Government of Sultanate of Oman

Information Technology Authority

Oman eGovernment Architecture Framework (OeGAF)

Technical Reference Guide

Revision History

Version	Date of Revision	Prepared / Updated By	Reviewed By	Reason for Change	Affected Sections
1.4	11 Dec 13	Project Manager	OeGAF Core Team	Have removed "Considerations and Recommendations Matrix" from Introduction and created as new document for easy referencing	This is a new document
1.6	03 March 2014	Project Manager	OeGAF Core Team	Moved Service Access & Service Integration from TRM to SRM reference. Updated all the cross references to the various standards in different documents	All

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1 Overview

1.1 Objectives of Technical Reference Guide

The objectives of this technical reference guide are as follows:

(a) To guide government agencies in selecting the appropriate design architecture considerations, technical standards, general standards and best practices

(b) To provide factors for considerations and recommendations in the final selection.

1.2 Components of Technical Reference Guide

Since this is a technical reference guide, this list is aligned to the three reference models – Solution Reference Model (SRM), Information Reference Model (IRM) and Technical Reference Model (TRM). There is no technical reference for Business Reference Model (BRM).

For each domain within the reference model, the relevant technical guidelines are described within technology categories. The guide lists the technology domains, technology categories, factors for consideration, the recommendations and references to clauses described in SRM, IRM and TRM. It is also recommended to refer to the OeGAF Obsolete Technologies Compliance List for completeness.

The recommendations listed in this guide are for normal business operations. Additional or specific recommendations are also listed in the 'Business Criticality' column for agencies with critical business operations.

Note: In OeGAF Version 1.0, this content was originally under the Introduction chapter. It was removed into a new document for easy referencing with additional information.

2 Technical Reference Details

2.1 Technical Reference for Solution Reference Model

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
Application Design and Development Technology	Application Design	Choice of application tier has to support business operations.	Use 3-tier application architecture which can support many common business operations.	Consider using N-tier architecture that provides additional scalability and multi-access methods (i.e. browser, micro-browser and clients).	SRM Architecture Design Considerations Section 3.5.1; SRM General and Technical Standards Section 3.6; SRM Best Practices Section 3.7.2 (see Table SA-2 for Guide to Application Tier)
		Encourage re-use so that application design and development is fast and efficient.	Use an application framework as a standard in the government agency; Use Service-Oriented Architecture (SOA) approach.	Refer to Recommendation.	

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
	Application Development	Commercial-Off-The-Shelf (COTS) applications versus bespoke applications (i.e. developed based on requirements)	There are typically many government bespoke applications as they have unique requirements. However, use COTS to support large operations that are not unique (e.g. customer relationship management and enterprise resource planning)	Refer to Recommendation.	SRM Architecture Design Considerations Section 3.5.2; SRM General and Technical Standards Section 3.6; and SRM Best Practices Section 3.7.3
		In-house versus outsourced application development	Consider in-house development if agency has the capability and resources available.	Refer to Recommendation.	

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
			Alternatively, government agencies can let cost be the main decision factor to choose either in-house or outsourced development.		
	Application Testing	The type and method of testing depends on the criticality of the application.	Minimally, static testing has to be carried out.	Carry out load / stress testing to determine application's performance threshold. Carry out security testing for application systems supporting critical business operation.	SRM Architecture Design Considerations Section 3.5.3; SRM General and Technical Standards Section 3.6; and SRM Best Practices Section 3.7.4 (see Table SA-7 for

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
					Minimum testing by Application Types)
	Application Deployment	Assurance of correct application version gets deployed timely.	Develop a standard application deployment procedure.	Refer to Recommendation.	SRM Architecture Design Considerations Section 3.5.4;
	Application Configuration Management	Validating and verifying configurations and changes to applications are approved and documented.	Develop a Configuration Management Plan.	Refer to Recommendation.	SRM General and Technical Standards Section 3.6; and SRM Best Practices Section 3.7.5

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
Service Access	Web Application Platform	The web application platform has to support the application tier design (see 'Application Design' category above). The choice of web platform between Microsoft .NET and Java (J2EE).	Develop the web application platform according to the tier architecture (see 'Application Design' category above). Choose either .NET or J2EE or have both (please see Table SA-10 of the SRM for a comparison between the 2).	Provide redundancy in the web platform for e.g. additional web, application and database servers. Also consider to use Enterprise Application Servers. Please also see other server recommendations below under Domain Name 'Platform'.	SRM Architecture Design Considerations Section 4.4.1; SRM General and Technical Standards Section 4.5; and SRM Best Practices Section 4.6.1 Please also see other server information below under Domain Name 'Platform'.

