



## Enterprise Architecture (EA) Principles

### Introduction

The Enterprise Architecture principles express how Highways England needs to design and deploy information systems across the organisation. They serve to streamline and reduce the complexity of IT investment decisions.

The principles should be used to:

- Evaluate the selection of suppliers, solution designs, products and services
- Support evidence-based decision making
- Help define functional requirements

These principles help projects and suppliers with their architecture and service management planning and must be used throughout the project lifecycle from concept validation to procurement and delivery. The principles are relevant for planning and delivering future ICT. They are inter-related and must be considered as a set. They describe the desired behaviors, and rationale, expected in all initiatives containing any elements of Information, Communications or Technology (ICT).

This version of the principles supersedes all previous versions and references. The previous version built on an example set of good generic architecture principles. This version increases the relevance to Highways England in achieving the desired state for Future ICT. They are aligned with service design guidance from Government Digital Service and proven industry best practice, including The Open Group Architecture Framework (TOGAF) and IT Service Management (ITSM).

The diagram at the end of this document shows how and when to engage with the Enterprise Architecture team.

### General Principles

#### GP1: Primacy of Principles

Statement	These principles apply to all directorates within the company. Any team or individual is required to either comply with these principles or to explain why they can't or won't comply.
Rationale	Compliance with these principles is the only way that a consistent and measurable level of ICT quality and service delivery can be provided to the business.
Implications	Wholesale divergence from the principles will increase the complexity of ICT service delivery to the business and potentially lead to higher total cost of ownership.

**GP2: Reuse before buy, before build**

Statement	Business applications, system components and data will be reused wherever possible, purchased as commodity solutions if necessary and only built if there is a unique requirement that cannot otherwise be fulfilled.
Rationale	Reuse will provide value for money by simplifying the ICT landscape, reducing data duplication and adopting common business processes.
Implications	Funding of programmes and projects will need to cater for cross project delivery (shared services) to avoid unnecessary duplication of ICT services (silos). To maximise value and reduce complexity requirements for shared services should be captured cross project.

**GP3: Seek architecture approval**

Statement	All projects and programmes will be subject to architectural approval at key stages throughout the delivery lifecycle.
Rationale	To ensure that projects collectively move in the technology direction that is required by the Highways EA. To control and prevent divergence from strategic intent and to understand the trade-offs around any divergence.
Implications	Projects must provide a clear business justification for changes to the architecture. Changes to the architecture need to be formally managed so that divergence is controlled. Exceptions may be granted on the understanding that re-alignment is achieved at some future date through an approved plan of action. Dispensations would normally be granted for a limited duration only.

**Information Principles****IP1: Manage data as an asset**

Statement	Data will be managed to ensure its accuracy and quality to support informed business decisions.
Rationale	Information is the lifeblood of the company and data needs to be managed accordingly. Accurate, timely data is critical to deliver information and support informed business decisions.
Implications	There must be an Information Asset Owner (IAO) that is responsible for assuring that information is properly managed. All projects that handle a significant amount of data must have a data management plan and information asset register to describe the data used and the security classification of the data.

**IP2: Ensure data is mastered and shared**

Statement	Everyone must work from the same data and know its source.
Rationale	Proliferation of structured data and unstructured data must be controlled to ensure accurate data is provided.
Implications	<p>Standard data models, data elements, and other metadata that defines the data needs to be developed and maintained.</p> <p>Technology solutions may necessitate technical copies of data. Any such technical requirement must have its design reviewed to ensure that the copies are synchronised with approved master sources of data.</p> <p>Technical copies of data must not be allowed as an alternative to system integration unless the copy of data can be synchronised with its recognised master.</p>

**IP3: Make data accessible**

Statement	Data must be easy to find and retrieve and present a single version of the truth.
Rationale	Data must come from a single authorised source that can be directly referenced.
Implications	The way information is accessed and displayed must be sufficiently adaptable to meet a wide range of users and their corresponding methods of access.

