Identity Management and Access Control in Multi-clouds

January 23rd-24th, 2020
Day 2
Welcome
Panel:
Experiences – Early Adopters

(MOTE: This portion will not be webcast)

Moderator:
Deeepak Jeewankumar,
Dell Tech Capital

Panelists:

- Aradhna Chetal, Global Head Cloud Sec Architecture, HSBC
- Anil Vatti, Chief Architect, Visa
- Lixun Qi, Senior Tech Lead, Freddie Mac
Keynote:
Cyber Future: Evolution, Mutations, Salutations. Oh my!

André Mendes
Chief Information Officer (Acting), DoC
Cyber Future
Evolution, Mutations, Saltations. Oh my!

André V. Mendes
Chief Information Office (Acting)
Department of Commerce

January 24th, 2020
About this presentation...

• Technology evolution mirrors biological evolution
  • Organizations that fail to adapt…. fail

• Tech strategy must be driven by likely corollaries
  • Unlimited processing, storage and bandwidth

• Cyber Security will become world security
  • Ubiquitous virtualization drives requirements

• Wet interfaces/upgrades = ultimate opportunity/peril

• For next 30 minutes….abandon what you know today.
4 Billion Years of Biological Evolution

• Unicellular organisms - Billions of years
  • Creation of basic life functions
  • Rise of DNA as digital repository (code, execution, result)
• Higher level organisms - Tens of millions of years
  • Sophisticated species interaction
• Humanoids - Millions of years
  • Societal structures and functional differentiations
• Homo Sapiens Sapiens - Hundreds of thousands of years
  • Sentience, Conscience, Ethics, Philosophy, Abstraction
• Much shorter intervals, much bigger leaps
Continues in accelerating societal change

• 19th century – More growth than previous 18
  • Industrial Revolution, Rise of Democracy
• First 20 years of 20th - Eclipsed all of the 19th
  • Sanitation, Expansion of Electricity
• Commercial WWW is about 26 years old
  • Facebook, Twitter are teenagers, Instagram is 10
• 21st will unleash ±200 centuries of progress
  • It is virtually impossible to predict 2099
  • Except for this:
    • By century’s end standard humans will not be top of heap
Infinite/”Affordable” Computing Power

• 1997 - ASCI Red
  • 1.3 Teraflops (Trillion Flops)
• 2015 - Intel’s “Knight’s Landing”
  • 8 Teraflops
• 2021 – DOE/INTEL/Cray – Aurora
  • 1 EXAflap (Quintillion)
  • 1,000,000,000,000,000,000,000 Flops
• 2099 – Unknown entity, name
  • Unthinkable, distributed capacity
Infinite/"Affordable" Storage

• 2002 IBM Shark SAN
  • 1.3 Terabyte!
  • Large Freezer Size
• 2016 Hitachi Desktar
  • 4 Terabytes
  • Cell phone Size
• 2018 SanDisk Micro SD Card
  • 1 Terabyte
  • Fingernail size
Massive Bandwidth Expansion

• How long to download an HD Movie?
  • 2001 – 3G Cellular – 384 Kbps – 26 Hours
  • 2009 – 4G Cellular – 100 Mbps – 6 Minutes
  • 2020 – 5G Cellular – 10 Gbps – 3.6 seconds
  • 2099 – ? – Immediate access to everything
Ruthless paradigms!

Graph showing the exponential increase in MIPS, bandwidth, and storage from 1970 to 2020.
Imagine a future where...

- Unlimited Computing Power
- Unlimited Storage
- Unlimited Metadata
- Unlimited Indexing
- Unlimited Bandwidth
- Feed a chip directly into your imagination
Back to evolution...

