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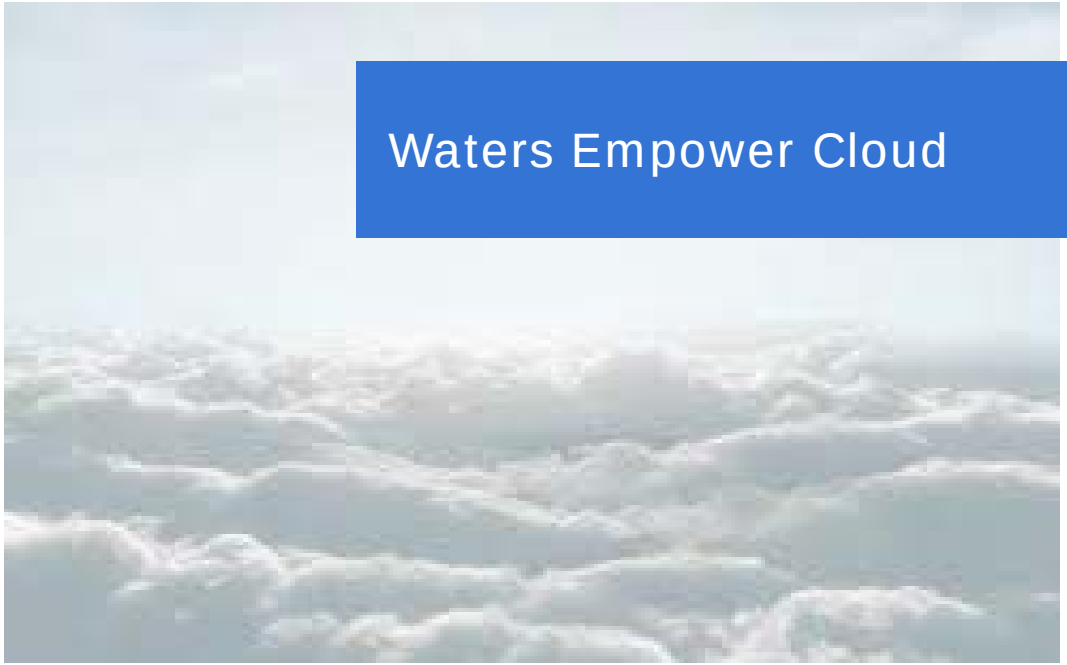

Waters Empower Cloud

Technical Presentation

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What is Cloud Computing…

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According to the National Institute of Standards and Technology, "cloud computing is a model for enabling ubiquitous, convenient, **on-demand network access to a shared pool of configurable computing resources** (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

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On-Premises vs AWS comparison

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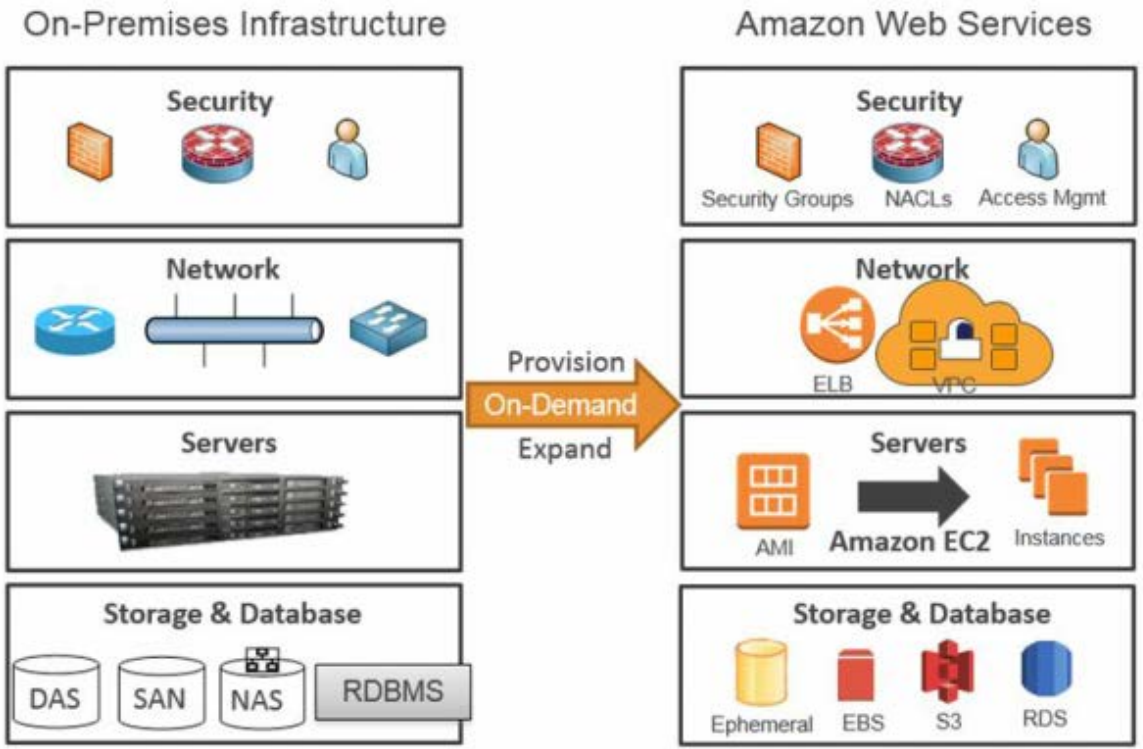