**Application Principles****AP1: Use existing services**

Statement	Don't do everything yourself, consume and use existing Application Program Interfaces (APIs). The functionality needed could be provided by an existing service.
Rationale	Modern applications (digital services) are built on top of a wide range of APIs. Eliminating the effort designing and implementing a duplicate service will reduce ICT project costs and shorten the time to deliver ICT projects.
Implications	<p>Projects and ICT service providers need to understand what services exists, are being built and planned so that they can plan and cost implementation activities accordingly.</p> <p>A service catalogue needs to be developed and maintained as the source of this information. This must be established for Future ICT bottom-up based on users' needs to avoid defining services based on existing legacy IT services.</p> <p>There must be a single service catalogue supporting ITSM and EA. This needs to communicate a pipeline of services to clearly show those proposed, under development, in operation and being retired.</p>

**AP2: Build services not applications**

Statement	Applications will be built as a collection of services that expose an Application Program Interface (API) enabling them to be combined to deliver users what they need.
Rationale	This facilitates reuse, interoperability and the ability to scale by reducing tight dependencies between components.
Implications	<p>Cloud-services and COTS products are expected to have well-defined APIs.</p> <p>An overlap of functionality can exist within multiple Cloud and COTS solutions. This must be managed to prevent unnecessary duplication of services.</p> <p>Service Design will need to cover Supplier Management, Availability Management, Capacity Management, Information Security Management and Service Continuity Management.</p>

**AP3: User interfaces should be browser-based**

Statement	User interfaces shall be delivered as web-based HTTP applications using using HTML5, CSS and JavaScript.
Rationale	Ensures that applications are independent of underlying platforms and are easy to use. This enables accessibility across different devices and decreases maintenance and deployment effort.
Implications	<p>Applications are web-based and stateless as reasonably possible.</p> <p>Commercial Off-The-Shelf (COTS) solutions may limit choices.</p> <p>Exceptions may arise for functions and services that are constrained by the selected platform, for example the roadside (cold and wet) technology.</p>

**AP4: Design applications to meet user needs**

Statement	User needs will be discovered from direct participation with users and evidence gathered on existing services usage.
Rationale	Understanding user needs and what functions and features are regularly used by them in existing services helps to prioritise and plan the delivery of new services and make changes to existing ones.
Implications	A small team will be required consisting of stakeholders and technical staff. Expertise in User Experience (UX) consultancy will be required.

**AP5: Pilot new applications and services**

Statement	Build a prototype, test it with users and learn from it.
Rationale	It is impossible to accurately predict everything upfront. A try before you buy approach validates investment plans, designs and technologies. Prototypes enable users to provide early feedback about the design of the solution.
Implications	Projects must be open to investing and testing new products and services on a small scale in order to de-risk large scale delivery projects. Consultation with Service Management is necessary to aid transition planning for service operation. This is only required for validated solutions that are being recommended for further development.

**Technology Principles****TP1: Use Open Standards and Open Source**

Statement	Open standards must be used in all solution designs to enable interoperability. Open source software must be compared and considered alongside commercial software when selecting technology solutions.
Rationale	Closed proprietary standards restrict reuse, reduce interoperability and can create vendor lock-in that leads to unforeseen financial costs. Compliance with <a href="#">HM Government Open Standards Principles</a> and GOV.UK <a href="#">Technology code of practice Point 5 and 6</a> .
Implications	Exit, rebid and rebuild costs must be taken into consideration during procurement decisions for best value for money comparisons, between open source and proprietary solutions. Open Source is not necessarily free to use. Many independent software vendors and value added resellers use open source technology within proprietary for-profit services. Other companies provide commercial service management wrappers around open source products. Commercial software needs to be considered alongside open source equivalents from a total cost of ownership perspective.

**TP2: Exploit the Cloud**

Statement	Solutions will be assessed to determine the benefits of migration to Cloud-based service models for infrastructure, platform and software.
Rationale	Assessment of architectures, workloads, finance, business risks, operations and security will determine if a solution can be re-hosted (IaaS), rebuilt (PaaS), replaced (SaaS) or refactored as a hybrid solution.
Implications	<p>Not every ICT service will be appropriate for delivery via the cloud. Evaluation criteria need to be created to provide the basis for an assessment model that can be used to justify architecture decisions. Cloud Service Providers must evidence the ITSM best practices, security and data protection standards followed.</p> <p>HE Service Management must include change management of SaaS based subscriptions to ensure that costs are controlled effectively.</p> <p>Disintermediation must be controlled. Cloud services must not be procured directly by business teams. This can unintentionally introduce unnecessary OPEX costs and inhibit reuse.</p>

