



Data Exchange Technologies Department
Information Security Research Institute

Interoperability Architecture for Digital Government Organization

Version 1.0
Taavi Toomere

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Mailing address:
Cybernetica AS
Mäealuse 2/1
12618 Tallinn
Estonia

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Abstract

This paper studies the selection of interoperability architecture for digital governments, with an emphasis on the sovereignty of government entities. Initially, the paper presents an overview of how various political systems lead to differing levels of centralization in government organizations. It then illustrates how decentralized government entities achieve digital sovereignty through the adoption of decentralized data management and interoperability approaches, whereas centralized governments tend to opt for centralized data management and exchange mechanisms.

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1 Introduction

Digital transformation of governments requires a software solution that exposes government data and services to eligible stakeholders. The OECD advises countries to build digital government platforms to maximize the socio-economic benefits of the solution [OEC20]. However, one of the challenges that governments face is selecting an interoperability software architecture for their digital government platform. This paper examines how the political system shapes the centralization and digital sovereignty of government entities and how this, in turn, influences the selection of the interoperability platform architecture for the government.

1.1 Key Concepts and Definitions

The chapter provides definitions of the key concepts used in the paper.

Interoperability can be defined as either the ability to share information and services, or the ability of systems or components to exchange and use information or provide and receive services from other systems [Gro21].

Digital government interoperability platform can be seen as a building block for the digital transformation of public administrations. These interoperability platforms “allow public and private sector entities to control which external parties get access to their databases securely” [eE21].

In more technical terms, the building blocks of the digital government interoperability platform reference architecture have been analyzed by Cybernetica. [Cyb22].

The interoperability platform establishes secure and trusted data exchange between the organizations that use the platform. The platform implements interoperability technical standards. The standards are often defined in the national interoperability framework. The platform also implements various regulations, such as security and privacy regulations. A central authority governs the platform and sets the policies for the platform.

One of the main functions of the digital government interoperability platform is to organize secure data exchange. Government organizations maintain various databases. Government entities, non-governmental organizations (NGOs), and private businesses use the data in their business processes. The interoperability platform solves the data exchange for digitalized business processes in a uniformly secure manner while preserving the data sovereignty of the organizations that maintain the data.

The benefits of the government interoperability platform are realized when a certain number of organizations start to exchange data using the platform. Proper statistics about the critical mass is hard to find. Vassil [Vas16] has shown that in Estonia the critical mass for the interoperability platform was 50 datasets. Vassil does not, however, specify the number of critical number of organizations.

Architecture is defined in two ways by the Open Group, the first being a "formal description of a system or a delayed plan of the system" (via ISO/ IEC 42010:2007) or the second as a "structure of components, their inter-relationships, as well as the principles and guidelines that govern their design and evolution over time" [Gro21].

Digital government architecture exists in several forms and with various architectural patterns. Some of the different ones identified include service-oriented architecture, a one-stop portal service center, semantic web services, layered architectures, enterprise, hybrid and distributed, decentralized, and multi-agent-based architectures [BLS20].

A **sovereign government entity** means a central government or an agency, department, ministry, or central bank of a central government [Cor23].

Digital sovereignty refers to an organization's ability to govern the digital technologies used within it. This includes the power to regulate the use of data and the internet, as well as the ability to control access to digital infrastructure.[Zex23]

Data sovereignty refers to the concept that individuals, organizations, or governments have the ultimate authority and control over the data they generate, collect, store, or process. It encompasses the idea that data should be subject to the laws, regulations, and policies of the jurisdiction in which it originates. [Imp23]

Data sovereignty can have implications at various levels, such as national, regional, or organizational. It can influence decisions regarding data storage locations, cross-border data transfers, and the establishment of data protection regulations.

2 Methodology

The research process involved several steps. Firstly, desk research was conducted to gain insights into the interoperability platforms that governments use for data exchange. Secondly, the topological properties of government organizations were analyzed. The third step involved desk research to examine the relationship between political regimes and the degree of centralization.

Finally, a model was created that examines how the centralization of government organization and data sovereignty influence the choice of data architecture and interoperability platform architecture. The model investigates the extent to which government entities can exercise control over their data, which affects the way data is managed and shared.

