information systems framework
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Executive Summary

The Government has invested in a number of ‘vertical’ strategic systems over the years. Typical systems in this context include Inland Revenue, Social Security and Vehicle Registration Systems amongst a number of others. Additionally, a number of ‘horizontal’, mostly shared services and / or solutions were also put in place, including the original payment and sms gateways. A number of these have, or are in the process of being supplemented, with a number of other key strategic investments in the areas of Electronic Forms (eForms), a centralised and personalised billing portal (myBills) as well as others.

The ability to share and re-use, to the maximum extent possible, current and future investment is considered a critical element for ensuring the best return on investment as well as the required degree of consolidation. In this respect, one of the key objectives of the Information Systems Framework is to act as an ‘information toolbox’ for information systems to increase their application scope and capabilities by making use of shareable and mashable ‘intelligence’. This augmented intelligence and subsequently value can be provided via investments made in corporate and shared systems. Such approach towards the capitalisation of external constituent intelligence by such systems in order to create new and innovative systems able to cater for an even wider set of functionality, is considered to be one of the best ways to introduce further innovation as well as reduce costs.

The Information Systems Framework presents the Government Strategic and Business models as the underlying patterns to the approaches Government intends to undertake in order to achieve the objectives highlighted above. It also portrays an Information Systems Blueprint intended to provide a high level perspective of the key vertical and horizontal systems that constitute the core information system landscape. A number of fundamental technology guiding principles are also described briefly, and mandated where contextually appropriate, to ensure the required degree of interoperability of solutions. These include open standards and service oriented architectures. This also increases the ability to ensure maximum re-use and hence better return on investment.

The Information Systems Framework also provides a basic set of indicators which specify best practices and patterns that can be applied to ensure smooth integration between the various horizontal and vertical solutions. This should enable quicker and additional service orchestrations which introduce the additional value added services from current investments. In this context, it is important that the necessary governance parameters, roles and responsibilities are clearly articulated. The Information Systems Framework provides a set of key guidelines to this extent as well.
This document should be read in conjunction with the National Interoperability Framework (NIF). One of the key objectives of the NIF is to present a strong vision of a “connected” Government through the alignment of departmental business processes, the standardisation, discovery and reuse of ICT assets and a continuous rigour in improving the level of trust in the services provided by the Public Sector. During the articulation of the NIF, the European context was duly considered by incorporating the principles and recommendations of initiatives such as the European Interoperability Framework, European Interoperability Strategy and the Semantic Interoperability Centre Europe (SEMIC.EU). The building blocks that are proposed are based on international best practices and experience acquired from 20 years of continuous ICT investment.

Finally, given the continued investments in the overall Information System landscape, as well as the opportunities to come up with innovative services based on current building blocks, the Information Systems Framework needs to be continuously kept up to date to reflect the current state. It should therefore be treated as a document which has a revision period of 12 months.
1. Roles and Responsibilities

This section highlights the primary roles and stakeholders within MITA together with their respective responsibilities of the Information Systems Framework.

**Business Clusters**

The Business Clusters group are responsible to ensure that the information systems currently in use, as well as those which are intended for introduction within the IS landscape, are reflected within the Information Systems Framework.

**Technology And Systems Governance**

The Technology and Systems Governance group are responsible to ensure that the relevant, key technological, architectural and best practice measures required for adoption are clearly described and kept up to date. The same applies to the articulation and currency of key Information Systems governance principles.

**Corporate Shared Services**

The Corporate Shared Services group are responsible for bringing together the various horizontal central systems that are common to a wide user population under a single management structure.

**eGoverment Team**

The eGovernment Department is responsible for seizing the opportunity of technology to deliver on a vision for eGovernment to become an essential component of public service transformation identified by a transparent, lean, well-connected administration. This administration will deliver a guaranteed quality of service for all, and do so with the highest possible consideration of the needs and expectations of the citizen as its customer.

**Strategy and Planning**

The Strategy and Planning group are responsible to ensure that the relevant strategies are established and are supported by appropriate business planning, ICT budgeting, performance management and governance processes. The department is also responsible for the process of delegation of responsibilities to line ministries.
2. Introduction to the Information Systems Framework

The National ICT Strategy for Malta (2008-2010) articulates a number of objectives in the Government’s context and vision for 2015. Based on a number of streams ranging from infrastructure to governance and regulation, it also establishes a number of targets which are intended to enable the transformation of Malta as a regional ICT services hub.

The MITA Strategic Plan\(^1\) is squarely aimed as one of the key enablers of this vision. It contextualises a number of initiatives which are planned to ensure that this vision is achieved. One of the deliverables of this plan intended to assist in achieving the objectives laid out is the articulation of the Information Systems Framework (ISF).

The primary objectives of the ISF is to describe a number of key building blocks that constitute the primary information system ecosystem currently in use within Government as well as to provide a clear set of definitions, roles and responsibilities applicable in context. The ISF brings together a number of perspectives including governance, regulatory and business which enable its audience to have concrete visibility of Government’s Information System landscape. A set of definitions are also provided, intended to ensure a common baseline for the interpretation of significant information systems concepts as applied within the same ecosystem.

The key audience of this Information Systems Framework include:

- Ministries & Chief Information Officers (CIO’s)
- Private and Public Sector
- General Public

This document is organised as follows.

2.1 Structure of Document

1. It articulates the mandates, roles and responsibilities of the relevant.
2. The document makes reference to several standards and procedures, together with the existing frameworks that MITA has been adopting in its operations.
3. A comprehensive outlook on the Government Strategic Model and the respective Information Systems Blue Print is subsequently provided.

