Web Services

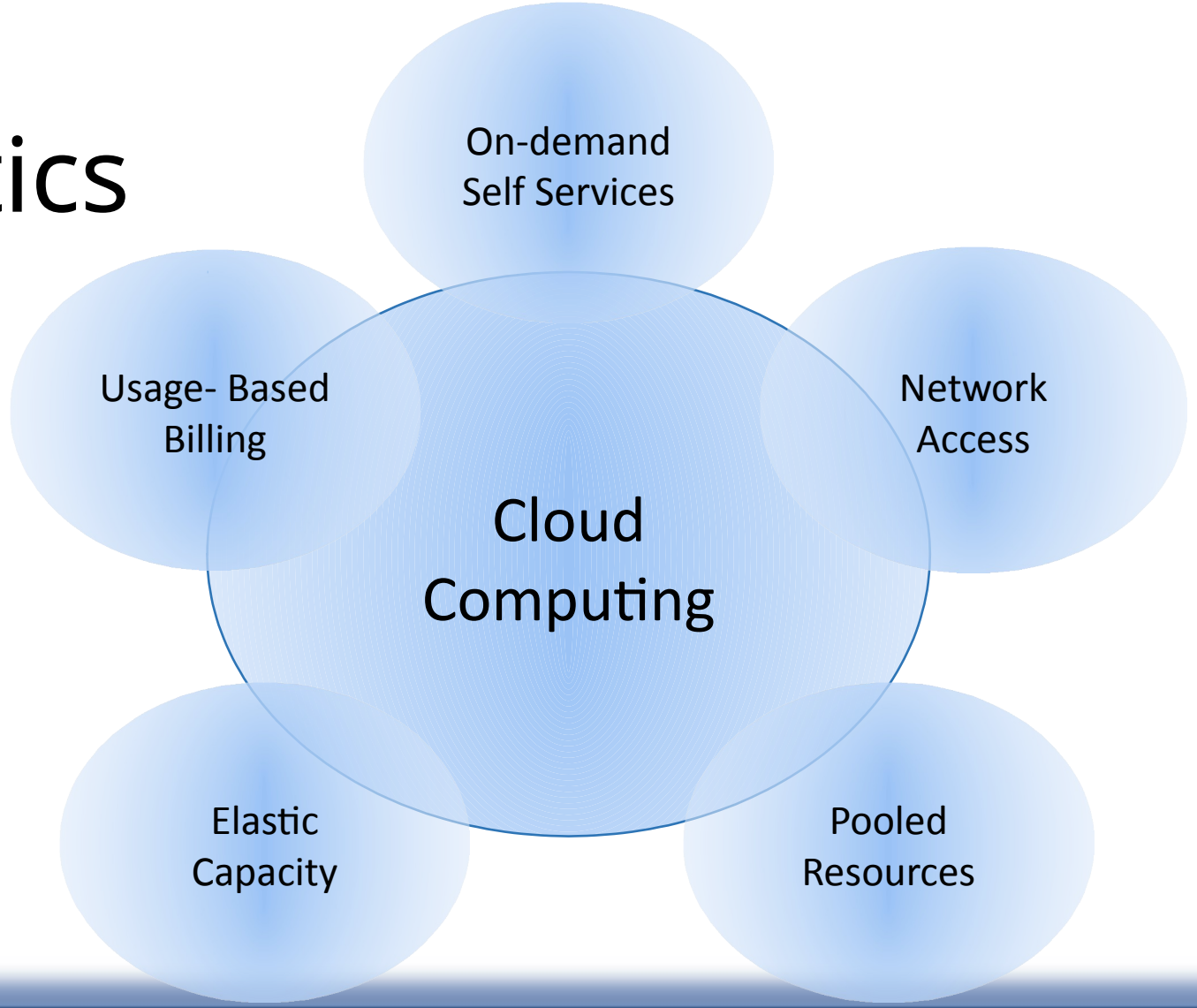
Cloud Computing

East Tennessee State University
Department of Computing
Jack Ramsey, Lecturer

What is it?

Model for enabling 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 - (National Institute of Standards and Technology)

Main Characteristics



Cloud Configurations

- Private
- Public
- Hybrid
- Community

Private Cloud

- Operated for and by a single organization.
- Operates within that organization's corporate firewall.
- These services are managed and provided within the organization.
- Complete control over data.
- Vendors: IBM, VMware, HP, Oracle (Data centers), etc.

Private Cloud - Advantages

- Total control over operations and data
- More uniform scale out
- Tighter integration
- Units self-contained / already tested
- More homogeneity / less chaos

Private Cloud - Downside

- EXPENSIVE!
- Have to maintain full IT staff (good for us)
- Have to purchase (lease?) own hardware
- Have to provision space/power/HVAC/fire suppression/security on own dime
- Replacing data center?
- Benefits of cloud technology / Cost of data center

Private Cloud - Summary

- Bonuses
  - Greater security
  - Greater control over data/operations
  - Compliance with regulations
- Drawbacks
  - Return on Investment (ROI) – The company shoulders the cost of running and maintaining the data center
  - Danger of data loss in event of a catastrophe

Private Cloud vs. Traditional Data Center

- Data center, “We need more storage!”
  - Plug in disk
  - May be different vendors
  - Connections likely ad hoc
  - Over time, chaos
- Resources - network, storage, compute - added as single unit
  - Tighter integration
  - Cloud benefits - greater automation/responsiveness

Private Cloud vs. Traditional Data Center

- Traditional Data Center
  - Built by adding more compute, storage, networking
  - Usually buy components individually & assemble
  - Scale out separately
  - Process is slow and labor intensive
  - As much as 80% of budget is used for maintaining aging legacy hardware and software
  - Made up mostly of client-server type applications

Private Cloud vs. Traditional Data Center

- Private Cloud
  - Resource acquisition is different
  - Expansion is through purchase of containers of compute, network, and storage
  - Each is plugged in to the existing infrastructure
  - Needs are then logically assigned using software
  - Containers (called PODs) are pre-built and pre-tested
  - Makes it elastic in the sense that when more is needed, it can easily be purchased and integrated
  - Instead of client-server, uses service oriented architecture – platform independent

Private Cloud vs. Traditional Data Center

- The bottom line is that a Private Cloud adds a layer of automation to the operation and maintenance of the data center.
- Resources are allocated as needed in response to the Private Cloud's operating system and pre-established rules.
- Example: if a server crashes, the system will sense it and immediately restart it or shift over to another server.

