Federal GIS Conference
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Using ArcGIS for Server in the Amazon Cloud

Bonnie Stayer, Esri

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Session Outline

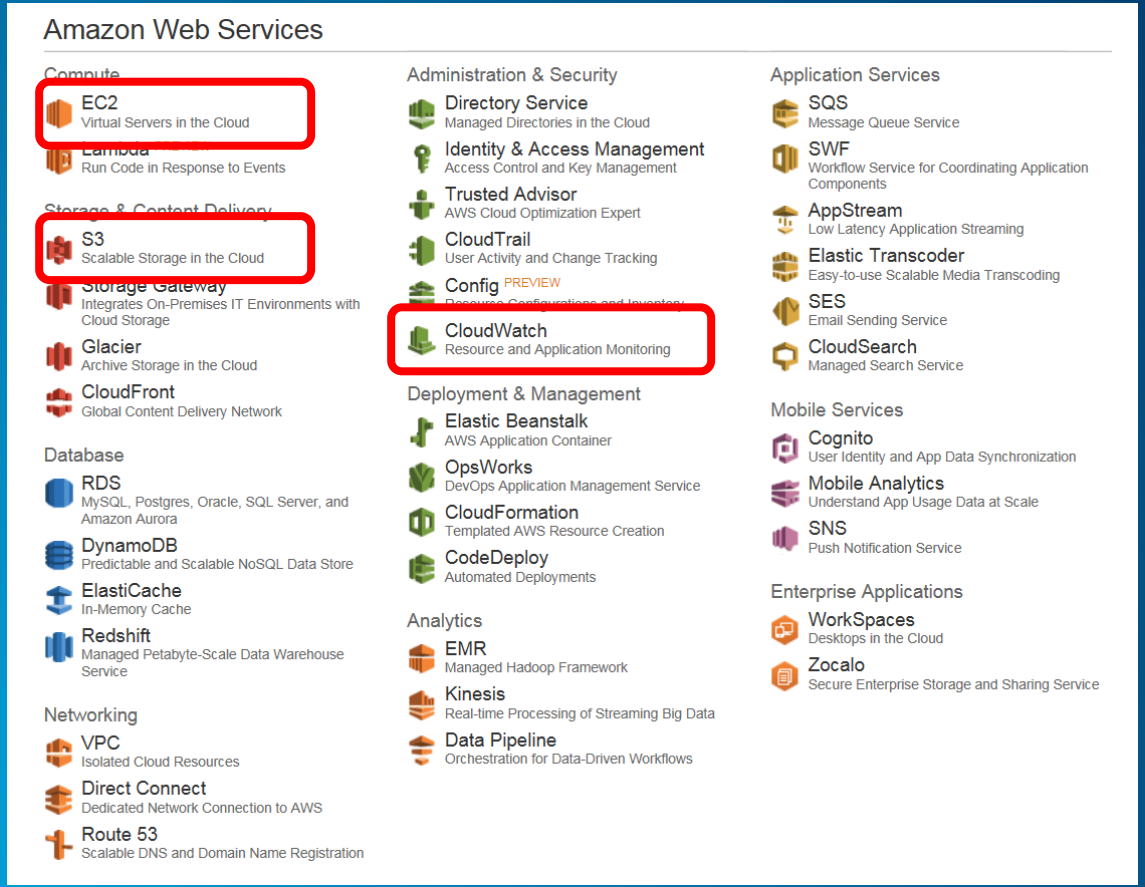
- AWS Overview
- ArcGIS in AWS
- Cloud Builder
- Benefits
- Security
- Case Study from Blue Raster

AWS Overview

Utility Computing

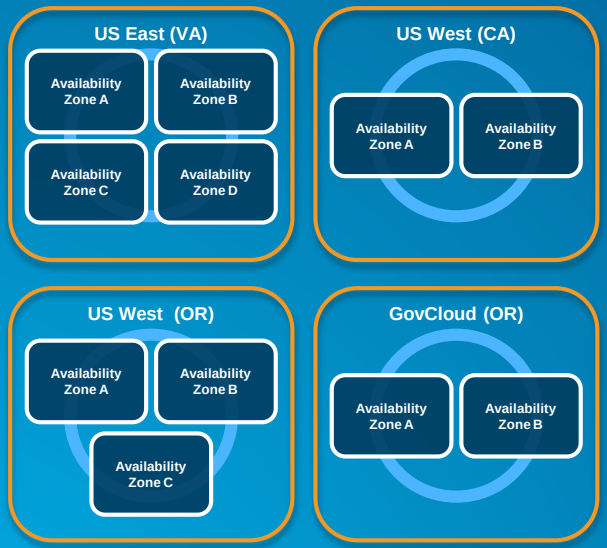
ON DEMAND
UNIFORM
PAY AS YOU GO
AVAILABLE

ON DEMAND
UNIFORM
PAY AS YOU GO
AVAILABLE

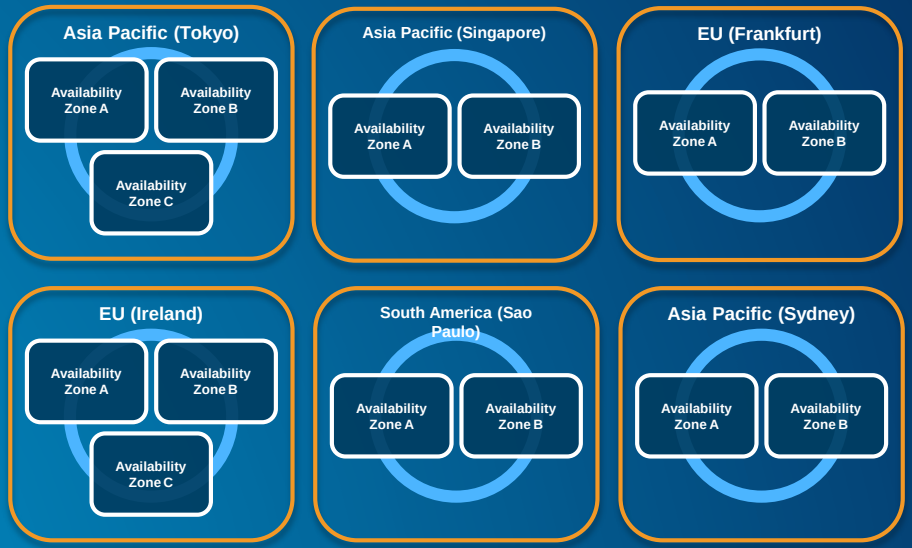

Amazon Web Services
Compute
EC2
Virtual Servers in the Cloud
Lambda
Run Code in Response to Events
Storage & Content Delivery
S3
Scalable Storage in the Cloud
Storage Gateway
Integrates On-Premises IT Environments with Cloud Storage
Glacier
Archive Storage in the Cloud
CloudFront
Global Content Delivery Network
Database
RDS
MySQL, Postgres, Oracle, SQL Server, and Amazon Aurora
DynamoDB
Predictable and Scalable NoSQL Data Store
ElastiCache
In-Memory Cache
Redshift
Managed Petabyte-Scale Data Warehouse Service
Networking
VPC
Isolated Cloud Resources
Direct Connect
Dedicated Network Connection to AWS
Route 53
Scalable DNS and Domain Name Registration
Administration & Security
Directory Service
Managed Directories in the Cloud
Identity & Access Management
Access Control and Key Management
Trusted Advisor
AWS Cloud Optimization Expert
CloudTrail
User Activity and Change Tracking
Config PREVIEW
CloudWatch
Resource and Application Monitoring
Deployment & Management
Elastic Beanstalk
AWS Application Container
OpsWorks
DevOps Application Management Service
CloudFormation
Templated AWS Resource Creation
CodeDeploy
Automated Deployments
Analytics
EMR
Managed Hadoop Framework
Kinesis
Real-time Processing of Streaming Big Data
Data Pipeline
Orchestration for Data-Driven Workflows
Application Services
SQS
Message Queue Service
SWF
Workflow Service for Coordinating Application Components
AppStream
Low Latency Application Streaming
Elastic Transcoder
Easy-to-use Scalable Media Transcoding
SES
Email Sending Service
CloudSearch
Managed Search Service
Mobile Services
Cognito
User Identity and App Data Synchronization
Mobile Analytics
Understand App Usage Data at Scale
SNS
Push Notification Service
Enterprise Applications
WorkSpaces
Desktops in the Cloud
Zocalo
Secure Enterprise Storage and Sharing Service

10 AWS Regions
30+ AWS Edge Locations

US Regions



Global Regions



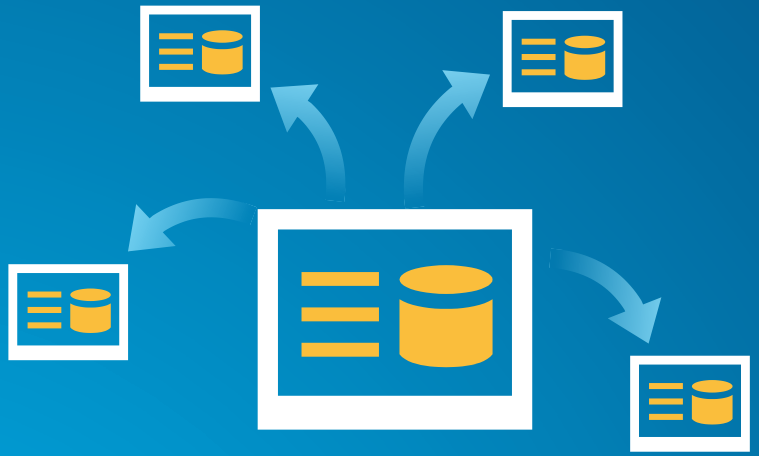
Note: Conceptual drawing only. The number of Availability Zones may vary.

