Effective Implementation of Government Platforms

How architectural decisions, operational approaches, and government structures alter the economic benefits and costs of government platforms.

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Executive Summary

The private sector has successfully used platforms[1] to capitalize on various economic properties. These properties include economies of scale, economies of scope, and network effects. Increasingly, governments are also using these platforms to improve service delivery while reducing financial and economic costs and increasing economic benefits.

However, the term "platform" is used to describe several different architectural designs and operational approaches. To understand how to properly leverage platforms and receive the many economic benefits platforms offer, governments must understand how a platform is built. **Each platform ecosystem has nuanced architectural and operational specifications which alter economic impact.**

Further, there are **many government structures in place that can make platforms the wrong solution for some technical or operational problems.** Even when a platform is the right solution, these government structures can prevent the total capitalization of benefits or, in some instances, create harm.

As a government increases its use of platforms, it must understand how they may be built, used, and operated within its organization. Only then can a government begin to quantify the true economic impact a platform will have.

Why Platforms?

Platforms have been part of human consciousness and dialogue for centuries. Historically, platforms have been defined as physical foundations (e.g., loading docks). When interpreted broadly, this definition also applies to ideologies (e.g., political platforms) and technology (e.g., electricity). In part, this is how the term "platform" became the blanket-term to describe the abstraction of technical infrastructure. However, as this paper outlines in the definitions section, platforms are much more than abstraction tools..

Using platforms to improve government is also not a new idea. In 1086 William the Conqueror documented the people, land, and buildings of England to create a national register for tax purposes.[1] This national register, and other datasets like it,[2] were early government platforms because they created a common, reusable core component (the dataset) that removed the data collection process for many new projects. These registers made it easier to create new government functions, including tax law and property rights.

Digital platforms became more common in the second half of the 20th century, due to the rise of internet technology which unlocked the phenomenon of digitized information goods (e.g., books, music, computer software).

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1) Most frequently classified as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).

Andrew McAfee and Eric Brynjolfsson write about this in their 2017 book *Machine Platform Crowd*. They assert that when digitized information goods are provided through digital platforms, the economic properties of **free, perfect, and instant** are unlocked.This is because it is "essentially free" (or very, very cheap) to use digital platforms to make and store "perfect copies" of digitized information goods. It is also possible to transport these goods across networks (e.g., the Internet) almost instantly.[3]

Digital platforms are the key to realizing these properties. A platform can provide more of something (perfect copies) for nearly free when the quantity demanded is high and then provide less of it when the quantity demanded is low. In other words, platforms leverage the economic properties of free, perfect, and instant to generate a level of scalability that makes economies of scale frictionless.[4]

The private sector has proven that this new kind of platform provides access to substantial economic benefits. The prevalence and quick adoption of new technology has fundamentally changed how private and public sector organizations are expected to provide services. Many private sector organizations have changed their operations to meet or exceed these expectations, and digital platforms—because they can leverage powerful economic properties like economies of scale— have played an outsized role in these efforts.

Relatively new companies—such as Uber, Airbnb, and WhatsApp—learned how to leverage network effects to dominate their market. Other companies—including corporations that are large, highly regulated, and long-standing[5]—migrated to platforms as a way to abstract away old, burdensome technical infrastructure. The public sector has not had the same success in meeting the public's higher expectations for service delivery.[6] Ignoring or misusing platforms might be the reason why.

Key Takeaways From Report

This report is based on an extensive review of platform literature, primarily from the fields of industrial economics and engineering design, and dozens of practitioner interviews. It places a significant focus on understanding platform ecosystems, particularly on understanding the architectural designs, operational approaches, economic properties, and government structures that influence a platform ecosystem's adoption and impact. It concludes by analyzing how these four categories have influenced the economic benefits and costs faced by Login.Gov.

This document is the **first part of a larger initiative** to understand the economics of government platforms. Future work should focus on quantifying the economic benefits of government platforms and changing government structures to increase the possibility that platforms are used.

It argues that for a government to realize the economic benefits that these properties may provide, it must focus on four areas of understanding:

1. Understand the architectural design of a platform ecosystem.

a) A government must understand the **base architectural definition** underlying all platform ecosystems. A platform ecosystem's architecture is defined in this document as a system of low and high-variety components with specified stable interfaces through which one accesses those components. All platform ecosystems must meet this three-part architectural definition.

b) While the base architectural definition has three criteria that must be met, the way a platform ecosystem meets them may vary. These are referred to as **secondary architectural decisions**. A government must understand how these decisions can vary across platform ecosystems and influence how economic benefits are received. An example of this is the decision to make the "specified stable interfaces" open or closed.

c) A government must understand how to **translate this architectural definition into business terms**. This document focuses on the business terms Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). These terms can be thought of as the level of abstraction a platform ecosystem provides. More abstraction will mean less control over the final product. Less abstraction will mean more control. This changes how a platform ecosystem's architectural design confronts several government structures.

2. Understand the different operational approaches for implementation.

a) A government must **decide how the platform ecosystem will be used**. Governments have several options, ranging from using a platform ecosystem within a single department, sharing a platform ecosystem across many departments, and becoming a platform ecosystem.

b) A government must make **secondary operational decisions** about how to govern the platform ecosystem. These decisions must align with its operational approach. Examples of these decisions include if the ecosystem should be mandatory or voluntary; or if it should be cost-recoverable, subsidized, or free-to-use.

3. Understand the economic properties influencing the economics of platform ecosystems.

a) At a high level, a government must understand how platform ecosystems are influenced by **economies of scale, economies of scope, combinatorial innovation, complementary goods, and network effects**. These economic properties provide important information about how economic benefits can be achieved.

b) A government must also understand how its **operational and secondary architectural decisions can amplify or constrain economic benefits**. For example, the economic properties of combinatorial innovation and complementary goods are impacted by how open the platform is, and the potency of network effects is impacted by the operational approach.

4. Understand the government structures that influence the use of platform ecosystems.

a) Government structures influence how decisions about platform ecosystems are made. This document outlines six structures that influence platform ecosystems: **procurement, budgeting, security, accountability and ownership, regulations, and political support**.

b) These government structures change how politically expedient, financially sound, or operationally feasible using a platform ecosystem is. A government must understand how these structures translate to its context, how **strong or weak** they are, and if they will create barriers to using platform ecosystems.

Recommendations from Part One

1. Understand Platform Ecosystem Definitions

The definitions outlined in this document are important because **platform ecosystems are not built or used equally**. These differences correlate with real financial, operational, and political changes that governments must acknowledge and address. The only way to properly use a platform ecosystem is to understand the impact of each definition and decision separately and think through how their interactions will change the ecosystem's dynamics.

2. Understand the Economic Properties Influencing Platform Ecosystems

Platform ecosystems leverage a set of economic properties. The way that these properties are leveraged depends on secondary architectural decisions and the operational approach. Decision-makers must **understand the mechanics of these economic properties and how they interact with the architectural and operational definitions.**

3. Have an Operational Transformation Strategy

A government's **operational needs will change over time**, and platform ecosystems should be able to adapt to these changes. These changes might occur because a platform ecosystem supports a function that has commoditized or because changes to government structures (political support, budget process) make a different operational approach more feasible. Whatever the reason, decision-makers should prepare for these changes.

4. Start Where Economic Costs Are Low

Decision-makers should feel **comfortable starting where government structures are weaker** and there are fewer barriers to entry for platform ecosystems. This strategy will build up momentum that can be used to challenge stronger structures while simultaneously addressing or mitigating weaker structures.

5. Monitor and Measure the Economic Benefits Provided by a Platform Ecosystem

Governments should monitor and measure how these economic properties (e.g., economies of scale) translate into economic benefits within its departments or agencies. This includes monitoring cost savings and beginning to think about the **value of a citizen's time, the value of integrated systems, or the value of extensibility.**

Looking Forward

This work is the first part of a larger research initiative that aims to understand the economics of platform ecosystems. This future research may focus on:

1. **Convincing decision-makers** by quantifying the financial and non-financial economic benefits of platform ecosystems.

2. **Changing structures** by proposing policy changes in areas that constrain the use of platform ecosystems.

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Chapter One: Platform Architecture

Platform Ecosystems: ***a system of low and high-variety components with specified stable interfaces through which one accesses those components.***

1.1 Why Does This Matter?

This paper places high importance on defining platforms because the way a platform is defined changes its economic impact. A platform ecosystem's architecture determines which economic benefits are realized and how. This is best explained by Mitch Kapor's famous line, "**architecture is politics**."

The way a platform is architecturally defined and built results in different political, operational, and financial considerations for the ecosystem's consumer.[7]

This happens because architectural choices enforce certain organizational structures or set rules for which interactions will be supported.

Decision-makers must assess a platform ecosystem's architectural design and understand how architectural decisions will impact how a government can use a platform ecosystem.

Why Architectural and Operational?

The word "platform" is frequently used to describe several different architectural designs and operational approaches, resulting in a term that means different things to different people. This has occurred because research on managing "technological platforms has been developed from two separate streams of academic literature: industrial economics and engineering design."[8]

From these bodies of literature, it is clear that "the economics perspective focuses on how platforms as markets mediate transactions"—the operational approaches. In contrast, "the engineering perspective views product platforms as technological designs that help firms generate modular product innovation"—the architectural designs (Gawer, 2014).[9]

Simply, the architectural design refers to how the platform is built, while the operational approach refers to how the platform is used. For governments to understand the benefits of using platforms, both of these perspectives must be carefully considered. While there is not yet a single definition for a platform's architectural design, the academic literature reviewed in this paper (supplemented with practitioner conversations) reveals common themes from which a shared understanding can be built.

1.2 Defining Platform Architectural Design

Platform ecosystems are a system of low and high-variety components with specified stable interfaces through which one accesses those components.

This definition is derived from the following academic literature. In the literature, it is clear that architecturally a "platform" is a set of modular systems that combine to create a platform ecosystem. For this reason, this paper views and refers to platforms as ecosystems.

The **low-variety component** or the "core component" refers to highly reusable elements of the ecosystem that remain relatively stable and provide the main functionality.[1]

The **interfaces** "govern the interactions of components,"[10] are fully stable over time, and provide a way to control the entire platform ecosystem.

Selected Architectural Definitions Literature

"A product platform is a set of common components, modules, or parts from which a stream of derivative products can be efficiently created and launched" (Meyer and Lehnerd, 1997). [12]

"An evolving system made of interdependent pieces that can each be innovated upon" (Gawer and Cusumano, 2002). [13]

"Platform architectures are modularizations of complex systems in which certain components (the platform itself) remain stable while others (the complements) are allowed to vary in cross-section or over time" (Baldwin and Woodard, 2008). [14]

"A set of subsystems and interfaces internal to the organisation that have been intentionally planned and developed to form a common structure from which a stream of derivative products can be efficiently developed and produced" or a set of subsystems which "replicate the benefits of internal platforms across interfaces amongst different organisations within a supply chain" (Brown et al., 2017). [15]

These two pieces—the low-variety component and the stable interfaces—**create the feature of "abstraction"** most commonly associated with platform ecosystems.

However, the third architectural condition, **high variety components**, is a required piece of this platform ecosystem definition. High variety components or "complements"—refers to a number of components that are peripheral to the core functionality,[11] are encouraged to change over time, and are supplied by one or many firms.

1) The architecture of the core component can fluctuate over time if interfaces are stable (allowing for the platform ecosystem to evolve) but should retain as much stability as possible for the complements.

Apple's iPhone provides an easy-to-understand example of this three-part platform ecosystem.

- **Low-Volatility Component (Core)**: iOS, the system that provides the iPhone's functionality
- **Stable Interface**: The App Store, a place for the market (iPhone users, app makers) to access iPhone components
- **High-Volatility Component (Complements)**: Applications (e.g., Uber)

Figure 1.1: iPhone with Applications on Home Screen

Source: Photo by David Švihovec on Unsplash, License

1.3 Understanding Secondary Architectural Design

For something to be a platform ecosystem, it must meet this base architectural definition: core components, complements, and stable interfaces. However, **the way a platform ecosystem meets these three criteria may vary.** For example, one ecosystem may have relatively open interfaces while another may have relatively closed ones. Both of these platform ecosystems have met the base architectural criteria of having a stable interface, but each ecosystem has made a secondary architectural decision that differentiates the offering. **Further, a platform ecosystem with a closed interface will interact with economic properties differently from a platform ecosystem with open interfaces.** A closed interface will attract fewer external complements and diminish combinatorial innovation.

