Cloud Enablement Engine: A Practical Guide

Prescriptive Guidance for Establishing a Cloud Enablement Engine

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Abstract

This paper is a practical playbook for defining, establishing, and implementing a Cloud Enablement Engine (CEE). It collates and summarizes the lessons learned and anti-patterns gathered from the CEE journeys successfully navigated at Amazon and other large enterprise companies. Much has been written about the need to establish a CEE, the benefits of moving to a productization mindset, and the business value of tribes, guilds, and two-pizza teams. However, larger organizations are still struggling with a CEE 30-60-90-day plan, and the essential components of the CEE during its first six months in existence.

The prescriptive guidance in this document provides pragmatic and tactical advice for establishing a Cloud Enablement Engine (CEE), also referred to as a Cloud Center of Excellence (CCoE) or Cloud Enablement Team. This paper serves as a step-by-step guide for the initial setup activities, and the top ten best practices that have been extrapolated from working across a large number of customers.

Introduction

A key focus of the Cloud Enablement Engine (CEE) is transforming the information technology (IT) organization from an on-premises operating model to a Cloud Operating Model (COM). The transformation to COM and the charter of a CEE are highly correlated and interconnected. During the nascent stage of the CEE, the focus of the CEE is the infrastructure components of a COM. These components include the operations, security and control, platform architecture and governance, and infrastructure provisioning and configuration management functions. Amazon Web Services (AWS) understands that enterprise (on-premises) operating models are based on Information Technology Infrastructure Library (ITIL). The cloud transformation from an on-premises operating model to a COM includes mapping ITIL to a cloud, agile, and DevOps based capabilities and processes. ITIL 4.0 embraces DevOps, cloud, and agile.

First, the CEE must focus on the needs of business (line of business [LOB] and product owners) and internal IT customers (development, operations, security, database, and infrastructure teams). Establishing a CEE is not instantaneous or a single operation, it is an iterative process. Organizational and cultural change takes leadership commitment and time. Most customers begin with a landing zone, a lab environment, and three to five re-hosted test applications, and scale out as they become more comfortable. The first CEE results, in the form of production cloud adoption, can be achieved within three months. To leverage the full benefits of cloud in terms of operations, management, provisioning, and cloud native architectures, the process can take a year or more.

AWS CEE perspective on implementation

Philip Potloff, the Head of Enterprise Strategy at AWS, describes a CCoE (using the traditional name of a CEE) in this Challenging Conventional Wisdom About How to Build a Cloud Center of Excellence. “The CCoE is a multi-disciplinary team that is assembled to implement the governance, best practices, training, and architecture needed for cloud adoption in a manner that provides repeatable patterns for the larger enterprise to follow”, says Philip. This blog post focuses on the instantiation and composition of the initial team, advising the team be a combination of cross functional team members that have not worked closely together, and a group of *A-team* players that have a long track record of close collaboration and success.

The building out of a CEE starts with one person, a Cloud Sponsor – an executive that is accountable by success of CEE. This sponsor ensures that the CEE key performance indicators (KPIs) and objectives are directly aligned to company business goals.

As explained in Appendix A: Evolution of an Enterprise CEE, the CEE evolves over time to be less centralized, and the services offered in the decentralized structure is assumed by the lines of business. details the organizational, process, tools, and architecture change that Amazon.com undertook during its transformation to service orientated architectures (SOA), microservices, freedom from monolithic relational databases (Oracle), two-pizza teams, and product operating model.

Five activities are required to start building out a CEE:

- Build the team
- Train and coach
- Pilot projects
- Architect for the cloud
- Operate in the cloud

Continuous improvement is an additional activity that should be kept in mind and will become paramount after the CEE has been functioning for a year or more.

Build the team

The first activity is defining the roles and responsibilities, and identifying team members through staff structure maps. An aspect of mapping team and staff structure involves mapping traditional roles to cloud roles. This scenario includes mapping architecture, infrastructure, operations, security, business and IT alignment, project management, data, and applications on-premises roles. The necessary skills and competencies to successfully fill the positions are critical.

> This document does not provide details on CEE roles and responsibilities, and the mapping of on-premises to cloud roles. For more detailed information on this topic, contact your local AWS Professional Services Advisory team.

It is important to indicate the initial roles that are crucial to the success of the instantiation of the CEE. The initial team member should be knowledgeable across AWS services, networking, security, operations, application development, migrations, databases, and infrastructure. They should be passionate about technology, but also have business acumen, the ability to internally evangelize technology and the value of the CEE, and have enough internal political capital to directly access and communicate

to line of business (LOB) leaders. Organizations typically limit the initial CEE to 3-5 people. This models the Amazon two-pizza team approach, and ensures an agile team that is empowered to make quick decisions.

The first resources include:

1. Infrastructure and operations person (such as a cloud architect)
2. Security and networking or migration specialist (depending on the CEE initial focus)
3. Cloud Platform Engineering (such as a scripting SME)
4. CEE leader that is hands-on and a respected member of the IT organization.