Public Cloud

- Available to general public or large industry group.
- Owned by an organization selling Cloud services.
- Services delivered to the client via the Internet from a third party service vendor.
- Vendors: Amazon, Google, Microsoft, IBM, Rackspace, DigitalOcean, Vmware,

Public Cloud

Public Cloud - Advantages

- Costs less
  - Vendor maintains
    - Software licenses
    - Hardware
    - Facilities - Floor space, HVAC, fire suppression, security, staff
- Pay-as-you-go
- Ease of implementation

Public Cloud - Disadvantages/Challenges

- Network connection potential single POF
- Bandwidth issues could affect service
- Compliance issues
- Where's my data?
- Reduced control over data

Hybrid Cloud

- Two or more Clouds that remain unique but are bound by technology that enables data and application portability.
- There is a combination of services provided from public and private Clouds.
- Often, an organization will maintain a data center and park some of its business processes on the Cloud
- Example: ERP in private Cloud / Sales and Email on public Cloud

Community Cloud

- Shared by several organizations, supporting a specific community.
- Community Cloud shares infrastructures between several organizations from a specific community whether managed internally or by a third-party and hosted internally or externally.
- Example: Mount Sinai Hospital in Toronto, Canada will give 14 area hospitals shared access to a fetal ultrasound application and data storage for patient information.

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Cloud Services

- Infrastructure as a Service (IaaS)
- Platform as a Service (PaaS)
- Software as a Service (SaaS)

Infrastructure as a Service - IaaS

- Cloud provider offers capacity for rent, basically hosted Data Center Servers.
- The service provider is responsible for the management of the underlying Cloud Infrastructure.
- Pay-as-you-go model
- Examples: Amazon EC2, HP Cloud, Google Compute Engine, Windows Azure VM, Rackspace, Joyent, 3Tera

Platform as a Service - PaaS

- Cloud providers deliver a computing Platform that enables application developers to develop, run and host their solutions.
- The underlying platform that includes network, servers, operating systems, software for application development, etc. is managed by the provider.
- Pay-as-you-go model
- Examples: Google AppsEngine, Windows Azure Compute, VMware, Force.com and SalesForce

Software as a Service - SaaS

- Users are provided access to application software and database on the Internet
- Service providers manage the infrastructure and platform on which applications run
- On-demand service -> Pay-as-you-go / pay per use
- Service Provides generally set subscription fee
- Examples: WindowsLive, Office 365, Hotmail/Outlook, Adobe

Summary - Benefits of the Cloud

- Pay-as-you-go
- Virtual and On-demand
- Agility, Flexibility, and Elasticity
- Ease of Implementation
- Pooled Resources

Summary - Challenges of the Cloud Model

- Network Dependency
- Privacy and security
- Vendor lock-in
- Reliability and availability
- Cultural resistance - “This is the way we’ve always done it!”
- Regulatory ambiguity
- Issues of taxation

Amazon Web Service

** Provided a generous grant for this course.

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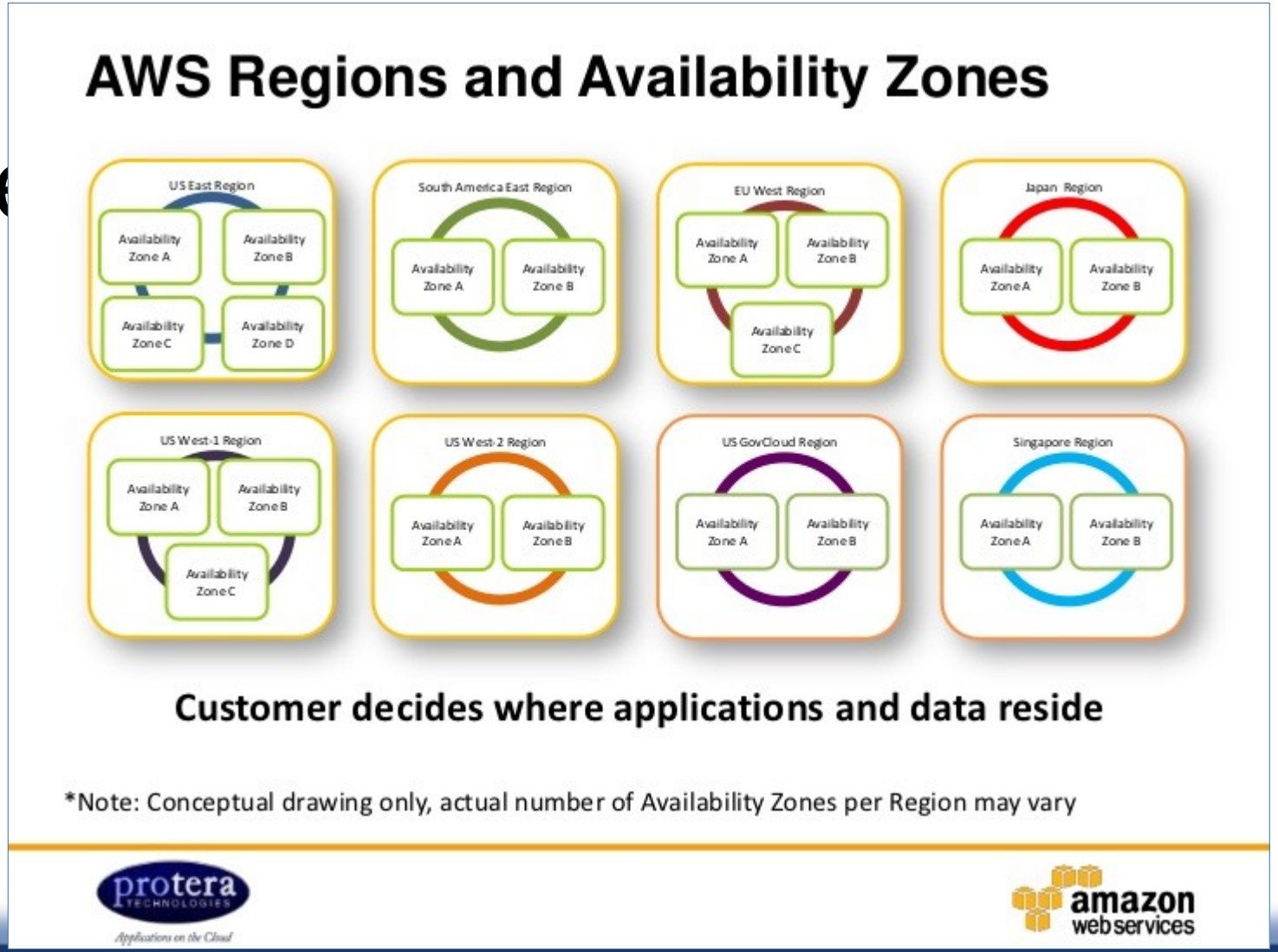
Amazon Regio

