Enhancing Research through Cloud Computing

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Answer These Questions

1. Can I have some Microsoft Technology?
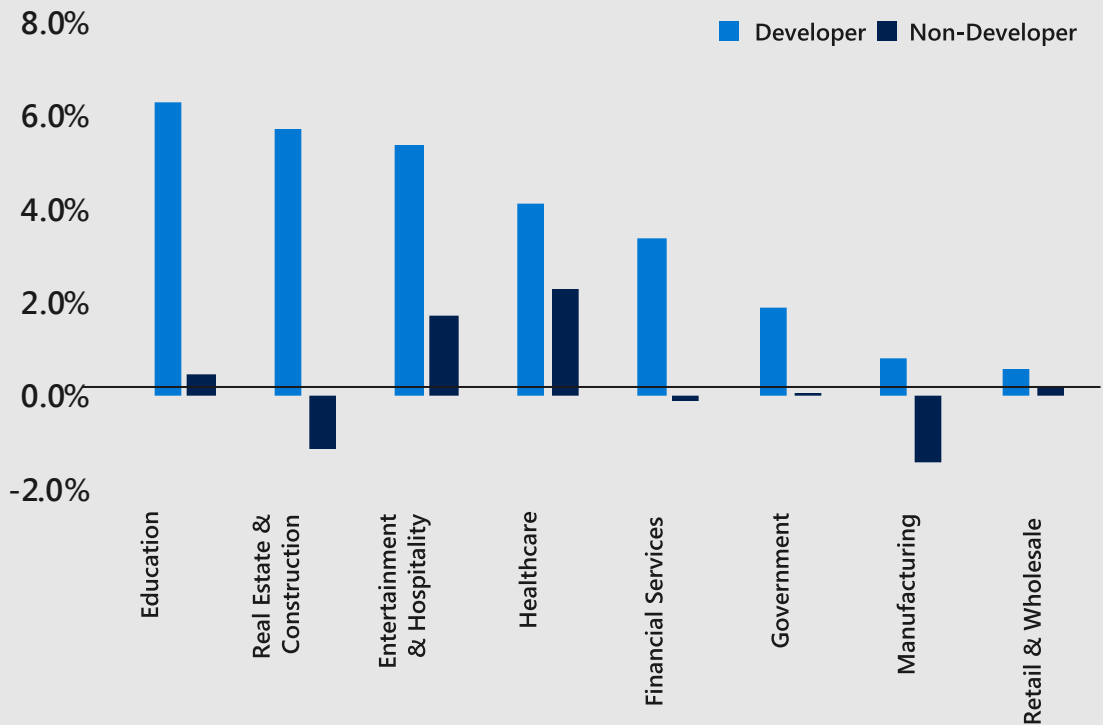2. How much does Microsoft cost?
3. Can I get 10 copies of Microsoft?

I get the same questions about Azure...