Part of building the team involves identifying the core services that will be offered, and setting the team goals, metrics, and KPIs. At the initial creation of the team, less is more. We recommend keeping the list of services offerings and capabilities offered to under six in the first 2 to 6 months.

Train and coach

The second activity is training and coaching. This activity should be conducted before activities three through five. The training and coaching activity involves building a cloud web portal (e.g. wiki, web site, etc.), identifying training gaps (LNA – Learning Needs Analysis), creating a training plan, internally training and/or identifying partners, rolling out the training, and getting people involved by running workshops, hackathons, immersion days, lunch and learns, etc. The CEE is not responsible for delivering all the training. The CEE will work with the internal corporate training team to do the following:

- create the learning paths
- identify certification training vendors (for example, Linux Academy, A Cloud Guru)
- deliver initial training
- train the trainers in the corporate training team

Pilot projects

The third activity is Pilot Projects and enables the CEE team to get hands-on experience with AWS. The team will experiment and play with some selected pilot projects using a lab environment. This approach gives the team the fastest ramp-up of

skills and ability to build out knowledge in-house. The CCE team will be trained on AWS Well-Architected, and become familiar with AWS reference architectures, AWS Quick Starts, and AWS Solutions. The goals are to increase agility, document lessons learned, and develop best practice policies.

Architect for the cloud

The fourth activity is architecting for the cloud and involves defining the AWS end state architecture for development, test, performance testing, QA, and production environments. The cloud identity access control policies are set, and the AWS account structure and IAM roles are defined. The billing and financial management processes are configured using AWS tagging and billing. Governance policies are set for access request, security, and usage, and service limits are set. AWS offers solutions for many of the deliverables of this activity such as AWS Landing Zone and AWS Control Tower.

Operate in the cloud

The fifth activity is operating in the cloud and focuses on how a company should operate in the cloud using the Cloud Operating Model (COM). For more information, see Building a Cloud Operating Model.

Operation capabilities include the following: infrastructure as code, code repositories and version control, monitoring, alerting, notifications and reporting, escalation policies, financial tracking and auditing, service deployment policies, and examination of opportunities for DevOps practices. This activity often involves creating an Operation Readiness Review (ORR) document and process, focused on infrastructure, to ensure new workloads moved to AWS are production ready. For more details on Cloud Operating Models, see Appendix D: Cloud Operating Model.

Continuous improvement

The sixth activity is continuous improvement and includes regular project reviews and post mortems, keeping up-to-date with latest technologies and innovations, automating everything (NoOps), tracking costs, KPI reviews through a KPI portal, monthly review meetings, and continuous training. It also involves using machine learning (ML) for operations, provisioning, alerting, and management.

Getting started: Service offerings

The primary function of the CEE team is to provide an enterprise ready AWS platform that is easily consumable by end-users. The cloud team is responsible for overall security hardening of the platform, which includes defining standard AWS Identity and Access Management (IAM) roles and policies, evaluating security, enabling AWS services using IAM policies, and platform SSO/AD federation. In addition, the cloud team is responsible for defining standard security groups (required backend systems), company standard OS AMIs, and managing the following: accounts and account strategy, billing and cost optimization, VPC builds, CI/CD toolchain (Jenkins, Ansible, etc.), API platform, and application onboarding.

Core services

The CEE team should offer the following core services in the first six months after becoming established.

FinOps

This service offers rigorous financial management processes for financial forecasting, monitoring, reporting, optimization, and allocation. Evaluate architectural solutions for cost efficiency in both architecture and infrastructure and recommend the most cost-efficient solution. Continually optimize allocated vs. utilized cloud assets to maximize utilization. Provide transparent reporting and forecasting through self-service dashboards to internal customers and stakeholders to help them manage their budget effectively. Analyze cloud invoices and allocate cost by internal customers and stakeholders. Ensure that cloud cost is optimized to deliver maximum business value at lowest possible cost by implementing the right financial controls.

Cloud Governance

This service refers to the decision-making processes, criteria, and policies involved in the planning, architecture, acquisition, deployment, operation, and management of a cloud computing capability. Cloud Governance covers a broad set of capabilities including: setting Service Level Objectives, governance of AWS including account strategy, security policies, account management, billing and cost controls (chargeback and show back), setting and measuring metrics and KPIs, and workload compliance to industry standards. The CEE team is responsible for updating, and implementing policies and practices to support governance models required to enable the workloads to be compliant with business operations (for example, PCI DSS, HIPAA, and

FedRAMP. The CEE will audit workloads from both a technical and a business compliance perspective, and report the current status to the executives and the board.

Migrations

This service enables the CEE team to create the AWS migration strategy, define the methodology, and develop and share migration best practices. This strategy includes recommendations on migration tools, decisions on when to apply one of the “6-Res” to an application (rehost, replace, rearchitect, re-platform, and re-engineer). The strategy includes a portfolio assessment, architecture review, security review/strategy, application migration planning, TCO analysis, application integration, deployment, and on-going operations. The teams will use this experience as the foundation for best practices and lessons learned focused on Migration, Modernization, and DC Consolidation.