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
	Internet / Intranet Access	Access provision for eServices over the Internet	Internet access is an important provision for citizens, residents and commercial establishments to access eServices. The following are the main recommendations: • Government agencies to deliver eServices through the Oman eGovernment Services Portal (see Shared Services and Central Initiatives) • Government agencies to publish information (both in Arabic and English) on its own portal or website (this website will be linked to the Oman	For critical operations, in addition to Internet access, government agency to provide services over Interactive Voice Response (IVR) which will support both Arabic and English.	SRM Architecture Design Considerations Section 4.4.2; SRM General and Technical Standards Section 4.5

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
			eGovernment Services Portal)		
	Telephony Access	Alternative access provision for eServices	While Internet is widely used, it is also important to provide alternative or secondary access to eServices. The following is recommended: • Government agencies to provide Short Message Service (SMS) for common eServices (including informative eServices)		SRM Architecture Design Considerations Section 4.4.3; SRM General and Technical Standards Section 4.5
	Collaboration Management	The choice of technologies depends on the government	To improve internal collaboration and communication within the agency, it is recommended that all government	Refer to Recommendation. Please see recommendation for	SRM Architecture Design Considerations Section 4.4.4;

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
		agency's requirements.	agencies implement email and SMS systems. Use workflow when there is a need to automate business process flows to increase efficiency. Use enterprise content management (ECM) for managing large amount of information from multiple sources.	SMS under Domain Name 'Service Access'.	SRM General and Technical Standards Section 4.5; and SRM Best Practices Section 4.6.2
Service Integration	Business Process Management	The business requirement drives the choice of service integration.	The choice of integration depends on the business operations requirements.	For time critical operations where information has to be sent or received	SRM Architecture Design Considerations Section 5.4;

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
	File Transfer Middleware Web Services Message-Oriented Middleware Adaptor Directory Services Integration Management		The following are recommended: • Use Business Process Management (BPM) to automate complex business process • Use File Transfer Middleware for simple regular data transfer; this method is not recommended for inter-agency data transfer • Instead Web Services are highly recommended for all inter-agency integration or data transfer (refer to Shared Services and Central Initiatives on the availability of services under the	immediately, consider using MOM as the main medium for service integration.	SRM General and Technical Standards Section 5.5; and SRM Best Practices Section 5.6

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
			Oman eGovernment Services Portal). Web Services should also be a standard for government agency's internal integration • Use Message-Oriented Middleware (MOM) when integration requires structured message format and guaranteed delivery • The use of adaptor is not recommended (only as a last resort when government agency is still using older technologies/platforms)		

2.2 Technical Reference for Information Reference Model

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
Data Management	Database Management	Ease of data retrieval.	Use widely adopted data access standards such as JDBC and ODBC when connecting to RDBMS.	Refer to Recommendation. For improved performance of database, consider database clustering which also improves database availability. Data integrity should be reinforced with the use of database auditing which should be regularly monitored. Please note that this may	IRM General and Technical Standards Section 4.5; and IRM Best Practices Section 4.6.1
		Performance of database.	Use data index, data clustering and database tuning to optimise the performance of database.		
		Data integrity is not compromised.	Ensure integrity by defining constraints within the database. Access control would also help in preserving data		

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
			integrity. Please refer to 'Data Security' below.	have trade-off with database performance.	
	Database Design	Design a database that suit the business requirement.	Use data modelling language to design the tables and its attributes (e.g. ER diagram).	Refer to Recommendation.	IRM General and Technical Standards Section 4.5
		Support for multiple languages.	Use database that supports international standards for multi-language encoding.		
	Data Exchange	Format of the file.	Use widely recognised file format. An example is JPEG for images.	Refer to Recommendation.	IRM General and Technical Standards Section 4.5

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
		File transfer technology.	Use file transfer protocols when exchanging data file. Use web services, message oriented middleware or directory services to exchange data.	Use encryption to protect critical data during data exchange. Please see recommendation on protecting data below under 'Data Security' category.	
	Data Security	Secure network and database.	Segregate network to prevent access of database from external network. Utilise database security controls.	Database supporting critical business operation should only be accessible by specific application system.	IRM General and Technical Standards Section 4.5

