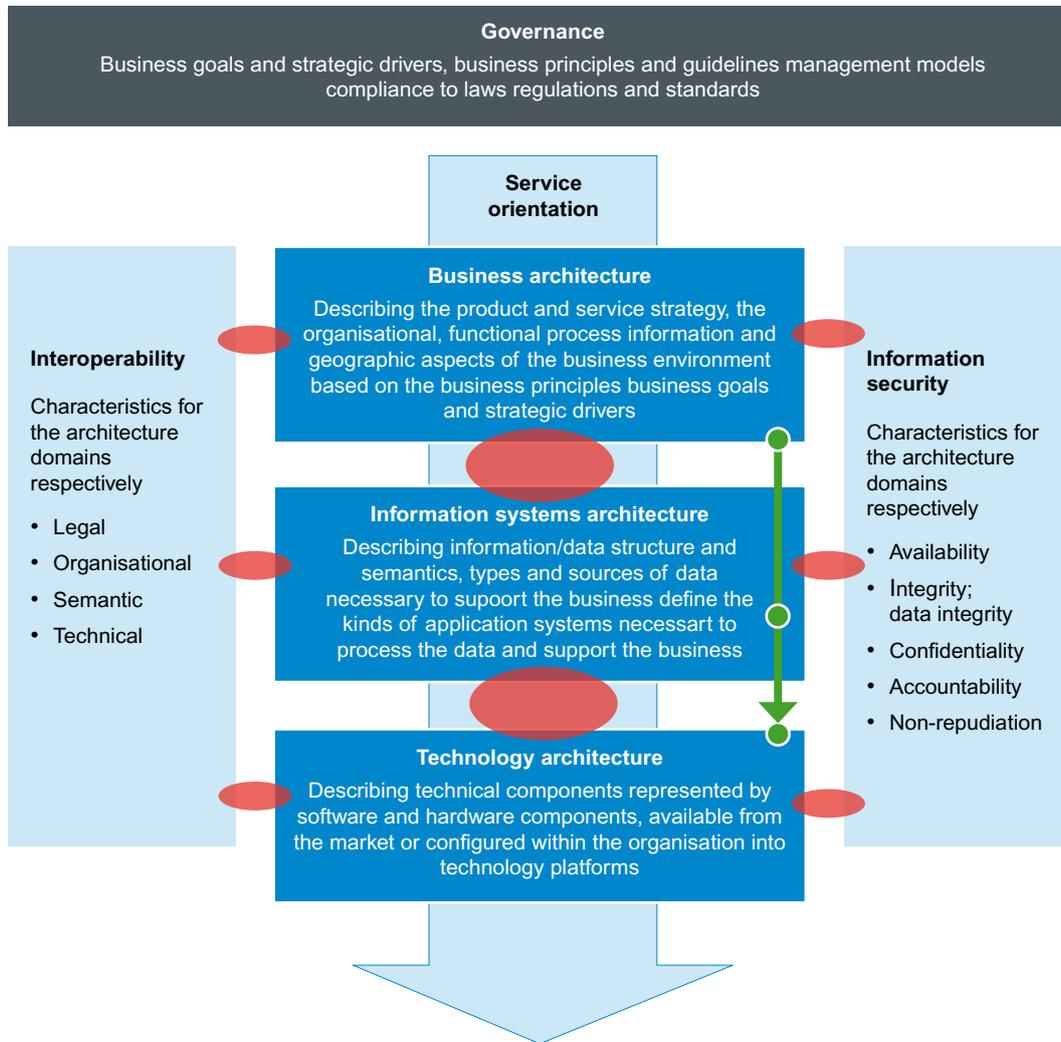


Fig 13. Consider everything in the architectural process

Just as a bus must pick up its passengers at every stop, an ICT architecture must attend to every detail and pick up on everything going on in the business: the processes behind business operations, the information handling, processing and transfer, and the technical architectures which all these exchanges and activities rely on.

This detail makes any architecture work a real challenge. Are there dependencies between the different domains, or it is possible to get away with a basic minimum?

Most enterprise architectures should be developed at all three levels (i.e. business, information, technical). TOGAF, provides guidance on this situation and recommends the following steps:

1. Select reference models (from the reference architecture), viewpoints and tools.
2. Develop a baseline ('as-is') architecture description.
3. Develop the target ('to-be') architecture description.
4. Perform gap analysis.
5. Define roadmap components.
6. Resolve impacts across the architecture landscape.
7. Conduct formal stakeholder review.
8. Finalise the architecture.
9. Create architecture definition document.

In reality, there are many more steps involved to complete the TOGAF Architecture Development Method (ADM) cycle, but the purpose of this publication is not to create another comprehensive architecture framework, and certainly not to copy TOGAF. Here we are identifying the 'what to do' at a high, conceptual level. By asking the right questions and dealing with all the issues we raise in this publication, it is possible to manage the architectural landscape correctly from both business and the technical perspective, using top down and bottom-up approaches in tandem.

As an architect works methodically through the architecture process, it is important to identify and classify the elements that require attention. One way to understand these elements is to answer the *who, how, where, when* and *why* from the perspective of each stakeholder group. Results can then be arranged in logical groups and further analysed, for example according to the Zachman Enterprise Architecture Framework¹¹. Good dialogue is important and these questions can be introduced at an early stage and more detail can be added as the work progresses. Enterprises must recognise that complete transparency is absolutely critical to the success of any architecture initiative – and more importantly the success of any subsequent change programme. Being transparent is a key success factor in any attempt to close the gap between business and ICT.

¹¹ See <http://www.zachmanframeworkassociates.com/index.php/top>

Another key success factor is that the enterprise must be able to transform the stated requirements into products (e.g. e-services), quickly and with the required level of quality and predictability. To do this it is necessary to build a service-oriented infrastructure platform; its structure and behaviour must refer back to the reference architecture. Coherent platforms will support the organisation's capabilities to deliver efficiently and effectively.

The schematic diagram below shows a reference model for a typical infrastructure oriented in layers, from a foundation of actively managed data up to the many channels of communication with citizens. This infrastructure supports a service-oriented approach. The adoption of the 'reusability' service-oriented principle means that the same channels will also be used to communicate with employees within the organisation and with people in other organisations. Machine-to-machine communication with other organisations takes place in the integration layer (Enterprise Service Bus). Again it is clearly important to apply a holistic view to the architecture work – this time towards infrastructure components.

