

# How cloud computing transforms actuarial modeling infrastructure

Insurers should understand the importance of cloud computing in actuarial modeling amidst new accounting and regulatory changes



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# Introduction

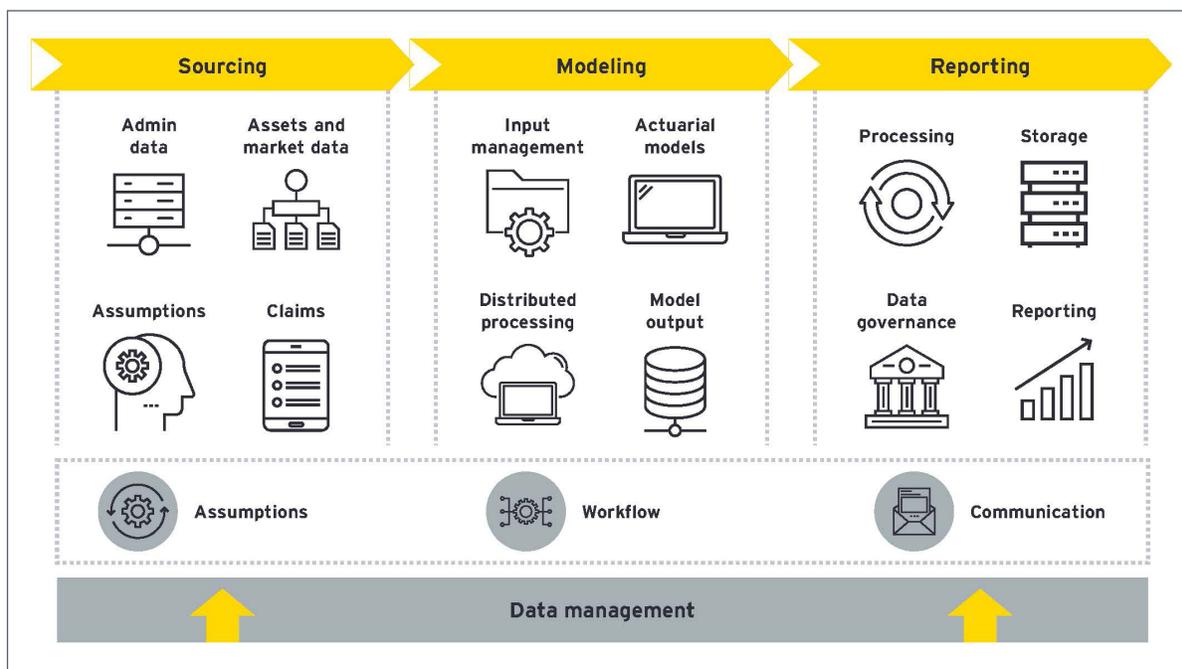
New accounting and regulatory changes, including GAAP long-duration targeted improvements (LDTI), IFRS 17 and principle-based reserving (PBR), require increased computational demands for actuarial valuation and projections, albeit within the same close calendar time constraints. This has led many insurance carriers to re-evaluate how to strategically position their financial modeling infrastructure for the long term, including compute, data and automation capabilities.

## A key decision point

in formation of this strategy is whether or not to establish hosted modeling infrastructure through a vendor off-premises (“cloud-managed”) or establish distributed processing capabilities directly (“on-premises”). Companies seek fast, inexpensive and robust technology solutions for their modeling operations. This article will explore considerations for cloud-managed and on-premises infrastructure for actuarial modeling applications.

**Figure 1** shows the different technology and infrastructure involved in a typical end-to-end actuarial process encompassing data sourcing, modeling and reporting. This article focuses primarily on associated technology and infrastructure for modeling.

Figure 1: Technology and infrastructure for actuarial applications





With the added requirements of accounting change and regulatory reform, the market is embracing opportunities to use new technology to transform its model infrastructure and operations. Setting up modeling infrastructure generally requires procuring networking and servers, data storage, processing, operating systems and applications either directly on-premises or cloud-managed through a vendor. The decisions made when procuring this technology will impact cost, people and processes. Planning and analysis are key steps when performing this selection.

**Key questions for on-premises vs. cloud-managed infrastructure for actuarial modeling applications include:**

What are the core components of modeling infrastructure, and how can they be procured?

How does cloud-managed compare to on-premises for people, process and technology?

What are industry trends for adoption and usage of cloud-managed infrastructure?

