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WHITE PAPER

DYA|INFRASTRUCTURE

THE ARCHITECTURAL FOUNDATION FOR THE IT-INFRASTRUCTURE

DANIËL JUMELET

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1 PREFACE

Infrastructure has always been a notable omission in the field of architecture but at last a methodology has been developed to fill that gap. Sogeti is proud to announce the newest addition to the architectural framework: DYA|Infrastructure.

DYA|Infrastructure answers the widespread demand to provide infrastructure with an architectural background. This paper will first explain the underlying need for architecture within the infrastructure domain and therefore the need for a method such as DYA|Infrastructure, before moving on to an overview of the method.

Until now, most architectural methods and frameworks focussed on application or software architecture. If one of those methods or frameworks paid any attention to infrastructure, it did so at a significantly lower level of abstraction than it did for the application landscape. From a historical perspective, this can be easily understood. During the first decades of IT development most infrastructure services remained relatively straightforward. While applications advanced in functionality and complexity, hardware just got 'faster'. The turning point came during the Internet hype when infrastructure (hardware) manufacturers started innovating and producing new products like never before. Infrastructure started to become 'smart'. At the same time, there was a massive growth in connectivity solutions. This coincided with the rapid development and deployment of new types of applications (such as e-marketing, e-commerce, ERP and data warehousing). These new applications each had new demands on the infrastructure which consequently led to the development of new infrastructure services.

A silent revolution has taken place within the field of infrastructure and indeed is still going on. Many new and complex types of infrastructure services have become available, while existing services continue to gain in functionality. Traditionally separate domains (such as telephony and video) are being completely integrated into the infrastructure domain, whilst standardised applications (such as mail, agenda and team collaboration services) are being incorporated into the same infrastructure domain. This results in complex infrastructure landscapes that are becoming increasingly difficult to manage.

Most infrastructure landscapes are the result of software projects indiscriminately implementing applications each on their own specific hardware platform. Mergers and acquisitions have made things even worse — leaving many companies with different versions of the same services which are difficult enough to connect to each other, let alone that they need to be integrated and consolidated.

Furthermore, infrastructure has distinctive properties compared to other IT facilities:

1. Infrastructure can be used by a multitude of (anonymous) processes, applications and users;
2. Infrastructure does not offer (financial) benefits on its own, but serves as a utility enabling business processes to be performed.

When organisations (out of sheer necessity) turn their attention to business continuity management or want to save on costly administrative staff, they must invest in an architectural method for modelling infrastructure to help rationalise, standardise and restructure their infrastructure landscapes. Organisations who need flexibility and agility from their IT facility will also benefit from architecture for their infrastructure, because a solid, modular and naturally scalable infrastructure provides a firm foundation for quick changes at higher levels. Tomorrows' market, full of digital natives (forming "markets of one"), asks for a degree of flexibility that can no longer be supported by infrastructures that are inconsistent and difficult to expand. They need an infrastructure made up of modular and standardized components.

Of course, proper project management, skilled design, construction and operation are essential to implement and maintain reliable infrastructure services. However, to ensure that an infrastructure design is consistent and that it will able to meet current and future business needs, infrastructure architecture is indispensable. Infrastructure landscapes are not the only ones to benefit from proper infrastructure architecture. To translate business, information and application architectures into solutions that really work in a real world, the supporting infrastructure services must be completely in line with the other architectures. The result will enhance architecture as a whole and enable solutions to be delivered that are consistent from beginning to end. Infrastructure architecture is essential to complete the whole picture.

1.1 What does DYA|Infrastructure offer?

DYA|Infrastructure brings business agility, architectural effectiveness and manageable and expandable infrastructure landscapes within the reach of any organisation.

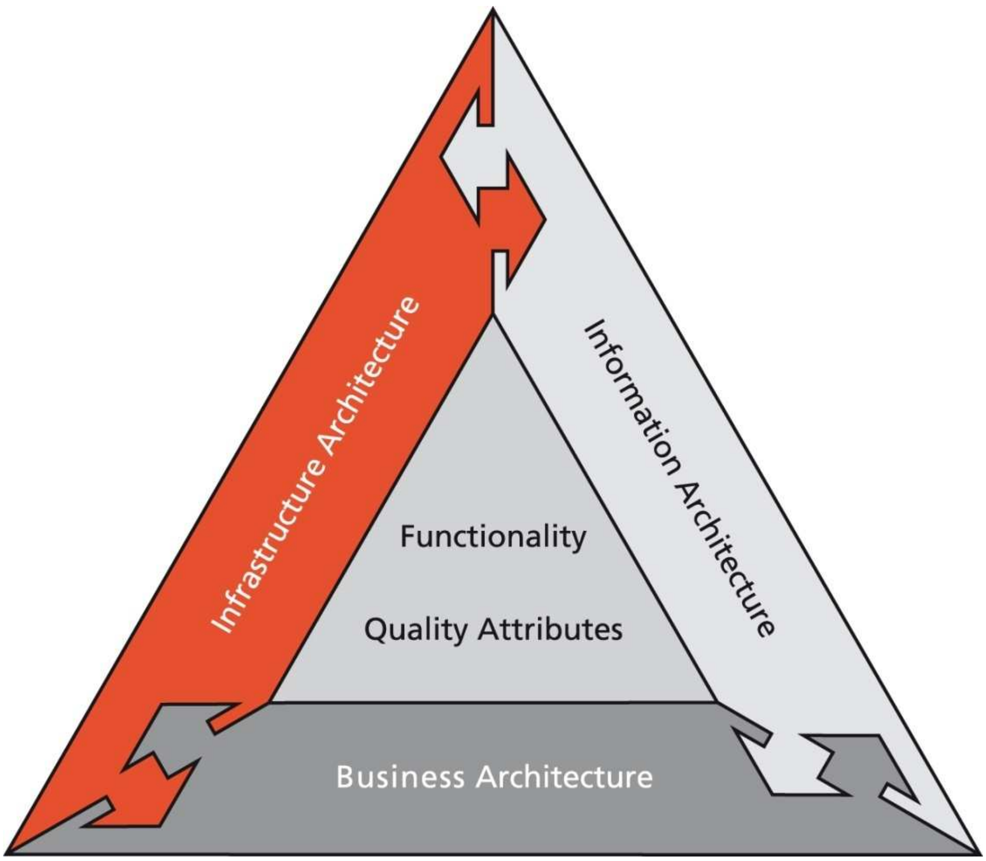
There are three mutually supportive key elements which DYA|Infrastructure provides:

