AWS Architecting & Ecosystem

Well Architected Framework - General Guiding Principles

In the cloud, if you want to have a good, cost-optimized and efficient architecture, you need to:

- **Stop guessing capacity needs** - Instead of guessing the capacity needs of your applications and pre-provisioning infrastructure, you can leverage aws services like ASGs and scale based on the actual demand.
- **Test your systems at production scale** - In the cloud, you can create and provision as much infrastructure as you want within minutes, so, it's always the best to test your applications at production scale even for one hour. This helps you evaluate the readiness of your systems.
- **Automate to make architectural experimentation easier** - Services like CloudFormation (IaC) and Beanstalk (PaaS) you can easily automate your system for experiments.
- **Allow for evolutionary architecture** - Make sure your systems are designed in a way that it can adapt to changing requirements and evolve rapidly.
- **Data-driven architectures** - Analyse the data and use the right services based on what you actually need
- **Improve through game days -** Simulate applications for flash sale days to analyse how it would perform under overwhelm, then, implement any changes needed to make it more efficient and optimal.

  For example, Netflix has something called the chaos monkey and it's a program that's in their EC2 environment which randomly terminates any EC2 instances at random. Through this, Netflix is able to check if their application is ready for failures in case of traffic spikes.

- **Start thinking like you're in the cloud - you have new and very powerful and useful capabilities.**

AWS / Cloud Design Principles - Best Practices

- **Scalability** - Vertical & horizontal
- **Disposable Resources** - Your servers in the cloud should be easily disposable and easily configurable - in the cloud, your architecture should be designed in such a way that all of your infrastructure should be disposable which implies that you need to make sure your data and configuration is backed up and that you have ways to quickly reconfigure your entire architecture. This is completely possible as we are in the cloud.
- **Automation** - Learn to leverage serverless, IaaS, IaC, auto-scaling, etc.
- **Loose coupling** - Initially, all applications have monolith architecture and as they grow larger over time, it becomes difficult to maintain and scale. So, it is recommended to break down your application into smaller loosely coupled components and the components can be linked through SQS or SNS.

  Also, it is important that a change or failure in one component should not affect the other components.
- **Think in terms of SERVICES not just servers** - don't just use EC2, leverage other managed services as well which make your lives and the users' lives easier.

Well Architected Framework - 6 Pillars

1. Operational Excellence
2. Security
3. Reliability

4. Performance Efficiency
5. Cost optimization
6. Sustainability

- By acting these 6 pillars, you have a good architecture in AWS.
- All these pillars go hand-in-hand. They create a synergy. You cannot compromise one either.

> You don't need to remember or memorize which service corresponds to which exact pillar but having an understanding helps.

