Document:

Reference Architecture

Part:

Reference Architecture

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# REFERENCE ARCHITECTURE

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## Introduction

Our Enterprise acquires and sustains a diverse range of capability systems that operate in varied environments. Many of our capability systems are ICT systems, and most others are highly dependent on ICT enablers. our capability systems typically require high levels of technical interoperability but are also typically acquired and sustained with minimal coordination. As a result, most of our capability systems have incompatible architectures and significant additional investment is necessary to achieve interoperability-in-service.

1. Reference Architectures are to be written to specific topic areas and represent the authority for introducing their architectural artefacts into the Enterprise and are the configuration control item for those artefacts. They should be enduring, representing conventional wisdom at the time.
2. A combination of Reference A and B have been used to determine the content of a Reference Architecture for use in Defence.

### Definition

From Reference A, a Reference Architecture is defined as:

An authoritative source of information about a specific subject area that guides and constrains the instantiations of multiple architectures and solutions

The definition is depicted in Figure 1 (also from Reference A). The purpose of Reference Architecture is to align the respective Solution Architectures of interdependent capability systems, and therefore achieve technical interoperability-by-design.

1. Diagram

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2. Figure 1: Purpose of Reference Architecture
3. This document is the Reference Architecture for Reference Architecture in Defence. It introduces what comprises a Reference Architecture and what they are for.

### Scope

This document applies to Reference Architecture for all subject areas in our business; at the Business, Information and Technology layers; in all security domains; in both the fixed and deployed environment.

### Audience

This document should be used by:

1. Enterprise Architects developing and maintaining Reference Architecture in Defence, and
2. Solution Architects, Capability Managers and Project Managers using Reference Architecture in Defence.

## Target Audience

Reference Architecture is relevant to audiences spanning senior business leaders to solution developers, and applies throughout the Capability Life Cycle from concept through to implementation (Reference B). The different components of Reference Architecture are typically tailored for different target audiences, as shown in Figure 2, and this difference is expressed through the level of detail or abstraction used to describe each component.

1. Diagram

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2. Figure 2: Target Audience of Reference Architecture Artefacts

## Structure

A Reference Architecture comprises the following components:

1. **Introduction.** Identifies goals and objectives of the Reference Architecture and describes the specific purpose.
2. **Discussion.** Provides the background and rational for the content of the Reference Architecture. Headings are appropriate to the content.
3. **Principles.** High-level guidance for the entire Reference Architecture.
4. **Reference Model.** A taxonomy of accepted concepts used to describe capability.
5. **Decision Frameworks.** Recommended combinations of Standards and Patterns for typical use cases based on the Reference Model.
6. **Standards.** Descriptions of preferred data formats or interface specifications that support the Reference Architecture’s technical intent.
7. **Patterns.** Descriptions of preferred technologies, designs and data formats that solve specific use cases.
8. Certain subject area Reference Architectures may only include a subset of these components.
9. The presentation of a Reference Architecture typically also includes an Overview section that contains background information and describes how it relates to other Reference Architectures.

## Overview

Reference Architecture bridges the highest-level driving factors in a business and the acquisition and sustainment activities performed by its projects, as shown in Figure 3.

1. Graphical user interface, application, email

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2. Figure 3: Context of Reference Architecture

### Background

Our Business is a large and complex enterprise that comprises many diverse lines of business with differing degrees of interdependency. It follows that the Reference Architecture for Defence will be correspondingly large and complex. A federated approach to developing and maintaining Reference Architecture is regarded as international best practice for large and complex enterprise8.

1. A federated architecture divides a large and complex enterprise into multiple subject areas, each of manageable complexity, and semi-independently develops and maintains each subject area Reference Architecture within a common governance framework. This approach enables an architecture practice to perform agile and asynchronous development and maintenance of its Reference Architecture. Within the Defence, the federated approach also accommodates the need for Enterprise Architects with the diverse, military-specific subject matter expertise required to effectively and efficiently develop and maintain Reference Architecture.
2. Various published architecture frameworks differ in their definition of the architecture stack, but generally agree that it comprises three core layers: Business, Information and Technology. Some frameworks further sub-divide these core layers, and propose different orderings of those sub-layers; however, Reference Architecture in Defence considers the three core layers only.

### Usage

Reference Architectures may be defined at many levels of detail and abstraction (from specific to generalised) and for many different purposes. In fact, a Reference Architecture for one subject area can be a specialisation of a more general Reference Architecture in another subject area. The level of abstraction provided in a Reference Architecture is a function of its intended usage.

1. Reference Architectures are to be the authority for:
2. introducing new artefacts in to the Enterprise Architecture,
3. the existence of patterns,
4. the applicability of standards, and
5. the application of rules and principle to guide solutions.
6. Reference Architectures are to be the Configuration Item (CI) that is approved, maintained and referenced. The models derived from the Reference Architecture and provisioned in modelling tools are to allow the information to be consumed and applied to various decision support processes.