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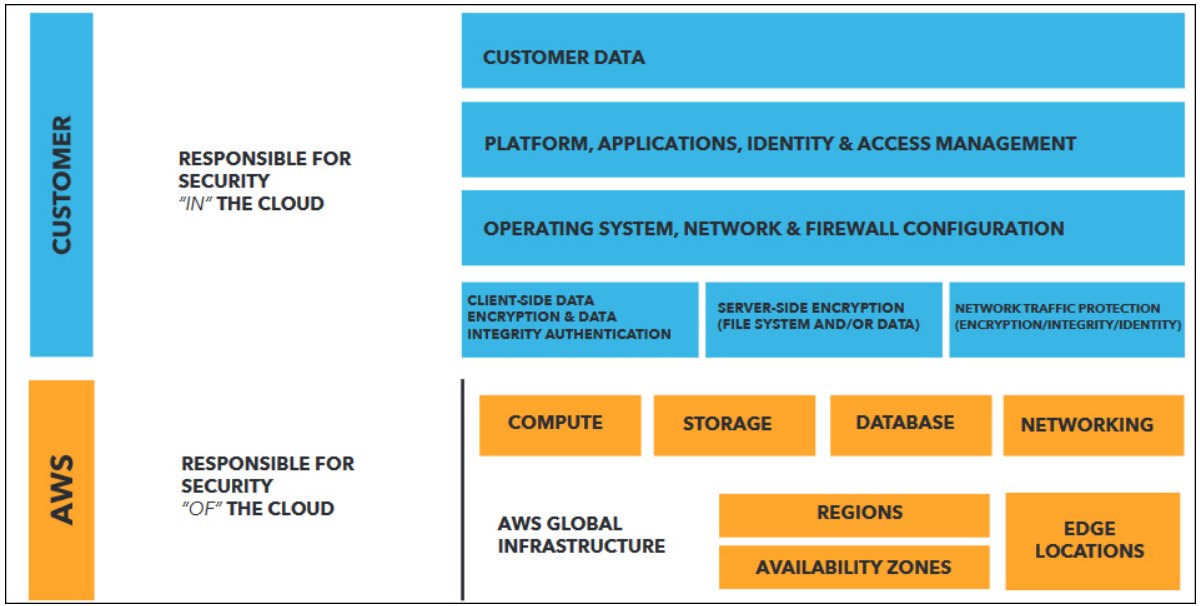
AWS Security

- Cloud Security is highest priority at AWS
- Customers benefit from a data center and network architecture built to meet the requirements of the most security-sensitive organizations

- Shared Responsibility Model
  - AWS is responsible for the security **OF** the Cloud
  - Customer is responsible for the security **IN** the Cloud
    - Retain control of what security to implement and how
      - no different than on-premises

- Inherit security standards accrued by AWS



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AWS Component Breakdown

An intro to some key AWS resources

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AWS Global Infrastructure
Regions and Availability Zones

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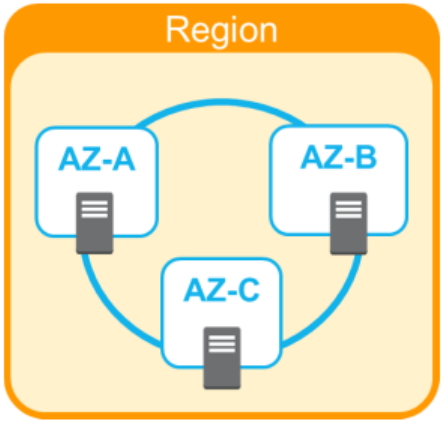
- A “Region” is a physical location in the world
  - Contains multiple Availability Zones
  - Isolated from other Regions
- “Availability Zones” consist of one or more redundant data centers in different locations/facilities
  - Low latency interconnectivity (<1ms)
  - Isolated from failures in other AZs
  - When compared to a single data center, AZ’s provide:
    - more high-availability services
    - more fault tolerance
    - more scalability



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AWS Global Infrastructure
Regions and Availability Zones

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Global Infrastructure

Region & Number of Availability Zones

US East
N. Virginia (6),
Ohio (3)

US West
N. California (3),
Oregon (3)

Asia Pacific
Mumbai (2),
Seoul (2),
Singapore (3),
Sydney (3),
Tokyo (4),
Osaka-Local (1)[1]

Canada
Central (2)

China
Beijing (2),
Ningxia (2)

Europe
Frankfurt (3),
Ireland (3),
London (3),
Paris (3)

South America
São Paulo (3)

AWS GovCloud (US-West) (3)

New Region (coming soon)

Bahrain

Hong Kong SAR, China

Sweden

AWS GovCloud (US-East)

