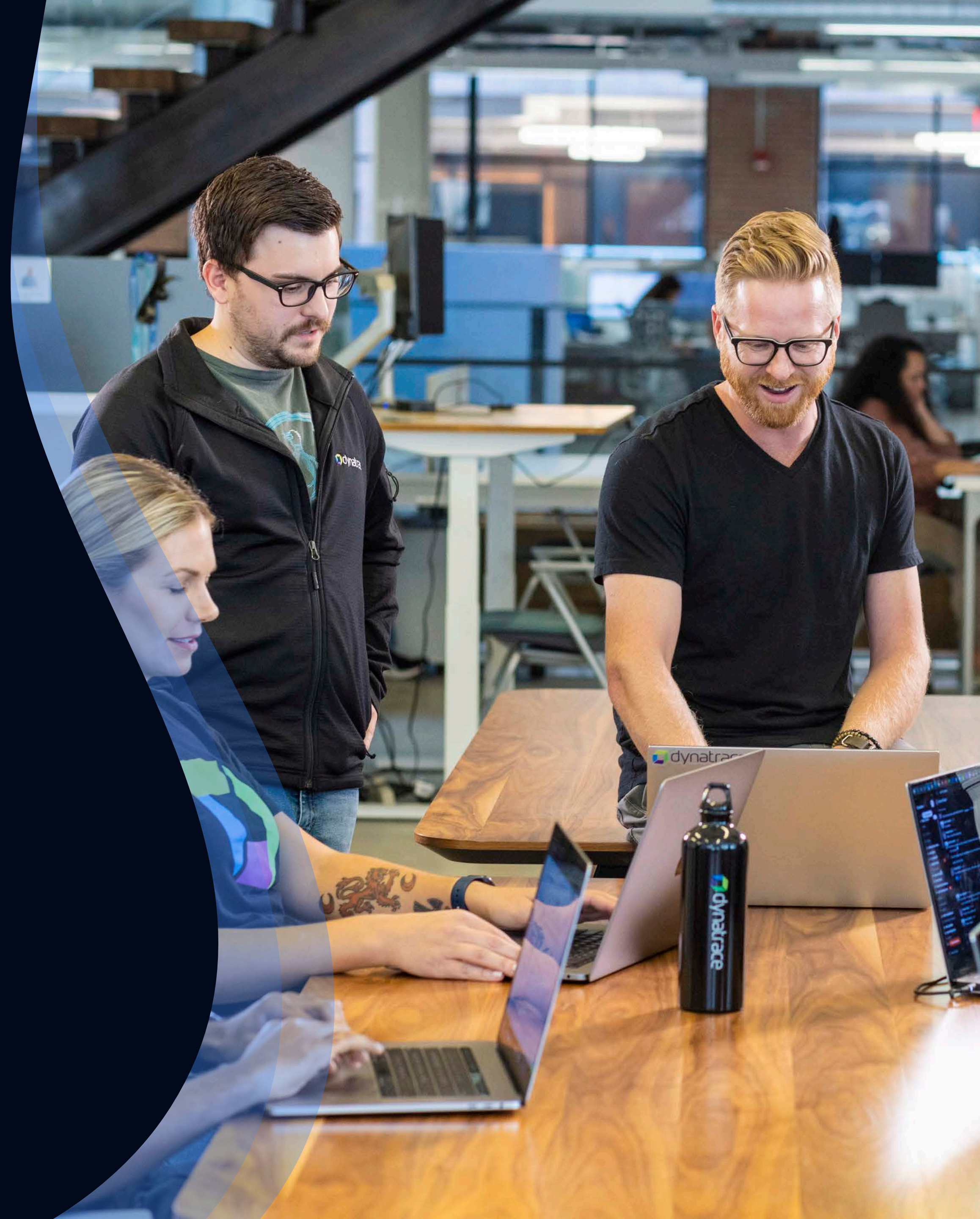




# Understanding your legacy environment

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The first step in your cloud journey



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## INTRODUCTION

# The pandemic exposed state and local agency shortcomings

Most state agencies have delayed their digital transformation initiatives — especially when it comes to modernizing applications and mainframes. According to a [state-by-state analysis](#), almost all states are only getting started with their IT modernization plans and most are missing at least one of the three key components of a modern digital government experience. In fact, only one can claim the characteristics of a modern digital government experience.

It's understandable that agencies push off these projects, considering the funding and time requirements. But time is of the essence in light of lessons learned once the pandemic hit.