Examining the Impact of Secondary Architectural Decisions

To better understand how secondary decisions impact a platform ecosystem's economics first consider organizational structure. A platform ecosystem enforces an **organizational structure through secondary architectural decisions.** An ecosystem can decide to make its architecture more open (e.g., the Internet) or closed (e.g., iOS). This decision represents an ideal or existing "organizational form" (Brown et al., 2017), which can either limit or encourage innovation and extensibility. This, in turn, changes how a government can interact with or build upon the ecosystem.[16]

Now, consider **decisions about interactions with the platform ecosystem.** The ecosystem's interfaces determine what types of interactions it can have and how modular it can be.[17] At one extreme, an ecosystem that wants to control all interactions will exert complete ownership over the interfaces and may intentionally restrict the ecosystem's modularity.[18] This changes how a government can use the ecosystem, impacting its operational approach. The platform ecosystem has a nuanced range of modularity options to choose from[19]—defined in literature as the "level of coupling" (Nielsen and Aanestad, 2006).[20]

These are just two types of secondary architectural decisions that change how a platform ecosystem leverages some economic properties. A further example of these two decisions is an architecture that enforces a restricted organizational structure and has a complicated integration process. This ecosystem will retain control over most complements, which may reduce the total number of complements in the platform ecosystem. This, in turn, may reduce the ecosystem's total value. The complicated integration process may also impact the operational approach.

1.4 Translating Architectural Definitions into Business Terms

While this architectural definition is politically and economically important, it's helpful to understand how it connects to the business terms that organizations use to describe platform ecosystems. A simplified way to think about a platform ecosystem's architecture is to focus on how it abstracts core functions or infrastructure. This abstraction makes it easier for a government to develop and provide products or services because it does not need to manage part (or all) of the infrastructure required for production.

Illustrated in Figure 1.2 are three levels of abstraction: Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS).[1] The blue boxes show what is managed by a government, and the grey boxes show what is managed within the platform ecosystem. **More grey boxes mean more abstraction or fewer processes for the government to manage**. Another way to think about this is that a function or service "sits on top of" the grey boxes.

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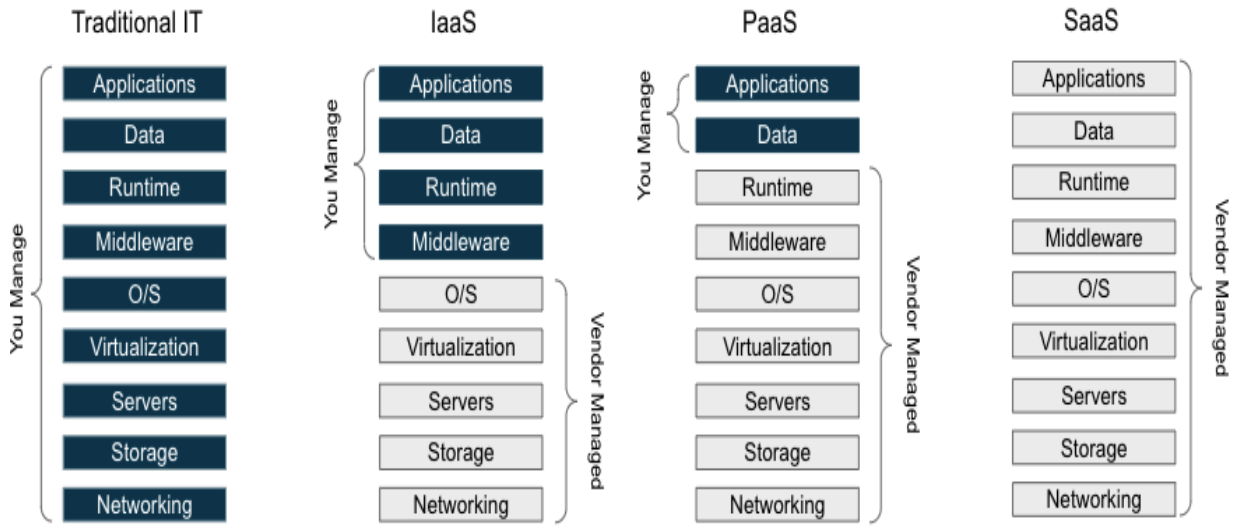
1) There are other "as a service" offerings, including Database as a Service (DBaaS), Containers as a Service (CaaS), and Functions as a Service (FaaS), which have become increasingly popular ways to abstract different core functions or infrastructure.

Most platform ecosystems will be marketed as one of these three levels of abstraction. Thus, a government needs to understand these terms and know what components will be abstracted. **However, it is more important for a government to understand the underlying architectural decisions, regardless of what the ecosystem is called.**

Figure 1.2: Platform Ecosystems as Levels of Abstraction



There are many examples of IaaS, PaaS, and SaaS offerings across the public and private sectors. Here are just a few of the many options available today.

- **IaaS**: Azure,[21] Amazon Web Services (AWS),[22] Google Cloud Platform (GCP)[23]
- **PaaS**: Cloud.Gov,[24] Federalist,[25] Azure Cognitive Search,[26] AWS Elastic Beanstalk[27]
- **SaaS**: Login.Gov,[28] Outlook,[29] Docusign[30]

Decision-makers should carefully consider what the platform ecosystem is abstracting and what they will be responsible for. More abstraction (i.e., SaaS ecosystems) will mean that the government has less control over the final product. Less abstraction (i.e., IaaS ecosystems) will mean the government has more control over the final product.

In giving up control, the government has to do less of the development and infrastructure management work. This can make the platform ecosystem easier to use, implement, and scale. However, there are many government structures in place that incentivize leaders to retain control when possible. **If a decision-maker wants to give up ecosystem control in favor of these benefits, they must assess what this abdication will mean for them and those they work with.**

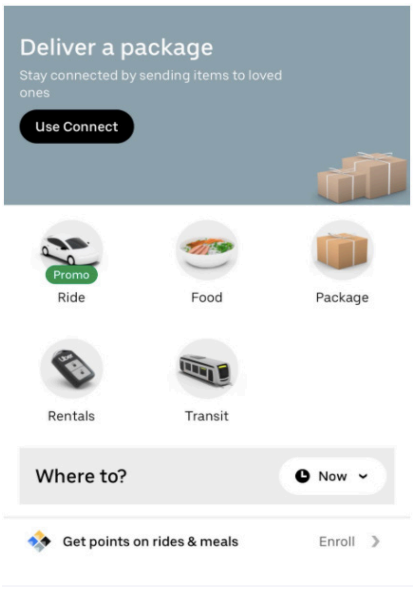
Why the Architectural Definition Matters More: Not All Abstraction Offerings Are Platform Ecosystems

It is easy to connect the business terms back to the core architectural definition. The abstracted processes, or greyed out boxes, are the platform ecosystem's **core components** (the low-volatility base of the ecosystem). These core components are accessible to users through **interfaces**. Additional components—**complements**—can be built on top of these core components and are made available for optional use. These are built by the platform ecosystem provider and, in some cases, by external firms.

Offerings that are referred to as IaaS and PaaS almost always meet all three of these architectural conditions. However, some offerings that are referred to as SaaS only meet the first two—offer core components and interfaces—and do not meet the third condition of having highly volatile and peripheral complements. **When this happens, the SaaS offering is not an independent platform ecosystem even though it might be marketed as one**. More likely, the SaaS offering is a product or complement that is part of a greater ecosystem.

The nuance between a SaaS offering that is a platform ecosystem versus a SaaS offering that is a complement can be easily understood by returning to the iPhone example. Consider the applications (complements) available on the App Store. Uber is a SaaS offering that meets all three architectural conditions required to be considered a platform ecosystem.[31] It has volatile, peripheral complements (e.g., ride-sharing, food delivery, package delivery) that sit on top of its core component (smartphone app named "Carbon"),[32] all of which are accessed through interfaces (e.g., user interface, login).

Figure 1.3: Uber Application Home Screen



Source: iPhone Uber Application

However, many App Store applications are not platform ecosystems. Some—such as games or meditation tools—are products. Others—such as Outlook or Gmail—are complements that sit within an ecosystem, but are not the core-component of that ecosystem.

Why Does This Matter?

There is an economic distinction between using a platform ecosystem and using a product or complement. For example, the base platform ecosystem benefits more from the economics of complements than any of its components do. This is why it's important for a government to know if it is just using a product that abstracts away parts of its process, or if it is really using a platform ecosystem.

This can be difficult because the term "platform" is frequently used as a marketing technique to sell offerings that are actually not platform ecosystems. As explained above, this can be particularly true with SaaS offerings. In the government context, this also frequently occurs with shared services.

When asked if all shared services should be considered platform ecosystems, many of the practitioners interviewed for this paper said, "If an organization can use a shared service to abstract away parts of its infrastructure, it is a platform." This response partially comes from practitioners not wanting to separate government shared services from the term "platform," which has come to mean "good" and "efficient."

Shared services that are not platform ecosystems can still be valuable. They are effective ways to improve user experience and reduce redundancies. However, a government must be able to distinguish between products and platforms, if only to be able to know what the economic impact will be. The value a government receives from using a shared service that is a product is different from the value it receives from using a shared service that is a platform ecosystem.

Chapter Two: Platform Operations

2.1 Why Does This Matter?

Platform operations come down to a single question: "how will the platform ecosystem be used?" The answer to this question is important; just as a platform ecosystem's architectural design changes its economic impact, so too does an ecosystem's operational approach.

2.2 Defining Platform Operational Approaches

To answer the question "how will the platform ecosystem be used?" governments may consider a range of options. These options can be distilled into the following three categories, one of which will align most closely with a government's operational approach. The most aligned category is a government's primary operational approach but there is fluidity across these categories and much grey space in between them. A government may leverage parts of each operational approach or use different platforms in different ways.

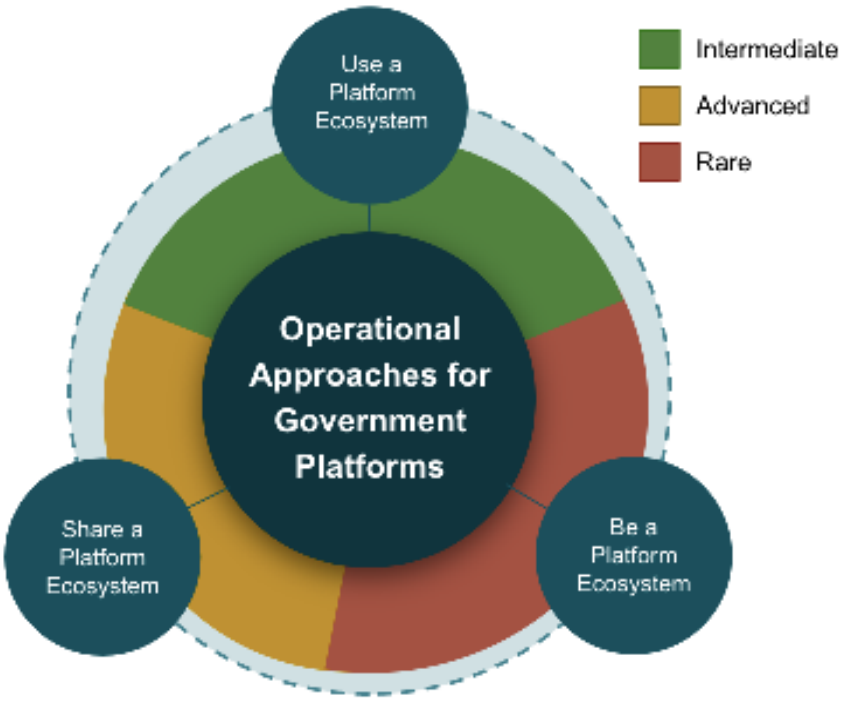
These three categories can be defined as follows:

> **Use a Platform**: A department decides which platform ecosystems to use without considering government-wide priorities. There might be a cross-government platform strategy or a centralized support office, but individual departments make decisions.
>
> **Share a Platform**: Departments frequently use a platform that is already used in other parts of the government, typically for core functions, such as hiring, payroll, authentication, or payments. Decisions about which platform to use are influenced by government-wide priorities and the number of other departments using the tool.
>
> **Be a Platform:** Most government functions exist within the same platform ecosystem. The low-volatility functions listed above (hiring, etc.) operate as the ecosystem's core components, which standardize them across all departments. Other high-volatility functions (department-specific operations) are provided by complements that sit on top of this platform.

A particular project will start with one of these operational approaches but it may transition over time to better reflect the government's evolving needs and capacities. For example, consider a government with the primary operational approach of "use a platform ecosystem." Over time, some of the platform ecosystems used by individual departments might gain traction within the government and get picked up by other departments. This shift would start to transition the operational approach for that platform ecosystem from "use a platform" to "share a platform."

Alternatively, at some point this same government may decide to explicitly change its primary operational approach from "use a platform" to "share a platform." This means all new projects would be subjected to a "share a platform" strategy. Over time, some of the existing ecosystems that followed a "use a platform" approach might also transition, or may be abandoned in favor of a shared platform. Both of these scenarios reflect the fluidity of a government's operational approach.

