Digital Government Authority
هـيـئـة الحكومة الرقـمـيـة

Guideline

Application Programming Interfaces (APIs)

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1 Introduction

Digital Government Authority works to enhance digital performance within government entities, raise the quality of digital services provided and improve the service experience, in line with the strategic directions of the Digital Government Authority to apply international best practices in various fields related to digital government. The authority has prepared the "Guideline for Application Programming Interfaces" to increase the rate of adoption of APIs, which in turn contributes to accelerating digital transformation processes.

The usage of APIs has been growing exponentially since several years. This includes both the number of provisioned APIs as well as the usage of APIs. Private sector has been at the centre of increased attention and investments. Since 2014, public APIs have grown by around 50% across all industries (and notably in hi-tech, retail and healthcare). Government entities are following suit as transaction volumes have grown. In KSA, Government Service Bus transactions have grown at almost 200% a year over the period 2009-2021.

Application Programming Interfaces (APIs) are major technology enablers widely adopted in the technology industry. Therefore, it is also important for government entities to have the ability to understand and take advantage of the capabilities of APIs.

This guide is one of the references that will contribute to promoting the adoption and use of Application Programming Interfaces (APIs) in support of digital transformation activities in government sector. In addition, this guide is part of a series of guiding documents aimed at supporting and promoting digital excellence.

2 Guideline Objectives

The guideline aims to:

1. Raising awareness among specialists in government entities in Effective implementation of API maximizing value of government services.

2. Enable government entities comprehensively understand API and its uses in government context and assist in sustain the adoption of API monitoring the progress

3. Facilitate connectivity to internal and external data sources to ensure that it is easier to draw upon data easier.

4. Facilitate the integration across government entities due to a unified interface technology.

3 Guideline Scope

The scope of API guideline divided into 7 sections, included API background, API Purpose/Value with supported Cases related, as well as API Requirements and developing a strategy and how government entities adopting this strategy, in addition API measurement.

4 Target audience

This guideline targets experts, practitioners and technical staff working to develop digital platforms, products and services in government sector.

5 Guideline Statement

5.1 API background

Through APIs; machine-readable data can be exchanged in a fast, scalable, and cost-effective way. APIs allow developers and applications to access resources without compromising security and control in a low-effort manner, enabling higher levels of data connectivity and real-time processing. Integration platforms are used to connect APIs, enabling applications to consume data and functionalities.

APIs enable seamless exchange of data and create opportunities for cross-sectoral collaboration. They represent a secure, effective pipeline between entities, operating in real time. Generally, APIs can be classified into three broad types:

- **Public/open**: principally used for user experience and monetization, such APIs are suited for drawing on the worldwide community of developers to create new product and service offerings and for participating in an API marketplace.

- **Partner/third party**: principally used for collaborative work, such APIs represent an integration between a third party and are suited for promoting seamless data exchange at scale and drawing on best-in-class partnering practices for improved business or customer outcomes.

- **Private/ internal:** principally used as a foundation for an enterprise's DevOps, such APIs improve flexibility, speed and integration within an entity by sharing core data and services internally. This can improve internal process performance and enable the reuse of common functionality as well as representing a single source of data.

5.2 API Purpose/Value

Across industries, APIs are rapidly changing the fundamentals of business. They can be regarded as no less than a game-changer. They represent both an explanation for heightened demand and the means of answering it:

- **Altered consumer expectations**: there is a generally higher expectation about innovative services and product offerings.

- **Product and service innovation**: the operation of APIs has itself fed demand for greater speed, mobility and automation.

- **Real-time information sharing**: APIs allow enterprises and the third parties with whom they work to exchange data in real-time to understand and react to customer behavior.

- **Deeper connectivity**: APIs permit an ever-growing number of internet-enabled devices to communicate with one another.

- **Evolving regulatory environment**: as governments and regulatory bodies come to understand APIs, so there are more requirements to show how data are securely held and used

- **New business models**: the context in which services are delivered and product offerings brought to market is being reshaped by new entrants using new business models.