Software is being infused in every part of a business, making every company a **software** company
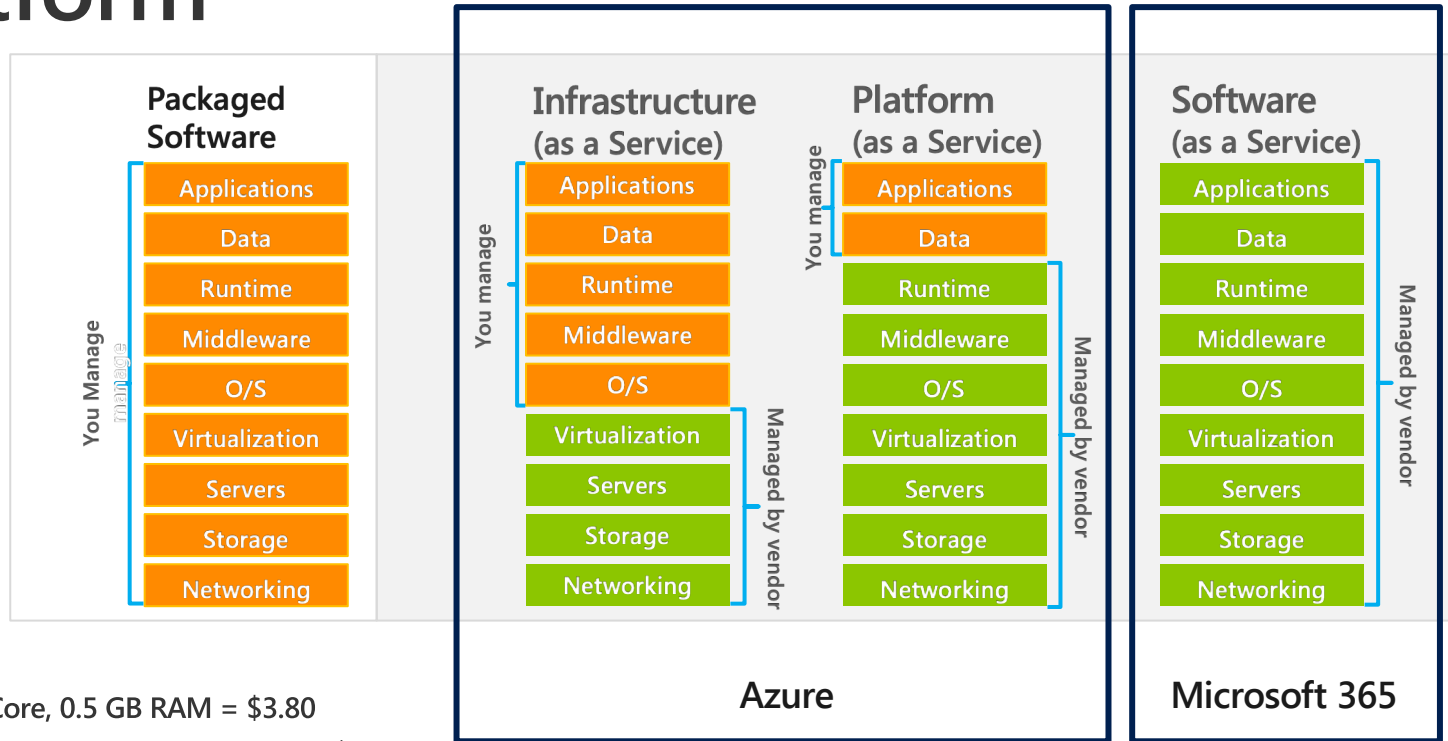
Nearly every industry is being affected...

Developer Growth
By industry (US), 2006-2016

Azure 101 – 10 minutes

Azure is Microsoft's cloud computing platform

Packaged Software	Infrastructure (as a Service)	Platform (as a Service)	Software (as a Service)
Applications	Applications	Applications	Applications
Data	Data	Data	Data
Runtime	Runtime	Runtime	Runtime
Middleware	Middleware	Middleware	Middleware
O/S	O/S	O/S	O/S
Virtualization	Virtualization	Virtualization	Virtualization
Servers	Servers	Servers	Servers
Storage	Storage	Storage	Storage
Networking	Networking	Networking	Networking
	Azure	Azure	Microsoft 365

B1LS – 1 Core, 0.5 GB RAM = $3.80

M208ms – 208 Cores, 5.7TB RAM = $32,572

Cognitive Services

Cognitive Services – Building Blocks for AI Apps

- Facial Recognition (are they the same? Where are the faces?)
- Emotion Recognition (same link)
- Text Analytics (Language, Sentiment, Key Phrases)
- Language Understanding (don't have to be exact)
- Speech to Text (1 speaker, whole meeting)
- Text to Speech (and build your own personal "voice font")
- Speech Translation
- Speaker Identification / Verification (ID Celebrity use voice for password)
- Video Indexing (Captions, keywords, known people, emotions, etc.)
- Personalizer
- Image Recognition (computer vision)
- Content Moderator (Image/Text/Video with "racy" or "offensive.")
- Ink recognition