Figure 2.1: Operational Approaches for Using Platform Ecosystems in Government



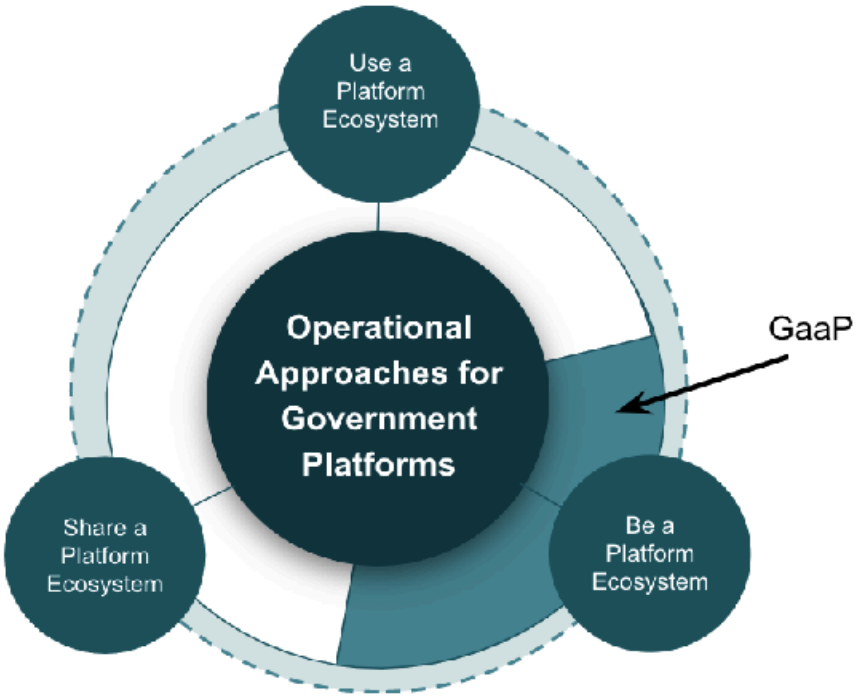
Demystifying Government-as-a-Platform

The term "Government-as-a-Platform" (GaaP) is frequently used to describe all uses of government platforms. This misunderstanding of GaaP complicates a government's ability to determine and apply an operational approach appropriately. The truth is, **while GaaP is an answer to "how will the platform ecosystem be used?" it is not the only answer, or even the best answer, for most governments.**

GaaP, as defined by Tim O'Reilly, is the digital version of projects where the government provides a physical platform ecosystem (e.g., highways, satellites). GaaP occurs when a government is the "platform provider," and the platform ecosystem it provides allows the government to function as a marketplace.[33] As written in (Brown et al., 2016), the concept of GaaP is inherently an operational approach, not an architectural one.[34] While various secondary architectural decisions influence the success of GaaP, the idea of GaaP is not concerned with the technology but rather with creating an organizational shift.[35]

All three of the operational categories listed above refer to government platform ecosystems. However, the term GaaP applies to only "be a platform ecosystem."

Figure 2.2: Government-as-a-Platform, One Type of Operational Approach



Why Does This Matter?

If a government's approach is to "provide a platform ecosystem" (GaaP), the creation of a two-sided or multi-sided market will be heavily subjected to the economic properties of network effects. This economic property is not as potent when following "share a platform ecosystem," and even smaller when following "use a platform ecosystem." Similarly, economies of scope may be stronger as more government services migrate to a single platform ecosystem, making "provide a platform ecosystem" or "share a platform ecosystem" better transmitters of those economic benefits.

Further, the operational approach changes how the platform ecosystem challenges government structures. **"Be a platform" requires a government to think about political support, procurement, and budgeting considerations differently from "use a platform."** In conclusion, each operational approach interacts with economic properties and government structures differently. A government should select an approach that is most aligned with its goals and is best suited for the types of government structures it operates within.

These three operational categories have been derived from academic literature and conversations with practitioners. The following are a selection of operational definitions from platform literature for reference.

Selected Platform Operations Literature

- Platform products "meet the needs of a core group of customers but [are designed] for easy modification into derivatives through the addition, substitution, or removal of features" (Wheelwright and Clark, 1992)[36]
- "The collection of assets that are shared by a set of products where assets may include components, processes, knowledge and people" (Robertson and Ulrich, 1998)[37]
- "We define a platform as a bundle of standard components around which buyers and sellers coordinate efforts" (Bresnahan and Greenstein, 1999)[38]
- "Freely available, standard definitions of service outcomes, processes, or technology that encourage multiple users to converge on utility consumption of services. . . which in turn encourages suppliers to innovate around these commodities" (Fishenden and Thompson, 2013)[39]
- "Economists view platforms as special kinds of markets that play the role of facilitators of exchange between different types of consumers that could not otherwise transact with each other" (Gawer 2014)[40]
- "Products, services or technologies that are developed by one or several firms, and which serve as foundations upon which other firms can build complementary products, services, or technologies" (Brown et al., 2017)[41]

2.3 Secondary Operational Decisions

Regardless of the selected operational approach, a government must make secondary operational decisions. The way these decisions are made and communicated will make it easier or more difficult to operate within the existing government structures. While there are countless secondary decisions that must be made, some high-level examples include:

Mandatory or Voluntary?

1. Should the platform ecosystem be optional, mandatory for certain departments, or universally mandated?

2. If mandatory for certain departments, which ones? How is this decided, and by whom? How is this communicated, and by whom?

3. How long will departments have to migrate? Who will be responsible for the cost of the migration? Who will do the work?

4. What are the consequences of not following a mandate?

5. If the ecosystem is voluntary, how are departments incentivized to use it? How do they find out about it? What is the procurement and integration or migration process?

Profitable, Cost-Recoverable, Subsidized, or Free?

1. Which cost model makes the most sense for this type of platform ecosystem?

2. Which cost model is most likely to pass through the budget or legislative process?

3. What impact will the cost model have on the platform ecosystem? And on feature enhancements in the future.

4. How will the cost model be explained, to whom, and by whom?

5. Who is impacted most by this cost model? Who are the financial “winners” and “losers”?

Build or Buy?

1. Should the government build the platform ecosystem in-house or procure it from an outside vendor?

2. How does this decision change based on operational approach? For example, are the considerations for a vendor platform ecosystem used within a department the same as for an ecosystem used across departments?

3. Do decisions about how the technology is built (e.g., data-ownership, API integrations) need to change based on operational approach? How does this change based on who builds the platform ecosystem?

Chapter Three: Understanding the Economic Properties Influencing Platform Ecosystems

As outlined earlier, platform ecosystems activate a variety of economic properties. Governments need to understand what these economic properties are and how platform ecosystems leverage them. Further, a government needs to know how its platform ecosystem's architectural design and operational approach may impact how an economic property is leveraged.

This paper considers the following properties:

1. Economies of Scale
2. Economies of Scope
3. Combinatorial Innovation
4. Complementary Goods
5. Network Effects

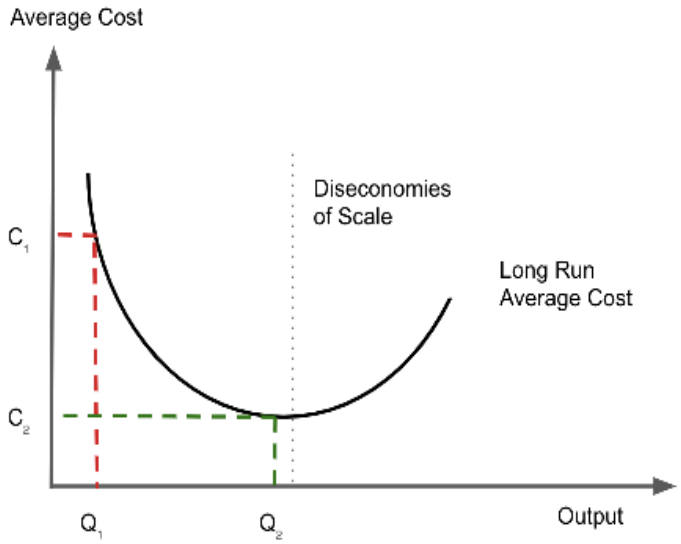
3.1 Economies of Scale

What are Economies of Scale?

Economies of scale occur when the **average cost for an additional unit of output decreases.** When this happens, there is a cost-advantage for a firm that has a larger-scale operation. Production costs are lower when the firm produces more.

Visually, economies of scale occur when Q1 shifts to Q2 and C1 shifts to C2, as shown in Figure 3.1 on the next page. In a typical industry, a firm will reach a point where it faces diseconomies of scale. This occurs when the average cost for an additional unit begins to increase, frequently due to organizational challenges that prevent additional growth.

Figure 3.1: Economies of Scale



Applying Economies of Scale to the Platform Ecosystem

Economies of scale are particularly strong when using cloud-based platform ecosystems because they can **leverage "extreme returns to scale"** (Cremer et al., 2019).[42] Cloud-based platform ecosystems have very low (near zero) marginal costs. This allows inputs to freely change as outputs change. In business terms, this is frequently talked about as scalability. For example, if using an IaaS offering, a firm can instantly scale up its compute power (input) as additional calculations need to be run (output). The inverse is also true; the firm can reduce its use and "ownership" of compute power as fewer calculations need to be run.

This technological phenomenon exists because platform ecosystems leverage the economic properties free, perfect, and instant, as discussed at the beginning of this paper. **These three properties allow the platform ecosystem to ensure constant or increasing returns to scale.**

Constant returns to scale: outputs and inputs change proportionally

Increasing returns to scale: outputs increase by more than a proportional change in inputs

Cloud-based platform ecosystems are designed to avoid a third scenario, decreasing returns to scale, which occur when output increases by less than a proportional change in inputs. For this reason, they **avoid diseconomies of scale**. This is because diseconomies of scale exist "if and only if returns to scale are decreasing" (Gelles and Mitchell, 1996).[43] **In conclusion, not only do cloud-based platform ecosystems foundationally provide economies of scale, they protect against diseconomies of scale.**

3.2 Economies of Scope

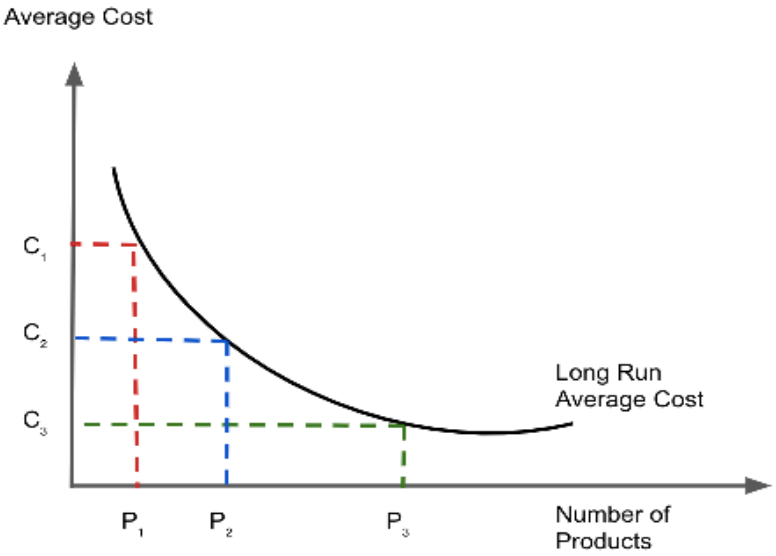
What are Economies of Scope?

Economies of scope occur when the **average cost of producing an additional unit decreases as the variety of product offerings increases**. In this scenario, a firm benefits from producing a wide variety of outputs.

This is described in literature as becoming "less costly to combine two or more product lines in one firm than to produce them separately" (Panzar and Willig, 1981).[44] Occurring when diversification of product offerings is "**based upon the common and recurrent use of proprietary know-how** or the common and recurrent use of a specialized and indivisible physical asset" (Teece, 1980).[45]

Visually, economies of scope occur when P1 shifts to P3, resulting in a shift in cost per unit from C1 to C3, as shown in Figure 3.2 below.

Figure 3.2: Economies of Scope



Applying Economies of Scope to the Platform Ecosystem

Economies of scope occur for most firms through common, reusable inputs, joint-production facilities, shared overhead costs, and diversified revenue streams. Platform ecosystems are no exception. The platform ecosystem owner realizes economies of scope through many of the factors mentioned here (e.g., diversified revenue streams), but most importantly, the ecosystem's architecture is designed to pass on economies of scope to its users.

As examined in the review of a platform ecosystem's architectural design, **ecosystems are built to provide a set of core components that are common and reusable.** These components ensure that a government does not need to "start from scratch" when creating new goods and services. Much of the core technical infrastructure has been built and is readily available for reuse. These common, reusable inputs make it cheaper and easier for governments to build new services or extend existing ones. This also reduces the cost of innovation and research and development.

3.3 Digital Combinatorial Innovation

What is Combinatorial Innovation?