The CEE team should become familiar with the AWS Migration Portfolio Assessment (MPA) tool, Experienced Based Accelerators (EBA) and Customer Success Matrix (CSMatrix) framework (built and maintained by AWS Account Teams). The EBA is a bank of interactive workshops that accelerates organizational change, portfolio rationalization and application migrations to the cloud. AWS CSMatrix is a framework to evaluate the current state of an organization's cloud capabilities with respect to six perspectives. The Business, People, and Governance perspectives focus on business capabilities and the Platform, Security, and Operations perspectives focus on technical capabilities. For more information on the AWS MPA and CSMatrix, see Appendix E: Migration.

Platform Configuration and Optimization

This service provides guidance to the company for the direction of the overall platform, provisions initial AWS environments, creates golden-image AMIs, automates infrastructure deployments through scripting, and optimizes the platform by deploying reference architectures. Provisioning of the AWS environment includes the initial account and billing structure, security, identity and assessment, logging, monitoring, and network structure using AWS Landing Zones and AWS Control Tower. Provisioning procedures help plan, implement, and maintain a stable technical infrastructure to support the organization’s business processes. The CEE team will use the AWS Well-Architected Framework to implement the latest AWS best practice advice and step-by-step guidance to address any gaps and to drive architecture using data. The team will continuously update reference architecture stacks and roadmaps based on business priorities. The objective of platform architecture service is to build the most effective

architectural solutions for recurring architecture patterns and promote reuse with appropriate customization required.

Operations

This service is offered for support, maintenance, monitoring, and incident management of the cloud platform. The CEE supports integration of enterprise tools and assets with cloud tools and assets. This service validates and orchestrates a business continuity plan (BCP) and disaster recovery (DR) scenarios and works with cloud platform engineering team to automate these scenarios. The team is responsible for establishing how the support structure will work in the cloud, including working with existing centralized support teams to establish the support model. The team also helps drive automation and change to existing processes, such as automation to update change records. The team also creates the initial application onboarding support, troubleshoots issues, and helps drive crowd sourcing for addressing support issues.

Process and Organizational Change Management

Technology is just one component of a cloud transformation. People, process, and organizational transformation are critical to a cloud transformation. Cloud drives pervasive change, including automation, across many critical functions including engineering, operations, security, compliance, finance, and more. The service also creates opportunities to organize more efficiently by creating cross-functional DevOps product teams. Change organization structure and relevant functions as appropriate to take advantage of the efficiency that cloud use introduces.

This service drives change across the organization in a carefully orchestrated manner. It assesses scope of change introduced by the cloud in various functions and works with stakeholders to plan how the organization will roll out the changes across these functions. It provides timely and targeted communication of change initiatives across the organization as it undertakes them. The organization change management team goes beyond the cloud technology initiatives to drive required changes to people and process across the organization.

Additional services

The second phase of the CEE typically provides additional services such as DevOps Engineering, Site Reliability Engineering (SRE), automated application deployment and CI/CD tool chain specialist, Cloud Operational Readiness and Cloud Operational Readiness Review (ORR) support, and pilot/proof-of-value support.

A mature CEE should contain two distinct teams: Cloud Business Office (CBO) and Cloud Platform Engineering (CPE). The CBO is focused on PMO, governance, process, and organizational change management. It also aligns the solutions and best practices delivered by the CPE team to the needs of the customers (Business, Development, and Operations) and key stakeholders (Finance, HR, EA, and Security).

The CPE team provides the enterprise standards as self-service capabilities that enable development teams to meet governance requirements while accelerating adoption. They are the hands-on doers. In the initial creation of the CEE, there will be one CEE organization.

Considerations

Establishing a CEE, identifying the correct resources, getting their time, identifying skill gaps, filling those gaps, building a landing zone, creating services, training, and integrating the CEE into your existing operations and accounting systems is a complex, time consuming, and non-trivial exercise. It is usually iterative, typically starts small and scales over time. Spending the time to build the correct foundation, processes, experimenting, fixing, and training will accelerate the total process. Verifying that the customers and senior managers have a clear understanding of the timeline and not overcommitting are important. Define requirements, build, test, and review with key stakeholders before committing to migration schedules or application go-live dates.

Patterns for success

Focus on these patterns for success in the first 90 to 100 days of CEE establishment.

Executive leadership

Executive leadership an essential prerequisite to secure the right level of organizational support to establish a CEE. Create an Executive Steering Committee made up of C-level executives. These executives are not part of CEE, but they serve as the North Star for CEE. This team ensures that the CEE is creating value and aligned to corporate and board level goals and objectives. The executive leadership provides guidance on course correction and removes impediments.

Cloud Steering Committee

This steering committee helps to ensure progress, remove roadblocks, and help with any critical decisions (that is, decisions around changing existing processes). The steering committee should empower the cloud team to think differently and challenge the status quo. At the beginning of the journey, when many of the critical decisions are being made, the committee should meet on a weekly/biweekly basis. As the team and processes mature, the cadence of the meetings can be reduced and eventually eliminated.