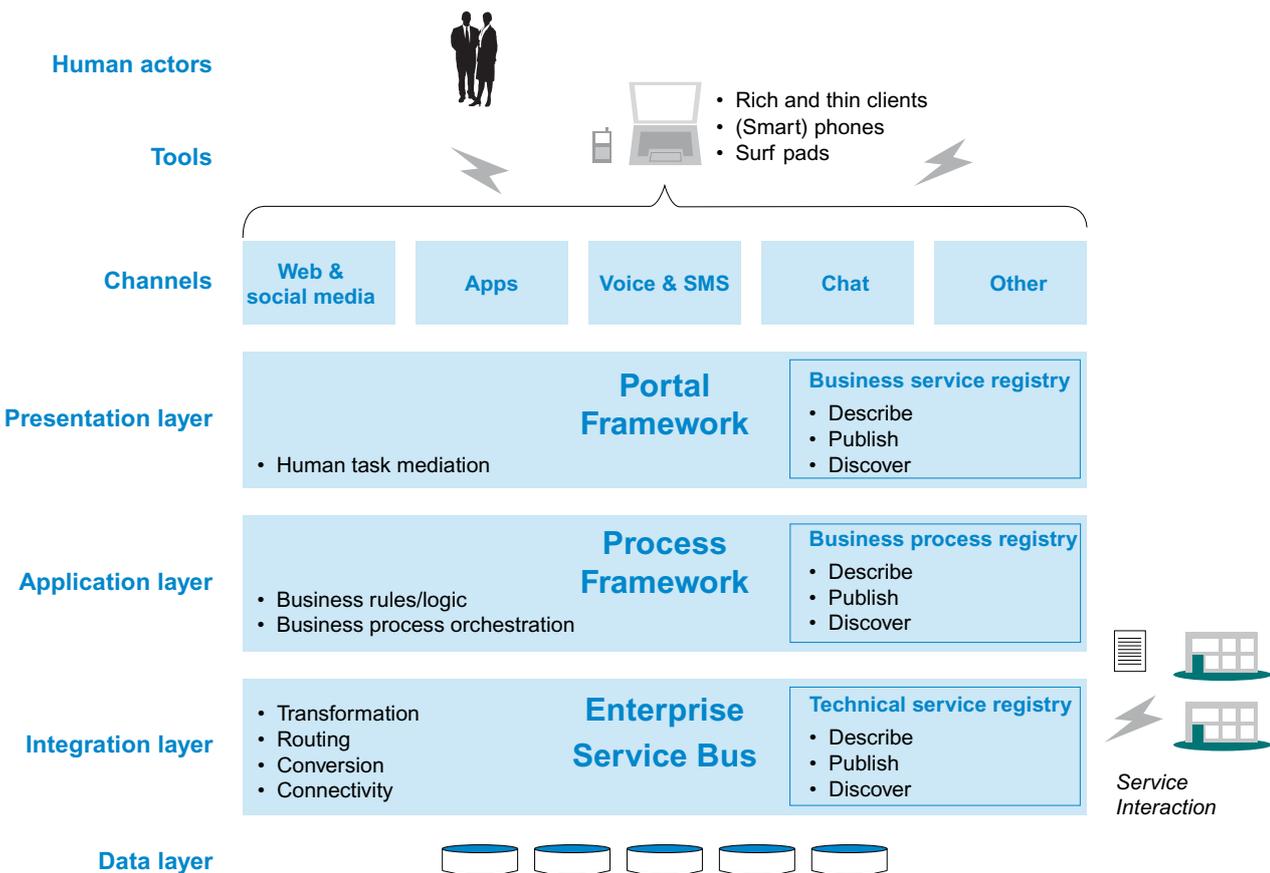


Fig 14. Reference model for a typical service oriented infrastructure

The reference model for the infrastructure layer may also be expressed as a high-level component-based model in the reference architecture (see diagram below). Both of these models may be adopted when working out baseline and target solution architectures.

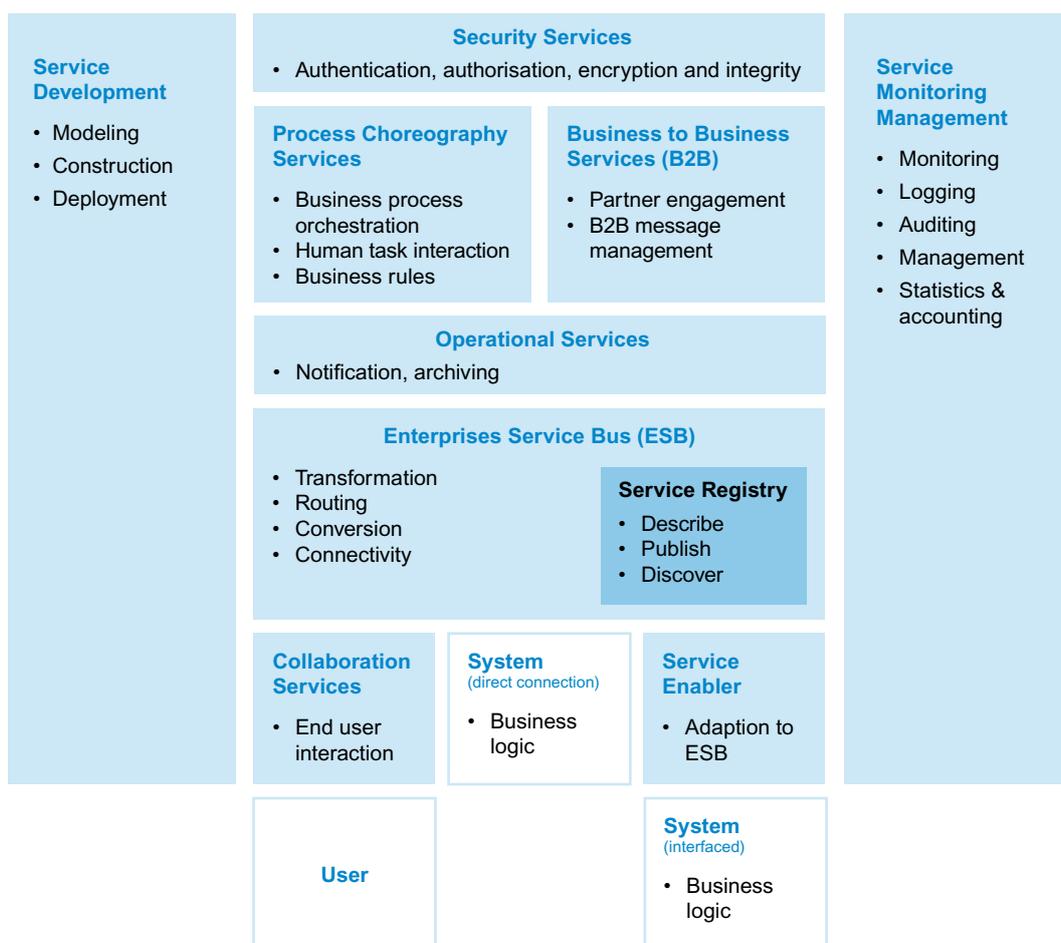


Figure 15. 'A high-level component-based technology reference model'

If organisations want to develop their ICT architectures along the lines outlined in this section, they must adopt strong governance systems and manage the resources and capabilities which exist within business and ICT operations. This may well call for a change in mindset among all the parties involved. Indeed, this change in thinking may be the most significant factor for success.

2.3 The architect's toolbox

The architect also needs a set of tools. The tools of the building architect's trade were his pencil, his ruler and his draughtsman's board. Today, most of the architect's work is accomplished on a computer using specialist software, computer-aided design and art applications. But good quality tools are essential for a successful job.

The enterprise architect (or any other ICT architect) also needs a set of tools. Different tools will be used for different tasks, depending on the type of enterprise under scrutiny and the level of detail required from the architecture work.

The architect's toolbox includes logical tools (reference architectures, models, methods and various reusable building blocks) and physical tools (for modelling and visualisation tasks, etc.). Armed with knowledge, skills and an appropriate methodology, the architect can – by using the necessary tools – deliver some outstanding results.

We have already seen that the business case for architecture should include some explanation of what the architecture work aims to achieve to meet business goals. Central to this explanation are 'use cases' which describe the business processes of an enterprise. 'Use cases' and 'actors' correspond to business processes and organisational participants (people, organisations, etc.). Business cases and use cases motivate the project and set the overall framework for the work. It is also important that the business case – the justification for the work – incorporates some goals and a strategy for how to launch the project and set it off on a good and sustainable footing.

A good example of this sort of business case – and one which contains some elements of an architecture – is *Antwoord*[®] (*Answer*[®]), *The Klant Contact Centrum (KCC, Customer Contact Centre) of local councils as the front office for the entire government*¹².

Answer[®] is a good example of a business case model that will help enterprises answer all the high-level elements to justify an architecture project.

¹² <http://www.antwoord.nl/binaries/antwoord/pdf/gemeente-heeft-antwoord-english.pdf>

Just a few of the many architecture tools currently available as listed in the table below.

“Tool in the toolbox”	Type	Note
Business process model ¹³	Business architecture	Useful for describing business processes
Business services reference architecture	Business architecture	Useful for describing how services relate to each other
Business case description template	Business architecture	Helps setting up a business case
Use case description template	Business architecture	Helps setting up a use case with actors corresponding to business processes and organisational participants
Class model, and mapping schema	Business architecture, information systems architecture	Useful for describing static information and the relationships between information. A class model also describes informational behaviours (methods or operations)
Technology reference architecture	Technology architecture	Guidance on technical components and how they relate to each other
Business Process Modelling Language BPMN	Descriptive language	Language used to describe business processes
Unified Modelling Language UML	Descriptive language	Language used to describe class models
ArchiMate enterprise architecture modeling language	Descriptive language	Language for describing an enterprise architecture http://www.opengroup.org/archimate/doc/ts_archimate/

¹³ See *improving business processes and delivering better e-services - A guide for municipalities from Smart Cities* <http://www.smartcities.info/business-processes>

It is also essential to think through some of the more practical aspects of any architecture work. For example, it is essential to have some sort of 'architecture repository' that can handle the vast amount of information that is acquired by and is linked to the architecture work. TOGAF¹⁴ suggests that this repository should contain:

- an architecture metamodel;
- a description of the architecture landscape;
- an architecture reference library;
- a standards information base;
- a governance log;
- architecture capabilities such as a skills repository, the organisational structure, etc.

2.4 Architecture measurements and metrics

External view

The work of an architecture project does not finish once a target architecture is published. Nor is the work completed when any new architecture is implemented. How do you know that the work has been successful? The external view of architecture measurement and metrics is about how successful the architecture work is with regards to the business.