### Modelling

The Reference Architectures themselves (and what they cross reference), the patterns, the standards and indeed the Reference Models that are introduced are all to be modelled in the Enterprise Architecture Repository.

1. This is intended to achieve two specific outcomes:
2. The management of the relationships between the artefacts will assist in the maintenance and discovery of the architectural artefacts.
3. The modelling of the Reference Models and the Decision Frameworks will provide the mechanisms for Solution Architects to apply guidance to their solutions.

### Intent

Reference Architectures are to be timeless (see Principles below). Therefore they should be written with appropriate language and a degree of abstractedness to allow for this. To support the timeless intent the following things would not typically be included in a Reference Architecture, unless abstracted to the extent that they are just concepts that survive over time:

1. Organisations details;
2. Processes, procedures and activities; and
3. Other dynamic processes.
4. If a Reference Architecture contains any of the above, then it is an indicator that what is being written may not be a Reference Architecture.

## Principles

This section captures the principles introduced in the Reference Architecture. The detail of the principle along with its source (ie the Reference Architecture) is to be captured in the model.

1. The following principles have been extracts from the discussion:
2. **Reference Architecture is federated.** Defence is too large and complex to be addressed by a monolithic Reference Architecture. A federated approach should be taken to develop and maintain a managed library of subject area Reference Architectures at the Business, Information and Technology layers, which individually describe the many diverse lines of business of the Department and collectively describe the entire One Defence Business Model.
3. **Reference Architecture is timeless.** A Reference Architecture should not include detail on specific organisations, capability systems or business processes. A Reference Architecture guides and constrains instantiated architectures which can describe ‘as-is’ or ‘to-be’ states of the business, it does not directly describe those temporal states. A Reference Architecture should instead describe capability concepts that will remain valid for the foreseeable future.
4. **Reference Architecture requires maintenance.** While Reference Architecture should be developed to remain valid for the foreseeable future, it must be maintained to ensure it remains valid as the business evolves. Standards, Patterns and Decision Frameworks in particular require frequent review and update to maintain their timeless relevance; Standards are revised or deprecated, reusable solutions may be harvested from projects to become Patterns, and changes in the business model will add, remove or change the use cases upon which Decision Frameworks are based.
5. **Reference Architecture requires configuration management.** A Reference Architecture is a Configuration Item and must be approved, maintained and controlled as such. Reference Models, Standards and Patterns should all be modelled in a suitable software modelling tool. All components should be managed in a suitable records management tool.

## Reference Models

Reference C defines a reference model as:

A Reference model is an abstract framework for understanding significant relationships among the entities of [an] environment, and for the development of consistent standards or specifications supporting that environment. A reference model is based on a small number of unifying concepts and may be used as a basis for education and explaining standards to a non-specialist. A reference model is not directly tied to any standards, technologies, or other concrete implementation details, but it does seek to provide common semantics that can be used unambiguously across and between different implementations.

Within a Reference Architecture, the discussion and the subsequent introduction of taxonomies and their relationships results in a reference model that can be included in the overall Enterprise Architecture.

1. For a given taxonomy the terms that make it up can be flat or hierarchical. The terms should form a complete, consistent set of like concepts and the thing that discriminates between the terms should be clearly articulated.
2. It is the Reference Model taxonomies that will form the basis for the Decision Framework.
3. **Standards.** Like patterns, standards can be introduced in a Reference Architecture. Indeed Reference Architectures are one method for making a standard authoritative.
4. **Decision Frameworks.** The application of the reference models, patterns and standards comprise a decision framework. The Decision Frame work is basically the logic that when applied to a set of variables or factors relating to a problem in the subject area covered by the Reference Architecture, results in appropriate patterns, standards or other guidelines being applied.

## Decision Framework

There is no decision framework associated with this Reference Architecture. In other documents any section that wasn’t used should be left out.

## Patterns

When specific questions need to be answered with a consistent approach or template solution, a pattern can be introduced. From Reference E:

The simplest way to describe a pattern is that it provides a proven solution to a common problem individually documented in a consistent format and usually as part of a larger collection.

As patterns are independent documents that should be written to standalone in the pattern library. ‘0001 – Architectural Patterns’ is the first pattern and is the template for Defence patterns. New and existing patterns can be called out in the Reference Architecture to achieve specific intents, they:

1. can be used to ensure consistency in how systems are designed and built;
2. are usually flexible and optional (and openly document the impacts of their application and even suggest alternative approaches); and
3. can enrich the vocabulary of a given IT field because each pattern is given a meaningful name.
4. A Pattern’s authority to be applied comes from its use in a Reference Architecture.

## Standards

Like patterns, standards can be introduced in a Reference Architecture. Indeed Reference Architectures are one method for making a standard authoritative.

1. As the target audience is predominately Defence, the approach to formatting Reference Architectures will conform to the styles and guideline of Reference D.

## Conclusion

Adherence to the guidelines and intent of this document will result in a consistent, coherent and long lived set of Reference Architectures that contribute to Defence’s Enterprise Architecture. These documents and the models they introduce will provide authoritative and consistent guidance to the acquisition process.