# Imagine an App: ChatBot for Help Desk, Student Services, Professor/Classroom support, etc.

- Non-English Speaking prospective student has questions
- Types in native language in chatbot
- We programmed answers in English, but responses are translated back
- Query doesn't 100% match our database of Q&A...but Language Understanding and Personalization "get the gist" of what they're asking and provides choices
- Student gets frustrated, language becomes..."harsher"...
- Text Analytics/Content Moderator recognizes words, immediately transfers to a human.
- Upgrade conversation to voice.
- Student speaks in native language
- Employee hears translation in English, responds in English, and Student hears response in native language.
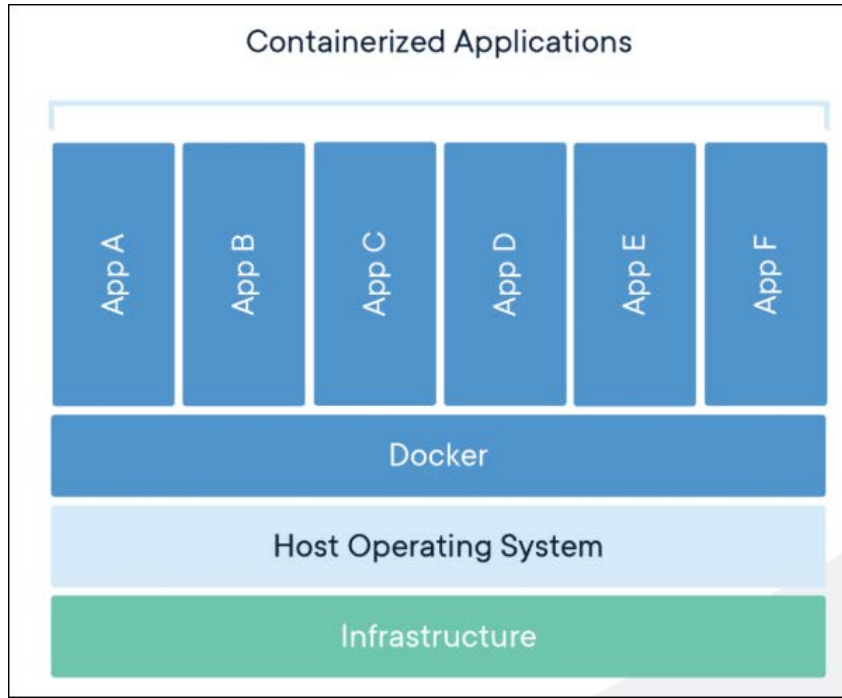
Containers

Understanding Containers:

- Recall the "VM" Concept:
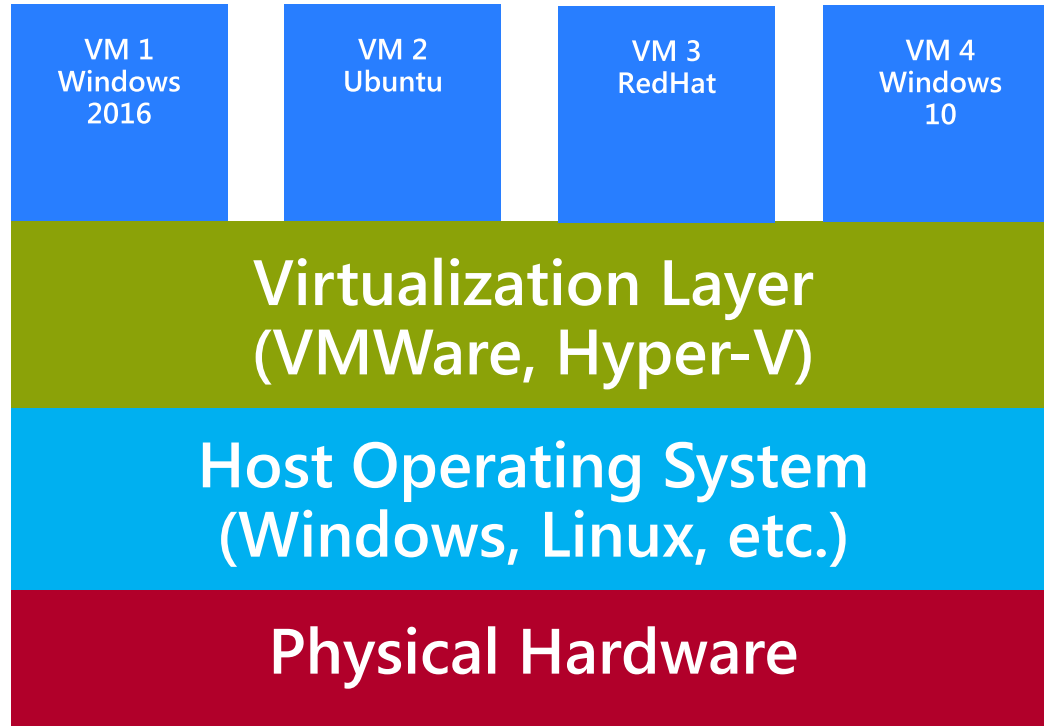
Containers

- Virtual Application Environments within the VM
- Includes storage, software, etc., everything needed to run an instance of the app

- One Physical server can hold several VMs.
- One VM can hold several _hundred_ containers.

Containers / Kubernetes

- ## Kubernetes: Open Source container-orchestration system
  - AKA: Manages container instances based on rules

  Examples:
- ## Student Registration System Application
  - Traditionally a few front-end web servers, maybe middle tier, and DB tier.
  - Need enough hardware to support your peak load
  - With containers and Kubernetes, just spawn an additional instance of the app for each student that is logging in, tear down when complete.