- Not different from Darwinian Evolution
- Except directed and accelerated
- With ever faster processors
- Betters sensors
- Exposed to ever more complex ethical issues
- Susceptible to “infection”
The Century of AI

• Every decade since the 70’s was the AI Decade
• Technological Presbyopia
  • Overestimate short term
  • Underestimate long term
• This is the AI Century (to 2035)
  • AI will decide what to call itself after that
  • My guess...”artificial” will not be a part of it
• Reached the crucial threshold of productive self-learning
Inexorable corollary

• Just like it evolved in carbon-based lifeforms:
  • Sentiency in Silicon-based systems a given
• Just as “values” have evolved in mankind:
  • We must infuse “Values” in every AI algorithm
• Just as “values” are routinely ignored in humankind:
  • “Values” will be ignored in rogue AI
• Are we AI?
• What is the difference?
  • Without upgrades....
  • Vastly inferior in processing, storage & bandwidth
Juggernaut?

• Massive opportunity for progress
  • Universal process optimization
  • Faster/cheaper services to citizens
  • Law enforcement, basic medicine, teaching
  • Self service everything
  • Accelerating progress in every field
  • Accelerating acceleration

• Literally creating a Science Fiction future
Or Tsunami?

• Not happening in a vacuum
  • Manufacturing globalization/Nationalism tensions
  • Technology ubiquity including global access
  • Massive displacement of lower skill employment
  • Substantial impact on low/mid level white collar employment
  • Potential unimaginable cultural disruption
  • Potential unthinkable wealth gaps (with UI denominators)
  • Potential for major geo-political upheaval

• Evolution’s rarely been easy, fair, considerate...
What about Homo Sapiens Sapiens?

• Significant life expectancy increases
  • Genomics, Proteomics, Nanotech

• Biologics and Immunotherapy

• Genomic optimizations
  • Pre-implantation (Fanconi’s Anemia)
  • CRSPER
  • Capability enhancement

• Dramatic increases in “upgrades”
  • Wet interfaces with sensors/robotics
  • Memory implants, “Net” Interfaces

• The first immortal human being is...
What about Cyber?

• If you think the stakes are high today....
  • IOT
  • End-to-End Automation
  • Artificial Intelligence
  • Human Interfaces/
    Upgrades

• Today’s challenges tomorrow’s Child’s Play

• How do we survive/thrive?
How do we survive the onslaught!

• Implement proven evolutionary lessons
  • Standardize and modularize everything
  • Create abstraction layers for commodity functions
  • Focus on positive “mutations” at the “value” layer
  • You cannot afford to “own”, “maintain”, “operate” the entire stack

• Security becomes the first development requirement
  • Not last check before deployment, not a funding afterthought, Day 1 ATO

• Establish authoritative Identification
• Tokens, PIV, Biometrics, MFA is a must
• Zero Trust environment with complete geographic abstraction
• Lowest denominator permissions with temporary elevation
• Establish common operating patterns to spot deviations
There are no significant saltations!

- Not in the biological realm, not in the cyber realm
- Most issues are preventable, avoidable, manageable
- Highest profile problems are self inflicted
  - Operational discipline – USAGM, OPM, Equifax
  - Insider threats – Manning, Snowden, Wikileaks
  - Supply chain – Target (POS), Huawei?
  - Phishing – Podesta and millions of other users
- Yet so much energy is pursuing esoteric targets
- Focus on the fundamentals, everything else will follow
- Boring is the new fun!
Coffee Break

Back @ 10:15 AM
We All Live in a Yellow Submarine (Multi-cloud World):
DevSecOps Challenges and Best Practices
We all live in a Yellow Submarine (Multi-Cloud World)

DevSecOps Challenges and Best Practices

Anil Karmel
Co-Founder and CEO, C2 Labs
Co-Chair, CSA Application Containers and Microservices Working Group
President, CSA DC Chapter
akarmel@c2labs.com
Definitions
Microservices and Containers

• Microservices
  – Decompose Complex Applications into Small, Independent Processes communicating with each other using language-agnostic API’s
  – Highly Decoupled and Modular with services organized around capabilities (e.g. User Interface, Billing)

