Federal GIS Conference 2014

February 10–11, 2014 | Washington DC

Leveraging ArcGIS in the Amazon Cloud

Bonnie Stayer, Esri

Amy Ramsdell, Blue Raster

Session Outline

- AWS Overview
- ArcGIS in AWS
- Cloud Builder
- Benefits
- Security
- Case Study: Blue Raster and Dept. of Ed.

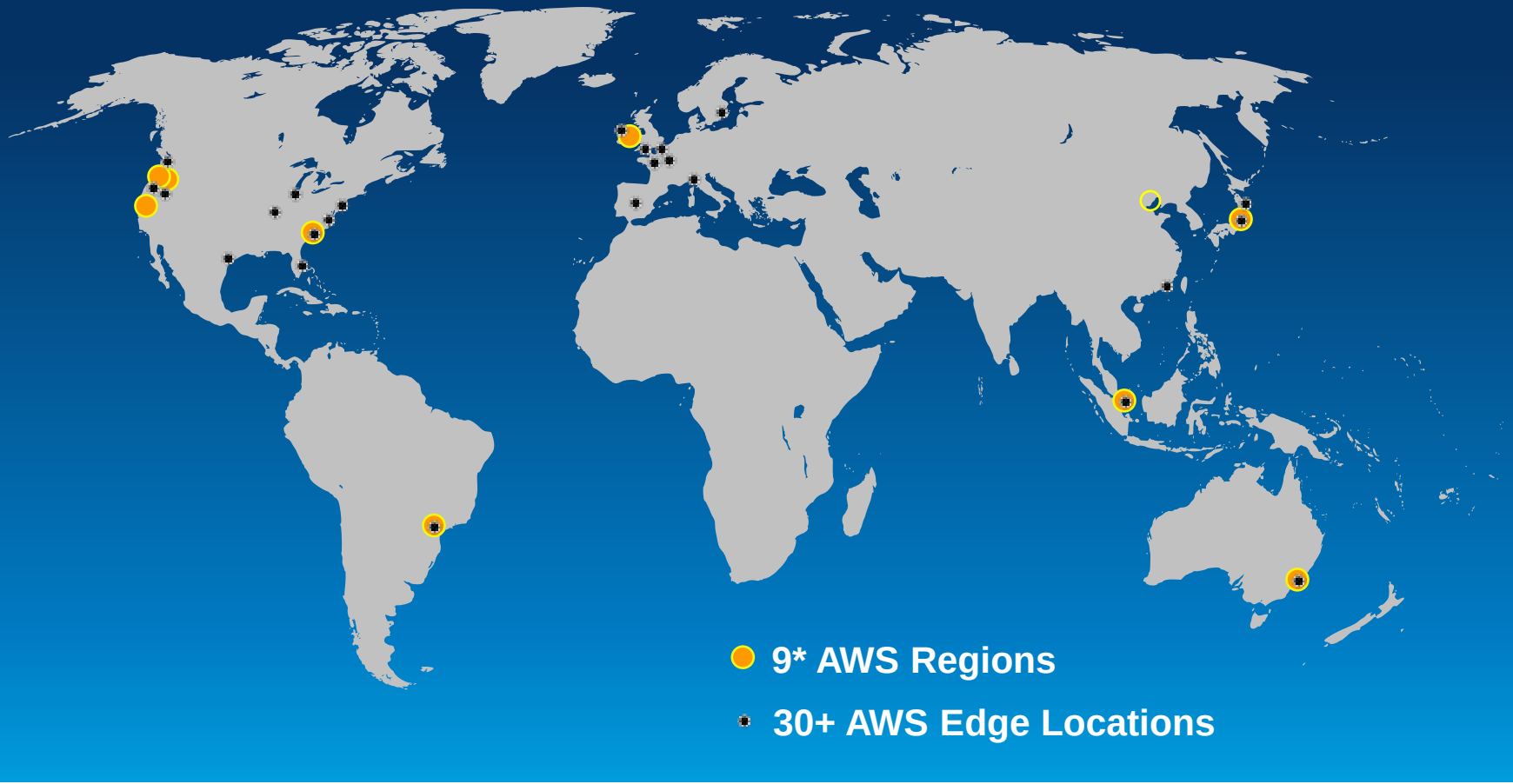
AWS Overview

Utility Computing

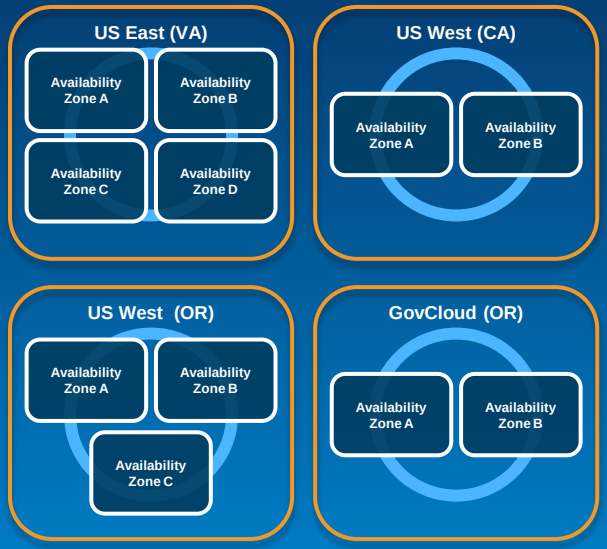
ON DEMAND
UNIFORM
PAY AS YOU GO
AVAILABLE

ON DEMAND
UNIFORM
PAY AS YOU GO
AVAILABLE

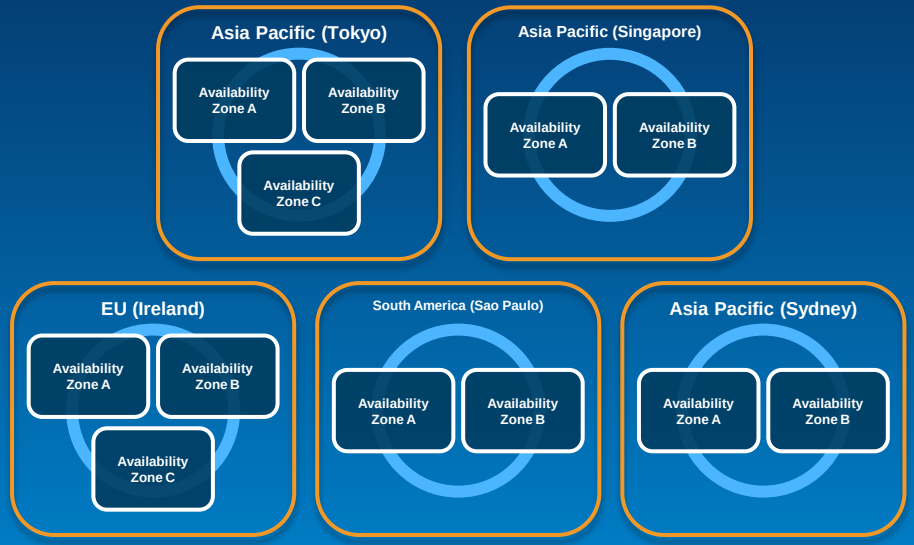
Amazon Web Services
Compute & Networking
Direct Connect
EC2
Virtual Servers in the Cloud
Route 53
Scalable Domain Name System
VPC
Isolated Cloud Resources
Storage & Content Delivery
CloudFront
Global Content Delivery Network
Glacier
S3
Scalable Storage in the Cloud
Storage Gateway
Integrates On-Premises IT Environments with Cloud Storage
Database
DynamoDB
Predictable and Scalable NoSQL Data Store
ElastiCache
In-Memory Cache
RDS
Managed Relational Database Service
Redshift
Managed Petabyte-Scale Data Warehouse Service
Deployment & Management
CloudFormation
Templated AWS Resource Creation
CloudTrail
User Activity and Change Tracking
CloudWatch
Resource and Application Monitoring
Elastic Beanstalk
AWS Application Container
IAM
Secure AWS Access Control
OpsWorks
DevOps Application Management Service
Analytics
Data Pipeline
Orchestration for Data-Driven Workflows
Elastic MapReduce
Managed Hadoop Framework
Kinesis
Real-time Processing of Streaming Big Data
App Services
CloudSearch
Managed Search Service
Elastic Transcoder
Easy-to-use Scalable Media Transcoding
SES
Email Sending Service
SNS
Push Notification Service
SQS
Message Queue Service
SWF
Workflow Service for Coordinating Application Components


9* AWS Regions
30+ AWS Edge Locations

US Regions



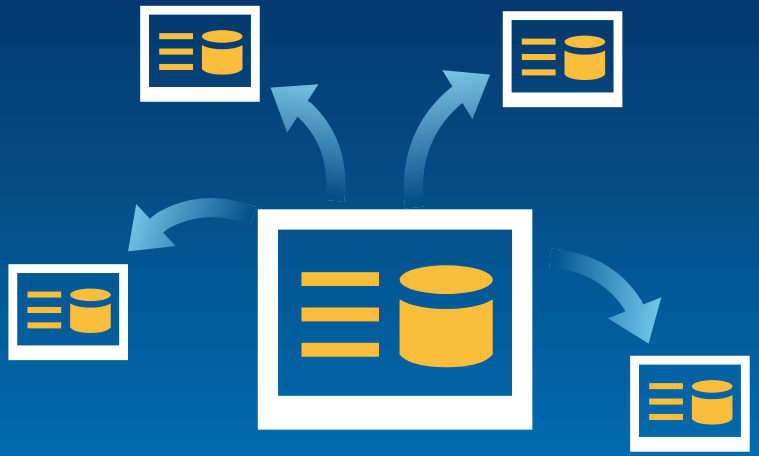
Global Regions



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

Virtual machines (instance types) optimized for:

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



Amazon Machine Image (AMI)