\(^1\)MITA Strategic Plan 2009-2012
3. ICT Governance

3.1 MITA's mandate

MITA’s mandate is articulated in a public statute approved by the Cabinet of Ministers on the 6th of May 2008. The MITA Strategic Plan 2009-2012 (Strategy) affirms the Agency’s mandate as, to:

- Serve as the central driver of information and communications technology strategy, programmes and initiatives in Malta.

- Deliver and manage the execution of programmes related to the implementation of information technology and related systems in Government with the aim of enhancing public service delivery.

- Provide efficient and effective information and communications technology infrastructure services to Government as directed by its key stakeholders from time to time.

- Proliferate further application and take-up of information and communications technologies in society and economy.

- Promote and deliver programmes aimed at enhancing ICT education and the use of ICT as a learning tool.

MITA’s strategic role is a departure point from the role of its predecessor, namely being the key solutions provider for practically all Information Systems / Information Technologies (IS/IT) solutions within Government. In line with its key guiding principles stated in the Strategy, MITA will focus on what is core to its operations and what is fundamental to Government’s success in its national programmes.

MITA will therefore set the strategy, establish the associated ICT budgeting requirements and prioritisation, institute the IS/IT governance framework and guide the various stakeholders and carry out appropriate programme management of the strategic, complex and enterprise-oriented activities and programmes.

For the Agency to succeed in this paradigm shift of focusing on what is core and decentralising other responsibilities where appropriate, the Agency needs to realise two key objectives, namely:

1. Devolving and decentralising responsibilities to the Ministry Office of CIO’s and Line Ministries. This includes the devolution of responsibilities for Minor Systems.

2. Capitalising on the strong relationship with industry experienced players.
From an operational standpoint, MITA is gearing itself to focus on what is core. In this respect, it is considered in-congruent to continue to provide projects and services which are vertical in nature and which are deemed as ‘non-core’.

It is believed that these vertical activities will be delivered more efficiently and effectively by Line Ministries / Office of the CIO’s. The centralisation of such operations is not considered to make financial or operational sense (unless explicit circumstances mandate otherwise) – such an approach also increases the risk of stifling initiatives.

MITA has an overall responsibility for the successful delivery of the overall ICT strategy. In this respect, MITA is implementing a number of measures to ensure that the decentralised IT/IS approach is successful. The following measures are being taken:

1. Building the capacity of the Office of CIO’s by permeating best practices through the deployment of the ICT Governance Framework. MITA is gradually delegating activities and empowering the CIO’s to operate within the new paradigm of this decentralised framework.

2. Assisting in building the Office of CIO’s capacity to take up more vertical operational responsibilities whilst widening relevant strategic supervision on respective Ministries’ activities, in line with the objectives set out for them.

3. Transferring the knowledge, resources, operational and administrative responsibility of both current and the new ‘non-core systems’ to the line Ministries. The delegation process will ensure that the specific requirements, enhancements and new developments would be decided upon directly by line Ministries, within the wider direction and standard-setting environment of MITA.

3.3 Suppliers and Vendors

Suppliers and vendors have a key role in the implementation of the overall Government ICT strategy. In line with key guiding principles, MITA will build, nurture and sustain first-rate relations with the local and international IT industry within an aggressive outsourcing policy framework and programme, wherein the industry’s capabilities will be sought and capitalised upon to the maximum extent possible.

MITA has taken various measures to outsource the maintenance and support of a number of non-core services and operations. Worth mentioning are the activities relating to desktop services and PC leasing, as well as the outsourcing of the support of a number of non-core applications.

A key area where suppliers will have a major role to play is in assisting Government transform the way public services are delivered through the implementation of technology solutions. MITA will apply technologies to take service delivery to a completely new league, apply increased focus to citizen-centricity, service-personalisation and multiple-channel delivery as well as aggressively pursue virtualisation and aggregation amongst others. This transformation will be accompanied by the rationalisation of resources, processes and expenditure to deliver faster, cheaper and leaner services.

A cornerstone for this transformation is the implementation of a number of Core Information Systems (CIS’s), Corporate Shared Services (CSS) and eGovernment initiatives. Key to MITA achieving this Strategy is the selection of industry players who are experienced in their respective fields and enter into strategic arrangements with them (including those based on SaaS) to implement proven best-practice solutions, through an open and competitive process. Within the current strategic objectives, Malta is currently considered a relatively small market to expect increased sustainability of bespoke solutions development in the longer term. It is also believed that such an approach would result in a lost opportunity in terms of not being able to capitalise on established industry best practices. MITA’s objective is to maximise the return on investment which government makes in products and/or services procured from these vendors.
The Agency will also extend its academic relations to capture the interest and participation of relevant academic institutions of international repute, with the intent of attracting them to establish satellite operations in Malta. Under this same umbrella, the Agency will also engage major global and regional vendors and service providers to extend the range of specialisations through the proliferation of vendor-driven academic programmes linked directly to the inherent specialisation requirements of the specific industry and the major vendors.

3.4 MITA’s remit

3.4.1 IS Governance

A pre-requisite for MITA and the various stakeholders to operate successfully in a new paradigm of decentralised IT and IS management requires that a strong governance framework is established and be functioning effectively. Two key actions that the Agency is taking are:

1. Setting up, owning, driving and sustaining an ICT Governance Framework by establishing a comprehensive body of standards, policies, procedures and directives. These are intended to be adhered to by the various stakeholders, including Ministries and CIO’s, private and public sector entities, employees and suppliers.