1. The definitive description of infrastructure architecture as an integral part of the architectural process and how it can help to enforce architectural principles. There are two focal points: the need for a functional approach to infrastructure facilities and how to select and work with the appropriate quality attributes.
2. The Building Blocks Model (an architectural meta-model for infrastructure) which can be used to a) make a categorical and functional inventory of existing infrastructure landscapes, b) create and describe logical, modular infrastructure facilities and c) structure and construct architectural products like Reference Architectures, Impact Analyses and Project Start Architectures.
3. A number of best practices to get infrastructure architecture off to a flying start within an organisation as well as guidelines for producing essential architectural artefacts which will make infrastructure architecture really work. Various implementation strategies are discussed, how to extend the Project Start Architecture is explained and the importance of a number of products such as Reference Architectures, Product Catalogues and Service Catalogues are also illustrated.

Apart from these three main ingredients, DYA|Infrastructure also provides guidance on how infrastructure architecture can improve security, project management, test management and production.

2 INFRASTRUCTURE ARCHITECTURE AND THE ARCHITECTURAL PROCESS

Business, information and infrastructure architectures share a common goal: to provide optimum support for an organisation's operations. This is impossible without input from and feedback between the three architectural disciplines. To act effectively within the architectural process and at the same time be sufficiently responsive, each discipline must follow the dynamics and structures which underline their own respective area of competence. This certainly applies to infrastructure architecture, which must make its role easily recognisable by clarifying the terms it uses within the infrastructure domain. The easiest way to do this is to describe infrastructure solutions in logical and functional terms. DYA|Infrastructure defines the "capability" of a solution with a set of quality attributes. Quality attributes also have an important role in harmonising the architectural process across the three architectural disciplines, because regardless of the underlying (technological) structure, quality attributes can be reconciled across the domains and be used throughout the entire solution. At the same time, they also provide input for the engineering, creation and testing of solutions within their own area of competence. That is why quality attributes are a recurring theme throughout the different phases and activities of infrastructure architecture and why it is of the utmost importance to choose and define quality attributes carefully. At the very least, they must illustrate the unique and inherent quality of an infrastructure solution.



The architectural process

2.1 Quality attributes

The architectural disciplines must be able to adjust to each other whenever necessary during the architectural process without compromising themselves. They should make clear what they can contribute and indicate their own limits. The full scope of wishes and requirements can not always be fulfilled; particularly if they (even minimally) conflict with each other. Should one of the disciplines want or need to dictate the eventual outcome, it should receive appropriate guidance from the architectural process, keeping in mind that the guidance must be relevant to the specific area of competence. The architectural process will select the quality attributes which are most realistic and appropriate for the direction in which the desired solution should be sought. This set of quality attributes can be seen as a mandate for each discipline to individually work on their own part of the total solution. The quality attributes ensure that the resulting solutions are not developed in isolation, but that they will remain consistent within the complete architectural framework. The set of quality attributes will also provide a means checking and reporting on delivered results.

To avoid disciplines talking at cross purposes, unequivocal agreement is needed on the quality attributes which each discipline brings into the architectural process. These must serve as the basis for the further reconciliation and harmonisation of definitions within the architectural process. Infrastructure architecture will provide its own set of quality attributes, alongside the specific quality attributes of the business and information architectures. Keeping in mind the objective of building the infrastructure function as a utility, there are three categories, with two quality attributes each, that express the inherent quality of infrastructure solutions:

- flexibility (adaptability and scalability);
- reliability (availability and security);
- operability (manageability and accountability).

The six quality attributes defined here do not apply exclusively to infrastructure applications, but they are the guiding set for building "infrastructure as utility".

Quality attributes are by nature abstract, because they indicate "how" but not "what". Within the architectural process, relationships are identified between the quality attributes from one discipline and comparable quality attributes in another discipline. This makes it easier to identify how choices made in one area will influence possible solutions in other areas. The more proactively this occurs and the more quality attributes that can be reconciled, the more constructive the process will be. Within this harmonisation process, “similar” quality attributes will be easily traceable to each other, while others are far more likely to underline the uniqueness of a particular discipline. Nevertheless, a discipline will usually recognise itself in the quality attributes of the other disciplines, provided that they have been properly defined and explained.