Virtual machines (instance types) optimized for:

- **General purpose**
- **Compute**
- **GPU**
- **Memory**
- **Storage**

Elastic Block Storage (EBS)

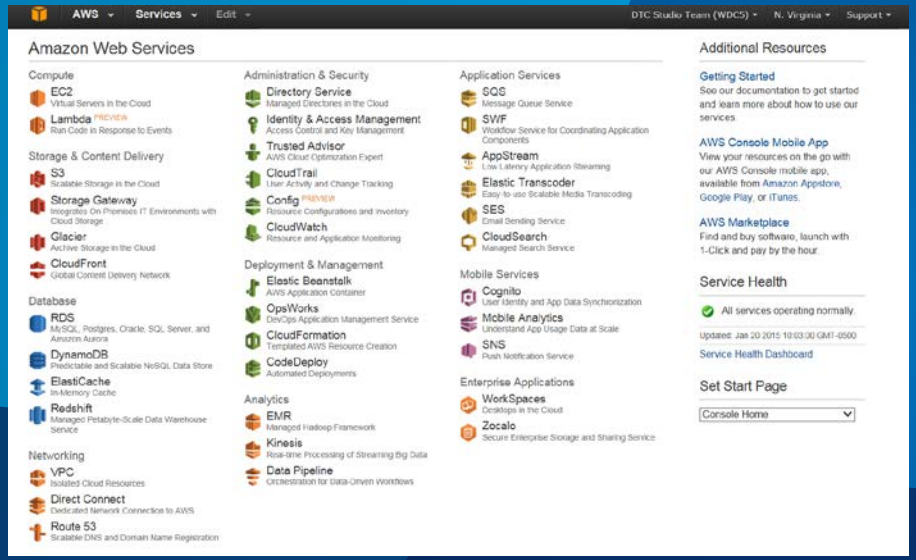
- Storage volumes can be attached to EC2 instances
- Can be detached and preserved separately



Amazon Machine Image (AMI)

Preconfigured with:

- **Operating system**
- **Architecture (32-bit or 64-bit)**
- **Storage**
- **Applications (i.e. ArcGIS)**



AWS Management Console

Demo

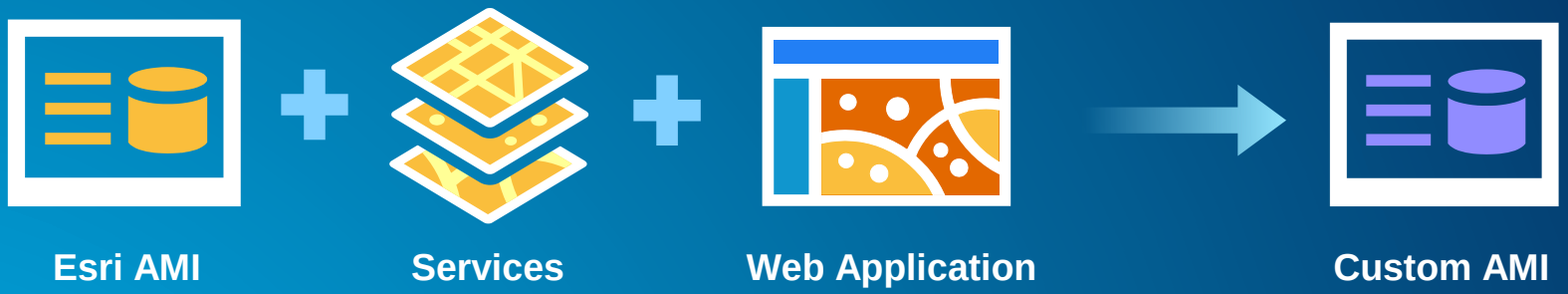
ArcGIS in AWS

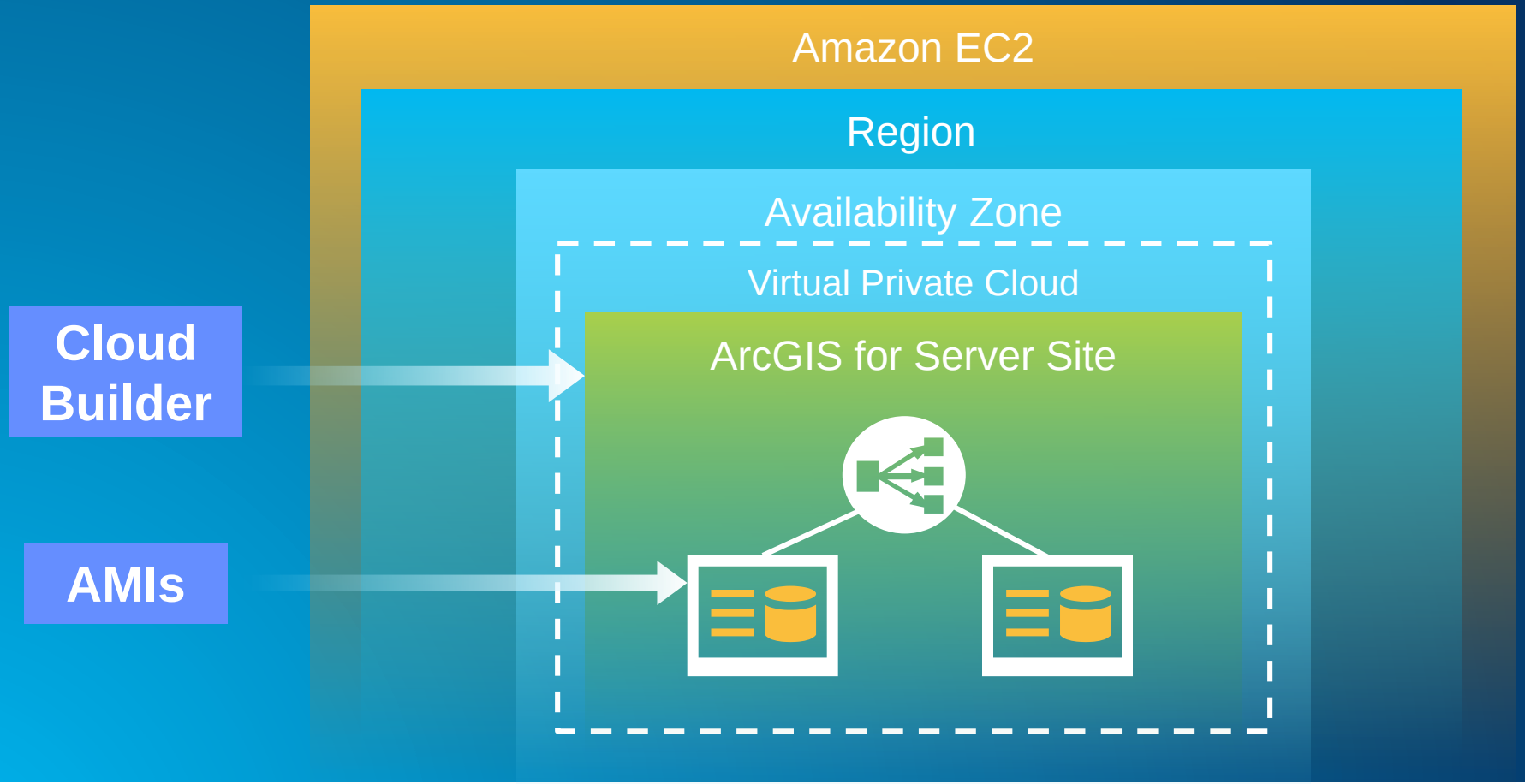
Desktop
Web
Device
ArcGIS Online
/ Portal
Server
Online Content
and Services