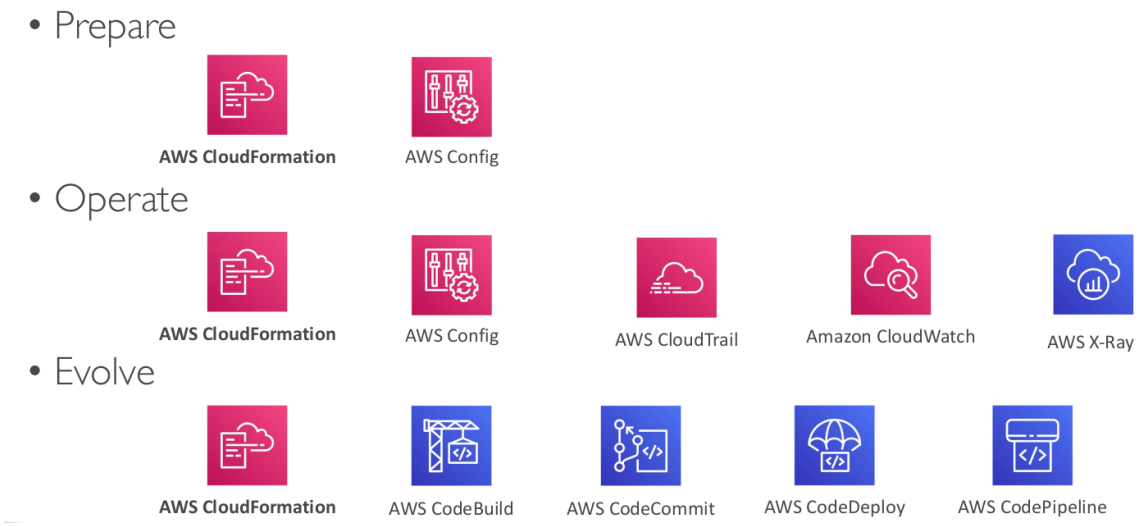
Pillar 1 - Operational Excellence

- Doing operations well, like managing and monitoring systems efficiently. Making sure everything runs smoothly and fixing any issues quickly.
- Includes the ability to run and monitor systems to deliver business value and to continually improve supporting processes and procedures.

- Design Principles
  - **Perform operations as code** - Infrastructure as code
  - **Annotate documentation** - Automate the creation of annotated documentation after every build
  - **Make frequent, small, reversible changes** - So that in case of any failure, you can reverse it
  - **Refine operations procedures frequently** - And ensure that team members are familiar with it
  - Anticipate failure
  - Learn from all operational failures

- **AWS CloudFormation is the main character for operational excellence.**

- WRT AWS Services:



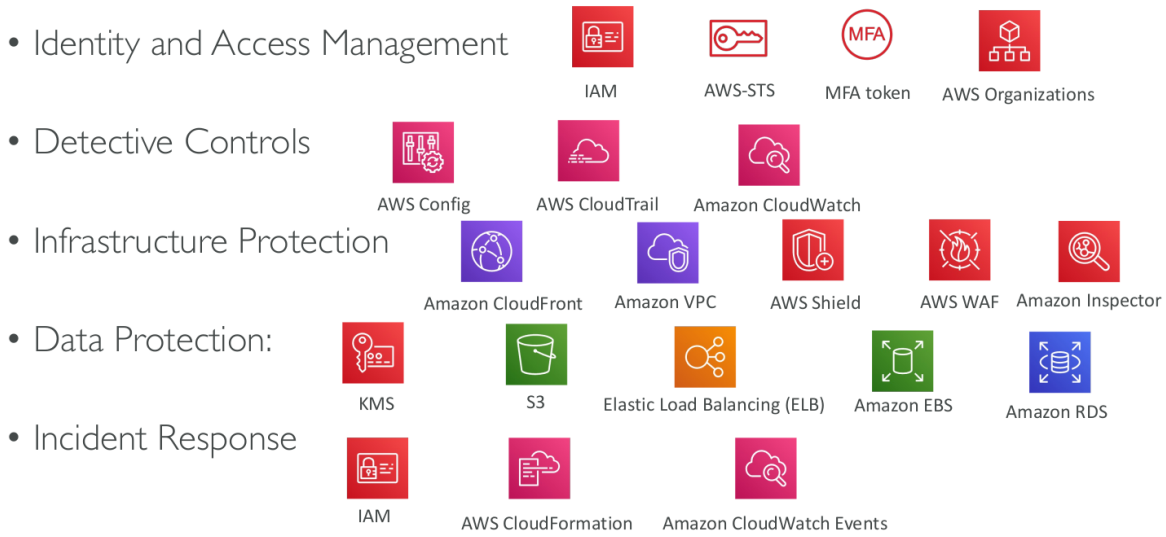
  - **Prepare** = how do you prepare everything to have operational excellence = **CloudFormation** (automate multiple mock runs or build tests through IaC) **+ Config** (to check the compliance of your CloudFormation templates).
  - **Operate** = automate as much as you can, avoid manual processes = **CloudFormation + Config + CloudTrail** (to keep track of API calls being made) **+ CloudWatch** (to monitor the application's and resources' behaviour) **+ X-Ray** (to analyse and track down the HTTP API requests made)
  - **Evolve** = overtime keep evolving your applications and architecture = **CloudFormation +** all the CI/CD tools (**CodeBuild, CodeCommit, CodeDeploy, CodePipeline**) to be able to iterate quickly, deploy easily and more often.