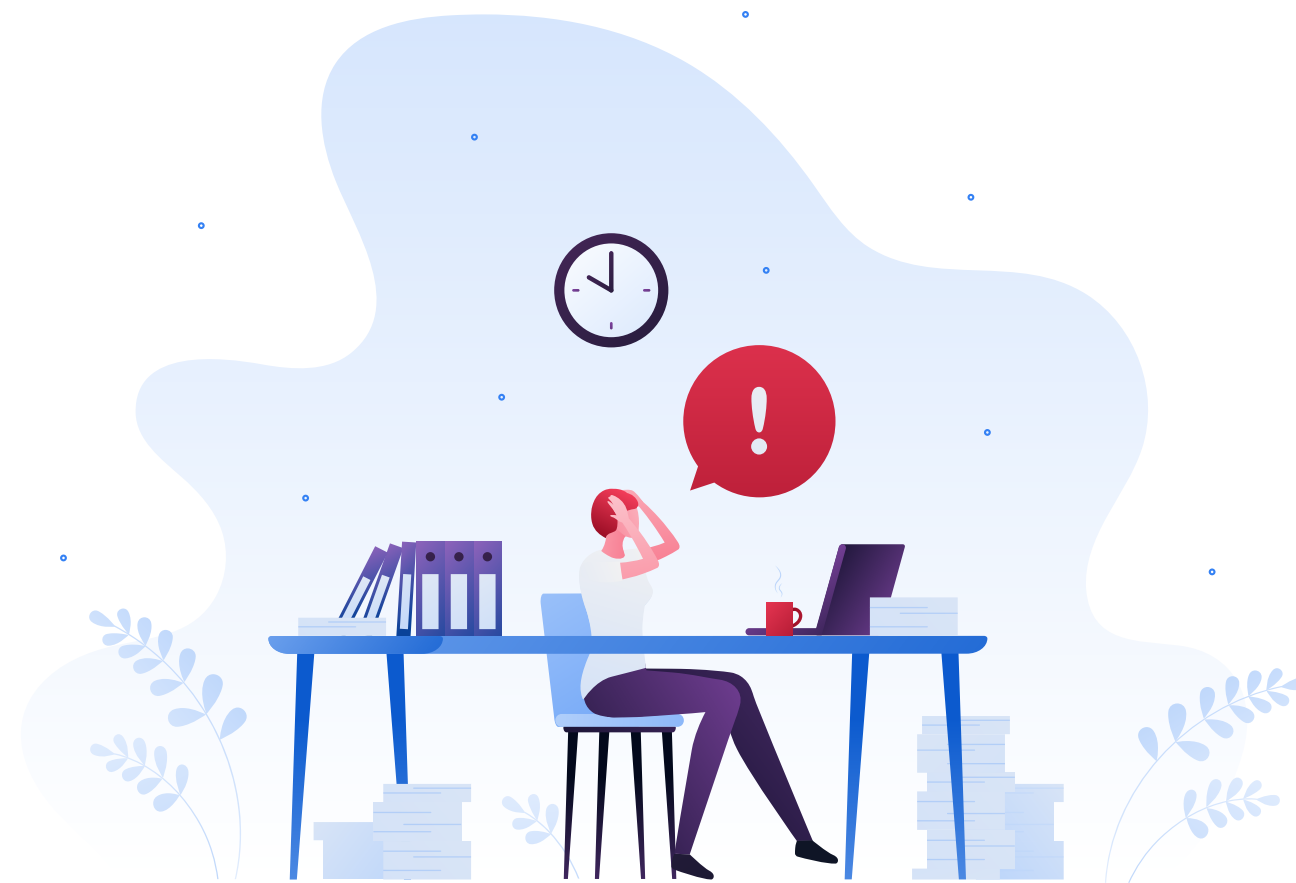


## Legacy systems failed

As [Denis Goulet](#), president of the National Association of State Chief Information Officers underscored, “Too often during the pandemic, we saw massive failures of legacy government systems — including unemployment insurance systems — built on 50-year-old technology... States should invest in cloud services for these modernization efforts...operating systems that continue to rely on outdated technologies simply cannot meet the future demand for increased digital services and the delivery of critical services and benefits to our citizens.”

[84% of government organizations](#) have started but failed to complete at least one modernization program. To help your agency avoid that fate — and optimize for your migration strategy — you need to know where you stand today.

In this ebook, we explain the urgent need for modernization, and the cornerstone of a move to the cloud – comprehending your existing IT environment. Along the way, we pose questions to help you gauge that understanding, and guide you on gaining a full view of your IT environment and legacy systems — [which Gartner defines](#) as “an information system that may be based on outdated technologies, but is critical to day-to-day operations.” With this understanding in hand, you can ensure a successful cloud migration from the start.



Whether a system or application is considered legacy because of its age, its incompatibility with newer software, or its inability to support today's needs, it hinders innovation and responsiveness.

## Modernization is a priority

As reported in the [2021 Mainframe Modernization Business Barometer Report](#), at the onset of COVID-19, many state unemployment insurance systems met their match when claims crashed legacy systems running decades-old coding languages. Months into COVID-19 in December 2020, as many as 15,000 Vermont citizens received their unemployment checks late [due to a technical error](#) caused by the state's mainframes. The State of New Jersey's mainframe was overwhelmed when hundreds of thousands of residents submitted applications to the state's unemployment system at the start of the pandemic.

Applying for unemployment benefits and filing state tax returns are just a few of the many services that would run more efficiently and securely if states modernized their IT infrastructure. That modernization hinges on embracing cloud services that make it possible for state websites and web-based applications to better handle sudden and unexpected traffic surges.

According to NASCIO's [2020 State CIO Survey](#), CIOs overwhelmingly identified the increased attention on digital government services and citizen experience as one of the top three business processes that are here to stay in a post-COVID world. Denis Goulet called the American Rescue Plan a "unique opportunity" for states. [He urges states](#) to use their incoming funds to "modernize legacy and outdated IT systems, improve our cybersecurity posture and invest in technologies to enhance how our citizens interact with their governments."

Alan Shark, the executive director of CompTIA's Public Technology Institute, [echoes this sentiment](#): "Local governments should use their relief funds on long-term IT projects, like migrating to cloud-based services, enhancing cybersecurity and investing in last-mile broadband."

"The pandemic exposed that legacy systems needed to be modernized, especially around citizen engagement and remote technologies."

— Phil Bertolini  
Vice President, [Center for Digital Government](#)

"Modernization is no longer an IT desire, but an operational necessity."

— Gartner, [Impacts of COVID-19 on Government Technology Optimization and Modernization](#), May 20, 2020 — Neville Cannon, Andrea Di Maio, Michael Brown

# The risks of sticking with the status quo

For more reasons than one, state and local agencies can no longer afford to delay their modernization initiatives. In addition to the examples of web-based applications failing in the face of huge traffic surges, government organizations must contend with:

<b>Dissatisfied citizens</b>	Legacy apps weren't designed for access by mobile phone. Even when these apps are updated to accommodate mobile access, the user experience is often lacking.
<b>Waning legacy skills</b>	As developers with expertise in core legacy languages and databases retire, organizations risk disruptions to operations.
<b>Lack of training</b>	Few agencies train their IT staff to maintain and further develop their legacy systems. The exceptions are those relying on a mainframe environment — which also exposes vulnerabilities. Young IT talent is skilled in today's cloud technologies and modern application development — not in maintaining mainframes. No wonder <a href="#">89% of organizations</a> are concerned about having the right IT talent to properly maintain and extend their legacy systems.
<b>Innovation barriers</b>	It's difficult to innovate when applications are in a monolithic, tightly coupled legacy environment due to the large codebase and complex functionalities. Unable to support modern requirements, legacy applications often fail to meet the demands of today's constituents and efficiency requirements of government agencies.
<b>High costs</b>	It's costly to maintain legacy systems. Consider that the federal government spends a <a href="#">staggering \$337 million</a> annually to maintain just 10 of its legacy platforms. Over 62% of respondents to the <a href="#">2021 Mainframe Modernization Business Barometer Report</a> say they could save up to a third of their IT expenditure if they modernized just one legacy system.
<b>Compliance and security risks</b>	Legacy systems are often incompatible with regulations such as HIPAA. At the same time, they are more vulnerable to cyberattacks because they don't protect data and system access using modern techniques. The U.S. Department of Labor's inspector general estimates that <a href="#">up to \$87 billion in fraudulent unemployment insurance claims</a> was paid out partly because of the vulnerabilities of outdated state unemployment insurance systems.
<b>Rise of sustainability initiatives</b>	In the face of growing demand to go green, organizations relying on resource-heavy legacy systems are at a disadvantage. Mainframes housed in private data centers undermine sustainability efforts: data centers alone are projected to account for 3.2% of global greenhouse gas emissions by 2025.