While economies of scope are the reuse of common components to reduce production costs, **combinatorial innovation is the reuse of these components to create something new.** This is described in the literature as "coming up with something new and valuable not by starting from scratch, but instead by putting together in new ways things that were already there (perhaps with a few generally novel ingredients)" (McAfee and Brynjolfsson, 2017).[46]

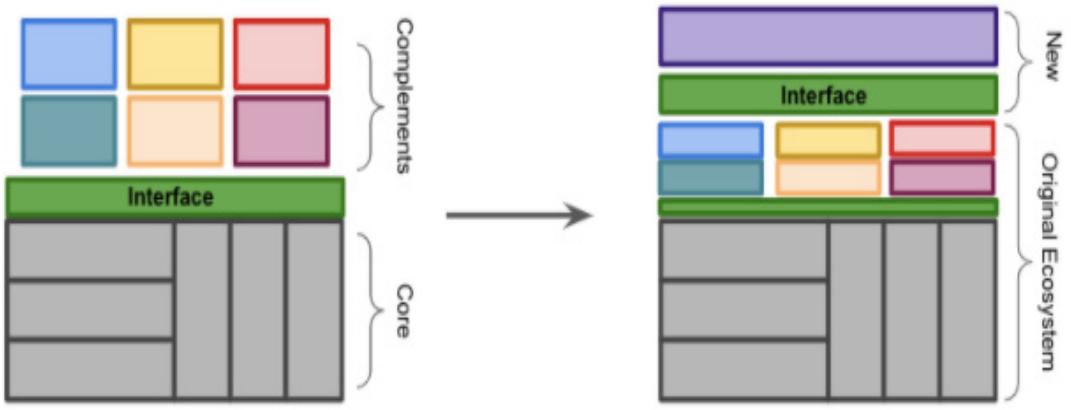
Applying Combinatorial Innovation to the Platform Ecosystem

There are two major ways that combinatorial innovation materializes.

Building

First, a new platform ecosystem can be built on top of an existing one. This **allows the new ecosystem to leverage the value of the initial offering**. For example, the Internet was a building block for the web; the smartphone was a building block for ride-sharing; Online commerce was a building block for secure, digital payment systems. Figure 3.3 shows one way that this may occur.

Figure 3.3: Combinatorial Innovation (Building 1)



Unbundling and Rebundling

A good or service can be taken apart (unbundled) into its component modules and repackaged differently to be more appealing to consumers (rebundled). As discussed in the architectural design section above, a platform ecosystem's architecture can allow for varied levels of modularity by controlling the ecosystem's interfaces and making integrations more or less difficult.[47] **These architectural choices will influence an ecosystem's ability to unbundle and rebundle components, thus influencing its ability to leverage this version of digital combinatorial innovation.**

Bundling can work in various ways. Figure 3.4 shows how **a complement might be rebundled as a low-volatility core component**. An example of this is Apple Pay.[48] Initially released as a complement (independent application), Apple Pay's application programming interface (API) and software development kit (SDK) have pushed Apple Pay into the platform ecosystem's core. Now, dozens of applications and sites are built on top of Apple Pay.

Figure 3.4: Combinatorial Innovation (Bundling 1)

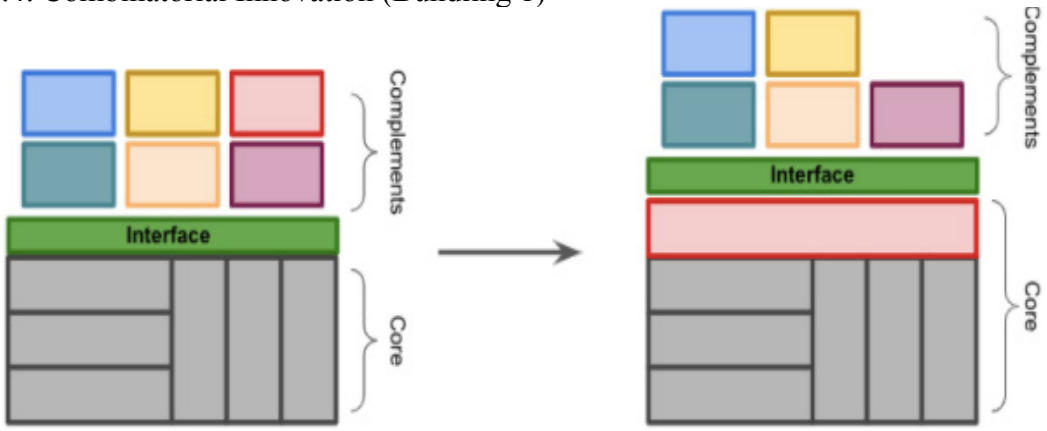
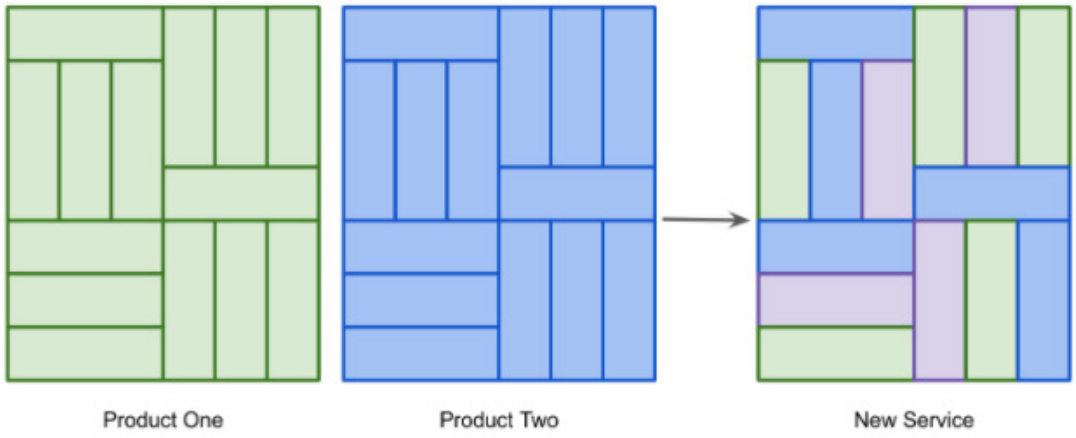


Figure 3.5 shows the second form of bundling. Here, **components from products one and two are combined with some new technology or feature requirements to create a new service.**

Figure 3.5: Combinatorial Innovation (Bundling 2)



Combined Impact

In their book, McAfee and Brynjolfsson[49] explain how the music industry has faced both types of combinatorial innovation across three waves of platform ecosystems. Below is a simplified version of their example.

First Wave: LimeWire et al. built a service on top of the web to provide an easy (albeit frequently illegal) way for consumers to access music.

Second Wave: iTunes built upon the web-music business and added the option to unbundle. For the first time, consumers could easily purchase a single song instead of an entire album.

Third Wave: Spotify built upon the prevalence of smartphones, WiFi, and data plans and added the option to rebundle. Not only could consumers pay for single songs, but they could also pay for all of their favorite songs to be rebundled into one easily accessible service.

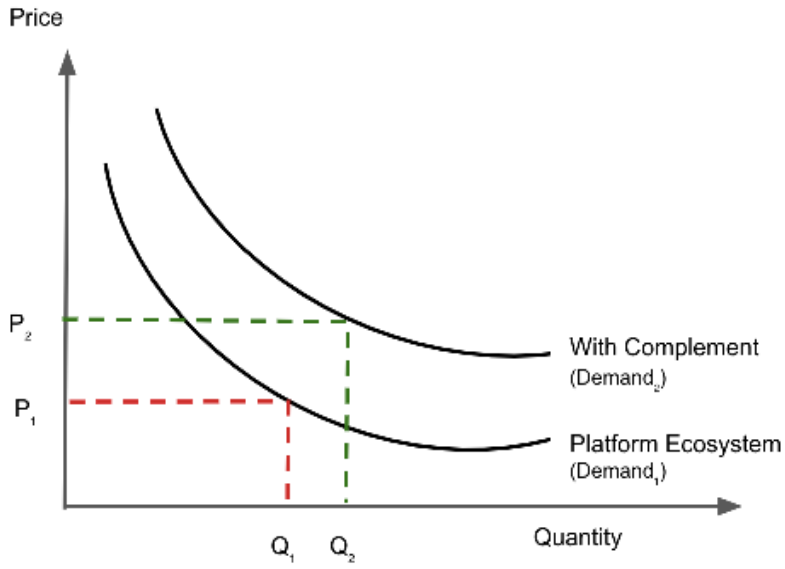
3.4 Complementary Goods

What are Complementary Goods?

When two goods are complements, they experience **joint demand**. There is a positive relationship between both goods; as the **quantity demanded of one increases, the quantity demanded of the complementary good will also increase**. Similarly to combinatorial innovation, a platform ecosystem may design its architecture to restrict or heavily regulate complements which will weaken this economic property.

Visually, when a good experiences an increase in quantity demanded, the demand curve of the good's complement will shift outward, from Demand1 to Demand2, as shown in Figure 3.6. This results in an increase in quantity demanded of the complement, from Q1 to Q2.

Figure 3.6: Complementary Goods



Applying Complementary Goods to the Platform Ecosystem

The degree of complementarity can vary. Some goods are perfect complements and must be consumed together, other goods have varying levels of mutual complementarity. **Platform ecosystems uniquely leverage a third kind of complementary relationship: nonmutual complementarity.** Here, one good benefits more from the complementary relationship than the other good. This typically occurs **when one good has many complements and the other has one or few complements.**

Under a nonmutual complementary relationship, a platform ecosystem's core component and complements both benefit, but the core component benefits more. However, since the core component has many complements (e.g., the App Store has many applications) it benefits from many complementary relationships and therefore does not have to heavily rely on a single complement. Conversely, a single complement in this ecosystem only has a complementary relationship with the core component (e.g. an application must rely on the App Store). It therefore heavily relies on the core component.

Complements increase the value of platform ecosystems; the more of them, the better. iPhone users benefit from having a wide variety of applications to choose from; thus, each additional application available on the App Store increases the quantity demanded for iPhones.

3.5 Network Effects

What are Network Effects?

Platform ecosystems leverage network effects differently based on operational choices. Network effects occur when an individual's behavior **depends on some average of the actions of others**. That is, the number of people doing something or using some product affects an individual's willingness to join in.[50]

This concept is clearly explained by Bruno Jullien and Wilfried Sand-Zantman (Jullien and Zantman, 2020) as the following:[51]

> *Consider network effects at the firm level and that initially, firm A captures slightly more than half of the market, firm B capturing slightly less. If the switching costs between A and B are not too large, some of B's consumers will switch to A. This move will amplify the difference between the two firms and ultimately all agents will opt for firm A. In the presence of network effects, there is a tendency for markets to favor only one firm, which we refer to as tipping.*

As Jullien and Zantman explain, if the platform ecosystem tips, a **bandwagon effect** occurs; with each new platform ecosystem user, even more consumers are incentivized to join the ecosystem. If the platform ecosystem does not tip, it is likely that another will replace it and consumers will leave the ecosystem.

Applying Network Effects to the Platform Ecosystem

The way a network effect materializes is dependent on a platform ecosystem's operational approach. If an ecosystem is a two-sided market (hosts an exchange between buyers and sellers), it will experience two-sided network effects. This means that as more of one side joins (i.e., buyers), more of the other side (i.e., sellers) will be incentivized to join. This positive feedback loop creates a strong network effect called a **cross-side exchange benefit**.

Network effects still exist in one-sided markets. For example, when governments share the same platform ecosystem, the value that each government department receives increases as more departments join the ecosystem. This value comes in many forms, including increased confidence in the platform ecosystems business model (e.g., knowing that it has stable revenue) and collective bargaining power (e.g., a stronger voice to support feature enhancements). This creates a **same-side exchange benefit**.

Network effects are not pure benefit. If a platform ecosystem does not reach the tipping point, it will not gain market dominance and may fail. Network effects are a potent property that result in either a platform ecosystem's opulence or obsolescence.

Chapter Four: The Structures that Influence How Governments Use a Platform Ecosystem

It is essential to understand the government structures that influence how decisions about platform ecosystems are made. The structures outlined here collectively contribute to the economic costs and benefits governments face when adopting or building platform ecosystems. **They do this by changing how politically expedient, financially sound, or operationally feasible using an ecosystem is.**

While **each structure exists within all governments, the realities they impose will vary greatly**. For one government, a structure will simplify the adoption of platform ecosystems. For another government, that same structure may create barriers that are too difficult to overcome. For a third, the structure may be neutral and neither help nor hurt the case for platform ecosystems.