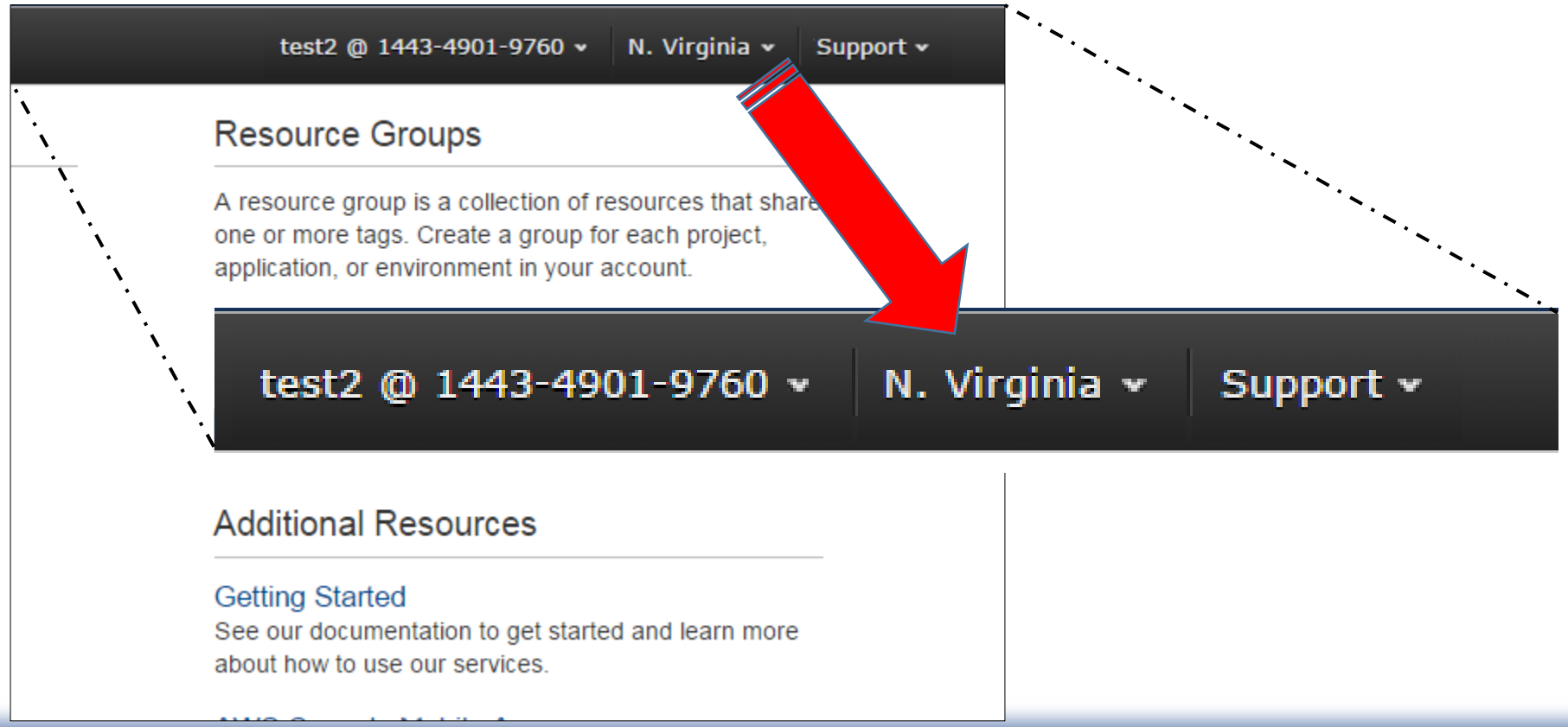
- Latency
- Compliance
- Regional Considerations (cost of land, etc.)
- Services

Amazon Availability Zone

- Resources available across AZs in any given region
- High availability
- Replicate data/services across multiple AZs
- If one goes down, no loss of service