Pillar 2 - Security

- Includes the ability to protect information, systems, and assets while delivering business value through risk assessments and mitigation strategies.

- Design Principles
  - **Implement a strong identity foundation -** Centralize privilege management and reduce (or even eliminate) reliance on long-term credentials - Principle of least privilege - IAM
  - **Enable traceability -** Integrate logs and metrics with systems to automatically respond and take action
  - **Apply security at all layers -** Like edge network, VPC, subnet, load balancer, every instance, operating system, and application
  - **Automate security best practices**
  - **Protect data in transit and at rest -** Encryption, tokenization, and access control
  - **Keep people away from data -** Reduce or eliminate the need for direct access or manual processing of data
  - **Prepare for security events -** Run incident response simulations and use tools with automation to increase your speed for detection, investigation, and recovery
  - **Shared Responsibility Model**

- WRT AWS Services:



Pillar 3 - Reliability

- Ability of a system to recover from infrastructure or service disruptions, dynamically acquire computing resources to meet demand, and mitigate disruptions such as misconfigurations or transient network issues

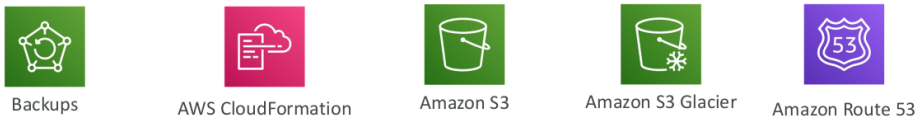
- Design Principles
  - **Test recovery procedures** - Use automation to simulate different failures or to recreate scenarios that led to failures before
  - **Automatically recover from failure** - Anticipate and remediate failures before they occur
  - **Scale horizontally to increase aggregate system availability** - Distribute requests across multiple, smaller resources to ensure that they don't share a common point of failure
  - **Stop guessing capacity** - Maintain the optimal level to satisfy demand without over or under provisioning - Use Auto Scaling
  - **Manage change in automation** - Use automation to make changes to infrastructure

- WRT AWS Services:

  - Foundations

  - Change Management

  - Failure Management



Pillar 4 - Performance Efficiency

- It's all about adapting and providing the best performance and making the best use of resources to get the job done.
- Includes the ability to use computing resources efficiently to meet system requirements, and to maintain that efficiency as demand changes and technologies evolve.

- Design Principles
  - **Democratize advanced technologies** - Advance technologies become services and hence you can focus more on product development
  - **Go global in minutes** - Easy deployment in multiple regions
  - **Use serverless architectures** - Avoid burden of managing servers
  - **Experiment more often** - Easy to carry out comparative testing
  - **Mechanical sympathy** - Be aware of all AWS services

- WRT AWS Services

Pillar 5 - Cost Optimization

- Includes the ability to run systems to deliver business value at the lowest price point

- Design Principles
  - **Adopt a consumption mode** - Pay only for what you use
  - **Measure overall efficiency** - Use CloudWatch
  - **Stop spending money on data center operations** - AWS does the infrastructure part and enables customer to focus on organization projects
  - **Analyze and attribute expenditure** - Accurate identification of system usage and costs, helps measure return on investment (ROI) - Make sure to use tags
  - **Use managed and application level services to reduce cost of ownership** - As managed services operate at cloud scale, they can offer a lower cost per transaction or service

- WRT AWS Services

  - Expenditure Awareness


AWS Budgets


AWS Cost and Usage Report


AWS Cost Explorer


Reserved Instance Reporting

  - Cost-Effective Resources


Spot instance


Reserved instance


Amazon S3 Glacier

  - Matching supply and demand


AWS Auto Scaling


AWS Lambda

  - Optimizing Over Time


AWS Trusted Advisor


AWS Cost and Usage Report

AWS News Blog

Pillar 6 - Sustainability

- The sustainability pillar focuses on minimizing the environmental impacts of running cloud workloads.