• Containers
  – Much like Virtualization abstracts the Operating System from Hardware, Containers abstracts Applications from the Operating System
  – Applications are isolated from other Applications on the same Operating System
  – Allows for Cloud Portability and Scale Up/Out
  – Security issues need to be evaluated and addressed in native container deployments
NIST and CSA Partnership
Researching Together to develop Best Practices

- NIST and CSA joined forces to define best practices for Application Containers and Microservices (ACM)
  - CSA ACM Members joined the NIST ACM Cloud Security Working Group
  - NIST artifacts served as the foundation for CSA ACM work
    - NIST SP 800-180: NIST Definition of Microservices, Application Containers and System Virtual Machines
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CSA Application Container and Microservices (ACM) Charter

CSA ACM Working Group Charter

•Objectives – Q1 2020
  – Best Practices to Implement a Secure Microservices Architecture
    – Microservices secure development guidance and governance
    – Best Practices for implementing a Microservices Architecture for Cloud-native applications
    – Best Practices for decomposing monolithic applications into Microservices
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Challenges in Securing Application Containers and Microservices
Integrating Application Container Security Considerations into the Engineering of Trustworthy Secure Systems

Best Practices for Implementing a Secure Application Container Architecture
Integrating Application Container Security Considerations into the Engineering of Trustworthy Secure Systems

Click on Titles to download the publications
Container Security Challenges

- **Increased Attack Surface**
  - Containers are far more complex than VM’s wherein a single Application can consist of 1000’s of microservices
  - Underlying Linux Operating System complexities can be exploited by attackers to compromise all containers on a host OS
  - Runtime Compromise / Vulnerabilities / Misconfiguration

- **Secure Software Development**
  - Containers can have code pushed to them from untrusted sources

- **Log Management**
  - Big Data Problem: How do you view and manage logs across 1000’s of containers

- **Orchestration**
  - Infrastructure now runs as code (Puppet/Chef/Ansible)
  - Software developers, not infrastructure staff now run the data center
Container Security Challenges

• File System Compromise
  – Microservices in the Application Container could be compromised by an attacker

• Networking
  – A compromised container could result in lateral movement

• Run Time Compromise / Privilege Escalation
  – An attacker could modify a microservice in an Application Container which compromises the application or container itself
Container Security Solutions

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  – Employ MicroVM’s (Just Enough VM)
  – Monitor Containers at Runtime / Real-time scan for Vulnerabilities and Misconfiguration and Remediate

• Secure Software Development
  – Whitelist/Blacklist Containers
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  – Sign containers and code (MD5)
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• Log Management
  – Centralize container logs including developer actions

• Orchestration
  – Employ orchestration platform to manage containers across environments (DEV,TEST,QA,PROD) and across clouds
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- **File System Compromise**
  - Ensure file system is read only
  - Treat infrastructure as stateless, ideally serverless

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  - Ensure application containers can only talk to other approved application containers
  - Leverage Namespaces and SDN in orchestration tools

- **Run Time Compromise / Privilege Escalation**
  - Set filter on Linux Kernel to prevent privilege escalation and implement white lists
  - Anomaly detection based on a deviation from a known baseline to prevent remote code execution
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• Decomposition of Applications
  – Need to decompose applications into microservices correctly, so they only do one thing well, driving development of secure code
  – Monolithic code with 1,000 DLLs needs to be decomposed into 1,000 microservices which makes it more secure and maintainable

• Interface-driven development
  – Need to have well defined REST API’s to ensure microservices talk consistently to each other
  – Authentication of API’s should leverage OAuth and other secure protocols
Real World Examples
Docker CI/CD Pipeline Overview w/ GitLab

Development
Version Control & Continuous Integration
Continuous Deployment

- Development
- Version Control & Continuous Integration
- Continuous Deployment

- Code Pull/Push
- CI/CD Pipeline (.gitlab-ci.yml)
- Docker Trusted Repository
- Docker Universal Control Plane

GitLab Runners
- Test Scripts
- Image Build
- Image Sign/Push
- Stack Deploy

Available on Linux and Windows

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Docker CI/CD Pipeline Stages - Customizable

Development Pipeline
- Build
- Clean
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Production Pipeline
- Build Dev
- Build ProdA
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GitHub Events

- Developer codes in their local feature branch.