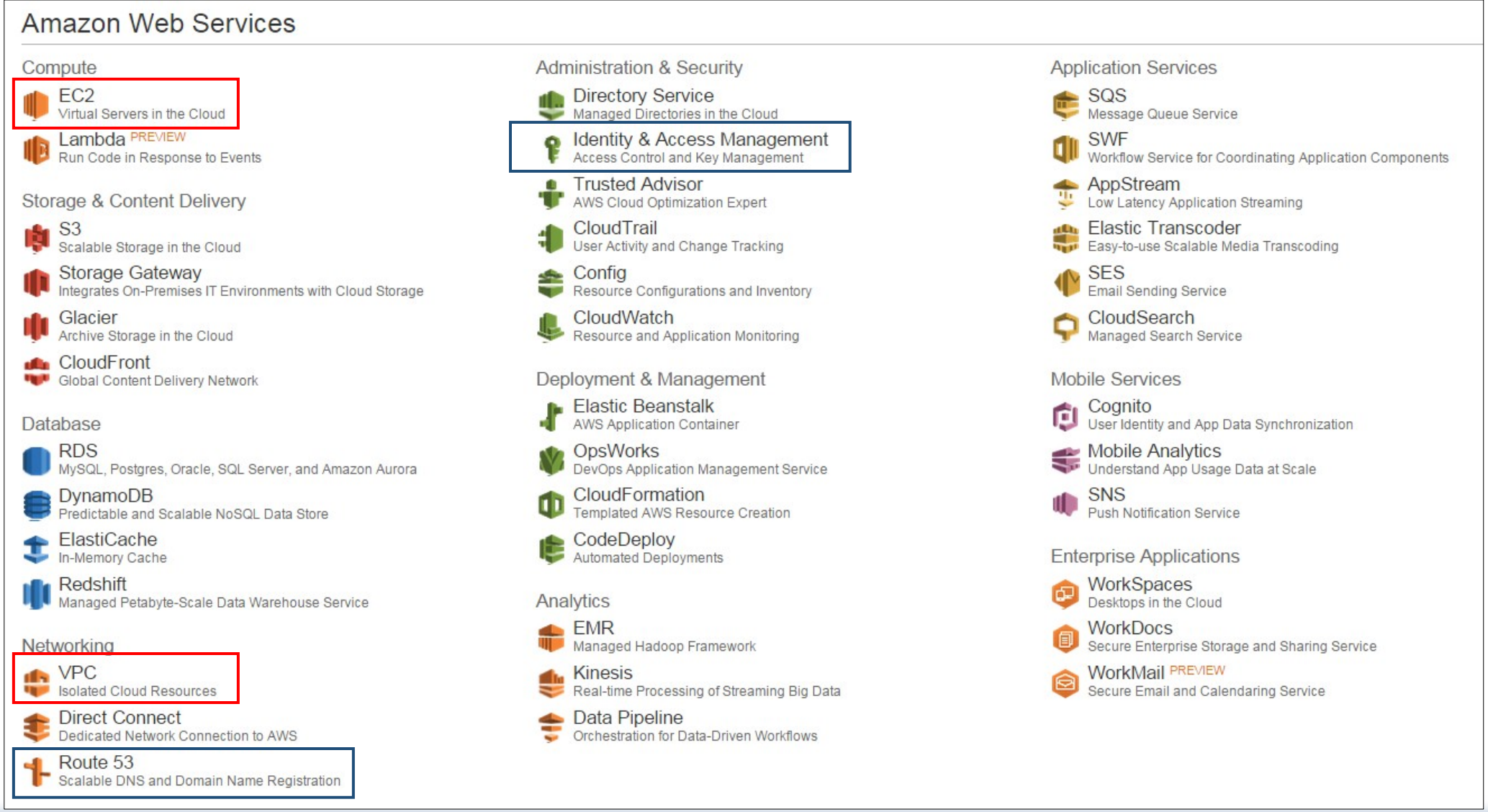
Amazon Regions



AWS Services and Appliances

- Cloud-based and virtual equivalents to traditional datacenter entities
- Examples
  - Server provisioning
  - Networking
  - Firewalls
  - Load balancers
  - Data stores
  - Deployment and management, etc.

AWS


Amazon Web Services
Compute
EC2
Virtual Servers in the Cloud
Lambda PREVIEW
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
Resource Configurations and Inventory
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
WorkDocs
Secure Enterprise Storage and Sharing Service
WorkMail PREVIEW
Secure Email and Calendaring Service

Amazon EC2

- Provision, configure, and launch server instances
- Resizable control of computing resources
- Best suited for horizontal scaling (not good for databases)
- http://ec2instances.info
- Instances are optimized for different use cases

Amazon EC2

- Purchasing Options
  - On demand - Pay as you go
  - Reserved - 1 or 3 year terms. Capacity available as needed
  - Spot Instances - customer bids on unused capacity. Price based on supply/demand; determined automatically.
    - For temporary computing needs
    - Pricing

EC2 Dashboard

EC2 Management Console

https://console.aws.amazon.com/ec2/v2/home?region=us-east-1#

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AWS | Services | Edit | test2 @ 1443-4901-9760 | N. Virginia | Support

EC2 Dashboard
Events
Tags
Reports
Limits

INSTANCES
Instances
Spot Requests
Reserved Instances

IMAGES
AMIs
Bundle Tasks

ELASTIC BLOCK STORE
Volumes
Snapshots

NETWORK & SECURITY
Security Groups
Elastic IPs
Placement Groups
Load Balancers
Key Pairs
Network Interfaces

AUTO SCALING
Launch Configurations
Auto Scaling Groups

Resources

You are using the following Amazon EC2 resources in the US East (N. Virginia) region:

0 Running Instances
8 Volumes
8 Key Pairs
0 Placement Groups
1 Elastic IPs
2 Snapshots
0 Load Balancers
7 Security Groups

Easily deploy Ruby, PHP, Java, .NET, Python, Node.js & Docker applications with Elastic Beanstalk.

Hide

Create Instance

To start using Amazon EC2 you will want to launch a virtual server, known as an Amazon EC2 instance.

Launch Instance

Note: Your instances will launch in the US East (N. Virginia) region

Service Health

Service Status:

US East (N. Virginia):
This service is operating normally

Availability Zone Status:

us-east-1a:
Availability zone is operating normally

us-east-1b:
Availability zone is operating normally

Scheduled Events

US East (N. Virginia):

No events

Account Attributes

Supported Platforms
VPC

Default VPC
vpc-6266dc07

Additional Information

Getting Started Guide
Documentation
All EC2 Resources
Forums
Pricing
Contact Us

AWS Marketplace

Find **free software trial** products in the AWS Marketplace from the EC2 Launch Wizard.
Or try these popular AMIs:

Vyatta Virtual Router/Firewall/VPN

Provided by Vyatta, Inc.
Rating ★★★★★
Pay by the hour for software and AWS usage
View all Networking

Alert Logic Threat Manager for AWS

Provided by Alert Logic, Inc.