The participants in the architectural process are not always sufficiently aware of the importance of their own quality attributes and the consequences which their explicit requirements will have on the other areas. It is then up to the other participants to explain the implicit or explicit consequences for their own domain. For example: a certain business architecture solution requires 99.99% “availability”. Infrastructure responds by saying they can meet this requirement in terms of “availability”, but it will have significant consequences in terms of “scalability” and “money”. Business architecture will then be expected to indicate whether, in that light, the specified availability requirement is still justifiable. A situation must be avoided where disciplines impose quality attributes and terms on each other purely to achieve their own purpose, because it will thwart the process and ultimately be counter-productive, since the terminology means nothing outside their own domain unless it can be fulfilled.

Apart from the quality attributes, there are two major factors that influence the potential direction of a solution, namely cost and time. These factors are imposed by the outside world (usually by the organisation) and affect all forms of architecture. Time and money are generally the most important determinants of the scale and quality and thus feasibility of a solution. In many cases, time and money are so restrictive that a different weighting must be given to a number of quality attributes to come up with a realistic solution. As a result, the architectural process will occasionally and justifiably turn into a debate resulting in a solution that will optimally serve the organisation's interests within the confines imposed by time and money.

The six dominant quality attributes for the infrastructure domain are explained in more detail below.

2.1.1 Adaptability

A solution's adaptability determines how easy or difficult it will be to make a change to the solution. Adaptability is achieved by designing modular systems (using standard components), applying standardised protocols and tools and limiting the complexity of offered functionality (services).

2.1.2 Scalability

A solution's scalability determines how easy or difficult it will be to alter the capacity of the solution. Infrastructure solutions have both an internal and an external scalability. Internal scalability is achieved by the expandability of individual components making up the solution, whereas external scalability is achieved by using components in parallel. When determining the scalability of a solution, it is advisable to devote extra attention to interfaces and aggregation points, because this is where most bottlenecks will be found.

2.1.3 Availability

A solution's availability determines the guarantee that the solution will correctly and adequately work within the constraints of time, depending on the input provided. This does not just mean that the functionality "will work", but also that the specified performance will be achieved, based on the expected input. The guaranteed availability of infrastructure is usually increased (in terms of performance and accessibility) by using several instances of the service. To utilise this higher level of availability, the application architecture must be aligned accordingly.

2.1.4 Security

A solution's security determines how easy or difficult it will be to misuse a system (possibly resulting in damage to the organisation). Security is created by taking measures designed to prevent different types of misuse:

- authentication/authorisation: based on identity, a user/administrator will be given access and assigned a role, enabling him/her to access and edit certain data
- accounting/auditing/logging: actions by users/administrators are logged to be able to trace misuse;
- barring: confidential data will be usable/viewable only by authorised users/administrators;
- guaranteed authenticity/non-repudiation: demonstrably shows that data originating from a source the user/administrator trusts is authentic and has not

been tampered with.

> Security measures are often complementary, and in many models availability is an element of security. Therefore, "CIA" encoding is often used to classify data, enabling data and applications to be categorised according to availability, integrity and confidentiality. DYA|Infrastructure respects this categorisation, but has opted to use its own categorisation of the architectural process, to assure a complete implementation of the "availability" quality attribute.
>
> The biggest risk with security is that it will be seen as a goal and not a means to achieve a goal, thus unnecessarily frustrating usage and management requirements through overly stringent security measures. Security requirements should therefore always primarily be related to everyday practice and the standards that apply in that setting. This will put the technical security measures into the right perspective.

2.1.5 Manageability

A solution's manageability determines how difficult or easy it will be to keep a system operational. Standardised safeguards (monitoring and alerting) can help to enhance manageability whilst consideration must be given to the additional expertise needed by system administrators, as well as the standardisation and complexity of managed service interfaces and tools.

2.1.6 Accountability

A solution's accountability determines how easy it will be to measure and charge usage costs. Defining units, such as building blocks and elements, and their related costs (procurement, operating and removal costs) will facilitate the accountability of a solution.

DYA|Infrastructure does not prescribe any particular quality attributes and the attributes above give no more than an indication of possible definitions. Each organisation may assign its own definition to quality attributes. The six quality attributes here are the ones most appropriate to the "infrastructure as utility" objective, but other quality attributes may also be meaningful within a certain context or a certain organisation. Provided that quality attributes are not imposed by other specialised areas, but are inherently suited to their own area of specialisation, they will be legitimate. Extraneous quality attributes may appear to work within the dialogue, but will ultimately prove meaningless when engineering workable solutions.

It often proves difficult to provide a complete list of quality attributes at the outset of a project. During the architectural process, quality attributes will be weighted and given the appropriate priority. Therefore, during the engineering process (when the focus is a specific solution in a specific context), it may be necessary to further elaborate on relevant quality attributes. Ideally, the infrastructure test plans will also be drawn up in the engineering phase, which will result almost automatically in a more detailed specification of the quality attributes.

DYA|Infrastructure gives quality attributes an explicit role within the Building Blocks Model. This meta-model aids a logical, functional description of infrastructure facilities, as demonstrated in the following section.