“For the government sector in particular, the pressure to modernize has grown.

Pandemic or not, the fact is that maintaining legacy systems will become increasingly difficult down the line amid challenges of diminishing talent, increased application development backlogs and money required for licensing.”

— [GCN, The time is now: Why government can't put off modernization, February 2, 2021](#)

## CHAPTER 1

# Starting your journey to the cloud

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It's clear why so many organizations are migrating to the cloud. Now more than ever, organizations need to move fast, be agile, and go digital to satisfy growing consumer demand for instant access to digital services and greater convenience.

While the COVID-19 pandemic wasn't most state and local governments' first foray into the cloud, it certainly accelerated most agencies' plans. Government agencies [discovered that cloud-based systems and applications](#) helped them meet core needs. That includes delivering existing and new digital resources to citizens and businesses.



# Agencies join the cloud revolution

As states responded to an unprecedented number of unemployment claims and demands for state social and healthcare services triggered by the pandemic, they accelerated the move to remote and hybrid workforces, digital services and elastic cloud solutions. As they did so, [two things became clear](#):

1. Digital matters are more important than ever
2. States must be able to rapidly adapt capacity to meet surges in demand

To avoid such situations in the future, [government agencies are now joining the cloud revolution](#) to ensure unimpeded operations in times of crisis.

Consider [The State of Minnesota](#), the government body that provides support for Minnesotan citizens. Its IT services team (MNIT) manages the critical applications and infrastructure that enable citizens to access essential government services online. These include the Department of Employment and Economic Development and Unemployment Insurance application. The application's average monthly traffic volume

of 638,000 visitors peaked at 6.6 million during the pandemic last year – a more than tenfold surge. This demand remained steady, with online visits to the application averaging above two million per month in 2021 — a volume the state likely wouldn't have been able to support on legacy infrastructure.

If you are reading this guide, you are likely considering a move to the cloud — like many of your peers.

## Does your state CIO organization have a strategy to migrate legacy applications to the cloud?

**41%**

We have a cloud first strategy for all new applications deployed to the cloud (when feasible)

**29%**

There is no statewide cloud migration strategy, but agencies are encouraged to leverage the cloud

**17%**

The state is moving or has moved to IaaS or third-party data center hosting, but applications are still managed by the individual agencies

**14%**

No cloud migration strategy planned or in place

Source: [2020 NASCIO State CIO Survey](#)



# Government struggles with modernization

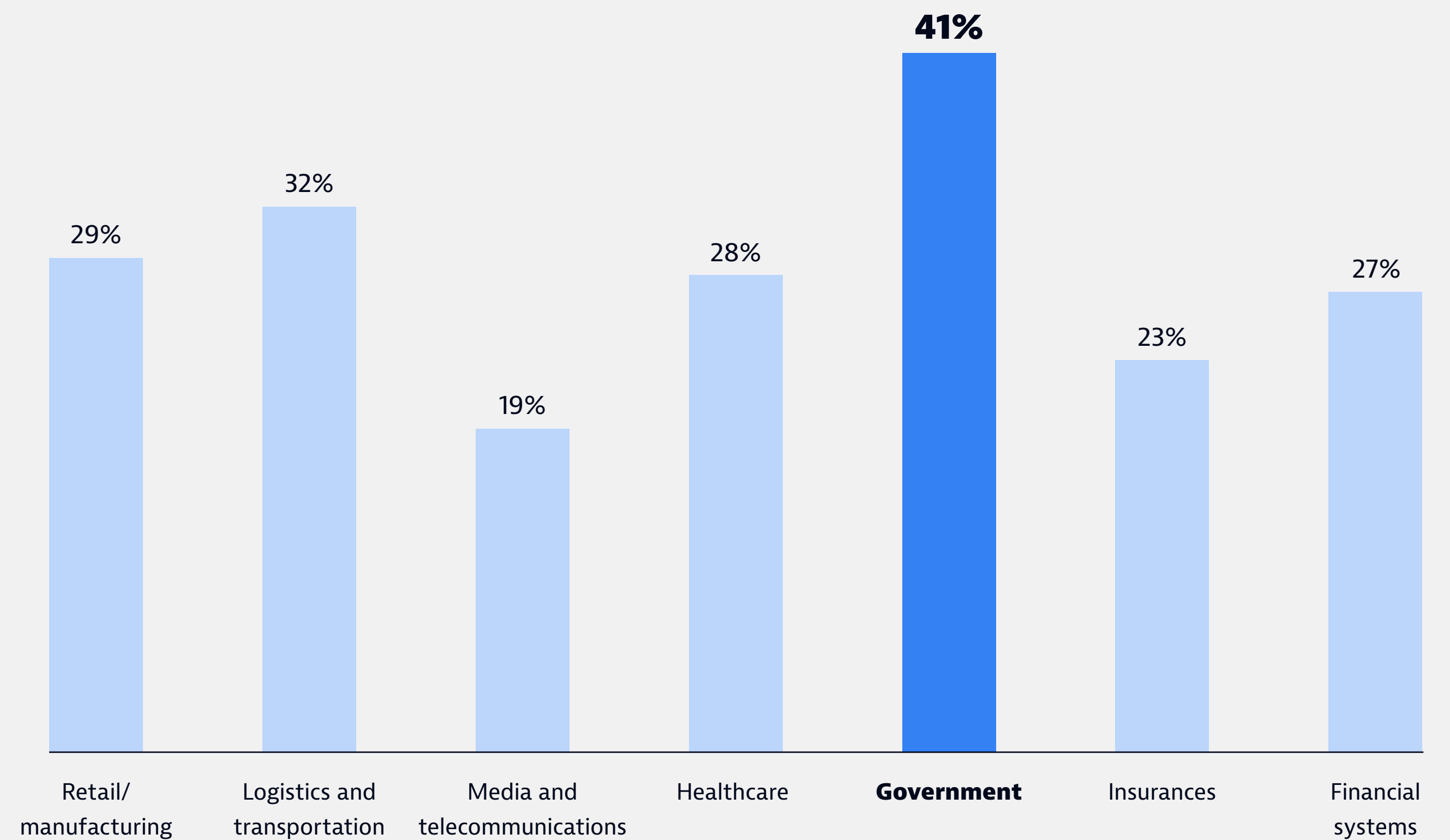
But how do you know what to migrate to the cloud and in which order? Which applications, services, processes, hosts, data centers and technologies are you running and where?