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Feedback

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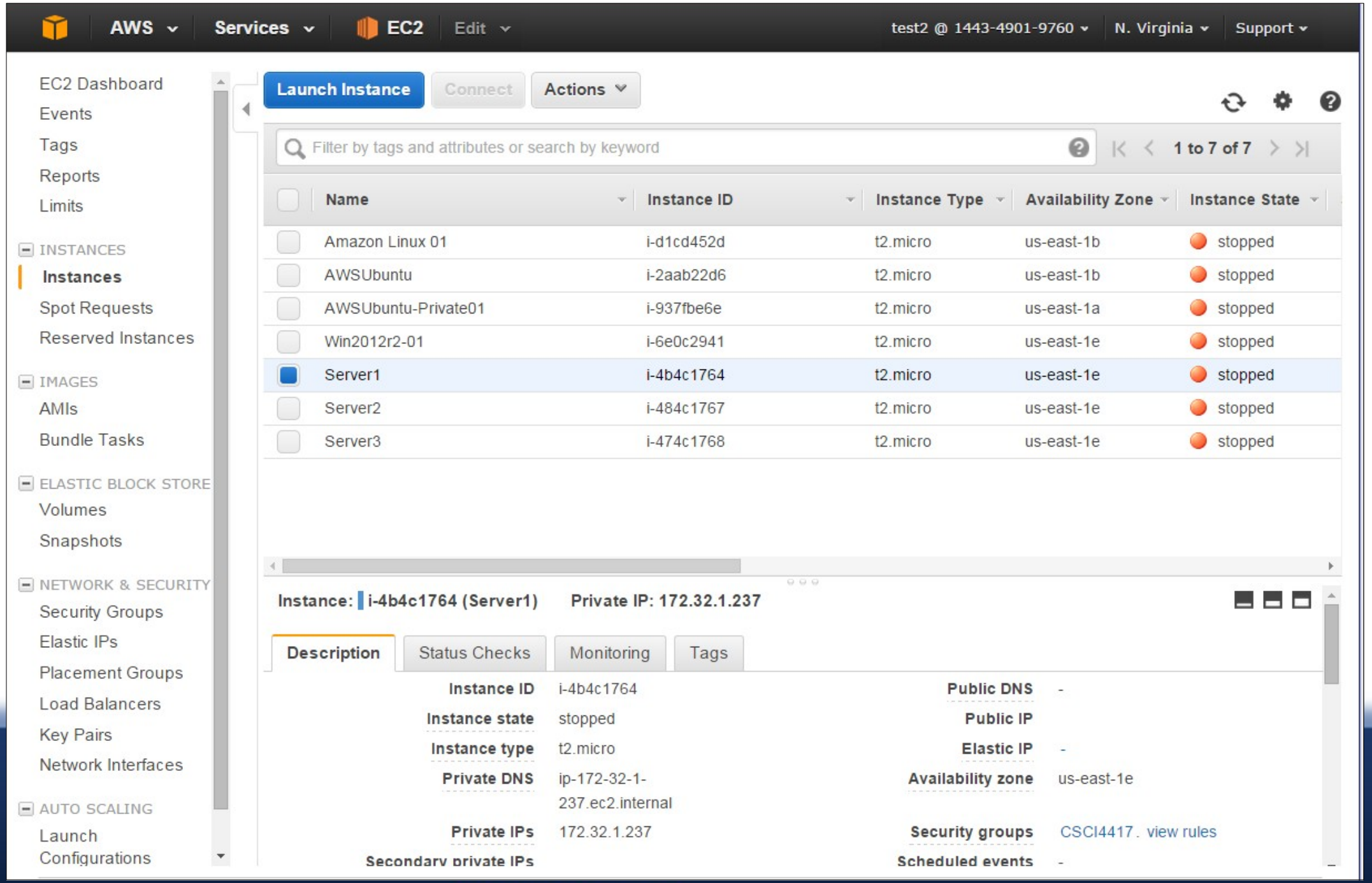
AWS
Services
EC2
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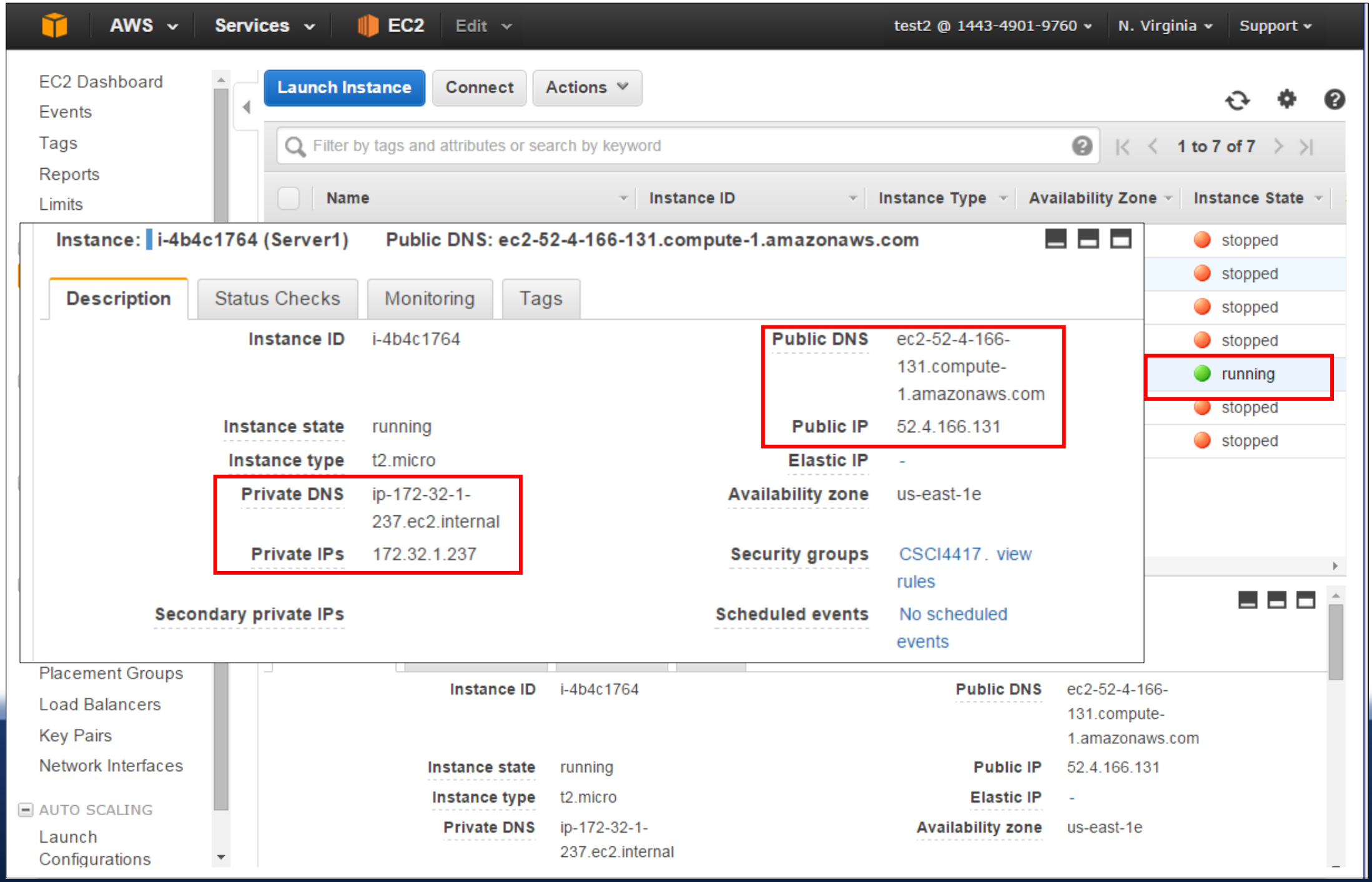
Key Pairs
Network Interfaces
AUTO SCALING
Launch Configurations
Launch Instance
Connect
Actions
Filter by tags and attributes or search by keyword
1 to 7 of 7
Name
Instance ID
Instance Type
Availability Zone
Instance State
Amazon Linux 01 i-d1cd452d t2.micro us-east-1b stopped
AWSUbuntu i-2aab22d6 t2.micro us-east-1b stopped
AWSUbuntu-Private01 i-937fbe6e t2.micro us-east-1a stopped
Win2012r2-01 i-6e0c2941 t2.micro us-east-1e stopped
Server1 i-4b4c1764 t2.micro us-east-1e stopped
Server2 i-484c1767 t2.micro us-east-1e stopped
Server3 i-474c1768 t2.micro us-east-1e stopped
Instance: i-4b4c1764 (Server1)
Private IP: 172.32.1.237
Description
Status Checks
Monitoring
Tags
Instance ID i-4b4c1764
Instance state stopped
Instance type t2.micro
Private DNS ip-172-32-1-237.ec2.internal
Private IPs 172.32.1.237
Secondary private IPs
Public DNS -
Public IP
Elastic IP -
Availability zone us-east-1e