3 Scope

Digital government interoperability platforms help to implement data integrations in three dimensions as shown in Figure 1:

- Horizontal integration: integration across sectors or institutions;
- Vertical integration: how the actions of national and sub-national levels of government can be aligned to result in coherent outcomes;
- Engagement of all stakeholders in the realisation of shared objectives.

The integration function of a digital government interoperability platform helps to build seamless processes that involve government organizations, private organizations and NGOs.

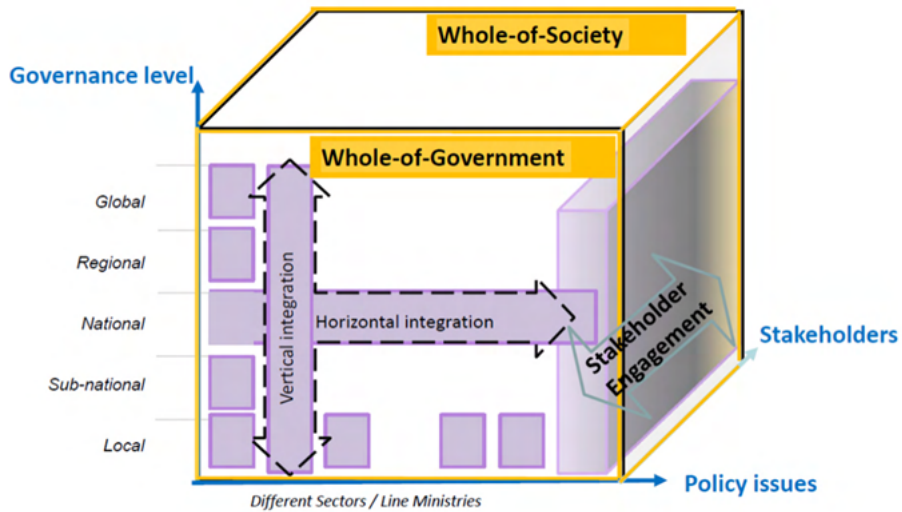


Figure 1: Whole-of-government and whole-of-society integrations. [UN18]

The European Interoperability Framework lists four interoperability layers as is shown in the Figure 2

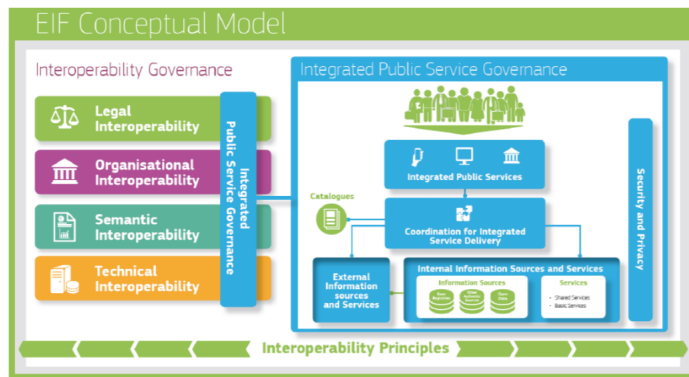


Figure 2: EIF conceptual model. [EU17]

The focus of this paper is on the organizational layer and the technical layer. The paper outlines how the structure of government organization and the sovereignty of government entities drives the selection of the digital government platform that is responsible for secure data exchange. In the vertical integration scale, the paper focuses mainly on the level of national governments.

4 Properties of Government Organization Topology

When we look at a government, it is made up of different sub-entities that each have specific responsibilities. Such entities can be ministries, government agencies or any other organizations established by the government.

This section outlines the properties of the government from the organization's architectural perspective. The properties will be used later to demonstrate how the architecture of the political organization of government determines optimal data exchange architecture.

4.1 Horizontal and Vertical Structure of the Government

Governments are not monolithic and are divided horizontally and vertically as shown in Figure 1. Horizontal government structures involve institutions that have the mandate to organize particular parts of government work. Vertical structures describe different layers of government, such as central and local governments.

Vertical structures can be from a single layer in unitary countries to several layers in federal countries.

4.2 Fragmentation and Concentration of Government

The term fragmentation refers to the number of distinct units in a government system. [Boy92] The concept of fragmentation refers to the number of government entities that realize the government's function. Government is highly fragmented horizontally if there are a high number of government institutions/entities per population or territory. At the highest political level, an example is the number of ministries in the central government. At the municipal level, fragmentation refers to the number of municipalities.