The output of the architecture work has to be monitored. Reports must be compiled and sent between the architecture function/organisation and the business/sponsor on a timely basis. These reports will be based on agreed and established measurements and metrics.

Exactly what one should monitor is typically defined by the business strategy: goals and drivers suggest which metrics should be measured. If you really want to know whether an architecture is working, reports should not only be presented to the Chief Information Office (CIO), but also to higher management. It may be difficult to get it on the agenda, but these reports should catch the attention of higher management because developing an architecture is ultimately all about using business resources in an efficient way.

Internal view

The performance of architecture work should also be monitored as a process in itself. Its output should be monitored against the architecture's stated vision and objectives.

¹⁴ <http://pubs.opengroup.org/architecture/togaf9-doc/arch>

The Smart Cities project has gathered some real-world examples of this type of monitoring from a number of e-government/architecture projects:

Kristiansand, Norway:

“Some of the interoperability features are measured, for example the use of obligatory standards...” and “the uptake of both obligatory and mandatory standards is measured.”

Groningen, Netherlands:

“In Groningen we’ve come to the conclusion that though architecture proved its value, we have to actualise the architecture (e.g. how to deal with social media, how to deal with the secondary processes like HRM, facilities...) and we have to apply our architecture more strictly.”

2.5 Architecture benefits

- An architecture describes content and visualises relationships between entities/components in the enterprise, creating a base for change management, strategic decisions and continuous improvements to the business and its services.
- As a process, architecture manages the requirements and expectations of stakeholders and highlights business strategies based on information collected and held by the business.
- As a part of a development and design process, architecture contributes to innovative thinking with the use of efficient methods and tools.
- As a control tool, architecture can prevent changes in the business which do not fit in the wider context and strategies of the business, thereby helping the business to deploy limited resources in the most efficient way.
- Architecture is also the link between business and IT, provided that the architect plays the part of an interpreter to both sides.

3. Supporting the architecture process

When an enterprise decides to work on its business strategies and ICT architectures it is imperative that all the relevant people involved in the work know about any European, national, regional and local laws, regulations, policies, guidelines or standards that may affect their work. This is a considerable task given the vast quantity of information one has to deal with, but it is certainly rewarding because this information offers a lot of valuable guidance.

It is always best when the management teams in European public administrations to make sure they are aware of relevant developments and staying abreast of changes in the field. Failure to keep up with legal or regulatory decisions can be financially costly and/or result in poor compliance and possible legal action.

The timeline below shows some of the milestones of European interoperability efforts that have been highlighted by the European Interoperability Framework (EIF). This timeline demonstrates the scope and volume of information which people engaged in enterprise architecture work need to understand.

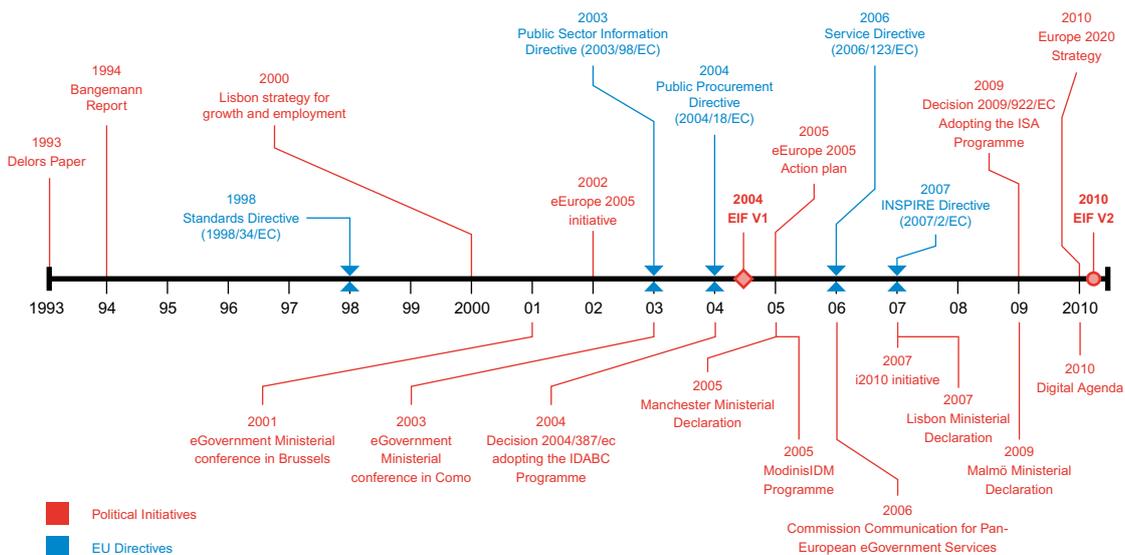


Figure 16. A timeline for important events and documents at the European level¹⁵

¹⁵ The European Interoperability Framework for European public services (EIF), page 4
http://ec.europa.eu/isa/strategy/doc/annex_ii_eif_en.pdf

The following sections of this publication look more closely at some of the most influential and important legislative, regulatory and guidance documents that are relevant for enterprise architecture. These documents can be used to build important checks and controls into any architecture work. Our aim is to raise awareness within the architecture community of the publications and decisions that are having the greatest impact on enterprise architectures today.

3.1 The European E-government Action Plan 2011-2015 ¹⁶

“The European E-government Action Plan aims “to maximise the complementary nature of national and European policy instruments. It supports the transition from current e-government to a new generation of open, flexible and collaborative seamless e-government services at local, regional, national and European levels that will empower citizens and businesses.”

According to the plan “there are powerful political and economic reasons to support European collaboration on e-government. Joint action on e-government can contribute to overcoming the current economic crisis by using public resources more efficiently and reducing public expenditures. E-government services can be developed more economically by coordinating and pooling public and private resources.”

The Action Plan also aims to “realise the ambitious vision contained in the Declaration made at the 5th Ministerial e-government Conference (the ‘Malmö Declaration’), which was also supported by industry and by a citizens’ panel.”

By 2015, the Action Plan wants, European public administrations to be “recognised for being open, flexible and collaborative in their relations with citizens and businesses. They use e-government to increase their efficiency and effectiveness and to constantly improve public services in a way that caters for users’ different needs and maximises public value, thus supporting the transition of Europe to a leading knowledge based economy.”

The Action Plan also covers the four political priorities for all European public administrations over the next five years, as set out in the Malmö Declaration. For an architect working on business architecture this information is absolutely essential if they are to understand long-term strategies:

- “Citizens and businesses are empowered by e-government services designed around users’ needs and developed in collaboration with third parties, as well as by increased access to public information, strengthened transparency and effective means for involvement of stakeholders in the policy process”;

¹⁶ http://ec.europa.eu/information_society/activities/egovernment/action_plan_2011_2015/docs/action_plan_en_act_part1_v2.pdf

- “Mobility in the Single Market is reinforced by seamless e-government services for the setting up and running of a business and for studying, working, residing and retiring anywhere in the European Union”;
- “Efficiency and effectiveness is enabled by a constant effort to use e-government to reduce the administrative burden, improve organisational processes and promote a sustainable low-carbon economy”;
- “The implementation of the policy priorities is made possible by creating the appropriate key enablers and by establishing the necessary legal and technical preconditions.”

The Action Plan provides more detail on these four priorities:

User empowerment will be achieved through:

- services designed around users’ needs and inclusive services;
- collaborative production of services;
- re-use of public sector information;
- improvement of transparency;
- involvement of citizens and businesses in policy-making processes.

The internal market will be reinforced through:

- seamless services for businesses;
- personal mobility;
- EU-wide implementation of cross-border services.

Efficiency and effectiveness of governments and administrations will be achieved through:

- improving organisational processes;
- reduction of administrative burdens;
- green government.

Finally, the Action Plan identifies a number of pre-conditions that should be met before administrations should begin to develop e-government, namely:

- the adoption of open specifications and interoperability;
- the deployment of key enablers such as the identification and authentication of persons or legal entities – *“Electronic identification (eID) technologies and authentication services are essential for the security of electronic transactions (in both the public and private sectors). Today the most common way to authenticate is by means of passwords, but more secure solutions protecting privacy are increasingly needed.”*
- innovative e-government – *“The new generation of e-government services will need to rely on and benefit from innovative technical approaches, such as clouds of public services and service oriented architecture (SOA) to build open, flexible and collaborative e-government services while at the same time lowering ICT costs. To promote the availability and use of convenient, on-demand access to shared resources and services for the provision of e-government services pilot projects will be launched. In addition, administrations will need to take action to upgrade IPv6-relevant e-government infrastructure (portals, websites, applications, etc.) and online services of public interest, in view of the depletion of IPv4 addresses. This take-up of IPv6 will be beneficial for public authorities in Member States to foster innovative, efficient and accessible applications and services.”*

For more information on European e-government policy and the E-government Action Plan, go to:
http://ec.europa.eu/information_society/activities/egovernment/index_en.htm

The Citadel Statement ¹⁷

The Citadel Statement aims to help ‘make Malmö real’ by making a pan-European ‘Call to Action that will help local government deliver on the key objectives of the Malmö Declaration.