Security groups CSCI4417. view rules
Scheduled events -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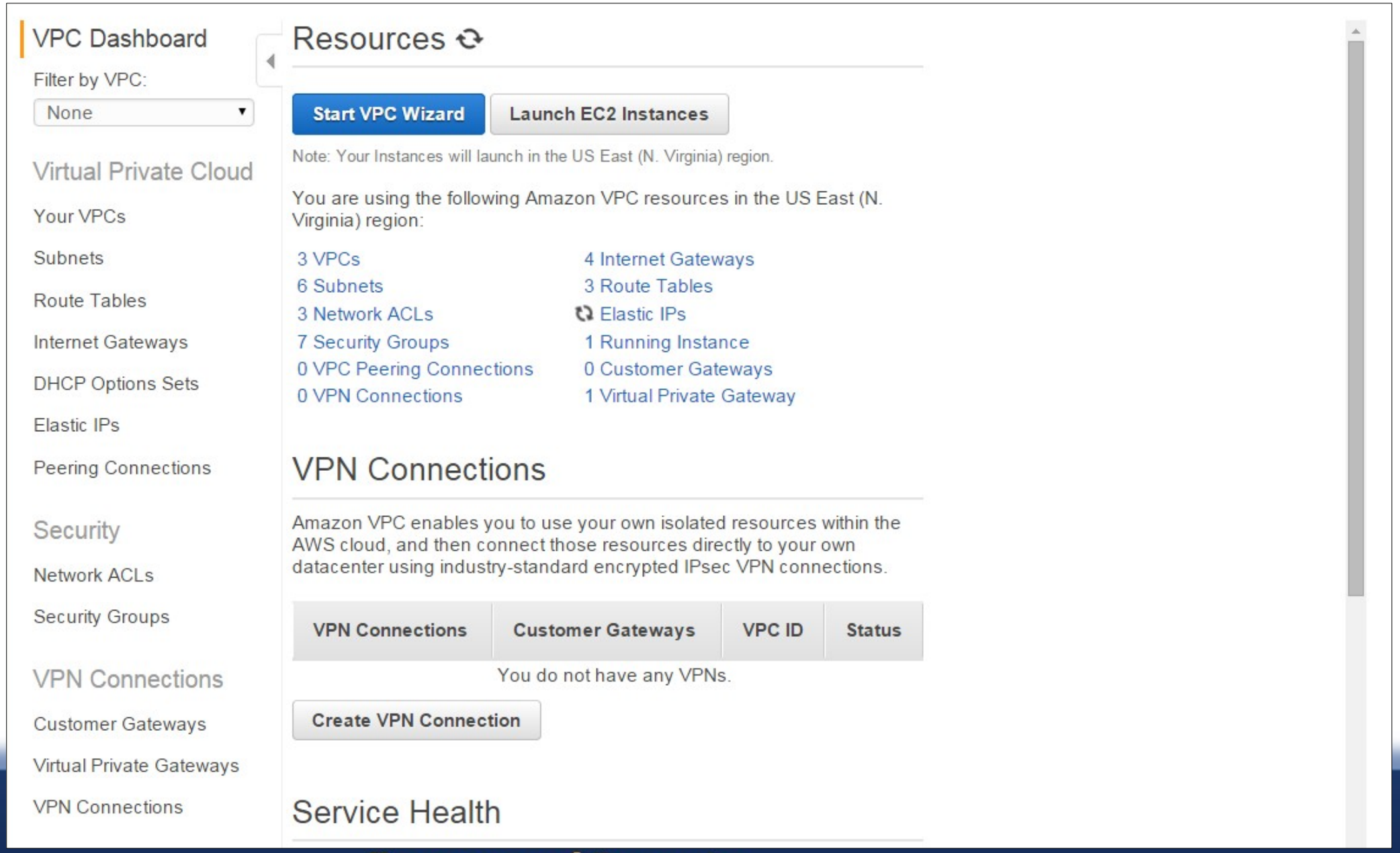
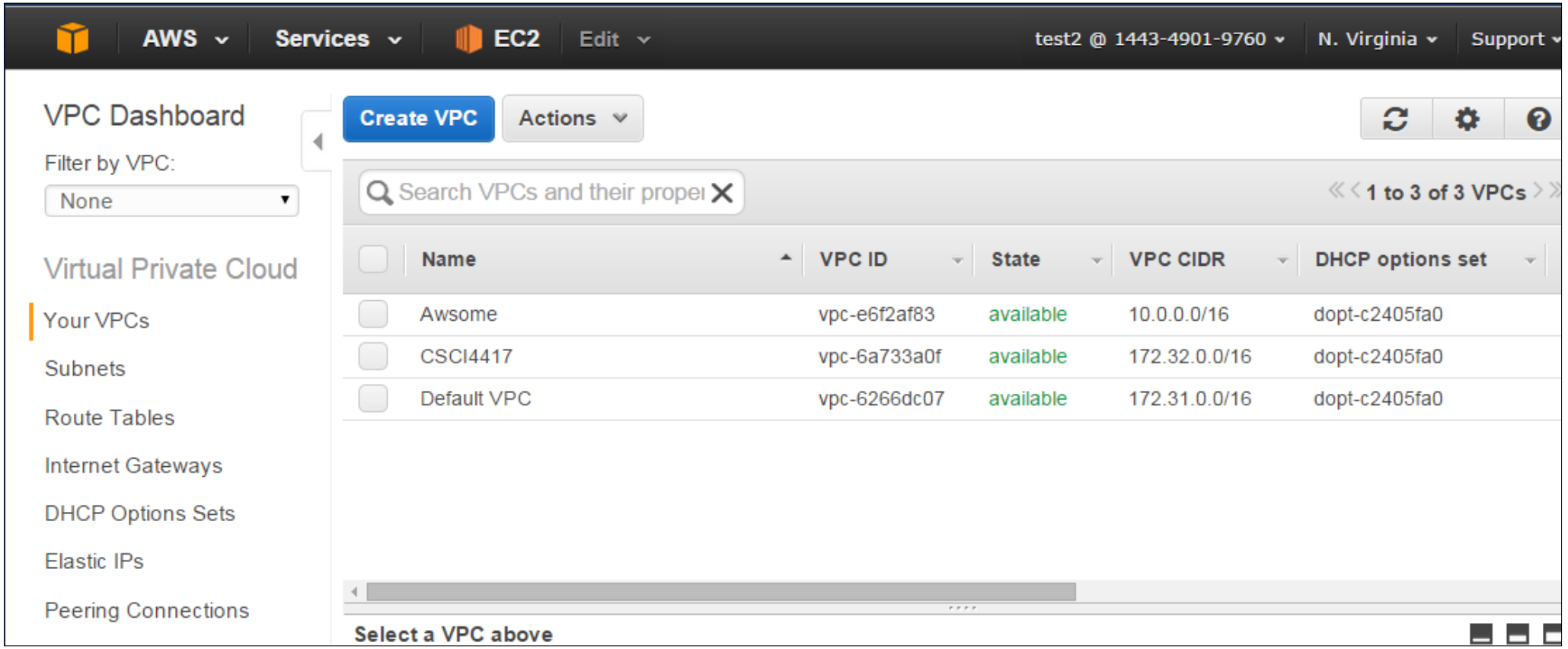
Filter by tags and attributes or search by keyword
1 to 7 of 7
Name
Instance ID
Instance Type
Availability Zone
Instance State
stopped
stopped
stopped
stopped
running
stopped
stopped
Instance: i-4b4c1764 (Server1)
Public DNS: ec2-52-4-166-131.compute-1.amazonaws.com
Description
Status Checks
Monitoring
Tags
Instance ID
i-4b4c1764
Instance state
running
Instance type
t2.micro
Private DNS
ip-172-32-1-237.ec2.internal
Private IPs
172.32.1.237
Secondary private IPs
Public DNS
ec2-52-4-166-131.compute-1.amazonaws.com
Public IP
52.4.166.131
Elastic IP
-
Availability zone
us-east-1e
Security groups
CSCI4417. view rules
Scheduled events
No scheduled events
Placement Groups
Load Balancers
Key Pairs
Network Interfaces
AUTO SCALING
Launch Configurations
Instance ID
i-4b4c1764
Instance state
running
Instance type
t2.micro
Private DNS
ip-172-32-1-237.ec2.internal
Public DNS
ec2-52-4-166-131.compute-1.amazonaws.com
Public IP
52.4.166.131
Elastic IP
-
Availability zone
us-east-1e