Can you confidently identify and recommend candidates to move to the cloud? Do you know which are the priorities for your organization?

If you can't answer these questions, you're not alone. [Half the government organizations](#) that have started but failed to complete at least one modernization program attribute their failures to poor information about legacy systems. In fact, government struggles more than any other industry when it comes to this crucial modernization stepping-stone.

## Percentage of respondents that agree poor information about legacy systems is a key challenge for modernization programs

(Source: [2021 Mainframe Modernization Business Barometer Report](#))



## CHAPTER 2

# Why to map your existing environment

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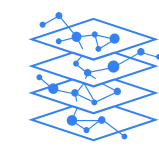
Before defining and executing a cloud migration strategy, you need a complete view of your IT environment. This perspective is essential for accurate assessments, better decisions, and optimized design of your cloud environment.

Undoubtedly, your organization's environment is [complex and highly intertwined](#) with core operations and processes. This reality makes it complicated — and essential — to gain a complete view into the interconnectedness of your IT environment.



Every journey starts with the first step. In your cloud journey, that step is getting a firm grasp on your existing IT architecture.

## Ideally you can:



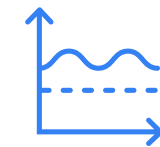
Create a complete, interactive dependency map of application components across the entire stack.



Identify key transactions and business KPIs.



Identify data repositories and activity.



Automatically create a detailed performance baseline.



Determine external resources and dependencies.



Use performance metrics for proper sizing and capacity planning.

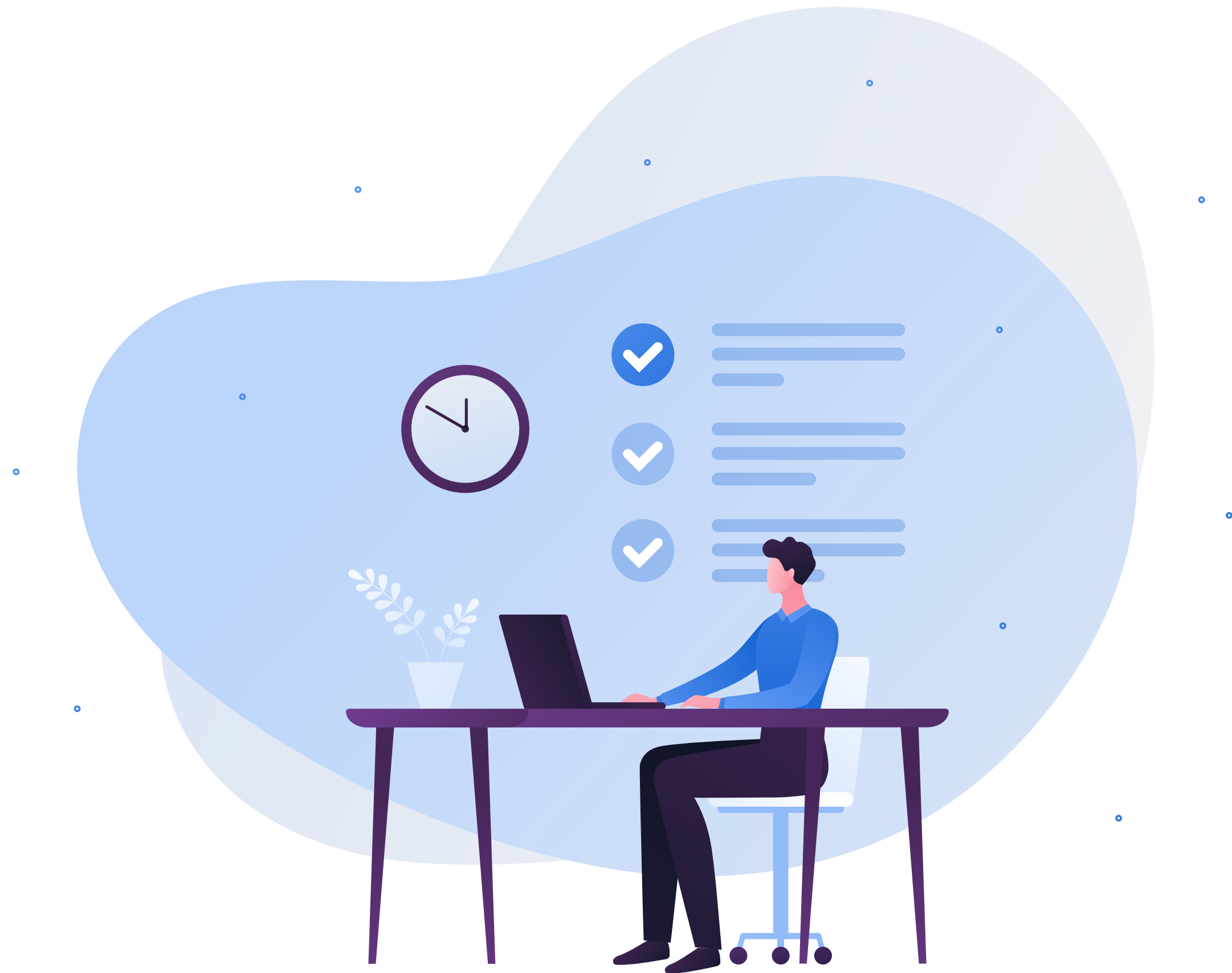


See how users access and interact with the application.

In other words, mapping is foundational to ensuring that your apps are well suited for cloud, and that your new design and cloud architecture are effective.