In most countries throughout Europe, local government has the greatest amount of contact with citizens, and is at the forefront of service delivery. Despite numerous policy documents and ‘how to’ manuals on local e-government, nearly one year on, the ‘Malmö Vision’ is still not being translated ‘on the ground’ at the local level. Smaller communities are finding it especially difficult to implement innovative ICT projects.

¹⁷ <http://www.smartcities.info/citadel-statement>

Supporting local e-government delivery activities needs to be a higher priority than it has been in the past: EU, national, regional and local governments need to work together to deliver the benefits of e-government to citizens.

The signatories of the Citadel Statement, believe that European and national decision makers should look to local government to see how their e-government policies are being delivered in practice, and whether national and regional e-government programmes are helping to improve service delivery at the local level. The Citadel Statement aims to help in this effort by better understanding why local communities are finding it challenging to implement e-government in an innovative, cost-effective and efficient manner and by identifying practical solutions to combat working barriers at the local level.

Based on extensive consultation across Europe, the Citadel Statement sets out five core areas where European and national decision makers can provide tangible support to improve local e-government:

1. Common architecture, shared services and standards

Incorporate EU best practices into a common service delivery architecture (information, process and application-layer) that provides one common language and helps local governments share services and learn from other 'best practices' such as how to work with authentic registrations, how to create personalized access to services, etc. Bolster this architecture by creating standards for government communication that helps citizens find their way in all governmental websites.

2. Open data, transparency and personal rights

Show a commitment to making public data open and accessible by establishing a well maintained repository of definitions and taxonomies that makes data consistent throughout Europe. Develop clear guidelines and data models for the use of personal details about citizens. Mandate five key areas where data can reasonably be expected to be shared nationally and across Europe by 2013. Areas could include: public service lists, standard information on citizens, standard information on businesses, transport timetables, environmental information and geodata (GIS-data).

3. Citizen participation and involvement

Demonstrate political leadership and courage by actively championing the advantages now offered by ICT to improve the democratic process and facilitate citizen participation in decision-making across Europe. Promote the value of co-designing services in conjunction with citizens as a first step in making government more people-focused. Provide guidelines, training and methodologies on involving citizens in decision making and service design.

4. Privacy and identification of individuals

Create a robust political and policy framework to address common privacy issues across Europe associated with personal data. Provide protocols that enable the easy identification of individuals over the Internet and facilitate mobility by developing shared standards for the identification of people that makes it easier to travel and do business all over Europe.

5. Rural inclusion

Promote the concept of broadband as a public utility that – like electricity and water – should be available to all communities no matter how small or geographically dispersed. Enhance and improve the broadband capacity of both rural and urban areas alike by supporting EU regulation to set a minimum standard for broadband access in all of Europe to be achieved by 2015. Equality of access is an important precondition for the growth of superfast broadband – an economic necessity in today's growing marketplace.

In addition, supporters also call upon European and national decision makers to provide greater support to local government around shared quality and benchmarking and the simplification of processes particularly in the areas of procurement and funding where regulations often conflict with the mandate to 'build once, deploy many times'.

Supporters of the Citadel Statement hope that their call to action becomes a 'living document' that continues to evolve in the run-up to 2015 in a manner that spurs local government to achieve better e-services for citizens.

To create the basis for the online consultation, the Flemish e-government Authority joined forces with LOLA, the Linked Organisation of Local Authority ICT Societies to host a one day workshop at the 2010 SOCITM conference in Brighton. The workshop, *which included the Smart Cities project*, gathered experts from across Europe to identify top actions that local governments need from national and EU decision-makers in order to better implement e-government.”

Smart Cities: what we have learned ¹⁸

Smart Cities: what we have learned brings together some of the lessons learned by the project participants on how national and local governments could work together in partnership to deliver more effective e-government and e-services. Partnerships could help to improve planning and the exchange of information, and identify and use good practice to provide better and more integrated e-services.

The document describes and provides some context on the preparation of the Citadel Statement on Local E-government, at the Flemish Conference on Local E-government held in Ghent on 14 December 2010.

The first part of the publication summarises what the Smart Cities project learned about delivering better e-government, drawing on the experiences of the project partners from seven EU countries. The second part of the document ('Row less, steer more') puts these issues into a broader social and governmental context and asks what administrations need to do differently if they are to develop and deliver more effective and efficient e-government.

These issues are outlined below:

I. Understanding e-government

- E-government covers many different institutions and we deliver a wide range of things to a wide range of different customers – be they citizens, businesses or other parts of government.
- E-government is not about technology; it is about organisations and how organisations can use technology and data to deliver better services. Technology is an enabler, but not the answer.

II. A shared ambition for local e-government

- Putting customers first.
- Developing and delivering shared visions and strategies across all levels and types of government.
- Work across disciplines and think holistically.
- Find out what works – use the experience and skills of academics and specialists.

¹⁸ <http://www.smartcities.info/what-we-have-learned>

III. Standards and infrastructure

- National governments and local authorities should work together to develop standards for e-services and e-government.
- Effective local e-government requires regional or national infrastructure.
- Share data.
- Learn from local government.

IV. Measuring the impact of e-government

- Set clear, measurable targets and provide targeted funds to help authorities meet them.
- Measure impact, not just output.
- Involve citizens in every step of service design, from inspiration to delivery.

Creating Customer Contact Centres

Creating Customer Contact Centres: A guide to municipalities from Smart Cities (<http://www.smartcities.info/customer-contact-centres>) looks at the rationale and challenges behind the implementing and running a municipal customer contact centre.

The guide shows that an organisation must be able to:

- run, manage, monitor and improve business processes through their lifecycle;
- deliver, manage, monitor and improve business services through their lifecycle;
- provide people (staff and customers) with information at the right time with the right level of quality, while maintaining information security;
- manage incidents (i.e. disturbances in service delivery);
- have the ability to solve problems which cause incidents, and do this within agreed service levels;
- manage changes emerging from new customer requirements, the organisation itself or requirements driven from legislation, and do this within agreed service levels; manage assets (including information assets) used to keep the customer contact centre running.

A customer contact centre is, in fact, a service management enterprise which requires:

- service management capabilities for services, processes and assets including information assets;
- capabilities to investigate, invent and develop services, processes and assets;
- capabilities to govern all of its operations and to do this with a holistic approach.

This publication explains how architecture can make a significant and essential contribution to the development of a customer contact centre. A customer contact centre relies on effective processes and high quality data; detailed process mapping is an important piece of architectural work within this business domain. By following a set of principles and carrying out this exercise using a suitable process management tool which is accessible to everyone involved should help to create a strong team that can map, visualise, share, re-use and eventually run processes.

When an enterprise gets round to running mapped processes, data objects must be published and made accessible on some kind of service-oriented integration platform where process applications created by the organisation can interact with other applications either within the organisation or with cross-border services.

The delivery of these data objects relies on an ability to control the semantics and structure of information and data. This control, however, is the 'Achilles heel' of most organisations and a domain where great improvements are needed.

3.2 Controls analysis as an input to the architecture

It is important that the architecture work ensures that the organisation's business goals are met. Using the documents presented in the previous sections of this publication, we suggest just a few ways in which an organisation may formulate controls at the business level (vision, goals, etc.). Establishing such controls is a task for the business and the architecture should comply, although sometimes the identification and implementation of controls may be supported through the architecture itself.

When formulating controls it is wise to consider any relevant 'steering documents' starting at the European level and working down to the local context, aligning all controls to a coherent end product. Using this analysis it should be possible to define how the architecture work will be controlled.

Vision, goals and metrics

Vision

Based on the European E-government Action Plan 2011-2015 it is possible to formulate a vision for the organisation (municipality):

By 2015 our administration will be recognised for being open, flexible and collaborative in our relations with citizens and businesses. We use e-government to increase our efficiency and effectiveness and we constantly improve public services in a way that caters for users' different needs and maximises public value, thus supporting the transition of Europe to a leading knowledge based economy.

High-level business goals

#1 The capacity of our [municipality's] citizens, businesses and other organisations to be pro-active in our municipality should increase through the use of new technological tools¹⁹.