Ubuntu with PostgreSQL

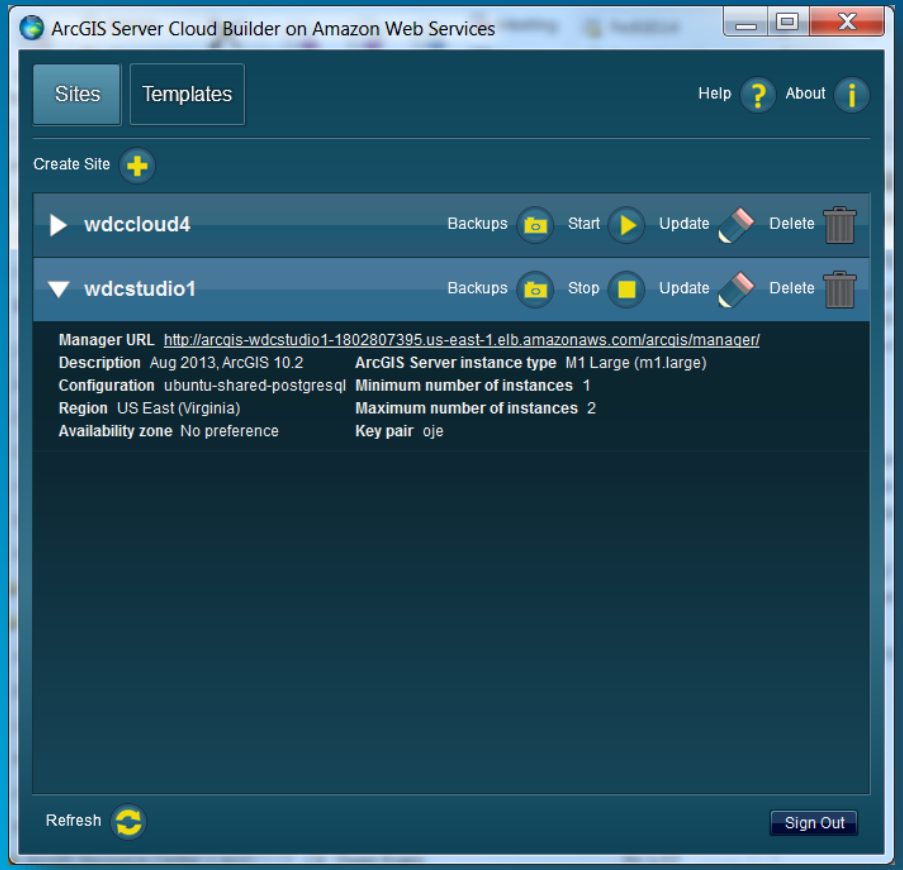
Windows Server with SQL Server

Windows Server with SQL Express


Esri AMI
Services
Web Application
Custom AMI


Amazon EC2
Region
Availability Zone
Virtual Private Cloud
ArcGIS for Server Site
Cloud Builder
AMIs

Cloud Builder



- **Create new sites**
- **Create custom sites**
- **Manage sites**
- **Make backups**

- Applies the Server license file
- Optionally set up a database in a separate instance
- Creates the PSA account
- Creates an elastic load balancer and puts all the server instances under it
- Sets up a common configuration store, server directories, etc. for all instances
- Provides auto-scaling options

Cloud Builder

Demo

1. **Initial setup**
   a. **Sign up for an Amazon Account**
   b. **Send AWS account # to service@esri.com**
   c. **Get Cloud Builder (http://my.esri.com)**

1. Initial setup
2. Deploy site using Cloud Builder

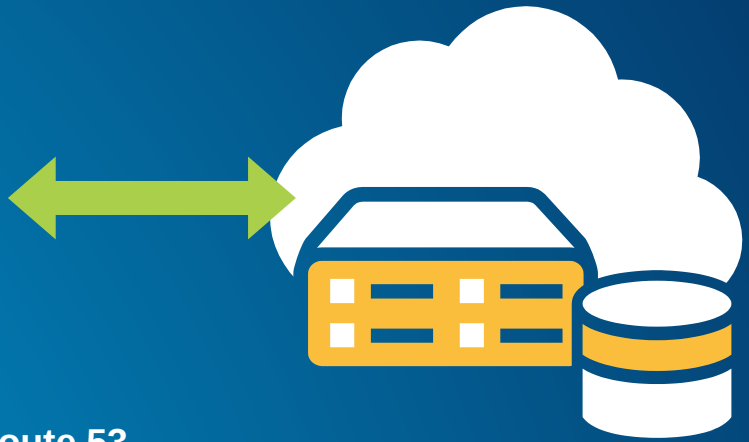
1. Initial setup
2. Deploy site using Cloud Builder
3. Publish Services
    a. Copy/replicate data to server (optional)
    b. Publish services

1. Initial setup
2. Deploy site using Cloud Builder
3. Publish Services
4. Create web maps/apps

Benefits

- **Can help you optimize…**
  - **Setup Time**
  - **Scalability**
  - **Cost**

- **Machine cost**
  - Instance size and type
  - Storage
  - Bandwidth
- **Other costs**
  - Extra storage: S3, CloudFront
  - Elastic Load Balancer, Elastic IP, Route 53
  - Monitoring: CloudWatch



- **Running Servers (includes OS licensing):**
  - On Demand – hourly rate
  - Reserved Instance – upfront charge, reduced hourly rate

- **Storing Data (per month):**
  - Transfer in to AWS: free
  - Transfer out from AWS: sliding scale (1 GB free, then $0.12/GB max)
  - EBS Storage: $0.10 / GB of volume size

- 1 Windows Large Instance
- On-Demand Pricing (per hour, no upfront)
- US East (Northern VA)

24 x 365

x $0.266/hr

$2330.16/yr

- **Reserved Instance Pricing**
- **Heavy Utilization (always on)**

$602 +

24 x 365

x $0.106/hr

$1530.56/yr

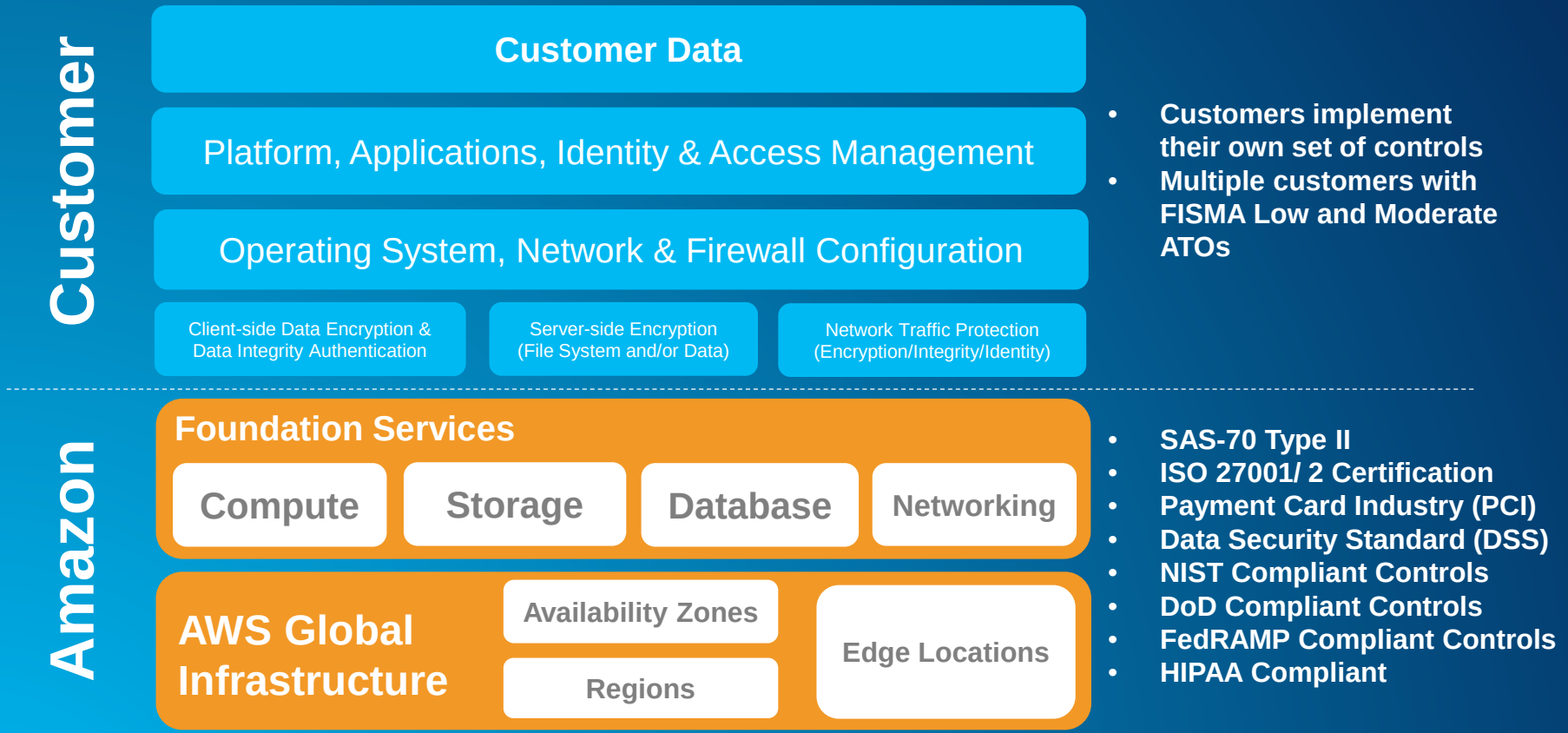
- Add a server for a week
- On-Demand Pricing (per hour, no upfront)
- US East (Northern VA)

24 x 7

x $0.266/hr

$44.69/wk

Security


Customer
Customer Data
Platform, Applications, Identity & Access Management
Operating System, Network & Firewall Configuration
Client-side Data Encryption & Data Integrity Authentication
Server-side Encryption (File System and/or Data)
Network Traffic Protection (Encryption/Integrity/Identity)
Amazon
Foundation Services
Compute
Storage
Database
Networking
AWS Global Infrastructure
Availability Zones
Regions
Edge Locations
• Customers implement their own set of controls
• Multiple customers with FISMA Low and Moderate ATOs
• SAS-70 Type II
• ISO 27001/ 2 Certification
• Payment Card Industry (PCI)
• Data Security Standard (DSS)
• NIST Compliant Controls
• DoD Compliant Controls
• FedRAMP Compliant Controls
• HIPAA Compliant

