Building a Cloud Operating Model

AWS Whitepapers

Building a Cloud Operating Model: AWS Whitepapers

Table of Contents

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Today, many information technology (IT) leaders want to understand how to adopt cloud technology while maximizing cloud benefits, such as business agility, risk reduction, staff efficiency, and cost reduction. This paper outlines the principles for building a successful cloud operating model (COM) that delivers innovative, cost effective, reliable, and secure solutions for the consumption and acceleration of business outcomes by the organizational business units.

Introduction

Establishing an appropriate COM is critical to forming your organization's successful adoption of cloud and delivering greater business agility.The impact of the cloud will be felt across your entire organization (not just IT) and will significantly affect, and be affectedby, your organizational culture and IT delivery structures. Understanding these implications and your company's desire to change are important elements of building a successful COM.

To support such a transformation, your organization must have a critical mass of people with experiencein the Amazon Web Services (AWS) Cloud who can productionize and operate the underlying platform ina product-centric approach.

Many organizations start by taking a traditional, project-based approach, adding cloud as an additional technology layer into their existing operating model and landscape. While they may start to realize value and savings from reduced infrastructure spend over traditional and legacy on-premises approaches, adding yet another technology into the mix does bring challenges. Most worryingly, it can mean that organizations are unable to adopt and support new business initiatives at a pace demanded by the business. It is not until events and issues arise that many IT leaders are forced into acting and doing something different, such as setting up a focused Cloud team/Center of Excellence (COE).

At AWS, we refer to this capability as a Cloud Enablement Engine (CEE). This is a branch of technology and business resources, with a focus on leading the organization on its cloud adoption journey, that maps to the most important needs of the business (and not just information technologists).

This whitepaper discusses critical elements for creating a successful cloud adoption capability, and identifies mechanisms for acceleration that can be applied prior to a major event or issue. The guide also highlights how the AWS Domain model can be used to establish an aligning of the operating model with the most important needs of the business.

Prerequisites

The CEE should be aligned to the primary business objectives and outcomes. This ensures that the success of the cloud adoption will be measured in terms of business benefits from the outset, and set the foundation for the operating model and prioritization of tasks. A critical prerequisite to success is the endorsement of organizational leaders and commitment of executive sponsorship in the form of a Cloud Leadership Team. Successful cloud adopters are disrupting the status quo within their organizations. Without this sponsorship and backing, CEEs will stall and slow down.

For large multi-business unit organizations, the operating model may need to apply additional or alternative federated approaches, such as building a Community of Practice instead of a central team.

Target business outcomes and value

Unlike some of the more technical domains, building out and establishing a COM is more fluid in terms of prescriptive outcomes. Our experience in working with successful cloud technology leaders (for example, chief information officers (CIOs)/chief technology officers (CTOs)) is that they look to establish a CEE capability that is value generating before they are faced with failures and firefighting. Examples of value generation seen by some AWS adopters include:

- 60% reduction in downtime
- 51% efficiency savings
- 14x reduction in time to deliver
- 43% reduction in operational costs

Unfortunately, all too often there is a focus solely on the technology of cloud, and it is not until issues arise that that many IT leaders are forced into acting and doing something different. The four most common issues are as follows:

- Bill shock, such as significantly higher cloud costs than anticipated
- Operational outages, and a timely struggle to recover
- Security and data breaches
- Stalled projects caused by a desire to build the perfect cloud data center project with no return in value

A successful COM enables organizations to operate applications with a faster pace of innovation and value to the business, reliably and securely in the cloud. A key component of leading COM approaches is the adoption of a *product-based approach* of the cloud platform. By adopting a *product* mindset, each team can take the responsibility for increased awareness, ownership, and operational excellence, through self-healing systems that can recover quickly using integrated failure detection and remediation. Platform optimization can also be added through the measurement of known application baselines, and testing those baselines using chaos engineering (failure injection) and game days (interactive team-based hands-on learning exercises).

Achieving these recommendations most likely requires a culture shift around how organizations design, deploy, and operate their cloud platform, and a focus on automation with repeatable, ongoing processes.

Product-based delivery of cloud

Our most successful cloud customers utilize a *product* mindset to ensure great customer experiences. A product in this context is defined by:

- Performing a constrained number of common tasks very well
- Having clearly defined inputs and outputs
- Being useful to multiple customers
- Continuously improved to meet the needs of those customers

For example, Amazon.com uses multiple product teams to run their customer website. Product definition is important, because it's the interrelationship between products, the customers that use the products (consumers), and the teams that create the products (suppliers). These interdependent relationships highlight where product teams are both consumers and suppliers. This interdependency requires an additional level of ownership, accountability, and scrutiny so that each team is encouraged to provide higher quality products and services.

When companies do not effectively define and operate their systems as products, they often experience foundational failures that cross-product accountability would inherently handle or avoid. With each product team fully functional from business to operations, they are wholly accountable for all aspects of their services. Even shared service providers are product owners and offer a service that other product teams can choose to use. Note, however, that the products should be in demand, any that are not useful to the business should be de-prioritized. The core outcome is that each product team owns accountability and does not surrender this responsibility to any other product supplier.