3 THE BUILDING BLOCKS MODEL

The DYA|Infrastructure approach includes several best practices and a meta-model as a modelling tool. The approach is based largely on use of the model and therefore model and approach cannot be considered separately. For practical reasons, however, this section of the document starts by describing the model. In a later section, we will deal with the specific parts of the approach which focuses on use of the model.

The prime aim of DYA|Infrastructure is to create infrastructure functionality based on standard modules. To underline this, the model has been called the "Building Blocks Model". In actual fact, the Building Blocks Model has several other important dimensions, but Building Blocks are the most characteristic ones. The Building Blocks Model is unique in that it provides a firm grip on complex infrastructure landscapes and was designed as a result of comparing and investigating the working practices of senior infrastructure specialists and architects employed in large and medium sized companies.

Within DYA|Infrastructure, the Building Blocks Model serves three purposes:
- The model is more than helpful during decomposition, development and definition of the infrastructure landscape. Functionality, Quality Attributes and technology are clearly identified, without creating overly stringent lines of division, but at the same time providing sufficient insight to facilitate consolidation of overlapping facilities. It provides a consistent translation of functionality into required technology and produces architecture documents that are structured, are readable and able to be discussed between infrastructure architects and other specialists.
- The model yields reusable architecture products. Consistent application of the model creates a library of standard, logical infrastructure facilities (Building Blocks), which in each subsequent engineering process and related implementation can serve both as a reference and a starting point. New or changing situations (and the related requirements) can quickly be dealt with, because in many cases existing Building Blocks can be re-used. Using Building Blocks and standard modules promotes the expandability, adaptability and flexibility of the infrastructure landscape.
- The model supports creating several architectural products, because it provides a maintainable structure for these products. Examples of products that benefit from the basic Building Blocks Model structure are Reference Architectures, Global Taxonomies, Impact Analyses and Product Start Architectures. In the following paragraph, these products are described in more detail.

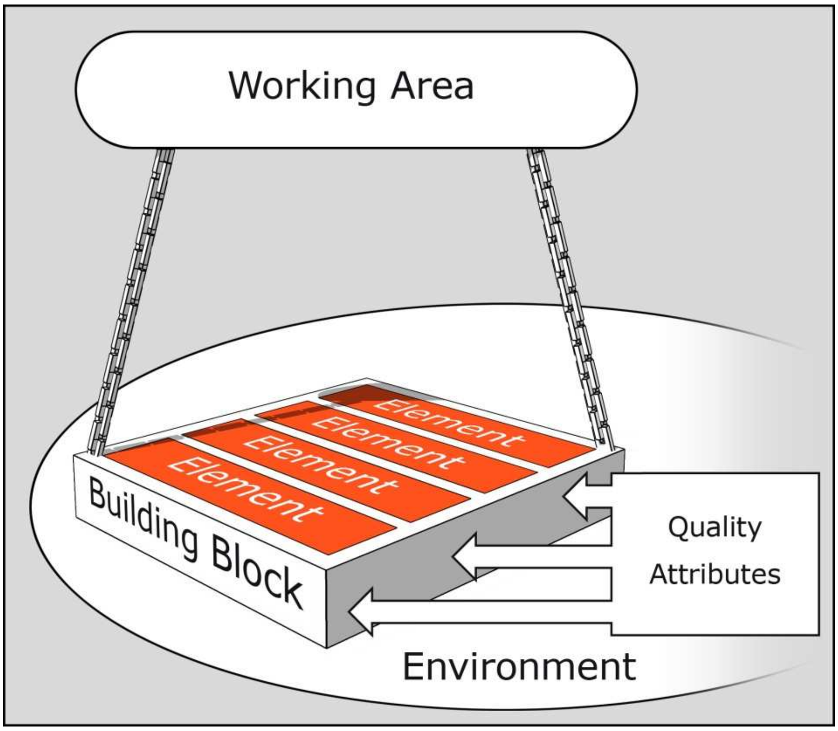
The use of the Building Blocks Model obviously requires skilled infrastructure construction. As with every (meta-)model, the Building Blocks Model provides an abstract approach to reality. It is a tool for structured development of infrastructure architecture to produce usable input for engineering processes. In that sense, it does not yield off-the-peg infrastructure products, so the infrastructure specialists still have an essential contribution to make in creating real, usable services. Similarly, when creating a Building Block, specialists need to be directly involved to safeguard the relationship between the architecture and constructional skills. During the detailed specification of a Building Block, the required technical components and/or standards will be chosen and defined. The structure of the Building Blocks Model was specifically chosen to enable discussion and to facilitate defining functionality and Quality Attributes of infrastructure facilities within the architectural process.

3.1 Structure

Fundamentally, the Building Blocks Model has a functional structure. Building Block types are defined for each type of a logical infrastructure facility. Within a specific organisation or specific environment, several variants of a Building Block type will typically be found.

The Building Blocks Model has the following dimensions/components:

- *Working Area*. A Working Area defines a commonly recognised area of expertise within the infrastructure domain;
- *Environment*. In this context, environment means a functionally demarcated domain within an organisation's infrastructure landscape. Environments differ from each other primarily in the types of functionality they offer and the way and under what conditions infrastructure facilities are being used. A further subdivision of environments in location types can be made if the facilities provided at each location are so different that it is logical to make a further breakdown;
- *Building block*. A Building Block is a single, logical infrastructure facility that, in the context of an environment, provides uniform and specific infrastructure functionality. Several variants of a certain type of building block may occur within an organisation, depending on the diversity of Environments;
- *Element*. Elements are technical components/functions (hardware, software, protocols) used to construct Building Blocks;
- *Quality Attribute*. Quality Attributes determine how a Building Block functions. Quality Attributes influence the elements used to construct a building block.



