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IST 615 – CLOUD MANAGEMENT

CLOUD AND NETWORKING TECHNOLOGY FUNDAMENTALS - PART 3 AZURE AND AWS

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Outline

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- Announcements
- Recap
- Lab #1 review – VMs in Azure
- Additional Virtual machine and Cloud concepts
- Intro to AWS – Part 1
- Overview of Lab #2 (AWS Lab)

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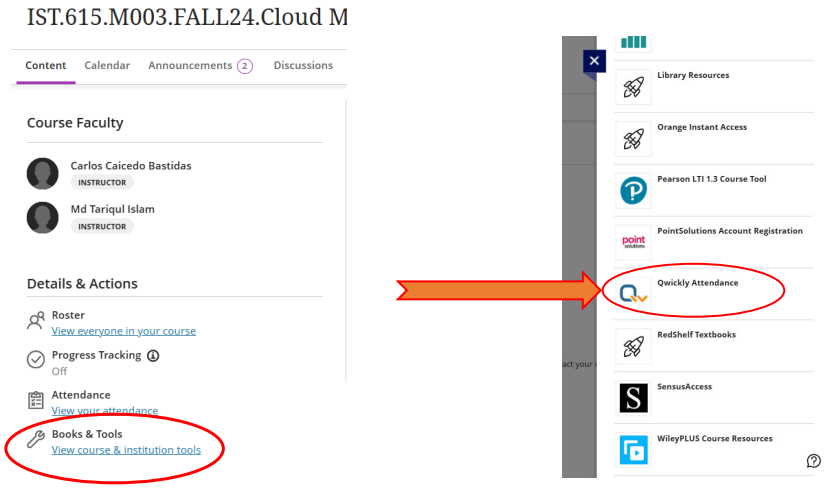
Attendance

- We will use the Qwickly attendance tool to register attendance for each session of the course.
  - Go to Blackboard and click on the "View course and Institutions tools" link
  - On the list of tools, click on "Qwickly Attendance" and follow the instructions provided in class to register your attendance



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Announcements (1)

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- Access to Microsoft Azure resources and more…
  - The Visual Studio Enterprise Subscription can be purchased by IST 615 students through the bookstore. The process to acquire it and use it is described here: https://su-jsm.atlassian.net/wiki/x/QA3zC
  - Focus on completing the steps mentioned in the "Getting started" section. The rest of the sections in the webpage are just informational. The "Getting started" section and the Campus bookstore link is where students will need to go to complete their purchase. It will likely take 24 hours for the subscriptions to process.
  - Subscription provides $150 of Azure resources PER MONTH (i.e. it renews every month) for at least a year
    - *You buy the subscription only ONCE from the bookstore*

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Microsoft Azure (2)

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- **Alternative option**: Azure for Students (NOT RECOMMENDED)
  - Provides $100 in Azure credits to be used over 12 months ***if you have not used this subscription for another course in the past !!***
    - Once the $100 credit is consumed you have to move to pay-as-you-go option
  - Details: https://azure.microsoft.com/en-us/free/students/
  - NOTE 1: This option is not recommended for IST 615 !!
    - The VSE subscription gives access to more Azure services than the Azure for Students account
    - You can have both VSE and Azure for Student subscriptions with no conflicts
  - NOTE 2: This option is *different* from the *Azure Free Account*
    - The Azure Free Account has many service restrictions
    - Make sure you subscribe to the option you really want to work with
- Complete the process to get access to Azure resources on or **before Tuesday, September 10**

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Labs

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- Lab 1: Virtual Machines in Azure
  - To be released today
  - *Due: September 20@ noon (extended deadline)*
  - Review session in the next class session (September 17) to address any issues found
- Lab 2: AWS
  - To be released next week
  - Due: September 24@ 5 p.m.

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Labs – Troubleshooting

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- Students can create Discussion topics to get help from classmates and faculty on lab related problems or issues
  - Use the "Discussions" tool in Blackboard and create a "New Discussion"
  - Please describe your problem clearly and mention **at least 2 approaches** to solve the problem that you have already tried.
  - After posting an issue, e-mail the instructor if you want him to get involved
  - Other students can also proceed to provide help and it would be counted as participation in class (see Participation points)
  - If possible, include a Kaltura Media video capture of the problem and try not to include private credentials in the video or problem description

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Announcements (2)

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- Accounts to use resources from the AWS Academy have been setup
  - If you haven't received an e-mail about AWS Academy, I can re-send the invitation to you.