The concentration of government refers to the distribution of service delivery and/or revenue generation responsibilities. [Boy92]

An example of a political order with a highly concentrated government is a kingdom or an authoritarian regime. In this case, all the power is dependent on one person. An example of a lower concentration of government is a confederation where confederated units, such as cantons in Switzerland, have relatively high authority in many government areas.

4.3 Integration of Government Organizations

Scholl and Klischewski define integration from the following angles for government organizations [SK07]:

1. the fusion of different public administration functions, services, or products,
2. the cooperation and collaboration among government entities and units, and
3. the interoperation of digital government information systems.

Scholl and Klischewski also propose separate definitions for different natures of integration such as ad-hoc, federation and interoperability.

4.4 Involvement of Non-Government Organizations

Government data and services also serve other stakeholders in digital societies besides governmental organizations as is shown in the Figure 1 "Stakeholders" axis.

In the context of digital government, non-governmental organizations can integrate with digital government organization using government Application Programming Interfaces (API) or portals. Government APIs enable non-government organizations to develop seamless services for their customers that involve government data.

The number of private sector and NGOs that want to integrate with government APIs can be potentially very large. Thus, it may increase the number of entities that use the digital government platform significantly.

5 The Political System and Centralization of Government

The political system is the main driver of the horizontal centralization of the government organization.

This section follows the classification of political systems based on Britannica [Enc21]

- **Absolute monarchy.** An absolute monarchy is characterized by a hereditary monarch who has complete power over the state. In this system, the monarch is the central authority, and there is little to no decentralization of power.
- **Constitutional monarchy.** A constitutional monarchy is characterized by a monarch who serves as a ceremonial head of state, while real power is held by a democratically elected government. In this system, power is more decentralized, with the monarch serving as a symbolic figurehead.
- **Presidential republic.** Presidential democracy is characterized by a system in which citizens elect a president, who serves as both head of state and head of government. In this system, power is more centralized in the hands of the president.
- **Parliamentary republic.** A parliamentary republic is characterized by a system in which citizens elect representatives to make decisions on their behalf. In this system, power is decentralized to some degree, with elected officials serving as decision-makers.
- **Dictatorship.** A dictatorship is characterized by a single ruler or a few rulers who have complete control over the government and the society. In this system, power is highly centralized in the hands of the dictator or the junta.

There are other marginal situations where a country is in transition from one political system to another or there is no basis for a political system.

Political systems per country are listed for example in [Wik23]. Roughly 21 percent of countries are monarchies, 73 percent are republics and the rest have an unclear political system.

5.1 Typology of National Governments

The vertical structure of the government organization can be characterized by the division of countries to unitary and federal countries.

Unitary National State. A unitary national state is a political system in which the central government holds all political power, with little or no power being held by subnational units such as states or provinces. This system is characterized by a high degree of centralization of institutions, which means that decision-making power is concentrated in the hands of the central government.

Federal states are characterized by a system in which power is divided between a central government and regional governments. In this system, power is more decentralized, with regional governments having significant decision-making authority

6 Sovereignty of Government Organization

Section 5 outlined the primary political systems based on the degree of centralization or decentralization. In section 6.1, we introduced the concept of government organization sovereignty.

6.1 Sovereignty of Government Entities

An entity is considered sovereign by the central government when it can act independently of the central government and exercise its authority within a defined domain. In other words, a sovereign entity has the power to govern and make decisions without interference from the central government.

Several factors that contribute to the sovereignty of entities from the central government. One of the most important is the legal framework that defines the entity's authority and responsibilities. A study by Goodman and Jinks [GJ04] highlights that entities that are protected by law and have a clear legal mandate are more likely to be recognized as sovereign by the central government and other actors.

Secondly, the financial autonomy of an entity is also an important factor in determining its sovereignty. Financially self-sufficient entities are less dependent on the central government for funding and are more likely to be able to act independently. This point is supported by a study by Besley and Case [BC95], who argue that the degree of fiscal autonomy enjoyed by local governments is an important determinant of their ability to act independently of the central government

Thirdly, the degree of political autonomy enjoyed by the entity is an important factor in determining its sovereignty. Entities that are free from political interference and can make decisions based on their expertise and judgement are more likely to be considered sovereign. A study by Stein [Ste82] highlights that the level of political autonomy enjoyed by local governments is a crucial factor in determining their ability to act independently of the central government.