2. Establishing a new Information Systems Framework (this document) intended to assist in the provisioning of the right environment for stimulating increased value from information systems investments within the public sector. This approach will strengthen IS governance, promote structured interoperability, encourage the attainment of improved integration and better define the multiple stakeholders’ roles and responsibilities in the effective deployment of information systems.

3.4.2 Enterprise Architecture Governance

Enterprise Architecture comprises of the entire Government IT ecosystem which includes Corporate Information Systems, the Core Information Systems, the eGovernment Shared Services and the underlying IT Infrastructure Services. MITA is responsible for ensuring a coherent Enterprise Architecture within Government. CIO’s are actively encouraged to pursue effective conformance with the Enterprise Architecture direction, including related applicable requirements as published in policies, procedures, technical standards and guidelines. Respective CIO contribution is considered a critical success factor in this regard. A comprehensive toolset to assist in relevant architecture assessment processes is in place. This process evaluates ICT solutions from five key perspectives namely the Enterprise, Business, Data, Application, and Technology viewpoints. Through this process, solutions are assessed and verified to conform with the current enterprise architecture direction and recorded within an authoritative inventory that is maintained by MITA. This acts as a point of reference with respect to the current state of the Government wide Enterprise Architecture. The overall Enterprise Architecture governance process is described, at a high level, in Figure 1.
3.4.3 Programme Management

One of the key activities that MITA is responsible for is the programme management of the various activities included in the MITA Strategic Plan. Programme management is especially important in view of the following considerations:

1. Transformational nature of the activities;
2. The importance of focusing on business outcomes which render business benefits and value, rather than merely on technology deliverables;
3. The complex and large-scale nature of the activities;
4. The involvement of various stakeholders.

3.4.4 Supporting Infrastructure

Another important role that MITA has been entrusted with is that of design, sourcing, deployment, maintenance, operation and support of secure infrastructure platforms required for the implementation of the programme of activities described in the strategy. MITA is responsible to ensure business continuity, data guardianship and effective governance of government’s data and information systems resources.

In the implementation of supporting infrastructure and platforms, suppliers and vendors are increasingly playing a fundamental role. Supplementing this Information Systems Framework, through respective roadmaps and blueprints, MITA will provide solution providers and their clients with the necessary visibility of the infrastructure opportunities being made available for the deployment of solutions.
3.5 Frameworks

3.5.1 Methodologies and Technologies
MITA is establishing a framework through which the industry is made aware of Government’s preferred technologies. MITA is committed to publish a Technology Outlook and Roadmap on a regular basis. The Agency’s posture of embracing the application of open standards and technologies as a matter of policy as well as a generic guideline for all technology-related decisions, making proprietary technologies an exception, is important. This is coupled with the smart consideration for open source applications and systems which will widen the Agency’s scope towards harnessing benefits for large-scale public implementations.

3.5.2 Core Information Systems Contractual Framework
The Agency has committed to partner with industry to develop an enhanced procurement framework for the acquisition of CIS’s. This is to achieve the two faceted objective of increasing the number of capable bidders competing for the provision of services to government and reducing the procurement cycle from requirements definition to implementation. Besides increased visibility of government’s procurement intentions, the Agency will also accelerate the adoption of ‘pre-qualification processes’, standard contracting documentation, price cap pre-notification and simplification of functional requirements. In this regard, MITA has embarked on a public consultation exercise on the proposed Contractual Framework which will govern the provisioning of CIS to the Government of Malta.

3.5.3 Procurement Framework
MITA is categorised as a Schedule 3 entity, meaning that the Agency can administer its own public procurement in accordance with the provisions of the Public Procurement Regulations 2010.

On a consistent basis, the Agency publishes a Procurement Outlook\(^2\), intended to provide the industry with prior visibility of tenders that are anticipated to be published over a period of time. This enables the industry to be better prepared to contribute to MITA’s and Government’s IT and IS requirements. This Outlook is not a definitive and/or exhaustive list and is compiled according to the general information available to MITA on the date of publication.

From an eGovernment perspective, an agile procurement framework, based on an open competitive process, is also being articulated. This is meant to be used by Public Sector entities to commission services related to the implementation, support and maintenance of eGovernment applications. These services range from business analysis, design, development, copyrighting, and maintenance and support of these applications.

3.5.4 The Programme Management Framework

If MITA is to be successful in its role, particularly that of transforming the way public services are delivered and implementing measures for Government to maximise the benefit from its IS/IT investments, the Agency cannot solely consider technological deliverables in isolation, but must focus on achieving the expected business outcomes and objectives through the implementation of IS/IT.

An important consideration in this regard is that MITA must move away from being primarily a software development shop and more towards becoming a programme management organisation of excellence. In this regard, the Agency is looking into establishing a Programme Management Framework which is based on industry best practices and which will enable a holistic, streamlined and standard operation for all programmes to the benefit of all relevant stakeholders. The programme management framework will be used to:

1. Implement the outcomes as identified in the Policy Documents / Strategies;
2. Manage the sourcing and deployment of the CIS/CSSs;
3. Manage the transformation of the public services based on industry best practices;
4. Establish and achieve the intended benefits.

3.5.5 GMICT Framework

In the current scenario where MITA is increasing outsourcing activities; contracting third-parties on a number of major investments related to business critical information systems and supporting platforms; taking measures to further empower the Office of CIO’s and Line Ministries as well as assuming a stronger governance and programme management role, having a strong IS/IT framework of policies, procedures and standards becomes fundamental.