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Announcements

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- Cloud news
  - https://www.ciodive.com/news/aws-microsoft-azure-cloud-skills-job-postings-data/727010/
  - https://www.ciodive.com/news/aws-data-center-ai-infrastructure-investment-billions-uk/726761/

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Recap

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Internet Architecture

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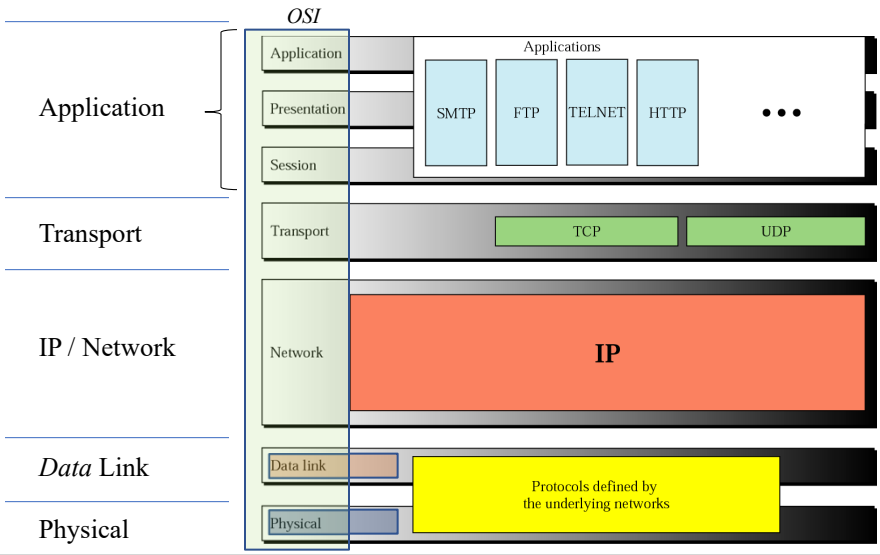

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Internet Addressing

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- Each host in the network is assigned a unique 32-bit address: the IP address
- For convenience, an IP address is depicted using decimal notation
  10000000 00000011 00001001 00000001
  = 128.3.9.1
- Conceptually, each address is a pair (Network Identifier, and Host Identifier)
- The IP address does not specify an individual machine, but a connection to a network
  - A host or device can have multiple connections (multi-homing)

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Private IP addresses

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- For private internets, the choice of network prefix can be made by the organization
  - To help make this assigment unique, RFC 1918 recommends specific address blocks that can be used in private internets
  - 10.0.0.0 - 10.255.255.255 (10/8 prefix)
  - 172.16.0.0 - 172.31.255.255 (172.16/12 prefix)
  - 192.168.0.0 - 192.168.255.255 (192.168/16 prefix)

13

Transport Layer

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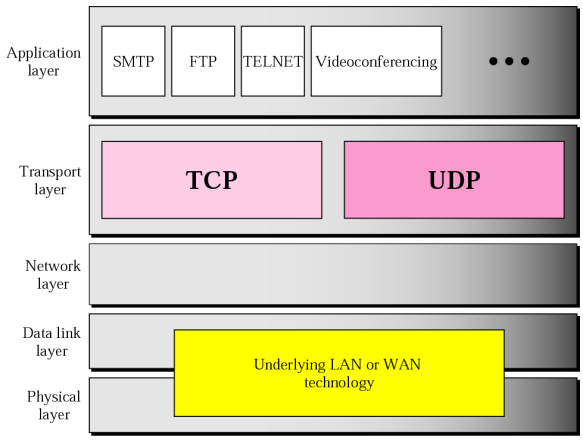

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Transport Layer

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- Gives support to application layer services
- Manages the connection between hosts
- Connections can have a range of features
  - Quality of service, security, etc.

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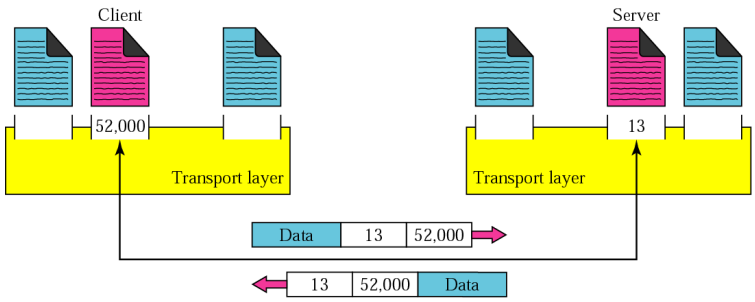
Port Numbers



- Clients use temporary port numbers
- Servers use well-know port numbers

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Well-Known Port Numbers

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Port	Primary Protocol	Application
22	TCP	Secure Shell (SSH)
80	TCP	Hypertext Transfer Protocol (HTTP)
110	TCP	Post Office Protocol (POP)
135-139	TCP	NETBIOS service for peer-to-peer file sharing in older versions of Windows
143	TCP	Internet Message Access Protocol (IMAP)
161	UDP	Simple Network Management Protocol (SNMP)
443	TCP	HTTP over SSL/TLS

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Connecting to a "node" on the Internet (in the Cloud)

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- You need to know the IP address of the "node" (e.g. a virtual machine)
  - OR know its *full name* and have DNS find the IP address

AND

- You need to know the (transport layer) port number over which the connection is supported
  - Typically SSH runs on TCP port 22

- Note: All of this assumes that you have the proper permissions and system configurations to access the node

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What is SSH (Secure Shell)?