**TP3: Manage technical debt and obsolescence**

Statement	The Future ICT for the company must make changes easier. Any tactical decisions that introduce technical debt (quick but messy solutions) will only be endorsed if there is a recognised actionable plan to address both of them technically and financially.
Rationale	Unaddressed technical debt increases the complexity and costs of maintaining ICT making it harder to upgrade software, transition services and deliver solutions that meet users' needs.
Implications	<p>Reducing technical debt must become part of the companies culture so that the current accrued debt in the ICT estate can be addressed.</p> <p>Dispensations for short term technical debt to meet tactical business imperatives can be granted.</p> <p>Applications and services need to be designed and delivered to be as technology independent as possible. An increased level of service-based architecture will be required. See AP1.</p> <p>Delivery projects adopting an Agile delivery method will need to have an Architecture Owner to safeguard against adding new technical debt into the Future ICT estate.</p> <p>Software and hardware ICT assets (non-Cloud) must be recorded and managed in a configuration management system.</p>

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**Change History**

<b>Version</b>	<b>Date</b>	<b>Author</b>	<b>Change</b>
1.0	November 2008	Mike Williams	First version
1.1 – 1.6	Nov 2008 – Jan 2009	Mike Williams	Minor changes and refinement
1.7	March 2010	Ivan Wells	Alignment with TOGAF and Government ICT Strategy
2.0	October 2015	Dave Horton	Simplification and alignment with UK.GOV digital service design guidance.
2.1	January 2016	Dave Horton	Updated guidance on page 8.

**Approvals**

<b>Name</b>	<b>Role</b>	<b>Date</b>	<b>Version</b>
Ivan Wells	Senior Enterprise Architect	30 <sup>th</sup> September 2015	2.0
Ivan Wells	Senior Enterprise Architect	11 <sup>th</sup> January 2016	2.1