By owning the operation of a product all the way to the end customer (internal/external), companies cultivate empathy with the customer's perspective. As product owners choose to enter into contracts with other product owners, a supplier/consumer relationship is created and trust is developed. Empowering product teams to make their own choices on how they solve problems and which other products they use enables full accountability for the product and how it is perceived by their customers.

Core to a properly functioning product mindset are four key foundational concepts that will help ensure future customer-impacting events are minimized:

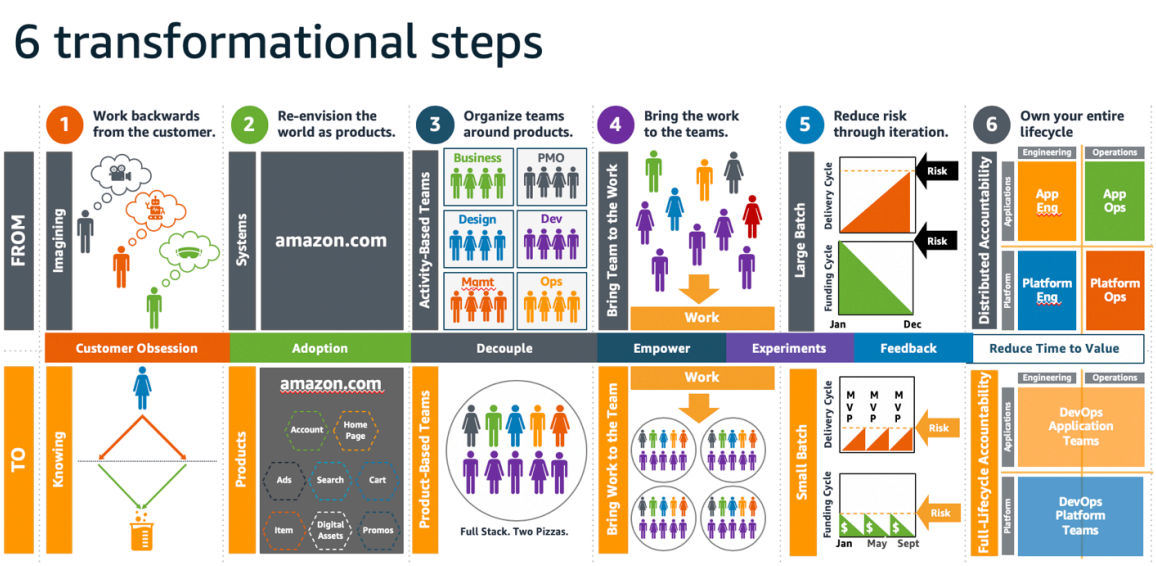
- **Appropriately defined products** are fully owned from requirements to production support by a single two-pizza team (6–10 people).
- **A culture of accountability, empowerment, and self-reliance** for each product team, such that any and all services they provide exceed expectations regardless of any dependencies or other leveraged products/services..
- A clear structure of what is **minimally required for a journey to production and who is influential/responsible in each step** along the way. There should be minimal gates, but there should be an abundance of high-quality advice provided by key product teams.
- **The product definition, metrics, and dependencies** (including application programming interfaces (APIs), root cause analysis, disaster recovery testing, and game days) that a product owner understands about their product is centrally published and available to other product owners who are consumers or suppliers. By understanding more about your dependencies, you understand more about your own product.

Summary of activities

A number of key activities can facilitate, support, and even accelerate the achievement of cloud adoption and delivery of business outcomes. Enterprises almost always have a multitude of competing priorities, even within their cloud strategy. Failure to transform operating models can result in a *great stall* phenomenon where adoption momentum stops or slows to a crawl. One of the key factors observed in those customers who have avoided this effect is the successful establishment of a cloud delivery and governance function, often referred to as a Cloud Center of Excellence (CCoE) or CEE.

This document includes six steps that companies should follow to build out a successful CEE.

1. Work backwards from the customer
2. Re-envision the world as products
3. Organize teams around products
4. Bring the work to the team
5. Reduce risk through iteration
6. Own your entire lifecycle