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
		Protect data from unauthorised access.	Encrypt sensitive data and destroy data that is no longer required. These practices will prevent unauthorised access to sensitive data.	Refer to Recommendation.	
	Data Storage, Backup and Archival	Type of storage media.	Use Storage Area Network (SAN) or Network Attached Storage (NAS) to store or backup data over the network.	For critical business operation, SAN or NAS solutions offers high availability and reliability.	IRM Architecture Design Considerations Section 4.4.2; IRM General and Technical Standards Section 4.5
		Time taken to recover backup data.	In general cases, backup should be implemented for all systems. Incremental backup could be implemented in most cases.	For critical business operation, full backup should be considered as it would allow faster data recovery. The trade-off would be longer scheduled	

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
				downtime during the full backup process.	
		Framework used in archiving data.	Use international standards such as OAIS to establish an archival system and Dublin Core metadata to describe the data.	For critical operation, it is advisable to establish an archival strategy to prevent the loss of important data.	
	Data Management Strategy	Capture meta data of structured and spatial data.	Use meta data frameworks such as Meta Data Object Facility (MOF), Resource Description Framework (RDF) and Common Warehouse Metamodel (CWM) for structured data.	Refer to Recommendation.	IRM Architecture Design Considerations Section 4.4.1; IRM General and Technical Standards Section 4.5; and

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
			Use geospatial frameworks from ISO or Open GIS to manage spatial data.		IRM Best Practices Section 4.6.1
		Meta data schemas reside in disparate systems.	Implement enterprise schema management to manage a central repository of meta data schema.		
		Requirement to derive useful information to aid decision making from existing data.	Implement business intelligence which will provide analytical information for business decision making process.		

2.3 Technical Reference for Technical Reference Model

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
Platform	Servers	Cost and performance are the two main factors in determining the type of servers to implement. It is often a fine balance to maximise the above two factors.	The following are recommended based on the application needs: Use high-end servers for mission-critical applications only. While these servers are costly, high server performance is required to meet the mission-critical requirements. Use mid-range servers for agency-wide applications (for e.g. Enterprise Resource Planning System, Customer	For government agencies with critical operations, use high-end servers. In addition, there should be server clustering and load balancing to achieve high availability.	TRM Architecture Design Considerations Section 4.6.1; TRM General and Standards Section 4.7; and TRM Best Practices Section 4.8

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
			Relationship Management System and Database Management System). Use entry-level servers for small applications and general infrastructure services for e.g. print server, file server and Domain Naming Service (DNS). These applications or services do not need high performance servers.		
	Clients	Employees' mobility. When employees only work at the office, then there is no need for mobile	Use portable computers (e.g. notebook) for employees who need mobility.	Refer to Recommendation.	TRM Architecture Design Considerations Section 4.6.2;

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
		clients. However, there is an increasing trend where employees work both in office and other premises.			TRM General and Technical Standards Section 4.7; and TRM Best Practices Section 4.8
	Peripherals	Integration of office automation to improve productivity and efficiency.	Use peripherals that are connected to the LAN.	Refer to Recommendation.	TRM Architecture Design Considerations Section 4.6.3
	Storage and Backup	Amount of data is an important factor in choice of storage and backup.	Use Storage Area Network (SAN) when raw data exceeds 200 GB. In addition, SAN can be used for agency-wide disk storage consolidation.	For critical operations, either SAN or NAS provide high availability to data. Ensure reliable data backup and	TRM Architecture Design Considerations Section 4.6.4;

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
			When data is small, use Networked Attached Storage (NAS).	restoration are in place.	TRM General and Technical Standards Section 4.7; and TRM Best Practices Section 4.8
	Platform Management	Platform can be managed either as centralised or de-centralise solution.	Centralised, web-based platform management is recommended.	Refer to Recommendation.	TRM General and Technical Standards Section 4.7; and TRM Best Practices Section 4.8
Network	Wide Area Network (WAN)	Government agencies with departments or offices all over Oman.	Connect to Oman Government Network which provides inter-office connectivity across Oman.	The Oman Government Network provides high level of service as it has	Architecture Design Considerations in Section 4.5.1;