- Design Principles
  - **Understand your impact** – establish performance indicators, evaluate improvements
  - **Establish sustainability goals** – Set long-term goals for each workload, model return on investment (ROI)
  - **Maximize utilizatio**n – Right size each workload to maximize the energy efficiency of the underlying hardware and minimize idle resources.
  - **Anticipate and adopt new, more efficient hardware and software offerings** – and design for flexibility to adopt new technologies over time.
  - **Use managed services** – Shared services reduce the amount of infrastructure; Managed services help automate sustainability best practices as moving infrequent accessed data to cold storage and adjusting compute capacity.
  - **Reduce the downstream impact of your cloud workloads** – Reduce the amount of energy or resources required to use your services and reduce the need for your customers to upgrade their devices

- WRT AWS Services:

AWS Services

- EC2 Auto Scaling, Serverless Offering (Lambda, Fargate)
- Cost Explorer, AWS Graviton 2, EC2 T instances, @Spot Instances
- EFS-IA, Amazon S3 Glacier, EBS Cold HDD volumes
- S3 Lifecycle Configurations, S3 Intelligent Tiering
- Amazon Data Lifecycle Manager
- Read Local, Write Global: RDS Read Replicas, Aurora Global DB, DynamoDB Global Table, CloudFront

AWS Well-Architected Tool

- To review your application's architecture against the 6 pillars of design by AWS, there exists this free tool.

- How does it work?
  - Select your workload and answer questions
  - Review your answers against the 6 pillars
  - Obtain advice: get videos and documentations, generate a report, see the results in a dashboard

- Let’s have a look: https://console.aws.amazon.com/wellarchitected - super useful tool to test your application against the 6 pillars and evaluate where your architecture design stands.

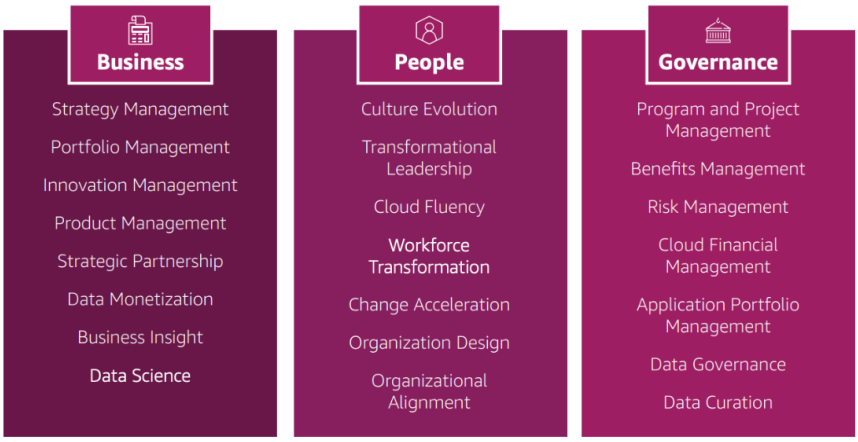
AWS CAF (Cloud Adoption Framework)

- 2-3 Q’s at the exam: imp - 6 perspectives, map capability to a perspective, 4 transformation domains, 4 transformation phases

- CAF is basically an e-book which will help you build and execute a comprehensive plan to do your digital transformation by leveraging AWS.
- A compilation of taking advantage of the AWS best practices and lessons learnt by dealing with 1000s of customers, created by AWS professionals.
- The CAF has two components -
  - **organizational capabilities** which analyse successful cloud transformations
  - **grouping capabilities in six perspectives** - business, people, governance, platform, security, operations
- **The 6 perspectives can be divided into two categories**
  1. Business Capabilities - business, people, governance
  2. Technical Capabilities - platform, security, operations