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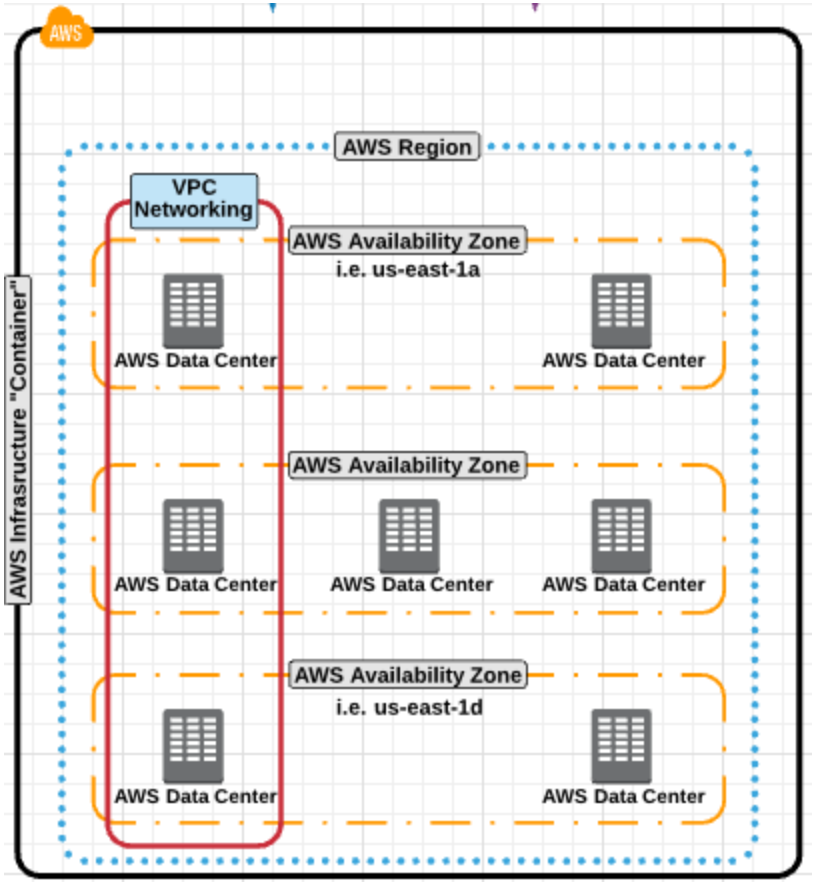
Network Component
Amazon Virtual Private Cloud (VPC)

- Create Isolated cloud resources
  - This is the foundation for the infrastructure
- Private, virtual network
- Deployed in a “Region”
  - Access to multiple Availability Zones
- Can be “Peered” across Multiple VPCs
- Customer maintains control of
  - IP address range
  - Public and private subnets
  - Network topologies
  - Route table and network gateway configuration
  - Control access using NACLs and Security Groups
- Connect VPC to on-premise IT infrastructure via Direct Connect and/or Virtual Private Networks



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Network Component
AWS Direct Connect

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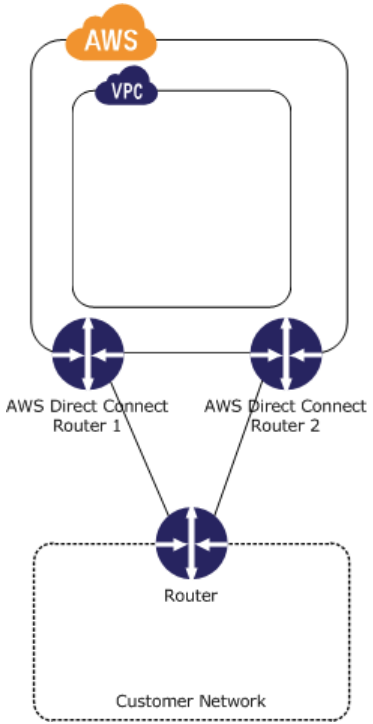
- Customer establishes a high speed, low latency dedicated network connection between on-premise and to an AWS datacenter
  - Elastic Connection speeds ranging from 1Gbps to 10Gbps
  - VPN speeds can top out at 4Gbps
- Private connection
  - Connects to single VPC
- Reduce network costs by not traversing over common internet
- Provides consistent network and application performance
  - Not subject to volatility of internet traffic
  - Consistent network latency



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Key Points…

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- Shared-Responsibility model **empowers** Customers
- Customer **defines** how the virtual network is deployed and connected to
  - This **IS** an **extension** of **existing** corporate network
  - Direct Connect provides a private, secure, low-latency, consistent, high-speed connection
- Customer **chooses** where to deploy solutions
  - What regions and what availability zones
- Customer **defines** controls around data accessibility
  - Security Groups and NACLs
  - Keep data isolated to specific region or single AZ
- Customer **inherits** security standards of most security-sensitive organizations
- Customers **implements** business continuity practices that meets their organizational needs

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Compute and Storage Component
Amazon Elastic Compute Cloud (EC2)

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Amazon EC2

- Virtual computing environments, commonly known as “Instances”
- Built from Amazon Machine Images (AMIs)
- Many Instance Types (CPU, Memory, Storage, Networking Capacity)
- Secured access (Remote Login) by Key-Pair Challenge
  - AWS stores public key, customer stores private key
- Deployed into VPC subnets residing in AZ/Region of your choice
- Service Level Agreement of 99.99%
- Security Groups are assigned (Firewall for Instance)
  - Multiple Security Groups can be assigned
- Persistent Storage for EC2 Instances are provided through EBS volumes
- EC2 Instances can be monitored by AWS CloudWatch

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Compute and Storage Component
Amazon Elastic Compute Cloud (EC2)

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- 75 Current Generation EC2 Instance Types
- Range from General Purpose to Compute Optimized to Storage Optimized
- Any Instance Type can be changed when instance not running
- Empower Cloud Default Instance Type is a c4

C4

C4 instances are the latest generation of Compute-optimized instances, featuring the highest performing processors and the lowest price/compute performance in EC2.