Finally, the level of public support enjoyed by the entity is an important factor in determining its sovereignty. Entities that are perceived as serving the interests of the public and can build public trust are more likely to be able to act independently of the central government. A study by Moe [Moe84] argues that public support is crucial for entities to maintain their independence from the central government.

The sovereignty of entities is also a close concept to the independence of entities. Based on [Tro17] independence of government organizations refers to their ability to act relatively independently from other government organizations. Such organizations have some degree of autonomy.

6.2 The Sovereignty of Government entities in the Federal States

Sovereignty in a federal state refers to the distribution of ultimate authority and power among multiple levels of government within a given country or political system. In federalism, the central government shares sovereignty with regional or local governments, where each level of government possesses independent authority over specific policy areas [Hey13]. This shared authority and autonomy is a defining characteristic of federal systems and is intended to provide a framework for cooperation and collaboration between different levels of government while also preserving the sovereignty of individual states [OR17].

Sovereignty in federal states can be complex and multifaceted. The precise division of sovereignty between the federal government and regional or local governments can vary depending on the country's constitution and legal framework. Generally, the federal government has ultimate authority over certain matters, such as national defense, foreign affairs, and monetary policy, while regional or local governments have authority over areas such as education, healthcare, and law enforcement [Hey13].

Despite the challenges and tensions that can arise from shared sovereignty, federal systems have been adopted by numerous countries across the world, including the United States, Canada, Australia, and India, among others. This type of governance is often seen as providing a balance of power and protection against centralized tyranny while also facilitating regional diversity and local autonomy [OR17].

7 A Model For Selecting Interoperability Architecture for Centralized and Decentralized Organization

In this section, we develop a model for selecting proper government interoperability architecture for centralized/decentralized government organization

In the subsequent chapters, we simplify our observations to examine purely centralized and decentralized governments. However, it's important to note that most countries do not have pure centralized or decentralized governments, but rather a combination of both. We also simplify the sovereignty of organizations which is considered to be either zero or absolute while in the real world, it is somewhere between the values.

7.1 Organization Sovereignty

The sovereignty of centralized and decentralized government organizations differ significantly, as illustrated in Figure 3.

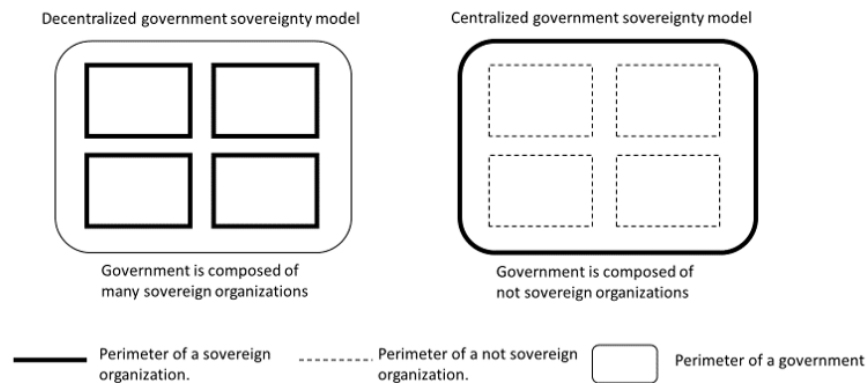


Figure 3: Sovereignty model of centralized and decentralized governments. Created by the author

In a centralized government, sovereignty is concentrated at the top level, typically with the central government or a single governing entity. This means that decision-making authority, policy formulation, and control over resources are primarily vested in the central government. Other entities or sub-organizations within the government framework may not possess independent sovereignty. Instead, their authority is derived from and enforced by the central government. The central government acts as the overarching authority that defines and maintains the perimeter within which these entities operate.

In contrast, a decentralized government distributes sovereignty among various sub-entities or levels within the government structure. These sub-entities, such as states, provinces, or local governments, have a degree of autonomy and independent decision-making power. They possess their sovereignty within their respective jurisdictions, often granted by a constitution or legislation. The decentralized nature of governance means that the government organization's perimeter, or the central government's authority, is relatively less important. Instead, the sub-entities have the freedom to exercise their sovereignty within the limits defined by law.