Feature Branch Merge Request to DEV Branch

- Approve Merge Request for DEV Branch

DEV Branch Merge Request to Master Branch

- Approve Merge Request for Master Branch

STAGES:
- Build and push the container
- NPM Security Scan
- Container Security Scan (Anchore)
- Static Code Analysis (SonarQube)
- Unit Testing
- SOL Compliance Checks

STAGES:
- Build SQL script and update PROD database
- Deploy to PROD Azure Kubernetes
- System Integration Tests
- Build and publish technical documents
- Log errors to Salesforce Service Cloud (if tagged release, push container to Docker Hub)
Multi-Stage Pipeline

- Container is built and pushed to our private Azure Registry
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Slide 49
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Cloud Smart, Application Rationalization, and ICAM

Stephen Naumann
Senior Advisor - Data Center Practitioner
GSA
Overview

Data Center and Cloud Optimization Initiative PMO

Data Center Optimization Initiative
- Closure & Consolidation
- Optimization

Cloud Smart
- Workforce
- Security
- Procurement

Application Rationalization
- Review; Reward;
- Refresh; Remove
Application Rationalization

- What is Application Rationalization?
- How is it connected to ICAM?
Cloud Policy Landscape

Implications for ICAM

Cloud Smart Strategy encourages:
- SLAs for access to log data
- Governance model aligned to ICAM systems

Other policies and paradigms:
- TIC 3.0
- Zero Trust Networks
- The Internet of Things
Cloud Adoption & ICAM

Challenges of Moving to Cloud

Recommended Process:

- Assess enterprise capabilities
  - Federation?
  - Fault tolerant?
  - Secure?
- Perform an ICAM gap analysis
- Address gaps (buy new or modify existing)
Goals in Common

Goal 1
Strengthen the Federal Government’s information and physical security

1.1 Ensure that only authorized users can access protected resources
1.2 Enable agencies to establish and manage proven, trusted identities for all system users
1.3 Support the adoption and use of credentials that provide an efficient, secure means of accessing resources
1.4 Monitor user behavior and system security through diagnostics, analytics, and reporting

Goal 2
Enable information sharing and safeguarding within the Federal government and with external partners

2.1 Automate information discovery and access across the Federal Government in all security domains
2.2 Facilitate external partnerships by aligning ICAM business processes and technical interfaces with partners’ best practices
2.3 Enable interoperability by standardizing information sharing agreements and establishing a common ICAM data architecture across government

Goal 3
Enable agencies to securely deliver mission services to customers

3.1 Design systems to allow customers frictionless access to information and resources
3.2 Foster trust by building protections for privacy and civil liberties into business processes and technical solutions

Goal 4
Support Federal Government efficiency in information technology

4.1 Streamline ICAM governance and program management within each agency or department
4.2 Standardize and automate ICAM business processes across the Federal Government
4.3 Establish shared service platforms and reuse or repurpose existing hardware and infrastructure when possible
Questions?
Email dccoi@gsa.gov
Questions
(Slido)
Ad-Hoc Panel:
What is in Your Mind When You Think ZTA & DevSecOps

Moderator 1: Jeyappragash Jeyakeerth
Co-Founder, Tetrate

Moderator 2: Michaela Iorga
Senior Security Technical Lead, NIST

This is an ad-hoc panel and the panelists will be selected randomly from the members of the audience that expressed interest in participating in this dialog by registering in advance.

11:30 am
Day 2
Closing Remarks and Adjourn

5:00 pm

National Institute of Standards and Technology
U.S. Department of Commerce