In this respect, MITA is taking a number of steps to publish new and pertinent business, data, applications and technological standards, policies and procedures as well as ensure the continued updating of the current suite of policies. These measures, supported by a thorough compliance process and self-regulation are deemed to be critical for the successful implementation of the decentralised IS/IT management paradigm.

3.5.6 National ICT Interoperability Framework (NIF)

The National ICT Interoperability Framework (NIF) is driven by the following objectives describing the desired state of play of interoperable Public services:

1. Shared and re-usable ICT assets owned by Government are discoverable and can be easily used by Public services with minimal effort thus reducing their overall cost burden;
2. Public services are deployed on a flexible architecture centred on business needs and provisioned via standardised approaches and capabilities reducing dependencies on specific vendors, technologies and practices. In turn this promotes:
   a. a level playing field that allows multiple vendors to compete fairly and equally based on the feature set and performance levels of their products;
   b. more choices during the acquisition process which improves business continuity and exit strategy scenarios while keeping with the required performance levels and functional capabilities;
   c. the ability to take advantage of pre-established international best practices that have been proven to work by EU Member States;
3. Public services mediate administrative business processes by offering user-centric and one-stop shop services;
4. Inter-connectivity and information sharing between solution constituents, Public services and EU-wide implementations is transparent, secure and reliant;
5. Citizens can at any point in time request and make use of public information.
The NIF establishes a set of guiding principles that contribute towards improved interoperability among public services. The NIF provides focus on the identification of technical enablers for the exchange of meaningful information and the ability to re-use existing ICT resources. The NIF also takes into account the European context by adopting the definitions and introducing the principles and recommendations issued by the European Interoperability Framework (EIF) as directed by the European Interoperability Strategy (EIS). It also serves as an enabler for complimentary initiatives developed by MITA that specifically deal with the development and support of Public Services including, but not limited to, the Information Systems Framework and the Information Technology Strategic Plan. For its governance aspects, the NIF refers to the ICT Governance Framework and the Compliance Management Framework.

3.5.7 Other Related Frameworks

MITA has launched or plans to launch other frameworks which are intended to directly or indirectly support, to varying degrees, this Information Systems Framework. Particularly in view of the substantial investments that are happening or which are due to occur, the following frameworks are worth mentioning:

1. A basic framework has been drafted to identify the gap in the annual funding requirements between the cash outflows and the cash inflows required for the implementation of CIS/CSS. The cash outflows will need to cover the total costs of the solution / service over its entire lifetime, and will include (but will not be limited to) partner/supplier costs and MITA labour effort and infrastructure costs. Costs may be capital and/or recurrent in nature depending on the procurement approach and the contractual agreement established with the selected partner/s. The cash inflows will depend on various aspects including the annual budget allocation by Government, EU funding, the attainment of efficiency gains and the reduction in operational costs relating to systems that will be replaced by the new suite of CIS/CSS to be implemented. MITA may opt for various models in order to finance the annual funding gap. Such options may include (but are not limited to) Government charge-back, acquiring short-term financing options, and adopting long-term financing options both in terms the way agreements are done with partners/suppliers as well as through debt financing.

2. A value-optimisation framework to ensure that Government maximises the value and the benefits generated from the IT/IS investment. MITA intends to implement an industry standard framework for IT/IS Value Optimisation and apply it to its operations. The Agency will adopt a two phased approach with the first phase focusing on identifying and contracting training institutions that are certified to deliver training value optimisation framework, and to identify and contract suppliers that can provide assistance for the ex-ante work on key investments which MITA is performing and which are in the preparatory stages. The second phase will carry out a review of the outcomes of the first phase and upon confirming the value that MITA can gain from the implementation of the Framework, then the Agency will formalise the use of the Framework.
4. Information Systems Framework

The Information Systems Framework is made up of four key perspectives. These are the Government Strategic Model, Government Business Model, Information Systems Blueprint and Enterprise Architecture Governance Model.

The Government Strategic Model focuses on the high level perspectives which describe the three basic categories of Information Systems namely the Corporate, Citizen Facing and Core Information Systems.

The Government business model describes the modus operandi in which Government operates, making reference to the homogenous systems mapped to the Government business functions such as Taxation, Revenue Generating, Administration, Energy, Border Control, etc.
The Information Systems Blueprint provides a graphical representation of the main building blocks of the Information Systems Blueprint, highlighting the key interactions and the relationships within the Government Strategic Model.

Finally, the Enterprise Architecture Governance Model represents the key objectives of the Architecture Assessment process. The Architecture Assessment process verifies the alignment of the respective ICT investment to the Enterprise Architecture direction.