5.3 API Cases

Government entities can look at API applications both in terms of the service relationships they support (in other word, whether government is interacting with citizens (G2C), with businesses (G2B), and with other governments entities (G2G)) and in terms of the broader functionality types they enable.

Service relationships

Government-sector API applications can be used with different groups of beneficiaries. Examples of those services:

- **Services provided to citizens (G2C):** digital IDs, authentication and identification, hosted email, electronic signature for validation of legal actions, a registry for service use, a communications system, registration of property ownership/sales, and electronic payment processing.

- **Services provided to business (G2B) :**business registration, financial services (including credit profiling and loan provision as well as basic banking), transaction processing for trading, providing an electronic procurement platform, data analytics services and an API portal for registry purposes, real estate records and maps.

- ■ Services provided to government entities (G2G): data exchange, e.g., between road transportation and tax authorities or for market overview, and leverage of common platforms.

As suggested above, however, it may also be helpful to consider in more detail the different types of functionalities that government entities can support using APIs.

Authentication

APIs can help government entities and their stakeholders by enabling and assuring digital IDs. These comprise a secure means of capturing and using basic information about an individual citizen, exchanging those data safely and securely, making sure authenticity is checked, and associated documents are safely stored and/or shared. A specific subset of uses attaches to digital signatures for use in the confirmation of legally relevant actions and/or documents.

Interaction

APIs can be part of government entities' solutions for formal communications by providing standardized channels across which this information can be exchanged. APIs can also assist in the provision of both manually triggered and automated notifications, as well as for hosting and processing feedback forms and surveys, promoting open discussion as well as enabling service performance management. They also can be used for e-payments systems, notably for services provided government entities.

Other uses

APIs can enable government entities to allow a common search interface for multiple online services from different sources, in effect providing a single register to consult. They can also allow a more efficient and consistent service to users in respect of commonly- and frequently asked questions and consent processes (more generally the kind of enquiries that government entities' stakeholders are likely to make across multiple departments and entities as well as GDPR-related and other consent requirements which can recorded in respect of multiple departments and entities).

Examples of using API by the government entities

there are already compelling Saudi government entity examples of API use. One examples of this is the Ministry of Commerce. The ministry has translated its main government services into APIs. These APIs can be browsed and integrated into other applications on the ministry's website. It has set up its services to interact with the backend only through APIs. The Platform is called Wathq. It offers corporate clients different API tools, which extract, filter and analyze existing data from ministry sources. For example, Commercial Registration API allows users to inquire about all commercial registration data for companies and institutions in detail, such as trade name, register status, capital, owners. Another example is the Saudi Open Data Portal, which provides an overview of datasets that are provided by different entities within the Saudi government ecosystem. It also provides API for the real-time access to dedicated data sets as for Covid 19 as well as for Air Quality. The platform acts as a central provider for the information for how to access and incorporate the APIs.

5.4 API Requirements

API setup, government entities can benefit from first assessing their current overall level of API development maturity – whether they are entirely new to the approach or have already embarked on its implementation. In either case, this diagnosis represents a useful start to map the adoption journey towards a truly API-first culture.

Typical dimensions for a successful implementation include:

- **Strategy:** The existence of an API strategy in the entity that defines the purpose and goals in regard to APIs. This includes a roadmap to implement APIs.

- **Operating model:** The internal processes and governance needed to maintain the APIs and to ensure a high quality of delivery.

- **Technology:** The technical enablers needed to support and sustain API-based applications and integration patterns.

- **People:** The expertise needed to develop and maintain and API strategy and the capabilities of the developers to effectively leverage APIs in their day-to-day work

API providers can assess their maturity using a 1-5 rating system along these four key dimensions to help set the foundation of successful API adoption (see Table 1). This assessment allows identifying the key dimensions as well as the required amendments to take the API strategy forward. Typically, the result should be on average the same across the different main dimensions. If there is one area that is specifically behind what is identified as best practice compared to other dimensions we also see that this is typically the area, which carries most benefits going forward.