Six transformational steps for building a cloud operating model

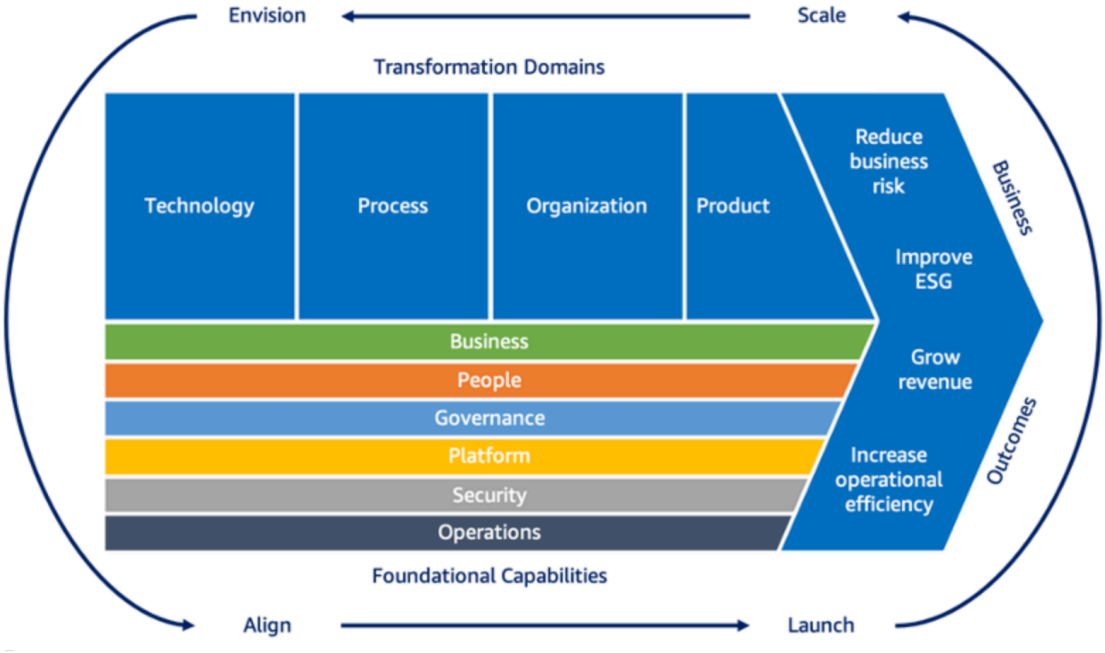
Step 1. Work backwards from the customer

AWS believes that the mission for successful COMS should be to deliver innovative, cost effective, reliable, and secure solutions for the consumption and acceleration of business outcomes by the organizational business units.

Many companies make guesses or inferences about what their customers want. They imagine, or have hunches or feelings. Unfortunately, this increases the odds of being wrong. If you want to be customer-centric, or even customer-obsessed, you need to move from imagining to knowing. This requires the team to spend time getting to know their customer, and finding out what delights them and what pain points they have. Ideally, we have and use data to prove that we truly know our customers and what they

want or need. Then, we think of what the best solutions might be to address their pain points, narrowing the list until we arrive at what proves itself to be the simplest way to solve their problem.

A CEE needs to provide a balanced emphasis on core COM capabilities, where innovation must be embraced without compromising security. Reliability is essential, yet the organization must operate and invest within the realities of a constrained budget. AWS helps our customers achieve this by aligning the delivery to our Cloud Adoption Framework (CAF) based methodology drawn from the best practices of cloud transformations over many years.



The AWS Cloud Adoption Framework - capabilities and domians

Connect business goals to business and technology enablers

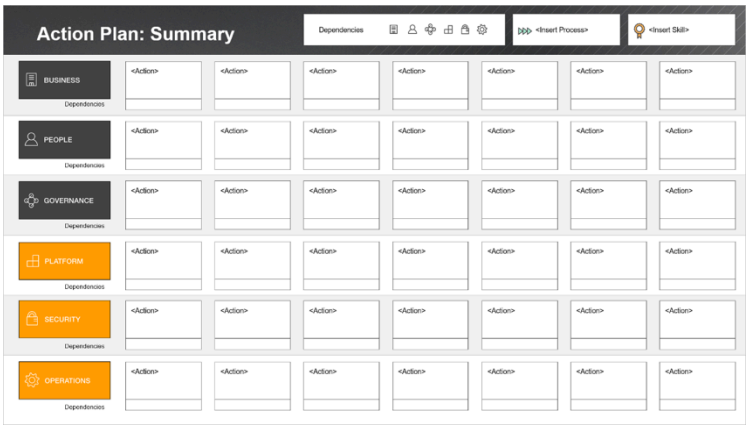
Many cloud adoptions start from a very technical basis. AWS uses a combination of our working backwards and envisioning processes to help lay a foundation for acloud strategy and operating model that returns ongoing measurable value to your organization.The envisioning process connects business goals and outcomes to enabling technologies, identifies key measures, and helps you prioritize your cloud initiatives.While the working backwards process translates this into acustomer-facing narrative so you can validate your vision with key stakeholders before embarking on development.The outcome is a clear link between enabling technologies and cloud initiatives, and stakeholder approval that you prioritize on the most important business outcomes and success measures. Ideally, these should be developed iteratively and in partnership with key stakeholder representation.

Align stakeholders to overcome blockers

Having established a shared vision, it's important to establish a backlog of tasks (*epics* and *stories* in agile parlance). The AWS CAF Align phase focuses on identifying capability gaps across six perspectives (Business, People, Governance, Platform, Security, and Operations), identifying cross-organizational dependencies, and surfacing stakeholder concerns and challenges. Using output of the envisioning processas its input, the CAF align phase establishes a collaborative, practicable action plan to facilitate the kickstart of a COM aligned to key initiatives.

This approach is based on identifying the blockers and concerns across six groups of stakeholder perspectives. Each of the six perspectives contains a set of defined capabilities that are often significantly impacted with the adoption of cloud. Using a CAF alignment-based approach, customers can learn and plan for the impact that cloud has on the implementation of a wide range of capabilities, not just the technology challenges.

The CAF alignment approach is designed to help customers understand these changes and show thatthey are common and well-understood, while also helping develop a prescriptive action plan to address concerns and remove the blockers to cloud adoption.



CAF action plan template

Step 2. Re-envision the world as products

In many organizations, systems that support the business are large, complex, tangled messes of functionality that have developed organically over time. Once upon a time, Amazon was no different.The *system* that supported the Amazon.com business was a large, Java-based ecommerce application.