Features:

- High frequency Intel Xeon E5-2666 v3 (Haswell) processors optimized specifically for EC2
- EBS-optimized by default and at no additional cost
- Ability to control processor C-state and P-state configuration on the c4.8xlarge instance type
- Support for Enhanced Networking and Clustering

Model	vCPU	Mem (GiB)	Storage	Dedicated EBS Bandwidth (Mbps)
c4.large	2	3.75	EBS-Only	500
c4.xlarge	4	7.5	EBS-Only	750
c4.2xlarge	8	15	EBS-Only	1,000
c4.4xlarge	16	30	EBS-Only	2,000
c4.8xlarge	36	60	EBS-Only	4,000

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Compute and Storage Component
Amazon Elastic Block Storage (EBS)

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Amazon EBS

- Provides block level storage for use with EC2 Instances
  - Like a traditional hard drive
  - Magnetic or SSD media
- Can be attached to any instance in the same AZ as Instance
- Can be encrypted for added security
  - Includes data at rest, disk I/O, snapshots
  - Encryption occurs on server hosting EC2 instances
- Currently support volume sizing up to 16TB
- Elastic volumes allows you modify volumes as you need
  - increase volume Size, change IOPS performance, change volume type
  - without impacting production status of EC2 instance or EBS volumes
- Highly available (99.999% availability)
  - Volumes are replicated across multiple servers within AZs
  - Point-in-Time Snapshots of EBS volumes can be copied to S3 globally accessible storage

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Enterprise Application Components
Amazon Workspaces

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- Managed desktop-as-a-service (DaaS) offering
- Allows for quick provisioning of cloud-based desktops
- Offers high quality desk top experience available from anywhere on any device
- By default AWS takes care of daily backups and patching
  - Updates are automatically delivered weekly during maintenance windows
  - Customers can control how patching is configured
- Existing Software Management technologies can be used to manage application deployments of a provisioned workspace
- Data is stored in cloud, not on devices
- Only pixels delivered (PCoIP)

amazon WorkSpaces

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Key Points…

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- EC2
  - EC2 Instances have SLA of **99.99%**
  - Vast array of compute power **readily** available within a few mouse clicks or CLI command calls
  - EC2 Instance types can be **changed** without redeployment
    - does require planned downtime activity to make the change
  - EC2 Instances are initially **deployed** from AMIs
  - Security Groups are setup to **govern** access to EC2 Instances

- EBS
  - EBS have SLA of **99.999%**
  - Each Amazon EBS volume automatically replicates within its Availability Zone to protect your applications from component failure.
  - Customer can **dynamically** adjust EBS volumes (size, performance, type) without downtime
  - Amazon CloudWatch can **monitor** and provide **metrics** on EC2 and EBS usage
  - Storage volumes can be **encrypted** which include data-at-rest, data-in-transit between instances and EBS volumes as well as snapshots

- Workspaces
  - Amazon WorkSpaces is a fully managed, secure Desktop-as-a-Service (DaaS) solution which runs on AWS
  - **Reduce** capital expenses by procuring less expensive end user hardware
    - Accessible on multiple platforms (Windows, OSX, iOS, Chromebooks, Fire tables, Android tablets, Firefox and Chrome browsers)
  - Supports **native** deployment of applications
  - Each workspace runs on **dedicated** computing resources (not shared)
  - **Alternative** to Citrix

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So how does this come together?

Introducing Empower Cloud on AWS

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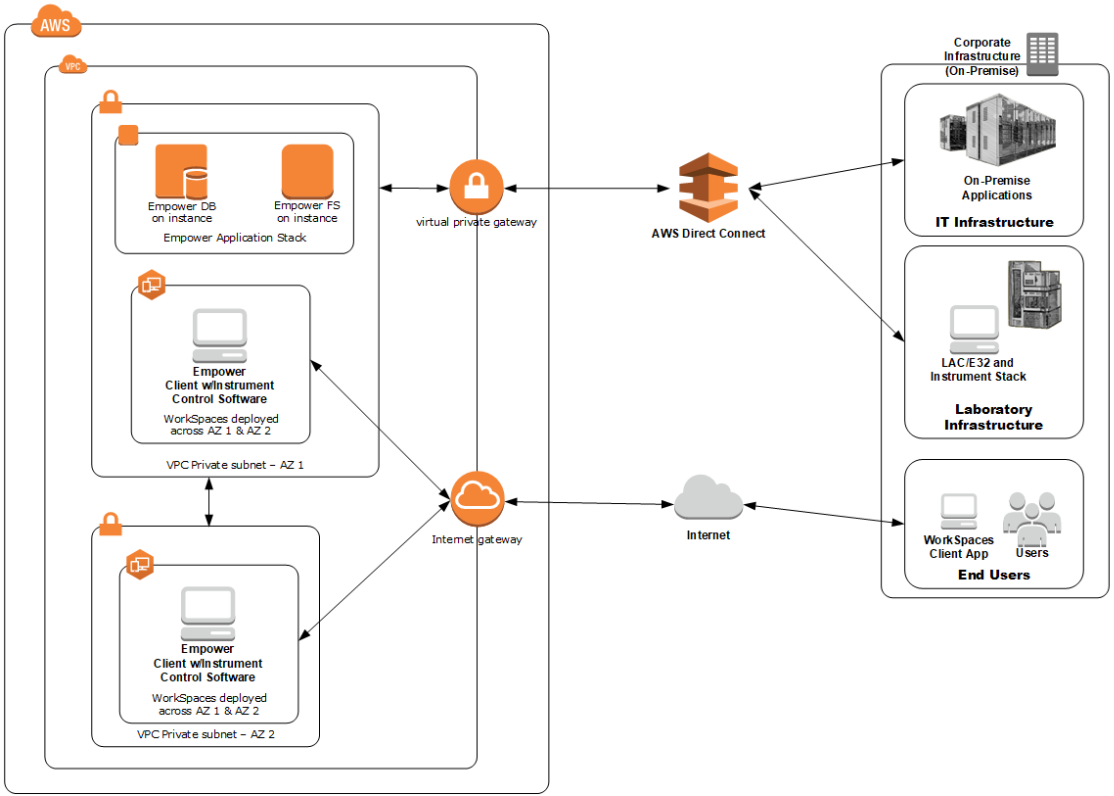
Empower Cloud on AWS