7.2 Data Sovereignty

Data sovereignty refers to the ability of an organization or government to exercise control over data that is stored or processed within its jurisdiction, to ensure that the data is subject to the laws and regulations of that jurisdiction. This includes the ability to control access to data, to determine where data is stored or processed and to set standards for data security and privacy.

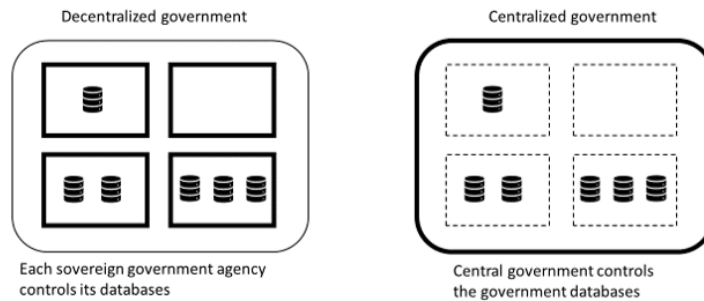


Figure 4: Data sovereignty of centralized and decentralized government. Created by the author

Data sovereignty is a crucial component of organizational sovereignty in the digital realm. It refers to the principle that organizations, such as governments or businesses, have exclusive control over the data they collect, store, and process.

Figure 4 illustrates that in a decentralized government, data sovereignty empowers each government entity to have control over the data they are responsible for managing. This means that they can make decisions about how that data is collected, stored, and used. In such a system, government entities are not dependent on the centralized government for access to data or for decision-making regarding data management. Instead, they can operate independently, with a greater degree of autonomy.

On the other hand, in a centralized government, data sovereignty is limited, and government entities have only restricted control over the data they are mandated to manage. This is because the centralized government retains the majority of decision-making power regarding data management. As a result, government entities are reliant on the centralized government for access to data and decision-making regarding data management.

In summary, data sovereignty is a vital concept in the digital environment, and it is closely linked to organizational sovereignty. In a decentralized government, data sovereignty empowers each government entity with control over the data they manage, whereas in a centralized government, data sovereignty is limited, and government entities have only restricted control over the data they are mandated to manage.

7.3 Data Interfaces of Sovereign Organizations

In digital governments, data is often served over interfaces such as APIs. These interfaces provide a standardized way for different systems and applications to interact with each other and access data and the same time help to enforce data sovereignty.

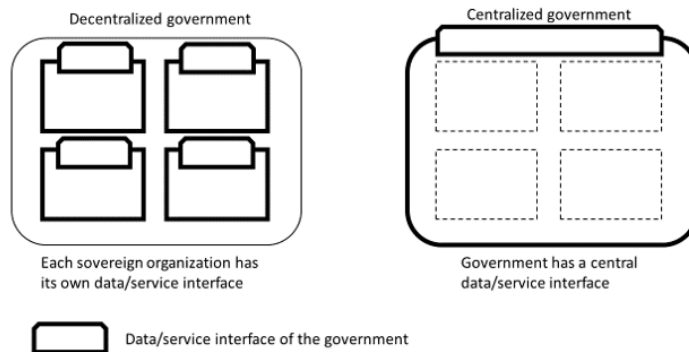


Figure 5: Interfaces of centralized and decentralized governments. Created by the author.

As illustrated in Figure 5, in a decentralized government, sovereign entities establish their interface at the perimeter of their organization as this allows them to maintain control over their data and manage access to it in a more granular way. Each entity can determine which external stakeholders are authorized to access their data and set appropriate security protocols.

Similarly, centralized governments establish an interface at the perimeter of their organization, which serves as the gateway for external stakeholders to access government data. This approach allows the centralized government to maintain greater control over access to data and set uniform standards for data management across different government entities.

In summary, interfaces play a critical role in enabling data access and management in digital organizations. In decentralized governments, each entity establishes its interface at the perimeter of its organization to maintain control over its data. In contrast, centralized governments typically provide an interface to manage access to government data for external stakeholders.