To move to a product-model where we could drive adoption and reuse of the functionality within Amazon.com for other purposes beyond retail, we first had to reimagine what those individual products would be. Examples include:

- Home page
- Customer account
- Search
- Shopping cart
- Item management

It's important to note that this is not the act of refactoring the architecture. Refactoring can't happen until you know what the components of that future architecture will ultimately be.

For the cloud platform, that means moving away from a systems and technology focused alignment, into collections of products, services, and technologies that are grouped together into a product that aligns to our four-point definition highlighted previously in this document. Examples of cloud products (which could include multiple AWS and non-AWS products and services) include:

- Digital access gateway
- Search
- Video streaming
- Data ingest and conversion

- Database migration
- Continuous compliance

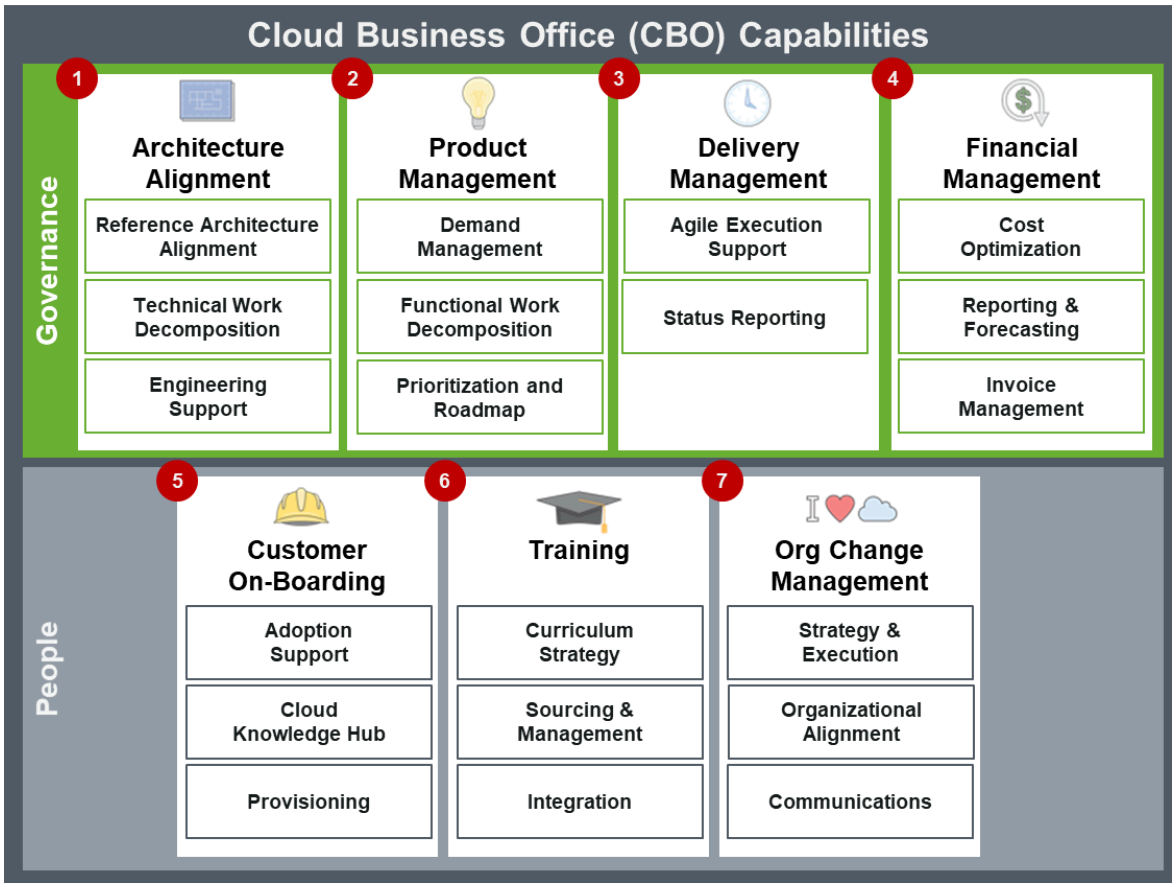
Step 3. Organize the teams around products

Once you've identified a set of cloud products, customers should look to build teams around the ownership and accountability for one or more products by a team.

A successful COM ensures that all components such as people, processes, and tools are set up to support one another effectively. It is imperative to keep evolving to meet product consumers' expectations as their needs differ and change over time. Clear product ownership is key.

Organizations with great product ownership are driven by metrics and clear accountability with strong service definitions and consistent delivery, all vital preconditions for success in the cloud and faster delivery of business outcomes.

Achieving this requires the formation of a CEE, which consists of two functional domains: *Cloud Business Office* CBO) and *Cloud Platform Engineering* (CPE). The CBO is responsible for aligning the products and services offered by the CEE with the needs of its enterprise customers and leadership. It focuses on the business governance and people enablement aspects of cloud adoption.