Dedicated Instances

Single Tenant Physical Nodes

Run your virtualized operating systems and apps in a “single tenant per physical node” model within the AWS infrastructure

Security Groups

Instance firewalls

Firewall control on instances via Security Groups

CLIs and APIs

Instantly audit your entire AWS infrastructure from scriptable APIs – generate an on-demand IT inventory enabled by programmatic nature of AWS

VPC

Subnet control

Create low level networking constraints for resource access, such as public and private subnets, internet gateways and NATs

Bastion hosts

Only allow access for management of production resources from a bastion host. Turn off when not needed

Direct Connect & VPN

Private connections to VPC

Secured access to resources in AWS over software or hardware VPN and dedicated network links

GovCloud

- Available to U.S. federal, state, and local government clients, contractors, and educational institutions
- ITAR-compliant
- Supports CUI workloads
- More expensive
- Esri AMIs

Migrating the National Center for Education Statistics ArcGIS Servers to Amazon Web Services Cloud Hosting

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@amyrams

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BLUE RASTER

Topics Covered

- NCES ArcGIS Server platform
- Planning for operation in Amazon cloud
- Launching an Esri ArcGIS Server AMI
- Requirements for publishing a map service
- Monitoring and Backups
- Other Useful Amazon Web Services
- Lessons Learned

Background

National Center for Education Statistics (NCES)

- Primary federal entity for collecting and analyzing education data

- NCES uses the Esri ArcGIS platform to provide geospatial context to education data

STORY MAPS TOPICS PROGRAMS MAP VIEWERS HELP

map.ed

Educational Attainment Comparison of School Districts and the Nation

Compare school districts to the nation for ages 25 years and over in three levels of educational attainment: high school graduate (or equivalent) or higher, bachelor's degree or higher, and graduate or professional degree.

View Story

Educational Attainment

Enrollment in Public/Private School by Race

School Bullying

Assessment
Math Reading

Demographic
Age Ancestry
Language Place of Birth
Race Sex

Economic
Income Poverty

Employment
Commuting Status Occupation

Housing
Costs Mortgage
Rent Residence
Structure Value

Social
Citizenship Education
Family Household
Veteran

ACS
American Community Survey
Info Map

CCD
Common Core of Data
Info Map

IPEDS
Integrated Postsecondary Education Data System
Info Map

NAEP
National Assessment of Educational Progress
Info Map

PSS
Private School Universe Survey
Info Map

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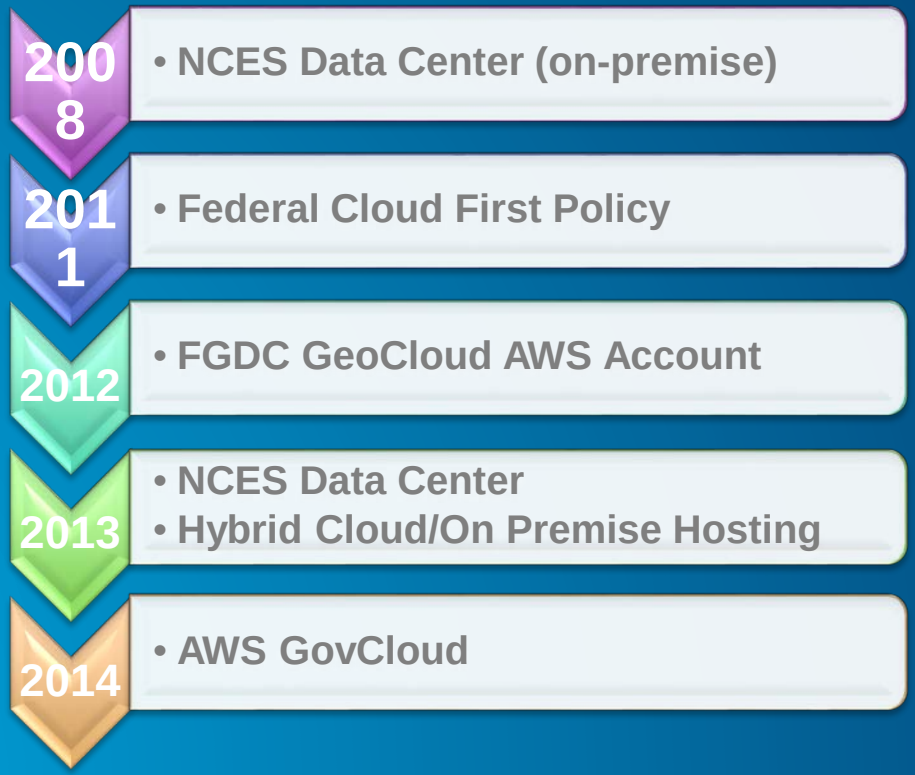
Progression of NCES ArcGIS Servers



esri

amazon web services™

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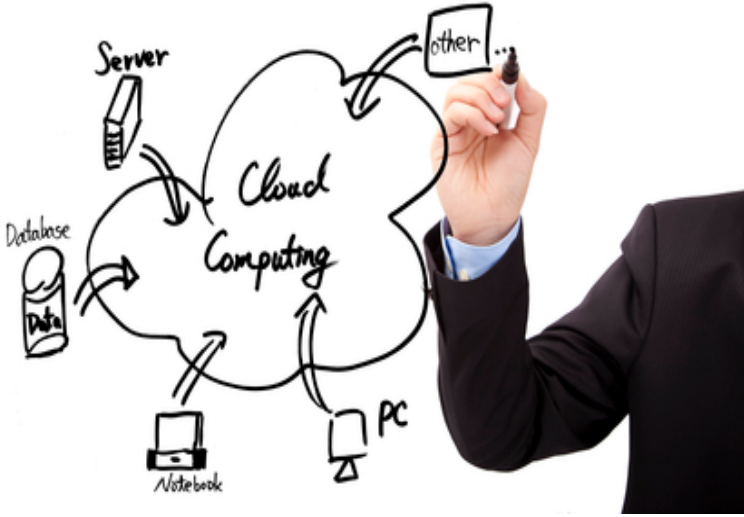
Planning



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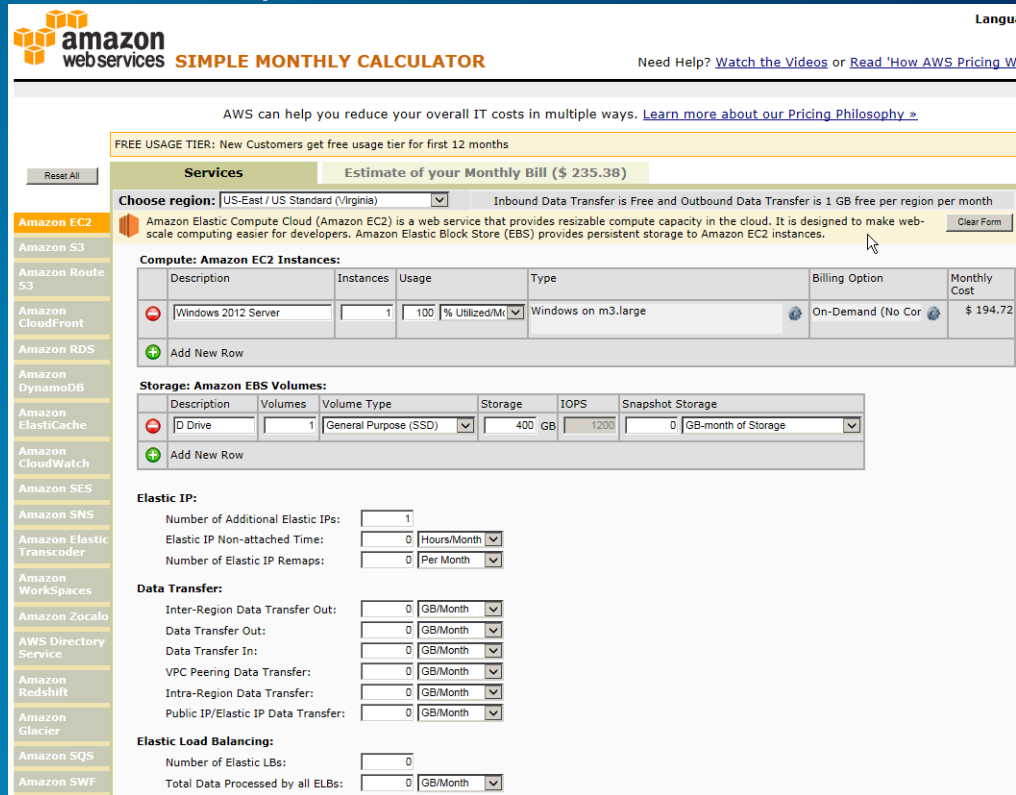
Costs to project for expansion