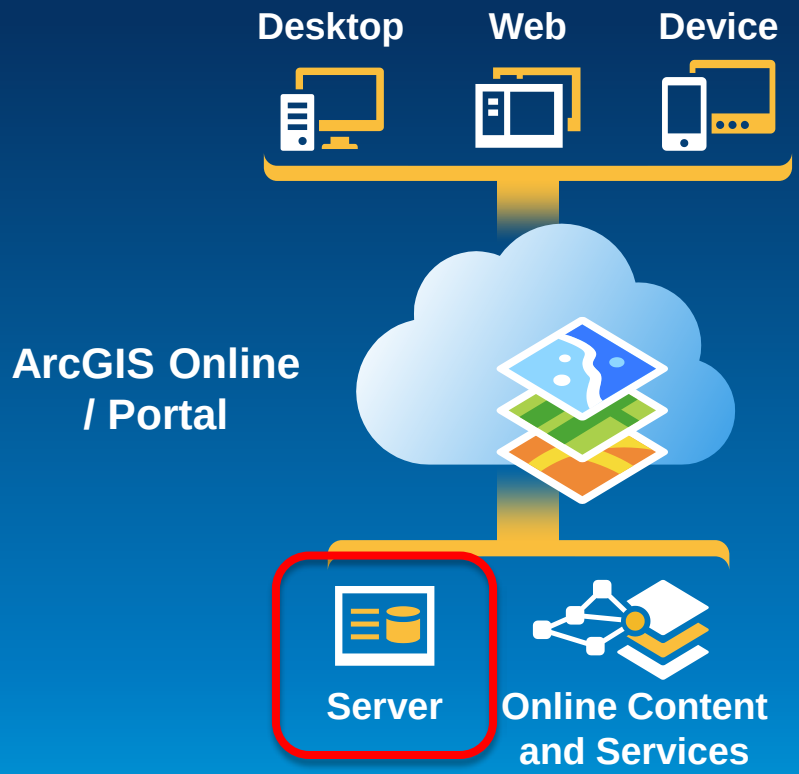
Preconfigured with:

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

Demo

AWS Management Console

ArcGIS in AWS

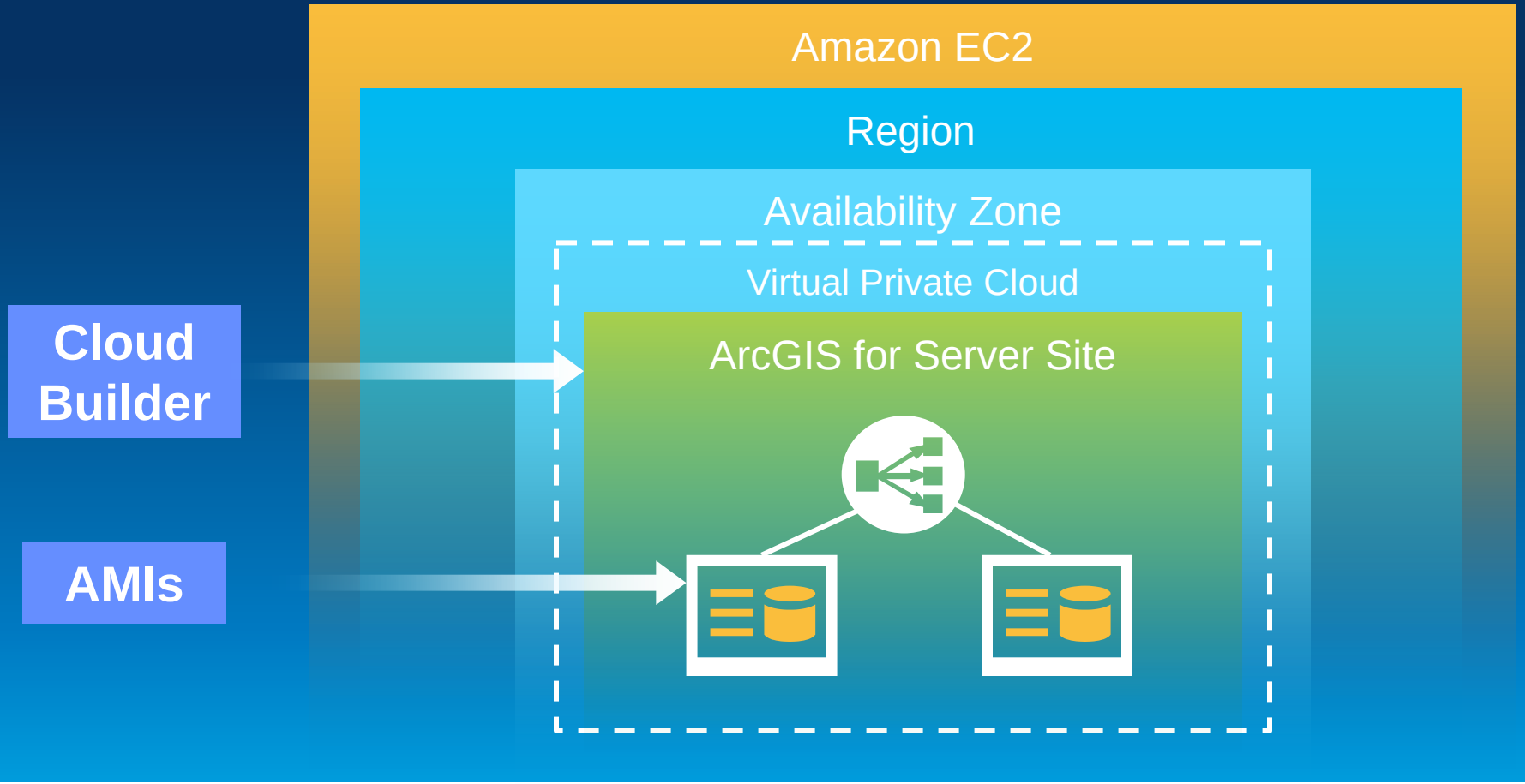

Desktop
Web
Device
ArcGIS Online
/ Portal
Server
Online Content
and Services

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

Demo

Cloud Builder

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

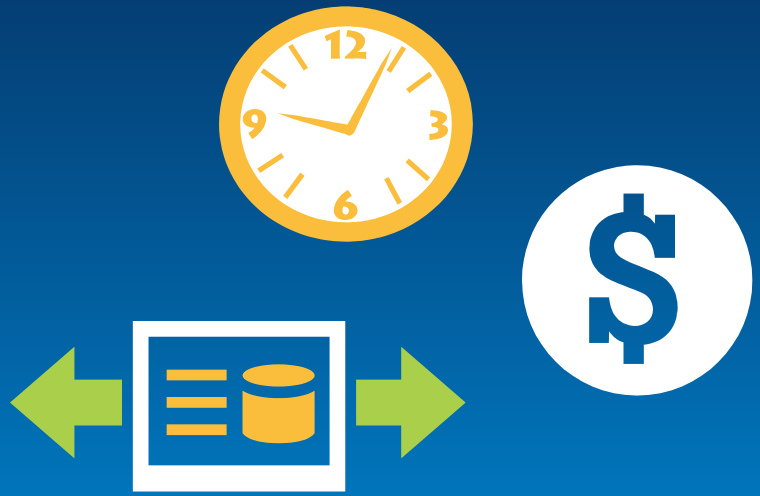
1. **Initial setup**
2. **Deploy site using Cloud Builder**

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

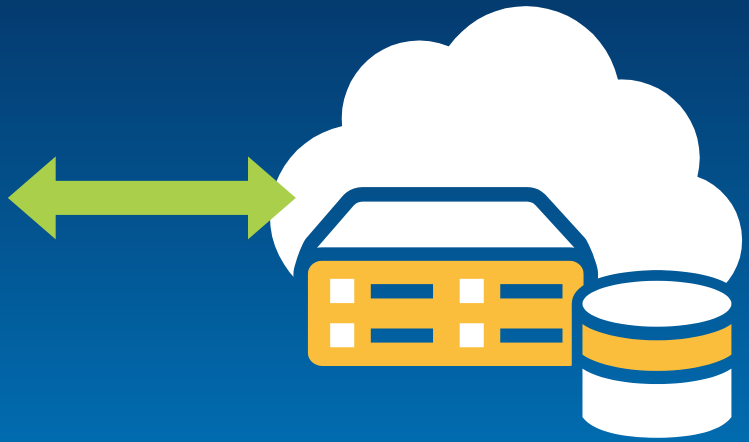
- **Can help you optimize…**
  - **Setup Time**
  - **Scalability**
  - **Cost**



- No hardware acquisition time
- Literally minutes to launch a new server
- Esri pre-built AMIs
- Can save own AMIs

- Amazon offers monitoring & auto-scaling
- Detects CPU load, starts new server
- You set up max & min instances, thresholds

- **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)**
  - **Storage: $0.05 / GB of volume size**

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

24 x 365

x $0.351/hr

$3074.76/yr

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

$730 +

24 x 365

x $0.128/hr

$1851.28/yr

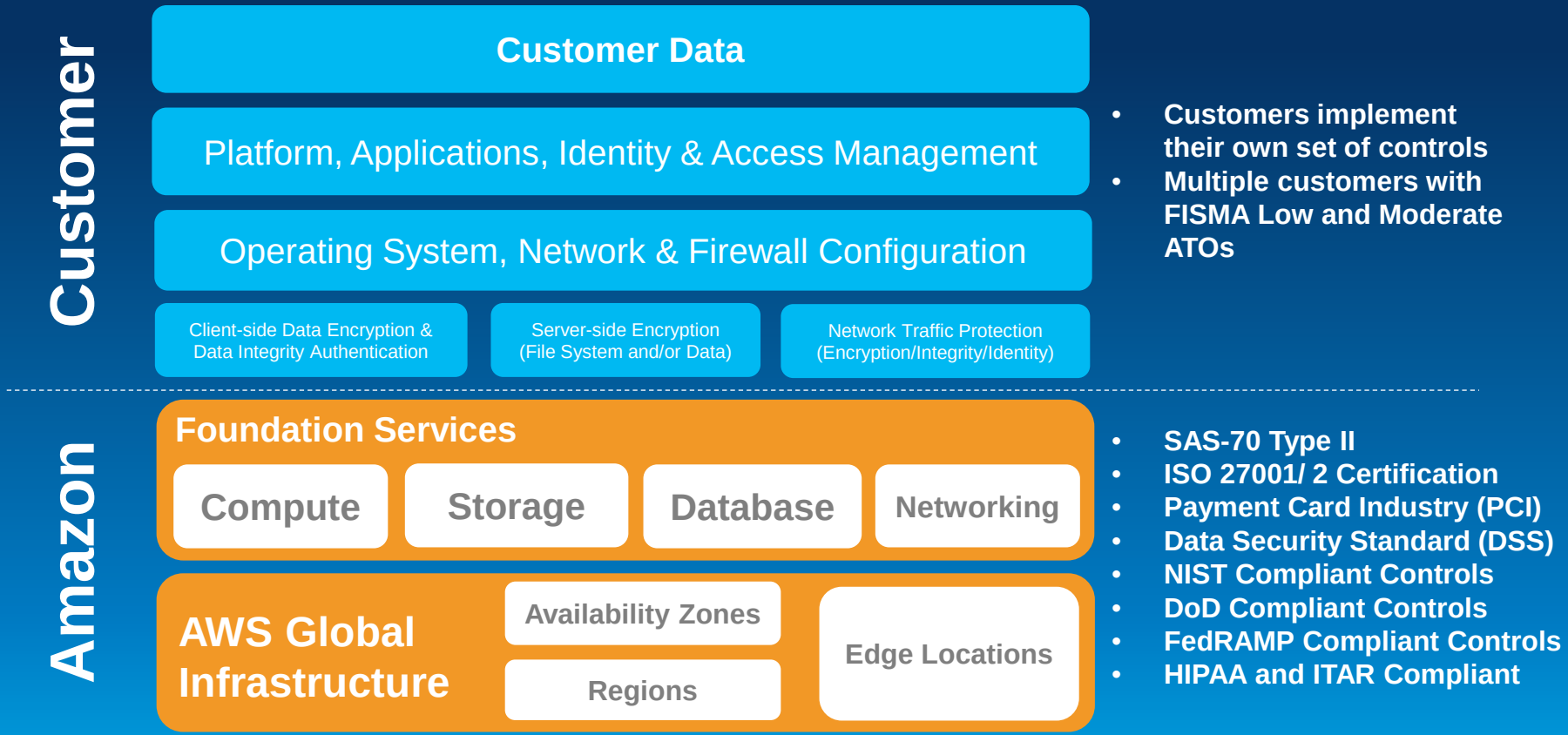
- **Add a server for a week**
- **On-Demand Pricing (per hour, no upfront)**
- **US East (Northern VA)**