Project Management Office (PMO)

The PMO typically consists of technical scrum masters/project managers that coordinate work across all IT verticals, across the cloud team, and with application teams. However, scrum and agile are the vision. Initially, the PMO communicates executive updates, communications across all verticals, establishes cloud communities, contributes to IT newsletters, coordinates lunch-n-learns, produces internal articles, shares best practices, ensures technical/end-user documentation is in place, and engages in issue resolution across all verticals.

A PMO office is critical to the long-term success, but should not be burdensome (over engineer the communication and information sharing processes) when cloud usage is low in the company. Communication is key when the CEE is in its infancy, and the goal of the team should be communicate, communicate, and then communicate again. A Cloud Manifesto or PR/FAQ are a great communication asset to start with, and has been successfully used by AWS customers. The cloud manifesto includes the guiding principles and tenets of the modernization and transformation to AWS. The manifesto can be used to guide the decision making regarding the people transformation, process changes, organizational change, cloud architecture, and cultural change. The Cloud PMO can also make an impact facilitating and leading weekly cloud forum call.

Prescriptive guidance documents are another great mechanism for sharing best practices and lessons learned in a specific domain such as hybrid cloud, application modernization, and Operational Readiness. The Enterprise Transformation Community of Practice has created prescriptive guidance documents discussing hybrid cloud on AWS, application resiliency, migration acceleration, disaster recovery, and application modernization. These documents can be used by customer CEEs and can be made available to account teams with an NDA.

Training

The CEE team is responsible for collaborating with the internal training organization to ensure the completion of training for corporate resources, CEE team members, and/or core AWS resources. The CEE validates that the training requirements of the organization cover all four spectrums of training and education: mass awareness, certifications, custom workshops, and Just in Time (JIT) training. AWS 100 and 200 level webinars and lunch-and-learns can bring awareness of AWS and cloud concepts to a majority of the company. A few examples can be found on the AWS Online Tech Talks site.

AWS Solution Architect Associate and Professional certification training creates a foundation of AWS knowledge, and is an important outcome to build strong delivery, implementation, and managed services capability within the CEE and IT organizations. Custom workshops for migrations, security, networking, AWS architecture fundamentals, and operating AWS are all key foundational training opportunities. The CEE members are the mentors, champions, and key enablers of AWS and cloud awareness and knowledge. In addition to training the technical resources across the company, training the executives is critical. Executives that are part of the steering committee, in particular, need to understand cloud capabilities, services, processes, tools, and methodologies so that they can provide effective support and guidance.

Core CEE team dynamics

CEEs are typically staffed by a team of open-minded change agents, tasked with initiating and implementing a fundamental shift in how the organization functions. The team comprises specialists across the spectrum of IT roles including networking, security, database, application development, operations, and program management. The individuals in the CEE are hands on, big picture thinkers who are ready to lead business transformation by using cloud services, tools, and technologies. CEE resources are typically structured from an organizational perspective into one of the following configurations:

- centralized model, where one team reports into one leader
- decentralized model, where the team is embedded in the lines of business and has a dotted line to the IT organization,
- federated model, where the organization shares characteristics of the centralized and decentralized models

Pragmatic and practical governance

Day one involves establishment of a tagging strategy. Next, establish and standardize cost optimization through show back/chargeback, standardize cost management, identify and measure metrics and KPIs (example incident response operation KPIs can be found in Appendix G: Operations KPIs), and implement optimization tools such as AWS Trusted Advisor, and partner solutions, such as CloudHealth, CloudCheckr, and Cloudability.

Other initial governance tasks include:

- Identifying and documenting compliance through configuration management
- Managing software licenses
- Managing AWS accounts and billing
- Defining IAM policies
- Implementing processes for how to handle service limit increases across accounts (service limit incidences can account for over 50% of support incidences in customers new to AWS)

Provide early value

Demonstrate early value by delivering three to five small applications (Drupal, LAMP, or AWS supported ISV SaaS application), delivering lift-and-shift migrations to AWS that reduce run time and operational costs, or developing and delivering an infrastructure-as-code system for AWS. The CEE must deliver two to three tangible results that drive business value and outcomes in the first 90 days. Early value can also be demonstrated through certifying a certain number of resources on AWS, or creating a FinOps model. Gamification of these early accomplishments can help you drive success.

Mandate AWS Well-Architected Reviews

AWS Well-Architected Reviews should be mandatory for all applications running on AWS. Well-Architected Reviews can be executed for on-premises workloads as well. In fact, over 7000 (10% of all reviews) have been completed on on-premises workloads. Performing these reviews on applications before they are moved to AWS can prepare these applications and corresponding workloads for migration or modernization to AWS.

Practice operations

Use events such as AWS GameDay to practice incident response. AWS GameDay is workshop that immerses teams into a fictitious scenario where they are challenged to build and maintain highly available and highly scalable solutions. Netflix Chaos Monkey is an open source tool that was inspired by AWS GameDay and is aimed at training developers and operations resources in the management of production incidents.