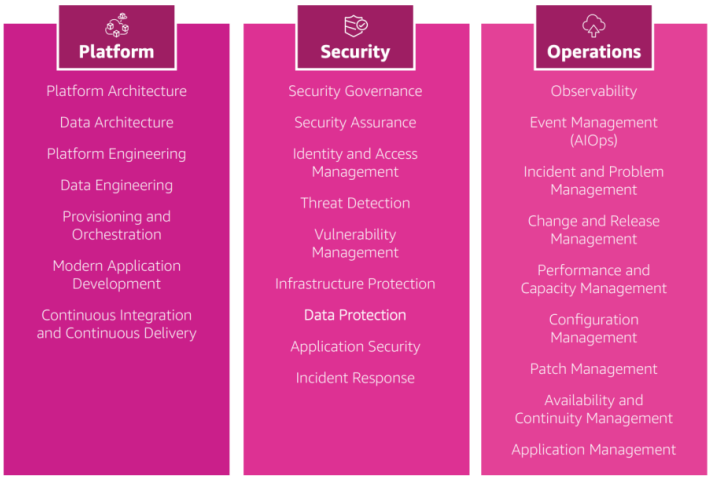
Business Capabilities

- Business Perspective helps ensure that your cloud investments accelerate your digital transformation ambitions and business outcomes.
- People Perspective serves **as a bridge between technology and business**, accelerating the cloud journey to help organizations more rapidly evolve to a culture of continuous growth, learning, and where change becomes business-as-normal, with focus on culture, organizational structure, leadership, and workforce.
- Governance Perspective helps you orchestrate your cloud initiatives while maximizing organizational benefits and minimizing transformation-related risks.



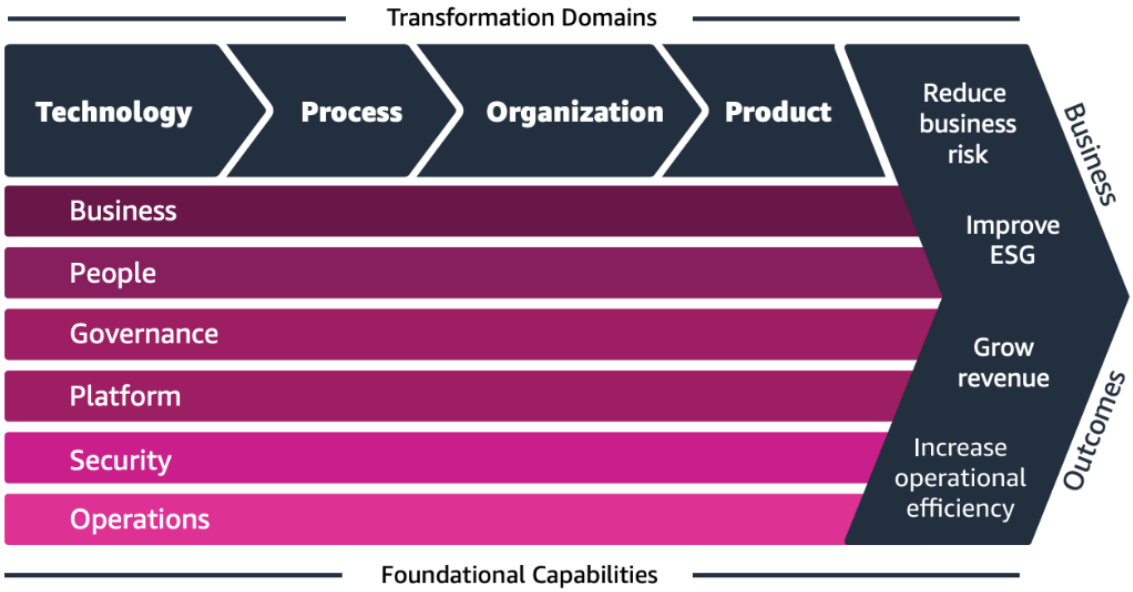
Technical Capabilities

- Platform Perspective helps you build an enterprise-grade, scalable, hybrid cloud platform; modernize existing workloads; and implement new cloud-native solutions.
- Security Perspective helps you achieve the confidentiality, integrity, and availability of your data and cloud workloads.
- Operations Perspective helps ensure that your cloud services are delivered at a level that meets the needs of your business.