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
			(see Shared Services and Central Initiatives)	redundancies built in the network.	TRM General and Technical Standards in Section 4.6
		Connectivity to other government agencies.	Connect to Oman Government Network which provides inter-connectivity to other government agencies.	For access to remote areas not covered by Oman Government Network, consider using satellite or other communication technologies.	
	Local Area Network (LAN)	LAN is required to link employees and other resources within the same building. The main factor for consideration would	The following are recommended based on the number of LAN users: • Less than 50 users, use 2-tier network architecture	If the operations are critical, it is recommended to implement both LAN and wireless LAN.	TRM Architecture Design Considerations in Section 4.5.2;

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
		be number of users in the LAN.	• Exceeds 50 users, use 3-tier network architecture Note: For very small office where there are less than 5 users, LAN is not required.	In particular, wireless LAN connectivity should be given to those who provide key operations within the government agency.	TRM General and Technical Standards in Section 4.6; and TRM Best Practices in Section 4.7.1
	Wireless LAN	The main consideration is the need for mobility of the users in the government agency.	Wireless LAN is recommended: • When there are mobile users who need to access information from various parts of the building(s) • When LAN cannot be implemented due to physical cabling constraints		

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
	IP Telephony & Video Conferencing	IP telephony is required when there is a high integration requirement for office automation. Typically, these requirements are needed to support the agency operations. Video conferencing is useful for discussion between parties who are physically separated.	Government agencies are recommended to use IP telephony: • When moving to a new premise for the main office where LAN is required For video conferencing, the following is recommended: • When there are frequent communication sessions between the physically separated offices of the government agency	IP telephony and video conferencing provide alternative communication mediums for critical operations. When telephone communications are unavailable, IP telephony and video conferencing over the network are possible options.	TRM Architecture Design Considerations in Section 4.5.4; TRM General and Technical Standards in Section 4.6

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
	Network Management	Network can be managed either as centralised or de-centralise solution.	Centralised network management is recommended. Use network management tools to manage the various networks.	Refer to Recommendation.	TRM General and Technical Standards in Section 4.6
Data Centre	Physical Site Layout	Need for floor plan	Many data centres and computer rooms do not have a proper floor plan. It is important to plan as it determines the requirements for the location and number of racks, the power density, and the amount of cooling. Government agencies are recommended to:	For government agencies with critical operations, Tier 3 reliability is required. In addition, a disaster recovery site is required to ensure fast recovery and continued operations. Government agencies	TRM Architecture Design Considerations in Section 3.5.1, 3.5.2, 3.5.4; TRM General and Technical Standards in Section 3.6

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
			(a) Design and maintain a floor plan (b) For new data centre or computer room, design the floor plan according to the Figure TA-6: Sample Data Centre Physical Layout; also to contact ITA for consultancy advice	are to consider the GDC as a primary option for disaster recovery site.	
		Cost versus size	The bigger the physical layout is, the higher would be the cost of building and maintaining the data centre. It is recommended for government agencies to build a data centre if there are economies of scale.		

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
	Cabling Infrastructure	There is cabling infrastructure norm for data centre.	Comply with TRM technical and general standards.		TRM General and Technical Standards in Section 3.6
	Tiered Reliability	The level of tiered reliability is dependent on a number of attributes. Government agencies to use the rack size as the main consideration.	If the rack size requirement: • Less than 3 racks, these racks can be placed together with the network equipment in the Network Centre (refer to Network Domain, Best Practice Section 3.8.3) or use Government Data Center (GDC)(refer to TRM Central Initiatives Section 2.4.1) • Less than 10 racks, use a computer room (refer to Network Domain) or use GDC		TRM Architecture Design Considerations in Section 3.5.3; TRM General and Technical Standards in Section 3.6

Domain Name	Technology Category	Factors for Consideration	Recommendation	Business Criticality	Reference
			• Less than 30 racks, use GDC • More than 30 racks, build based on Tier 3; please consult ITA before design stage		
	Environment Factors	Power and cooling tend to increase significantly due to new requirements.	In addition to growth in rack size, government agencies to forecast growth for power and cooling requirements. Government agencies also to review and provide a safe working environment as the amount of electro-magnetic field interferences increase.		TRM General and Technical Standards in Section 3.6; and TRM Best Practices in Section 3.7.1