The following list of existing government structures was **generated from interviews with public-sector, private-sector, and non-profit-sector practitioners who work on digital government or platform projects.**

The structures are:

1. Procurement
2. Budgeting
3. Security
4. Accountability and Ownership
5. Regulations
6. Political support

4.1 Procurement

Government procurement is a broad term that refers to how departments and agencies procure goods and services. Procurement regulations vary widely across governments. The specifics of the examples given here do not apply to every government, but the idea that procurement is a government structure that influences how platform ecosystems are used is universal. Various considerations influence how this structure may support or prevent the use of platform ecosystems. These considerations are **length and type of process, proposal evaluation, decision-making authority, vendor relationships, and integration.**

Length and Type of Process

The length of a procurement process impacts how easy it is to purchase access to platform ecosystems, which, in turn, affects how frequently these ecosystems are used. The easier the procurement process, the more likely the government is to access platform ecosystems. While this point is straightforward, the United States Federal Government provides an interesting example of how creating different procurement processes with varying levels of difficulty can impact a government's **operational approach** to using platform ecosystems.

The U.S. Federal Government's procurement process is contingent upon the entity providing the good or service. If a department wishes to contract with a nongovernment provider, it must initiate an acquisition process; but, if a department wishes to contract with another government department, it can instead enter into an inter-agency agreement.

In the U.S., an acquisition process begins with the department specifying the requirements of some federal activity (although the Tech FAR asks departments to identify a "Product Vision" rather than a strict set of requirements).[52] The department then reviews proposals that meet these requirements or product vision and award a contract. This simplified explanation smooths over the complicated regulations a department must follow, the number of resources required to draft a fair and inclusive request for proposals (RFP), and the resources needed to complete the subsequent evaluation of those responses.

The acquisition process takes financial capital, personnel time, and political capital. There is no formal estimate for how long this process takes, but conversations with government practitioners revealed the expectation that it takes between three and nine months for an "average-sized" project. This does not include security authorizations, integrations, or training.

The inter-agency agreement, allowed for by The Economy Act,[53] is an easier alternative to this complicated and time-consuming process. An inter-agency agreement is defined as "a procedure by which a [department] needing supplies or services obtains them from another [department], by an assisted acquisition or a direct acquisition."[54] **This option clearly benefits the U.S. Federal Government-owned and operated platforms such as Login.Gov and Cloud.Gov by making it easier for a department to use these platform ecosystems over others**. For this reason, this incentive structure has direct implications on the U.S. government's operational approach.

Proposal Evaluation

The department or government's approach to technology procurement determines how it will evaluate proposals. Is the government working towards a long-term, big-picture strategy? Or, do departments meet needs as they arise?

The United States provides an example of how a proposal's evaluation process impacts the use of platform ecosystems. **In the U.S., a department frequently focuses its procurement on finding a solution to a set of requirements.**

According to Traci Walker, Director of Digital Service Procurement for the U.S. Digital Service, this often means that departments are in "reactionary mode," where "their primary mission is not around technology, it is around solving the problem that they have." This frequently results in **short-term and hyper-targeted solutions rather than big-picture thinking about what technology solutions would be best for the department or the government in the long term.** This may impact a government's use of platform ecosystems in several ways. One way is by changing a government's ability to focus on a long-term platform ecosystem strategy and instead biasing it towards selecting niche products that solve a current problem.

Decision-Making Authority

Similarly, a government's use of platform ecosystems is heavily influenced by who makes the procurement decisions. Amanda Hallock, an IT Manager and Digital Transformation specialist for Scranton, Pennsylvania, explained that the IT team does not control the City's procurement. Individual City departments can contract with technology providers of their choosing. The inability to ensure cross-government use may make it difficult for the City to propose and implement a platform ecosystem or shared services strategy.

A similar tension exists in the U.S. Federal Government, where a department's Chief Information Officer (CIO) frequently **does not control all technology decisions or spending**. Here, the CIO can exert political power and influence over many procurement decisions but they still rely on the acceptance and compliance of those they cannot directly control.

Vendor Relationships

Governments are frequently concerned about vendor "lock-in." Contracts that require a tool to be built on government-controlled infrastructure protect against this vendor lock-in and provide the government more flexibility once the contract has expired. This procurement structure makes it easier for governments to migrate to new systems. Without these protections, a department that wants to change systems might need to rebuild everything. Understandably, this poses a considerable economic cost the departments want to avoid. **Even if the benefits of migrating to a new system are clear and strong, the upfront cost of migration might be too costly.**

Integration

Traci Walker listed integration as a key consideration in all procurements, stating that it is important to know ahead of time how difficult the integration will be and what types of support systems exist (through the vendor or in the market) to ensure that integration is successful. As discussed earlier in this paper, a platform ecosystem's architecture can be designed to make integration easy or difficult. **Ecosystems with an easier integration or robust integration support systems are better suited for the government's existing procurement structures** (thus more straightforward to use) **than ecosystems with complicated, low-support integrations.**

4.2 Budgeting

A government's financial approach towards procuring or developing platform ecosystems creates economic costs and benefits. While each government has a unique budgeting process, there are some common considerations. These considerations are the **timing of financial costs and benefits**, **distribution of funds**, and **accessibility of nongovernment funding**.

Timing of Financial Costs and Benefits

Frequently, a **platform ecosystem's financial benefits are realized after the financial (accounting) costs** have been paid. For example, it will take the average government department a few years to migrate all of its technical infrastructure to an IaaS offering. For many departments, this migration might also include reworking entire systems and reviewing hundreds (or thousands) of paper documents that are not yet digitized. All of this work comes with large, upfront financial costs.

Governments are familiar with projects with high upfront financial costs that eventually provide financial and economic benefits—buildings, trains, rockets. When it comes to technical infrastructure, the mechanics of getting upfront funding are no different; create a road-map for the project, complete a long-term cost-benefit analysis, prove operational capacity and public value, add in some political will and the project is funded. The problem with platform ecosystems is that **the arguments for why the long-term economic benefits are worth the upfront financial costs can be more complicated to explain or prove.**

Granted, it is not just explaining the value of the economic benefits. There are more complicated considerations for how and when this migration can occur, which has little to do with the budget office's wishes and more to do with outdated contracts, overlapping costs, and the tensions between decentralized and centralized authority.

Here is an example that touches on all three of these sticking points. In a medium-sized U.S. State, the government has a traditional IT technology stack (refer to Figure 1.2.), which includes a set amount of infrastructure. IT teams within each of the departments pay the centralized IT team to use this infrastructure. **As some departments migrate off this centralized, on-premise infrastructure and onto an IaaS offering, fewer departments are responsible for the same centralized costs.**

This makes it financially and politically difficult for the centralized IT department (or departments that cannot migrate to IaaS) to support the departments that want to migrate, even if the economic benefits are clear and well defined. **Without support from the central IT team, departments face more scrutiny over their budgetary choice to fund an IaaS offering and migration.**

Distribution of Government Funds

If funding for platform development is required, consider where the funds should come from and how the government should distribute them. For example, if the platform ecosystem will save a department time and money, should funding come directly from that department's budget? Should the budget office require a platform ecosystem built with its funds to be cost-recoverable or profitable in the future? These are the questions Alex Holmes, former Chief Operating Officer of the U.K.'s Government Digital Service, was asked when advocating for GOV.UK Verify's funding.[55]According to Holmes, the budget office expects to see proven, direct financial benefits for shared services. These could be realized by ensuring that the service is cost-recoverable or by reducing a department's budget by the amount they are estimated to save with the new service.

This is a reasonable long-term strategy—as the technical cost of providing services decreases, governments should redirect cost savings. However, suppose any department that agrees to use a centrally built platform ecosystem loses a percentage of its budget before the ecosystem is built and integrated. In that case, it becomes challenging to find departments willing to be early adopters, and thus difficult for the centralized team to prove a strong business case or need. Balancing these interests is even more complicated in the long-term. Who will provide continued funding? How does this change the new platform ecosystem is a mandatory shared-ecosystem, meaning all departments must use it?

Accessibility of Nongovernment Funding

Funding that comes from nongovernment sources (intergovernmental organizations, donor bodies, private institutions, public-private partnerships, and philanthropic groups) may be a powerful supplement or replacement for government funding. That said, governments looking to fund platform ecosystems using nongovernment funding must prove value in the funder's issue-area or mission.

According to Kevin O'Neil, Director of Data and Technology at The Rockefeller Foundation, **it is difficult for platforms to meet this requirement.** This is because it is difficult to quantify the real impact a platform ecosystem has on an issue-area (e.g., education) compared to other programs or services that the organization could fund that more directly target the specific issue and lend themselves to conventional impact assessment methods, especially in the short term. This makes it challenging for funders like The Rockefeller Foundation, who focus on achieving measurable gains in specific issue areas, to fund generic IaaS or PaaS offerings that are aimed at improving all government services. **These tools are too far removed from the issue area and it is difficult to attribute their impact on relevant outcome metrics.**

4.3 Security

Two types of security considerations impact a government's approach to platform ecosystems: **security processes and regulations** that an ecosystem must meet before the government can use it and the **level of trust the government has in the ecosystem's security**.

Security Processes and Regulations

C**omplicated and time-consuming security processes** impact how a government uses platform ecosystems in two ways. First, it can price-out smaller vendors who do not have the staff to navigate the process. Second, it can disincentivize departments from contracting with an uncertified commercial vendor, even when it is the best available option.

The U.S. Federal Government program called Federal Risk and Authorization Management Program (FedRAMP) has become a double-edged sword. It is a way to standardize and ensure security assessments, authorization, and monitoring. It has certainly improved how secure the government's cloud services and platform ecosystems are. But, it is also a substantial barrier-to-entry for new vendors. Since FedRAMP is mandatory for any cloud services that hold federal data, this process has a clear impact on the economic costs associated with particular platform ecosystems.

Some private-sector and public-sector platform ecosystems are pre-authorized and available to government departments via the FedRAMP Marketplace. These offerings (Cloud.gov, Azure, Microsoft Office 365) come with lower barriers-to-use than non-authorized alternatives. Lower economic costs may make pre-approved ecosystems more appealing to government departments.

Trust in the Ecosystem's Security

Many of the **practitioners interviewed for this paper explained that they are still working on getting governments to believe that "cloud infrastructure offerings are safe and secure,"** with one person stating, "many governments still do not see cloud as being a less risky solution to having an on-premise solution."

The FedRAMP program has helped quell some of these concerns, and a 2017 report published by Intel Security shows that trust outnumbers distrust for public clouds "by more than 2-to-1." However, platform ecosystem providers, digital service groups, and government leaders still have plenty of work to do in this area. Understandably, if a government department does not think their data or systems will be secure in a platform ecosystem, no explanation of economic benefits or mitigation of economic costs will persuade them.

4.4 Accountability and Ownership

Accountability and ownership structures are the counterpart to security structures. Like some security concerns, these structures relate to **distrusting an external group with infrastructure components**. However, unlike those security concerns, this distrust is **rooted in operational or political considerations, not technical ones**. The accountability and ownership considerations are dependencies and control and relationships with platform ecosystem providers.

Dependencies and Control

Traci Walker, Director of Digital Service Procurement for the U.S. Digital Service, explained that **"governments understand risk both in terms of security and as 'where do I have control.'"** Using **platform ecosystems inherently requires governments to abstract away some of their technical infrastructure or service delivery process.** The entire goal of a platform ecosystem is to make it such that a government does not have to monitor its infrastructure, secure its data, or manage its runtime. If this abstraction, or "lack of control," as government practitioners have referred to it, is bothersome, then there is a structural barrier to governments using platform ecosystems.

Mark Schwartz, an Enterprise Strategist at Amazon Web Services and former Chief Information Officer (CIO) of the U.S. Citizenship and Immigration Services (USCIS), describes this desire for control another way: the mitigation of dependencies. Schwartz explained a tension that many government CIOs are already familiar with, **"how do you use platform ecosystems to improve your technology processes without adding unnecessary dependencies which you do not control but are ultimately responsible for if they fail."** This tension is difficult to navigate. **The existing government accountability structures do not reward innovation or trying something new; instead, these structures reward stability.**

Relationships with Platform Ecosystem Providers

Building off of this, government leaders are held responsible if their technology infrastructure fails. It does not matter if the failing piece was something the department-owned or something provided by a vendor. This perpetuates the fear of "losing control" over infrastructure and the desire to "avoid dependencies." **For platform ecosystems to be used effectively, departments must have trusting relationships with ecosystem providers.**

Several government practitioners expressed their distrust of the General Services Administration (GSA), where 18F is housed. Because these practitioners do not trust GSA's ability to deliver quality platform ecosystems reliably, they said they are unlikely to use tools such as Login.Gov and Cloud.Gov voluntarily. This is not an issue unique to the United States. Alex Holmes, former Chief Operating Officer of the U.K.'s Government Digital Service, discussed how U.K. ministries lacked trust in both the Cabinet Office and the Government Digital Service (GDS) during his time in government. In the U.K., this too led to ministries being unwilling or reluctant to use GDS built and operated platforms, such as GOV.UK Notify and GOV.UK Verify.