- Operating hours:
  - Use Reserved Instances
- VPC or Classic EC2
- Bring Your Own License for SQL Server/Oracle or other database
- ArcGIS licensing

http://calculator.s3.amazonaws.com/index.html



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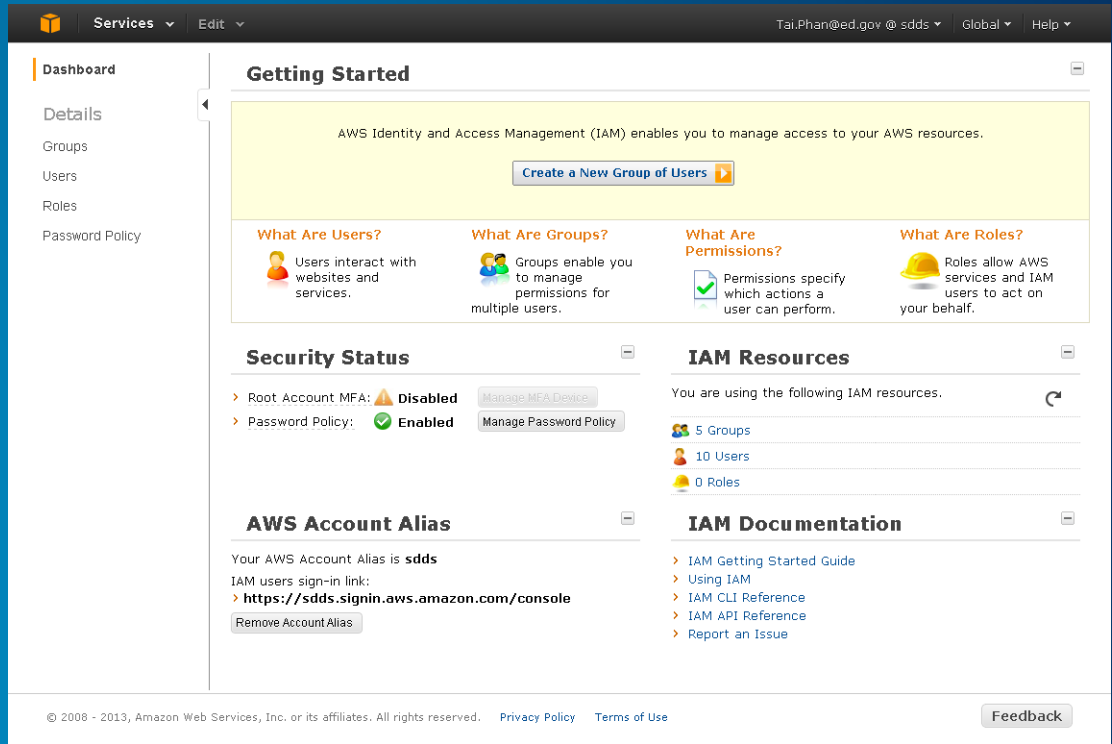
IAM Console Security

- Control users and groups within account
- Unique security credentials for access keys and login/passwords



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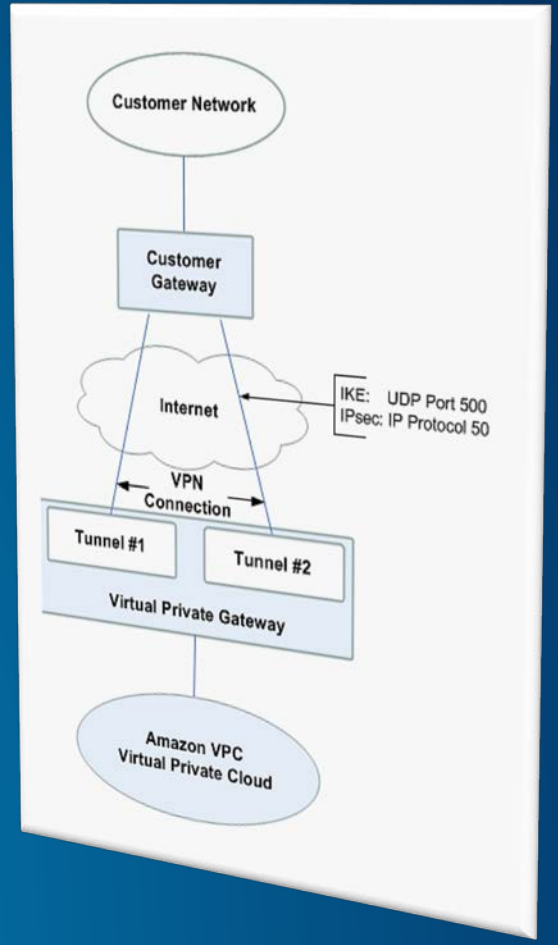
Amazon Virtual Private Cloud

1) Set Up the VPC and Internet Gateway
2) Create a Security Group for Your VPC
3) Launch an Instance into Your VPC
4) Assign an Elastic IP Address to Your Instance



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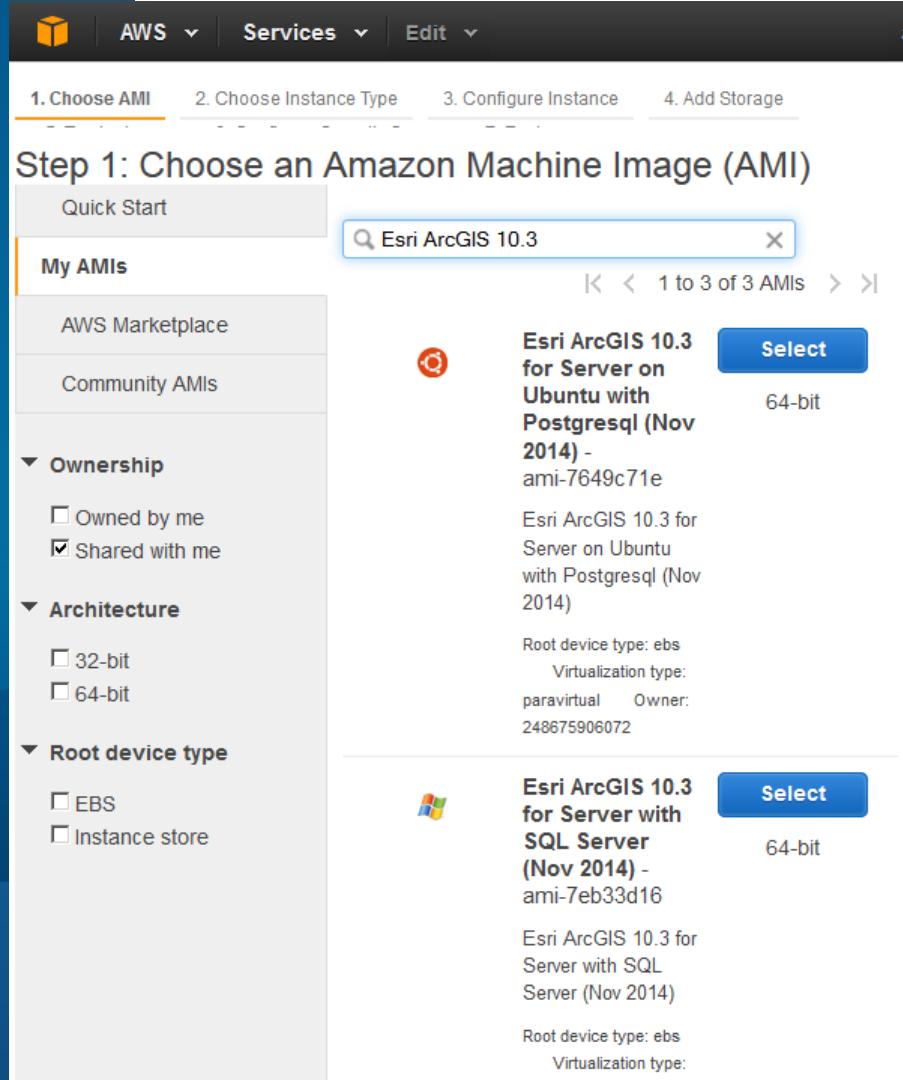
Launching an Esri AMI



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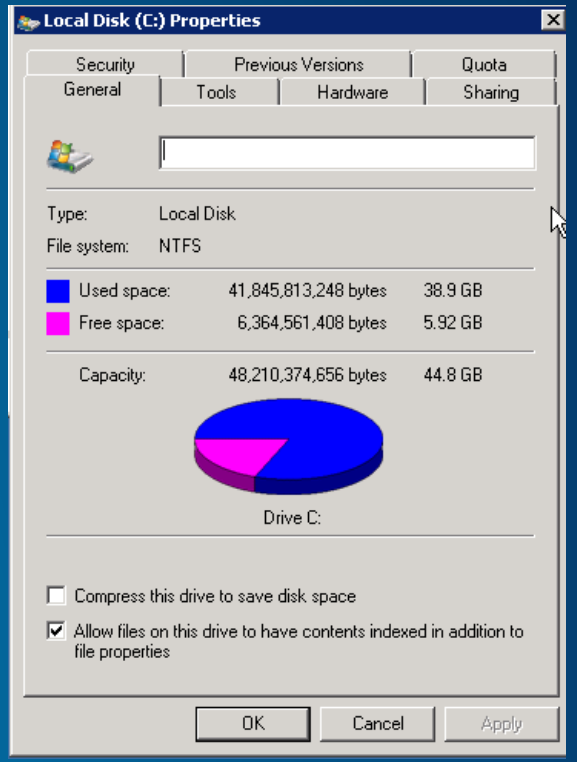
Disk Space