24 x 7

x $0.351/hr

$58.97/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 and ITAR 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

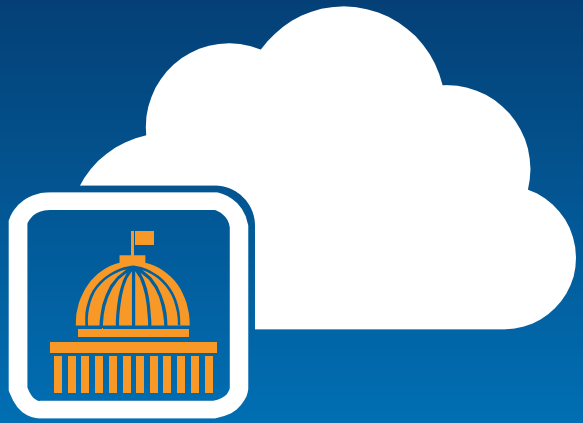
Bastion hosts

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



- ITAR-compliant
- Supports CUI workloads
- Available to U.S. government clients
- More expensive
- Esri AMIs

Migrating Department of Education ArcGIS Servers to Amazon Web Services Cloud Hosting

Amy Ramsdell, Blue Raster
@amyrams

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

SDDS SCHOOL DISTRICT DEMOGRAPHICS SYSTEM

What is SDDS?

The School District Demographics System provides access to school district demographic and related geographic data. The site's purpose is:

1. To provide access to information about demographics, social characteristics, and economics of children and school districts from the National Center for Education Statistics (NCES) of the U.S. Department of Education.
2. To enable users to directly access school district geographic and demographic data.
3. To provide information about school district demographic concepts, uses, and applications to facilitate effective use of these information resources.

Map Viewers

STANDARD
Map Viewer allows users to view maps of states, school districts and school points, while overlaying U.S. Census Bureau and Education data.

Select

EXPRESS
Create your map the easy way. Select your data theme, set your options, and you're done.

Start Map Viewer Express

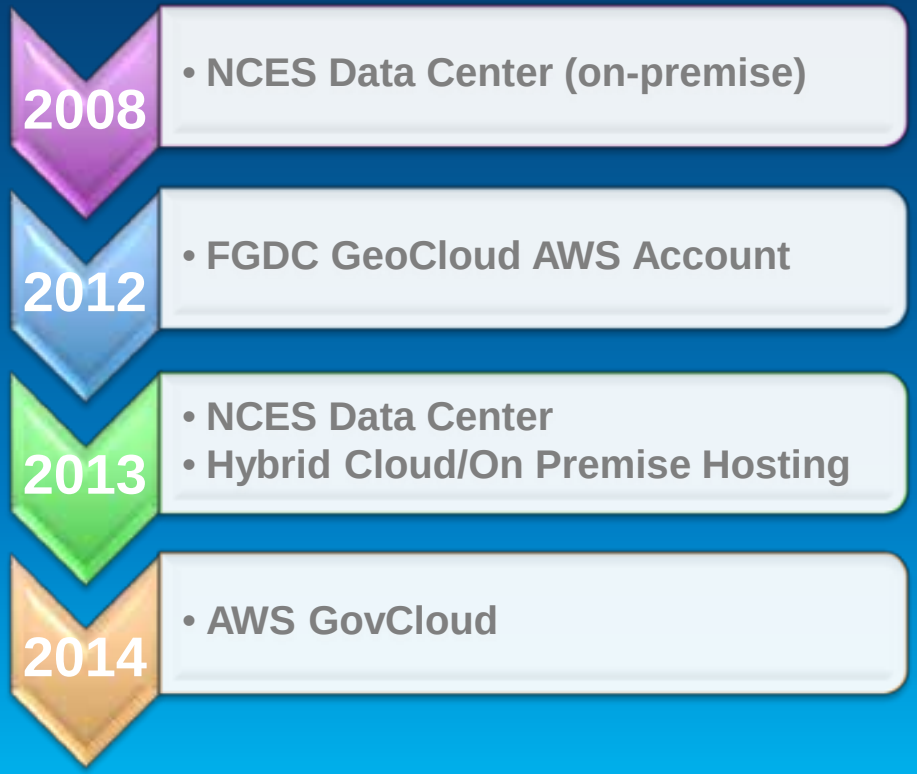
MOBILE
Introducing the NEW SDDS Map Viewer Mobile designed especially for iPad (also for use by other mobile devices).

Start Map Viewer Mobile

NEW DEMOGRAPHIC PROFILE WEBMAP
Introducing the NEW Demographic Profile Webmap with American Community Survey 2006-10 and Census 2010 profile data, including percentages.