- ## Teaching SQL Language
  - Each student needs own SQL engine (MySQL, NoSQL, etc.)
  - 1 VM per student can be expensive, pain to maintain 100+ VMs
  - Create a Container for each student, save config & de-spawn when not active, re-spawn and load config when active.

IoT

Azure Sphere

A solution for creating highly-secured, connected MCU-powered devices.

New security threats emerge every day. Azure Sphere provides a foundation of security and connectivity that lets you create intelligent products and experiences that customers love—and get them to market quickly—at a price point that enables IoT at scale.

A turnkey end-to-end security solution that guards Azure Sphere devices and renews security for a 13-year lifetime of each device.

Open to any cloud. Devices are secured in Azure, but you are free to connect to Azure or any other cloud, proprietary or public, for application data and telemetry.

Three components, for one low price.
No subscription required.

Order a devkit: https://ms-device-contact.com/

Learn more: www.microsoft.com/azure-sphere

Azure Sphere's three-part solution provides you with the confidence and the power to reimagine your business and create the future.
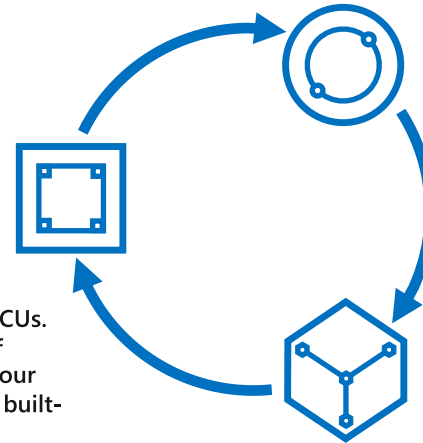
The Azure Sphere OS. An OS purpose-built for security and agility to create a trustworthy platform for new IoT experiences. Secured by Microsoft for the device's 10-year lifetime.

Azure Sphere certified MCUs. A new cross-over class of MCUs, manufactured by our silicon partners, includes built-in Microsoft security technology, connectivity, and the headroom to support dynamic new experiences.
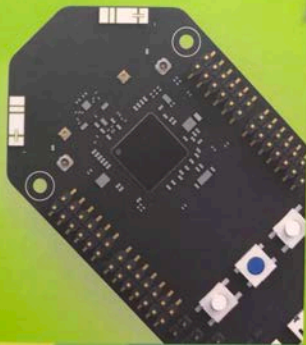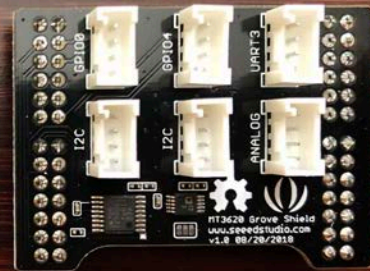
The Azure Sphere Security Service guards every Azure Sphere device; brokers trust for device-to-device and device-to-cloud communication, detects emerging threats, and renews device security.