7.4 Sovereign Data Exchange

The sovereignty of the data exchange is a part of data sovereignty of sovereign entities. Sovereignty in the data exchange refers to the ability of a government or organization to exercise control over data that is processed, or exchanged within its jurisdiction. Sovereignty in this context is closely tied to concepts of national security, data protection, and data privacy, and is particularly important for government entities that deal with sensitive or classified information [Bel19].

The concept of sovereignty in the data exchange is complex and multifaceted and is influenced by a range of legal, political, and technical factors. In particular, the rise of cloud computing and other technologies that allow for the storage and processing of data across national borders has raised important questions about the ability of governments to maintain control over data that is stored or processed outside of their jurisdiction.

To address these challenges, governments have developed a range of policies and regulations aimed at enforcing data sovereignty. These policies may include data localization requirements, data access controls, encryption and data security measures, and legal and regulatory requirements aimed at ensuring that data is subject to the laws and regulations of the jurisdiction in which it is stored or processed [Com17].

7.5 Data Exchange Between Government Entities

The exchange of data between government entities is heavily influenced by the centralization of the government.

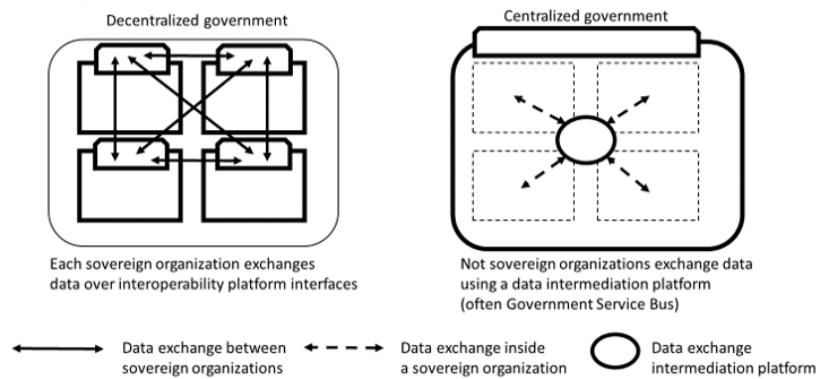


Figure 6: Data exchange between the government entities. Created by the author.

As depicted in Figure 6, in a decentralized government, each entity has its sovereignty and maintains control over the data exchange. As a result, decentralized governments should prefer a point-to-point data exchange model, which enables entities to have greater control over who has access to their data. This approach helps to prevent a centralized data exchange model, which may lead to concerns about privacy and security if a central government is perceived to be controlling the data exchange.

In contrast, in a centralized government, entities have a lower degree of sovereignty, and the central government should prefer to have greater control over the data exchange. As a result, a centralized platform is often used for data exchange, which is commonly referred to as a Government Service Bus (GSB). The GSB allows for standardized and centralized data exchange across different government entities, enabling the central government to set uniform standards for data exchange and management.

7.6 Data Exchange between Government Entities and External Stakeholders

Government entities often need to exchange data with external organizations, such as private businesses and non-governmental organizations. However, external organizations are not under government control, and the communication needs to follow regulations, be secure, and be trusted.

In a decentralized government, as shown in Figure 7, the same interoperability platform used for communication between government entities can also be used for external communication. This approach provides a standardized and secure communication channel for exchanging data with external organizations. Additionally, the decentralized government can enforce its sovereignty in the data exchange, ensuring that external organizations are adhering to the same regulations as government entities.

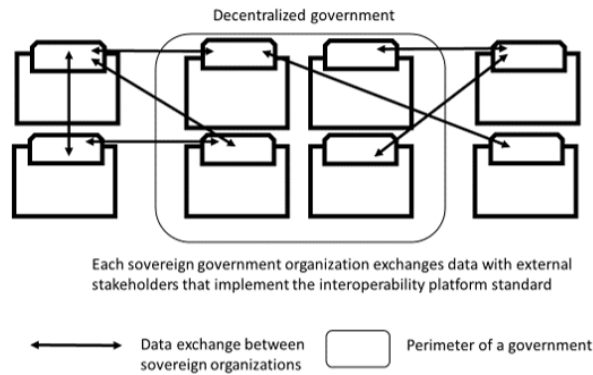


Figure 7: Data exchange between decentralized government and external stakeholders. Created by the author.