## Answer these questions:

- 1 Where should we reduce data transfer in general?
- 2 Which hosts are not candidates for migration because of excessive network traffic?
- 3 Should we invest in data compression? If so, where?
- 4 What is the distance between your most critical features and your data center?
- 5 Would the end-user experience improve by moving the feature closer to the end user?
- 6 Are any features currently relying on dedicated hardware better suited for on-demand cloud infrastructure?



## CHAPTER 3

# Why dependencies matter

It's critical to understand your legacy systems under real-world conditions — including all dependencies and underlying technologies. Knowing network usage between hosts you intend to migrate and hosts that will not be moved helps with if/then decisions based on future costs. It also helps you understand implications. For example, you don't want to migrate a service and unexpectedly introduce high latency or costs because of a missed dependency.



## Set yourself up for success

Plus, it's key to understand how your services interact and operate under real-world conditions. That includes knowing how different end-user behavior and devices affect service flows, CPU loads, database queries, system availability, and performance.

Remember: Cloud migration also presents opportunities to migrate individual features versus complete applications. To make that decision, you need to be informed on all back-end services, front-end API services, and user-facing features.

Moreover, understanding how your applications and infrastructure are interrelated informs what needs to be moved simultaneously to the cloud to avoid unintended downtime. It may also inform whether you start your migration with applications experiencing performance or reliability issues.

Tackling this low-hanging fruit first can help set up the rest of your migration for success and give you a real-world sense of how the cloud will enhance your systems and services.



# Insight into dependencies is an enabler

According to the [2021 Accenture and NASCIO Cloud Study](#), "The key to understanding what can be migrated to cloud, and in what order, is understanding the applications in the current application portfolio, their characteristics and their associated business priorities and risks. While this may be harder in a decentralized environment, it is important for all states to establish a baseline inventory and assessment. This initial effort is essential to a successful enterprise cloud computing strategy."

## Network usage between hosts

- Helps with if/then decisions based on future costs
- Provides insight into implications of moves to the cloud

## How services interact and operate under real-world conditions helps pinpoint:

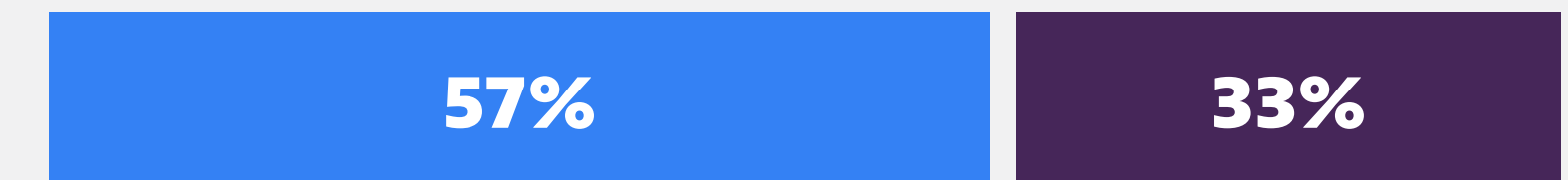
- Which individual app features and/or complete apps to move the cloud
- What to move simultaneously to avoid downtime
- Apps experiencing performance or reliability issues

Yet, according to the [2021 NASCIO/Accenture Cloud Study](#), just over half of states (57%) have a statewide application inventory, fewer states (40%) have an application risk assessment and still fewer (34%) report a legacy application assessment.

## Do you have up-to-date, statewide versions of the following?

(Source: [2021 NASCIO/Accenture Cloud Study](#))

### Application inventory



### Application risk assessment



### Legacy application assessment



■ Yes ■ No

## Answer these questions:

- 1 What services can be migrated in isolation?
- 2 Which services have tight dependencies?
- 3 What is the network traffic between services you could migrate and those needing to stay in the current data center?
- 4 What are your services' current usage and resource consumption patterns?
- 5 What will it cost when those services are running in the cloud?





## CHAPTER 4

# Database migration considerations

Moving on-premise databases to the cloud offers the same benefits as migrating your apps. But database moves can be the trickiest part of cloud migration since they often involve downtime as you rework data schemas. Plus, before you can move a database, you need to migrate all the data within it. In addition to properly timing that move, it's essential to understand dependencies — just as with your apps and other IT components.



By understanding database dependencies, you gain insights that inform what to migrate, retain or replace with database services in the cloud. Key considerations include:

- Understanding resource utilization data, since that is essential to right-size lift-and-shift instances.
- Identifying the apps and services with tight dependencies, and determining which would be better co-located.
- Gathering robust, accurate data on large relational databases to understand key queries to optimize and which data is less critical (and a candidate for more cost-efficient options).

### The unique challenges of migrating databases



- Must rework data schemas, resulting in downtime
- Must properly time move of data within databases
- Must understand all dependencies

## Answer these questions:

- 1 How many and which databases do we run?
- 2 What is their resource consumption?
- 3 Which are candidates for cloud migration?
- 4 Which applications and services might be impacted this these databases being migrated?
- 5 Should we co-locate certain databases? If so, which ones and why?
- 6 What is the current performance of key database queries and stored procedures?
- 7 What tables and data are candidates to extract into a cheaper database system?

## CHAPTER 5

# Challenges mapping legacy environments

If you've struggled to answer any of the questions posed so far, you realize that it's often challenging to understand your existing environment. Perhaps your organization has developed systems with third-party developers over several iterations. Or maybe it has independently expanded its environment over time. Either way, it can be difficult to develop and maintain a complete understanding of all existing technologies and how they work.

Getting this step right is essential. Doing so allows you to:

- Identify which systems and components to migrate first
- Discover whether anything else needing to be migrated at the same time
- Uncover technical constraints or bottlenecks to consider during your migration

In other words, you don't want to move forward with a migration until you nail this step.



# Understand cloud basics

The US National Institute of Standards and Technology provides the following definitions for [cloud-service and -deployment models](#):

## Service models

**Infrastructure as a service (IaaS)** provides users with processing, storage, networks, and other computing infrastructure resources. The user does not manage or control the infrastructure but has control over operating systems, applications, and programming frameworks.

**Platform as a service (PaaS)** enables users to deploy applications developed using specified programming languages or frameworks and tools onto a cloud infrastructure. The user does not manage or control the underlying infrastructure but has control over deployed applications.