Order a devkit to test the Azure Sphere MCU and get access to the public preview Azure Sphere OS and Security Service.
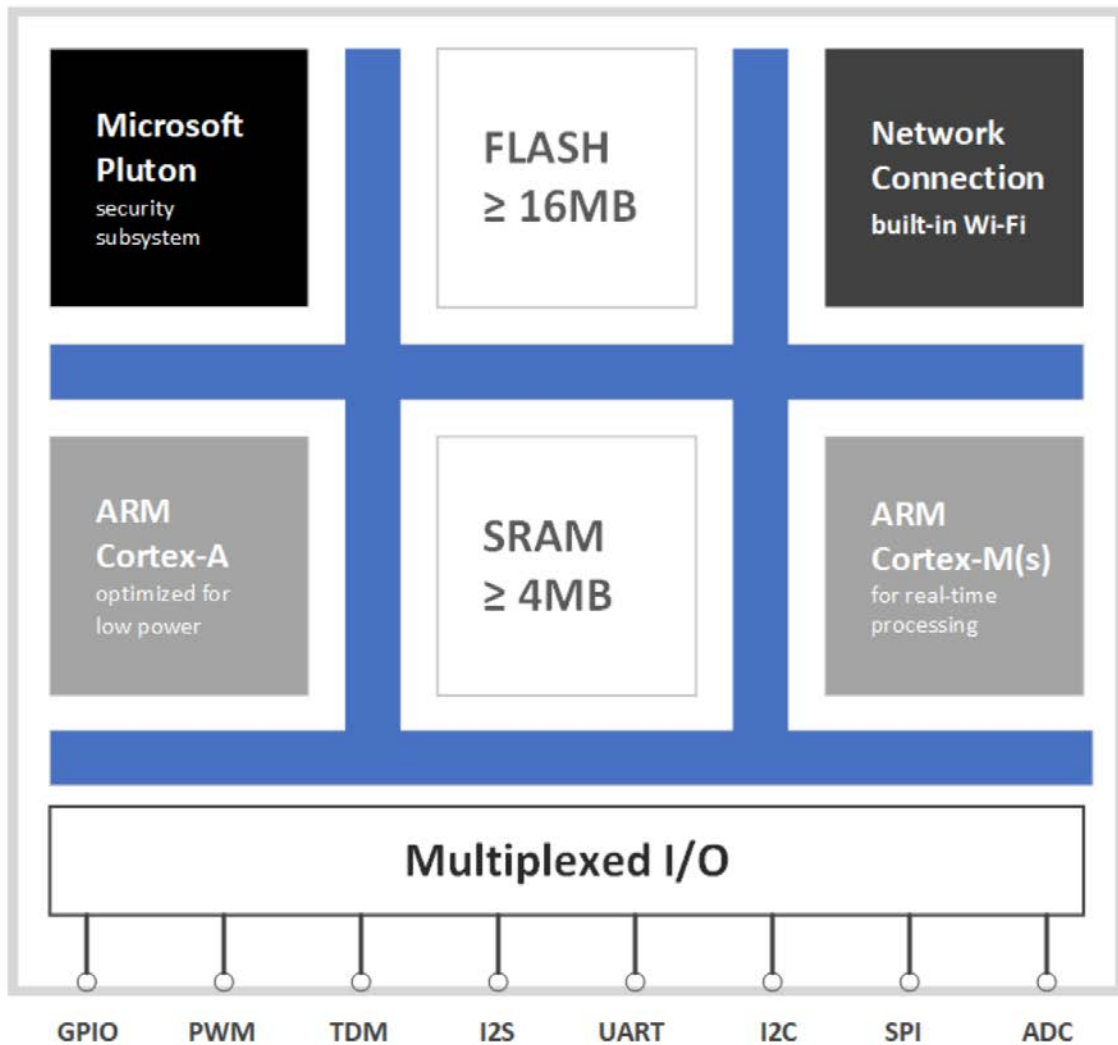
Azure Sphere MT3620
Development Kit

• Azure Sphere: End-to-end security for IoT devices

• Dual-band 802.11 b/g/n with antenna diversity

• Tri-core microcontroller with on-chip RAM & flash

• Microsoft Visual Studio development environment

• Online authentication & updates for device lifetime

seeed
The IoT Hardware Enabler

Aux Antenna

Main Antenna

H2

H4

P-CDVBB-1-4

Azure Sphere MT3620
Development Kit_US Version
S/N: 102991012_1831000021 9

GND

A   reset   B   5V

J1: ADC VREF
J2: 3V3 Isolation
J3: RTC 3V3

3V3

1 2 3 4

GPIO0   GPIO4   UART3

I2C   I2C   ANALOG

MT3620 Grove Shield
www.seeedstudio.com
v1.0 08/20/2018

Grove - Rotary Angle Sensor

This is a potentiometer that produces analog output between 0 and Vcc (5V DC with Arduino) on its D1 connector. The D2 connector is not used. The angular range is 300 degrees, with a linear change in value. The resistance value is 10k ohm, perfect for Arduino use. This may also be known as a rotary angle sensor.

. Interface: Analog port
. Supply Voltage: 0-Vin
. Angular range: 300 degrees
. Resistance value: 10K ohm

wiki.seeed.cc

Grove – OLED Display 1.12"

Grove – OLED 1.12" is constructed with 128 x 128 dot matrix OLED module and SH1107G driver IC. The characteristics of the display module are high brightness, self-emission, high contrast ratio, slim / thin outline, wide viewing angle, wide temperature range, and low power consumption.

. Interface: I2C
. Display Color: White
. Supply Voltage: 3.3V/5V

seeedstudio.com/wiki/Grove

Grove - Buzzer

Grove - Buzzer is simple and enjoyable grove device. It can be connected to digital outputs, and will emit a tone when the output is high. Alternatively it can be connected to an analog pulse-width modulation output to generate various tones and effects.