4.5 Regulations

There are many ways that regulations can impact a government's use of platform ecosystems. This paper has discussed procurement, security, and budgeting regulations as separate issues. In addition to these, there are other types of regulations that require attention. For example, a regulation requiring a government to accept and store paper applications might make using a platform ecosystem challenging and reduce its effectiveness. **A platform ecosystem must operate within this regulated environment.** To understand how this environment will impact how a government can use platform ecosystems, it must consider **formal and informal regulations.**

Formal Regulations

Formal regulations refer to real restrictions or rules that impact how a government can operate. These regulations are sticky. They may be difficult to change and pose legal consequences to those who break them. The example above about storing paper applications is a formal regulation that a U.S. State currently follows. This state could (and should) use platform ecosystems, but it must consider integrating the stored paper documents that exist today and the paper documents that may arrive in the future.

Formal regulations are complicated and precise to a government, department, or subsets of government departments. **It will be a challenge for those who want to drive the government's use of platform ecosystems to learn about and understand all of the regulations that apply, let alone navigate and build around them.**

Informal Regulations

Informal regulations, or assumed regulations, refer to a long-standing interpretation of what is "allowed" and "not allowed." This can usually be traced back to one interpretation of a law passed down over the years. Sometimes, this interpretation is incorrect, misguided, or embellishes the truth. For example, consider the U.S. Digital Service's (USDS) early work to introduce user testing to the U.S. Federal Government. USDS received pushback, most commonly that "user testing is illegal." This, of course, is not a real U.S. Federal Government regulation but rather a result of a long-standing approach based on passed-down interpretations of the law.

Other informal regulations are "best practices" or agreed ways of conducting business. While these practices often feel like regulatory restraints, the way to navigate them is not through legislation or executive support (as it is for formal regulations) but through the difficult work of change management. **Frequently, it is political structures that support and perpetuate these informal regulations.**

4.6 Political Support

Each of these groups will be involved in the process of using a platform ecosystem. Some groups will have minimal involvement, others will be very vocal. A delicate balance must be maintained between all groups to ensure that the initiative does not lose political support. To understand how this structure influences platform ecosystems, consider how each group feels about the initiative and who is doing the work.

Groups That Impact Political Support

- **Elected and Appointed Officials**: Must balance its limited political capital, time, and resources across competing priorities. Often, the most urgent, highest-impact, or highest-profile priorities win out as this group is incentivized to continually show that they are delivering something valuable to their constituents. This group benefits from government platforms because they can more easily deliver services, but they will need to show immediate benefit to constituents to validate investment.

- **Government Employees**: Must navigate complicated rules, regulations, and guidelines (while working with outdated technical tools) to meet the demands of their job. They are not incentivized to try something new or innovate on an existing process.

- **Employee Unions**: This group is committed to protecting the current jobs held by government employees. They are incentivized to ensure that current employees continue to run government systems as the infrastructure changes. They are also incentivized to prevent large changes to employee's job descriptions. In one mid-sized city in the United States, union involvement has prevented the city government from requiring employees to use computers. In the United States Federal Government, if a department wants to migrate its on-premise infrastructure to an IaaS offering, it works against both of these union incentives—it cannot fire workers, and it cannot change those workers' jobs.

- **Citizens**: This group does not have direct power over the government's use of platform ecosystems, but it does provide feedback to elected officials about its feelings towards government services through elections, donations, town hall meetings, social media, and direct communication campaigns. Many citizens have only a few interactions with government services a year. Others (frequently the most in need) regularly rely on well-functioning government programs.

- **The Press**: This group frequently acts as a "check" on government power. They are incentivized to ensure that government services are running correctly and that funds are not misused.

- **Private Sector Partners**: This group often provides platform ecosystems to governments in the form of IaaS, PaaS, and SaaS offerings. This group helps governments use technological solutions but is incentivized to make a profit and act in its business interest.

Where in the Government is the Work Taking Place?

A platform ecosystem initiative led by the executive (e.g., Cabinet Office, Executive Branch) will be built or implemented differently (operational approach, secondary architectural decisions) than one led by a department or agency. For one, the incentive structure is different at each of these levels. The Executive Branch is incentivized to think about the government overall. It is likely to consider the operational approach "share a platform ecosystem" instead of "use a platform ecosystem." It is also incentivized to focus on interoperability and extensibility.

Alternatively, a department is incentivized to only assess its own systems and risk tolerance. They cannot do much to enforce an operational approach of "share a platform ecosystem" and therefore tend to focus on "use a platform ecosystem." An example of this comes Mark Schwartz, an Enterprise Strategist at Amazon Web Services and former Chief Information Officer (CIO) of the U.S. Citizenship and Immigration Services (USCIS). When interviewed for this paper, Schwartz said, "Login.gov makes a lot of sense, but only if it's widely used across government agencies. I could see the White House mandating that agencies use it. But since they didn't, my agency didn't want to use it, because they were afraid they'd be the only ones."

It matters which part of the government is willing to take on the political work of using platform ecosystems. This political choice will directly impact how platform ecosystems are used within the government.

Chapter Five: Login.Gov Case, Bringing Everything Together

A brief summary of terms frequently used in identity management.

Identity: "A group of attributes that describes a unique, single entity within a set of records."[56]

Identity Management: A combination of identity proofing, authentication, and authorization that allows the system to decide access rights for a certain entity.

- **Identity Proofing**: Are you the person you are claiming to be?
  - **Validation**: Is there a record that matches the attributes you shared?
  - **Verification**: Are you the person described by that record?
- **Authentication**: Does this account belong to you?
- **Authorization**: What are you allowed to do with this account?

What is Login.Gov?

Login.Gov[1] is a single sign-on solution for government websites.[57] Before Login.Gov, departments "built their own login systems from scratch with various levels of usability, security, and privacy."[58] With Login.Gov, citizens may use the same username and password across any department or agency that has integrated the solution. In addition to improving the citizen experience, Login.Gov can "enable the smart and secure transfer of data between agencies"[59] when this type of cross-department communication is required to provide a service.

The Login.Gov project was jointly developed by the U.S. Digital Service and 18F alongside smart and dedicated career civil servants. It was first announced in a blog post in May 2016[60] and later launched in April 2017.[61] In May 2017, Login.Gov secured its first government client, the Customs and Border Protection agency within the Department of Homeland Security.[62]

Login.Gov is currently provided by Technology Transformation Services (TTS) within the General Services Administration (GSA).[63] The long-term goal of Login.Gov is to reduce the government's consumer identity costs while "improving access and usability [for] each and every American."[64]

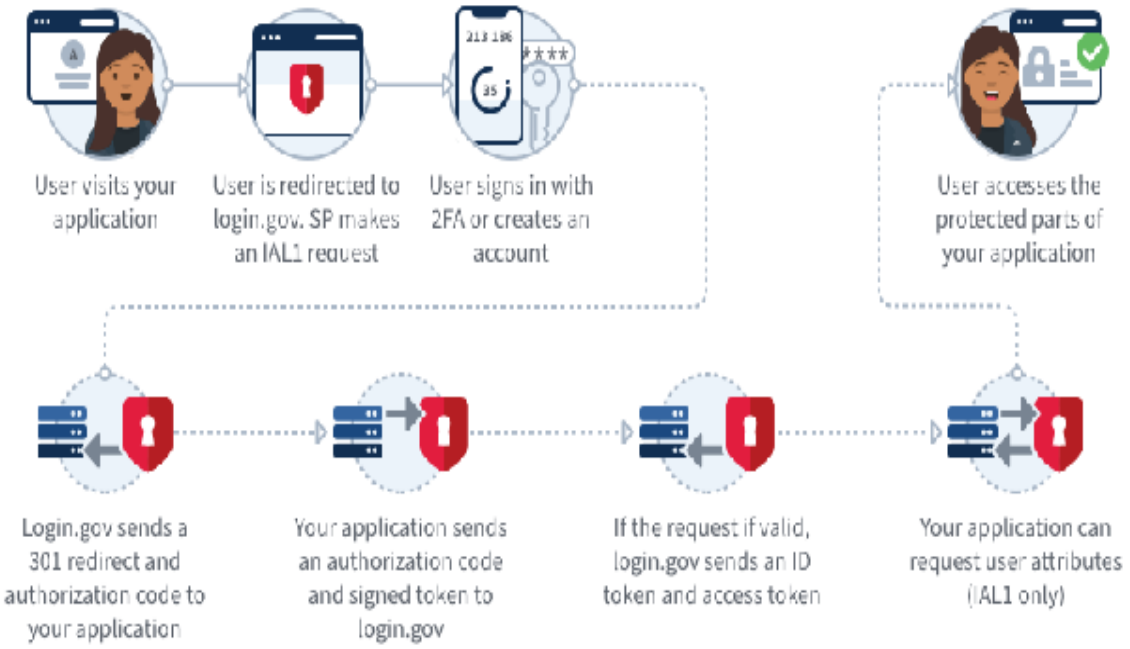
The Architectural Decisions and Operational Approach for Login.Gov

Login.Gov's ability to meet this goal is connected to its secondary architectural decisions and operational approach. First, consider how Login.Gov's architecture maps to the base architectural definition for platform ecosystems.

- **Low-Volatility Component (Core)**: Login.Gov production environment[65]
- **Stable Interface**: Choice between OIDC[66] or SAML[67] protocols, application[68]
- **High-Volatility Component (Complements)**: Self-Asserted Identity Management (Identity Assurance Level 1 (IAL1)), Proofed Identity Management (Identity Assurance Level 2 (IAL2))[69]

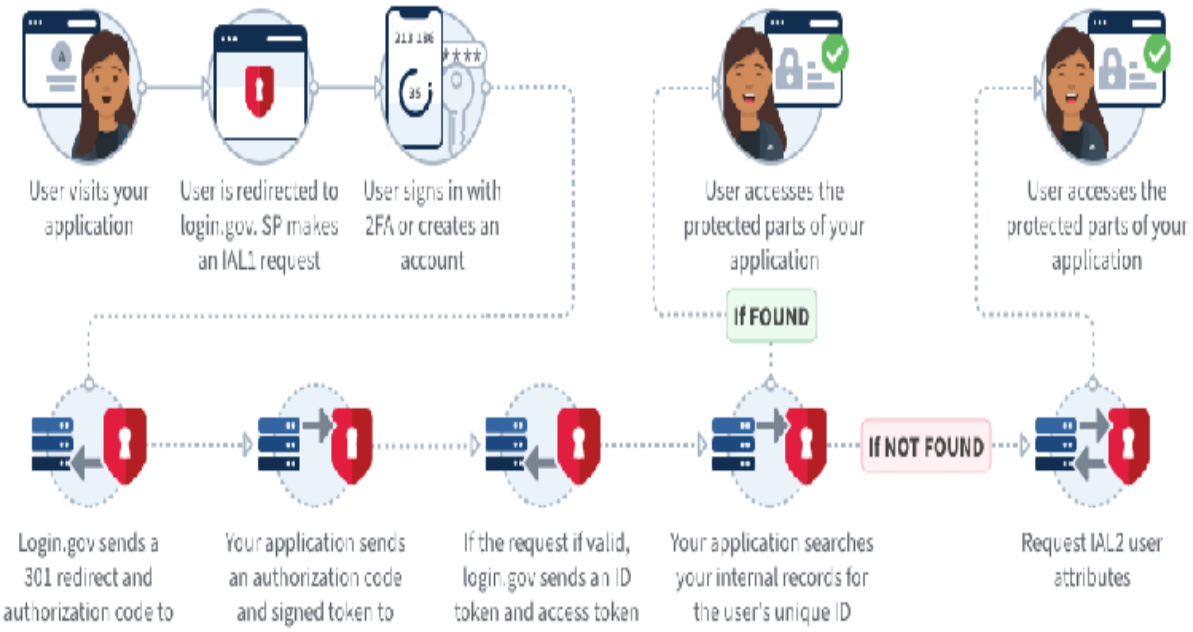
1) Login.Gov is a U.S. government shared service. Therefore, references to departments, agencies, and development processes in this case study are U.S.-centric.

Figure 5.1: Login.Gov Flow Chart (IAL1)



Source: Login.Gov Developer Site, Reuse and Copyright Policy

Figure 5.2: Login.Gov Flow Chart (IAL2)



Source: Login.Gov Developer Site, Reuse and Copyright Policy

The Login.Gov team also made a number of secondary architectural decisions while building the service. Here are just two.

- **Integration:** Login.Gov provides a team of "integration experts to help agency developers integrate their code with Login.Gov in less than four hours."[70]

- **Data Storage:** Privacy and end-to-end encryption are the cornerstones of Login.Gov's data storage practice. No information is shared with the partner agency unless the citizen "has given express permission"[71] and no information is shared across partner agencies.

Login.Gov's primary operational approach is "share a platform ecosystem." The platform ecosystem's goal of improving the access and usability of the government's identity services while reducing costs can only be achieved when multiple departments and agencies are using the platform ecosystem. From creating a seamless integration system to housing the platform ecosystem within TTS, Login.Gov is architecturally and operationally designed to be shared across the government.