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- "SSH is a protocol for secure remote login and other secure network services over an insecure network." – RFC 4251
- Establishes a secure communication channel between two computers
  - Provides data confidentiality and integrity
  - ssh client: local computer running an SSH client application
  - ssh server: remove computer running an SSH server process
- Besides "remote shell access", SSH offers many other capabilities.

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20 Lab #1 review

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Lab #1 review

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- Review of Lab #1 steps
  - Let's go through the lab document
  - Summary video (to be presented in class)

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22 Virtualization

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Virtualization is a key component of many cloud services

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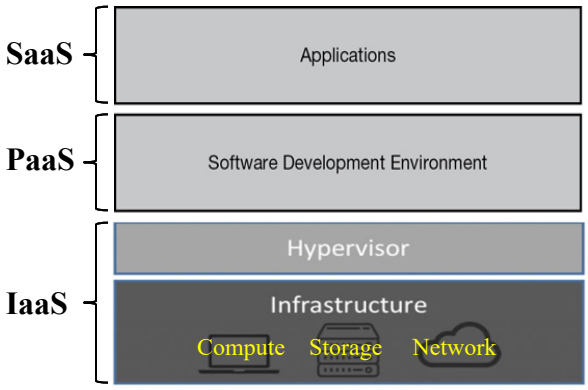

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Hypervisor platforms/tools

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- KVM
  - Included with Linux
  - + virt_manager
- VMware
  - vSphere ESXi
  - vCenter
- Citrix XEN
- Virtual Box (from Oracle)

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Terminology

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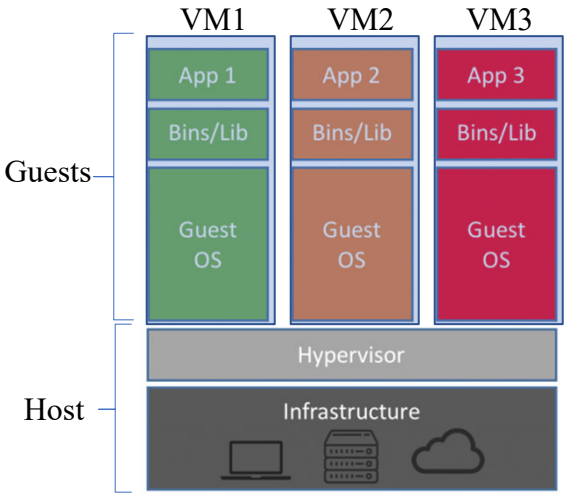

The guest's operating system (Guest OS) can be any OS supported by the architecture of the server hardware (host) and the hypervisor.

- You need the code for the OS, also referred to as the *OS Image*
- The OS image can be in many formats, you should use one supported by your virtualization platform/software.
  - iso, qcow2, ovf, raw, img

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KVM

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- KVM (Kernel-based Virtual Machine):
  - Full virtualization solution for Linux on x86 hardware (and other platforms)
  - Using KVM, one can run multiple virtual machines running unmodified Linux or Windows OS images.
    - Each virtual machine has its own virtualized hardware
      - E.g. a network card, disk, graphics adapter, etc.

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Virt-manager

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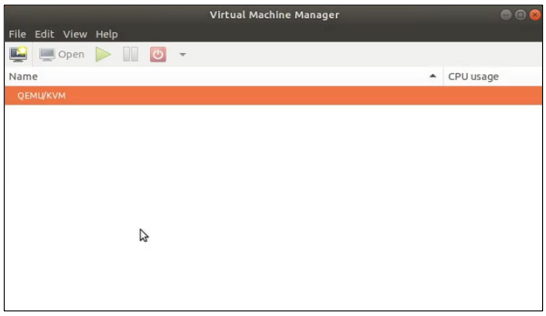
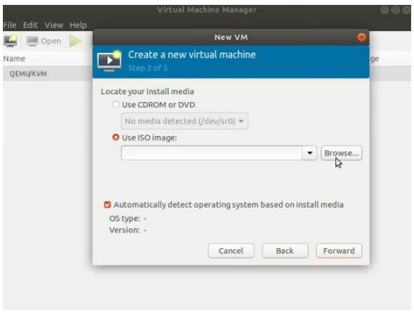
- Virt-manager = The "Virtual Machine Manager"
  - It provides a desktop user interface for managing virtual machines.
  - It allows you to view the performance & resource utilization statistics of VMs.
  - Wizards enable the creation of new VMs, resources, and configurations





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VMware

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- vSphere ESXi : main software component that implements VMware's hypervisor
  - Every server with ESXi can be a host to several Virtual Machines (guests)
  - All servers with ESXi and their guests can be managed with vCenter
- vCenter: Provides a central management interface to all ESXi hosts and VMs
  - Supports advanced features such as: VM Cloning, vMotion, High Availability (HA), Fault tolerance and others