Community of practice

In conjunction with the development of a CEE, AWS has observed that developing a Community of Practice (CoP) is beneficial. The CoP identifies and shares best practices and supports upskilling and crowdsourcing efforts. These efforts are helpful to evolve the culture and federate expertise across different business units, teams, and roles. These communities of practice provide safe zones where peers can help each other, and share real-world issues. Sometimes, organizations that have not established CoPs have had their adoption efforts stalled as the number of teams needing support exceeds the capacity of the CEE. The CoP enables community members to help each other, reducing the workload on the CEE. The CoP is analogous to a Guild in the Spotify implementation of DevOps. Amazon and AWS have Technical Field/Feedback Communities (TFCs).

Anti-patterns – Actions to avoid

These anti-patterns are focused on actions, strategies, and approaches taken by enterprise CEEs that can have negatives consequences on the success of a CEE.

Believe in build it and they will come

The consumers of cloud are the customer. In the case of a CEE, the consumers of the cloud are the line-of-business owners, product owners, finance, marketing, and the IT teams; infrastructure, operations, application development, security, and database. Understand their needs and provide the services and tools that support those needs. The CEE needs to ensure CEE backlog is driven by the internal customer's clearly defined needs and requirements. Building the perfect AWS landing zone does not ensure lines-of-business will move to the cloud. Developing a sophisticated cloud monitoring platform does not mean lines-of-business nor operations will embrace this new concept. For example, a global manufacturing company developed an AWS monitoring platform. The CEE team went to roll out this platform and discovered that

one of the lines-of-business had developed their own monitoring platform that was similar. The line-of-business, of course, chose to continue using the platform they developed.

Underestimate the power of middle management

More so than talent mismatch, we have seen that the biggest blocker to change, and therefore cloud adoption is buy-in from leaders one level down from executives. With the previous global manufacturing company example, this company struggled for almost three years to fully migrate to AWS (beyond the innovation group). Once they were able to achieve cloud adoption across the company, they were able to successfully migrate to AWS. Keep in mind that many decisions during a cloud transformation are (including what to migrate first) made because of political reasons, not business outcomes or the *right* technology.

Organizational and culture change

Although, organizational change doesn't happen overnight and is one of the forced multipliers of Amazon innovation formula (Charlie Bell; formula for innovation), many cloud modernization, digital transformation, and cloud transformation efforts fail or stall because a company attempts to change an organization, or move to DevOps, Agile, or two pizza teams. The reality is organizational change is difficult and disruptive, and cultural change (culture is essentially the unwritten, inexplicable way people make decisions, interact with each other, and interface with partners and customers) isn't in the short term. The success of technology and process change influences organizational and cultural change. Do not change your organizational structure without launching cloud projects. For example, implement a CI/CD pipeline. This change will force changes to tooling, architecture and technology, and processes, which will force organizational structure and culture to change. It took Amazon over 10+ years to fully change organizational structure and architecture/technology to move to cloud. Amazon did not have as much legacy technical debt, had a defined culture of innovation (leadership principles, two-way and one-way doors, etc.), and was only a 6+ years old company when it started.

Mismatched guardrails

Mismatched guardrails refers to building too much security for workloads that don't need it; or, conversely, not building any. The guardrails should be appropriate for the portfolio at the time. That said, there are minimal guardrails that must be established at the beginning and are difficult to redo (one-way door).

Lack of or incomplete upskilling strategy

Common anti-patterns can range from: Customers training everyone but don't have a plan to provide these individuals with hands on experience which leads to illusion of expertise; Nobody is trained, so those that know get overwhelmed or frustrated with the many that don't; No formal way to share best practices. Connecting experts with newbies via meetups, summits, and communities of practice is a way to slowly increase the skill of the employees.

Cloud agnostic tool chains

In terms of actual implementation, enterprise customers have few actual production systems that provide cloud brokerage, management, provisioning, and operations across multi-clouds. Enterprises can spend an inordinate amount of time on CEE tools, technologies, and processes that are cloud agnostic before getting one public cloud implementation right. For example, a customer may iterate over various vendor solutions that provided cloud portability for CI/CD, operations, and management space and then finally decide to go on AWS first.

Build an ivory tower

The CEE should not be staffed with *thought leaders* and thinkers only. The CEE team members should be builders with hands-on skills. All members of CEE team should have direct access to their customers, listen to their needs and build CEE's backlog based on business requirements.

Staffing the CEE with Enterprise Architects

Correlated to point six, consider the amount of Enterprise Architects that are involved in the cloud initiative. Studies have been done that show an inverse relationship between the number of Enterprise Architects on a cloud initiative and the success of the cloud initiative. Think of the "*too many cooks in a kitchen*" phrase.

Personal credit card usage

Personal credit card usage to create test, pilot, or development accounts create irrevocable challenges in terms, of cost control, cost reduction, potential loss of intellectual property (IP), or even loss of service. This is both a cost and an IP issue.