Domain	Area	Low maturity	High maturity
Strategy	Business and IT priorities	Business and IT priorities are transparent and aligned to one another, summarized in a clear API strategy	There is no clear overview about business priorities and the overarching API strategy is not known
	API roadmap and prioritization	There is a clear roadmap of APIs to be implemented (e.g., central backlog can feed itself from various decentral ones with a clear identification process)	There is no overview about which APIs are being prioritized and implemented
	API re-usability	APIs are clearly categorized (e.g., experience APIs, process APIs) and commonly	Mostly single consumer per API with limited reusability;

		re-used; re-use is proactively promoted	re-use is not actively promoted
Operating model	Governance	APIs are not embedded in the overarching business and IT governance	Several governance elements are in place and are being constantly refined by a central API governance team
	Funding	APIs are typically deprioritized as there is no budget for their implementation available	API implementation and operations are being funded as part of the overarching product lifecycle as they are included in the business case
	Business and IT collaboration	There is no clear API collaboration model between business and IT defined	A clear model with central and/or decentral API (development) teams among business and IT defined
	API lifecycle management	No version control, change management of APIs with duplication of APIs across entity	There is a clear API lifecycle defined with clear responsibilities from identification to decommissioning
Technology	API management platform	There is no API management platform in place	A standardized API management platform is fully implemented and used across the entire entity

	Guidelines and standards	No guidelines and standards exist; APIs are implemented on a best-effort basis	There are clear coding guidelines and standards available which have to be applied by the whole entity; a central team monitors conformity to them
	API developer portal	There is no external / internal API developer portal available	Developer portal for both internal and external needs with API definitions and sandbox features for rapid API adoption
	API taxonomy	Lack of a uniform classification and grouping of APIs	APIs classified into domain, process and experience using BIAN and/or customer journeys
People	"API-first" culture	APIs are typically not known of and there is no focused communication; if they are, they are often deprioritized or disregarded	"API-first" is central to every decision the company takes and clearly communicated by top management; the value of APIs is fully understood by business
	Talent	API development and operations are outsourced	A large majority of API-related work is conducted by internal talent
	Training and awareness	No awareness sessions (IT and business) and no training on API development	Focused awareness and training program available and actively promoted

Table1 : API self-assessment

5.5 API Strategy

The implementation of APIs follows two phases. Initially the government entity needs to define the API strategy and roadmap taking into account alignment with strategic directions of Digital government and the national data strategy and related regulations issued by the Digital Government Authority, Once this is completed, individual product/developer teams can implement the actual APIs. There are five steps to develop API strategy.

1. The first step is the **analysis of the individual needs** in terms of APIs for the different users/ beneficiaries of APIs within the government entity as well as outside. The analysis of these needs also include whether or not the government entity has the underlying data and functionality available to provide the API or whether another owner is better suited.

2. The second step will be the analysis of the exist gaps. This include the definition of possible additional API or required extensions of the existing landscape.

3. The third step for the strategy implementation will be the development of the roadmap and budgetary requirements in order to fulfill the needs that have been identified in the second step. This step will also include the prioritization and focusing of the API roadmap – i.e. which APIs should really be priority with respect to the government entity's goals.

4. The fourth step will be the deployment and the operationalization of the APIs. This step will include the actual development of the functioanlity as well as the integration of the underlying data sets. This also include the necessary development and integration of prerquisites as tooling. This phase will be later further elaborated on in the section on API adoption.

5. The fifth step is monitoring and possible refinement. This step includes the monitoring of the actual usage of the APIs as well as the impact they have on the overall ecosystem,. This also include the identification of unused functionality in order to identify posible refinements/ required adjustments of the overall APIs.

5.6 API Strategy Adoption

Government entities implementing an API for the first time need to develop and articulate a clear adoption as elaborated on slightly already in the API strategy section. This section sets out in detail the key activities required to facilitate an API development and adoption – as the actual usage of the APIs provided is a key cornerstone of the strategy.

5.6.1 Development of APIs

APIs can be developed using typical frameworks (as e.g. REST) in order to ensure easy adoption of the respective APIs. This would also ensure that the respective APIs can be easily reused. Similarly, APIs developed according to the high-value opportunities that were identified from a government entity point of view to ensure that there are no overlaps with existing functionalities and there is a significant probability that APIs will be used. This applies both to internal and external usage.