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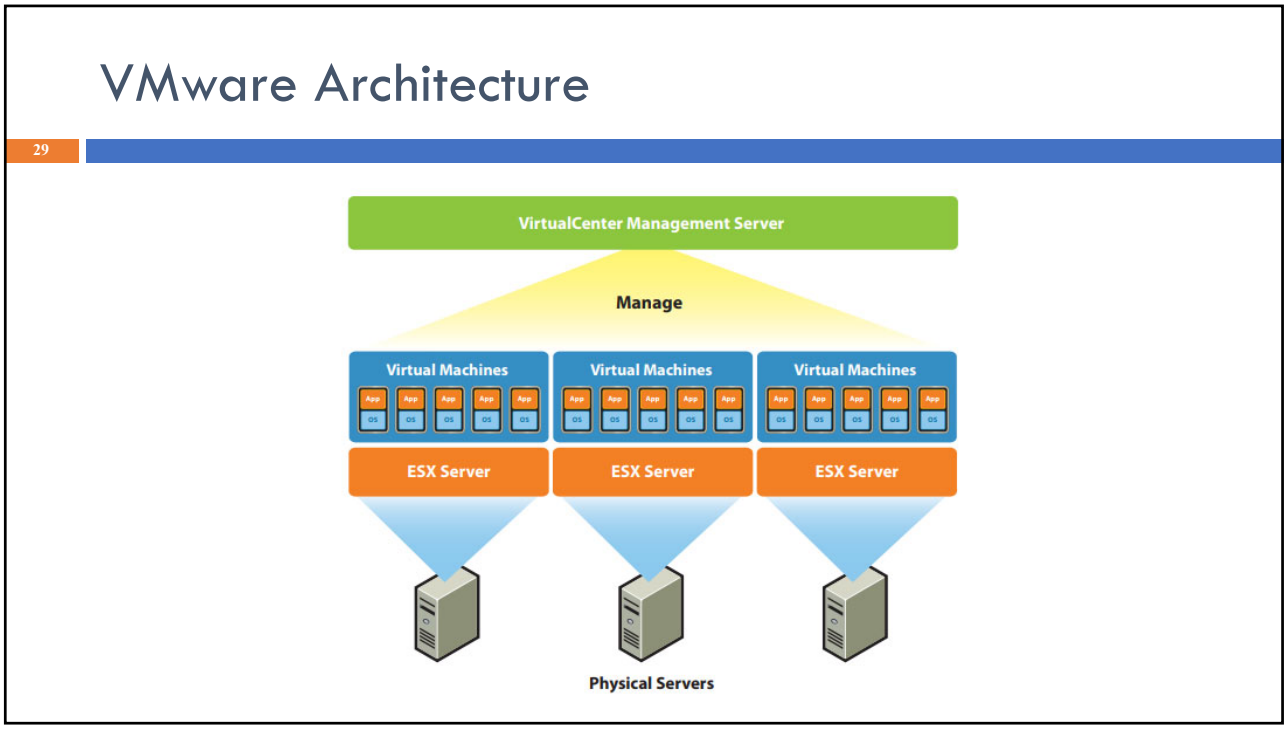
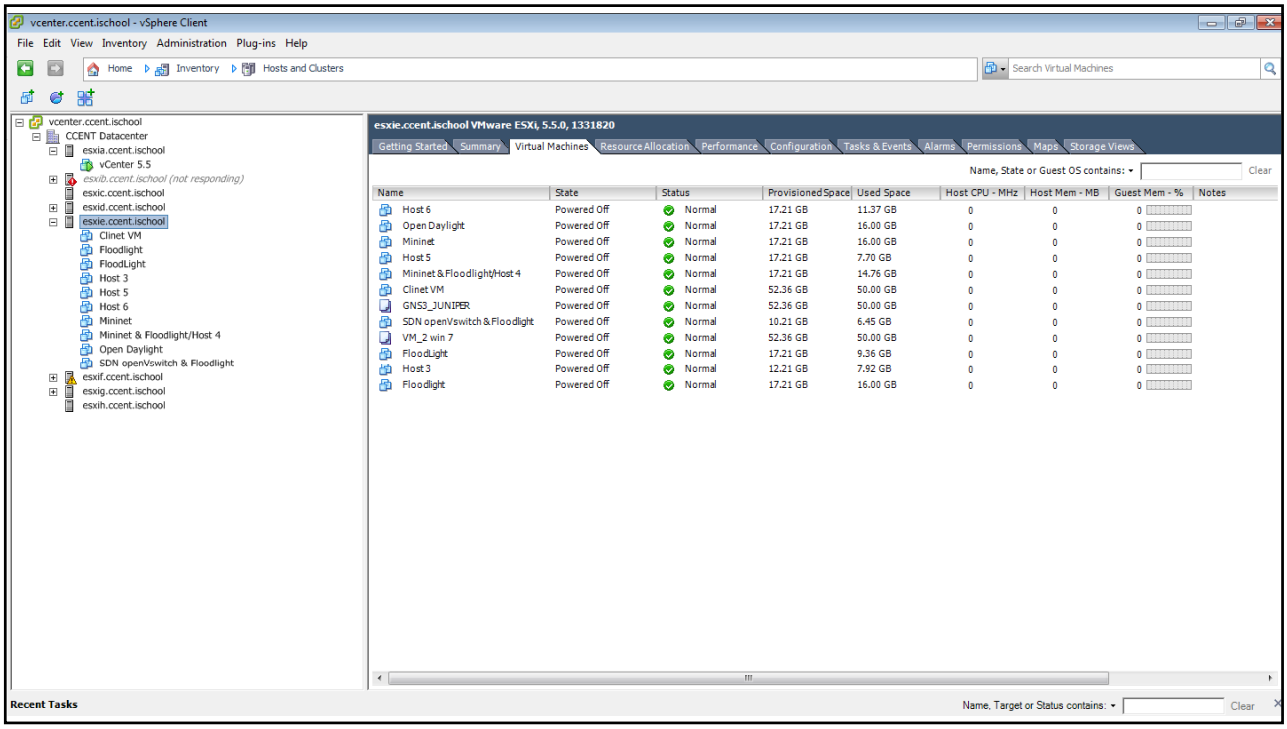