The Government Strategic Model (GSM) is based on three key facets, namely, corporate, citizen facing (or rather eGovernment) and core (including minor and information systems). All strategic building blocks are governed by the ICT Governance program which is managed and operated by MITA. The key objectives including attributes pertaining to the respective strategic building block consist of the following:

**4.1 Government Strategic Model**

**eGovernment Shared Services**
- Information Systems that facilitate the implementation of point of single contact public services
- Implement functionality common to all Core Information Systems
- Establish as a horizontal function that is managed by MITA
- Facilitate citizen participation through collaboration tools (Web 2.0)
- Provide guidelines on eGovernment Shared Services
- Facilitate, through guidance, the alignment to EU obligations related to public service delivery
- Concerned with the delivery of value-add services to the citizen
- Business change control process determined by MITA

**Core Information Systems**
- Information Systems intended to support the delivery and execution of the respective government business functions
- Owned by the respective line ministry
- Managed by the respective business cluster
- Operated according to defined roles and responsibilities
- MITA provides the necessary assistance and advisory support to the respective line minister
- Business change control process determined by the respective CIO

**Minor Information Systems**
- Transferred to line Ministries
- Responsibility taken over by Permanent Secretaries and CIO's
- MITA facilitates the relocation to line Ministries
- MITA provides the necessary assistance and advisory support to the respective line minister
- Systems logically grouped within a Business Cluster

**Corporate Shared Service**
- Information Systems intended to facilitate the execution of public administration
- Intendend to reduce redundant efforts in establishing enterprise wide services
- Owned and managed centrally
- Mainly operated by MITA
- Concerned on delivering value-add services to the administration
- Business change control process determined by MITA
All of the above share the following common characteristics:

- Governed by the GMICT Policies and Standards
- Enterprise Architecture alignment is confirmed through the Architecture Assessment process
- MITA provides relevant computing resources where applicable including the consideration for co-location services, dedicated virtual stacks to facilitate rapid solution deployment and operational autonomy

4.2 Government Business Model

There are a number of core business functions within Government such as taxation, revenue generation, and energy, and others. The Government Business Model (GBM) is intended to provide the business model the Government operates within in this context by mapping the respective systems to these core business functions.

Four Business Areas delineate Government operations into high-level categories relating to the purpose of Government (Services for Citizens), the mechanisms the Government uses to achieve its purpose (Mode of Delivery), the support functions necessary to conduct Government operations (Support Delivery of Services), and the resource management functions that support all areas of the Government’s business (Management of Government Resources). Figure 4 portrays a graphical representation of the GBM and how the Government’s solutions are mapped in this respect.
The Information System Blueprint provides a pictorial representation in Figure 5 of the architectural building blocks that represent the key Government systems and building blocks as well as their basic interactions and relationships. In line with the GSM, there are a number of key dimensions to the GSM, namely the citizen facing elements, the line of business (or vertical) systems, the common and shared systems as well as the horizontal counterparts.

Typical Vertical systems include
- Inland Revenue System
- Value Added Tax System
- Vehicle Registration System

Typical Citizen Facing systems include
- Inland Revenue Online
- myGov
- eForms

Typical Common Shared systems include
- Unified Communications
- eForms
- eMail
- Corporate Data Repository
The Government of Malta strives to ensure that maximum benefit and operational efficiency is derived from all technology investments. A number of technology strategic principles are therefore in place to engage MITA, vendors and suppliers towards providing solutions that follow this direction. These principles include abstraction, interoperability, loose coupling, cohesiveness and generality.

In this context, and where applicable, Government will try to give preference to solutions that exhibit concrete evidence of a number of key attributes that enable these principles. These attributes are identified in constituents that clearly reflect engineering patterns based on discrete yet highly interoperable elements. All inter-connectivity and information exchange (at hardware, network and software levels, etc.) between the solution constituents is to be built on the standards applicable in context. Software, Network and Hardware elements etc, as well as their intra-constituents should be independent of each other to the maximum extent possible.

Amongst others, Virtualisation and Open Standards are key enablers of the principles discussed herewith, as well as appropriate segregation at key layers of solution and component constituents. Specifically with respect to solution stacks (and irrespective whether the implementation is physical, virtual or otherwise) access to external (from respective sandboxed environments when in place) resources (including databases, directory services, etc.) is to be governed by appropriate adaptation (‘adapters’) schemes. Adapters are logical segregators – these adapters vary in shape and form, ranging from in-house developed software, off-the shelf software or specialised devices / environments (including firewalls, VLAN’s) as well as specific commercial arrangements.

The desktop element is considered even more critical in terms of the application and adherence to these principles. In this respect and to the maximum extent possible, dependencies on specific hardware and software stacks and respective configurations should be avoided or appropriately mitigated.
When procurement of information systems is initiated, a number of governing principles are being adopted to ensure that, to the extent possible, the above are met, namely:

1. If specific functionality exists and is available via solutions already in operation within the ICT landscape, an in-depth assessment of whether and to what extent the consideration for not using / procuring the replicated functionality is required. This is governed through the respective Enterprise Architecture evaluation processes identified herewith.

2. For acquired solutions, in line with the principles articulated above, key intelligence and processes provided by the said solution should actively try to expose such functionality in an industry standard fashion, using open standards approaches to the maximum extent possible.

3. The ability to transform data is considered a critical element. The ability to have the required degree of access to the governing schema as well as underlying data is thus considered to be a critical success factor.

4. The ability to seamlessly inter-operate between key ICT ecosystem solutions and services using industry standard approaches is considered critical. Solutions and services must therefore clearly exhibit engineering properties which enable interoperability to the maximum possible extent.

5. The Government actively encourages the appropriate mashing up of existing intelligence to promote and come up with new solutions and services.

This section provides a basic set of considerations that are intended to positively contribute towards achieving the objectives laid down by the key technology principles articulated earlier.

Under most circumstances and through normal evolution, each system will at some point in time need to provide or be provided with information from external systems. Irrespective of architecture style, some form of inter-operation is frequently required. Interoperation cannot be considered as an afterthought through system extensions, customisations, data import/export modules, etc. Furthermore, the European dimension has also introduced increased challenges in the context of the requirement to provide services which are not solely intended for Maltese citizens but also to other European citizens and systems which need to interact with Government’s systems amplifying the importance of pan-European interoperability.