On the other hand, in a centralized government, as depicted in Figure 8, there is no such platform in place for external communication. In this case, the government may need to introduce an interoperability platform or build ad-hoc integrations with external organizations to exchange data securely and efficiently. The centralized government may face additional challenges in enforcing sovereignty over the data exchange, as external organizations may be less likely to adhere to government regulations.

In both centralized and decentralized governments, the approach to data exchange with external organizations must be carefully considered to ensure that data is exchanged securely and efficiently. Standardization and interoperability are key factors to consider, as they can simplify the process of exchanging data while also ensuring that all parties are adhering to regulations and security standards. Additionally, enforcing sovereignty over the data exchange is important for both centralized and decentralized governments to maintain control over their data and ensure that external organizations are following the same regulations as government entities.

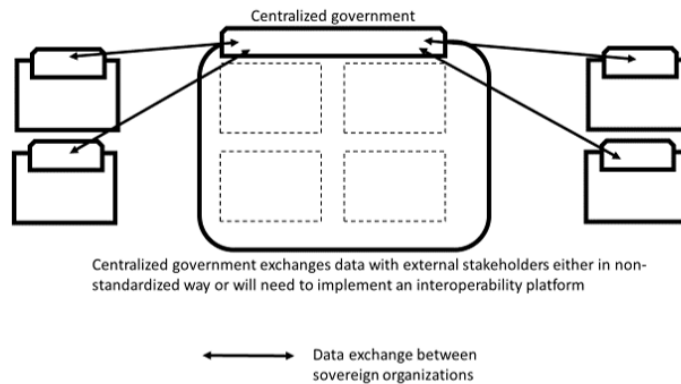


Figure 8: Data exchange Between centralized government and external stakeholders. Created by the author

7.7 Data Exchange In Federal States

In countries with a federal political system, such as the United States, Canada, or Germany, different levels of government have varying degrees of sovereignty, as discussed in Section 6.2. This distribution of sovereignty also impacts the data exchange architectures that may evolve in such countries.

One real-world example of this is the European Union, where nation-states utilize both centralized and decentralized data exchange platforms, as highlighted in a recent report by McBride *et al.* [MKV⁺22]. The European Union is composed of 27 member states, each with its own government, and the EU as a whole also possesses its set of governing bodies. Consequently, the European Union requires a complex data exchange architecture to facilitate interoperability between its various member states and governing bodies.

Currently, the design of cross-border interoperability in the European Union is still being planned and has not yet been fully decided, as noted in a recent communication from the European Commission [Eur21]. The development of such a system will require careful consideration of the various levels of sovereignty at play, as well as the differing data exchange architectures used by member states. Ultimately, the goal of any such system would be to facilitate secure and efficient data exchange between member states and EU governing bodies, while also ensuring adherence to regulations and standards.

8 Summary

The political system and constitution of a country play a crucial role in determining the topology of the government organization and the sovereignty of sub-entities in the government organization. Data sovereignty is a core part of the digital sovereignty of organizations. Data sovereignty determines which entities manage the data, provide data interfaces and control the data exchange.

Based on the developed model, we claim that centralized governments, such as autocracies and some monarchies, have central power-level data sovereignty, giving the central government control over data management and data exchange among government entities. As a result, centralized governments often choose centralized interoperability platform. This creates a difficulty for data exchange with external organizations that often requires a separate solution.

In contrast, decentralized governments, such as republics, enable entity-level data sovereignty, allowing entities to control their data and oversee data exchange. As a result, a decentralized interoperability platform can facilitate communication not only within the government but also between government entities and external organizations.

The model has certain limitations. First, in practice, there are rarely pure centralized and decentralized cases. Governments are some sort of a combination of the two approaches. Secondly, in the real world sovereignty of organizations is not zero or absolute, but rather between the two values.

There are plenty of areas in the field that require further research. For instance, practical methods for measuring government sovereignty need to be developed.

Further research in these areas can contribute to the development of effective data exchange and sharing systems for governments, ultimately leading to better governance and improved public services.