. Interface: Digital port
. Supply Voltage: 3.3/5V
. Resonant Frequency: 2300±300Hz

wiki.seeed.cc

Grove - Relay

Relay is a digital normally open switch capable of switching much higher voltage and current than Arduino boards. When set to HIGH, the LED will light up and the relay will be closed allowing current to flow. The peak voltage capability is 250V at 10 Amps.

. Interface: Digital port
. Supply Voltage: 3.3/5V
. Max Switching Voltage: 250VAC/30...
. Max Switching Current: 5A

wiki.seeedstudio.com

Grove - Blue LED Button

Get bored with normal button, how about integrated a button with a LED, which can change its status every time the button is clicked. The Grove - Blue LED Button is the button you are looking for! It is a button, and also a Blue LED, with which you can know whether you have clicked the button successfully.

. Supply Voltage: 3.3V / 5V
. Interface: Digital
. LED Color: Blue

wiki.seeedstudio.com

Grove - Temperature&Humidity Sensor (SHT31)

Grove - SHT31 Sensor is a highest-accuracy temperature and humidity sensor. It has a very stable output curve in the measure range so we get a value in a very small error. It can be used in a workshop and laboratory.

. Interface: I2C
. Supply power: 3.3/5V
. Accuracy of temp: ±0.3℃
. Accuracy of humi: ±2%

wiki.seeed.cc

Grove - Light Sensor v1.2

The Grove - Light Sensor can detect the intensity of the indoor light. The output is an analog value, but you can get an approximate lux value according to the reference table.Everybody has their own requirement about the light,you can set a light trigger as your wish.

. Interface: Analog port
. Supply power: 5V
. Max lux detected: 350 lux

wiki.seeedstudio.com

High Performance Computing (HPC)

Cornell University – Lab of Ornithology

- 1st Problem: to Analyze 1 species of bird for 1 year it takes about 3 weeks, mostly manual work
- 2nd Problem: We need to analyze 400 species for 4 years (aka Impossible. 92 years).

- Solution: Azure HDInsight

| Apache Hadoop | Apache Spark | Apache Kafka | Apache HBase | Interactive Query | Apache Storm | ML Services |

- Resolved: Now takes under 3 hours and if fully automated

- [YouTube Video](#)
- [Case Study](#)

NIST

Definitions

- CUI: <u>Controlled Unclassified Information</u>.   Information that should not be made public, but not sensitive enough to warrant high-level security clearances.
  - Example: Social Security numbers, credit card info, names & addresses, any financial info, intellectual property, anything IT related that could compromise security, etc.

- <u>NIST 800-171</u>: Gov't recommended requirements when non-Federal agencies hand CUI.

- Compliance: Customer self-attests compliance. However, auditors will want your documented <u>System Security Plan</u> that maps to the 14 NIST control families and your Plan of Actions & Milestones

TABLE 1: SECURITY REQUIREMENT FAMILIES

FAMILY	FAMILY
Access Control	Media Protection
Awareness and Training	Personnel Security
Audit and Accountability	Physical Protection
Configuration Management	Risk Assessment
Identification and Authentication	Security Assessment
Incident Response	System and Communications Protection
Maintenance	System and Information Integrity

The Challenge (Current State)

How can we ensure security of research data while effectively meeting NIST 800-171 (CUI) requirements?

Current standards of the CUI controls are vague at best.

PI's/Researchers who have awards with CUI compliance typically own the responsibility for implementing and overseeing the controls.

Non-compliance with controls is getting expensive

"Command and control" institution-wide point solutions frustrate and impede progress

Desired State

- Maintain accountability and protect restricted data

- Minimize administrative burden and overhead from the research teams giving them the freedom to focus on their work

- Provide path of least resistance for the research community

- [Microsoft NIST Compliance](#)
- [Azure NIST Blueprints](#)
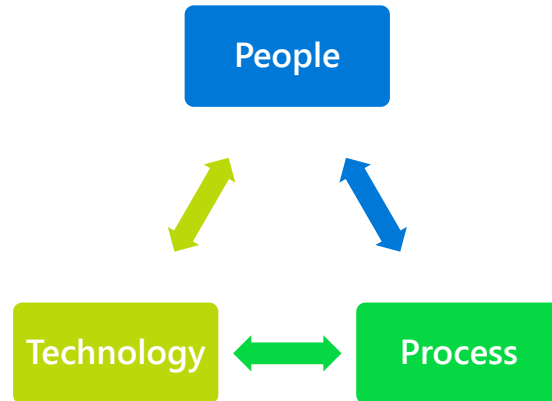
Azure Services Required