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# Chapter 1: Modeling infrastructure component overview

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**Explore the underlying technology infrastructure supporting both on-premises and cloud-managed solutions**

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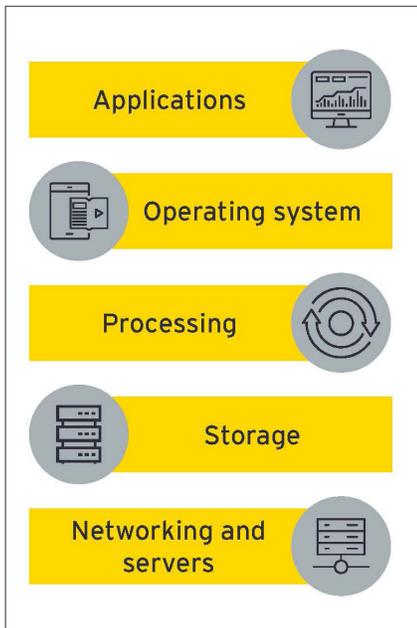
Large actuarial modeling operations were traditionally hosted on-premises. The arrival of cloud-managed created a compelling reason to evaluate the cost-benefit of where to host modeling technology infrastructure. The industry has seen a shift of migrating modeling infrastructure to the cloud from what used to be largely on-premises solutions solutions to a variety of new platforms. Adding to the choices, many actuarial software vendors now offer cloud-managed solutions.

To better understand the opportunity, we'll begin with a high-level overview of the technology infrastructure that supports modeling operations under both on-premises and cloud-managed solutions. This overview will provide the reader with a better understanding of the infrastructure required and how procuring and managing it compares for on-premises and cloud-managed solutions.



**The industry has seen a shift of migrating modeling infrastructure to the cloud from what used to be largely on-premises solutions to a variety of new platforms.**

**Figure 2: Summary of modeling technology infrastructure core components**



As shown in **Figure 2**, there are several core components to modeling infrastructure. A detailed discussion is beyond the scope of this article, but the summary below describes the core components that underlie both on-premises and cloud-managed solutions.

**Core components of technology infrastructure required for modeling operations include:**

- 1 Networking** – enables computing and communication among users, services, applications and processes through hardware and software, including routers, switches, network operations software, security and IP addresses
- 2 Servers** – dedicated machines that serve information to other clients across a network and may be designed for specific tasks (file servers, application servers, database servers, compute-job servers ("workers"), etc.)
- 3 Data storage** – the storage or databases that hold information for the applications, providing services like updating, deleting and finding data, and performing searches across data

- 4 Compute processing** – typically thought of as one or more workers with a set of CPU/GPU processors that perform jobs in a queue; these servers typically come with a sizeable number of CPU cores that perform the computations
- 5 Operating System (OS)** – software required to run applications and utilities, acting as a bridge between application programs and hardware of the computer and network
- 6 Applications** – software packages that perform specific functions; common applications here will be the vendor-based modeling applications (FIS Prophet, Moody's Axis, etc.) and supporting applications like Excel and PowerBI with which actuaries typically interact for analysis

**Options for procuring modeling infrastructure**

For on-premises solutions, an organization would procure its own infrastructure (as described above), locating it on the premises of the organization's data center (or similar) rather than acquiring it through a service provider. The modeling infrastructure and the applications are under the ownership of the company and not "rented."

In contrast, companies can explore a variety of cloud-managed solutions. Cloud-managed is a method of enabling on-demand network access to a shared pool of resources, including networks, servers, storage, applications and services as described on page 3.

**Modern cloud computing is often categorized into three categories:**

- ▶ **Infrastructure as a Service (IaaS)** – the hardware and software that act as the foundation to support applications and operating systems, including servers, storage, networks and virtualization
- ▶ **Platform as a Service (PaaS)** – tools and services that are designed to make coding and deploying those applications quicker and more efficient without worrying about infrastructure provision or the OS
- ▶ **Software as a Service (SaaS)** – applications designed for end users and delivered over the web, providing needed infrastructure, platforms and applications as a service that requires only configuration

To summarize, IaaS offers networking, storage, servers and virtualization on demand. It is the most fundamental level and provides a cloud-based foundation to build on top the operating systems, data and applications. PaaS then layers on an organization's operating systems. This offers an environment that is ready for development and deployment. Finally, SaaS incorporates an organization's data and applications, or software, which sit on the top of the technology stack.

**Figure 3: Understanding infrastructure options**

Type of hosting solutions		
On-premises	Cloud-managed	
	IaaS/PaaS	SaaS
Apps	Apps	Apps
OS	OS	OS
Compute	Compute	Compute
Storage	Storage	Storage
Networking	Networking	Networking

**Key:** You manage Service provider manage

As shown in **Figure 3**, the range of options from on-premises to cloud-managed varies by what an organization manages vs. what the service provider manages. IaaS/PaaS and SaaS are IaaS-managed options. By better understanding the options for procuring infrastructure, we can now better understand and discuss the comparisons of on-premises to cloud-managed.

# Chapter 2: Comparisons

## Deep dive into considerations: on-premises vs. cloud-managed solutions

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To better understand the opportunity, we'll begin with a high-level overview of the technology infrastructure that supports modeling operations under both on-premises and cloud-managed solutions. This overview will provide the reader with a better understanding of the infrastructure required and how procuring and managing it compares for on-premises and cloud-managed solutions.