Empower Cloud is deployed within a customer's AWS account, using customer's provisioned Virtual Private Cloud and private subnets. Customers will connect their on-premise environment to their provisioned Virtual Private Cloud by use of a Virtual Private Gateway and AWS Direct Connect. Empower users will interact with the Empower Application Stack through the usage of AWS Workspaces (configured with Empower Client Components). AWS Workspaces provides a means to securely communicate between the Empower Application Stack and On-Premise resources (such as LAC/E[32] and Instrumentation Stacks, and other corporate infrastructure)



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Empower Cloud on AWS Details

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- Accessible via AWS Marketplace (Became Available in Q1 2018)
- Empower 3 Enterprise Feature Release 4 (FR4) English
- Two (2) EC2 Windows 2012 R2 Instances are created in Customer AWS VPC
  - (1) Empower 3 Enterprise Database Server with FR4
  - (1) Empower 3 Enterprise Raw Data File Server with FR4
- Empower 3 Enterprise Clients shall be deployed on AWS Workspaces
  - Deployment details are captured during site-assessment
  - AWS Workspaces are not automatically deployed as part of Waters structurally validated templates
- Connectivity to on-premises resources via Direct Connect (Customer responsibility)

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Empower Cloud on AWS
AWS Supported Regions

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- Initially supported in 7 out of the 19 AWS Regions
- AWS routinely expands service offerings

AWS Service	US East (N.Virginia)	US West (Oregon)	Asia Pacific (Singapore)	Asia Pacific (Sydney)	Asia Pacific (Tokyo)	Asia Pacific (Seoul)	EU (Ireland)	EU (Frankfurt)	EU (London)	Canada (Central)	South America (Sao Paulo)
AWS VPC	X	X	X	X	X	X	X	X	X	X	X
AWS EC2	X	X	X	X	X	X	X	X	X	X	X
AWS Directory Service	X	X	X	X	X	X	X	X	X	X	X
AWS Direct Connect	X	X	X	X	X	X	X	X	X	X	X
AWS Workspaces	X	X	X	X	X	X	X	X	X	X	X
AWS CloudFormation	X	X	X	X	X	X	X	X	X	X	X
AWS Service Catalog	X	X	X	X	X	X	X	X	X	X	X
AWS Simple Storage Service (S3)	X	X	X	X	X	X	X	X	X	X	X
AWS Config	X	X	X	X	X	X	X	X	X	X	X
AWS Inspector	X	X		X	X	X	X	X			
AWS CloudWatch	X	X	X	X	X	X	X	X	X	X	X

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Deployment Components
Site Assessment

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- Just like today, before Empower is deployed an installation assessment is performed
- Same premise applies
  - How much storage is needed for the Empower Database Server?
  - How much storage is needed for the Empower RawData File Server?
  - How many users/Laces/systems are going to be accessing the Empower application?
  - What is the network topology for the deployment?
  - Is this a WAN deployment?
  - Are there multiple instances needed?
  - Which Active Directory will be used and how will it be accessed?
  - How does the customer wish to secure access to the application?
  - Etc…
- Information from the Site-Assessment will be entered as answers to deployment questions

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Deployment Components
Site Assessment

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- Additionally, we will obtain information about their AWS Environment
  - Does the customer/company have an AWS account and experience with AWS?
  - Where the Empower application is to be deployed, AWS Region(s) and local sites?
  - How has the customer configured their network topology?
  - How is the customer connecting on premise resources to their AWS VPC?
  - Has the customer identified how they are going to provide access to AD services in the cloud?
  - How does the customer plan to monitor activity of AWS resources?
  - Etc…
- Waters will act as a trusted advisor to help the customer with these and other questions

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Empower Cloud Deployment Workflow