Cloud Transformation value chain (4 domains)

- **The 4 transformation domains** - technology, process, organizations, product



- **Technology** - using the cloud to migrate and modernize legacy infrastructure, applications, data and analytics platforms…
- **Process** - digitizing, automating, and optimizing your business operations
  - leveraging new data and analytics platforms to create actionable insights
  - using machine learning (ML) to improve your customer service experience…
- **Organization** - Reimagining your operating model
  - Organizing your teams around products and value streams
  - Leveraging agile methods to rapidly iterate and evolve
- **Product** – reimagining your business model by creating new value propositions (products & services) and revenue models

CAF - 4 Transformation Phases

- **Envision** – demonstrate how the Cloud will accelerate business outcomes by identifying transformation opportunities and create a foundation for your digital transformation
- **Align** – identify capability gaps across the 6 AWS CAF Perspectives which results in an Action Plan
- **Launch** – build and deliver pilot initiatives in production and demonstrate incremental business value
- **Scale** – expand pilot initiatives to the desired scale while realizing the desired business benefits

AWS Right Sizing

- It is not a service but more of a practice or a process
- Emphasis on choosing the most cost optimized solution that meets the demands

- EC2 has many instance types, but choosing the most powerful instance type isn't the best choice, because the cloud is **elastic**
- Right sizing is the process of matching instance types and sizes to your workload performance and capacity requirements **at the lowest possible cost**
- Scaling up is easy so always start small
- It's also the process of looking at deployed instances and identifying opportunities to eliminate or downsize without compromising capacity or other requirements, which results in lower costs
- It's important to Right Size…
  - before a Cloud Migration
  - continuously after the cloud onboarding process (requirements change over time)
- CloudWatch, Cost Explorer, Trusted Advisor, 3rd party tools can help

AWS Ecosystem

- 2 Q's in the exam.

Free Resources

- AWS Blogs: https://aws.amazon.com/blogs/aws/
- AWS Forums (community): https://forums.aws.amazon.com/index.jspa
- AWS Whitepapers & Guides: https://aws.amazon.com/whitepapers
- AWS Partner Solutions (formerly Quick Star ts):

  https://aws.amazon.com/quickstart/
  - Automated, gold-standard deployments in the AWS Cloud
  - Build your production environment quickly with templates
  - Example: WordPress on AWS

  https://fwd.aws/P3yyv?did=qs_card&trk=qs_card
  - Leverages CloudFormation
- AWS Solutions: https://aws.amazon.com/solutions/
  - Vetted Technology Solutions for the AWS Cloud
  - Example - AWS Landing Zone: secure, multi-account AWS environment

- https://aws.amazon.com/solutions/implementations/aws-landing-zone/
- "Replaced" by AWS Control Tower

AWS Support Models

DEVELOPER	• Business hours email access to Cloud Support Associates • General guidance: < 24 business hours • System impaired: < 12 business hours
BUSINESS	• 24x7 phone, email, and chat access to Cloud Support Engineers • Production system impaired: < 4 hours • Production system down: < 1 hour
ENTERPRISE	• Access to a Technical Account Manager (TAM) • Concierge Support Team (for billing and account best practices) • Business-critical system down: < 15 minutes

AWS Marketplace

- Digital catalog with thousands of software listings from **independent software vendors** (3rd party)
- Example:
  - Custom AMI (custom OS, firewalls, technical solutions…)
  - CloudFormation templates
  - Software as a Service
  - Containers
- If you buy through the AWS Marketplace, it goes into your AWS bill
- You can **sell your own solutions** on the AWS Marketplace

AWS Training

- AWS Digital (online) and Classroom Training (in-person or virtual)
- AWS Private Training (for your organization)
- Training and Certification for the U.S Government
- Training and Certification for the Enterprise