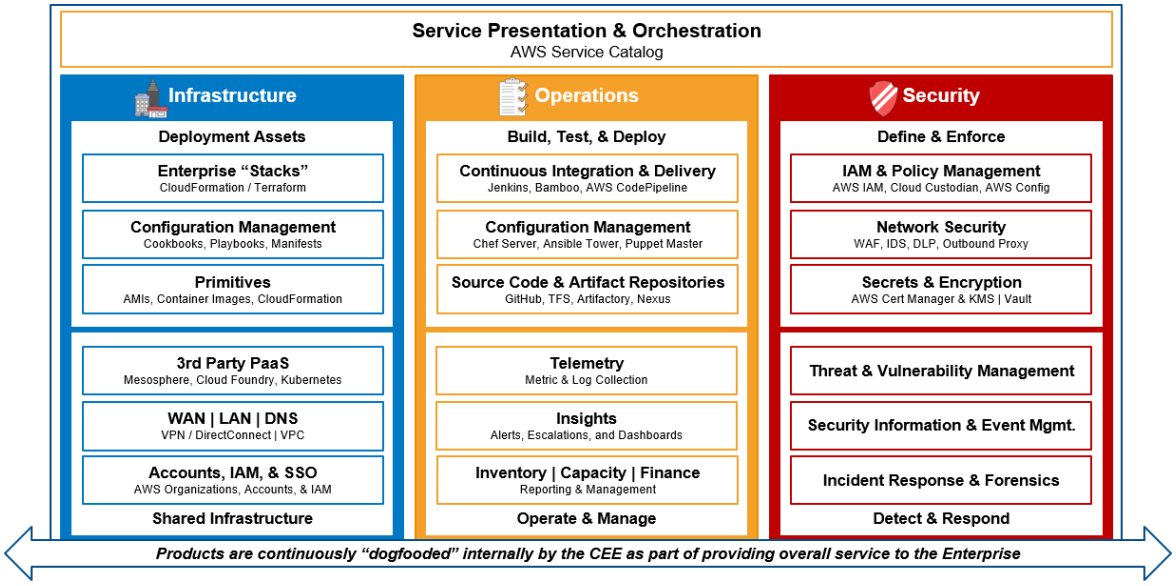
CBO capabilities

The responsibilities of the CBO include:

- Establishing the overall cloud change strategy to be delivered and enabled by the CEE to drive successful implementation across the organization.

- Providing alignment between enterprise architecture and the CEE.
- Establishing processes to evaluate and develop new cloud patterns to support teams looking to adopt cloud.
- Understanding customer requirements and demand for cloud products; translating requirements and demand into a prioritized backlog of work
- Managing the delivery of items within the CPE and CBO backlogs.
- Providing mechanisms to accurately allocate, forecast, and optimize spending by cloud consumers.
- Enabling self-service capabilities for consumers and executives to manage current and forecasted spend.
- Guiding consumer teams through the process of migrating to the cloud, including training, deployments, migration, and the transition to steady-state operation.

Underpinning the CBO is CPE, which is responsible for codifying differences between stock AWS service configurations and enterprise standards applicable for use within your organization. This function is responsible for packaging and continuously improving the cloud platform as a set of self-service deployable products for customers and consumers. This CPE is the foundational structure which is responsible for the delivery of a set of products, as highlighted in the following diagram:



Cloud platform engineering capabilities

The responsibilities of the CPE teams include:

- **Establishing the core and shared platform capabilities** and codified patterns to enable enterprise self-service deployments by application development teams through a service catalog and templates.
- **Building the operational platform and shared capabilities** required to enable automated build and release processes, end-to-end operations, integration of operations products across all *codified patterns*, and self-service deployments, alerts, and reporting.
- **Creating codified corporate security policies and controls** in the cloud, and using automation and self-service tools whenever possible. Proactively assess and monitor environment to enforce security policies and mitigate threats.

Automation is central to a product mentality and all elements of the CPE delivery, particularlyas teams consider resiliency and availability of their products. Automation should be employed to resolve incidents that use repetitive standard operational activities without human intervention. This automation

is the basis for self-healing systems that can not only rapidly detect failures, but proactively alert on potentially impacting behaviors, carry out test scenarios and remediation workflows to decrease times to resolve, enhance service levels, and improve product availability.

Step 4. Bring the work to the teams

We don't recommend building an entire Cloud Enablement Engine to support the whole business all at once. Instead, we recommend, *think big, but start small*. This gives your team and its customers the opportunity and to build and learn iteratively and incrementally, as they scale adoption.

The *cloud foundation team* is the first *product team*. The team should be cross-functional, and represents all the roles and capabilities that will eventually scale into a full CEE. In staffing a product team, you want to balance four concerns or perspectives:

- **Viability** — A customer and business perspective.
- **Desirability** — Of the products being created and the change being driven through the organization.
- **Feasibility** — A technical delivery perspective.
- **Operability** — Of the products in production.

As cloud adoption grows, the cloud foundation team will need to increase and scale to support the pace and direction of your AWS customer journey. While every customer journey is different, a general pattern of successful cloud adopters follows a *subdivide and specialize* approach. In this approach, the initial CEE is typically split into four product teams, one for the CBO and three in the CPE. For large organizations, this process of subdivide and specialize continues again in line with the backlog of work.