Demographic Profile Webmap

Progression of NCES ArcGIS Servers



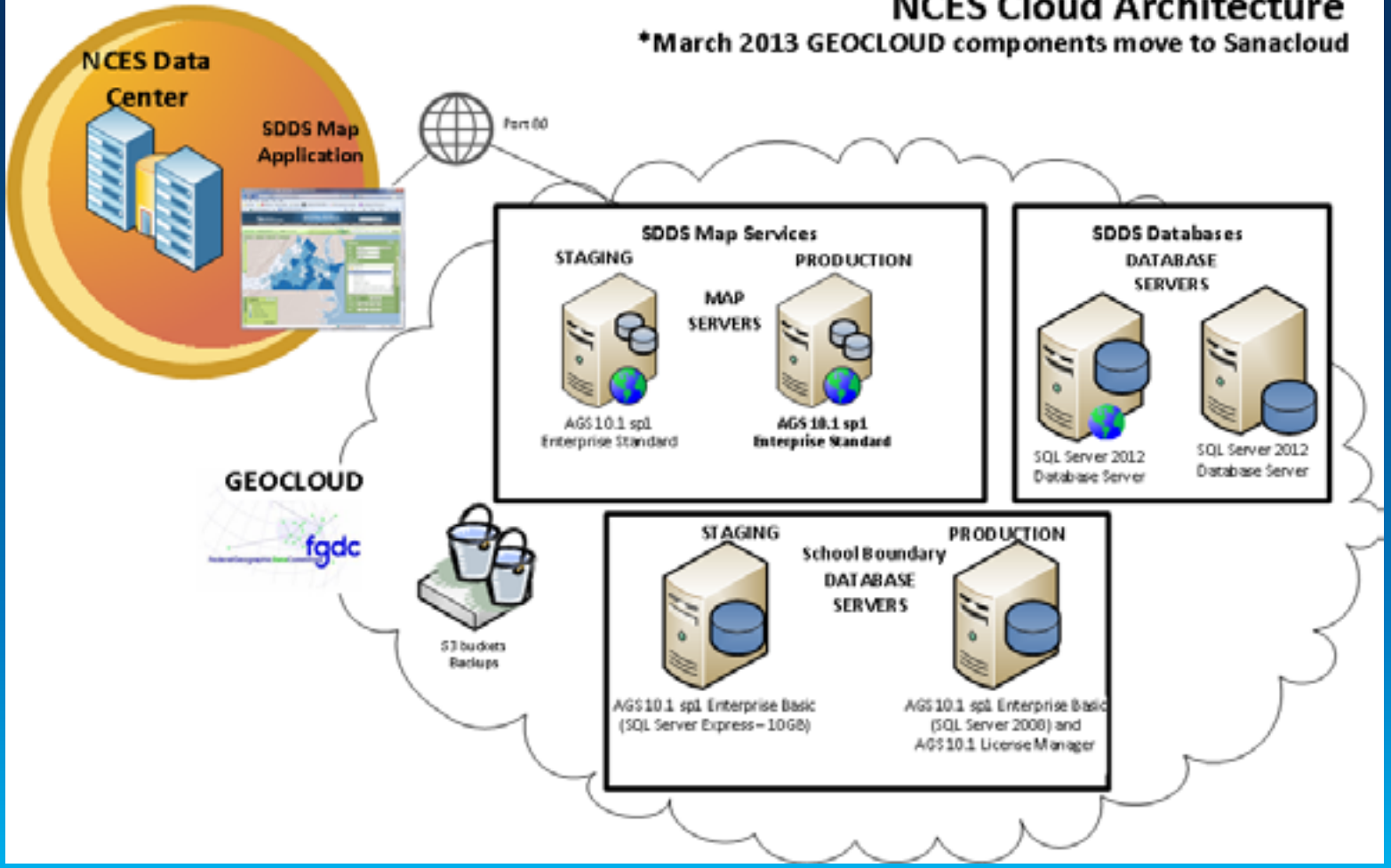
esri

amazon web services™

ies NATIONAL CENTER FOR EDUCATION STATISTICS

NCES Cloud Architecture

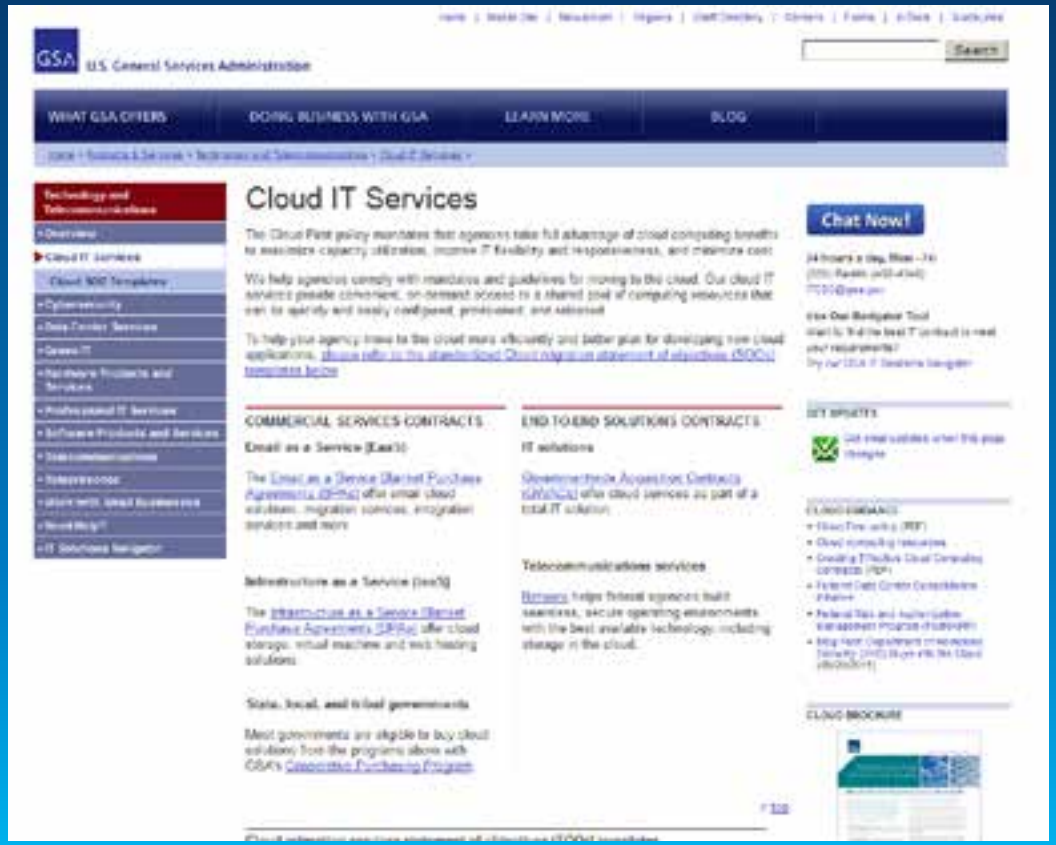
*March 2013 GEOCLOUD components move to Sanacloud