**Software as a service (SaaS)** enables users to access applications running on a cloud infrastructure from various end-user devices (generally through a Web browser). The user does not manage or control the underlying cloud infrastructure or individual application capabilities other than a limited number of user-specific application settings

## Deployment models

**Private clouds** are operated solely for one organization. They may be managed by the organization itself or by a third party, and they may be located on or off the user's premises.

**Public clouds** are open to the general public or a large industry group and are owned and managed by a cloud service provider. These are located off the user's premises.

**Hybrid clouds** combine two or more clouds (private or public) that remain unique entities but are bound together by technology that enables data and application portability

**Community clouds** feature infrastructure that is shared by several organizations and supports a specific community of users. They may be managed by the user organizations or a third party, and they may be located on or off the user's premises

## CHAPTER 6

# Options for mapping your environment

You can map your environment manually, or use an automated solution — either agentless or by installing agents.

Inventorying and analyzing your legacy systems manually can be time-consuming, especially when you have to map a range of different:

- Programming languages
- Operating systems
- Databases
- Services
- Application frameworks

In fact, mapping application dependency manually is nearly impossible. How will you identify all interconnections and understand why they exist?



## Manual mapping

Some base their manual maps off IT architecture diagrams. However, this assumes someone has kept the diagrams up to date with each change to the environment over time.

The other option is to use network mapping tools. Some find these difficult to set up since it requires significant manual effort to install agents on each application. In addition, you need a solid and accurate understanding of your environment to know where to install the agents. Otherwise, the task is nearly impossible.

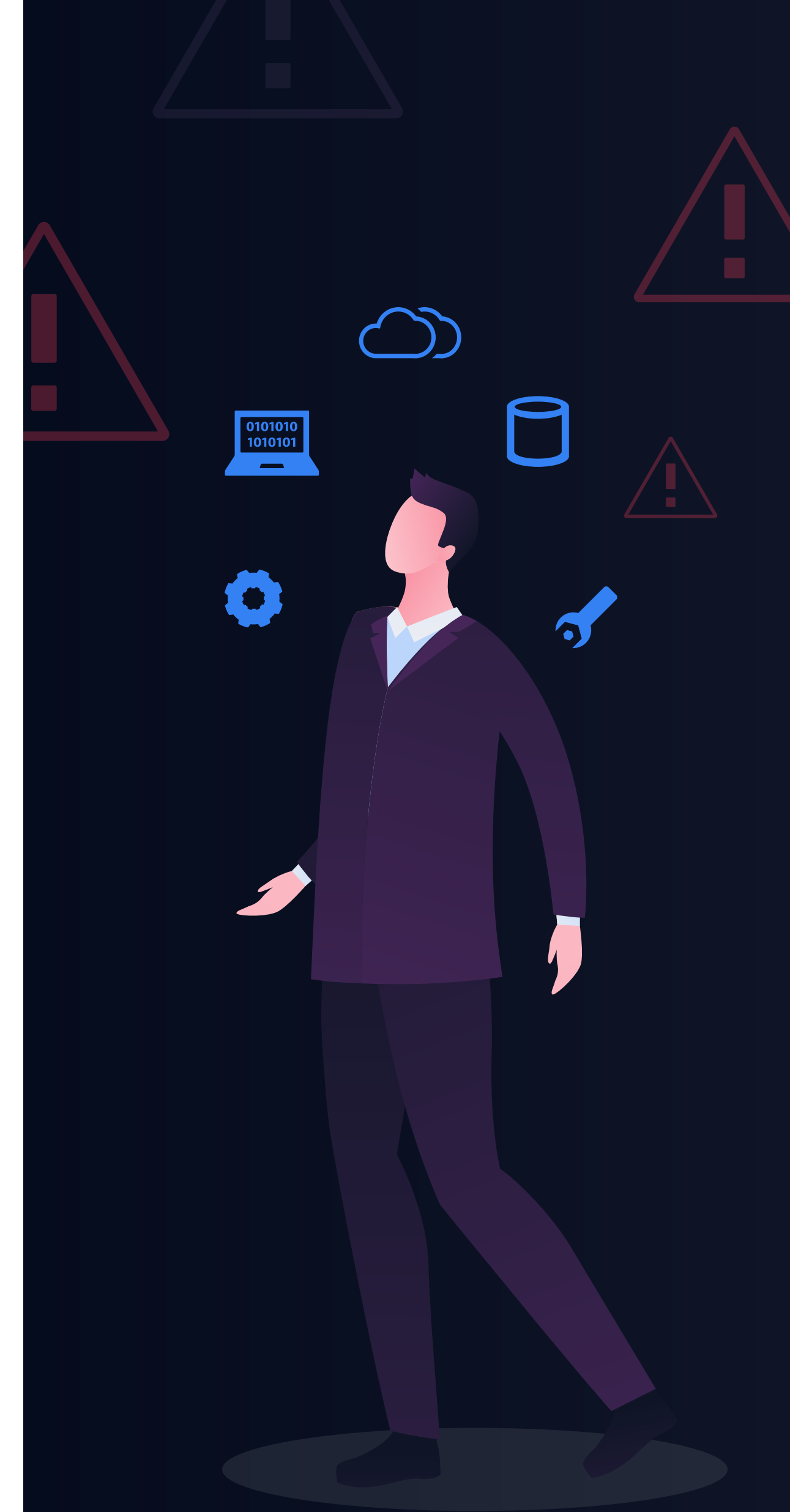
Plus, these tools only map a single architecture layer – and do so by sampling network traffic at intervals to reduce bandwidth consumption. That means they rely on partial data and miss the causal dependencies between websites, applications, services, processes, hosts, and infrastructure.

Whatever method is used for manual mapping, it's safe to say it takes either months of effort for at least one person from each application team or hundreds of thousands of dollars to hire a third party.

Again, this is just to complete the mapping portion of your cloud migration. The bigger the IT environment, the more time and people this exercise will require. Because the process can take so long, it's common for dependencies to change during the mapping and go undiscovered. Moreover, relying on internal staff to complete the mapping means you are pulling them from their core responsibilities.



Few tools can locate all the dependencies in your application stack, never mind inform how they work together collectively. The right monitoring solution can help you effectively profile legacy systems and entire architectures.