In addition to this primary operational approach, the Login.Gov team made a number of secondary operational decisions. The two most prominent secondary operational decisions the Login.Gov team made were for the ecosystem to be voluntary and to use a cost-recoverable, tiered pricing model for both product offerings.

Government Structures Supporting and Opposing Login.Gov

Here are examples of how all of the government structures impacted Login.Gov.

- **Procurement:** Because Login.Gov is a government-built and run platform ecosystem it can be procured through an interagency agreement. This is a simpler and faster process than external procurement.[72] A simple and supported integration also makes it easy to procure Login.Gov.

- **Budgeting:** Login.gov decided to run like a business from the very beginning. Joel Minton, the Founder and Former Executive Director of Login.Gov, explained that the plan was to operate "more like a startup, where Login.Gov took money from GSA to initially build it, but then after it was built and we started charging for it to allow full financial self-sufficiency."

- **Security:** Login.Gov has a FedRAMP Moderate Authority to Operate (ATO) and is synchronized with National Institute of Standards and Technology (NIST) guidelines.[73] Adherence to these authorizations and guidelines makes Login.Gov ready to use at low risk. Currently, Login.Gov is hosted in Amazon Web Services East/West (AWS E/W) with plans to migrate to AWS GovCloud. Login.Gov also set privacy and security as core development principles early on.

- **Accountability and Ownership:** Even though Login.Gov provides technical support and sends bi-weekly communications to partner agencies, some government leaders are worried that it is too risky to give up control over a process as important to security as identity management. Those who feel this way have said they are concerned about being held accountable for failures in a system that they don't control and do not trust the TTS team to update features or provide support in a timely manner.

- **Regulations:** Login.Gov's goal is to work across many agencies and departments. This means that it must confront various regulations, both informal and formal.

- **Political support:** Both 18F and the U.S. Digital Service supported the development of Login.Gov. Currently, 60 applications across 17 government agencies use Login.Gov.[74] However, the White House has not asked agencies to prioritize using Login.Gov, and the ecosystem does not have a mandate. Most ordinary citizens are not familiar with the platform ecosystem, at least not enough to advocate for its widespread use. And inter-department or inter-agency conflicts have caused some government leaders to avoid working with GSA when possible, which complicates the adoption process for Login.Gov.

Two Examples of How These Technical Decisions and Government Structures Changed the Economics of Login.Gov

Economies of Scale

Login.Gov creates economies of scale by tapping into a platform's ability to leverage common components and near-zero marginal costs. As discussed above, Login.Gov provides three types of identity management: identity proofing, authentication, and authorization.

When interviewed for this report, Joel Minton, the Founder and Former Executive Director of Login.Gov, explained just how costly identity management is. Minton shared that identity proofing alone could cost between $0.50 to $5.00 per proof. He added, "If you have to do that for 300 million Americans that gets really expensive really fast. Even more if you're doing that for many different agencies, so that's why it was really important to have a central identity solution."

Because of the way Login.Gov's platform ecosystem was built, when identity proofing is done for one agency that information can be reused across other agencies that require proofing. This makes it much cheaper to operate Login.Gov, and since the platform ecosystem chose to operate on a cost-recoverable basis this drives down costs for all partner agencies.

Network Effects

Login.Gov chose to be a voluntary platform ecosystem from the start. Joel Minton said:

> *"From the beginning we understood that if we mandated it, it would rub people the wrong way. So we said, let's not do a mandate, let's just build a great product and find the agencies that have pain points, the agencies that want to get out of this business and not do it themselves. We wanted to build a product and ensure we had the right market incentives to build something that people wanted to use and was competitive with the private sector."*

Without a mandate, Login.Gov needs to convince agencies to migrate to their platform ecosystem using familiar business strategies: product differentiation, usability, price competitiveness. And, Login.Gov must understand and properly leverage network effects to reach a critical number of users.

This economic property is actively at work within the Login.Gov ecosystem. Currently, Login.Gov has 60 applications across 17 government agencies.[75] Recently, Login.Gov expanded its operations to federally funded state and local government programs.[76] This market penetration has given Login.Gov name recognition, which will attract more partner agencies and may push Login.Gov to the tipping point outlined in the network effects chapter.

A federal mandate may force this tipping point. If the U.S. federal government does want to have a centralized, internal identity management system it might be time for one now; as Joel Minton stated, "Login.Gov is at that point now where, with additional investment and growth of the team, a mandate might help. Doing a mandate super early before there was cost recoverability didn't make a lot of sense, but it could make sense now." Alternatively, Login.Gov may reach this tipping point organically, and then eventually (due in part to the bandwagon effect) reach ubiquitous use across government departments and agencies.

Chapter Six: Recommendations Based on Part One

This document summarizes the research completed for part one of this project. This research has led to a few early recommendations for governments looking to use platform ecosystems.

6.1 Understand Platform Ecosystem Definitions

These definitions matter because platform ecosystems are not built or used equally. Differences correlate with real financial, operational, and political changes that governments must acknowledge and address. Decision-makers need to understand both architectural and operational definitions; they represent separate but equally important decisions made by governments using platform ecosystems. The only way to properly prepare to migrate to a platform ecosystem is to understand the impact of each definition and decision separately and think through how their interactions will change the ecosystem's dynamics.

For review, here is a summary of those definitions.

Architectural Design

- **Definition:** A system of low and high-variety components with specified stable interfaces through which one accesses those components.
- **Business Terms**: IaaS, PaaS, SaaS—a way to abstract core functions and processes
- **Example of Secondary Decisions:** Open or closed interface

Operational Approach

- **Definition:** Approaches ranging from using to being a platform ecosystem.
- **Business Terms:** Government Platforms, Government-as-a-Platform
- **Example of Secondary Decisions:** Mandatory or voluntary

6.2 Understand the Economic Properties Influencing Platform Ecosystems

As outlined in chapter three, platform ecosystems leverage a set of economic properties. **The way that these properties are leveraged depends on secondary architectural decisions and the operational approach.** For example, a platform ecosystem's core components and complements ensure combinatorial innovation and complementary goods; but the way these economic properties materialize depends on a set of secondary architectural choices (i.e., open or closed interfaces).

Further, an ecosystem's operational approach (i.e., use a platform, share a platform, be a platform) determines what types of network effects take hold and how strong these effects are. Decision makers must understand the mechanics of these economic properties and how they interact with the architectural and operational definitions.

6.3 Have an Operational Transformation Strategy

A government's operational needs will change over time and platform ecosystems should be able to adapt to these changes. These changes might occur because a platform ecosystem supports a function that has commoditized, making it beneficial if not necessary to pursue a "be a platform" or "share a platform" approach. Or, these changes might occur because changes to government structures (political support, budget process) make a different operational approach more feasible. Whatever the reason, decision-makers should prepare for these changes. Preparations may include flexible platform ecosystem policies and architectural designs that can be modified to better support a new approach.

6.4 Start Where Economic Costs are Low

High-profile projects often come with relatively strong government structures. These projects require a great deal of political support and practitioner buy-in. Decision-makers should feel comfortable starting where government structures are weaker and there are less barriers to entry for platform ecosystems. This strategy will **build up momentum that can be used to challenge stronger structures while simultaneously addressing weaker structures and preventing them from blocking larger projects.**

6.5 Monitor and Measure the Economic Benefits Provided by a Platform Ecosystem

Governments should begin to **monitor and measure** how these **economic properties** (e.g. economies of scale) translate into economic benefits within its departments or agencies. This includes monitoring cost savings, but also beginning to think about the **value of a citizen's time, the value of integrated systems, or the value of extensibility.** The cost savings that come from using many platform ecosystems, particularly IaaS offerings, has been proven across academic and business literature. **However governments have done little to monitor the other economic benefits that come from using platform ecosystems.** More details on how one might start this research are below.

Chapter Seven: Setting Up Part Two

How Definitions and Economic Properties Interact with Government Structures

There are two ways to help governments use more platform ecosystems. **When government structures are relatively weak, quantifying and communicating a platform ecosystem's economic benefits will increase use.** It is a matter of convincing decision-makers to try something different. **When government structures are relatively strong, the only way to increase platform ecosystem use is to change those structures.** Frequently decision-makers do not have the flexibility they need to make a different decision, and no amount of data about the economic benefits will help them.

Identifying if a government structure is strong or weak is part of the challenge. Most structures codified into law (formal regulations, procurement, budgeting practices) should be considered strong. Structures supported through political dynamics could be strong or weak, depending on the government and the group pushing for the use of platform-ecosystems.

7.1 Quantifying Economic Benefits

When government structures are relatively weak, a clear analysis of quantified economic benefits may convince decision-makers to use platform ecosystems. This includes the internal cost savings that governments receive through realizing economies of scale and economies of scope. However, **equally important are the more intangible economic benefits that arise from the full spectrum of economic properties supporting government platform ecosystems.**

These economic benefits will vary across governments, based on an ecosystem's operational approach and secondary architectural design. **The literature review and interviews with practitioners resulted in the following list of economic benefits.** This list is just a starting point for future research which would undoubtedly reveal more economic benefits. To quantify these benefits future work should include an economic benefit-specific literature review, identifying or collecting appropriate data, and robust statistical analyses.

Economic Benefit	Hypothesis for Why
Citizen Interactions	
Faster Government Response Time	Government platform ecosystems will speed up internal processing time, therefore reducing how long it takes to respond to a citizen's request or interaction (e.g., tax refunds, work authorization, street repair).
Improved Citizen Experience	A shared platform ecosystem approach may improve the citizen experience by standardizing service design and websites, allowing for a single sign-on solution (e.g., Login.Gov), or having a single source for notifications (e.g., Notify).
Inter-Government Interactions	
Increased Innovation, Decreased Development Time	Platform ecosystems increase in value as additional services are built on top of them. This incentivizes additional more government services to join the platform ecosystem. The economies of combinatorial innovation support the development of new services by allowing governments to repurpose parts of the ecosystem instead of developing a new service from scratch. This also makes it easier to experiment and test. This makes it easier to experiment and beta-test. Further, when additional core components are built a standardization process may occur. This produces more reusable components and furthers the cycle of combinatorial innovation. Lastly, the ecosystem reuses core components, meaning that when more services are added it realizes economies of scope.
Financial Savings	At a minimum, platform ecosystems deliver financial savings to governments through economies of scale and by abstracting core technical infrastructure. A government's secondary architectural design and operational approach will determine additional financial savings such as reducing redundancies and lowering development costs.

7.2 Changing Government Structures

When government structures are relatively strong, it is misguided to focus on finding better ways to explain or quantify a platform ecosystem's economic benefits. Instead, efforts should be focused on changing the structures that are preventing platform ecosystem's from being used. When interviewed for this document, an IT manager from a U.S. City explained this approach best; **"it is insulting to assume that I do not understand the economic benefits of platforms. Of course, I do. I just cannot do anything about it until we get these other things [procurement, budgeting] to change."**

Identifying and changing structures will vary across governments (and within governments, across departments). **This document is a starting point for understanding which relatively strong structures may need to be changed and how.** For this approach, future work should be government-specific and focus on actionable policy changes that may help alleviate the restrictions these structures create and thus increase the use of platform ecosystems.

In interviews, many of the practitioners who outlined these government structures had ideas for changing them or examples of how they have been addressed within a specific government. These are documented below. Some of these solutions have been implemented.

Structure	Brainstormed Changes
Procurement	• Technology Federal Acquisition Regulation[77] rethinks the way the government procures digital.
Budgeting	• Technology Modernization Fund[78] reimagines how IT modernization projects are funded and executed. • Create policies or funding strategies that support centralized, shared platform ecosystems financially. • Initially fund government platform ecosystems (especially shared ones) as startups. If required, have lenient timelines for cost-recoverability. If required, do not subtract financial savings from departments using the ecosystem until the ecosystem has had a few years to be developed and fully implemented.

Structure	Brainstormed Changes
Security	• Invest in training and education programs designed to increase government practitioners trust in platform ecosystems (particularly IaaS and PaaS offerings). • Ensure that security programs (e.g., FedRAMP) do not create a bottleneck in the procurement or integration process.
Accountability and Ownership	• Invest in forward-thinking leadership that rewards innovation and encourages "blame-free" postmortems. • Restructure department accountability structures to account for shared platform ecosystems. Ensure a shared understanding of the technology that is and is not controlled by a department.
Regulations	• Conduct a thorough review of existing regulations to properly understand the limitations that exist. • Rollback and prevent legislation that is overly prescriptive regarding which technology to use or how to complete a process.
Political Support	• Secure executive political support to signal to each group (legislators, business partners, unions, citizens, media) that finding ways to use platform ecosystems will be a priority moving forward. • Use this support to change other structures or policies, rally public opinion, and explain to the media how this work will improve service delivery.

Endnotes

1 D'Silva, Francis, and Bendik Bygstad. "GOVERNMENT AS A PLATFORM: A HISTORICAL AND ARCHITECTURAL ANALYSIS." Conference Paper: NOKOBIT - Norsk Konferanse Om Organisasjoners Bruk Av ITAt: Ålesund, Norway, Nov. 2015.