The five dimensions of the Building Blocks Model

To produce a meaningful overview, a proper perspective is crucial. Imagine a city and think about what is necessary to produce a quick survey that describes the ‘look and feel’ of that city.

At street level, you can examine the details of buildings in front of you, but these buildings are in front of other buildings, stopping you from seeing those buildings. It is also impossible to detect the possible relationship between buildings based on their business function. For example, the Main Post Office might be located right behind the Central Train Station for sound business reasons, but I can’t possibly see this if I just stand in front of the Central Train Station. Of course, it is possible to travel from building to building within a city and exhaustively describe every single building and their (business) relationships with the surrounding buildings. This will provide an overwhelming amount of accurate data that will however defeat the objective of providing an overview of the situation.

On the other hand, I could choose to use Google Earth and zoom into the city. Google Earth provides me with a quick superficial overview of the positioning of the buildings within this city. All the rooftops are displayed, the structure of the streets is provided, but we learn nothing about the function of these buildings or their characteristics.

However, if I were a bird, I could survey a city quickly from several perspectives. I could use the high level (Google Earth) perspective to decide how to divide the city into sections. I could zoom in on a certain section and discover which buildings provide which services within that section and the way those buildings relate to each other. I could even zoom in on particular building to examine how they are constructed (the street level perspective).

The Building Blocks Model brings several dimensions offering the various levels of perspective to allow us to formulate an abstract decomposition and description of an infrastructure landscape — understandable for both business and information architects — that at the same time provides enough depth to make sense to the technicians who must design and build the infrastructure.

3.2 Functions and relationships

Each dimension and component of the Building Blocks Model has its own function and they are all related to each other in a certain way. To explain the working of the Building Blocks Model, the functions and relationships of the various dimensions and components are explained below.

3.2.1 Working Area

At the highest level of abstraction, the Building Blocks Model envisages a subdivision of an organisation’s infrastructure landscape into Working Areas. Working Areas are aligned to the different areas of expertise typical to the infrastructure field. This dimension is used to allocate knowledge and assign responsibility for each facility within a particular area to architects, specialists and engineers with expertise in that area.

The standard Working Areas defined within the Building Blocks Model are:

- *Servers* embraces a broad Working Area focused on (logically) centralised delivery of processing and computing capabilities. Around servers there are countless facilities in the form of generic, centralised applications and management tools. They will usually be facilities that form part of an operating system or are closely associated with it. Examples are directory services, mail facilities, management and monitoring facilities;
- *Middleware* is a Working Area focused on applications that fulfil generic functions to support business applications and, as such, do not have a purpose of their own. They include messaging facilities and database management systems;
- *Storage* is a Working Area that provides numerous different types of permanent and semi-permanent data storage;
- *Network* is a Working Area for the transmission of data, controlled and conditioned or otherwise, between systems;
- *Client realm* has the infrastructure that provides various user interfaces as its Working Area. These include (mobile) workstations and printers.

3.2.2 Environment

At the next level of abstraction, Environments within each Working Area can be discerned. An Environment is a functionally demarcated domain and offers its own distinct type of functionality coupled to the way its facilities and services can be used. Environments can also differ from each other as a result of the requirements the services must satisfy (both functionally and in terms of Quality Attributes). An example is a hospital that has identified three Environments within its Working Area "Client realm": "office workstations", "medical workstations" and "visitor workstations". Another example is an organisation that within its working area "network" has defined an "office LAN", a "server LAN", a "demilitarised zone" and a "WAN" Environment. Within Environments a further distinction can be made according to location types (such as a Head Office LAN and a Service Point Office LAN) if the infrastructure services differ so much as to justify a further subdivision. The different variants of Building Blocks will then be defined from location to location.

The purpose of defining Environments is to make a structural distinction between Building Block variants. Per Environment, relevant Quality Attributes and their value are determined on a global level. To achieve the fullest possible standardisation, it is important to keep the number of Environments as small as possible. Only after domains have been identified with an abundantly clear difference in functionality will separate Environments be defined for them.

3.2.3 Building block

A Building Block is a logical infrastructure facility defined by a functional description, which includes the purpose, offered facility and method of use of the Building Block. The functional definition of a Building Block will be discussed and agreed with the other architecture disciplines. The Quality Attributes which will determine which characteristics the infrastructure service must satisfy will be one of the prime subjects in this discussion. The relevant types of Building Blocks (including the necessary variants) will be decided on for each type of Environment. The table below shows frequently used building blocks for each type of Working Area:

Storage	Network	Server	Middleware	Client realm
Centralised Storage	Access	Authentication Management	Database Management	PC
Distributed Storage	Distribution	Authorisation Management	Asynchronous Messaging	Terminal
Back-up & restore	Core	Asset Management	Synchronous Messaging	Laptop/tablet PC
Archiving	Interconnection	Data Repository	Message Routing & Translation	PDA
Storage Transport	Zone Protection	File	Distributed Transaction Management	(IP) Phone
	Load balancing	Print	Service Repository & Management	Cell Phone
	Intrusion Prevention/ Detection	Application Platform	Application Triggering	Printer
	Client IP Management	Presentation		Scanner
		Mail		
		Calendar		
		User Messaging		
		Call Management		
		Web		
		Video		
		Audio		
		Monitoring		
		Management Tooling		

In contrast to the other working areas, the guiding principle for distinguishing the building block types in “Client realm” is not only the type of facility but also the form of the facility. This approach was adopted because of the great diversity of devices with very similar functionalities within this working area.