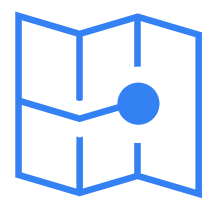


## Agentless vs. agent-based mapping

The agentless approach results in a small overhead footprint but usually does not provide a complete picture of your environment. That's because the agentless approach doesn't have the ability to peer into and capture every aspect of your IT landscape. While installing agents might result in a slightly bigger footprint for your application, it makes it possible to capture the entire IT topology

Advanced solutions calling upon agents can map and profile your environment with minimal effort, enabling you to easily visualize important dependencies and automatically baseline usual application performance.

### Agent-based mapping solutions allow you to:



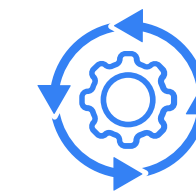
Identify, map, and visualize system components



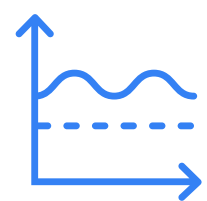
Display interactive topology maps



Cover technology end to end



Reduce your effort because they automatically set up



Automatically produce performance baselines for each system component






Deliver performance profiling under real-world conditions



Enable full stress testing for different systems.

# Summary of mapping techniques

	Manual mapping 	Agentless mapping 	Agent-based mapping 
Pros		<ul style="list-style-type: none"> <li>• Automatically baselines usual app performance</li> <li>• Frees staff from mapping</li> <li>• Small overhead footprint</li> </ul>	<ul style="list-style-type: none"> <li>• Captures the entire IT topology</li> <li>• Automatically baselines usual app performance</li> <li>• Frees staff from mapping</li> </ul>
Cons	<ul style="list-style-type: none"> <li>• Time consuming and/or expensive</li> <li>• Distracts staff from core responsibilities</li> <li>• Dependent on someone maintaining up-to-date architecture diagrams</li> <li>• Lead to oversights due to partial information</li> </ul>	<ul style="list-style-type: none"> <li>• Does not enable a complete picture of the environment</li> </ul>	<ul style="list-style-type: none"> <li>• Slightly increases the application footprint</li> </ul>



## CHAPTER 7

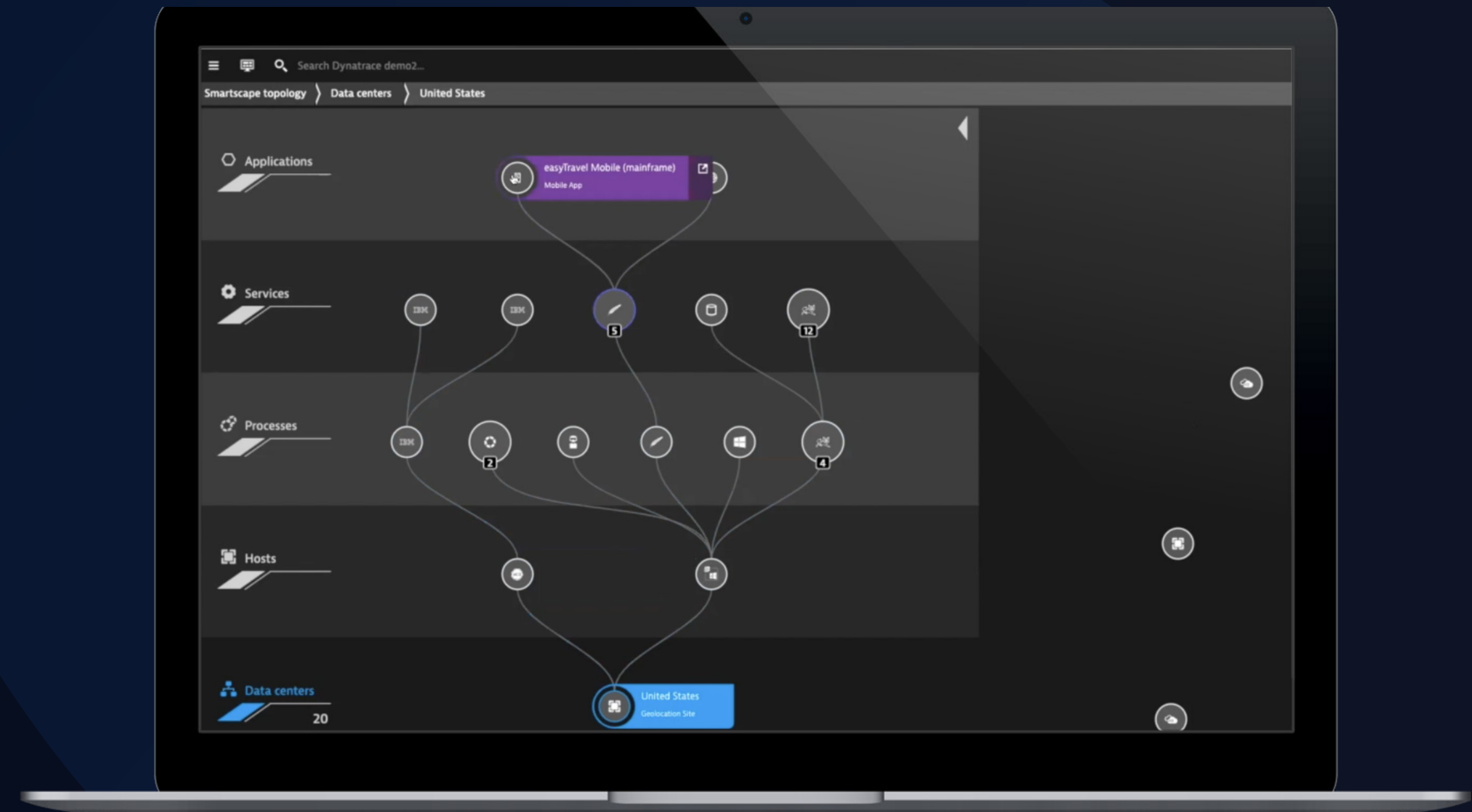
# Dynatrace enables efficient, accurate mapping