ICT systems in Government have witnessed different architecture patterns in their design; mostly lying on a continuum of architectures which, at one end presents a shared everything approach and on the other a share nothing (silo) style. Both extremes were (and to varying extents sometimes still are) well suited for specific situations. It is crucial to ensure that any integration (in its wider context) of different solutions is approached and implemented using open standards (briefly discussed later on). This is key to ensure that whilst the individual eco-systems sustained by such solutions (and the solution itself) can evolve at their own pace, any ‘linkages’/’interconnections’ that exist between the different eco-systems themselves at any point in time, are not brittle and thus easily prone to break with discrete or direct changes, creating ‘fissures’ which are expensive to remedy.

One of the key objectives of the Government’s Interoperability initiative is to facilitate the delivery of Government Public Services to citizens, business communities and European member state administrations through interoperability. MITA adapted the European Interoperability Framework’s definition and application of, aligning it to the local context:
“Interoperability, within the context of public services 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.”

Each information system is effectively composed of a number of layers, starting with the business processes it supports, the actual information (or data) it has to understand and utilise and the underlying technical infrastructure that supports it. All these layers have respective interoperability requirements and challenges, which can be mitigated by a number of key enablers. In this section we mention three key pillars for Interoperability, i.e. Open Standards, Service Oriented Architectures and the Enterprise Service Bus.

4.3.2.2 Interoperability levels

Information systems tend to reflect the technology, design patterns and influencing factors that are present / available during their conception. It is also normal that information systems go through an evolutionary process through their lifetime which reflect and accommodate for additional or changes in requirements, as well as at times, to re-align with newer technologies. Volatility plays an important part in determining information systems life-span and how they evolve through time. Furthermore, numerous factors will influence interoperability properties, emergent or otherwise, including but not limited to market forces and technologies, which cannot be identified nor quantified at this point in time.

A number of interoperability levels, based on those presented in the ‘Levels Of Conceptual Interoperability Model’ (LCIM)³ have been identified as initial baselines to gauge the current level of interoperability of the various information systems currently employed within the Government ICT ecosystems into consideration, summarised below.

- **Level 0**: No connection is possible at all.
- **Level 1**: The technical level, physical connectivity is possible allowing bits and bytes to be exchange.
- **Level 2**: The syntactical level, data can be exchanged in standardised formats, i.e., the same protocols and formats are supported.
- **Level 3**: The semantic level, not only data but also its contexts, i.e. information, can be exchanged. The unambiguous meaning of data is defined by common reference models.
- **Level 4**: The pragmatic/dynamical level, information and its use and applicability, i.e. knowledge, can be exchanged. The applicability of information is here defined in an unambiguous form.
- **Level 5**: As a system operates on data over time, the state of that system will change, and this includes the assumptions and constraints that affect its data interchange. If systems have attained Dynamic Interoperability, they are able to comprehend the state changes that occur in the assumptions and constraints that each is making over time, and they are able to take advantage of those changes. When interested specifically in the effects of operations, this becomes increasingly important; the effect of the information exchange within the participating systems is unambiguously defined.
- **Level 6**: If the conceptual model – i.e. the assumptions and constraints of the meaningful abstraction of reality – are aligned, the highest level of interoperability is reached: Conceptual Interoperability. This requires that conceptual models are documented based on engineering methods enabling their interpretation and evaluation by other engineers.

Within the wider scope of Government, the desired baseline interoperability level established is Level 5 of the LCIM model. This level of interoperability is defined as “the pragmatic/dynamical level, information and its use and applicability, i.e. knowledge, can be exchanged. The applicability of information is here defined in an unambiguous form”. The selection is based on the importance that MITA is giving to the adoption of open standards/specifications, which are amongst the primary enables for interoperability. It is pertinent to note that the particular selection of this level is simply a measure adopted for the sake of this context rather than based on any particular requirement.

³Tolk Andreas Dr and Maguira James (2003). The Levels of Conceptual Interoperability. Virginia Modeling Analysis & Simulation Center (VMASC) College of Engineering and Technology Old Dominion University Norfolk, VA 3529. [Online] Available at www.se.cmu.edu/isis/pdfs/tolk.pdf
The average life-span (based purely from a total technology refresh perspective) of a strategic information system at large can be assumed to be between 36 to 52 months. In order to ensure the required degree of re-use of solutions and intelligence that is already in operation, it is fundamental that the guiding principles proposed herewith are adopted and adhered to upfront.

The European Commission has recently launched its 10-year Digital Agenda, Europe’s strategy for a flourishing digital economy by 2020. Amongst others, the strategy proposes to increase the quantity and quality of standards recognised and developed in Europe and promotes a better use of such standards.

The need for inter-operation has in time created the need for repeatability, compatibility and now adaptability capabilities. In this context, a standard is a technical specification, set as a rule, guideline or definition, which is approved by a recognised organisation and also designed to be consistently used within the industry. Calling a standard as ‘open’ makes a clear distinction against the so-called ‘closed’, ‘de facto’ or ‘proprietary’ standards which may favour a single vendor or a small group of vendors only.

Open standards are normally subject to full public assessment and can be used without constraints in an equally available manner. The market is not however only made up of completely ‘open’ or ‘closed’ standards; some standards may require purchase of the specification, have restrictions to certain fields of application and require royalty payments to intellectual property owners. Common types of intellectual property include patents, copyrights and trademarks and may apply differently according to the relevant legal jurisdiction.