Organisations are obviously free to choose their own way of distinguishing categories and defining their own Building Blocks, as is appropriate for their own infrastructure landscape. The Building Blocks’ primary description must always be functional and logical to avoid a technical and product orientation. Definitions of Building Blocks included in the Reference Architecture are considered to be organisation-wide. These are the Building Blocks which will be used when starting a project (for example, whilst preparing an Impact Analysis and the Project Start Architecture).

3.2.4 Element

A Building Block consists of one or more technical components referred to as the standard (and preferred) Elements. The description of a Building Block includes the hardware, software, protocols and standards which preferably should be used when constructing the Building Block. Variants of a (type of) Building Block can consist (partly) of different elements, depending on the requirements which the envisaged Environment (in which the Building Block will be used) imposes on an infrastructure facility.

The composition of a Building Block variant will be decided on in cooperation with infrastructure specialists. This will bring in specialists at an early stage of the architecture and engineering process, allowing the architecture documentation to become sufficiently specific and with unambiguous specifications. This is not only important for the architectural process; it also provides procurement departments with enough information to make an informed choice during the selection process. As specialists are already involved during the architecture phase, the engineering phases in projects will speed up. By defining and using Elements, DYA|Infrastructure has created an explicit place for technical specifications in the architectural process.

3.2.5 Quality attribute

Quality attributes determine the 'capability' of a building block (infrastructure service). Quality Attributes shape building block types and variants, and are of prime importance in selecting the correct Building Block. The most relevant Quality Attributes, together with their appropriate weightings, will be determined during the architectural process. During the engineering and building processes, Quality Attributes will be specified and quantified in greater detail.

4 BEST PRACTICES AND ARCHITECTURAL PRODUCTS

DYA|Infrastructure provides a number of products and best practices which can be used in the architectural process for infrastructure. The DYA® Working Model has already defined a number of architectural products, such as the Reference Architecture, the Architectural Study, the Impact Analysis and, probably the most important, the Project Start Architecture. DYA|Infrastructure concentrates on the application of these products within the architectural process for infrastructure and provides specific instructions on the use of these products. Because of the special nature of infrastructure - that of a common utility - an additional number of specialised products is included, such as the Organisational Context Analysis and the Future Developments & Planning.

A distinction is made between core products and products that are involved with project guidance.

Core products are:
Organisational Context Analysis
Reference Architecture
Product Catalogue
Future Developments & Planning

Project Guidance products are:
Architectural Study and Impact Analysis
Project Start Architecture
Design Guidance
Guidance of Building, Testing and Deployment
Problem solving support

This paragraph provides a quick overview over these products and their related best practices.

4.1 Core products

The DYA|Infrastructure core products are created and used within the architectural process. They function as the starting point for the other products to be delivered during project guidance.

4.1.1 Organisational Context Analysis

The Organisational Context Analysis (OCA) creates an overview of an organisation, including its goals, organisational structure and business processes, the application landscape and existing infrastructure. An OCA is especially convenient when there is no concise Business Architecture and Information Architecture description. In that case, the OCA provides essential background information to the architectural process for infrastructure. Infrastructure architects need first to understand how infrastructure facilities serve the organisation in which these facilities have been deployed and are being used. To create a categorical, structured overview of existing infrastructure landscapes, the OCA offers a Global Taxonomy. This Global Taxonomy can be reused when setting up a Reference Architecture.

4.1.2 Reference Architecture

A Reference Architecture is the framework within which an organisation's infrastructure principles and present and future standards are described and defined. The Reference Architecture is structured using the Building Blocks Model. The standards included in the Reference Architecture have the form of a Building Block: single, logically defined facilities of which functionality and intended use and management are described, together with the Elements (technical components, like hardware, software and protocols).