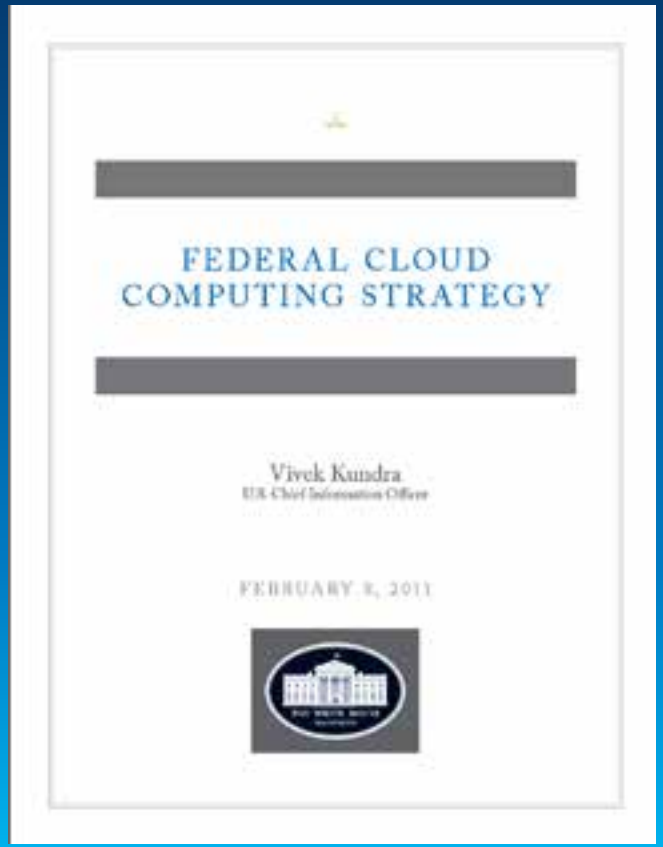


ies NATIONAL CENTER FOR EDUCATION STATISTICS

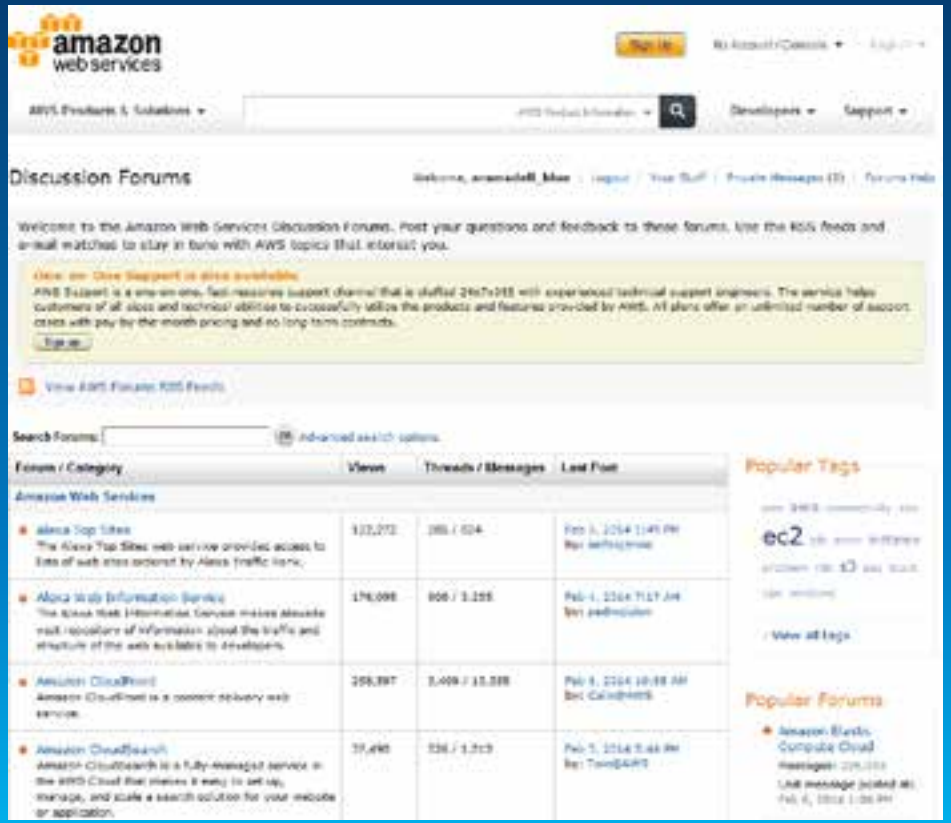
Planning

Federal Cloud First Policy – Migrating ArcGIS

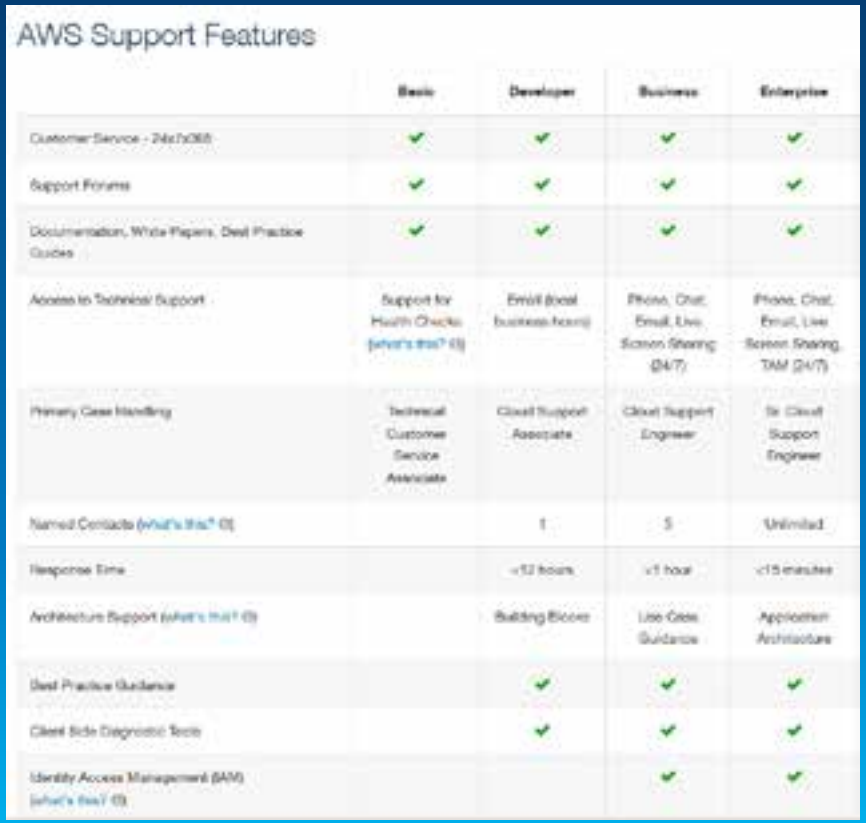




Support Forums

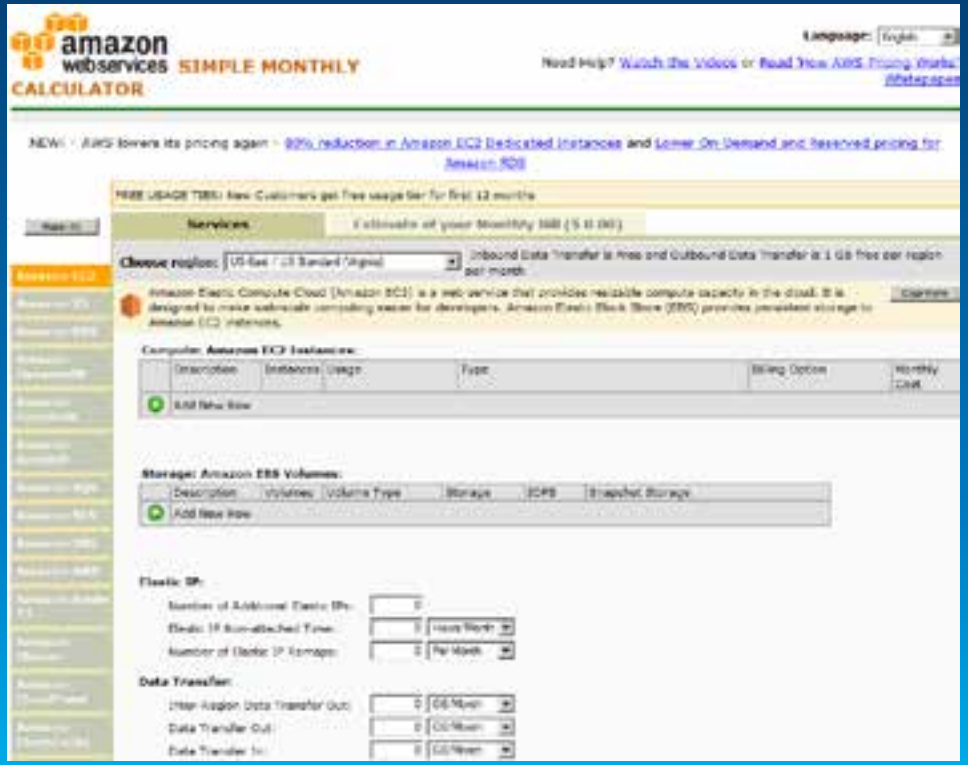


Support Plans



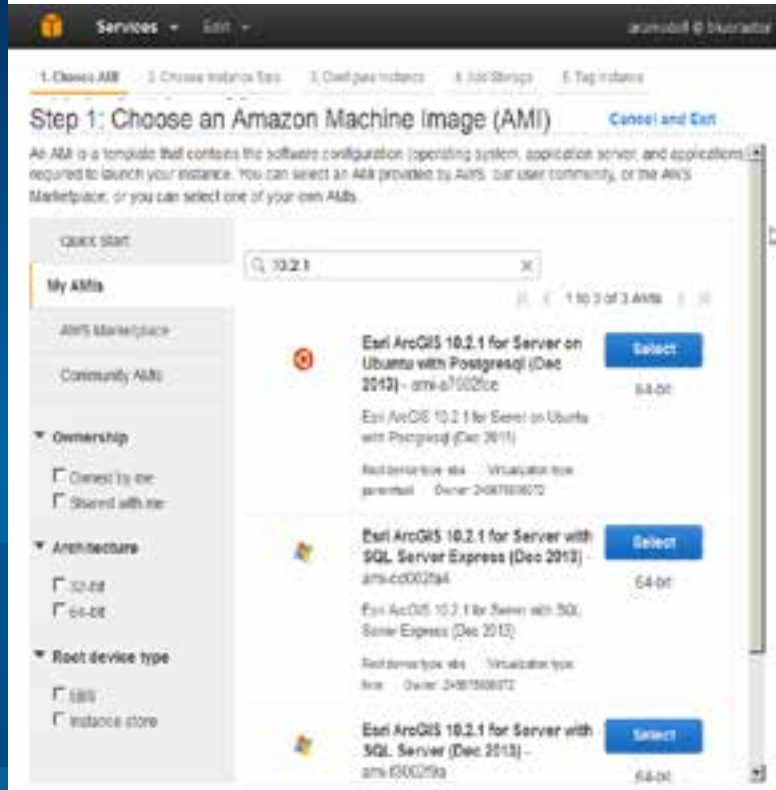
Costs to project for expansion

- Operating hours
  - Use Reserved Instances
- Use AWS Cost Calculator
- Bring Your Own License for SQL Server/Oracle or other database
- ArcGIS licensing



ies NATIONAL CENTER FOR EDUCATION STATISTICS

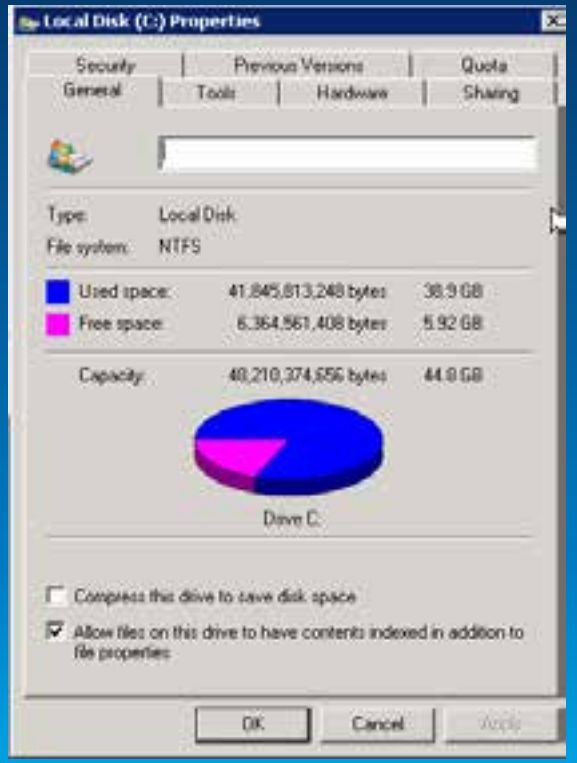
Considerations: Launching an Esri AMI from AWS Console



ies NATIONAL CENTER FOR EDUCATION STATISTICS

Disk Space

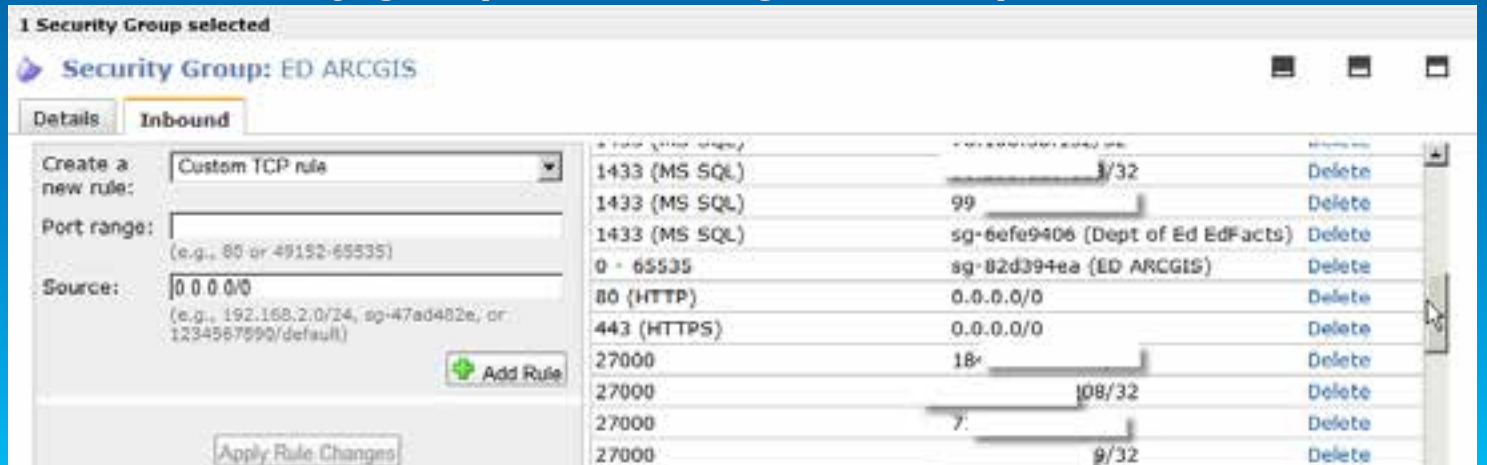
- ~ 40 GB taken by OS and Programs
- Good rule of thumb keep 10% disk space
- Easy to increase root disk space in AWS console
  1) Take snapshot of existing volume
  2) Create a new volume and resize it
  3) Detach existing
  4) Attach new



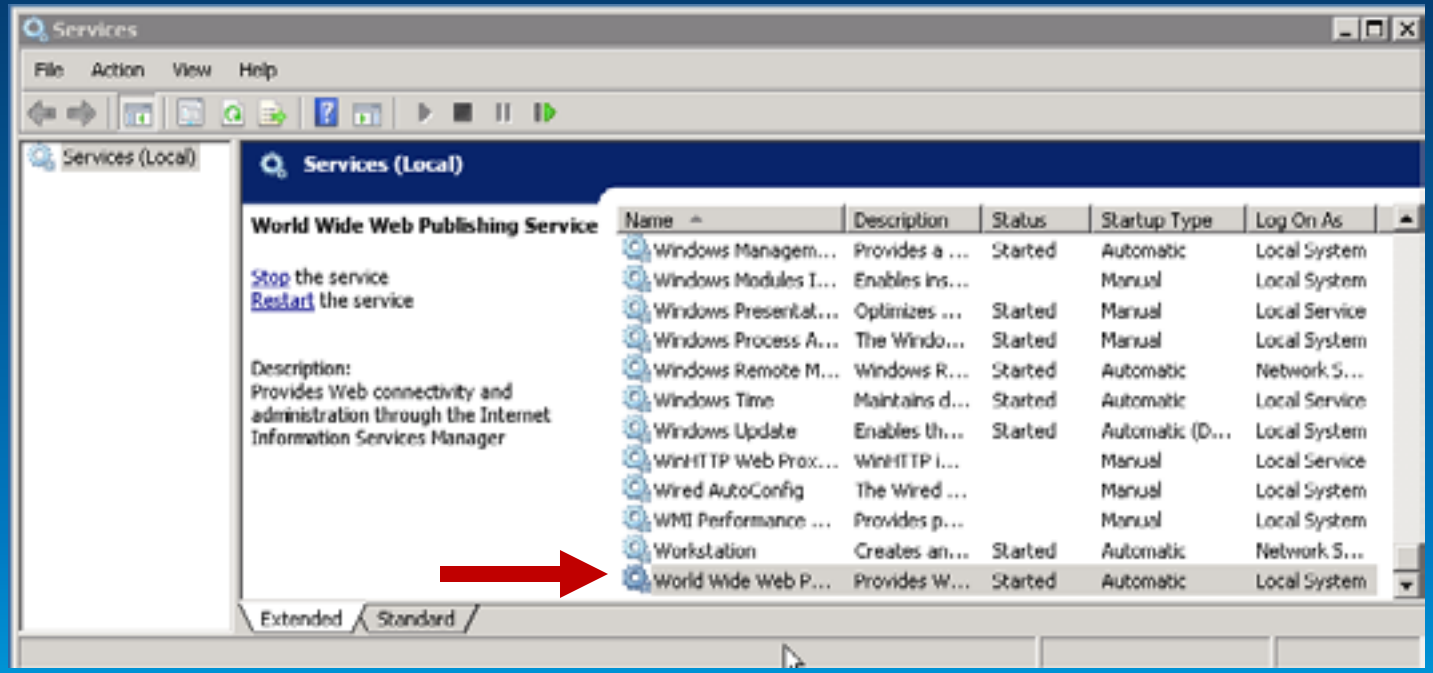
ies NATIONAL CENTER FOR EDUCATION STATISTICS

What Ports to Open on the Security Group?