Keep the same processes and tools

Developers, operations, system administrators, application developers, and DBAs are interested in keeping the same tools. Project managers, auditors, risk and compliance, and governance teams desire to keep the same processes in place. It is the role of the CEE to educate these individuals that without process change and new tooling, the full benefit of the cloud cannot be realized, such as new pricing models, on-demand compute, ephemeral and immutable architectures, agility, flexibility, and global expansion. Part of this education is mapping current ITIL-based processes to new cloud friendly capabilities and processes. The argument made for keeping the identical tools and processes is that AWS, *is just another co-lo facility*. This perception will stifle the process, cultural, and organizational change that will an enable a transformation from an on-premises operating model to a COM.

Let the CEE become a blocker to cloud adoption

A CEE is intended to be an enabler of cloud adoption. However, if the CEE does not produce results, retains the same on-premises operating model processes, or becomes the single point of validation for all AWS deployments, the CEE will be perceived as an impediment to cloud adoption.

Conclusion

A minimal viable product (MVP) approach should be taken to building the CEE team, and its offerings. Although a fully automated infrastructure and application deployment using CI/CD supported by DevOps engineers may be the ultimate objective, the CEE needs to first establish a foundation architecture with the appropriate security, logging and monitoring, AWS service tagging, infrastructure as code, and a resilient network in place. The CEE needs to put guard rails in place for the operations of the AWS environment, and establish and govern the metrics and KPIs used to ensure operational excellence. The service level objectives (SLO) and service level indicators (SLIs) will enable the portfolio companies to measure success, and establish a baseline for continuous improvement. The CEE will learn, iterate, and provide more capabilities. There is no compression algorithm for experience.

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Appendix A: Evolution of an Enterprise CEE

Amazon Web Services (AWS) has observed two high level approaches to a CEE – *prescriptive* and *advising*.

In the *prescriptive* approach, the CEE directly oversees or implements all cloud projects. Engaging with the CEE early in project implementation is a mandatory step for the business unit or line of business. A common use case for when this approach is taken is when an enterprise is undergoing a mass migration to AWS driven by data center closure or an *all-in* strategy. A prescriptive CEE is usually temporary (1 to 3 years) and provides a residence for cloud expertise until wider adoption is reached. This approach is implemented by companies that start their cloud journeys.

In the *advising* approach, the CEE team members serve as internal SMEs for cloud projects. This type of CEE performs an advising function, advising on architecture, services available, and best practices. They provide standards, along with secure, and repeatable solutions for teams to consume so they can be self-sufficient. The advisory CEE accelerates cloud application projects implementation, but is not responsible for implementing them. The primary use cases are new projects and application migrations to AWS driven by business case or a tech refresh (cost avoidance) strategy. The advisory approach is used by advanced cloud companies, such as Amazon.com.

Customers frequently begin with the *prescriptive* approach and move to an *advising* approach as the adoption of cloud scales across an enterprise. This metamorphosis from prescriptive to *advising* fits well with the evolution of enterprise IT from traditional operations to the future-state of IT operating models (cloud operating models) that AWS is adopting.

Appendix B: The Amazon.com story

In 2001, Amazon.com was a monolithic application with monolithic teams. The monolithic application was written in Perl using an Oracle database as persistent storage. The application contained all display, business, and database logic across all business functionality. This included all the logic and functionality that Amazon eventually became famous for: one-click ordering, similarities, and recommendations. The first big milestone was the release across all of Amazon.com of a deployment service called Apollo. This service become AWS CodeDeploy. In 2009, Amazon.com conducted an internal study to find out where inefficiencies might still exist. What they found was that many teams were still being slowed down by manual processes and

work flows. This was the reason around the Amazon development of a code pipeline tool; this tool was the foundation for AWS CodePipeline. During the cultural, organizational, technology, and process journey from 2001 to 2009, Amazon.com moved from projects, centralized IT, and ITIL-based processes to productization, two pizza teams, and implemented tools such as Apollo and code pipeline. The outcome was the ability for Amazon.com to achieve 50 million deployments a year in 2016. Werner Vogels discusses aspects of the Amazon.com business and technology transformation in A Conversation with Werner Vogels: Learning from the Amazon technology platform. Amazon.com migrated to Amazon Elastic Compute Cloud (Amazon EC2) (lift and shift style) in 2012. On October 15, 2019 Amazon.com turned off its final Oracle database, having migrated to open source relational databases: NoSQL (Amazon DynamoDB), Amazon EMR, Amazon Redshift, and Amazon Simple Storage Service (Amazon S3). Traditionally, the relational database has been the database option for all data persistence use cases. The *new world* model is to use the database that best supports the use case.