#2 Our administration will support the European Internal Market's growth through the development of 'seamless' services for entrepreneurs to set up and run a business anywhere in Europe and allow individuals to study, work, reside, receive health care and retire anywhere in the European Union²⁰.

#3 Efficiency and effectiveness of our administration should increase through reduction of the administrative burden, improving organisational processes and promoting a sustainable low carbon economy with the use of ICT and enabling changes to deliver better, less intrusive, more sustainable and faster public services²¹.

High-level business metrics

Based on the European E-government Action Plan 2011-2015 (page 5) it is possible to formulate some targets for the administration (municipality) as:

- By 2015, 50% of our (the municipality's) citizens (50% of EU citizens) will have used e-government services.
- By 2015, 80% of our (the municipality's) enterprises will have used e-government services.

¹⁹ Based on the European E-government Action Plan 2011-2015, page 6

²⁰ Based on the European E-government Action Plan 2011-2015, page 9

²¹ Based on the European E-government Action Plan 2011-2015, page 11

Principles

General rules and guidelines which hold up over time and seldom change are known as principles. They support and clarify the way in which an organisation goes about fulfilling its mission. Principles reflect a level of consensus through the organisation and form the basis for future decisions.

Every enterprise needs a set of principles before it can begin to develop architectures. Architecture principles are typically developed by the lead enterprise architect, in conjunction with the enterprise's CIO, the architecture board, and other key business stakeholders.

Architecture principles should be formulated to support an organisation's business principles, business goals and strategic business drivers, not contradict them. Within an architecture project, the architect will normally need to ensure that principles are current and to clarify any areas of ambiguity.

TOGAF argues that "merely having a written statement that is called a principle does not mean that the principle is good, even if everyone agrees with it."

"A good set of principles will be founded in the beliefs and values of the organization and expressed in language that the business understands and uses. Principles should be few in number, future-oriented, and endorsed and championed by senior management. They provide a firm foundation for making architecture and planning decisions, framing policies, procedures, and standards, and supporting resolution of contradictory situations. A poor set of principles will quickly become disused, and the resultant architectures, policies, and standards will appear arbitrary or self-serving, and thus lack credibility. Essentially, principles drive behavior."

According to TOGAF there are five criteria that distinguish a good set of principles:

Understandable

"The underlying tenets can be quickly grasped and understood by individuals throughout the organization. The intention of the principle is clear and unambiguous, so that violations, whether intentional or not, are minimized."

Robust

"Enable good quality decisions about architectures and plans to be made, and enforceable policies and standards to be created. Each principle should be sufficiently definitive and precise to support consistent decision-making in complex, potentially controversial situations."

Complete

“Every potentially important principle governing the management of information and technology for the organization is defined. The principles cover every situation perceived.”

Consistent

“Strict adherence to one principle may require a loose interpretation of another principle. The set of principles must be expressed in a way that allows a balance of interpretations. Principles should not be contradictory to the point where adhering to one principle would violate the spirit of another. Every word in a principle statement should be carefully chosen to allow consistent yet flexible interpretation.”

Stable

“Principles should be enduring, yet able to accommodate changes. An amendment process should be established for adding, removing, or altering principles after they are ratified initially.”

TOGAF also states that it is “useful to have a standard way of defining architecture principles. In addition to a definition statement, each principle should have associated rationale and implications statements, both to promote understanding and acceptance of the principles themselves, and to support the use of the principles in explaining and justifying why specific decisions are made.”

The table below shows how, according to TOGAF, the components of architecture principles should be structured (descriptions in this table have been shortened from the original TOGAF descriptions).

Name	Should both represent the essence of the rule as well as be easy to remember.
Statement	Should clearly and unambiguously communicate the fundamental rule.
Rationale	Should highlight the business benefits of adhering to the principle, using business terminology
Implications	Should highlight the requirements, both for the business and ICT, for carrying out the principle – in terms of resources, costs, and activities/tasks.

Figure 17. The structure of principles

For more information on how to formulate principles, see TOGAF, Chapter 23.6 “Example Set of Architecture Principles” (<http://pubs.opengroup.org/architecture/togaf9-doc/arch/>)

For more information on SOA principles, see *SOA Principles, An introduction to the Service Orientation Paradigm* by Thomas Erl (http://www.soapprinciples.com/standardized_service_contract.php and http://www.soabooks.com/posters/SOA_Principles_Poster.pdf)

4. Aligning the architecture process with IT service management

The purpose of any architecture work is ultimately to improve the business according to a set of goals or to follow a specific strategy. For this reason architecture work must also be fully integrated with an organisation's ability to deliver services.

This publication takes its inspiration from two of the most widely adopted architecture frameworks in the world – TOGAF, version 9 and the IT Infrastructure Library (ITIL®, version 3²²). In this publication we show a way to align the architecture process with the service design phase in ITIL® as a reinforcement of capabilities. It is imperative that the two frameworks are coordinated. Both of them deal with the transformation of requirements into usable services, but they differ in scope and responsibility as explained below.

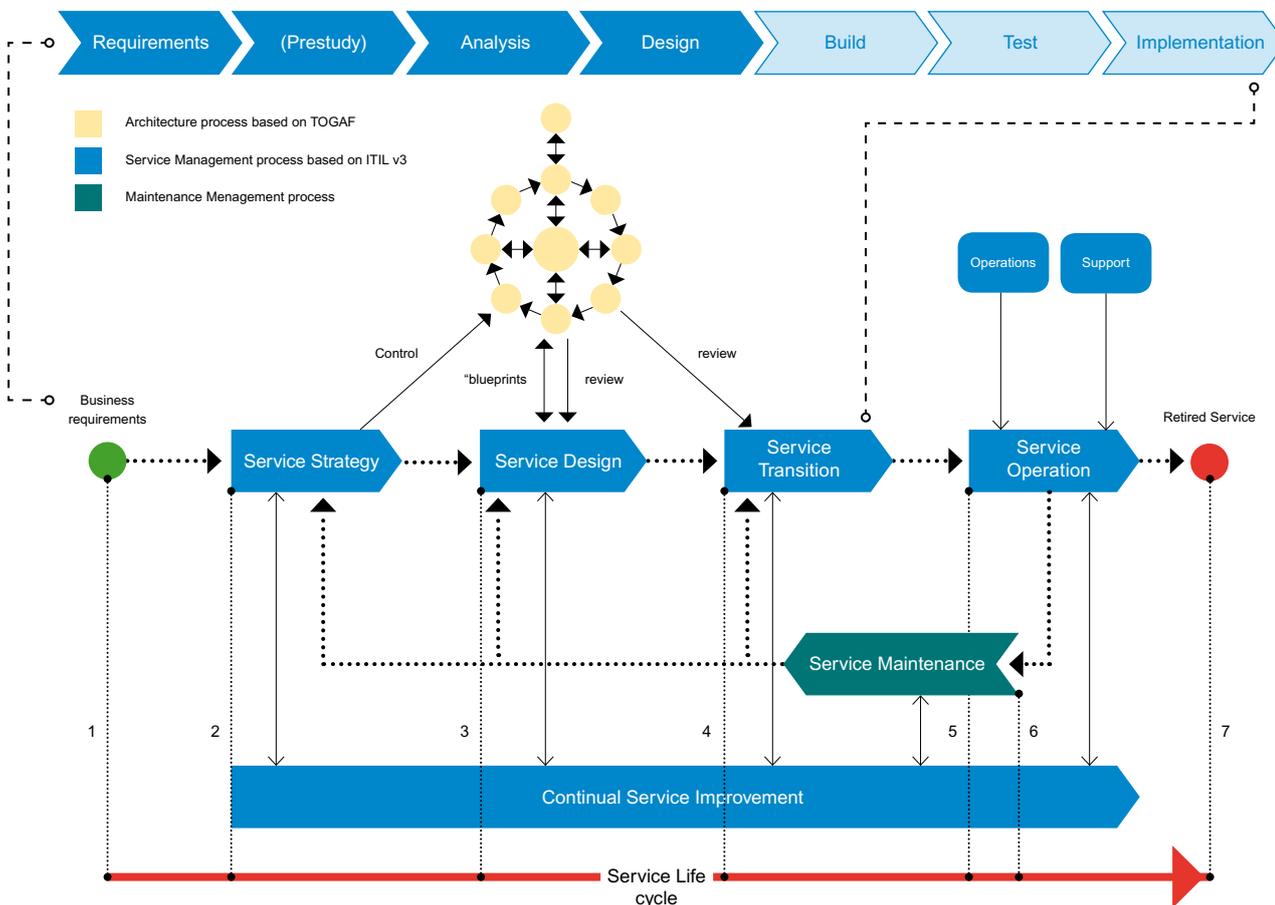


Figure 18. Architecture process aligned with IT service management

²² ITIL® is a Registered Trade Mark of the Office of Government Commerce in the United Kingdom and other countries