VMware Architecture
29
VirtualCenter Management Server
Manage
Virtual Machines
Virtual Machines
Virtual Machines
ESX Server
ESX Server
ESX Server
Physical Servers

29


vcenter.ccent.ischool - vSphere Client
File Edit View Inventory Administration Plug-ins Help
Home Inventory Hosts and Clusters
Search Virtual Machines
vcenter.ccent.ischool
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esxic.ccent.ischool
esxid.ccent.ischool
esxie.ccent.ischool
Clinet VM
Floodlight
FloodLight
Host 3
Host 5
Host 6
Mininet
Mininet & Floodlight/Host 4
Open Daylight
SDN openVswitch & Floodlight
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esxig.ccent.ischool
esxih.ccent.ischool
esxie.ccent.ischool VMware ESXi, 5.5.0, 1331820
Getting Started Summary Virtual Machines Resource Allocation Performance Configuration Tasks & Events Alarms Permissions Maps Storage Views
Name, State or Guest OS contains:
Clear
Name State Status Provisioned Space Used Space Host CPU - MHz Host Mem - MB Guest Mem - % Notes
Host 6 Powered Off Normal 17.21 GB 11.37 GB 0 0 0
Open Daylight Powered Off Normal 17.21 GB 16.00 GB 0 0 0
Mininet Powered Off Normal 17.21 GB 16.00 GB 0 0 0
Host 5 Powered Off Normal 17.21 GB 7.70 GB 0 0 0
Mininet & Floodlight/Host 4 Powered Off Normal 17.21 GB 14.76 GB 0 0 0
Clinet VM Powered Off Normal 52.36 GB 50.00 GB 0 0 0
GNS3_JUNIPER Powered Off Normal 52.36 GB 50.00 GB 0 0 0
SDN openVswitch & Floodlight Powered Off Normal 10.21 GB 6.45 GB 0 0 0
VM_2 win 7 Powered Off Normal 52.36 GB 50.00 GB 0 0 0
FloodLight Powered Off Normal 17.21 GB 9.36 GB 0 0 0
Host 3 Powered Off Normal 12.21 GB 7.92 GB 0 0 0
Floodlight Powered Off Normal 17.21 GB 16.00 GB 0 0 0
Recent Tasks
Name, Target or Status contains:
Clear

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OpenStack

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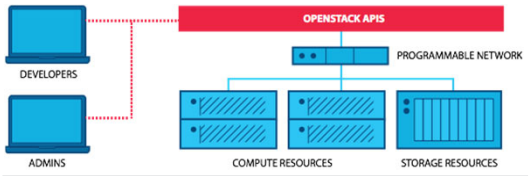
- OpenStack is open source software for building clouds.
- It offers a programmable infrastructure that allows users to have one platform for virtual machines, containers and bare metal systems.
- OpenStack has multiple projects under its name. The projects cover foundational elements like compute, networking and storage, but also span from telemetry to orchestration to container APIs.



Programmable infrastructure that lays a common set of APIs on top of compute, networking and storage

One platform for virtual machines, containers and bare metal

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openstack.

OpenStack is open source

HERE'S WHY THAT MATTERS

Choice & control: ability to choose between and switch vendors

Ability to contribute or directly influence the roadmap

Widely adopted open source APIs are the new standards

Part of a vibrant community to share knowledge and help each other

OPENSTACK PRINCIPLES

1. OPEN SOURCE
2. OPEN DESIGN
3. OPEN DEVELOPMENT
4. OPEN COMMUNITY

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openstack.

Primary business drivers

#1 avoid vendor lock-in

#2 accelerate innovation

#3 operational efficiency

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openstack.

Which industries choose OpenStack?