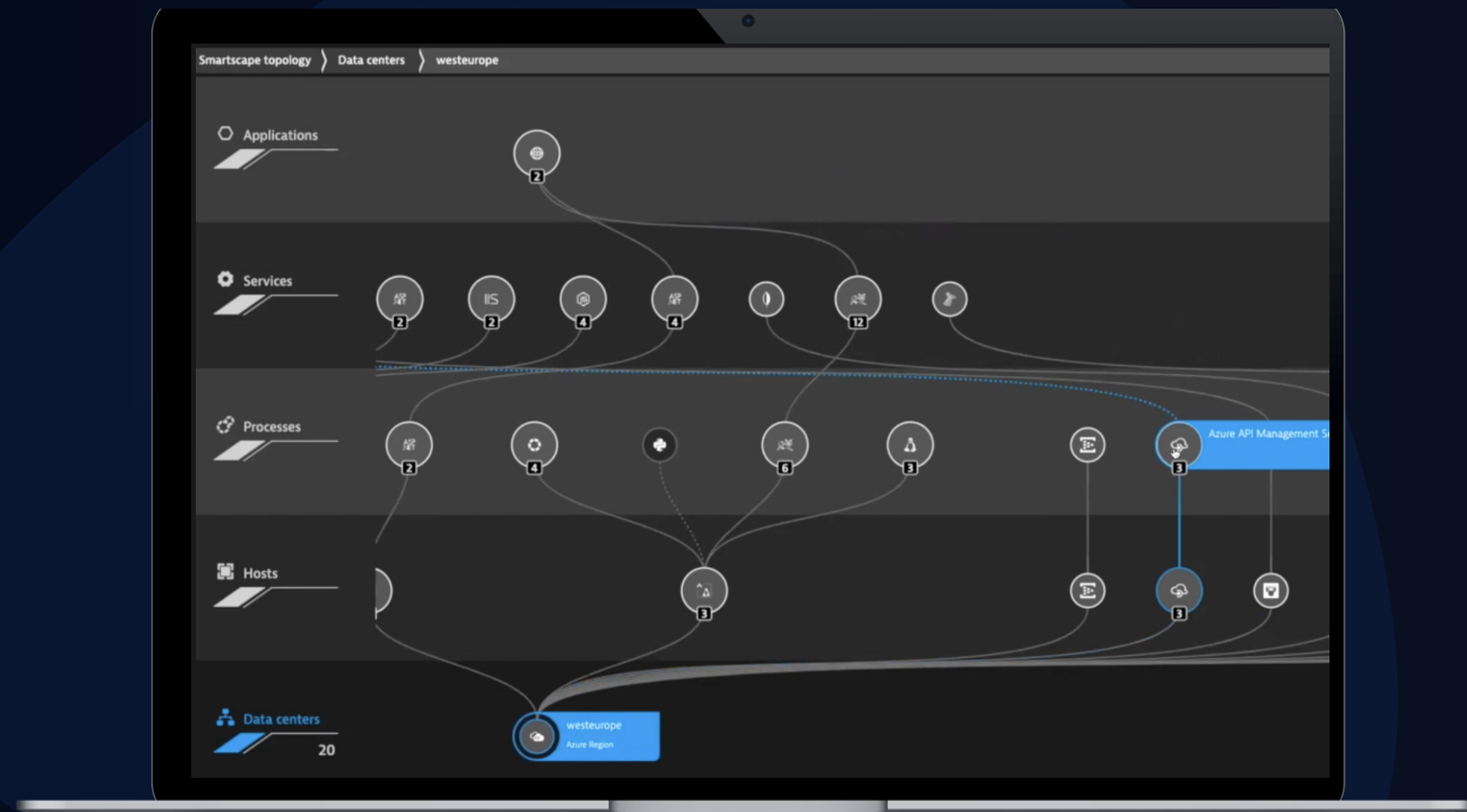
Dynatrace can create a real-time map of your entire IT environment, showing your data center and all components within it and whatever is running on those components. That includes which technology stacks and code serve content, such as for mobile or web applications used by your citizens.

As you see the dependency mapping of your various technologies and infrastructure components, you can make informed decisions about the low-hanging fruit to move to the cloud first. Plus, you'll identify issues within your existing environment that you can address immediately — such as poor performance or a broken process.



To create this topology mapping, you install agents within your infrastructure — a very quick and easy process. Once the agents are in place, they automatically show the technology stacks and software components you are running, along with the front end of your environment that is directly interacting with citizens.





If you are already using cloud-native services such as Azure, Amazon Web Services (AWS) or Google Cloud Platform (GCP), Dynatrace provides insight into those as well. You will understand not only your application infrastructure and performance, but also the underlying infrastructure.

Dynatrace allows you to understand your IT environment — whether on prem, cloud, or hybrid. It also pinpoints problems happening in your environment, showing the impact and the root cause, so you can remediate them faster.

## CONCLUSION

# Now is the time for modernization

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For decades, government agencies have been followers when it comes to pursuing innovation. However, in today's world, agencies can no longer risk the negative impact to their constituents and operations associated with legacy IT. The mandate is to modernize apps as soon as possible. And the first step to success is dependency mapping.



# A proven solution

Once you map your IT environment, you can inventory all the components in your legacy environment and all the dependencies between them. The more data you are able to map and analyze, the better you can understand your entire environment and successfully design your migration plan and new cloud environment.

Your mapping exercise will also provide insights and data that pave the way for making an effective business case — and securing support — for a cloud migration. Even before that happens, your big-picture understanding of your operating environment can guide decisions about how to optimize existing processes associated with your key applications.

Dynatrace offers a proven solution for quickly and efficiently gaining that deep understanding of your IT environment, positioning you for more effective operations today and a successful cloud migration from the start.



# Automatic and intelligent observability for hybrid multclouds

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We hope this ebook has inspired you to take  
the next step in your digital journey.

Dynatrace is committed to providing enterprises the data and intelligence they need to be successful with their enterprise cloud and digital transformation initiatives, no matter how complex.

[Learn more](#)

If you are ready to learn more, please visit [www.dynatrace.com/platform](https://www.dynatrace.com/platform) for assets, resources, and a **free 15-day trial**.



## **About Dynatrace**

Dynatrace provides software intelligence to simplify cloud complexity and accelerate digital transformation. With automatic and intelligent observability at scale, our all-in-one platform delivers precise answers about the performance and security of applications, the underlying infrastructure, and the experience of all users to enable organizations to innovate faster, collaborate more efficiently, and deliver more value with dramatically less effort. That's why many of the world's largest enterprises trust Dynatrace® to modernize and automate cloud operations, release better software faster, and deliver unrivalled digital experiences.

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