4.1.3 Product Catalogue

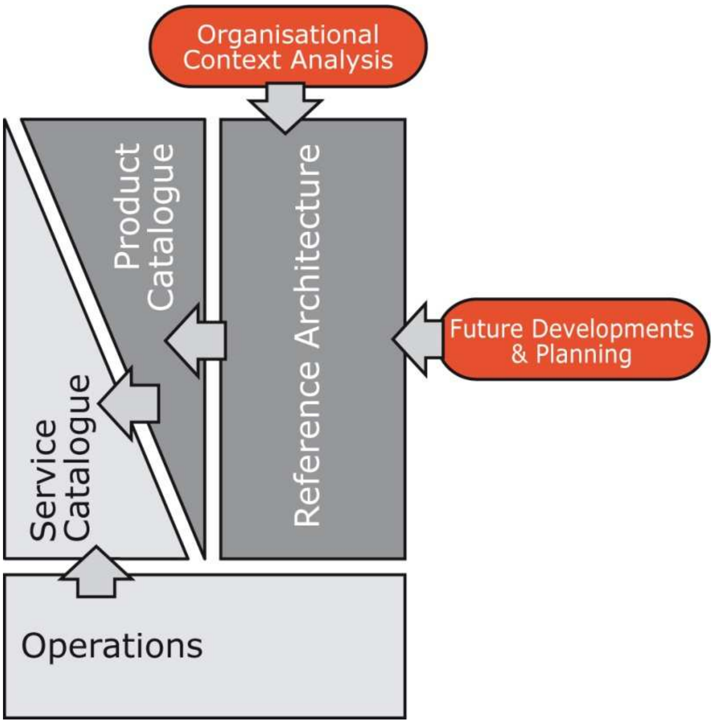
To prevent project architects, engineers or service managers from selecting Building Blocks which are incompatible (for example a high availability Application Platform coupled with a Centralised Storage facility with only best effort availability) each Building Block is detailed in the Product Catalogue. The Product Catalogue describes abstract patterns built up from combinations of Building Block that together offer complete, balanced infrastructure solutions. Service managers can reuse these patterns when defining their Service Catalogues. Unlike a Service Catalogue, a Product Catalogue does not concern itself with details such as back-up schedules or physical maintenance agreements. The Product Catalogue is meant to assist service managers in creating an easy to understand Service Catalogue with functional descriptions of available infrastructure services written at appropriate levels of abstraction.

The Reference Architecture, the Product Catalogue and the Service Catalogue are separate products in their own right. This guarantees the maintainability of these products to a certain degree. A single modification of a particular standard in the Reference Architecture does not automatically necessitate a change in the Product Catalogue and the Service Catalogue. A new Product can be easily defined without changing the Reference Architecture.

4.1.4 Future Developments & Planning

Since an infrastructure should essentially function as a common utility, a regular evaluation of the services it provides should be carried out. Organisational developments, existing problems and mismatches as well as technology innovations which could benefit the organisation will be examined in detail during Future Developments & Planning workshops. Other architectural disciplines, service managers, engineers and key business representatives should participate in these workshops in order to create maximum insight and support for planning infrastructure development.

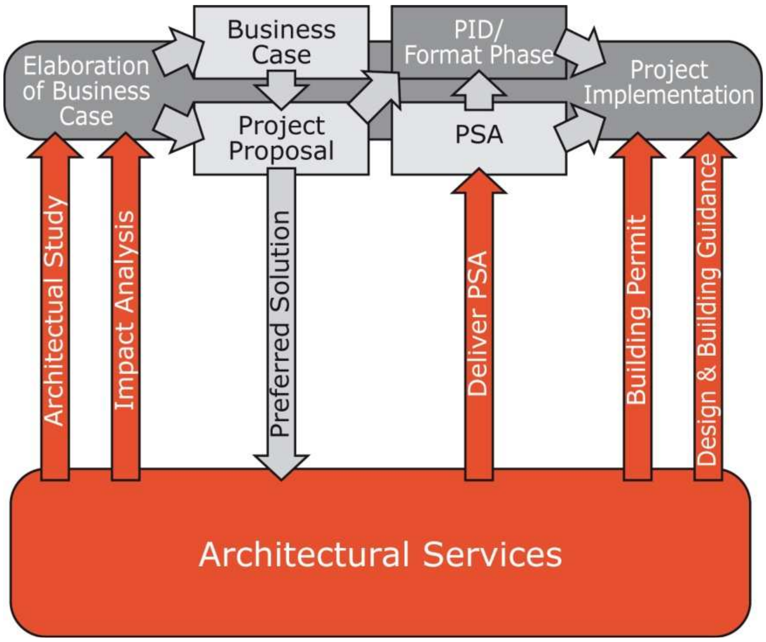
In the figure below, relationships between the core architectural products are shown:



Core architectural products and their relation

4.2 Project Guidance

Architecture Services plays an important role by providing projects with architectural guidance and instructions. It must also ensure that these instructions are properly implemented within the project. In the figure below, the relation between Architecture Services and a project is illustrated:



Project Guidance, offered by Architectural Services

A brief description of the various project guidance products created by Architectural Services is presented below.

4.2.1 Architectural Study & Impact Analysis

During initiation of a project, Architectural Services will provide input for the Business Case with an Architectural Study and an Impact Analysis. For every feasible solution, an Architectural Study will be drawn up. An Impact Analysis will accompany the Architectural Study detailing the probable impact of the solution. Specifically for infrastructure architecture, an Impact Analysis will contain a gap analysis identifying which existing infrastructure facilities will be shared (and therefore will remain unchanged), which infrastructure facilities need to be expanded to implement the project and which new (and newly defined) infrastructure facilities need to be developed. The Reference Architecture and Product Catalogue will provide the necessary background information for the gap analysis.

4.2.2 Project Start Architecture

A Project Start Architecture (PSA) contains all relevant principles, models and standards that are applicable to the type of project and represents the architectural instructions specific to the project. Input for the PSA comes from the Architectural Study and the Impact Analysis based on the project team's preferred solution. A PSA also specifies facilities needed by the project that are not part of the Reference Architecture or the Product Catalogue. The decision as to whether a change can be carried out within the project and under architectural supervision, or that new features can be developed without architectural supervision, depends on the scope of the project, its business value and the size and impact of the requested change. A specific project may be defined to provide new standards and solutions for new features. After validation of the PSA (by the responsible architectural authority), a so-called building permit will be issued allowing the project to continue.