AZURE ACTIVE DIRECTORY

AZURE AUTOMATION

***AZURE KEY VAULT**

AZURE MONITOR

AZURE POLICY

AZURE SECURITY CENTER
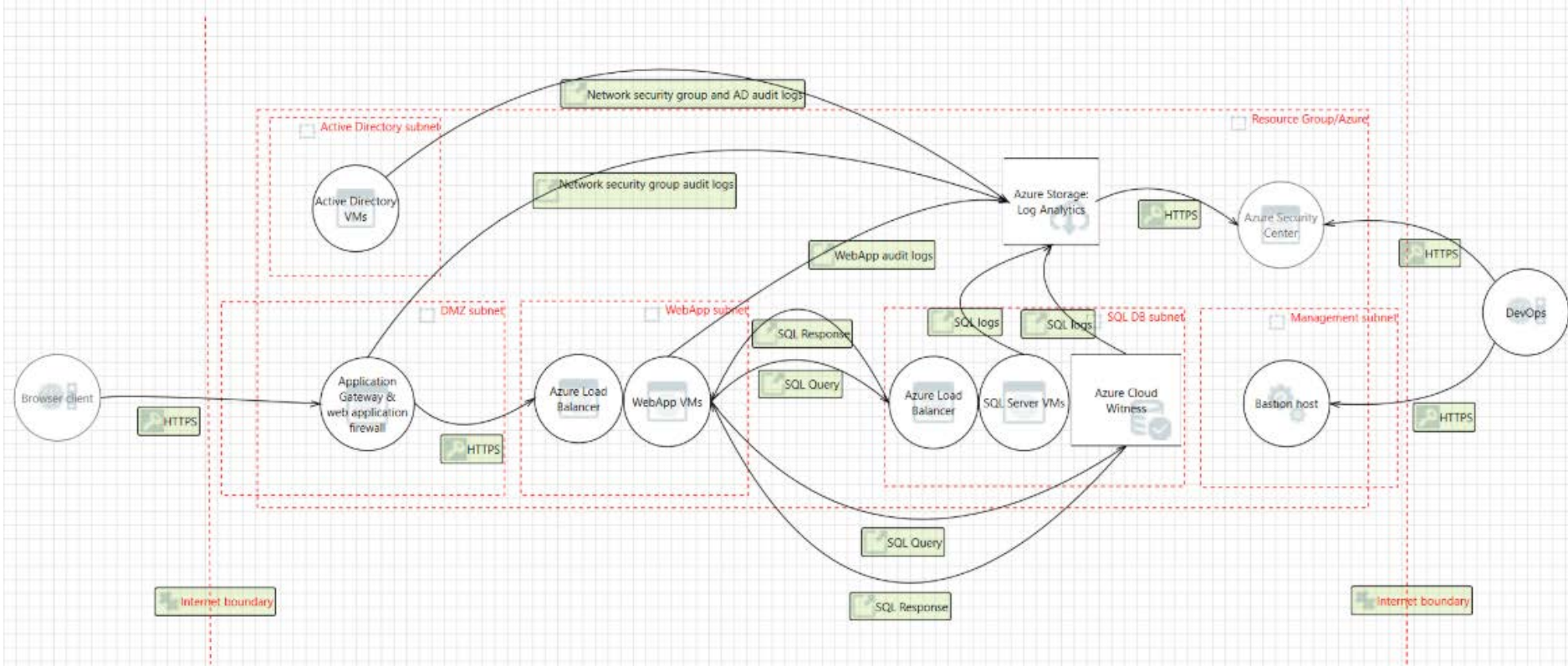
CUI Control Set Policies in Azure

Examples

- General
  - **Identity –Authentication and Access**
    - **3.1** ACCESS CONTROL
    - **3.5** IDENTIFICATION AND AUTHENTICATION
    - **3.9.1** Screen individuals prior to authorizing access to organizational systems containing CUI
  - **Tag:** Tag all resources created within a logical Resource Group
    - Label: NIST 800-171 Value: True
    - **3.3** AUDIT AND ACCOUNTABILITY
- IaaS
  - **VM Endpoints**: Ensure Endpoint protection is installed, running and updated.
    - **3.14.2** Provide protection from malicious code at designated locations within organizational systems.
    - **3.14.3** Monitor system security alerts and advisories and take action in response.
- Monitoring and Reporting:
  - Compliancy checks every hour
    - **3.4.2** Establish and enforce security configuration settings for information technology products employed in organizational systems.
  - Report in console dashboard.
    - **3.3.9** Limit management of audit logging functionality to a subset of privileged users.
  - Exportable