- AWS Academy: helps universities teach AWS

AWS Professional Services & Partner Network

1. **AWS Professional Services:**
   - **What it is:** Think of it as expert help directly from Amazon Web Services (AWS).
   - **Purpose:** These are specialists from AWS who can assist you in planning, designing, and implementing your projects on the AWS cloud.
   - **Example:** If you're building a complex application on AWS and need guidance, AWS Professional Services can provide expert advice to make sure everything works smoothly.
2. **AWS Partner Network (APN):**
   - **What it is:** A network of companies that work with AWS to provide additional services and solutions.
   - **Purpose:** These companies (partners) are not AWS employees, but they are trained and recognized by AWS to help customers with various aspects like consulting, software solutions, and more.
   - **Example:** If you need specialized software or consulting tailored to your AWS needs, you can find a partner in the AWS Partner Network to assist you.

In simpler terms, AWS Professional Services is like getting help directly from AWS experts, and the AWS Partner Network is a group of external companies approved by AWS that can provide additional support and solutions for your AWS projects.

- The AWS Professional Services organization is a global team of experts
- They work alongside your team and a chosen member of the APN
- APN = AWS Partner Network
- **APN Technology Partners:** providing hardware, connectivity, and software
- **APN Consulting Partners:** professional services firm to help build on AWS
- **APN Training Partners:** find who can help you learn AWS
- **AWS Competency Program:** AWS Competencies are granted to APN Partners who have demonstrated technical proficiency and proven customer success in specialized solution areas.
- **AWS Navigate Program:** help Partners become better Partners

AWS Knowledge Center

- super useful and handy even other than the exam

- Contains the most frequent & common questions and requests

https://aws.amazon.com/premiumsupport/knowledge-center/

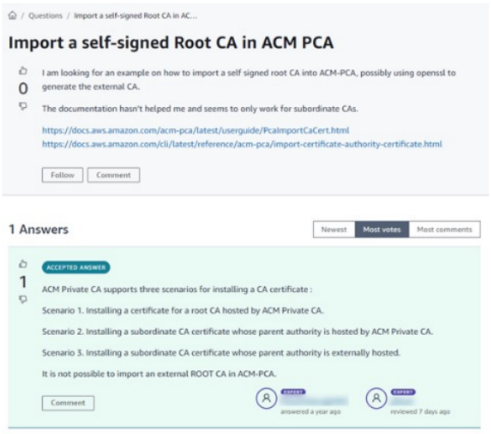
AWS IQ - help with experts

- Quickly find professional help for your AWS projects
- Engage and pay AWS Certified 3rd party experts for on-demand project work
- Video-conferencing, contract management, secure collaboration, integrated billing
- For Customers

- For Experts

AWS re:Post - help with Q&A forum (like StackOverFlow)

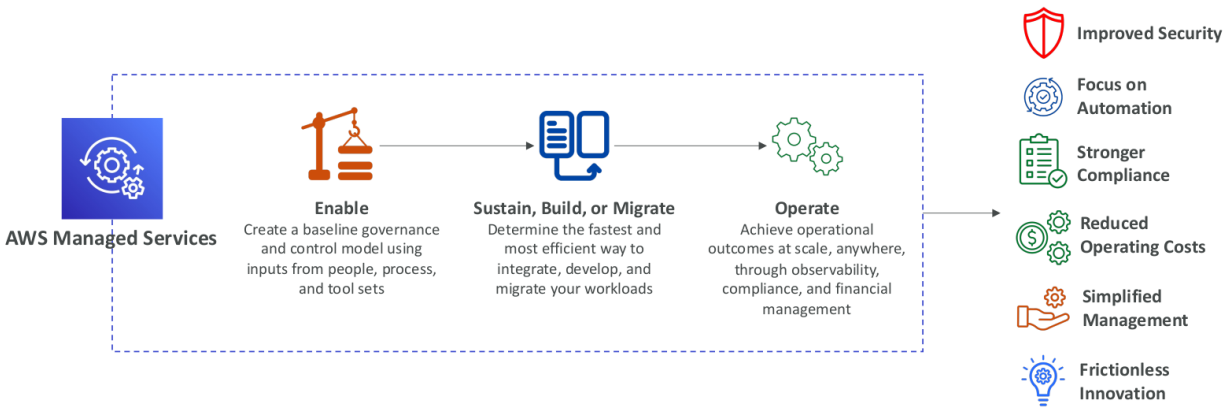
- AWS-managed Q&A service offering crowd-sourced, expert-reviewed answers to your technical questions about AWS that replaces the original AWS Forums
- Part of the AWS Free Tier
- Community members can earn reputation points to build up their community expert status by providing accepted answers and reviewing answers from other users
- Questions from AWS Premium Support customers that do not receive a response from the community are passed on to AWS Support engineers
- AWS re:Post is not intended to be used for questions that are time-sensitive or involve any proprietary information