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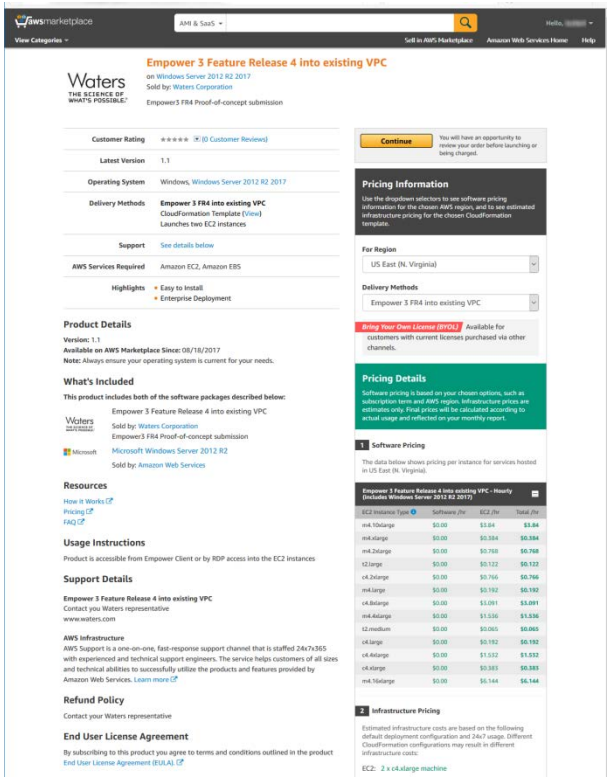
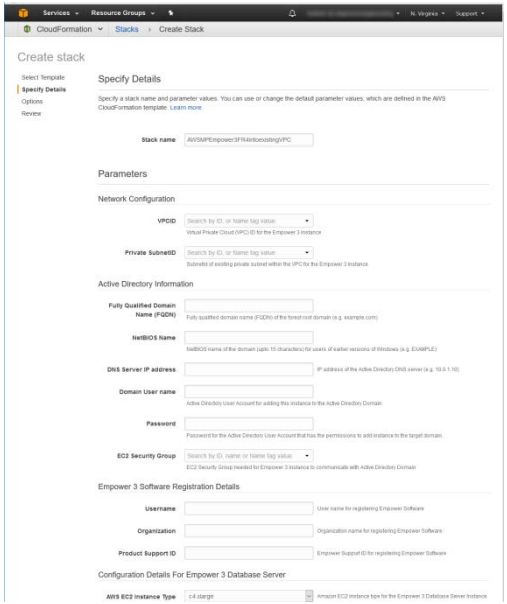


1. Go to publication on AWS Marketplace
2. Select region to deploy into
3. Launch Waters Empower Cloud template through AWS Marketplace



4. Provide deployment details
5. Empower Application stack is NOW deployed

   Continue deployment like traditionally performed….

6. License and launch Empower configuration manager
7. Manually deploy AWS Workspaces
8. Manually deploy on-premise LAC/E^{32} nodes

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Deployment Components
Behind-the-scenes: Instance Provisioning Details

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- Base Instance launched from source AMI published by Waters
- Instance is configured with custom
  - Machine Name
  - Domain Membership
  - IP Address
  - Volume sizes
  - Security groups
  - Key pair
- Instance is prepared with pre-requisites for Empower software being deployed
- Empower Software is silently installed
- The entire build can be monitored through the cloud formation service
- Instance creation is completed

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Amazon Workspaces
Empower Client Components

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- Virtual Desktops are deployed through Amazon Workspaces
- Workspaces can be created from COTS template or by customer customized workspace bundles
- Flexibility in deploying Empower Client and Instrument Driver Software
  - Leverage existing Systems Management Tools
  - Natively installed as part of a Workspace bundle
- Administrators can manage workspaces like any traditional desktop

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Empower in Cloud DR Data Management

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- The Empower Database is configured on installation to perform a RMAN database backups nightly along with the Raw Data Files
- It is the customers responsibility to copy the backups off of the server using 3rd party backup software and tools for DR
- Those practices should certainly continue with an Empower Cloud deployment
- Alternatively we can take advantage of the existing AWS cloud based services and options to perform and maintain the DR Backups
- This DR backup example will utilize the AWS S3 object storage

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S3 Simple Storage Service

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- Object-based storage built to store and retrieve any amount of data from anywhere
- Uses the same scalable object storage technology originally developed for their e-commerce
- Designed from the ground up to deliver 99.999999999% of durability
- S3 supports security standards and compliance certifications, including PCI-DSS, HIPAA/HITECH, FedRAMP, EU Data Protection Directive, and FISMA
- Supports AES 256 encryption
- Query in place analytics
- S3 is supported by tens of thousands of consulting, systems integrator, and independent software vendor partners, with more joining all the time
- Automatically distributed across a minimum of three physical Availability Zones (AZs)
- Available globally, should you have access.

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Empower in Cloud DR Data Management