Virtual Private Cloud (VPC)



Virtual Private Cloud (VPC)



Virtual Private Cloud (VPC)

VPC Management Console

https://console.aws.amazon.com/vpc/home?region=us-east-1#subnets:

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VPC Dashboard

Filter by VPC: None

Virtual Private Cloud

- Your VPCs
- Subnets
- Route Tables
- Internet Gateways
- DHCP Options Sets
- Elastic IPs
- Endpoints
- Peering Connections

Security

- Network ACLs
- Security Groups

VPN Connections

- Customer Gateways
- Virtual Private

Create Subnet | Subnet Actions

Search Subnets and their prop

1 to 3 of 3 Subnets

Name	Subnet ID	State	VPC	CIDR
testUbuntu	subnet-45282e32	available	vpc-ac30ccc8 (180.1.0.0/16) | testVPC	180.1.1.(
default	subnet-42e38635	available	vpc-6266dc07 (172.31.0.0/16) | Defa...	172.31.1
ramsey	subnet-c53f1aff	available	vpc-6a733a0f (172.32.0.0/16) | Admi...	172.32.0

subnet-45282e32 (180.1.1.0/24) | testUbuntu

Summary | Route Table | Network ACL | Flow Logs | Tags

Subnet ID: subnet-45282e32 | testUbuntu
CIDR: 180.1.1.0/24
State: available
VPC: vpc-ac30ccc8 (180.1.0.0/16) | testVPC
Available IPs: 251