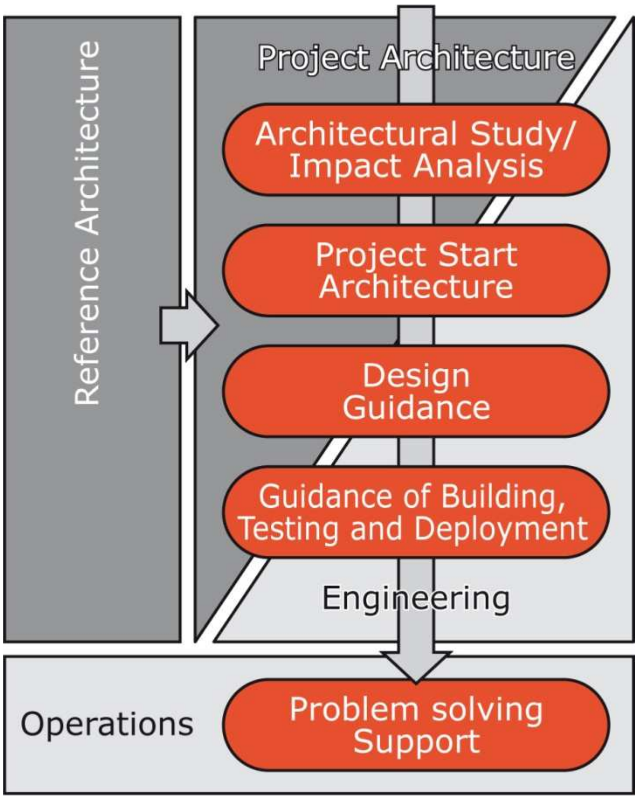
4.2.3 Design Guidance, Guidance of Building, Testing and Deployment

Once the PSA has been constructed, a project progresses through the various stages of design, build, test and deployment. During these phases, Architectural Services must actively support the project and monitor that the architectural instructions as set out in the PSA are being carried out properly. The best results come from a collaborative and open-minded attitude. Architects need to support project designers and engineers and be available to answer questions arising from practical application of architectural standards and instructions. If the standards apparently don't function as expected, architects should investigate and evaluate the standards to determine if changes are needed to the Product Catalogue and Reference Architecture, or that an exception needs to be made for the project. Once the change has been deployed, the appropriate building permit should be validated. If the architects have been continuously involved in the project, this step will obviously be a formality. If architects fail to provide projects with proactive support, the architectural process will probably be considered a burden instead of an efficient and beneficiary tool, which will make consolidation of the process with the organisation even more difficult.

4.3 Problem solving support

Once a facility is in use and can be regarded as a production facility, problems may occur which can be traced back to mismatches between standards. Proactive architectural support is decisive in such a situation. If facilities or solutions do not function as expected, architects should investigate the underlying problems and define changes to remedy these problems. Modifications to standards or solutions should also be made in the Reference Architecture and the Product Catalogue.

Architectural responsibility will change during the various stages of a project. This is illustrated in the figure below:



Input for and stages of Project Guidance

5 DYA|INFRASTRUCTURE AND SOA

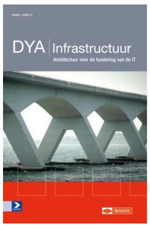
Implementing Service Oriented Architecture (SOA) will introduce the concept of common and shared services to the business and application architecture domains. As a result, both domains will acquire a number of typical infrastructure characteristics. For example, security issues and the need to accurately define priority, concepts which have been present within the infrastructure discipline for years. The further development of SOA may very well lead to a tighter integration of concepts within Business, Information and Infrastructure Architecture.

Infrastructure Architecture is none the less indispensable when implementing a Service Oriented Architecture, because for SOA to take root, a SOA-ready infrastructure must be available. A SOA-ready infrastructure must at least possess the following features:

- *Automation of Security and Management* – to enforce the complex security policies introduced by shared services and to enable detection and correction of failures affecting these services;
- *Identity Management & Federation* – to control authorised use of services both within and beyond organisational boundaries;
- *Standardised Enterprise Service Bus implementation* – to prevent or inhibit use of incompatible ESB facilities which may cause inefficient and ineffective SOA implementations;
- *Application Oriented Networking* – to enable redundant and intelligent routing and translation of messages between services;
- *Advanced Virtualisation* – to provide transparent infrastructure facilities to various classes of services.

DYA|Infrastructure helps to fulfil these demands on the infrastructure in two ways. Firstly, it deals with infrastructure from a service perspective, because it facilitates a decomposition of infrastructure landscapes into logically defined and functionally described facilities, which in DYA|Infrastructure terms are called Building Blocks. Secondly, it demonstrates how to integrate Business, Information and Infrastructure Architecture, providing an efficient and effective way to practise architecture within the infrastructure domain. These two measures bring a SOA-ready infrastructure within the reach of almost any organisation. It is therefore justifiable to claim that DYA|Infrastructure plays an important role in the evolution and implementation of SOA solutions.

6 DYA|INFRASTRUCTURE, THE BOOK



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6.1 Table of contents (translated)