- Ports 80 and 443 open by default
  - ArcGIS Server uses 6080
  - Use Web Adaptor to configure for port 80
    - Download from Esri Customer Care Portal
- Open 6080 in security group if not using Web Adaptor

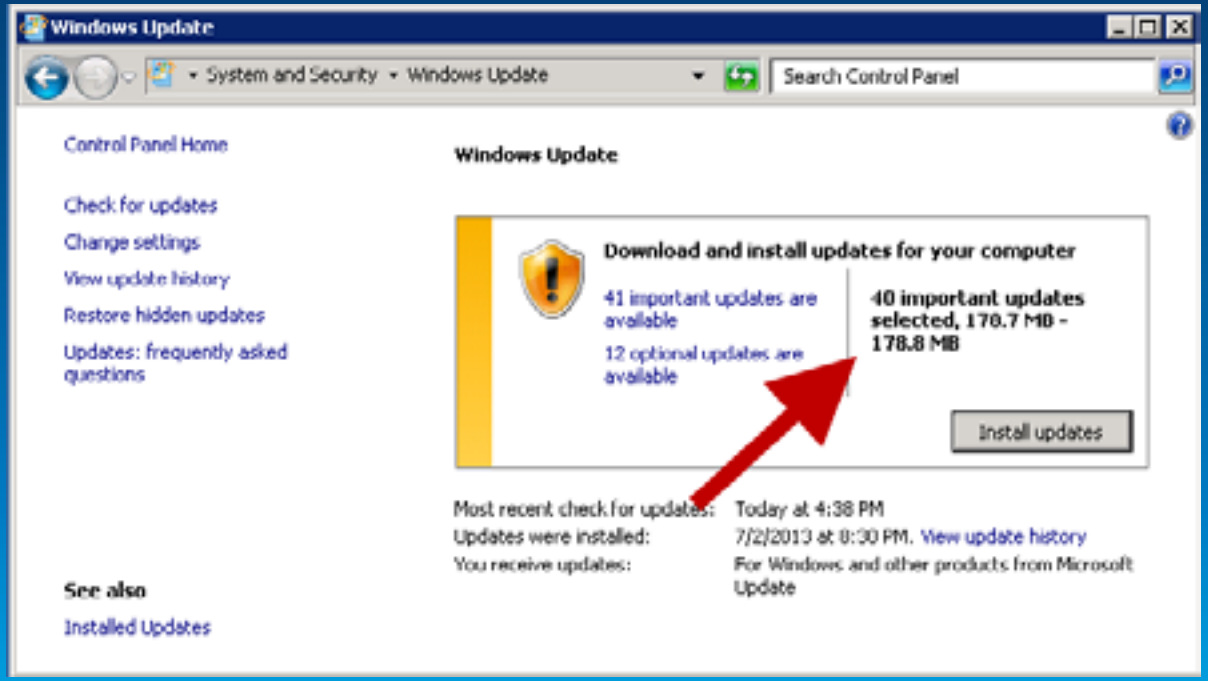


Start WWW service for Web Adaptor

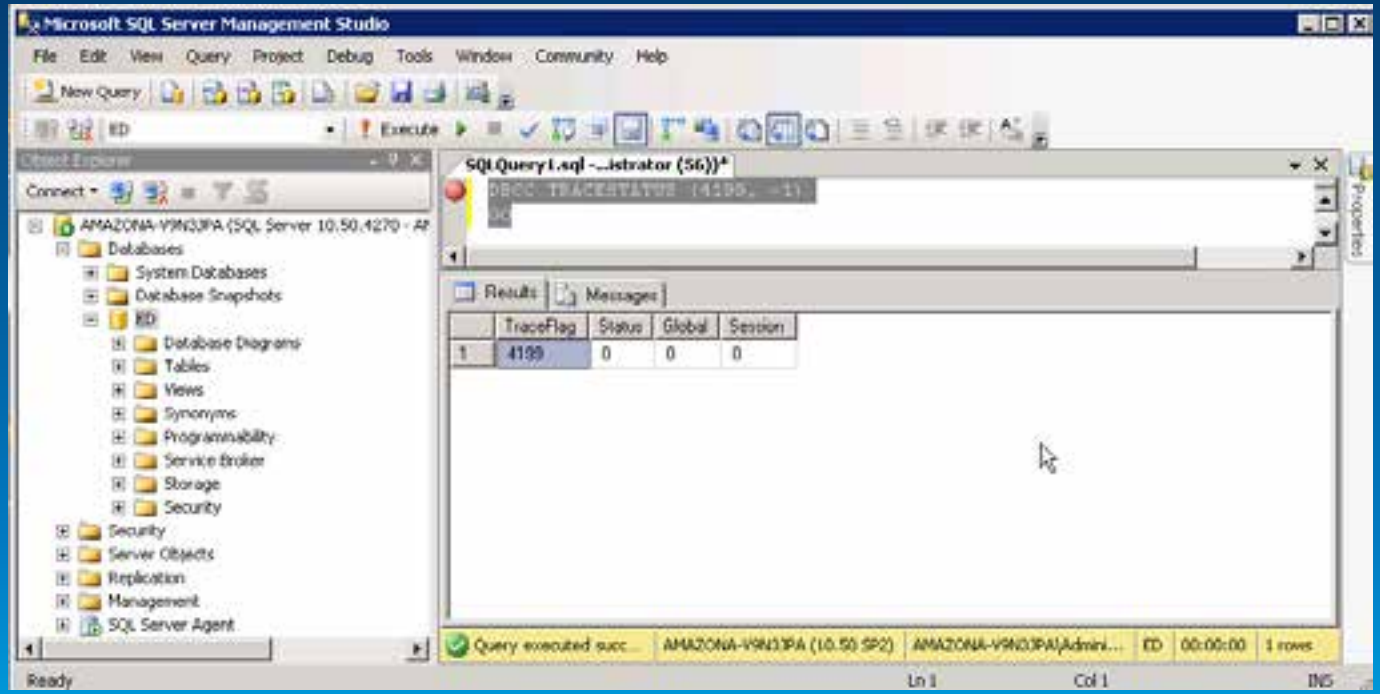


ies NATIONAL CENTER FOR EDUCATION STATISTICS

Apply Windows Updates



Apply Database Updates



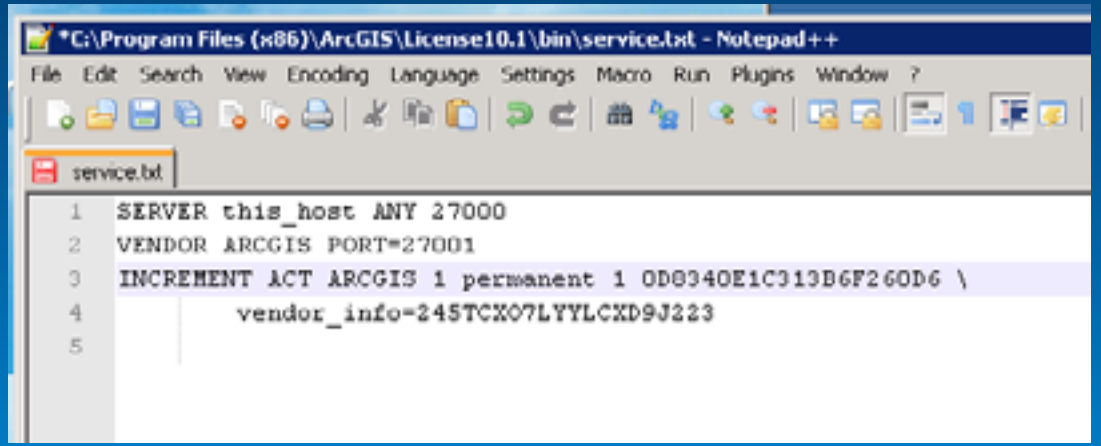
ies NATIONAL CENTER FOR EDUCATION STATISTICS

What do I need to publish a Map Service?

ies NATIONAL CENTER FOR EDUCATION STATISTICS

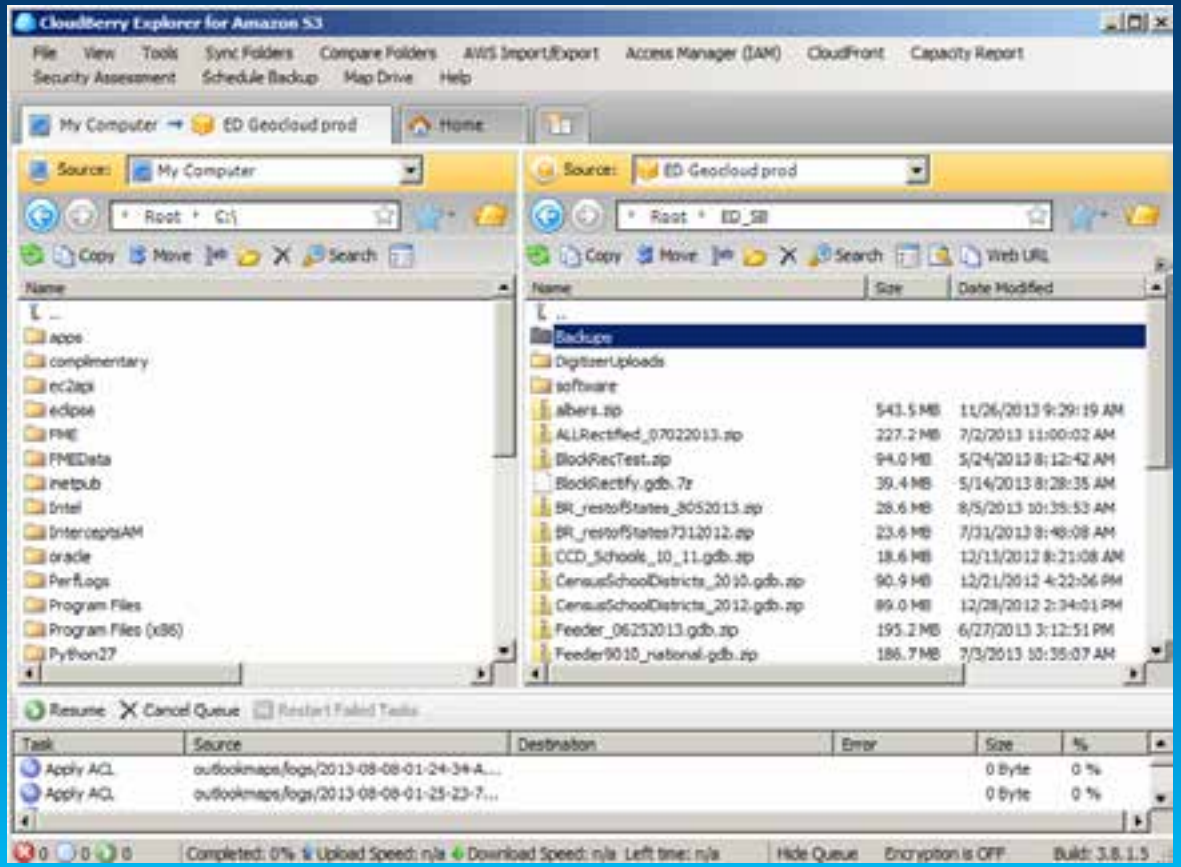
ArcGIS Desktop to administer and publish