**Table 1: Comparison between on-premises and cloud-managed solutions across technology, process, people and costs**

Area to consider	On-premises	Cloud-managed
<b>Technology</b> 	<ul style="list-style-type: none"> <li>Direct access to technology infrastructure, eliminating reliance on third-party providers; flexibility to acquire and use any technology or software desired</li> </ul>	<ul style="list-style-type: none"> <li>Reduced maintenance of on-premises data servers with ability to scale resources up or down as business needs change</li> <li>Constraints with vendors, including security, compute and data management, that could limit communication with external platforms or limit access to root functionality</li> </ul>
<b>Process/operation model</b> 	<ul style="list-style-type: none"> <li>Company-defined operating model requiring IT rigor and service-level agreements between business and IT</li> </ul>	<ul style="list-style-type: none"> <li>Must perform under service-level agreements related to uptime, downtime and disaster recovery, with clearly defined business and performance requirements</li> <li>Will still require IT process and expertise for working with technology vendor</li> <li>Must project need for future scalability and review vendor contracts – cannot assume "infinite" or "on-demand" scalability automatically exists</li> </ul>
<b>People</b> 	<ul style="list-style-type: none"> <li>Dedicated team required to procure and manage the infrastructure</li> <li>Must find the right talent and IT operating model to manage installation, hosting, management and software/hardware upgrades, and maintain availability of the applications</li> </ul>	<ul style="list-style-type: none"> <li>Outsourcing infrastructure management to vendor, streamlining workflows</li> <li>Ability to take advantage of remote work talent</li> <li>Still need technical expertise to manage integration and ongoing functionality</li> </ul>
<b>Costs</b> 	<ul style="list-style-type: none"> <li>Typically, a heavier upfront cost but do not need to pay a vendor "per core hour" charges for compute like in a cloud-managed service, and no incurred data egress charges</li> <li>Typically, minimal difference in software license costs compared to cloud-managed infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>Ideally should benefit from a vendor's large scale of infrastructure</li> <li>Likely to have to pay "per core hour" for compute, which can become expensive if not well managed and understood; need to understand, measure and manage applicable compute and data storage/egress fees</li> </ul>

# Chapter 3: Industry trends

## EY survey results highlight industry trend on cloud adoption, utilization and cost

To help understand current adoption trends and costs associated with cloud computing supporting actuarial modeling use cases, Ernst & Young LLP conducted a survey in 2023 of 20 different insurance companies, which included a diverse mix of type (stock and mutual), size and actuarial software usage. The goal was to understand the industry practice of hosting (e.g., on-premises, cloud-managed), utilization of distributed processing capacity, computing cost and expectations about future cloud usage.

### Key findings from the survey include:

#### On-premises and cloud-managed adoption

- ▶ Among the participants, **50% indicated utilizing cloud-based solutions exclusively**, with an even distribution between those using cloud providers and those opting for the modeling platform vendor. Meanwhile, **5% of respondents indicated that they rely solely on on-premises solutions**, and **45% reported using a combination of on-premises and cloud-managed solutions**.

#### On-premises and cloud-managed usage

- ▶ The industry continues to trend toward increased use of cloud-managed services, hosted technology solutions to support its actuarial modeling process, both as a complement to dedicated on-premises grids servicing peak demand periods (e.g., quarter-end) and as its own stand-alone solution (**more than 50% of the participants** indicated that cloud-managed solutions are used to facilitate all of their model runs).
- ▶ Actuarial software providers are increasingly entering the hosted solution market, with several survey participants identifying the use of cloud-managed services provided by their actuarial software vendors.

#### Usage by use case

- ▶ It is worth noting that all survey participants indicated that on-premises grids were established for general-purpose use rather than dedicated to a particular use case (e.g., hedging) or purpose.
- ▶ When it comes to concentrated usage of cloud computing, the primary use cases are use valuation, cash flow testing and capital modeling.

#### Computing costs

- ▶ As expected, larger companies tended to have larger overall spend. The survey results indicated that larger companies spent an average of **\$8.1m (with a range from \$750k to \$5m+) for the year 2022**, while small- to medium-sized companies averaged **\$1.6m (none of them exceeding \$5m)**.
- ▶ The participant group largely expects computing costs to either maintain or increase year over year. On-premises maintenance spend varied considerably across large- and small- to medium-sized companies reflecting varied size and IT cost structure considerations.

# Chapter 4: Conclusion

## Staying competitive: understanding modeling infrastructure costs, trade-offs and opportunities

Insurance companies are addressing the challenges posted by recent accounting and regulatory changes through a strategic reassessment of their modeling infrastructure, contemplating on-premises and cloud-managed solutions. While cloud solutions provide scalability, their cost-efficiency and suitability should be assessed with care. It is imperative for these organizations to thoroughly understand the costs and trade-offs associated with each option, and where they stand in relation to their peers.

By understanding these opportunities, actuaries and technologists can partner to transform to a future state that chooses optimal solution sets, balances cost and usability, and brings transparency to a process that must be managed like a well-constructed factory to remain competitive going forward.

**While cloud solutions provide scalability, their cost-efficiency and suitability should be assessed with care.**



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