Azure covers 91 compliance offerings

Azure has the deepest and most comprehensive compliance coverage in the industry

Global

- ISO 27001:2013
- ISO 27017:2015
- ISO 27018:2014
- ISO 22301:2012
- ISO 9001:2015
- ISO 20000-1:2011
- SOC 1 Type 2
- SOC 2 Type 2
- SOC 3
- CIS Benchmark
- CSA STAR Certification
- CSA STAR Attestation
- CSA STAR self-assessment
- WCAG 2.0 (ISO 40500:2012)

US Gov

- FedRAMP high
- FedRAMP moderate
- EAR
- ITAR
- DoD DISA SRG Level 5
- DoD DISA SRG Level 4
- DoD DISA SRG Level 2
- DFARS
- DoE 10 CFR Part 810
- NIST SP 800-171
- NIST CSF
- Section 508 VPATs
- FIPS 140-2
- CJIS
- IRS 1075
- CNSSI 1253

Industry

- PCI DSS Level 1
- GLBA (US)
- FFIEC (US)
- Shared assessments (US)
- SEC 17a-4 (US)
- CFTC 1.31 (US)
- FINRA 4511 (US)
- SOX (US)
- 23 NYCRR 500 (US)
- OSFI (Canada)
- FCA + PRA (UK)
- APRA (Australia)
- FINMA (Switzerland)
- FSA (Denmark)
- RBI + IRDAI (India)
- MAS + ABS (Singapore)
- NBB + FSMA (Belgium)

- AFM + DNB (Netherlands)
- AMF + ACPR (France)
- KNF (Poland)
- European Banking Authority (EBA)
- FISC (Japan)
- HIPAA BAA (US)
- HITRUST certification
- GxP (FDA 21 CFR Part 11)
- MARS-E (US)
- NHS IG Toolkit (UK)
- NEN 7510:2011 (Netherlands)
- FERPA (US)
- CDSA
- MPAA (US)
- FACT (UK)
- DPP (UK)
- TISAX (Germany)

Regional

- Argentina PDPA
- Australia IRAP Unclassified
- Australia IRAP PROTECTED
- Canada Privacy Laws
- China GB 18030:2005
- China DJCP (MLPS) Level 3
- China TRUCS/CCCPPF
- EU EN 301 549
- EU ENISA IAF
- EU model clauses
- EU—US privacy shield
- GDPR
- Germany C5
- Germany IT—Grundschutz workbook

- India MeitY
- Japan CS mark gold
- Japan my number act
- Netherlands BIR 2012
- New Zealand Gov CIO Framework
- Singapore MTCS Level 3
- Spain ENS High
- Spain DPA
- UK cyber essentials plus
- UK G-Cloud
- UK PASF
- Korea K-ISMS
- France HDS

https://aka.ms/AzureCompliance

Azure Labs

Azure Labs: Cloud-based Lab for Students

- Lab Manager creates "golden" lab environment, publishes the lab
- Invite students
- Student log in and spawn their own instance of the lab.
- Link

Manage your users and their access to resources

Monitor and control your VMs and their usage

My virtual machines

Accounting
Got to love accounting

▶ Start   ✐ Connect   ■ Stop

Economy
Prediction ... Prediction ...

▶ Start   ✐ Connect   ■ Stop

finance4

▶ Start   ✐ Connect   ■ Stop

Italian course
Come to Italy

1,910.7 / 250,000,000 hours used

▶ Start   ✐ Connect   ■ Stop

Latin
Carpe diem

▶ Start   ✐ Connect   ■ Stop

Richard's Lab
A playground for testing how this thing works.

▶ Start   ✐ Connect   ■ Stop

Roman History class
adfafa

▶ Start   ✐ Connect   ■ Stop

Spanish History
Flamengo

22 / 22 hours used

▶ Start   ✐ Connect   ■ Stop

⚠ No time remaining. Contact lab admin for assistance.

Swedish Traditions
So hot here

4 / 4 hours used

▶ Start   ✐ Connect   ■ Stop

⚠ No time remaining. Contact lab admin for assistance.

Your finance VM
Finance is cool

32 / 32 hours used

▶ Start   ✐ Connect   ■ Stop

⚠ No time remaining. Contact lab admin for assistance.

Simple view
for students

Thank You

Questions?