The key roles required in the cloud foundation team are:

- **Product owner** — Singularly accountable for the CEE's vision and its viability from a business perspective
- **Cloud architects** — Translates customer, business, and governance requirements into product architectures. You may have overall cloud architecture, or architects that represent platform, operations, and security.
- **Cloud engineers** — Because the CEE teams run in a *DevOps*, *you build it, you run it* model, the engineers on the team are responsible for both development and operations across the platform, operations, and security domains.

Additional roles that are typically added (though may be part time) include:

- **Financial analyst** — Responsible for financial budgeting, tracking and reporting; show-back/charge-backs and cost optimization.
- **Organizational change management specialist** — Responsible for making the move to cloud desirable for the organization through workforce preparedness, communications, training, resource and career management plans.
- **Scrum master** — Facilitates the Agile process and ensures forward progress towards business outcomes by the team.

Step 5. Reduce risk through iteration and automation

Implementing an operating model is an ongoing process with continuous improvement through measurement and testing.Al lproduct teams have a shared responsibility to establish measures to

ensure they are delivering what is expected and are operating within acceptable limits. In this model, the product owners are accountable for measurement of not only the product, but also the services their product is dependent upon. The transparency of metrics and measures provided and consumed by different product teams will allow each product team to make better decisions.

To ensure the operating model continues to function properly with the release of new products, it needs to embed constant, automated, and standardized testing into all new products. This testing not only needs to continuously test the resilience of applications to recover themselves, but also to simulate the failure of dependent services.

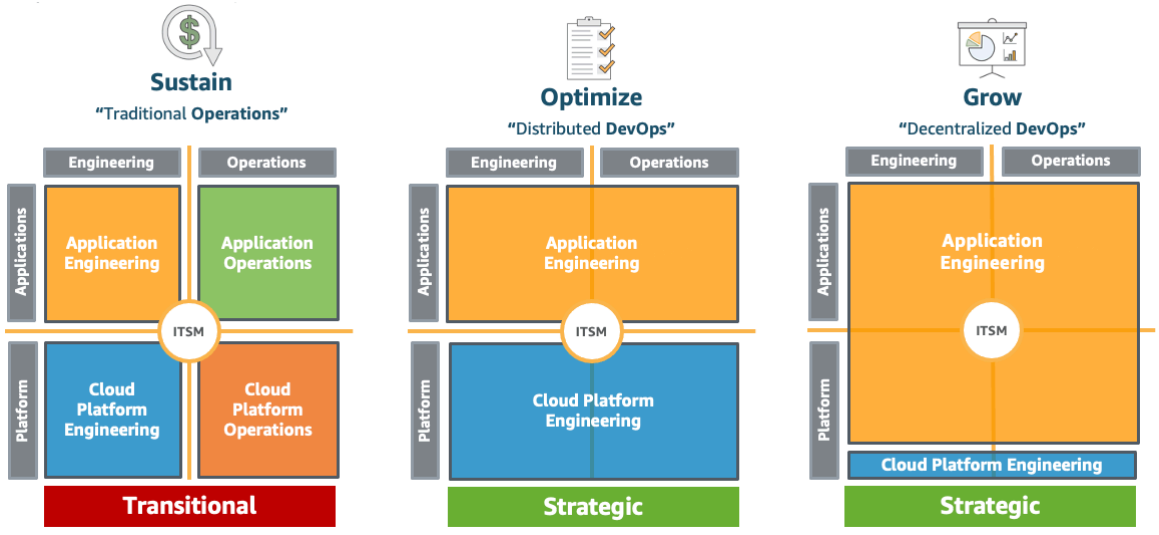
Step 6. Own your own lifecycle

The cloud offers a great deal of opportunity to mitigate the accumulation of workarounds and years of neglect and continuous addition to IT systems. What starts out as a simple, minimal, viable product can rapidly turn into a desire to build the perfect data center in the cloud. The consequence of this is a multi-year initiative, minimal workloads living in the cloud, and a trail of directional and resource changes with little or no business value or outcomes delivered.

Successful adopters take two key actions to help ensure they own their own lifecycle and deliver meaningful benefits. First, they align the operating model delivery approach to the strategic value of the workload and second, successful COMs and CEEs establish a clear roadmap of delivering capabilities and processes that align and underpin the ability to establish production operations in an MVP and iterative approach.

Operating model

While the cloud platform and the engineering team should adopt a DevOps (you build it, you run it) approach, don't expect everyone else to immediately have the desire to make the same change to their delivery model. In our engagements with customers, we have seen three broad models being adopted, as shown in the following diagram:



Modernizing IT

Sustain

This model takes on a *traditional operations* approach. This is nearly identical to the traditional, activity-based model we see in most organizations where engineering, operations, infrastructure, and application

teams and boundaries exist. This model works best for lift-and-shift workloads where there is little or no value in changing the operational approaches for the workload, either because it rarely changes, or has a limited lifespan left.

Optimize

In this model, application engineering is now also responsible for application operations. Think of this as *DevOps* for the application team, where they own the full outcome of delivering and operating their application. Similarly, CPE now owns engineering and operations of the platform services they provide to enable application teams. This approach implies a *shared responsibility model* between the application and platform teams. Platform teams provide the codified enterprise standards and governance that enable application teams to iterate quickly, without burdening them with knowing deep implementation details of the underlying platform.