Availability Zone: us-east-1a
Route table: rtb-ed01a089 | testRT
Network ACL: acl-9c33c8f8
Default subnet: no
Auto-assign Public IP: yes

Feedback | English | | Privacy Policy | Terms of Use

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Virtual Private Cloud (VPC)

VPC Management Console

https://console.aws.amazon.com/vpc/home?region=us-east-1#routetables:

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Create Route Table | Delete Route Table | Set As Main Table

Search Route Tables and their

1 to 3 of 3 Route Tables

Name	Route Table ID	Explicitly Associat	Main	VPC
testRT	rtb-ed01a089	1 Subnet	Yes	vpc-ac30ccc8 (180.1.0.0/16) | t
CSCI4417 RT	rtb-27144e42	0 Subnets	Yes	vpc-6a733a0f (172.32.0.0/16) |
Default	rtb-6365e006	0 Subnets	Yes	vpc-6266dc07 (172.31.0.0/16) |

rtb-ed01a089 | testRT

Summary | Routes | Subnet Associations | Route Propagation | Tags

Edit

Destination	Target	Status	Propagated
180.1.0.0/16	local	Active	No
0.0.0.0/0	igw-8aa586ef	Active	No

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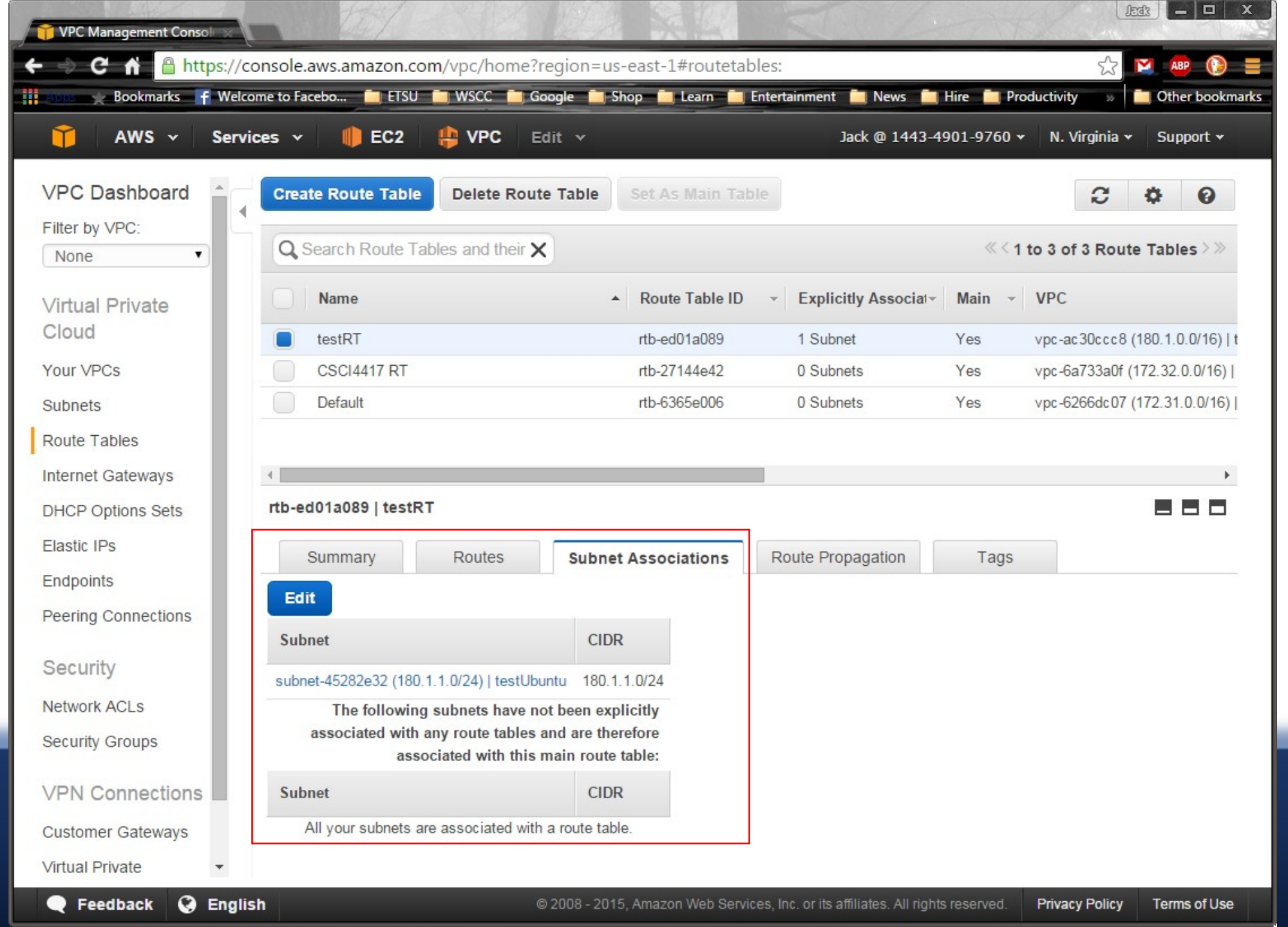
Virtual Private Cloud (VPC)



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Virtual Private Cloud (VPC)

VPC Dashboard

Filter by VPC:

None

Virtual Private Cloud

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- Elastic IPs
- Peering Connections

Security

- Network ACLs
- Security Groups

VPN Connections

- Customer Gateways
- Virtual Private Gateways

Create Security Group | Delete Security Group

Filter: All security groups | Search Security Groups and t

	sg-fa53549f	eastmanProject
	sg-c3f299a7	awsatlkey
	sg-66f89302	default
	sg-6daa9708	default
	sg-f7979092	Wide Open
■	sg-db5fcbbf	CSCI4417

sg-db5fcbbf

Summary | **Inbound Rules** | Outbound Rules

Edit

Type	Protocol	Port Range	Source
ALL Traffic	ALL	ALL	172.32.0.0/16
SSH (22)	TCP (6)	22	0.0.0.0/0
RDP (3389)	TCP (6)	3389	0.0.0.0/0
Custom TCP Rule	TCP (6)	3390	0.0.0.0/0
Custom UDP Rule	UDP (17)	3390	0.0.0.0/0

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Sources

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