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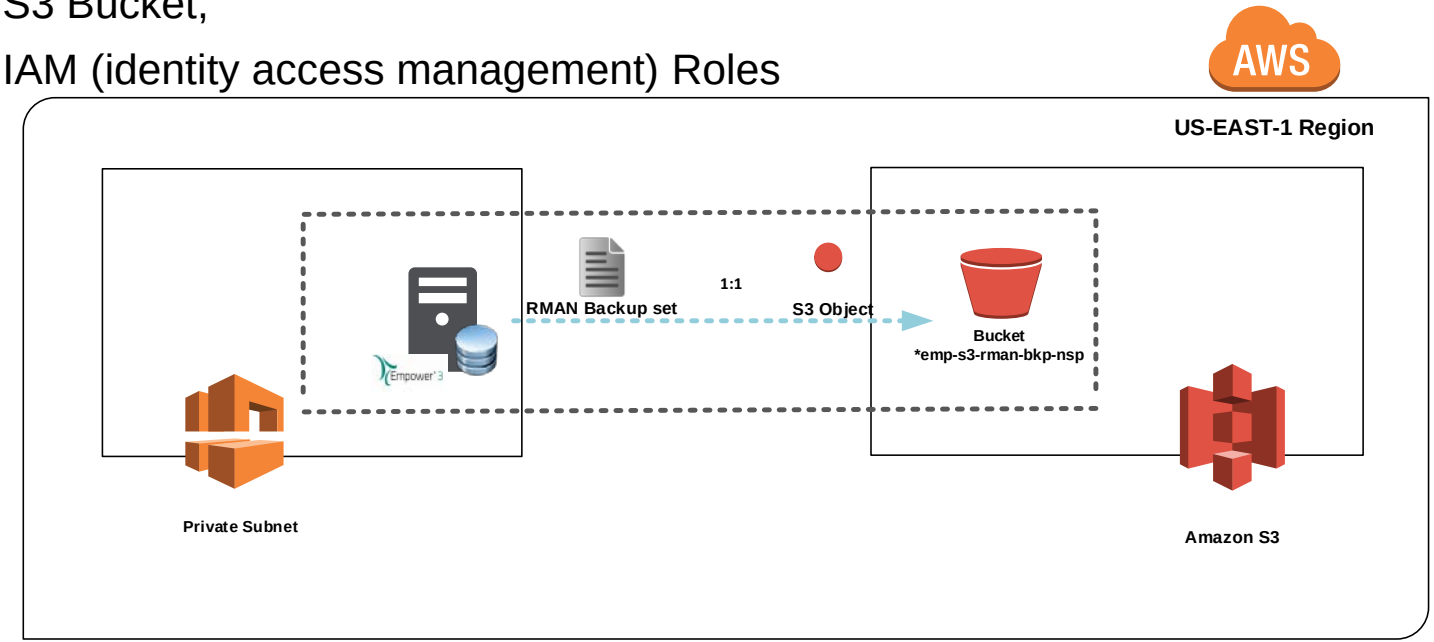
- Automated Empower Database RMAN Backup Transfer to S3 Storage
  - Leverages AWS powershell tools
  - S3 Bucket,
  - IAM (identity access management) Roles



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Empower in Cloud DR Data Management

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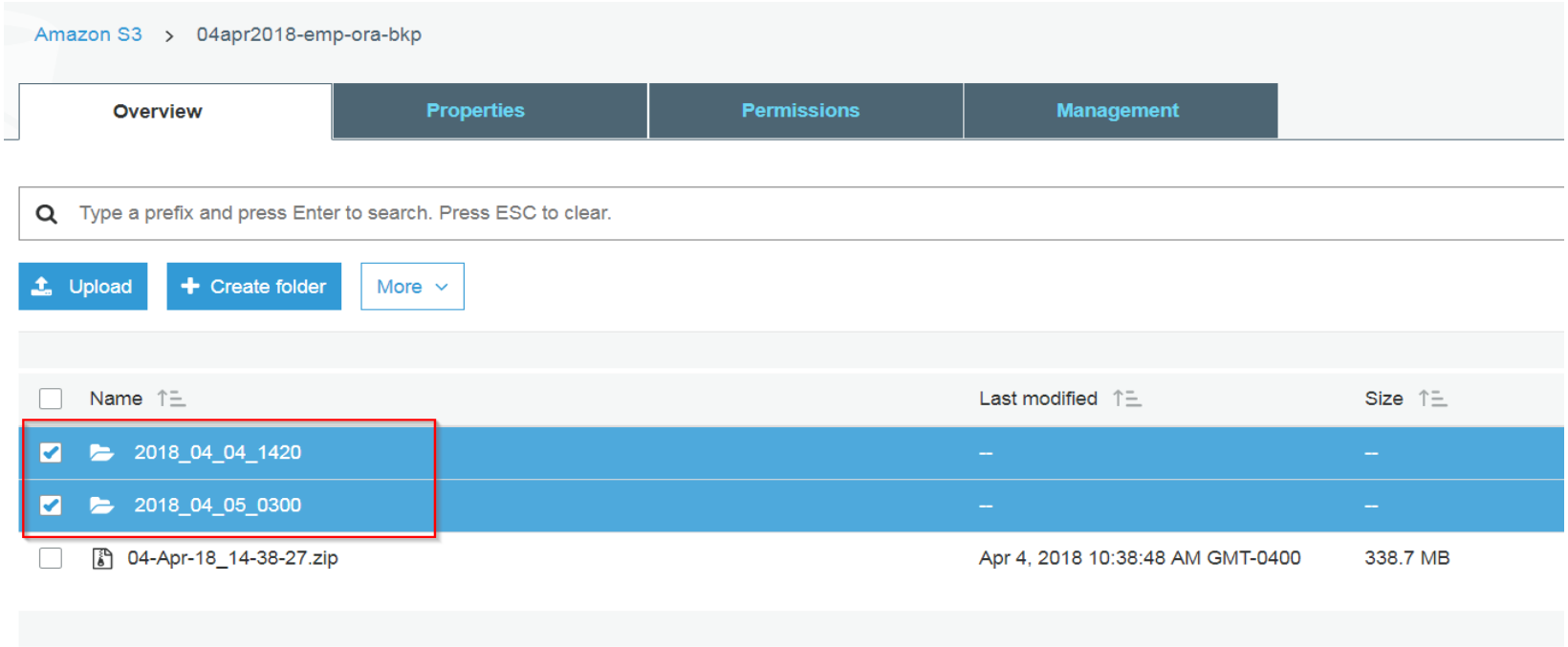

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Empower in Cloud DR Data Management