Grow

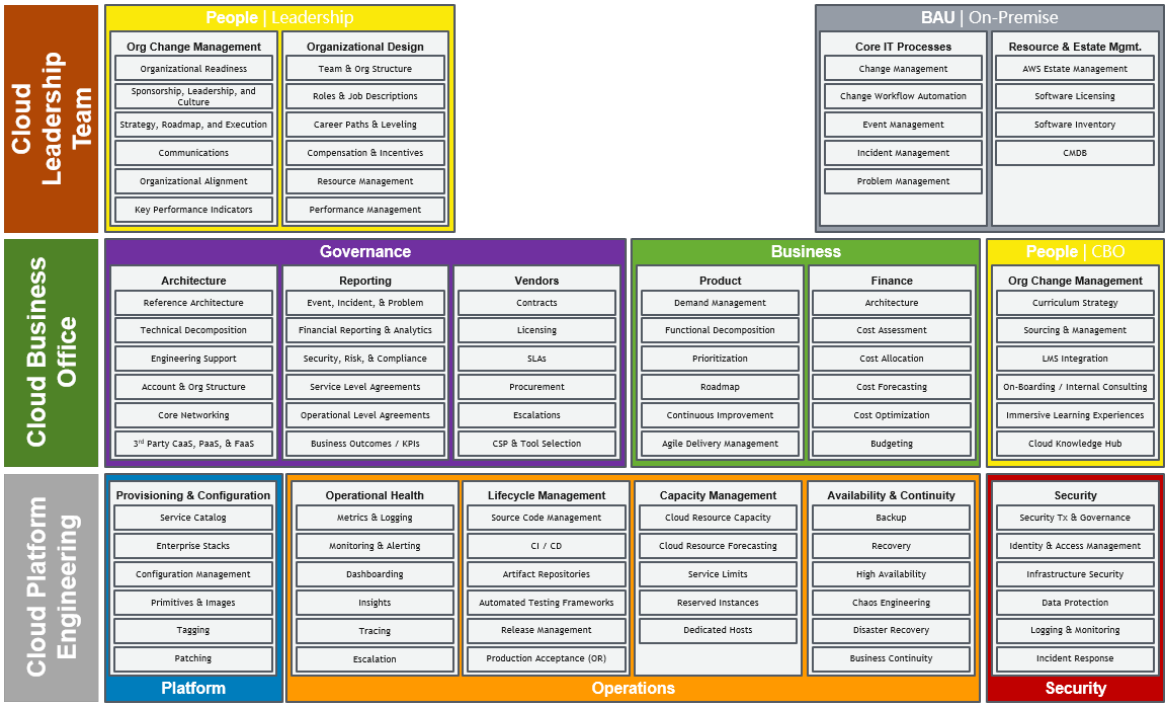
We see this model being adopted for teams that are on the bleeding edge of technology and looking to consume the latest AWS services. In this model, application engineering is responsible for their applications, but to avoid stifling innovation for high-growth areas of the company, they are empowered to build out platform capabilities that have not yet been standardized by the CPE team.CPE still provides standard accounts and guardrails that prevent application teams from configuring services in a way that would expose the enterprise to inappropriate security, financial, or operational risk.

The three models do not imply levels of maturity. In fact, we see all three of these operating modelsin most companies. That said, there is almost always a gravitational pull toward the “optimize” model. “Sustain” workloads get retired or outsourced, and the platform services used by “grow” workloads eventually become the new enterprise standards. This allows even the most cutting-edge teams to be supported by the CPE team, so that these application teams can focus on adding new digital business value, rather than doing the undifferentiated heavy lifting of maintaining platform capabilities.

Delivery roadmap

Many customers already have operational processes and procedures in place for IT delivery and change management. Some of these will be well documented and aligned to standards such as Information Technology Infrastructure Library (ITIL), while others will be implemented through localized ways of working.