Ultimately, the adoption of open standards will result in a number of tangible benefits, namely:

1. Reduced vendor lock-in and dependency on specific hardware and software;
2. Easier integration between ICT systems;
3. Efficient re-use of existing ICT resources;
4. Improved access to public information.

Data in general is regularly regarded as the crown jewel of most businesses and enterprises alike. It is also safe to infer that shareable data is one of the most valuable assets any generic information system ecosystem can be provided with. The Government of Malta was a very early adopter of sound shareable data principles. A number of highly successful initiatives, such as the Common Database and Corporate Data Repository, are typical examples in this respect. The ever increasing number of ‘consumers’ that are identifying the value, and require the consumption, of shareable data is on the increase, which further amplifies the requirement for shareable data elements and a sound platform for its provision.

Several additional major initiatives (or extensions) are also currently under-way in this respect that consume and contribute, to various extents, shareable data elements, including but not limited to the National Identity Management System. Additionally, information systems such as the Passports System and Electronic Identity (amongst others) continue to evolve at their own pace. This has created an opportunity window to take a step back and consider an evolution of the current approach towards the provisioning of shareable data from an architecture perspective.

Although there is no real formal definition, the notion of shareable data universes is a concept that allows federated pools of data (and / or aggregated for temporal or permanent usage where applicable and appropriate) to be able to seamlessly exchange typical Creating Reading Updating Deleting (CRUD) ‘operations’ (and others) via enterprise service buses, service oriented architectures and interface schemes based on de-facto industry standards. This approach creates the opportunity for the discrete elements (or planets in the universe, i.e. domains or line of business solutions) to evolve according to their own ecosystem requirements as well as pace, in a fully autonomous fashion.
Service oriented architectures are architectural styles that package discrete functions as a set of de-coupled, atomic and shareable services, which are offered for consumption via open standards. The Enterprise Service Bus (ESB) concept is based on “set of infrastructure capabilities implemented by middleware technology that enable an SOA. The ESB supports service, message, and event-based interactions in a heterogeneous environment, with appropriate service levels and manageability.”

Data services provide the appropriate processing logic that is required for performing the necessary CRUD and/or other operations. Integration is a process and approach which allows disparate and heterogeneous information systems and their data to be integrated together in a seamless fashion. In all circumstance, all these techniques and approaches shall only be employed in such a way that solely open standards are in use.

This approach embodies four important attributes that are essential to deliver a sound architecture for such a complex and highly dynamic environment, namely (Woods and Mattern, 2003):

- Simplicity
- Flexibility
- Distribution
- Control

Choosing the appropriate technical implementation only tackles one perspective of the information sharing challenge. Government services and underlying processes play in an important role in the information sharing lifecycle. The effective management and sharing of data across government will result in information being used more efficiently and effectively. This leads to a number of significant benefits, including:

- reduced costs of information collection and management through streamlined, processing and storage;
- improved decision making in the context of policy and business processes, resulting in an increasingly integrated planning and enhanced government service delivery;
- improved timeliness, consistency and quality of Government responses – information will be easily accessible, relevant, accurate, and complete;
- improved accountability and transparency;
- reduced costs and added value for government through the reuse of existing information, sharing infrastructure and designing integrated, collaborative methods of delivering services;
- improved national competitiveness; and
- improved national security.

The following data provisioning principles have been identified as key and which lead to an effective information sharing lifecycle contributing to a better quality and accuracy of information. These include:

a: Data should be made available and maintained by the respective legal owner and/or authorised custodian. This should be done directly at source;
b: Data manipulation (such as create, update, delete operations) should be mapped to real life event driven processes;
c: Services should be designed on the basis that business processes and technical implementations should result in the provision of consistent, reliable, secure, trustworthy and re-usable data;
d: Data context should under normal circumstances be applied at the time of consumption to safeguard the data authenticity and integrity;
e: Where Open Specifications that define data persistence, interchange and presentation exist, these must be used;
f: Initiatives and directives of Pan-European scope should be actively considered for the relevant principles, methodologies, approaches and guidelines;
g: Data Interchange services should be implemented using Service Oriented Architecture principles;
h: Data objects (‘packaged’ through services, interfaces or otherwise) should be uniquely identifiable. The scope of uniqueness is defined by the target audience and usage.

4.3.4 Data provisioning principles

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5www.gartner.com
7 Service Oriented Architectures are architectural styles that package discrete functions as a set of de-coupled, atomic, re-usable and shareable services
4.3.4.1 Service Oriented Architectures

Service-Oriented Architecture (SOA) enables service consumers and providers to exchange data and interoperate in a consistent, flexible way regardless of rapidly evolving enterprises, diverse information, solution architectures and technologies involved. SOA is not only able to mitigate the challenges associated with such issues but also able to standardise and unify processes as well as align IT architecture with business drivers.

From a technology perspective, SOA can be considered as a software design methodology that implements a set of design principles which enable the development of loosely coupled services that scale and can flexibly change in an efficient and controlled/governed manner. Through SOA, services have contract and policy metadata associated with them that govern the relationship between the service providers and consumers, promoting an environment that could change and scale in a controlled manner.