The steps highlighted in this diagram are explained below:

1. The starting point of the service management process is triggered by business requirements and concerns expressed by stakeholders. This may, or may not, start the lifecycle of a service depending on decisions taken.
2. The service strategy phase, where strategies are worked out and development of the new or changed service begins. The main components here are the service portfolio and the service portfolio management process. This phase delivers some of the controls for the architecture process. If a pre-study is required this activity can be initiated here.
3. The service design phase analyses, designs, develops and evaluates various options. These activities are based on outputs from the architecture process. Hopefully 'blueprints' are available; where these are unavailable new ones must be produced. A number of iterative refinements between the architecture process and the service design phase may be needed to get a satisfactory outcome.
4. The service transition phase is responsible for implementing solutions and making them operational. The main components for this are the change management and release management processes. Other vital components are the configuration management process and the configuration management database (CMDB). Ideally the architectural landscape should be represented in this database to make it possible for the architecture process and the change management process to perform at its best. In this scenario the CMDB should keep records of, and relations between, all registered configuration items in the organisation.
5. The service operation phase is responsible for operating and supporting services at agreed service levels.
6. The service maintenance process is responsible for the maintenance of infrastructure components and delivered services.
7. This is the endpoint of the service management process triggered by the retirement of a service, thereby completing the lifecycle of a service.

5. Appendix: E-government and architecture case studies

This appendix provides some real-world examples of e-government and architecture projects in action. They provide useful illustrations on how national strategies, principles and reference architectures underpin everyday enterprise architectures.

5.1 Netherlands

The following extract is taken from the Netherlands interoperability section of the European E-practice website (<http://www.epractice.eu>)²³.

“In the Netherlands, the Ministry of the Interior and Kingdom Relations publishes and maintains NORA²⁴: Nederlandse Overheid Referentie Architectuur – Dutch Government Reference Architecture. NORA 2.0 was published in April 2007 as a single reference document of 283 pages. NORA 3.0 added a separate publication, a strategy chapter, in 2009. The rest of NORA is being updated and restructured in articles.

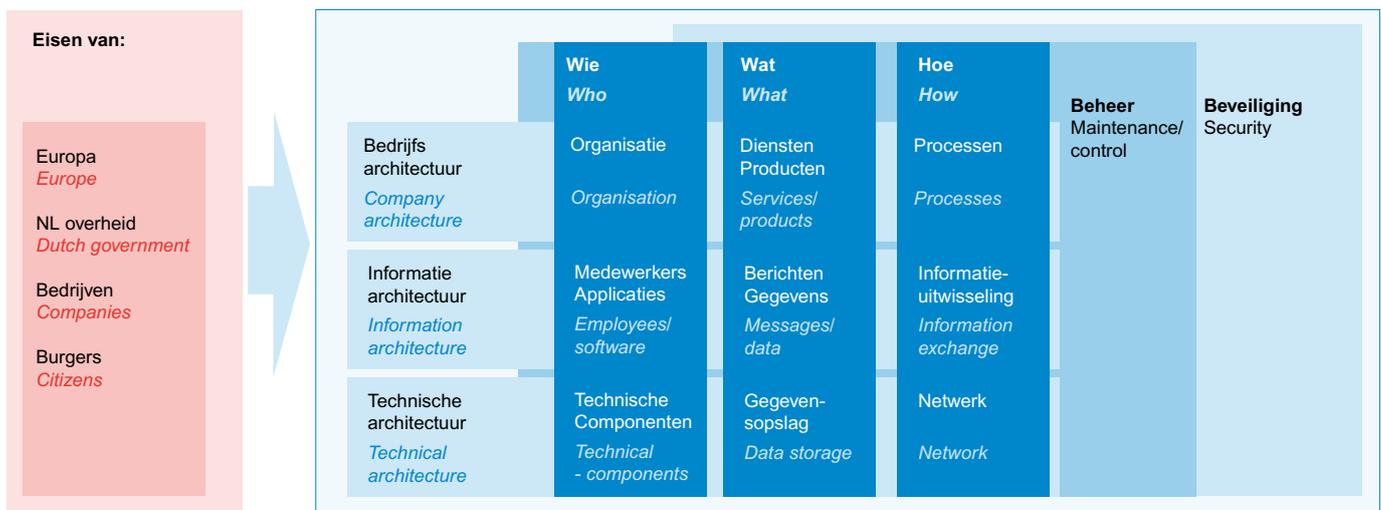


Figure 19. Dutch Government Reference Architecture

In addition to NORA, there is a list of open semantical and technical standards, which is governed by the Standardisation Board and Standardisation Forum, under the responsibility of the Ministry of Economic Affairs.

²³ <http://www.epractice.eu/files/Netherlands.pdf>

²⁴ <http://www.e-overheid.nl/onderwerpen/architectuur-en-nora/nora-30>

Part of the cabinet programme of 2007 is the vision of a citizen-oriented government, that is more efficient, less bureaucratic and offers high quality services. E-government plays a key role in over 50% of the expected efficiency gains. NORA is positioned as a framework for the creation of Step One in the e-government vision: the creation of reusable e-government assets.

The national implementation programme for service and e-government (NUP) has been agreed by all levels of government. NORA is explicitly part of this programme.

Key driver for the interoperability initiatives in the Netherlands is the Action Plan NOIV – “Nederland Open in Verbinding” (The Netherlands in Open Connection) dated November 2007 and approved by the Dutch parliament. In this plan, several actions have been defined, some of which are:

- The publication of the (abovementioned) list of open standards.
- The introduction of the comply-or-explain governance for implementation of these standards in the various layers of government.
- The revision of NORA to cover interoperability (version 3.0).
- Governance of open standards is based on the high trust principle with lightweight monitoring and tracking.
- ODF is supported for exchange of documents.

Although NORA has no legal basis in law, it has been deemed as the primary reference architecture for new ICT projects in the government by means of a cabinet decision (June 2008), either directly (at the national level) or via derived reference architectures at the provincial and municipal levels.

NORA provides directive design principles at the levels of organization, process, information and technology and is aimed to act as a reference for implementation projects of e-government assets. NORA is further refined to domain-specific reference architectures in the various layers of Dutch government (provinces, municipalities and water control boards).

There are no explicitly defined processes to capture and share best practices. The community approach to maintaining and updating NORA is expected to result in the capture of experiences with prior versions.

Because of its reference nature, NORA itself has relatively long update cycles. The list of open standards is maintained centrally and there is an explicitly defined selection and update process that takes place twice a year.”

For more information on e-government in the Netherlands, go to:

http://www.epractice.eu/en/factsheets/factsheet_all_chapters?filter=1&content_type=efactsheet_chapter&Countries=27&domain=10020&Factsheets_Topic=All&search=&op=Apply&form_build_id=form-bcfd2855590fef21d1a4f9043b9c965

5.2 Norway

The following extract is taken from the Norway interoperability section of the European E-practice website (<http://www.epractice.eu>)²⁵.

Context

“The Ministry of Government Administration and Reform has the overall strategic responsibility for ICT strategy, more specific the Department of ICT Policy and Public Sector Reform²⁶. The Agency for Public Management and e-government, Difi, is responsible for operational and governance actions. Both high-level and operational committees and cooperation are in place. Within Difi, the ICT governance and coordination department (ITS) is responsible for both architecture guidelines and the standardisation secretariat as well as for the Common Component Program. ITS take part in The EU EIF group as well as in other relevant (EU IDABC) expert groups.

There is not one single document, but several that define the Norwegian interoperability goals, principles and regimes. Important parts of an interoperability framework are in place, such as:

- political goals described in two Government Reports to the Parliament;
- the strategic and following-up responsibilities are defined;
- ICT architecture principles are defined and obligatory to follow (for large projects a self declaration must follow the plan and budget proposal). A governance regime is in place;
- a standardisation committee evaluate and propose suitable technical and other standards for the government and recommendations are enforced by government decisions (Catalogue). A governance regime is in place;
- a common portal (Altinn) with development tools, common semantic database and presentation layer is in place for all reporting of data from businesses/ legal persons/ private persons to the government (to various governmental bodies). Altinn is currently undergoing a new development process, where the functionalities are to be designed as modules. This will allow the re-use and sharing of these modules, which in fact will be separate components. These are to be available for public entities to use independently from the Altinn portal itself;

²⁵ <http://www.epractice.eu/files/Norway.pdf>

²⁶ <http://www.regjeringen.no/en/dep/fad/about-the-ministry/Organisation/Departments/departement-of-ict-policy-and-public-sect.html?id=1589>

- a program for evaluation of common components (eID and others, in a broad sense) is starting from 2010. For now, eID is in place, together with the AltInn portal;
- a portal for advice and sharing of best practice for running project management for ICT projects in the public sector is in place;
- some of the interoperability features are measured, as for example the use of obligatory standards, but regular broader surveying is not yet in place.