- **Common practice characteristics:**

  - APIs developed according to clear requirements either from internal or external users to identify the right ones for development.

  - APIs leverage common and unified frameworks in order to ensure easy adoption within typical frameworks.

- **Key recommendations to consider:**

  - APIs that already typically not be simply reproduced given challenges around data quality and single sources of data.

  - APIs frameworks unified throughout as otherwise adoption with framework changes becomes more difficult.

  - APIs need to have users – if none can be identified it is typically better to reconsider the development.

5.6.2 API documentation and publication

APIs need to be publicized to be adopted. This proceed through own or external portals that provide the relevant documentation as well as the relevant insights in order to see how they could best be used.

- **Common practice characteristics:**

  - APIs are publicized on relevant internal and external websites (e.g., the national websites offered by the Saudi government) in order to ensure that the provision of functionality is known

  - APIs are fully documented and appropriately described on these portals in order to ensure easy adoption

  - The relevant documentation is kept up to date on an ongoing basis

- **Key recommendations to consider:**

  - The APIs need to be documented so that they can be used without consulting the provider

  - Usage should not be inhibited

  - Usage should also follow appropriate security standards to not reveal sensitive information

5.6.3 Governance and funding

In order to enable easy adoption it is required to also have the right governance in place so that the relevant decision around API development can be taken quickly and in order to ensure that the right level of funding is available while making sure that development is not done without purpose.

- **Common practice characteristics:**

  - The entity identifies key capability gaps in its current or likely use of APIs (e.g., architecture and data modeling)

  - There is a clear plan to build a team that can define the enterprise standard and teach the entity

- In cases where the entity is assessed as being relatively immature in its implementation of an API, all development should be managed centrally to start with

- A clear governance is established to resolve any decisions regarding which APIs to implement and how to define the adoption measures

- Funding is assured for enterprise APIs independent of individual projects/products while also being clearly allocated to reach certain levels of adoption

- **Key recommendations to consider:**

  - API success and further funding should be allocated based on actual usage and monitored adoption

  - Setting up an adequate entity requires to build the right level of internal talent including key engineering capabilities as

    o Engineers being able to program and develop both the tooling as well as the actual APIs of the entity

    o Release Train engineers that can close the gap between development and productionizing the APIs

    o A monitoring team that derives the required data and insights to see which APIs also see traction

  - Governance has to balance between the requirements of making sure not to let APIs being developed and productionized that have no impact and making sure that API development is also incentivized

5.6.4 Talent management

Talent management is central to the success of an API implementation, and it is relevant for skills at every level of seniority. It is also a key requirement to set up the entity.

- **Common practice characteristics:**

  - Start with a leader who has done this before – API programs require distinctively characteristic specialized skills

- The entity attracts top digital talent by creating the right environment

  o The API Team (or similar) is run along agile principles

  o Digital products convey a strong value proposition

  o There is an open culture of experimentation

- Close attention is given to certain key roles that drive the API agenda, including Product owners and API architects with data modeling expertise

- **Key recommendations to consider:**

  - Make sure that senior talent is also internal to the entity

  - Enable growth of key talent within the entity and within the technology space

  - Enable training plans that are adequate and attractive to the talents and competencies

5.6.5 Stakeholder- and Performance management

Successful API implementation depends on educating and aligning the entity, through consistent communication. Achieving this requires a detailed communication plan.