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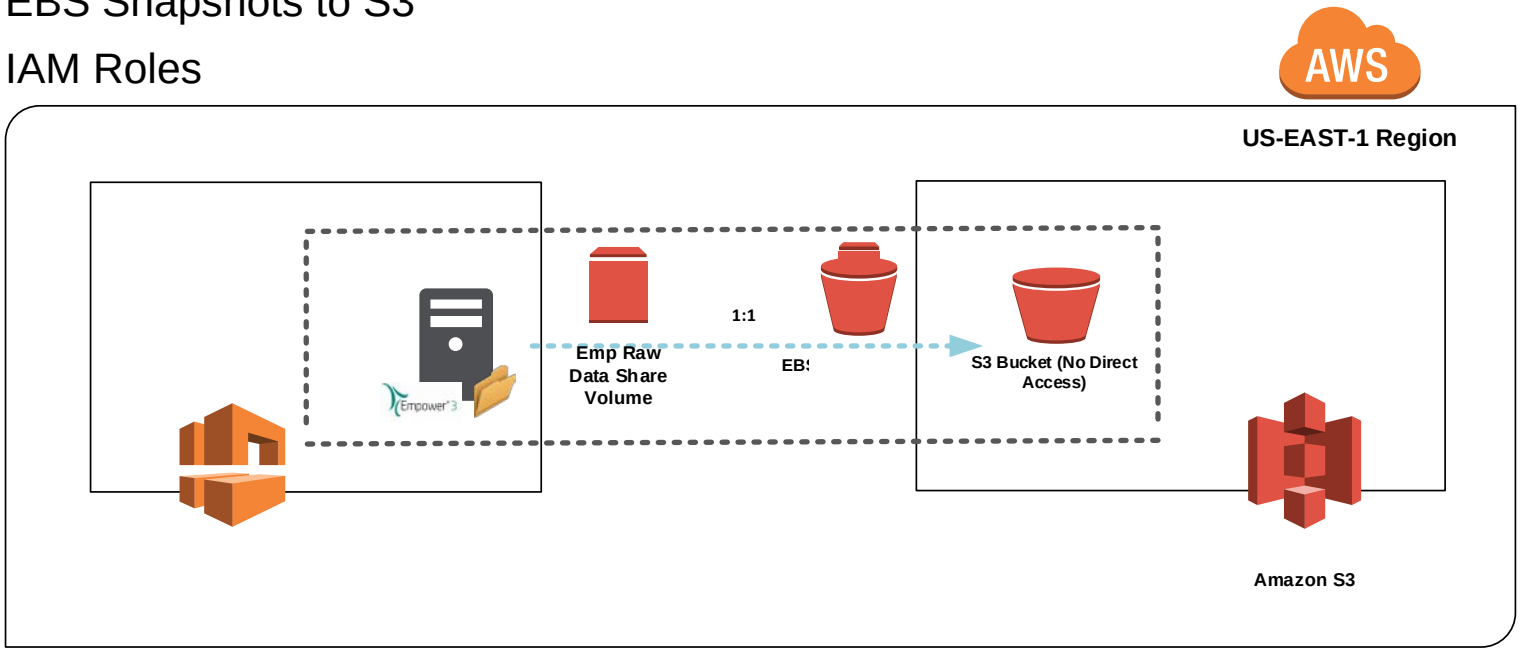
- Automated EBS Snapshots of Empower Raw Data File Share(s)
  - Leverages AWS CLI,
  - EBS Snapshots to S3
  - IAM Roles



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Empower in Cloud DR Data Management

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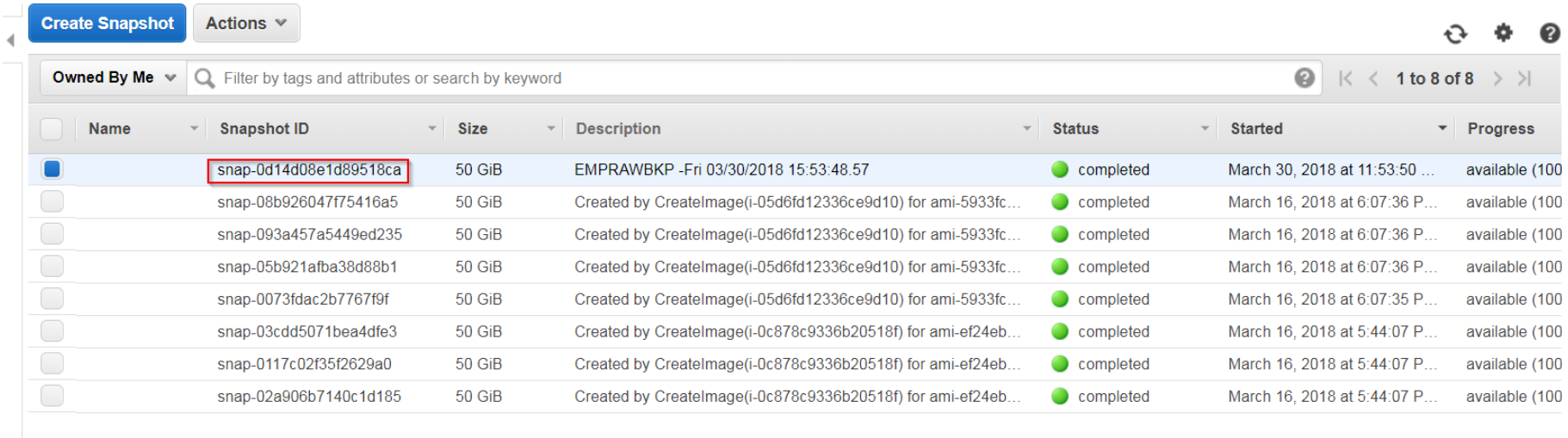

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