SOA’s key drivers include:

1. Encapsulation – process and behaviour of a service are packaged and consolidated
2. Loose Coupling – services maintain a relationship that minimises dependencies and only requires that they maintain an awareness of each other.
3. Service Contract – services adhere to a communications agreement, as defined collectively by one or more service contracts.
4. Abstraction – beyond descriptions in the service contract, services hide logic from the outside world and consumers
5. Reusability – the services is developed so as to promote re-use
6. Compensability – collections of services can be coordinated and assembled to form composite services.
7. Service discoverability – services are designed to be outwardly descriptive so that they can be found and assessed via available discovery mechanisms

From an implementation perspective, essentially, SOA is a software architecture that starts with an interface definition that defines the protocols and functionality of the service, and builds the entire application topology as a topology of interfaces, interface implementations and interface calls. This software architecture is commonly related and enabled through enterprise service buses.
An enterprise which makes use of SOA principles will meet several challenges to manage connections between services provided by diverse applications. When developing new SOA applications, the connections (integration, interfacing and communications) between the services will increase and the network will be more complex and more cumbersome to manage. This is further complicated with every service created.

An Enterprise Service Bus (ESB) is considered a platform that implements a set of features to realise a service oriented architecture, as it brings a set of concepts such as transformation and routing to SOA as well as management of the diverse networks resulting from multiple SOA solutions. An ESB provides abstraction for endpoints which promotes flexibility at the transport layer and enables loose coupling and easy connection between services which inherently promotes interoperability between services. Furthermore, an ESB provides adapters for supporting integration with legacy systems, based on standards such as Java EE Connector Architecture (JCA).

An Enterprise Service Bus enables the orchestration of connections between the services and provides transformed services to the consumer. Consequently, the service consumers will only have to integrate with the service bus and the network complexity will be abstracted through the ESB.

Basic computing can be split into three components processing capability, storage and I/O. Over the past years, MITA has experienced an increase in dedicated under-utilised ICT assets. Systems are deployed with spare capacity for a number of reasons ranging from erroneous computing resource requirement estimates to the unfeasibility of upgrading on a regular basis. The management of these resources is costly and complex and the inflexibility of physical computing resources makes it hard to meet business needs quickly, frequently resulting in the deployment of additional resources.
Over the past few years MITA has been actively addressing this issue via Physical and Application Consolidation. Physical consolidation reduces server footprint and offers additional management capabilities however utilisation remains low. Traditional application consolidation particularly on mainstream operating environments is rather challenging. In this respect, a number of additional recommendations and actions have been put in place in order to ensure that this challenge is appropriately tackled.

Virtualisation has become a key enabling technology. Virtualisation hides key physical characteristics of a computing platform from users, presenting an abstract computing view. Virtualisation is being applied at all technology dimensions. Separating storage from computing in a virtualised environment for example allows for the creation of virtual processing clusters which act as common execution environments for virtual servers. Virtual machines that are centralised on shared storage arrays can be executed on any of the servers in a cluster, thus enabling features such as live server migrations, high availability, reserved service levels, replication of virtual infrastructure to secondary sites and, to an extent, capacity on demand. In this context, MITA aims to have the majority of its services implemented on virtual servers. Once application workloads are placed in virtual machines, multiple workloads can be run on pools of virtualised ICT resources. Each application workload runs in its own virtual machine, isolated from any other virtual machines running on the system. The creation of ICT resource pools following the Infrastructure as a Service (IaaS) a facet of cloud computing will result in a number of benefits including but not limited to faster deployment time, maximisation of ICT asset use as well as lowering facilities recurring costs.

Figure 8: Server Utilisation

Figure 9: Pool based approach for resource provisioning
5. Closure

The Information Systems Framework lays out a number of guiding principles on how the Government intends to ensure appropriate levels of benefits realisation through re-use maximisation.

The Information Systems Framework should be read in conjunction with other complimentary initiatives developed by the Malta Information Technology Agency that specifically deal with the development and support of Public Services including, but not limited to, the National Interoperability Framework, the Information Technology Strategic Plan, the ICT Governance Framework and the Compliance Management Framework respectively.
Appendix A. Definitions Catalogue

This section provides a number of key definitions which provide the necessary context within this document. Reference is also made to the Vocabulary standard, GMICT X 0003, which also articulates a number of important definitions and which are also contextually relevant. Where a definition exists herewith as well as within GMICT X 0003, the latter supersedes the one presented here.

Government in this context refers to the wider public sector.

In Information Systems Framework context, the attribute Core is associated with service and system.

A Service is a means of delivering value to Customers by facilitating the outcomes sought without the ownership of specific costs and risks.

A Line of Business System is described as one which is intended to target a specific business domain.

A Vertical System also refers to a line of business system and both terms are used interchangeably.

Infrastructure refers to the basic underlying components which allow for the operation and execution of information systems.

A Core Information System is primarily defined as a system which exhibits a number of key attributes, namely

1. Revenue Generation Capability
2. Political Sensitivity
3. EU context
4. National Security Profile
5. Strong Social Impact and Reach
6. Investment critically

A Minor Information System is defined as a system which does not exhibit to any high degree the attributes associated with a Core Information system.

A Shared Service is defined as singular instances of a set of resources which service multiple consumers concurrently. A shared service can provide the ability to be used both interactively (via an appropriate interface) as well as in a machine to machine context.

A Corporate Information System is defined as a system which is intended for the wider Government. A corporate information system does not necessarily imply that it is a core information system.

A Common System is defined as a single system which is applied and in use in multiple locations.

eGovernment comprises the implementation of interrelated technology and processes to support the continuous transformation of public services into ever more transparent, lean, well-connected public administration. An eGovernment System is one which delivers a guaranteed quality of service with the highest possible consideration to the quality of life and competitiveness of people and businesses, as its customers, respectively.