- **Common practice characteristics:**

  - Senior executives lead the communication of the API implementation and set the tone for the entire entity – effective communication starts from the top

  - Communication is consistent – key messages have been agreed up front and are rigorously repeated

  - The language used is simple and business-friendly, so that everyone can grasp the importance and potential impact of APIs

  - Simple visuals, such as infographics, are used to align internal and external stakeholders

  - Key API metrics (e.g., usage volume) are tracked and used in communications to reinforce the impact of APIs

- **Key recommendations to consider:**

- A clear communication plan around the goals and the impact of API development should be in place to drive the required change

- Monitoring and communicating the outcomes should go together to enable quick reactions to feedback and external adoption of APIs

- Simplifying the communication is key to truly get the message across – not just in the technology department

5.6.6 API lifecycle

The concept of the API lifecycle is integral to this approach. It is not a single one-off project or collection of them:

- **Common practice characteristics:**

  - Business APIs are developed based on identified needs for capabilities that are in turn driven by the digital strategy

  - Product owners and architects naturally look to reuse before they build anything that is net new

  - All APIs are published in an enterprise catalogue for easy access for testing and use

  - APIs are actively managed and monitored, and retired or versioned as needed

  - APIs are managed across their lifecycles, not just during development

- **Key recommendations to consider:**

  - APIs never stay when not used – they also need to be retired

  - If duplications of APIs occur these resolved through the appropriate governance

  - The API portals leveraged to manage the internal lifecycle of APIs

5.6.7 API design and architecture

It is important to define clearly what 'good' looks like and ensure that it is understood and implemented on an enterprise-wide basis.

- **Common practice characteristics:**

  - There is consistency in API development across the entity, such that it utilizes the same architecture, toolset, and nomenclature throughout

  - New applications or functionality are designed with APIs and microservices and a plan is set in motion to migrate away from monolithic architecture

- **Key recommendations to consider:**

  - Typically, there ready-made design patterns available in the entity for APIs

  - There also clear guardrails for which tooling and frameworks to use to enable easy further developments

  - Appropriate architecture paradigms including allowing easy data access for the APIs a clear prerequisite

5.6.8 Development and operations

Great API DevOps combines the work of agile teams with that of product-aligned teams:

- **Common practice characteristics:**

  - APIs are typically developed at least two sprints in advance of teams developing consumption features

  - Domain-aligned API teams manage APIs through their lifecycle, conducting bug fixes and releasing updated versions when necessary

- **Key recommendations to consider:**

  - APIs developed in dedicated teams that also take on the relevant support and maintenance

5.7 API measurement

Tracking KPIs across a range of measures and with an appropriate level of frequency for each can both monitor and assure the progress of implementation. These can be divided into four

broad groups or types: those relating respectively to adoption, business impact, consumption, and enablement. Government entity first explores the range of KPIs that may be used in terms of each of these headings and then focus on some of the most important.

- **Adoption KPIs**

Table 2 below sets out a series of KPIs which may be deployed to track adoption, both through a real-time dashboard and in monthly reports with summary insights.

KPI	Unit of measurement
Number of APIs exposed	Number
% growth in number of APIs exposed	Percentage
Average number of APIs per entity	Number
Numbers of partners with at least one API	Number
% growth in new partners on boarded	Percentage (year-on-year or average annual)
Speed to develop an API	Time units (days or weeks)
Speed to on-board a new API	Time units (days or weeks)

Table 2: adoption KPIs

- **Business impact KPIs**

Table 3 below sets out a series of KPIs which may be deployed to track business impact. For efficiency, these can be selected and reported in response to surveys of stakeholders.

KPI	Unit of measurement
Total direct revenue generated through APIs	Currency
% growth in revenue	Percentage (year-on-year or average annual)
Average revenue generated per entity	Currency
% reduction in entity's costs as reported by providers	Percentage (from specific date to specific date)
Savings as a result of API reuse	Currency
Average saving per entity	Currency

Table 3: business impact KPIs

- Consumption KPIs

Table 4 below sets out a series of KPIs which may be deployed to track consumption, both through a real-time dashboard and in monthly reports with summary insights.

KPI	Unit of measurement
Number of users	Number
% growth in number of users	Percentage
Number of API calls	Number
Average number of API calls per user/entity	Number
Number of unique API beneficiaries	Number
% growth in number of unique API beneficiaries	Percentage
Number of individual applications accessible to beneficiaries	Number

Table 4: consumption KPIs

- Enablement KPIs

Table 5 below sets out a series of KPIs which may be deployed to track enablement and the data for which may be gathered through periodic (e.g., quarterly) surveys in both public and private sector user pools.