References

- [BC95] Timothy Besley and Anne Case. Incumbent behavior: Vote-seeking, tax-setting, and yardstick competition. *American economic review*, 85(1):25–45, 1995.
- [Bel19] Patrick Bellia. Sovereignty in the digital age. *Yale Law Journal*, 128(8):2570–2635, 2019.
- [BLS20] Baseer Ahmad Baheer, David Lamas, and Sónia Sousa. A systematic literature review on existing digital government architectures: State-of-the-art, challenges, and prospects. *Administrative Sciences*, 10(2), 2020.
- [Boy92] George Boyne. Local government structure and performance: Lessons for america? *IEEE Public Administration*, 70(3):333–357, 1992.
- [Com17] European Commission. Communication from the commission to the european parliament, the council, the european economic and social committee and the committee of the regions. data protection rules as a trust enabler in the eu and beyond–taking stock. Brussels: European Commission, 2017.
- [Cor23] Cornell Law School. Legal Information Institute - Definitions. Cornell Law School, 2023.
- [Cyb22] Cybernetica. Digital government interoperability platform reference architecture. https://cyber.ee/uploads/Digital_Government_Interoperability_Platform_Reference_Architecture_4d2b8a83f6.pdf, 2022. (accessed: 05.09.2023).
- [eE21] e Estonia. Why there’s no digital transformation without interoperability. <https://e-estonia.com/why-theres-no-digital-transformation-without-interoperability/>, 2021. (accessed: 08.05.2023).
- [Enc21] Encyclopedia Britannica. Political system, 2021. [Accessed May 10, 2023].
- [EU17] EU. The european interoperability framework (eif). <https://inspire.ec.europa.eu/news/new-european-interoperability-framework-eif>, 2017. (accessed: 13.04.2022).
- [Eur21] European Commission. An Interoperable Europe Act: Proposal for a Regulation. European Commission, December 2021.
- [GJ04] Ryan Goodman and Derek Jinks. How to influence states: Socialization and international human rights law. *Duke Law Journal*, 54(3):621–703, 2004.

- [Gro21] The Open Group. The TOGAF Standard, Definitions . https://pubs.opengroup.org/architecture/togaf9-doc/arch/chap03.html#tag_03_23, 2021. (accessed: 09.05.2023).
- [Hey13] A. Heywood. *Politics*. Palgrave Macmillan, 4th edition, 2013.
- [Imp23] Imperva. Data sovereignty. Imperva Website, 2023.
- [MKV⁺22] Keegan McBride, Sujani Kamalanathan, Sandhra-Mirella Valdma, Taavi Toomere, and Margus Freudenthal. Digital government interoperability and data exchange platforms: Insights from a twenty country comparative study. page 90–97, 2022.
- [Moe84] Terry M Moe. The new economics of organization. *American Journal of Political Science*, 28(4):739–777, 1984.
- [OEC20] OECD. The oecd digital government policy framework. <https://www.oecd.org/gov/the-oecd-digital-government-policy-framework-f64fed2a-en.htm>, 2020.
- [OR17] P. H. O’Neil and R. Rogowski. *Essential Readings in Comparative Politics*. W. W. Norton & Company, 5th edition, 2017.
- [SK07] Hans Scholl and Ralf Klischewski. E-government integration and interoperability: Framing the research agenda. *Intl Journal of Public Administration*, 30:889–920, 07 2007.
- [Ste82] Albert A Stein. Urban decentralization: A review of recent literature. *Journal of Regional Science*, 22(1):1–21, 1982.
- [Tro17] Bauer Trondal. Conceptualizing the european multilevel administrative order: Capturing variation in the european administrative system. *European Political Science Review*, 9(1):73–94, 2017.
- [UN18] UN. Working together: Integration, institutions and the sustainable development goals - world public sector report 2018. <https://publicadministration.un.org/publications/content/PDFs/WorldPublicSectorReport2018.pdf>, 2018. (accessed: 12.04.2022).
- [Vas16] Kristjan Vassil. Estonian e-Government Ecosystem: Foundation, Applications, Outcomes. <https://thedocs.worldbank.org/en/doc/165711456838073531-0050022016/original/WDR16BPEstonianeGovecosystemVassil.pdf>, 2016. (accessed: 09.05.2023).
- [Wik23] Wikipedia. List of countries by system of government. https://en.wikipedia.org/wiki/List_of_countries_by_system_of_government, 2023. (accessed: 09.05.2023).
- [Zex23] Zextras Community. Digital sovereignty vs data sovereignty: What are the differences? Zextras Community Blog, 2023.