- ~ 40 GB taken by OS and Programs
- Good rule: keep 10% C Drive space free
- Easy to increase disk space

1) Take snapshot of existing volume
2) Create a new volume and resize it
3) Detach existing
4) Attach new and extend volume



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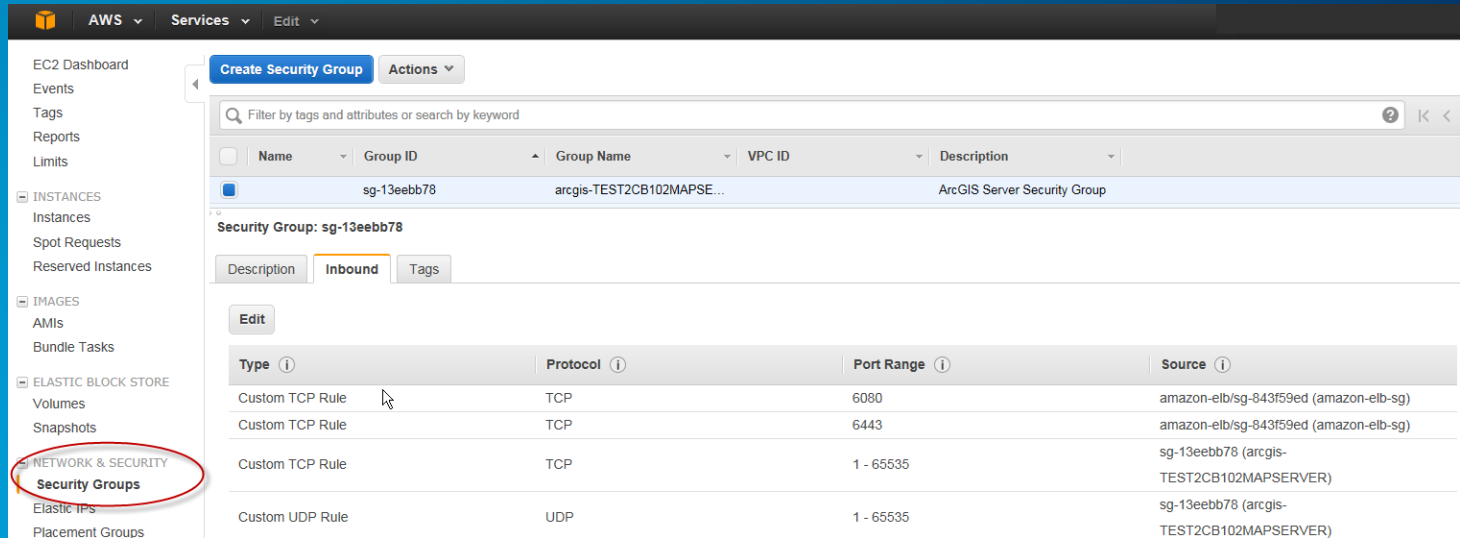
What Ports to Open on the Security Group?

- Web Adaptor or load balancer
- For Web Adaptor
  - Open Ports 80 and 443
  - Download from Esri Customer Care Portal



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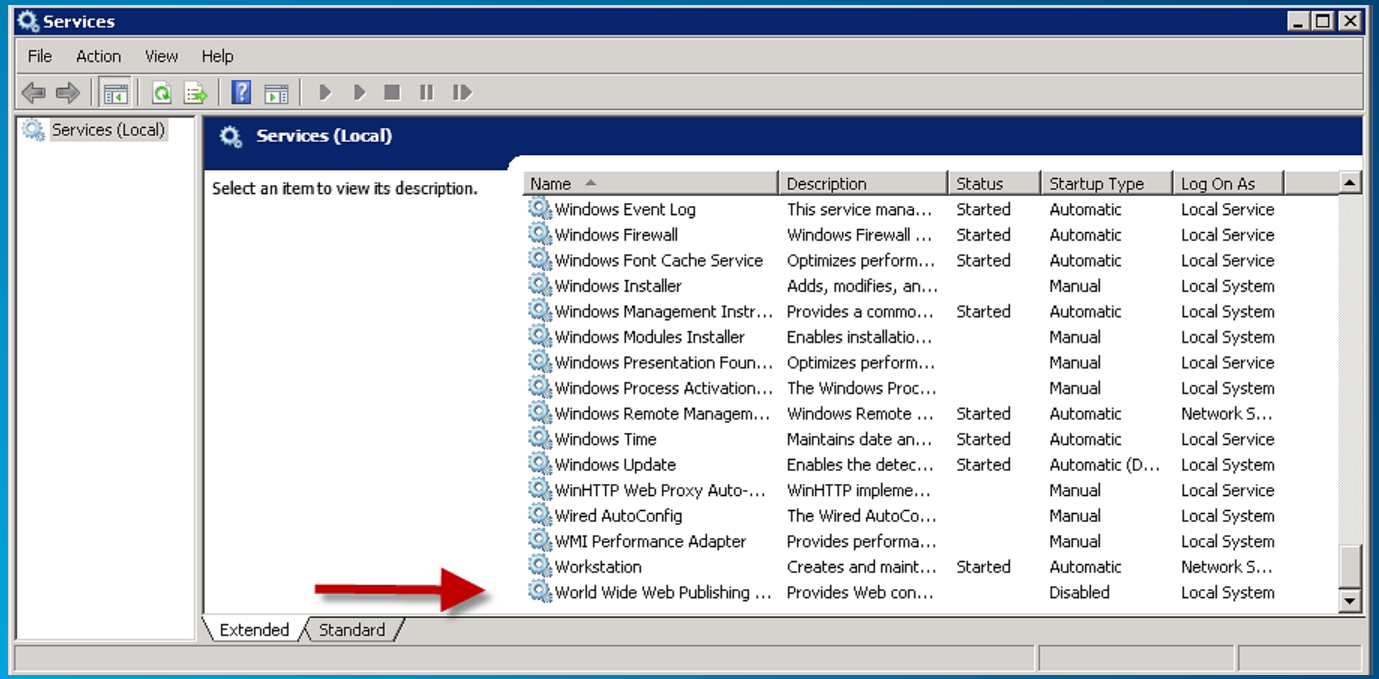
Start WWW service for Web Adaptor



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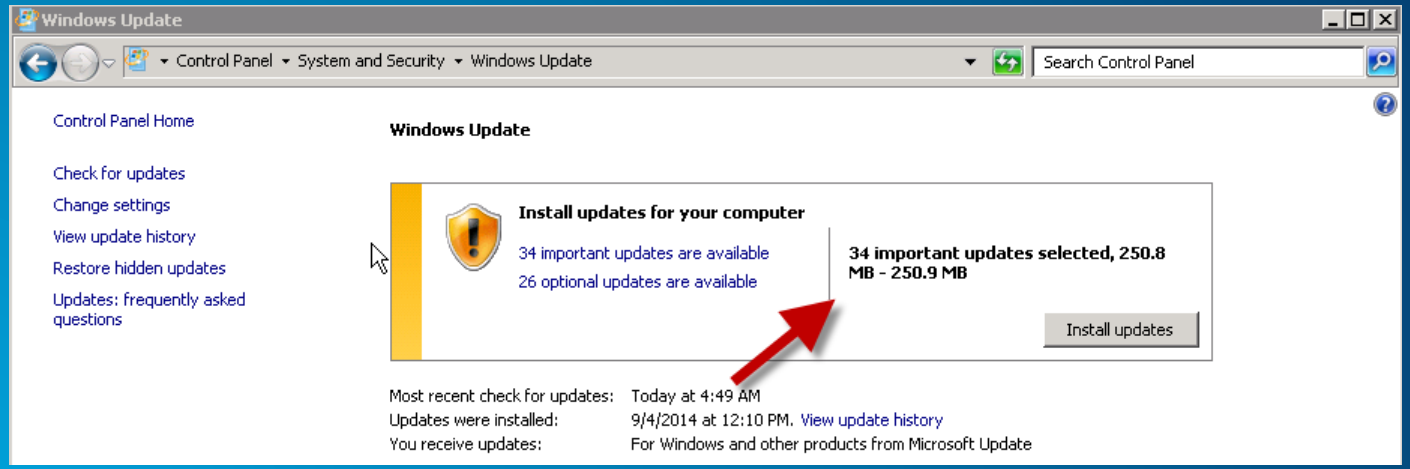
Apply Windows Updates