- Publish with Desktop
  - Install on the server
  - Connect from your computer
- License Manager
  - Lock down ports to 27000, 27001
  - Add to Security Group



ies NATIONAL CENTER FOR EDUCATION STATISTICS

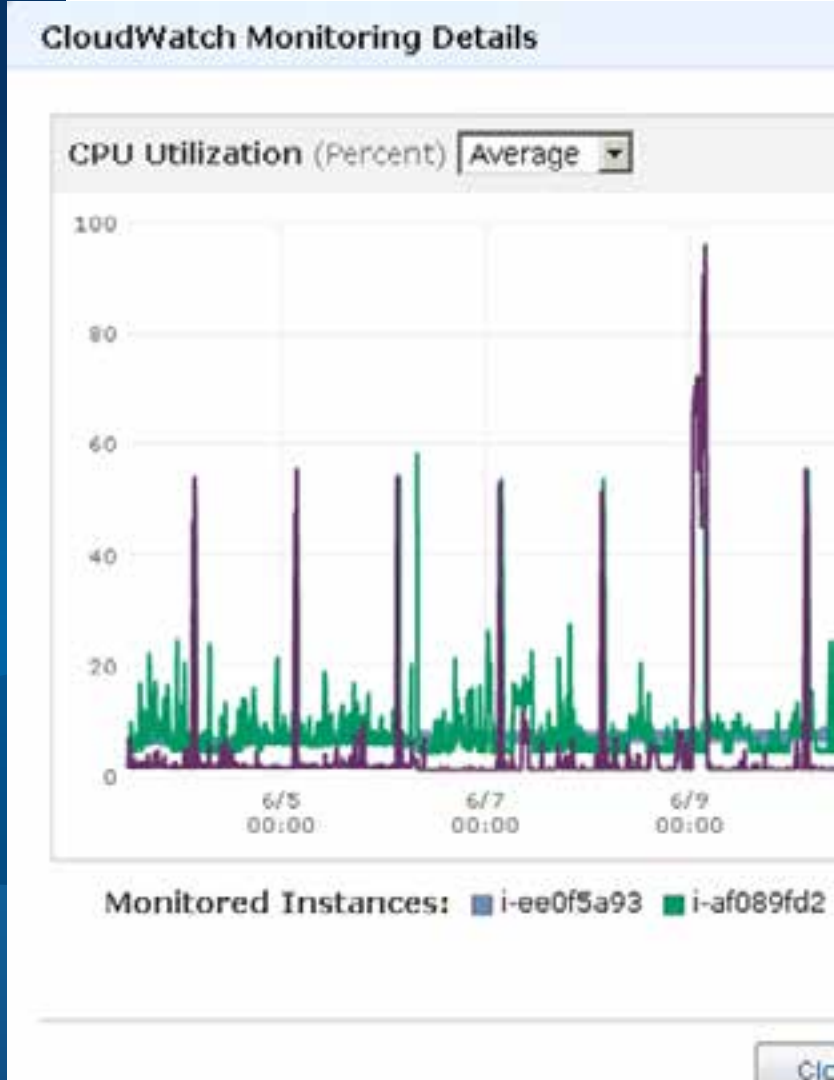
Migrate Data and MXDS to AWS S3 via CloudBerry