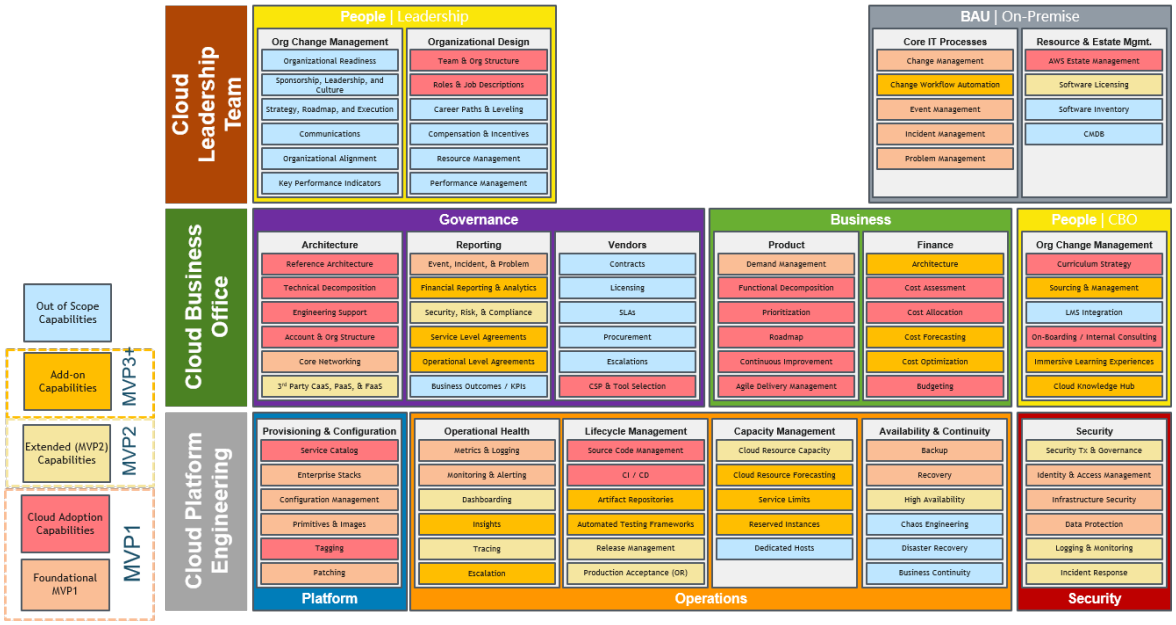
AWS established our operational integration domain-based blueprint model derived from assessing industry standards that were most applicable to cloud platforms and addressing the needs of our customers in establishing a COM and CEE. The AWS Operations Domains shown in the following diagram represent a framework, based on best practices, that enables IT (and business) organizations to transform their current ITIL- (and other) based operating models towards a cloud-based architecture adapted model.



AWS operational domain model

The domain model currently focuses on different aspects and highlights where they align into the CEE responsibilities. It is important to note that these domains continue to evolve through continuous improvement, and while they should cover most operational processes that a majority of customers will need, there may be additional operational processes unique to a customer's organization or specialized industry that need to be taken into consideration.

The domain model can be used to show and communicate the CEE operational capability roadmap across MVP cycles, as shown in the following diagram.



The operational capability roadmap

It's worth highlighting that ITIL and AWS operations domains are compatible. ITIL is a recognized industry standard, comparable to similar initiatives. The ITIL framework was built to improve and generalize a *best practice* in regards to implementing, maintaining and operating IT services. ITIL has a high number of certified practitioners, all over the world, but like all frameworks it is not perfect and has its set of criticisms. When hard-linked into systems (monitoring, ticketing, support services, etc.), ITIL processes can be complex to transform. The purpose of the domain model is to help the CEE own and establish its operating model roadmap.

Next steps

To properly set the stage for transformation, organizations need to move towards iterative and incremental operating model improvements and a product-based mindset to IT delivery. This guide covered best practices for establishing a cloud operating model, including:

- Start small, but keep the end in mind.
- Strive to define a future state model that the cloud affords, and aligns to outcomes that are core to your business.
- Be intentional about how you drive change and bring people along on the journey, and do so through iterative continuous improvements, cross-functional teams and experimentation.
- Pilot what success looks like by establishing an initial cloud foundation team, identifying several candidate workloads to run on AWS, tracking clearly defined metrics, creating opportunities for continuous learning, and celebrating early wins.

By following these guidelines, you can set a foundation that can be emulated and scaled to other parts of the organization.

Appendix A: Examples of AWS customer operating model transformations

The following table provides example information that shows how AWS has supported customers across each of the six elements of the AWS Cloud Adoption Framework:

AWS CAF Perspective	Summary	Link
Business	How Illumina is using AWS to offer their customers a lower cost, high-performance genomic-analysis platform, which can help them speed their time to answers.	Illumina case study
People	How Capital One reduced its data center footprint, expanded its use of microservices, and reimagined banking using AWS	Capital One on AWS Creating the Cloud Business Office
Governance	How Travis Perkins created a Center of Excellence to reduce end-to-end infrastructure setup time to two hours	Travis Perkins case study
Platform	How 3M Health Information Systems needed the agility to develop and deploy new applications faster.	3M Health Information Systems Case Study
Operations	How companies such as FINRA or Pekin Insurances have tackled challenges related to cloud operations.	FINRA Adopts AWS to Perform 500 Billion Validation Checks Daily Pekin Insurance Decreases Development Time by Months Through its AWS Cloud Transformation Program
Security	How Experian is using AWS technology as a differentiator that provides an environment that is elastic, flexible, and lowers time to market.	Experian Enables Next-Generation Credit-Data Analytics Platform Using AWS

Conclusion

Organizations that successfully establish a COM have a lot to gain. While the focus is often on cost savings, other benefits typically include reduced downtime, faster delivery of new services and capabilities, productivity improvements, and higher staff morale.

Organizations should consider developing a new operating model before they experience the four common pitfalls of unexpected and higher than predicted costs, slow and stalled adoption, outages, and/or security breaches.

The six-step approach contained in this whitepaper is provided to help guide cloud adoption leaders in developing a successful COM aligned to business needs.

Further reading

For additional information, refer to:

- AWS Architecture Center
- Migrating to Amazon Web Services
- Job Roles in the Cloud (online course from AWS Training and Certification)
- Reaching Cloud Velocity (book by Thomas Blood and Jonathan Allen; available for purchase)

Document revisions

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Note
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AWS glossary

For the latest AWS terminology, see the AWS glossary in the *AWS General Reference*.