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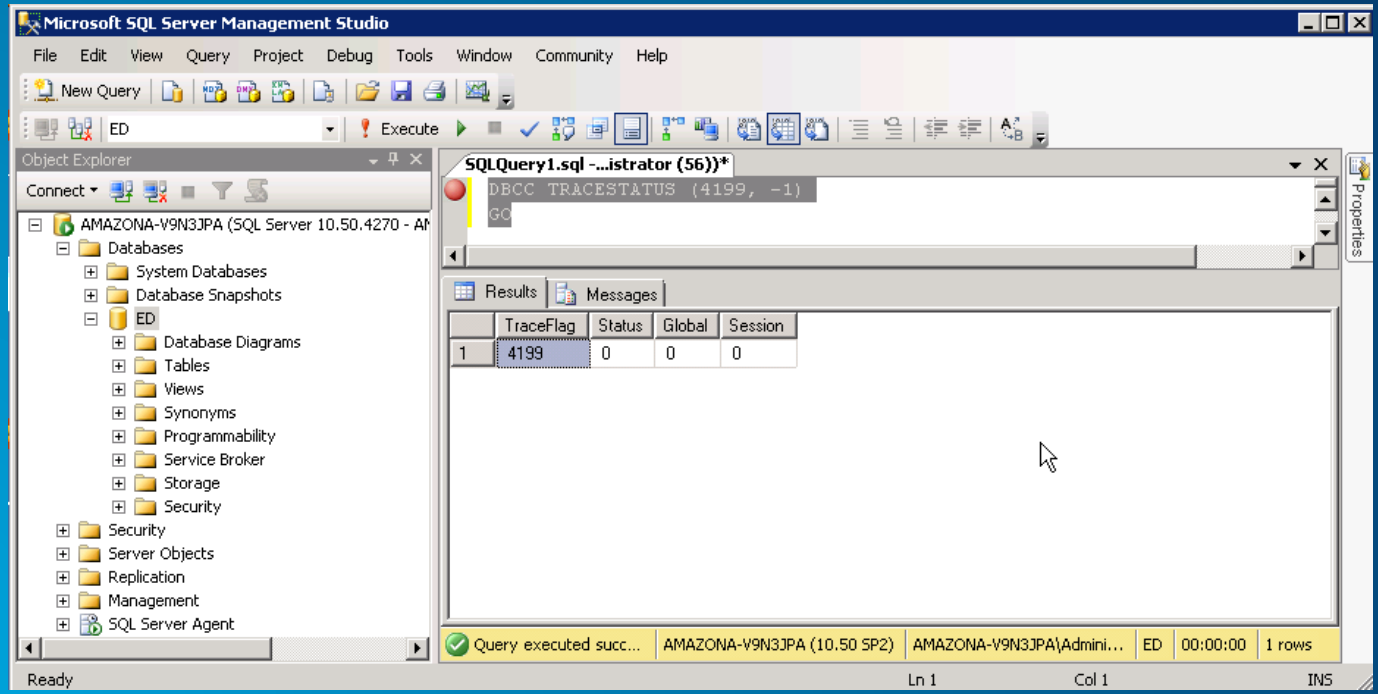
Apply Database Updates



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What do I need to publish a Map Service?

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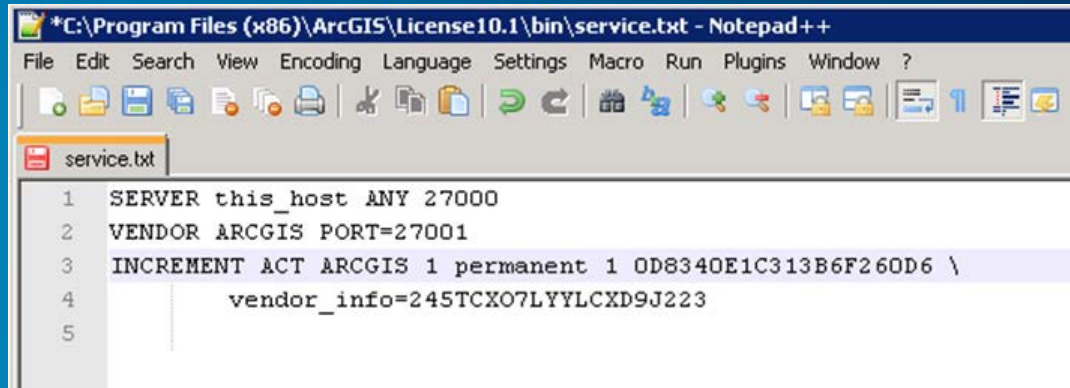
ArcGIS Desktop to administer and publish

- Publish with Desktop
  - Install on the server or
  - Connect from your computer

- License Manager on EC2
  - Lock down ports to 27000, 27001
  - Add to Security Group



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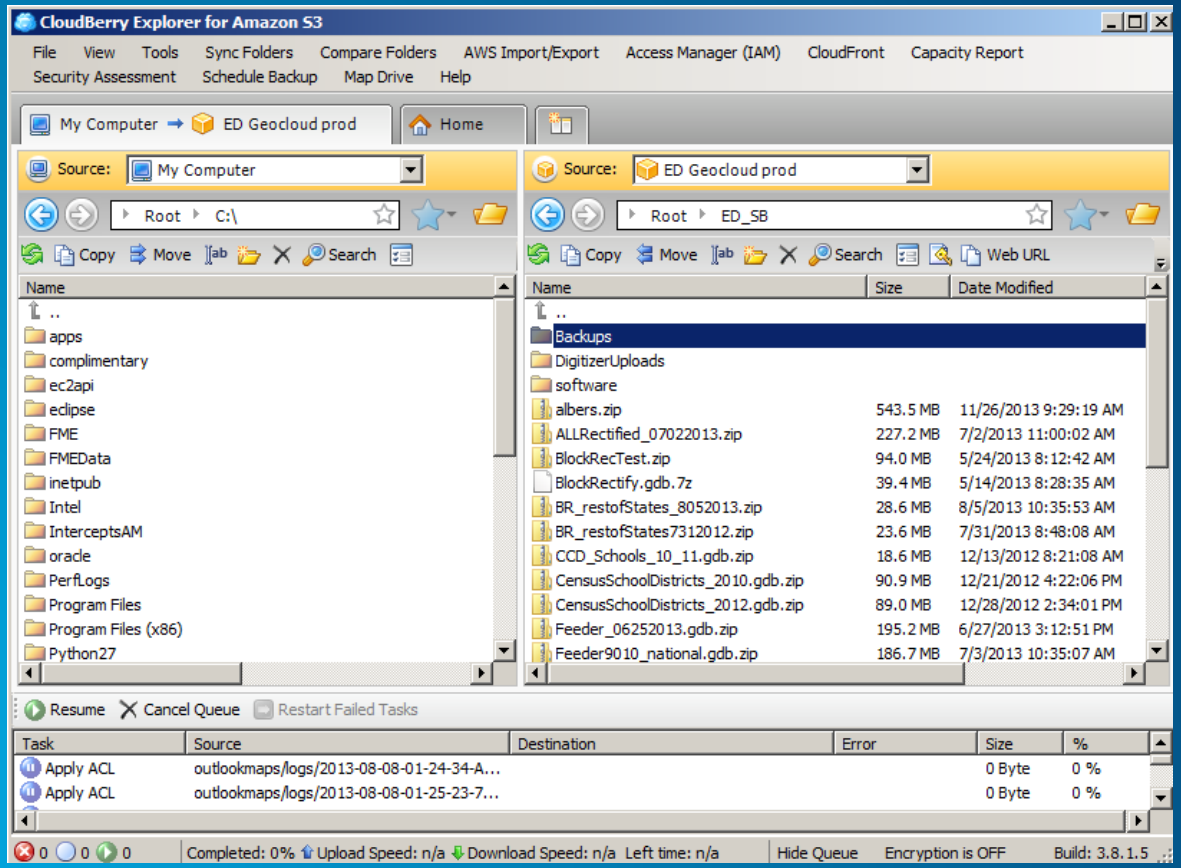
Migrate Data and MXDS to AWS S3 via CloudBerry



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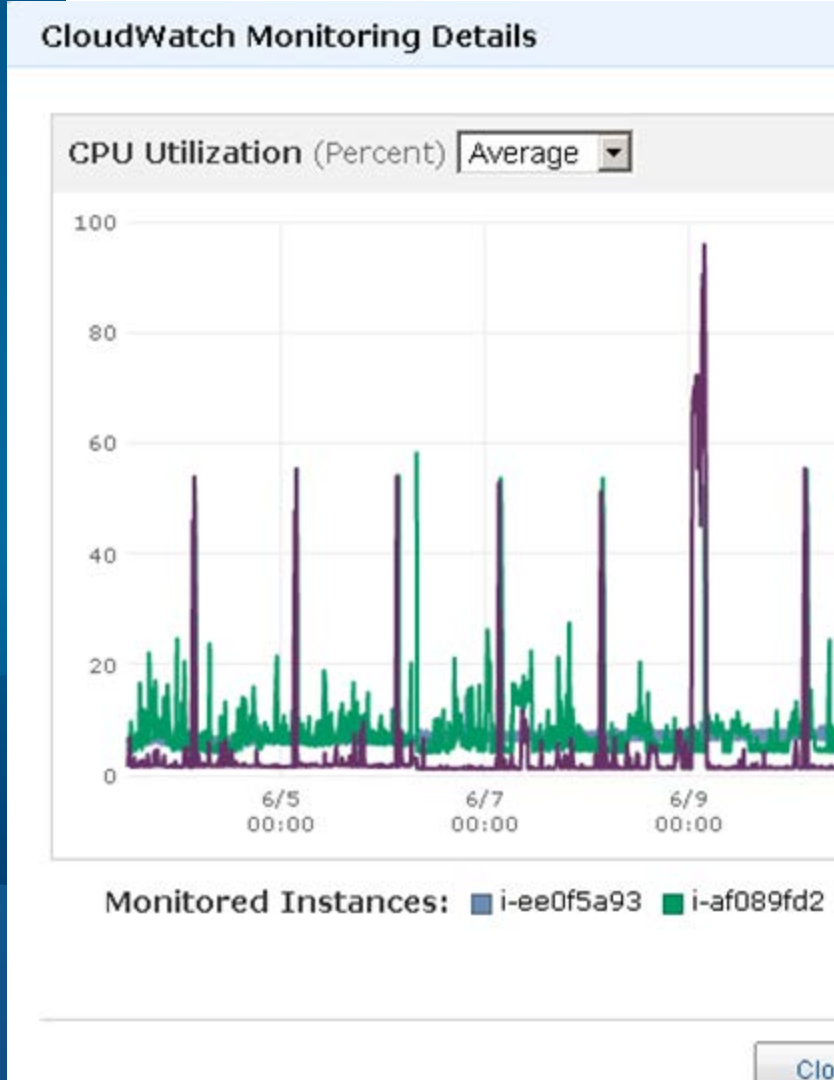
CloudBerry Explorer