AWS Managed Services (AMS)

- There are many services called as “managed” services on AWS like RDS, etc.
- But AMS is actually a team of people who provide support on AWS.

- Provides infrastructure and application support on AWS.
- AMS offers a team of AWS experts who manage and operate your infrastructure for security, reliability, and availability
- Helps organizations offload routine management tasks and focus on their business objectives.
- Fully managed service, so AWS handles common activities such as change requests, monitoring, patch management, security, and backup services
- Implements best practices and maintains your AWS infrastructure to reduce your operational overhead and risk
- AMS business hours are 24/365



QUIZ

Incorrect answer. Please try again.
The AWS Well-Architected Tool helps you review the state of your workloads and compares them to the latest AWS architectural best practices. It is based on the 6 pillars of the Well-Architected Framework (Operational Excellence, Security, Reliability, Performance Efficiency, Cost Optimization, and Sustainability). AWS Trusted Advisor is an online tool that provides you real time guidance to help you provision your resources following AWS best practices (Cost Optimization, Performance, Security, Fault Tolerance, and Service Limits).

This was discussed in Lecture 264: **AWS Well-Architected Tool** >

Question 2:

AWS Trusted Advisor can provide guidance against the 6 Well-Architected pillars and architectural best practices.

- ○ True
- ○ **False**

Good job!
Performance Efficiency design principles include: democratize advanced technologies, go global in minutes, use serverless architecture, experiment more often, mechanical sympathy.

This was discussed in Lecture 261: **Pillar 4: Performance Efficiency** >

Question 3:

Which of the following are design principles of Performance Efficiency?

- ◉ **Go global in minutes & experiment more often**
- ○ Analyze and attribute expenditure & stop spending money on data center operations
- ○ Make frequent, small, reversible changes & anticipate failure
- ○ Automate security best practices & keep away people from data

Good job!
This is a distractor. This type of AWS Partner Network does not exist. It is made up with words related to the AWS Partner Network.

Question 4:

Which of the following is NOT an AWS Partner Network (APN) type?

- ○ APN Technology Partners
- ◉ **APN Services Partners**
- ○ APN Consulting Partners
- ○ APN Training Partners

Good job!
Testing recovery procedures, stopping guessing capacity, and managing changes in automation are design principles of Reliability. Performance Efficiency design principles include: democratize advanced technologies, go global in minutes, use serverless architecture, experiment more often, mechanical sympathy.

Question 5:

Testing recovery procedures, stopping guessing capacity, and managing changes in automation are design principles of Performance Efficiency.

- ○ True
- ◉ **False**

Good job!
CloudFormation is a key service to Operational Excellence as it prepares, operates, and evolves, but also performs operations as code.

Question 6:

Which AWS service is the key to Operational Excellence?

- (●) **CloudFormation**
- ( ) EC2
- ( ) OpsWork
- ( ) CodeDeploy

Good job!
AWS Cost Explorer and AWS Trusted Advisor are Cost Optimization services examples. It also includes AWS Budgets, Cost and Usage Reports, etc.

Question 7:

AWS Cost Explorer and AWS Trusted Advisor are services examples of which Well-Architected Framework pillar?

- ( ) Security
- ( ) Operational Excellence
- (●) **Cost Optimization**
- ( ) Performance Efficiency