The issues outlined in this document as also followed up below (Section 'Interoperability, Political basis').

Principles

Seven architecture principles are defined:

- service orientation;
- interoperability;
- availability (independent of time, place, channel) and accessibility;
- information security (confidentiality, quality, availability);
- openness – public services should be based on open standards;
- flexibility for changes in use, content, ownership, organisation, infrastructure;
- scalability regarding number of users, data load and lifetime.

The principles are published on Difi's main portal²⁷ together with information about the budget procedure for major ICT development projects, standards, universal accessibility, information security and other topics.

Effectiveness

There is no overall surveying on the effectiveness of the interoperability work, however. The uptakes of both obligatory and mandatory standards are measured. Self-declaration on compliance with architecture principles will be used in the preparation for the budget procedure for 2011.

²⁷ <http://www.difi.no/emne/ikt/it-arkitektur/arkitekturprinsipper>

Political interoperability

Three documents define the political agenda:

- (St. meld. nr. 17) Report no. 17 (2006-2007) from the Government to the Parliament; An Information Society for All, published in December 2007 by the Ministry of Government Administration and Reform.
- (St. meld. nr. 19) Report no. 19 (2008-2009) from the Government to the Parliament; A Government for democracy and inclusiveness, by the Ministry of Government Administration and Reform.
- Project report Common ICT Architecture for the Public sector, established by a working group in August 2007 and presented to a Ministerial conference in March 2008 by the Ministry of Government Administration and Reform.

Legal interoperability

The interoperability work is supported by official guidelines, formal recommendations and legislation. The obligatory use of the architectural principles is stated in a governmental decision. It is enforced through instructions to all ministries and their underlying agencies. The principles must be taken into consideration for all ICT related initiatives and deviations must be explained, "comply or explain". The uses of standards are obligatory and recommended for the public sector through regulation of 25 September 2009 under the provision of the Administration Act, entering into force from 1 January 2010²⁸. The Anti-discrimination and accessibility act has a provision regarding requirements for accessibility of all ICT solutions directed at the public. The provision enters into force 1 July 2010.

Organisational interoperability

Difi is responsible for several initiatives and coordinating activities to promote and secure interoperability in the public sector. There are also established coordinating forums for e-government initiatives. In Difi's work with common ICT components an important element will be to establish models for governance and management of these common resources. There also exist several common standards and specifications which are obligatory and which also includes the organisational elements. In addition several projects are working on drafting process flows for a number of services:

SEMICOLON²⁹ (Semantic and Organisational Interoperability in Communicating and Collaborating Organisations) is a R&D- project partly funded by the Norwegian Research Council. The main goal of SEMICOLON is to develop and test ICT-based methods, tools and metrics to obtain faster and

²⁸ <http://www.regjeringen.no/en/dep/fad/press-centre/press-releases/2009/new-obligatory-it-standards-for-thestat.html?id=570650>

cheaper semantic and organisational interoperability both with and within the public sector. The SEMICOLON-consortium is multidisciplinary. It aims at identification of obstacles in real collaboration cases, and at the development of new methodologies, tools and metrics. The development work shall be based on prototypes, and the results shall be verified in real collaboration cases. SEMICOLON allows differences in collaborating organisations, such as different values, different goals, and different aspects of the same concept.

Semantic interoperability

Seres (Semantic register for electronic collaboration) is a project run by the Brønnøysund Register Center, which is a government body responsible for several national registers organised under the Ministry of Trade and Industry. Seres contains metadata on describing the semantics and information structure of data being exchanged with and between government bodies. Initially Seres will focus on structured information, and the metadata will be used in the production of electronic forms by defining the content of data flows. The Seres project will deliver solutions to provide necessary metadata to Altinn.

A national strategy for metadata is under development, and will be delivered by summer 2010. The strategy will be considering several ongoing initiatives and look at the need for metadata. The working group consists of representatives from several agencies, and Difi is secretariat for the group. There are also established metadata initiatives in the health sector, the geodata sector and the justice sector.

²⁹ <http://www.semicolon.no/Hjemmeside-E.html>

General support

Information is available via web sites and through collaborative portals. In general, the body being responsible for the services has the responsibility of providing relevant support. The level of support and tools provided will vary according to the complexity and necessity.

Tool support

Difi has established a portal prosjektveiviseren.no³⁰ which is a project management tool focusing on the requirements and frameworks which apply to public ICT projects. The portal provides resources for several agencies and puts them in a combined context. In addition the portal also highlights best practices and invites collaboration through interaction. For other specific measures and resources, tools are provided by the responsible body.

Integration

Guidelines to support the integration with service end-points and business processes are available for the required services.

Security

There is a common Requirements specification for PKI for the public sector³¹ which is currently being revised. Difi is responsible for the revision. In addition there is a Framework for authentication and non-denial for electronic communication with and within the public sector. During 2008 and 2009 Difi has established a common eID for public eServices, Security MinID (MyID), and an infrastructure for validation and federation of eIDs. The work is also in progress for a public PKI solution. There are also several other initiatives in specific sectors which have established common security norms, and there is a national strategy for information security and a coordination forum at ministerial level. Work is also in progress for evaluating standards for information security.”

For more information on e-government in Norway, go to:

http://www.epractice.eu/en/factsheets/factsheet_all_chapters?filter=1&content_type=efactsheet_chapter&Countries=28&domain=10020&Factsheets_Topic=All&search=&op=Apply&form_build_id=form-bcfd2855590fef21d1a4f9043b9c965

³⁰ <http://prosjektveiviseren.no/english>

³¹ <http://www.regjeringen.no/upload/kilde/mod/rap/2005/0005/ddd/pdfv/250615-kravspekk-engelsk-versjon.pdf>

5.3 Sweden

Sweden has no entries in the interoperability section of the E-practice website. Here we base our presentation of Sweden's activities in interoperability and architecture from a number of different sources. The bulk of the information comes from a presentation by the Swedish Ministry of Finance, made in December 2009, *Demand-driven development of e-government in Sweden*.³²

According to this presentation, Sweden's policy indicates the emergence of 'third generation e-government' where flexible interoperability is viewed as the means to reach the goal of maximising public value.

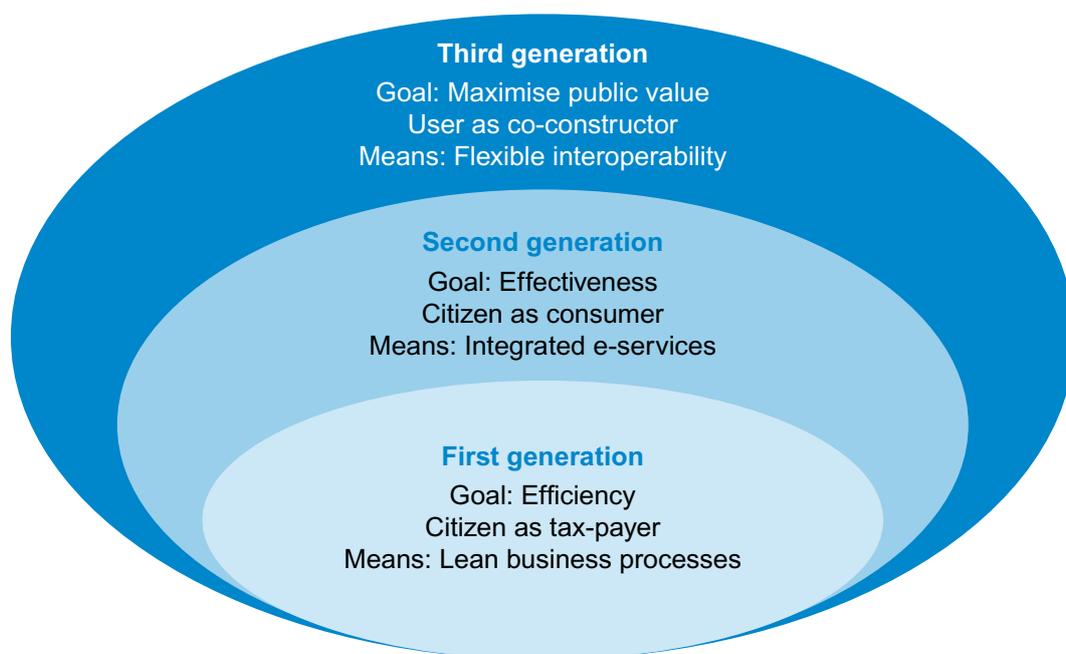


Figure 20. The emergence of 'third generation e-government'

³² <http://ec.europa.eu/idabc/servlets/Doc46f9.pdf?id=32452>

The E-government Delegation³³ was formed in 2009 and is represented by 14 Director Generals plus the Swedish Association of Local Authorities and Regions. Its remit is:

- to suggest a third generation e-government policy;
- to coordinate the development of e-government projects in Sweden;
- to follow up the results of e-government at national level;
- to coordinate ICT standardisation at state level;
- to support the government in international e-government work.