## Summary of Principles

### Highways England – Enterprise Architecture (EA) Principles

#### Plan

GP1 | Reuse before buy, before build

GP2 | Seek architecture approval

#### Information

IP1 | Manage data as an asset

IP2 | Ensure data is mastered and shared

IP3 | Make data accessible

#### Application

AP1 | Use existing services

AP2 | Build services not applications

AP3 | User interface should be browser-based

AP4 | Design applications to meet user needs

AP5 | Pilot new applications and services

#### Technology

TP1 | Use Open Standard and Open Source

TP2 | Exploit the Cloud

TP3 | Manage technical debt and obsolescence



# How to engage with the Service Design team

Idea	Start-up	Initiation	Requirements	Architecture	Solution Design	Procurement
<p><b>Why this is important</b></p> <p>To seek formal approval to progress to a business case</p> <p><b>What you need to do</b></p> <ul style="list-style-type: none"> <li>describe the opportunity</li> <li>define the need</li> <li>determine contribution to strategy</li> <li>define the scope</li> <li>identify business functions</li> <li>identify likely benefits</li> <li>identify likely costs</li> <li>identify funding source</li> </ul> <p><b>Groups consulted</b></p> <ul style="list-style-type: none"> <li>Service Design</li> <li>IT Business Partner</li> </ul> <p><b>Products</b></p> <ul style="list-style-type: none"> <li>project brief</li> <li>outline project plan</li> </ul> <p><b>Governance</b></p> <ul style="list-style-type: none"> <li>IPAG</li> </ul>	<p><b>Why this is important</b></p> <p>To provide sufficient information so that a decision can be made to progress to a project</p> <p><b>What you need to do</b></p> <ul style="list-style-type: none"> <li>establish project management</li> <li>produce project brief</li> <li>develop initiation plan</li> <li>determine benefits and costs</li> <li>identify funding and tolerances</li> <li>perform initial risk analysis</li> <li>high-level options analysis</li> <li>assess alignment to enterprise architecture principles</li> <li>produce strategic business case</li> </ul> <p><b>Groups consulted</b></p> <ul style="list-style-type: none"> <li>Service Design (TDA) (EA)</li> <li>IT Business Partner</li> </ul> <p><b>Products</b></p> <ul style="list-style-type: none"> <li>updated project brief / mandate</li> <li>updated project plan</li> <li>outline business case</li> </ul> <p><b>Governance</b></p> <ul style="list-style-type: none"> <li>IPAG</li> </ul>	<p><b>Why this is important</b></p> <p>To define how, why, what, when and estimated costs for approval by the IPAG</p> <p><b>What you need to do</b></p> <ul style="list-style-type: none"> <li>mobilise the project team</li> <li>assemble product descriptions</li> <li>determine deployment strategy</li> <li>create risk/issue logs</li> </ul> <p><b>Groups consulted</b></p> <ul style="list-style-type: none"> <li>IT Business Partner</li> <li>Service Towers (SIAM)</li> <li>Service Towers (as required)</li> </ul> <p><b>Products</b></p> <ul style="list-style-type: none"> <li>vision statement</li> <li>benefit profiles</li> <li>benefits realisation plan</li> <li>business change plan</li> <li>information assurance plan</li> <li>communications plan</li> <li>project quality plan</li> </ul> <p><b>Governance</b></p> <ul style="list-style-type: none"> <li>Project Board</li> </ul>	<p><b>Why this is important</b></p> <p>To define what the business needs and determine the needs of the user</p> <p><b>What you need to do</b></p> <ul style="list-style-type: none"> <li>determine user needs</li> <li>define to-be processes</li> <li>gather the requirements</li> <li>categorise requirements mandatory, highly desirable, desirable and optional</li> <li>obtain stakeholder buy-in</li> <li>develop conceptual architecture</li> <li>define change management approach</li> </ul> <p><b>Groups consulted</b></p> <ul style="list-style-type: none"> <li>Service Design (EA)</li> <li>Service Operations</li> <li>Information Management (Security)</li> <li>IT Business Partner</li> </ul> <p><b>Products</b></p> <ul style="list-style-type: none"> <li>solution architecture / blueprint</li> <li>change management approach</li> <li>business requirements</li> <li>updated benefits realisation plan</li> <li>requirements traceability matrix</li> <li>stakeholder engagement plan</li> <li>communications plan</li> <li>updated outline business case</li> </ul> <p><b>Governance</b></p> <ul style="list-style-type: none"> <li>Project Board</li> <li>Service Design</li> </ul>	<p><b>Why this is important</b></p> <p>To define what the proposed solution architecture and high-level design would be, have it reviewed and gain endorsement</p> <p><b>What you need to do</b></p> <ul style="list-style-type: none"> <li>describe and analyse current operational environment</li> <li>describe reuse opportunities, problems, compliance requirements</li> <li>define how solution contributes to the strategy</li> <li>perform options analysis</li> <li>assess and recommend options</li> </ul> <p><b>Groups consulted</b></p> <ul style="list-style-type: none"> <li>Service Design (EA)</li> <li>Service Operations</li> <li>Information Management (Security)</li> </ul> <p><b>Products</b></p> <ul style="list-style-type: none"> <li>target solution architecture</li> <li>detailed options analysis document</li> <li>software requirements specification</li> <li>solution architecture checklist</li> </ul> <p><b>Governance</b></p> <ul style="list-style-type: none"> <li>Service Design</li> <li>Information Management</li> </ul>	<p><b>Why this is important</b></p> <p>To finalise how the solution or service will be delivered</p> <p><b>What you need to do</b></p> <ul style="list-style-type: none"> <li>identify solution options</li> <li>define selection criteria</li> <li>evaluate options</li> <li>conduct risk assessment</li> <li>review costs and benefits</li> <li>obtain endorsement</li> <li>develop a physical architecture and update the enterprise architecture</li> <li>confirm funding</li> <li>develop test strategy and plan</li> </ul> <p><b>Groups consulted</b></p> <ul style="list-style-type: none"> <li>Service Design (EA)</li> <li>Service Transition</li> <li>Procurement</li> </ul> <p><b>Products</b></p> <ul style="list-style-type: none"> <li>updated solution architecture</li> <li>detailed options analysis document</li> <li>software requirements specification</li> <li>solution architecture checklist</li> </ul> <p><b>Governance</b></p> <ul style="list-style-type: none"> <li>Project Board</li> <li>IPAG</li> <li>Service Design</li> </ul>	<p><b>Why this is important</b></p> <p>To undertake a structured process to procure an ICT solution or system integrator capability to deliver the solution</p> <p><b>What you need to do</b></p> <ul style="list-style-type: none"> <li>finalise specifications</li> <li>issue tender</li> <li>evaluate offers using solution architecture checklist</li> <li>assess strategy alignment</li> <li>define plan to maintain enterprise architecture to update the solution definition</li> <li>negotiate / agree contract</li> <li>sign contract</li> </ul> <p><b>Groups consulted</b></p> <ul style="list-style-type: none"> <li>Service Design</li> <li>Service Transition</li> </ul> <p><b>Products</b></p> <ul style="list-style-type: none"> <li>full business case</li> <li>evaluation report</li> <li>contract schedules</li> <li>signed contract</li> </ul> <p><b>Governance</b></p> <ul style="list-style-type: none"> <li>Project Board</li> <li>IPAG</li> <li>Procurement</li> </ul>
<b>Concept Validation</b>		<b>Project Assurance</b>				
<b>Technical and Architectural Governance</b>						