2 Scott, James C. Seeing Like A State. Yale University Press, 1998.

3 McAfee, Andrew, and Erik Brynjolfsson. Machine | Platform | Crowd. W. W. Norton & Company , 2017.

4 McAfee, Andrew, and Erik Brynjolfsson. Machine | Platform | Crowd. W. W. Norton & Company , 2017.

5 Accenture. Moving to the Cloud: A Strategy for Banks in North America. https://www.accenture.com/_acnmedia/PDF-70/Accenture-moving-to-the-cloud-strategy-for-banks-in-North-America.pdf.

6 Pew Research. "Americans' Views of Government: Low Trust, but Some Positive Performance Ratings." Pew Research Center - U.S. Politics & Policy, 14 Sept. 2020, https://www.pewresearch.org/politics/2020/09/14/americans-views-of-government-low-trust-but-some-positive-performance-ratings/.

7 Baldwin, Carliss Y., and C. Jason Woodard . "The Architecture of Platforms: A Unified View." Draft Paper | Harvard Business School, 2008.

8 Gawer, Annabelle. "Bridging Differing Perspectives on Technological Platforms: Toward an Integrative Framework." Research Policy, vol. 43, no. 7, Sept. 2014, pp. 1239–49.

9 Gawer, Annabelle. "Bridging Differing Perspectives on Technological Platforms: Toward an Integrative Framework." Research Policy, vol. 43, no. 7, Sept. 2014, pp. 1239–49.

10 Baldwin, Carliss Y., and C. Jason Woodard . "The Architecture of Platforms: A Unified View." Draft Paper | Harvard Business School, 2008.

11 Tushman, Michael, and P. Murmann. "Dominant Designs, Innovation Types and Organizational Outcomes." Research in Organizational Behavior, vol. 20, 1998.

12 Lehnerd, Alvin P., and Marc H. Meyer. The Power of Product Platforms. THE FREE PRESS, 1997.

Endnotes

13 Cusumano, Michael A., and Annabelle Gawer. "The Elements of Platform Leadership." MIT Sloan Management Review, vol. 43, no. 3, Spring 2002, pp. 51–58.

14 Baldwin, Carliss Y., and C. Jason Woodard . "The Architecture of Platforms: A Unified View." Draft Paper | Harvard Business School, 2008.

15 Brown, A., et al. "Appraising the Impact and Role of Platform Models and Government as a Platform (GaaP) in UK Government Public Service Reform: Towards a Platform Assessment Framework (PAF)." Government Information Quarterly, vol. 34, no. 2, 2017, pp. 167–82.

16 Brown, A., et al. "Appraising the Impact and Role of Platform Models and Government as a Platform (GaaP) in UK Government Public Service Reform: Towards a Platform Assessment Framework (PAF)." Government Information Quarterly, vol. 34, no. 2, 2017, pp. 167–82.

17 Brown, A., et al. "Appraising the Impact and Role of Platform Models and Government as a Platform (GaaP) in UK Government Public Service Reform: Towards a Platform Assessment Framework (PAF)." Government Information Quarterly, vol. 34, no. 2, 2017, pp. 167–82.

18 Baldwin, Carliss Y., and C. Jason Woodard . "The Architecture of Platforms: A Unified View." Draft Paper | Harvard Business School, 2008.

19 Malhotra, Arvind, et al. "Absorptive Capacity Configurations in Supply Chains: Gearing for Partner-Enabled Market Knowledge Creation." Management Information Systems Quarterly, vol. 29, no. 1, Mar. 2005, pp. 145–87.

20 Nielsen, Petter, and Margunn Aanestad. "Control Devolution as Information Infrastructure Design Strategy: A Case Study of a Content Service Platform for Mobile Phones in Norway." Journal of Information Technology, vol. 21, no. 3, Sept. 2006, pp. 185–94. SAGE Journals, doi:10.1057/palgrave.jit.2000064.

21 Microsoft Azure. https://azure.microsoft.com/en-us/free/search/.

22 Amazon Web Services, Inc., https://aws.amazon.com/free/.

23 "Cloud Computing Services." Google Cloud, https://cloud.google.com/.

24 Cloud.Gov. https://cloud.gov/.

Endnotes

.

25 Federalist. https://federalist.18f.gov/.

26 Microsoft Azure. https://azure.microsoft.com/en-us/services/search/.

27 "AWS Elastic Beanstalk – Deploy Web Applications." Amazon Web Services, Inc., https://aws.amazon.com/elasticbeanstalk/.

28 Login.Gov. https://www.login.gov/.

29 Microsoft. "Outlook – Free Personal Email and Calendar from Microsoft." Outlook – Free Personal Email and Calendar from Microsoft, https://outlook.live.com/.

30 DocuSign | #1 in Electronic Signature and Agreement Cloud. https://www.docusign.com/.

31 "Microsoft's Bid to Make Outlook More than Email." Harvard Business Review, Aug. 2015. hbr.org, https://hbr.org/2015/08/microsofts-bid-to-make-outlook-more-than-email.

32 Dupree, Brett. "Architecting a Safe, Scalable, and Server-Driven Platform for Driver Preferences with RIBs." Uber Engineering Blog, 1 Mar. 2019, https://eng.uber.com/carbon-driver-app-preferences-ribs/.

33 Government As a Platform - Open Government [Book]. https://www.oreilly.com/library/view/open-government/9781449381936/ch02.html.

34 Brown, A., et al. "Appraising the Impact and Role of Platform Models and Government as a Platform (GaaP) in UK Government Public Service Reform: Towards a Platform Assessment Framework (PAF)." Government Information Quarterly, vol. 34, no. 2, 2017, pp. 167–82.

35 Brown, A., et al. "Appraising the Impact and Role of Platform Models and Government as a Platform (GaaP) in UK Government Public Service Reform: Towards a Platform Assessment Framework (PAF)." Government Information Quarterly, vol. 34, no. 2, 2017, pp. 167–82.

36 "Creating Project Plans to Focus Product Development." Harvard Business Review, Mar. 1992. hbr.org, https://hbr.org/1992/03/creating-project-plans-to-focus-product-development.

37 Robertson, David, and Karl Ulrich. "Planning for Product Platforms." Sloan Management Review, July 1998, pp. 19–31.

Endnotes

38 Bresnahan, Timothy, and Shane Greenstein. "Technological Competition and the Structure of the Computer Industry." Journal of Industrial Economics, vol. 47, no. 1, 1999, pp. 1–40.

39 Fishenden, Jerry, and Mark Thompson. "Digital Government, Open Architecture, and Innovation: Why Public Sector IT Will Never Be the Same Again." Journal of Public Administration Research and Theory, vol. 23, no. 4, Oct. 2013, pp. 977–1004, doi:https://doi.org/10.1093/jopart/mus022.

40 Gawer, Annabelle. "Bridging Differing Perspectives on Technological Platforms: Toward an Integrative Framework." Research Policy, vol. 43, no. 7, Sept. 2014, pp. 1239–49.

41 Brown, A., et al. "Appraising the Impact and Role of Platform Models and Government as a Platform (GaaP) in UK Government Public Service Reform: Towards a Platform Assessment Framework (PAF)." Government Information Quarterly, vol. 34, no. 2, 2017, pp. 167–82.

42 Crémer, Jacques, et al. Competition Policy for a Digital Era. EUROPEAN COMMISSION, Luxembourg: Publications Office of the European Union 2019.

43 Gelles, Gregory M., and Douglas W. Mitchell. "Returns to Scale and Economies of Scale: Further Observations." The Journal of Economic Education, vol. 27, no. 3, Summer 1996, pp. 259–61.

44 Gelles, Gregory M., and Douglas W. Mitchell. "Returns to Scale and Economies of Scale: Further Observations." The Journal of Economic Education, vol. 27, no. 3, Summer 1996, pp. 259–61.

45 Teece, David J. "Economies of Scope and the Scope of the Enterprise." Journal of Economic Behavior & Organization, vol. 1, no. 3, Sept. 1980, pp. 223–47. ScienceDirect, doi:10.1016/0167-2681(80)90002-5.

46 McAfee, Andrew, and Erik Brynjolfsson. Machine | Platform | Crowd. W. W. Norton & Company , 2017.

47 Nielsen, Petter, and Margunn Aanestad. "Control Devolution as Information Infrastructure Design Strategy: A Case Study of a Content Service Platform for Mobile Phones in Norway." Journal of Information Technology, vol. 21, no. 3, Sept. 2006, pp. 185–94. SAGE Journals, doi:10.1057/palgrave.jit.2000064.

48 Apple Pay - Implementing Apple Pay - Apple Developer. https://developer.apple.com/apple-pay/implementation/.

Endnotes

49 McAfee, Andrew, and Erik Brynjolfsson. Machine | Platform | Crowd. W. W. Norton & Company , 2017.

50 Acemoglu, Daron, and Asu Ozdaglar. Networks & Network Effects. https://economics.mit.edu/files/4831. MIT.

51 Jullien, Bruno, and Wilfried Sand-Zantman. "The Economics of Platforms: A Theory Guide for Competition Policy." Munich Society for the Promotion of Economic Research - CESifo Working Papers, no. 8463, July 2020.

52 Requirements | TechFAR Hub. https://techfarhub.cio.gov/handbook/requirements/.

53 17.502-2 The Economy Act. | Acquisition.GOV. https://www.acquisition.gov/far/17.502-2.

54 Sizemore, Steve, and Markesha McCants. Interagency Acquisition. https://www.gsa.gov/cdn-static/B2_S5_Interagency_Acquisition_CLP.pdf.

55 "GOV.UK Verify." GOV.UK, https://www.gov.uk/government/publications/introducing-gov-uk-verify/introducing-govuk-verify.

56 Login.Gov — Meghana Khandekar. https://mkhandekar.com/Login-gov.

57 "Government Launches Login.Gov to Simplify Access to Public Services." Digital.Gov, 28 Aug. 2017, /2017/08/28/government-launches-login-gov-to-simplify-access-to-public-services/.

58 "Government Launches Login.Gov to Simplify Access to Public Services." Digital.Gov, 28 Aug. 2017, /2017/08/28/government-launches-login-gov-to-simplify-access-to-public-services/.

59 "Government Launches Login.Gov to Simplify Access to Public Services." Digital.Gov, 28 Aug. 2017, /2017/08/28/government-launches-login-gov-to-simplify-access-to-public-services/.

60 Building a Modern Shared Authentication Platform | 18F: Digital Service Delivery. https://18f.gsa.gov/2016/05/10/building-a-modern-shared-authentication-platform/.

61 Government Launches Login.Gov to Simplify Access to Public Services | 18F: Digital Service Delivery. https://18f.gsa.gov/2017/08/22/government-launches-login-gov/.

62 "Login.Gov (Consumer Identity)." United States Digital Service, https://usds.gov/report-to-congress/2017/07/login-dot-gov/.

Endnotes

63 What Is Login.Gov? | Login.Gov. https://www.login.gov/what-is-login/.

64 "Login.Gov (Consumer Identity)." United States Digital Service, https://usds.gov/report-to-congress/2017/07/login-dot-gov/.

65 Production Deployment | Login.Gov. https://developers.login.gov/production/#changes-to-production-applications.

66 OpenID Connect | Login.Gov. https://developers.login.gov/oidc/.

67 SAML Developer Guide | Login.Gov. https://developers.login.gov/saml/.

68 Integration Overview | Login.Gov. https://developers.login.gov/overview/.

69 Integration Overview | Login.Gov. https://developers.login.gov/overview/.

70 "Government Launches Login.Gov to Simplify Access to Public Services." Digital.Gov, 28 Aug. 2017, /2017/08/28/government-launches-login-gov-to-simplify-access-to-public-services/.

71 "Government Launches Login.Gov to Simplify Access to Public Services." Digital.Gov, 28 Aug. 2017, /2017/08/28/government-launches-login-gov-to-simplify-access-to-public-services/.

72 Login.Gov Partners | Product | Login.Gov Partners. https://partners.login.gov/product/.

73 Login.Gov Partners | Product | Login.Gov Partners. https://partners.login.gov/product/.

74 Login.Gov Partners | Product | Login.Gov Partners. https://partners.login.gov/product/.

75 Login.Gov Partners | Product | Login.Gov Partners. https://partners.login.gov/product/.

76 Services, Login gov Team Post filed in: Technology Transformation. Login.Gov to Provide Authentication and Identity Proofing Services to a Limited Number of Federally Funded State and Local Government Programs. https://www.gsa.gov/blog/2021/02/18/logingov-to-provide-authentication-and-identity-proofing-services-to-a-limited-number-of-federally-funded-state-and-local-government-programs.

77 About the Hub | TechFAR Hub. https://techfarhub.cio.gov/about/.

78 "The Technology Modernization Fund." https://tmf.cio.gov/.

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