Third generation e-government strategy focuses on modular e-services that are designed to work in a loosely coupled structure through the use of configurable portlets. This approach allows individual users to build up a personalised portfolio of services as required. The strategy takes a federated governance model and incorporates all authorities at national, regional and local levels.

	Agency-centred e-government	User-centred e-government	Demand driven e-government
Production model	Individual e-services	Integrated e-services	Modular e-services
Access model	Many web-sites	One-stop-shop	Configurable portlets
Governance model	Individual agency	Whole-of-government	Federated governance

Figure 21. The evolution to a demand driven e-government

³³ <http://en.edelegationen.se/report/making-progress>

The third generation production model implies:

- the existence of a service-oriented architecture;
- cluster level integration;
- minimal state level integration;
- the need for ordinances to handle standard-based messages and SOA adapters;
- incremental solutions to semantic problems at the project level, but which can be re-used centrally.

A third generation access model implies:

- demand-driven development of services;
- catching demands by clusters;
- third-party collaboration in service development;
- increased re-use of public sector information;
- flexible responsibility for adding value to information and services (champions and challengers).

The implications which stem from the adoption of a third generation governance model are detailed in the figure below:

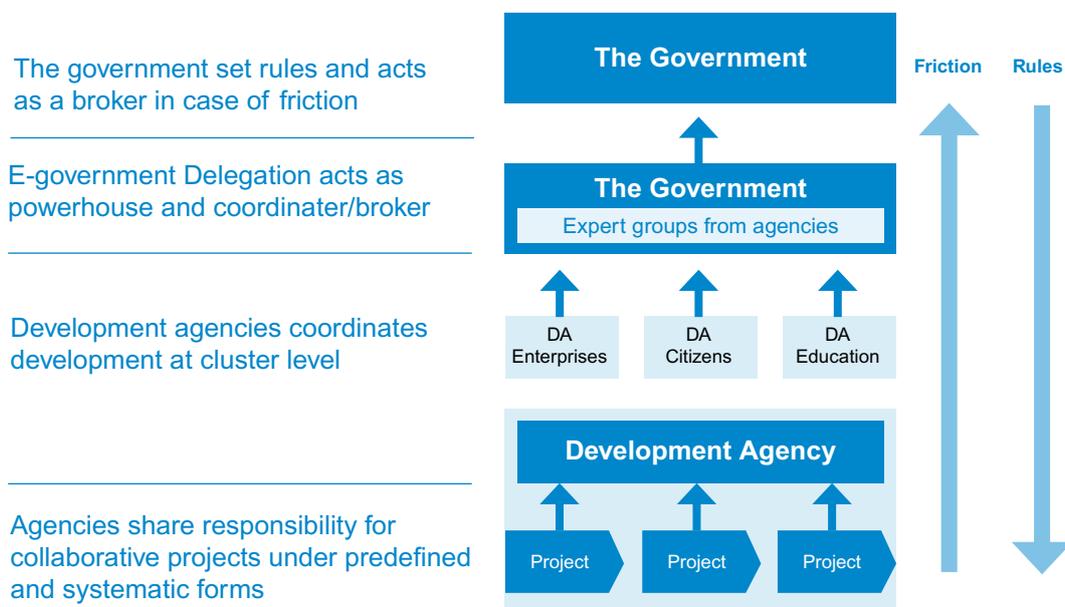


Figure 22. Third generation e-government governance model

Third generation e-government raises a number of issues in the domain of interoperability:

- Four different types of services and interoperability challenges:
 - autonomous services – do not require collaboration or interoperability;
 - federated service – requires collaboration and interoperability at least at a cluster level;
 - basic information services – appointed responsibility, require general interoperability;
 - infrastructural services – appointed responsibility, require general interoperability.
- What interoperability is necessary for third-party developers?
 - APIs and open standards becomes more important.
- Future-oriented and market-oriented model:
 - What is the state's responsibility for adding value to information and services?
 - How do we secure fair competition in a market for adding value to public information and services?

The Swedish Association of Local Authorities and Regions (SALAR)³⁴ is a nationwide body which participates in the development of e-government solutions. SALAR is responsible for coordinating national activities in cooperation with representatives from regions and municipalities.

A substantial share of e-government development is performed by the Swedish Ministry of Health and Social Affairs in partnership with the National Board of Health and Welfare. Most of the effort in this domain is to develop e-health systems, working with the Centre for eHealth in Sweden.³⁵

³⁴ <http://english.skl.se>

³⁵ <http://www.cehis.se/en>

Centre for eHealth in Sweden

The Centre for eHealth in Sweden states: “In order for county councils’ and regions’ eHealth collaboration to be run effectively with clear goals and continuity, consensus is needed on the focus and scope of the work. Joint efforts must be able to be controlled, prioritised and budgeted in a coordinated manner. The Centre for eHealth in Sweden has been formed to coordinate and push these efforts forward. The Centre shall create the long-term conditions necessary for developing and introducing nationwide use of IT in the decentralised health and social care system that the Swedish model is. The work comprises new citizens’ services and support for health and social care provision, a national technical infrastructure and common regulatory frameworks and standards³⁶. These joint eHealth solutions will improve accessibility of information, quality and patient safety. The Centre for eHealth in Sweden is governed by representatives of county councils and regions, the Swedish Association of Local Authorities and Regions (SALAR)³⁷, municipalities and private care providers.”

For more information on e-government in Sweden, go to:

http://www.epractice.eu/en/factsheets/factsheet_all_chapters?filter=1&content_type=efactsheet_chapter&Countries=36&domain=10020&Factsheets_Topic=All&search=&op=Apply&form_build_id=form-bcfd2855590fef21d1a4f9043b9c965

³⁶ http://www.cehis.se/arkitektur_regelverk/ (Swedish only)

³⁷ <http://english.skl.se/>

Smart Cities Guides

The Smart Cities project has produced a number of guides for municipalities and governments to help them design and deliver better e-services.

1. Customer Insight Profiling and Service Design Guide - <http://www.smartcities.info/customer-profiling>
2. Creating Customer Contact Centres - <http://www.smartcities.info/customer-contact-centres>
3. Creating Municipal ICT Architectures - <http://www.smartcities.info/ict-architecture>
4. Improving business processes and delivering better e-services - <http://www.smartcities.info/business-processes>
5. Using Co-design to design and deliver better e-services - <http://www.smartcities.info/co-design>
6. My City Online – making the case for municipal web portals - <http://www.smartcities.info/web-portals>
7. Using Geographic Information Systems to provide better e-services - <http://www.smartcities.info/gis>
8. An introduction to Municipal ICT Architectures for Managers - <http://www.smartcities.info/ict-architectureSmart>

Cities Research Reports

1. Comparing levels of internet access, internet use and e-government use in the Smart Cities countries
2. Customer profiling to target service delivery
3. Measuring levels of supply and demand for e-services and e-government: a toolkit for cities
4. An introduction to Process Modelling
5. Standards for classifying services and related information in the public sector
6. The Transformation of City portals
7. The Community of Practice as a virtual organisation
8. The Community of Practice as a virtual organisation: innovation seeking and knowledge creating
9. A Systems Perspective on Security Risk Identification: Methodology and Illustrations from City Councils
10. Making customer groups real – using personas
11. Using Customer Profiling and Activity Based Costing to inform channel shift and to increase service take-up – A practical guide
12. Customer Journey Mapping
13. What is a service list?
14. Ten reasons to use a service list
15. Evaluating e-services
16. Understanding web accessibility
17. Using email to deliver e-services
18. Edinburgh's Library App – a case study
19. BusTracker – bus information on the go
20. Using geolocation in e-services

These reports can be downloaded from <http://www.smartcities.info/research>