Monitoring



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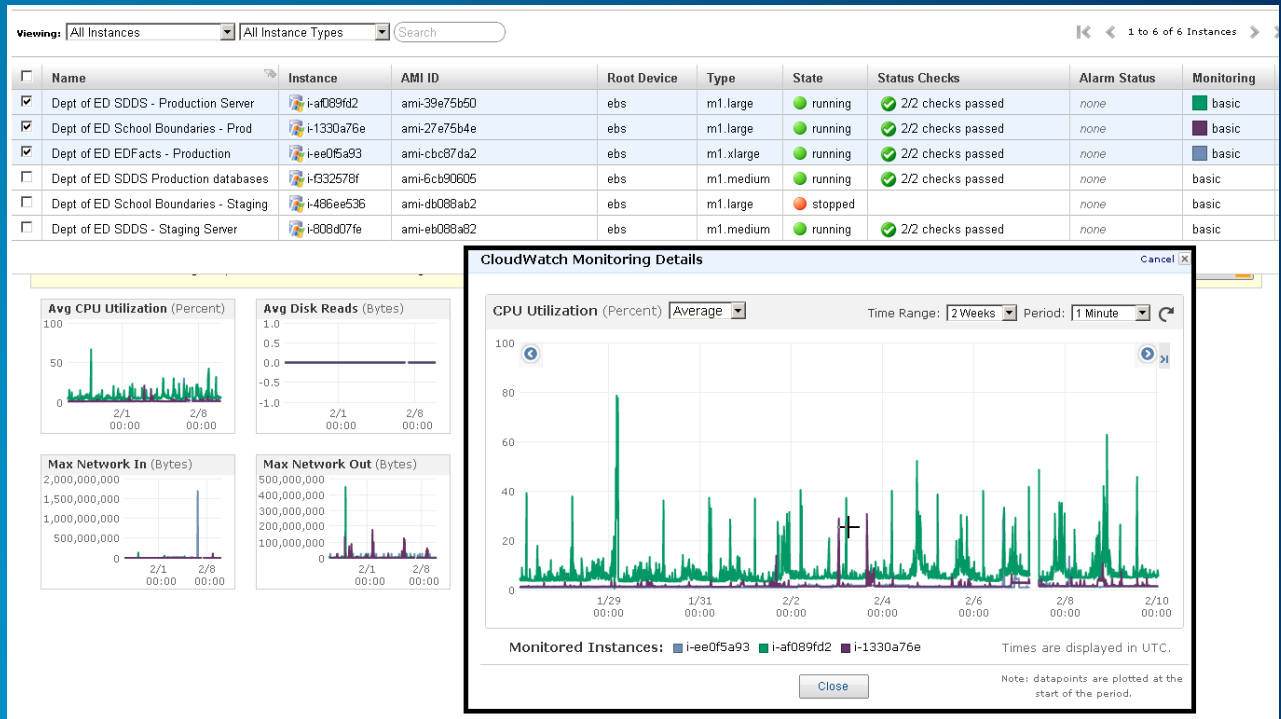
CloudWatch Metrics

1. Status Checks
   2/2 checks
2. Create alarms
3. Good server capacity planning tool



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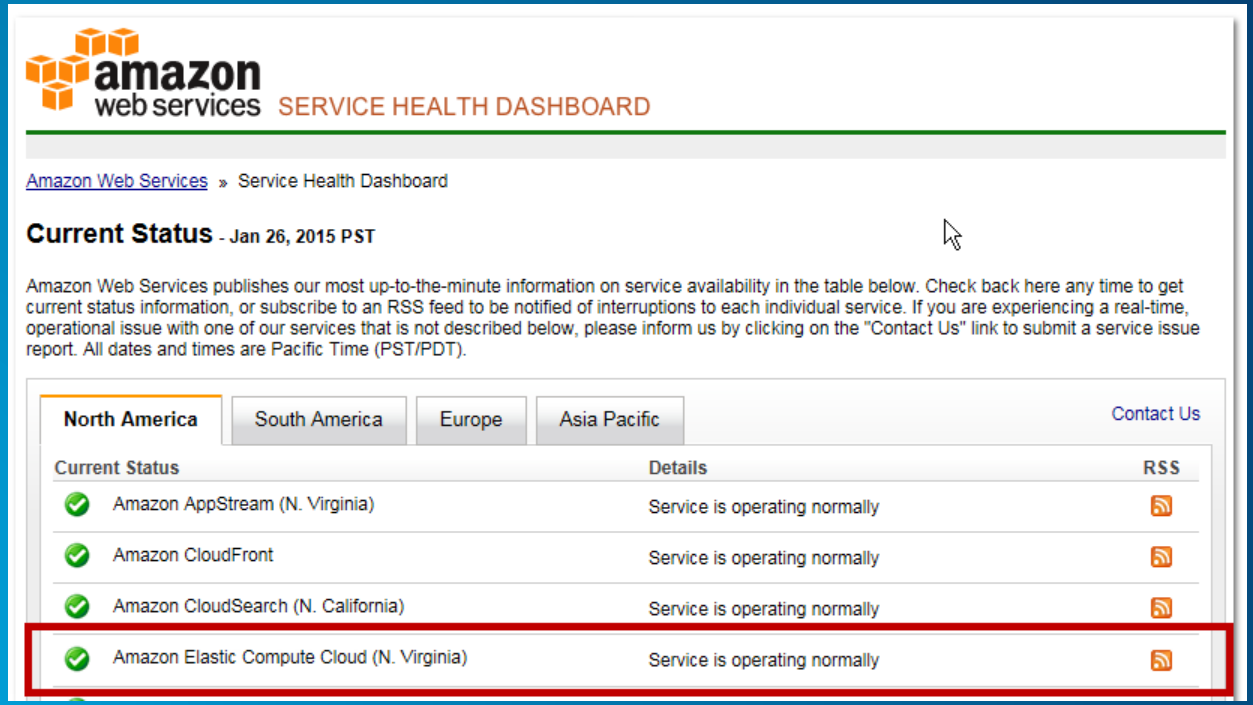
Amazon Service Health Dashboard

http://status.aws.amazon.com/



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Website Monitoring with Pingdom

https://www.pingdom.com/

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Instance Backup Strategy

Instance backups automated with Powershell scripts

- Daily volume snapshots and weekly AMIs
- Script cleans up snapshots and AMIs to reduce storage costs

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Frequently used Amazon Web Services

- Route 53 – hosted Domain Name server
- Cloudfront – Content delivery network for hosting your website on a global network of edge locations
- Simple Email Service (SES) – Email service instead of SMTP on EC2
- Simple Queue Service (SQS) - Message queuing service
- Simple Notification Service (SNS) – Push notifications to mobile devices by SMS text or email

Project Insights

- Esri's Amazon Machine Image for ArcGIS Server is a successful approach for a GIS platform.
- Work closely with IT group and know your security requirements
- Benefits of Cloud hosting
  1. Rapidly deploy/develop
  2. Reliable
  3. Flexible
     - Change configuration as needed

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Resources

- **Amazon EC2 - http://aws.amazon.com/ec2/?nc2=h_l3_c/**
- **ArcGIS for Server on AWS Help - http://server.arcgis.com/en/server/latest/cloud/amazon/amazon-quick-start-guide.htm**
- **Cloud Builder - http://server.arcgis.com/en/server/latest/cloud/amazon/overview-cloud-builder.htm**

- **Blue Raster:**
  - **http://www.blueraster.com/**
  - **Booth 519**

Upcoming Sessions

- **ArcGIS for Server: What's New**
  - **2:45pm – 3:45pm**
  - **Room 201**

- **Deploying ArcGIS Using Esri Managed Cloud Services**
  - **5:15pm – 6:15pm**
  - **Room 209B**

Understanding our world.