KPI	Unit of measurement
Number of private sector entities with API-based solutions	Number
% growth in number of private sector API-based solutions	Percentage
Number of startups set up to make use of APIs	Number
Barriers to private sector API adoption	Qualitative analysis of free text survey responses
Direct revenue generated from API-related initiatives	Currency

Table 5: enablement KPIs

- Core KPIs to use as a minimum

Table 6 below sets out a selection of KPIs upon which to focus if on nothing else.

Type of KPI	KPI	Questions to answer

Adoption	% growth in number of APIs exposed	Are current and new entities continuously using existing APIs and publishing new ones?
	% growth in new partners onboarded	Is the API program actively driving adoption by entities? How should government promote API use further?
Consumption	% growth in number of users	Are the API services being offered beneficial to beneficiaries?
	Number of individual applications accessible to beneficiaries	Is the API program being used by external beneficiaries?
Enablement	% growth in number of private sector API-based solutions	Is API adoption going beyond the public sector?
	Barriers to private sector API adoption	What can the API program do to promote and facilitate greater private sector adoption?

Table 6: the most important KPIs

6 Table of Definitions

The following terms and expressions - wherever they appear in this document - shall have the meanings indicated on the opposite side of each of them, unless the context requires otherwise

Term	Definition
Authority	Digital Government Authority
Government Entities	Ministries, authorities, public institutions, councils, national centers including any additional form of a public entity
Digital Government	Supporting administrative, organizational and operational processes within and between government sectors to achieve digital transformation, develop, improve and enable easy and effective access to government information and services.
Beneficiary	Citizens, residents, visitors, government agencies, private sector, non-for-profit sector, inside or outside the KSA that require to interact with a government entity to receive any of the services offered in the Kingdom
API	Set of commands, functions, objects and protocols developed to be used by programmers for developing software or interacting with other systems and/ or software.
Digital Transformation	Digitally and strategically transforming and developing business standards and models that would rely on data, technologies, and ICT.
API marketplace	A platform of the different APIs provided and consumed from different providers with the possibility to exchange information for how to integrate
API strategy	Overall definition of the roadmap and goals of the deployment of APIs in line with the business strategy
Stakeholder	Parties and entities that affect and are affected by decisions, directions, procedures, objectives, policies and initiatives of the digital government and share some of their interests and outputs and are affected by any change that occurs in them
REST framework	Framework for the interaction of APIs typically used to ensure easy adoption and exchange
Release train engineers	Infrastructure experts being able to bridge the gap between current engineering and development teams and possible deployments on actual infrastructure/ servers
API portal	An API portal is a place where API consumers can go to access a entity's APIs
Microservice	A small amount of functionality that can be independently deployed and made available for the consumption by others
DevOps	DevOps is the combination of cultural philosophies, practices, and tools that increases an organization's ability to deliver applications and services at high velocity: evolving and improving products at a faster pace than organizations using traditional software development and infrastructure management processes. This speed enables organizations to better serve their customers and compete more effectively in the market.
Data Modeling	The process of building a conceptual representation of data and their relationships to be stored in a database.
Agile	A methodology in the software development process in which software is created and developed through collaborative efforts within a designated, cross-functional team
Monolithic Architecture	A traditional model of a software program, which is built as a unified unit that is self-contained and independent from other applications.
Key Performance Indicator(KPI)	A performance indicator or key performance indicator is a type of performance measurement. KPIs evaluate the success of an organization or of a particular activity in which it engages

7 Table of Abbreviations

Abbreviation	Description
E2E	End-to-end
SRE	Site Reliability Engineering
UI	User Interface
API	Application Programmable Interface
DevOps	Software development methodology
GSB	Global Service Bus
CTO	Chief Technology Officer
BU	Business unit
REST	Representational state transfer
SOAP	Simple object access protocol
SCRUM	Agile software development methodology
GDPR	General Data protection regulation
KPI	Key performance indicator
G2G	Government to Government
G2C	Government to Consumer
G2B	Government to Business

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