The guiding principles of the Amazon.com transformation were:

- design for failure (everything fails all the time)
- centralized monitoring and management
- automation is not a phase
- continuous improvement
- SSH into servers not allowed
- support agile SDLC
- promote best practices without being restrictive (guardrails)
- decentralized ownership (self-service)
- continually looking for horizontal concepts

Seven technology areas that the effort focused on were:

- APIs
- microservices management
- continuous integration/delivery
- technology agnostic

- infrastructure as code
- monitoring/metrics/logging/APM
- communication and collaboration (ChatOps)

The lessons learned were:

- shared culture matters as much as tools, technologies, process, and strategy.
- Teams need to be highly autonomous product-based.
- Products not projects.
- This organizational structure drives ownership.
- The product teams share toolchains; the best tools become the de facto standard.
- There is no center of excellence, it is everywhere.
- A focus on cloud platform engineering, not a centralized CEE, is the best long-term approach.

Another lesson Amazon learned during the transformation is that it's not only the technology aspect that was improved by using products accessed by APIs and migrating to cloud. The development and operational process benefited from APIs, CI/CD, and DevOps. The product model was a key enabler in creating innovate solutions quickly with a strong customer focus. Each product team is completely responsible for the product, from scoping out the functionality, to architecting it, to building it, and operating it. Governance is achieved with thorough onboarding/training, regular technical and business metrics reviews, regular sharing of new tools, services, technologies, public sharing of correction of errors (COEs), and configuration management and provisioning (CI/CD).

The implementation of AWS Identity and Access Management (IAM) utilizes managing permissions in a centralized fashion at the API level and as an internal identity broker service. Automation is achieved using automated deployment (AWS CodeDeploy), continuous delivery (AWS CodePipeline), and infrastructure as code (AWS CloudFormation). Continuous monitoring is implemented using Amazon CloudWatch, alerting on business workflow in addition to on CPU or low-level infrastructure metrics, monitoring web services (metrics on services), and AWS X-Ray (end to end monitoring). Continuous improvement is achieved with narratives, PR/FAQs for new features, products, business process improvements, new initiatives, and other ideas, improvement Ninjas (centralized team that analyze current processes and makes

recommendations for improvement), COEs (Amazon mechanism where anyone can raise a concern about a process or product), AWS – PFR (customers can submit product feature requests), and an APIs first mentality. The user interface can be continuously improved if it accessed via an API. The console can be continuously improved if it is written using an open, REST-based API.

Appendix C: Two Pizza teams and Productization

Amazon and Amazon Web Services (AWS) 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; and continuously improving to meet the needs of those customers. For example, Amazon.com uses multiple product teams to run their customer website. Product definition is important as 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 incented to provide higher quality products and services.

When organizations 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 (although, the products should be in demand or we should question their existence). Regardless, the core outcome is the same. The product team owns accountability and does not surrender this responsibility to any other product supplier.

Finally, owning the operation of a product all the way to the end customer (internal/external) cultivates 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 the full and complete accountability for the product and how it is perceived by their customers.

Appendix D: Cloud Operating Model

AWS Professional Services Advisory defines a Cloud Operating Model as the alignment of IT and Business objectives through the formation of cross-functional empowered Product Teams that are customer obsessed; able to iterate and deliver value quickly; and optimize benefits from the Cloud. It is a best-practice prescriptive solution that transforms the way technology and business relationships work. There are 17 key operational domains of the cloud operating model:

- Strategy & Change
- Organization Design
- CBO: Platform Architecture & Governance
- CBO: Operational Reporting
- CBO: Vendor Management
- CBO: Product Management
- CBO: Financial Management
- CBO: Training & Onboarding
- Resource/Estate Management
- CPE: Provisioning & Configuration Management
- CPE: Availability & Continuity Management
- CPE: Capacity Management
- CPE: Lifecycle Management
- CPE: Core IT Processes
- CPE: Operational Health
- CPE: Security Management
- Data & Analytics

For more information, see Building a Cloud Operating Model

Appendix E: Migration

AWS CSMatrix - Capability Assessment tool

The CSMatrix is a questionnaire to determine the current state of company's IT/engineering capabilities in terms of business, governance, people, security, operations, and platform. This matrix is based on the AWS Cloud Adoption Framework (AWS CAF).

CSMatrix consists of 192 questions equally divided among the six CAF business and technical perspectives. Each question is assigned a rating from one to five that maps to the cloud stages of adoption - project, foundation, acceleration and migration, optimize and reinvention, and disrupt. A report including highlights and observations, CSMatrix radar chart, key takeaways, a functional rating (one to five) with recommendations to increase the rating across each of the six CAF perspectives is generated from the assessment.

Migration Portfolio Assessment (MPA) for TCO and ROI

The Migration Portfolio Assessment (MPA) tool is a migration cost and TCO tool. The tool is based upon actually customer migrations, empirical customer data points, and industry averages and assumptions. The tool generates reports for TCO (AWS run time costs) analysis and ROI (cost savings - migration costs) report. The estimated time to completion of the migration in months with the estimated number of resources is generated. The tool also provides the migration person hours, including the migration costs for AWS, customer resources, and a certified AWS migration partner.

The online tool can be run by AWS resources or AWS Partners participants.

For online APN training on Cloud Economics, see AWS Partner: Cloud Economics Accreditation. This training requires you to be logged into APN prior to starting.