RETAIL/E-COMMERCE

BEST BUY Walmart ebay overstock snapdeal

FINANCIAL

TD Bank PayPal FICO AMERICAN EXPRESS UnionPay 银联 CommonwealthBank

TELECOM

AT&T NTT Communications Transform. Transcend. Deutsche Telekom 中国移动 China Mobile

ACADEMIC/RESEARCH

Massachusetts Institute of Technology CERN HARVARD UNIVERSITY

ENERGY AND MANUFACTURING

STATE GRID CORPORATION OF CHINA

INSURANCE

iag Folksam

ENTERTAINMENT

COMCAST PADDYPOWER betfair

See more at openstack.org/user-stories

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OpenStack (Intro video)

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- https://video.syr.edu/media/t/1_102o3z0d

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36 Intro to AWS – Part 1

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Introduction to AWS

37

- Creating resources in AWS typically starts with the creation of what is called a virtual private cloud (VPC)
  - Virtual servers, virtual storage, and other resources on an isolated private network that you control
- You can create a complex combination of many AWS services
  - Companies moving to the public cloud will likely start with IaaS – moving their servers to the cloud
- Introduction video
  - https://www.youtube.com/watch?v=a9__D53WsUs

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Common AWS Services

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- Amazon EC2
  - Allows you to create virtual machines while managing other server features such as security, and storage.
  - https://www.youtube.com/watch?v=TsRBftzZsQo
- Amazon RDS
  - Relational Database Service (RDS): Allows you to create dedicated instances of databases (in minutes).
  - Instances can support multiple database engines
    - SQL Server, PostgreSQL, etc.
- S3 (Simple Storage Service)
  - Very secure and redundant file storage service
    - By default it stores data in three data centers within a specific region
    - Supports other security and high availability options
- Amazon VPC
  - This service creates a private virtual network that can only be accessed by the people and systems you authorize

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Common AWS Services (2)

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- CloudFront
  - Useful to improve website speed and access to cloud-based data
  - Basically, a Global Content Delivery Service (CDN)
- AWS Lambda
  - Serverless computing service
- AWS Autoscaling
  - Service allows you to configure the scaling of your servers for a particular application.
    - It can create multiple server instances when needed
  - It also offers predictive scaling
    - Provisions a number of EC2 instances ahead of future traffic spikes
- AWS IAM (Identity and Access Management)
  - https://www.youtube.com/watch?v=UI6FW4UANGc

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AWS Academy (1)

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- Students have been added to the AWS Academy
  - You will receive an e-mail with instructions and an invitation to join the academy
- Once you follow the instructions to setup your account (if any steps are necessary), keep in mind the following
  - The AWS Academy has its own LMS environment (Not Blackboard)
  - You will use the "AWS Academy Learner Lab" course
    - Previously, it was called AWS Academy Learner Lab – Foundations
  - Your budget is $100, once it expires it cannot be renewed !! Use it wisely.
  - Each lab session is allocated 4 hours of time – it can be extended
  - Work you do in the AWS Academy environment is long-lived. When the session timer runs to 0:00, the session will end, but any data and resources that you created in the AWS account will be retained.
  - Running resources (such as an EC2 instance) may be stopped. If you later launch a new session (for example, the next day), you will find that your work is still in the lab environment. However, you may need to manually start any stopped resources

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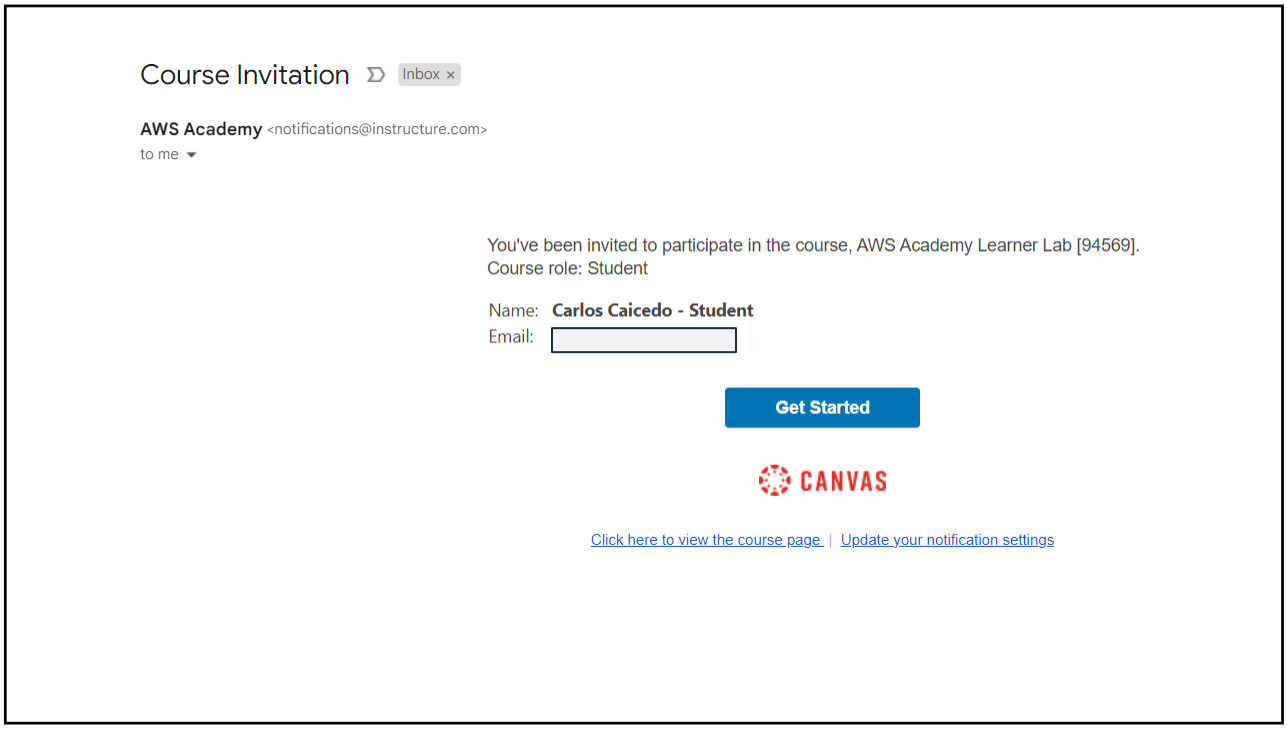
Course Invitation
Inbox ×
AWS Academy <notifications@instructure.com>
to me
You've been invited to participate in the course, AWS Academy Learner Lab [94569].
Course role: Student
Name: Carlos Caicedo - Student
Email:
Get Started
CANVAS
Click here to view the course page | Update your notification settings