ies NATIONAL CENTER FOR EDUCATION STATISTICS

CloudBerry Explorer

Monitoring



ies NATIONAL CENTER FOR EDUCATION STATISTICS

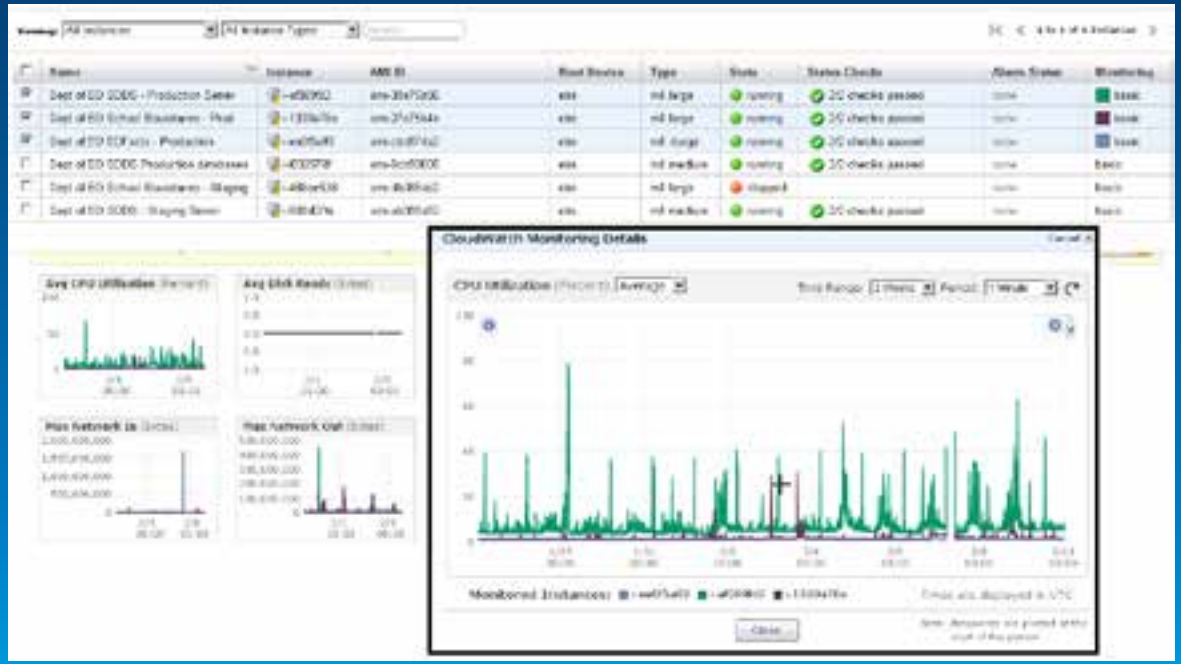
CloudWatch Metrics

1. **Status Checks**

   2/2 checks

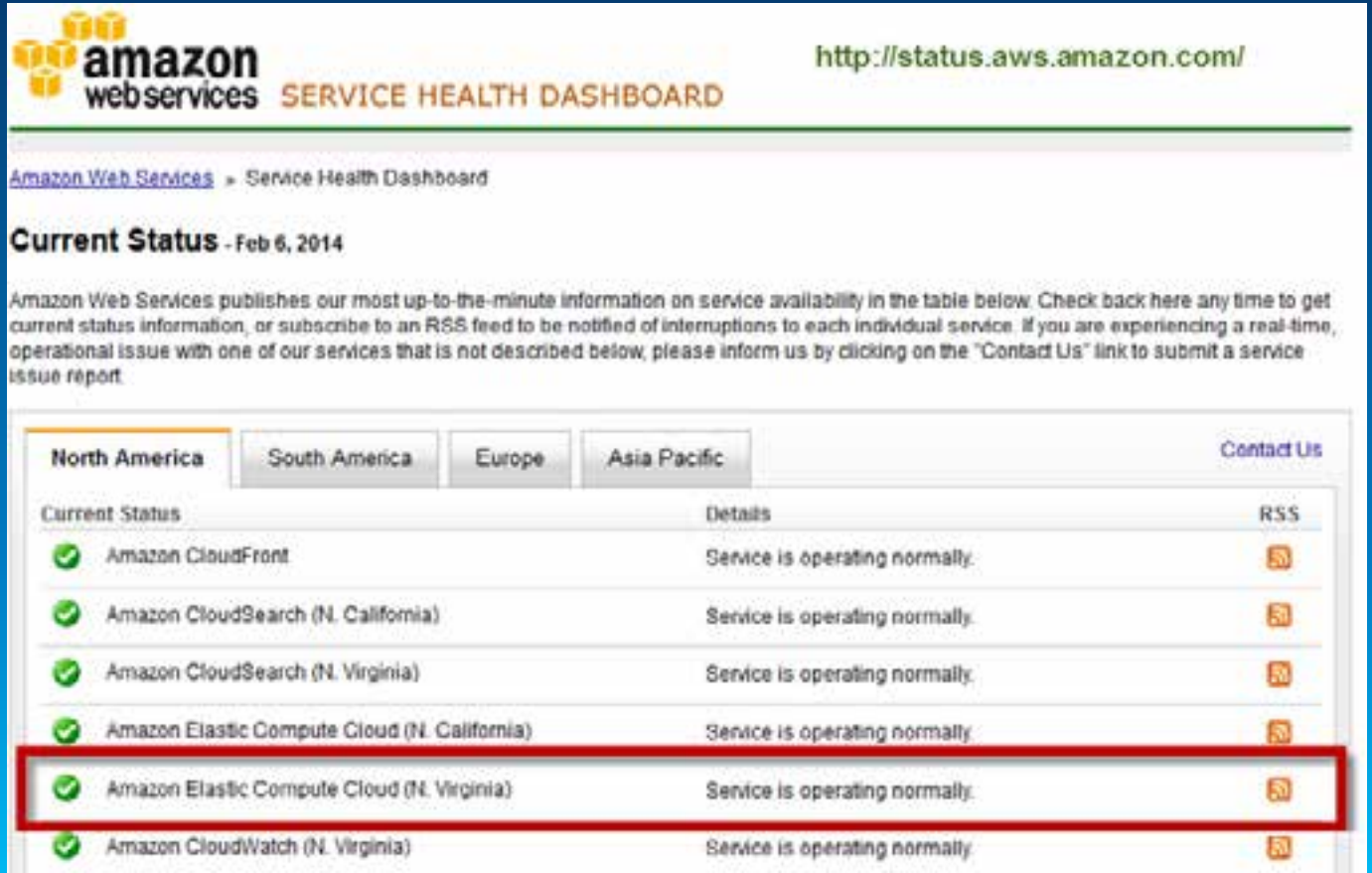
2. **Create CloudWatch alarms**

3. **Good planning tool server capacity**



ies NATIONAL CENTER FOR EDUCATION STATISTICS

Amazon Service Health Dashboard

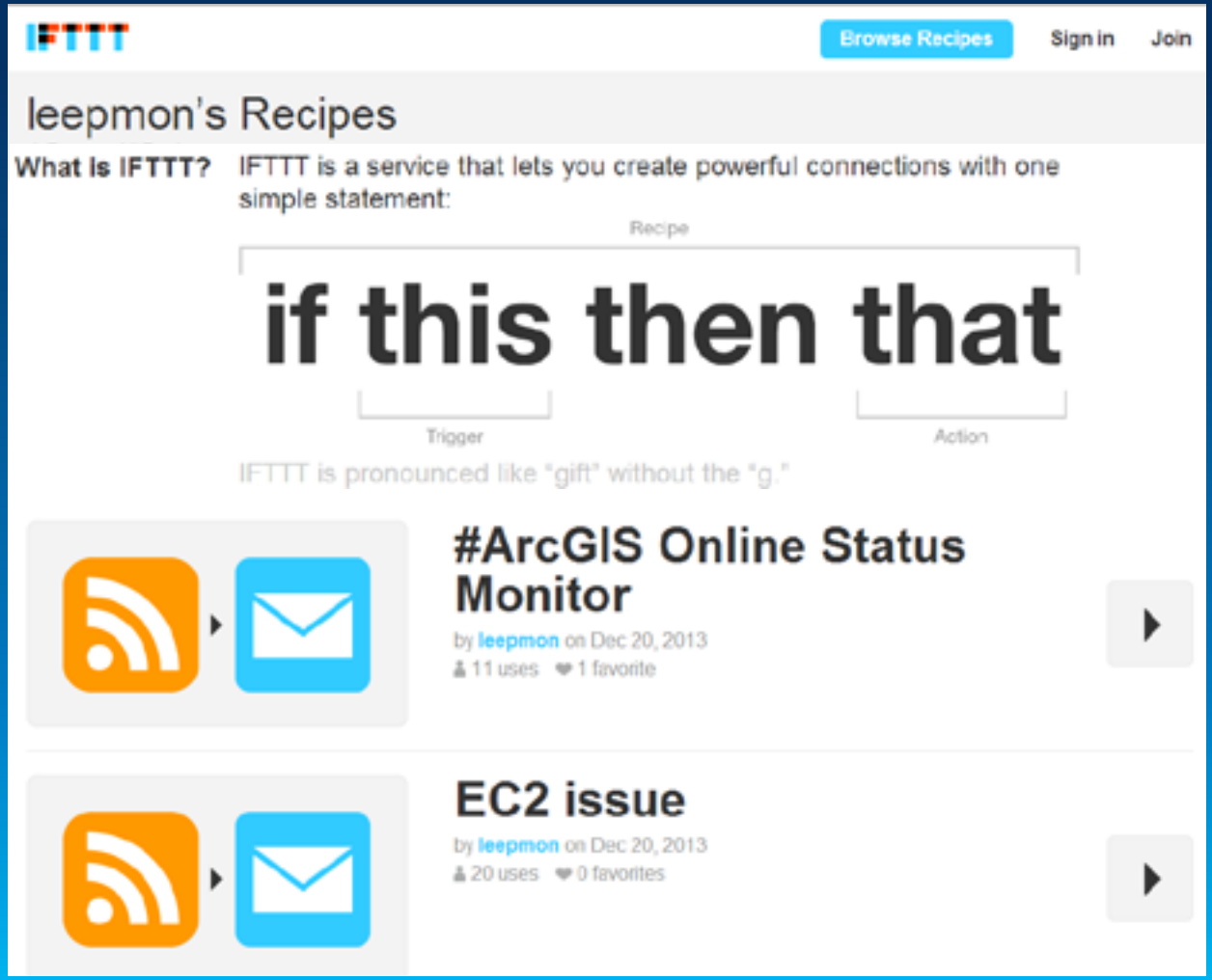


ies NATIONAL CENTER FOR EDUCATION STATISTICS

IFTTT Recipes

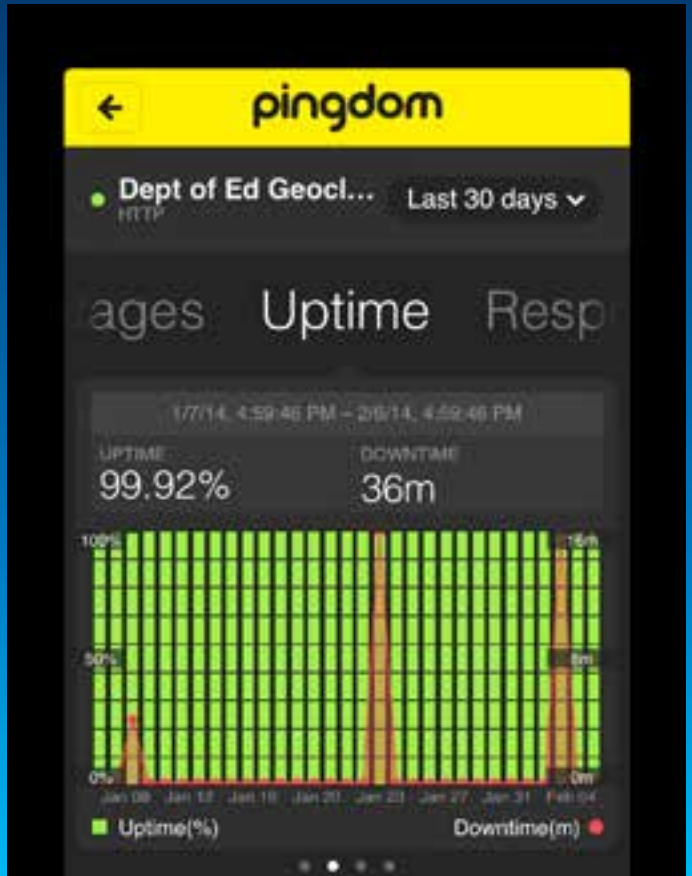
Set up alerts

https://ifttt.com/



ies NATIONAL CENTER FOR EDUCATION STATISTICS

Website Monitoring with Pingdom



ies NATIONAL CENTER FOR EDUCATION STATISTICS

Instance Backup Strategy

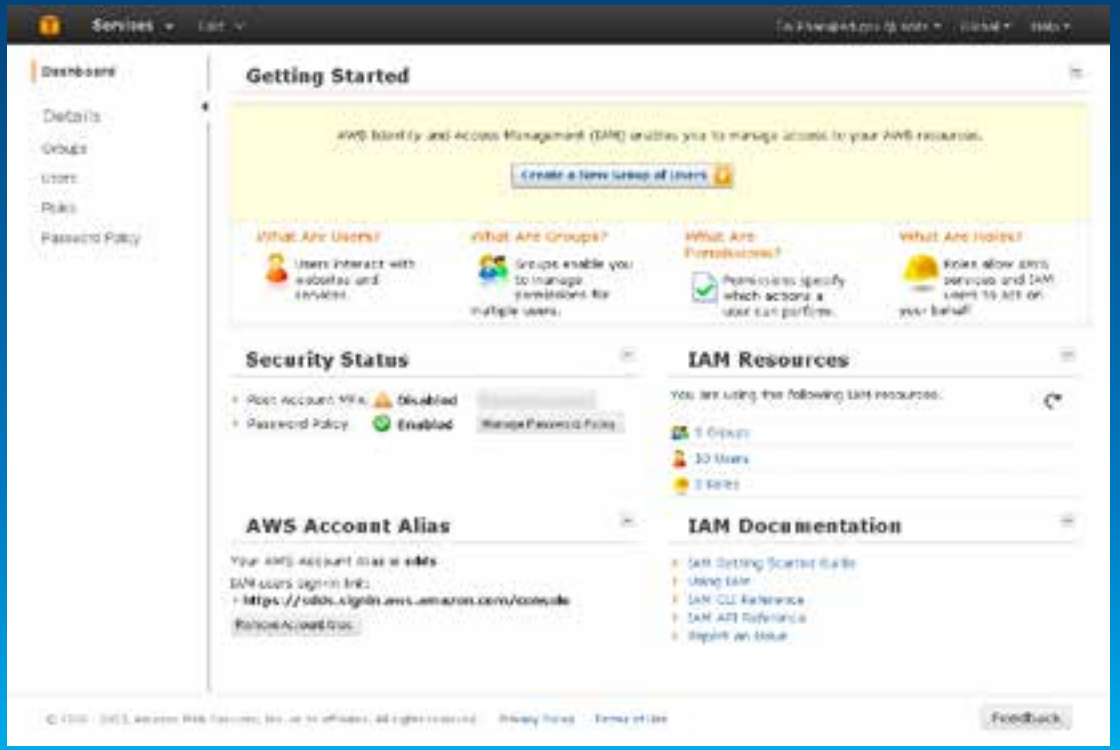
Instance backups automated with Powershell scripts

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

ies NATIONAL CENTER FOR EDUCATION STATISTICS

IAM Console Security

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



ies NATIONAL CENTER FOR EDUCATION STATISTICS

Lessons Learned

- 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

Thank You – Questions?

Amy Ramsdell

- Follow Blue Raster
  - Twitter - @blueraster
  - blueraster.com/blog
- Follow Me
  - Twitter - @amyrams

- **ArcGIS Cloud Security Roadmap & Best Practices for Federal Agencies**
  - **Tues. 8:30am – 9:30am; 145 AB**
  - **Tues. 4:00pm – 5:00pm; 146 C**
- **Understanding ArcGIS Deployments in Public and Private Clouds**
  - **Tues. 11:00am – 12:00am; 151 A**
- **ArcGIS and the Cloud – A Management Perspective**
  - **Tues. 5:15pm – 6:15pm**

Upcoming Sessions

Federal GIS Conference 2014

February 10–11, 2014 | Washington DC

esri

Don’t forget to complete a session evaluation form!

Federal GIS Conference 2014

February 10–11, 2014 | Washington DC

esri

Networking Reception

Smithsonian National Museum of Natural History

Tuesday, 6:30 PM–9:30 PM

Bus Pickup located on L Street

Federal GIS Conference 2014

February 10–11, 2014 | Washington DC

esri

Print your customized Certificate of Attendance!

Printing stations located in Hall B
and the 140/150 Room Concourse.

Federal GIS Conference 2014

February 10–11, 2014 | Washington DC

esri

GIS Solutions EXPO, Hall B

Monday, 12:30 PM–6:30 PM
Tuesday, 10:45 AM–4:00 PM

- Exhibitors
- Hands-On Learning Lab
- Technical & Extended Support
- Demo Theater
- Esri Showcase

Federal GIS Conference 2014

February 10–11, 2014 | Washington DC

Interested in diving deeper into Esri technology?

Add a day to your Fed GIS experience and register to attend the Esri DevSummit Washington DC**.** Stop by the registration counter to sign up.

Understanding our world.