Experience Based Accelerators (EBA)

Through completing thousands of applications migrations, AWS has learned that there is no substitute for hands on experience, repeatable pattern design and teamwork in the early stages of cloud transformation. Both application teams and business organizations find comfort in knowing they aren't the first to experience large scale changes of people,

process and technology. As a result, AWS has developed the Experience Based Acceleration program (EBA). The EBA was designed based on experience gained through thousands of migrations and hundreds of customer transformations. During the EBA, AWS brings experienced talent and methodology to work with and train customer resources to develop the best possible migration scenarios based on individual customer requirements. The EBA workshop is 4-5 days with preparations starting 3-4 weeks prior to the workshop.

Appendix F: Prescriptive Guidance

CEE created guidance, scoped to a specific technology or transformation topic. For example, guidance for how to approach a hybrid solution with their existing on-premises applications and assets, or how to effectively leverage the AWS Cloud in a disaster recovery strategy. Points of View have been created by the Americas Enterprise Technologist team that can be shared with partners and customer under NDA on demand:

- Application Resiliency and Productization
- Hybrid Cloud
- Disaster Recovery (Business Continuity)
- Migration at speed
- Monolithic to microservices decision tree

Appendix G: Operations KPIs

Business value becomes an organization wide imperative when it creates organization wide visibility of metrics that measure the business value. Metrics make business value real, immediate, and important. C-level leaders typically build a benefits realization workstream utilizing a Value Score card that measures key metrics relevant to their business objectives (M&A, New Markets, Operational Efficiency, Competitive Advantage). Therefore, it is important for the CEE to identify, measure, and report on key performance indicators (KPIs) based upon the services being offered. It is advised to start with no more than 10 metrics for each service. As metrics continue to turn green, they can be deprioritized, and new metrics can be added based on prioritized business objectives. The CEE should establish dashboards that report important metrics, and make them available to employees as appropriate.

Align with Needs of Internal Customers

- **Number of Target Teams Engaged**: Number of features in product backlog above watermark.
- **Percentage of Target Teams Engaged**: Number of target teams engaged / total number of target teams.
- **Percentage of Features Originating from Customers or Stakeholders**: Number of features in the product backlog from customers or stakeholders, and total number of features.

Improve Cloud Literacy and Fluency

- **Cloud Literacy in Target Teams**: Percentage of employees with cloud literacy in the target teams.
- **Cloud Certification in Target Teams**: Percentage of employees with cloud certification in the target teams.

Build Effective Reusable Solutions

- **Number of Solutions Available**
- **Number of Times Solutions Reused**
- **Times Solutions Are Reused**: Number of times solutions Are reused / total number of times requests received

Accelerate Customer Onboarding

- **Time to Onboard Team**: The time it takes to onboard a team with appropriate credentials and provide required access
- **Time to Provision Solution for Team**
- **Time to Train Team on Solution**
- **Number of Applications in Dev/Test**
- **Number of Applications in Production**
- **Number of Applications Migrated**
- **Number of Cloud Native Apps**

Improve Effectiveness of Applications Team

- **Deployment Frequency**: Number of times software is deployed to production during a time period
- **Deployment Time**: Time taken to deploy software to production after it's committed to version control
- **Change Volume**: Average volume of change in a deployment
- **Deployment Failure**: Number of times deployment leads to unexpected outages or unplanned failures
- **Mean Time to Detection**: Average time to detect failure after a deployment
- **Mean Time Between Failures**: Average time between failures
- **Mean Time to Recovery**: Average time to recover from failures

Improve Security and Compliance

- **Security Controls Implemented**: Number of security controls in place
- **Compliance Controls Implemented**: Number of compliance controls in place
- **Security Controls Automated**: Number of security controls automated
- **Compliance Controls Automated**: Number of compliance controls automated
- Percentage **of Security Controls Automated**
- Percentage **of Compliance Controls Automated**

Operations

Incident Management Metrics

Incident Management (IM) is a critical service and the IM service can usually be broken down into several sub-components:

- Service Desk
    - **Metrics**: Time to answer call, time to create ticket, number of calls matched against known error database.
- Log Generation
    - **Metrics**: Number of production incidents with logs available, number production systems recording logs, age of available records.

- Event Capture and alerting
    - Number false positives, number false Negatives, number events raised via alert vs manual, time taken to create tickets from automation alerts, uptime of central incident API, average number of Sev 1/2/3 incidents in prior month.
- Incident Triage and Classification
    - Number production applications with agreed upon triage plan, number incidents over/under classified, number of assigned resolver groups unavailable, average time taken for resolver groups to respond.
- Incident Workflow
    - RTO compliance, average time taken to close Sev 1/2/3 incidents.
- Critical Incident Management
    - Number critical incidents, average resolution time for critical incidents, number hours production business applications uptime lost during critical outages.
- User Communications
    - Number Incidents with communications released, average time to notify affected users, time to release critical post-incident analysis.

Automation Metrics

- Percentage of operations activities automated in target functions
- Percentage of operations activities automated vs delivered manually in target functions