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https://www.awsacademy.com/vforcesite/LMS_Login
Search
aws academy
Student Login
(For students enrolled in a class)
学生の方はこちらからログインしてください。
已注册课程的学生请在这里登录
Educator Login
(For educators who have access to the AWS Academy Portal)
講師の方（AWS Academyメンバーポータルのアカウントをお持ちの方）はこちらからログインしてください。
教师请在这里登录（您需使用AWS Academy Portal账户登录）

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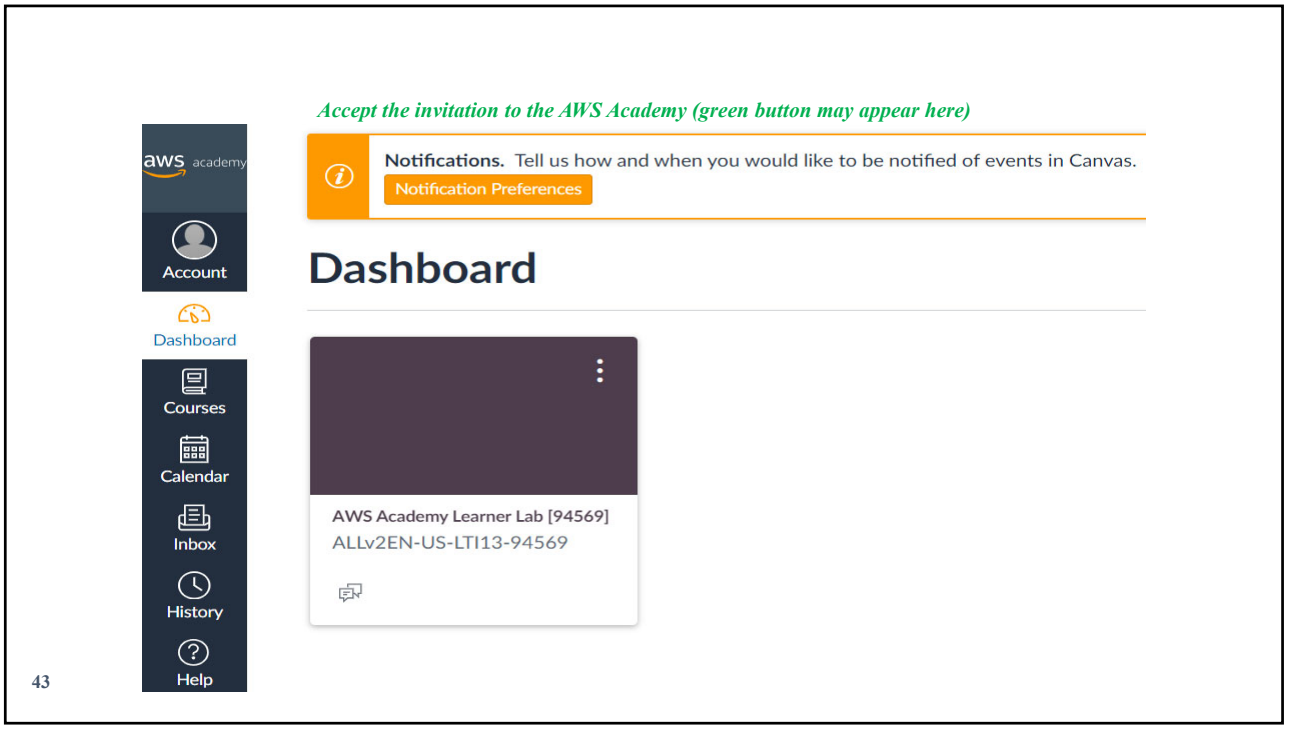
Accept the invitation to the AWS Academy (green button may appear here)
aws academy
Account
Dashboard
Courses
Calendar
Inbox
History
Help
Notifications. Tell us how and when you would like to be notified of events in Canvas.
Notification Preferences
Dashboard
AWS Academy Learner Lab [94569]
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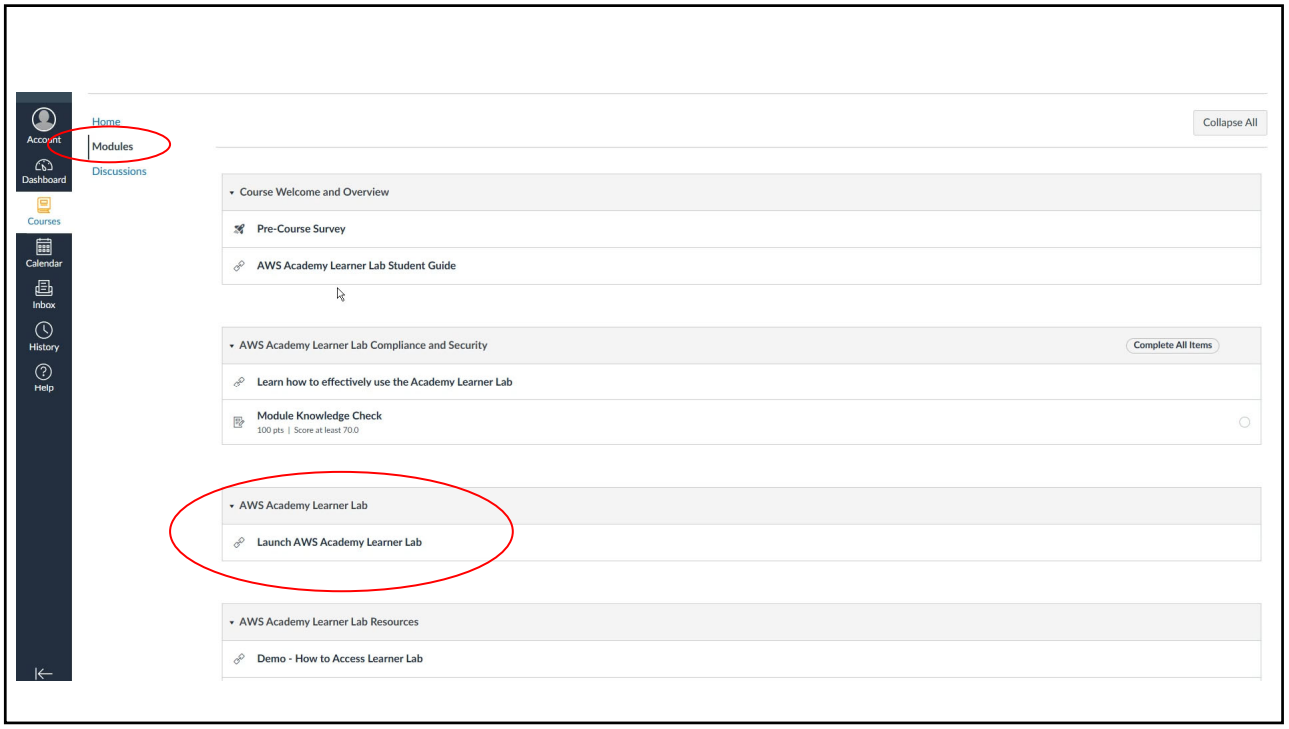
Account
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History
Help
Home
Modules
Discussions
Collapse All
Course Welcome and Overview
Pre-Course Survey
AWS Academy Learner Lab Student Guide
AWS Academy Learner Lab Compliance and Security
Complete All Items
Learn how to effectively use the Academy Learner Lab
Module Knowledge Check
100 pts | Score at least 70.0
AWS Academy Learner Lab
Launch AWS Academy Learner Lab
AWS Academy Learner Lab Resources
Demo - How to Access Learner Lab

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AWS Academy (2)

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- Intro to the AWS Academy environment
  - Read the student guide – In the Academy's Canvas environment
  - Video
    - https://video.syr.edu/media/t/1_ssq3fidc
- TO LOGIN INTO THE ACADEMY, use the following link ONLY after receiving confirmation that your account has been activated
  - https://www.awsacademy.com/LMS_Login
  - Or the link sent to you vie e-mail from AWS

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Assignments and Readings

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- **Lab #2 : AWS Lab**
  - Due September 24 – end of day
  - AWS Academy account is required
    - For Windows OS users
      - Changing security key permissions
        - To be able to use security/encryption keys for SSH the user permissions associated to the keys must be changed so that only one user/owner can have access to them
        - See video
          - https://video.syr.edu/media/t/1_inmargx5
- **Reading:**
  - Cloud pricing comparison: AWS vs. Microsoft Azure vs. Google Cloud vs. IBM Cloud
    - https://cast.ai/blog/cloud-pricing-comparison-aws-vs-azure-vs-google-cloud-platform/

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