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POWER OF OPPORTUNITY

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A Virtual and Software-Defined Security Architecture Workshop

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Introduction

- The world's gone virtual! Most IT environments are heavily virtualized and are starting to leverage SDN and API-driven components
- Major SDN tools and vendor products have emerged
- Today, as more and more organizations are virtualized and moving to SDN, we have:
  - Different architectural models
  - Different components
  - A totally new "security stack"

Virtual Networking: NFV and SDN

- Network Functions Virtualization (NFV) decouples network functions from dedicated hardware devices
  - Network services (routers, firewalls, load balancers , etc.) can now be hosted on virtual machines
- SDN is an architectural model that offers network virtualization and programmability
  - SDN abstracts the network control plane from the data plane
  - Some definitions are less focused on decoupling the planes, and more on APIs and integration

The Big Picture: Software-Defined Security

- Increasingly, we see Security as Code taking shape
- Security process automation needs to move at DevOps speed
- Less ownership, visibility, control
- Distributed “Workloads” – virtual, abstract, transient
- Large, flat, shared networks
- More and faster changes, with less control

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Defining the New Security Stack

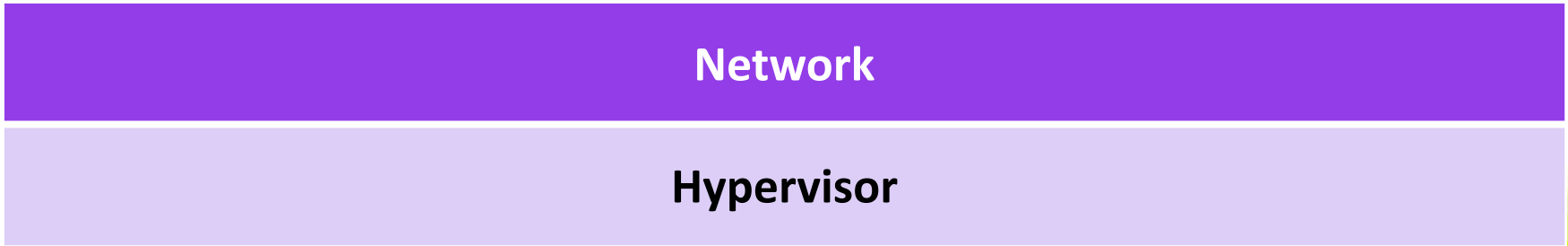
The Technology Stack: Hypervisors

- **Hypervisors are a low layer of the stack**
- **Private clouds require patching, configuration and access management**
- **Public clouds: Little to no visibility or control**

Hypervisor

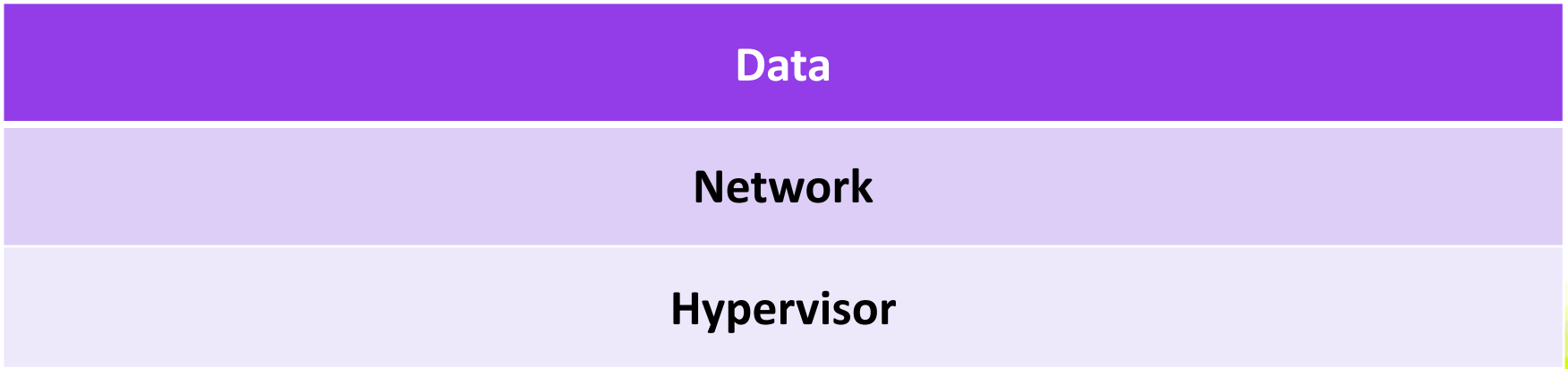
The Technology Stack

- **Confidentiality and integrity of data moving from your environment to CSP, and within CSP**
- **Access controls to resources**
- **Network protection (Layers 2-7)**
- **Availability**
- **Segregation/zones/domains**



The Technology Stack

- **Look at encryption controls for data at rest and in transit**
- **Cloud access gateways**
- **CASBs for data monitoring and content control**
- **DLP within SaaS environments**



The Technology Stack

- **OS hardening + access control**
- **Anti-malware and whitelisting**
- **Logging and monitoring**

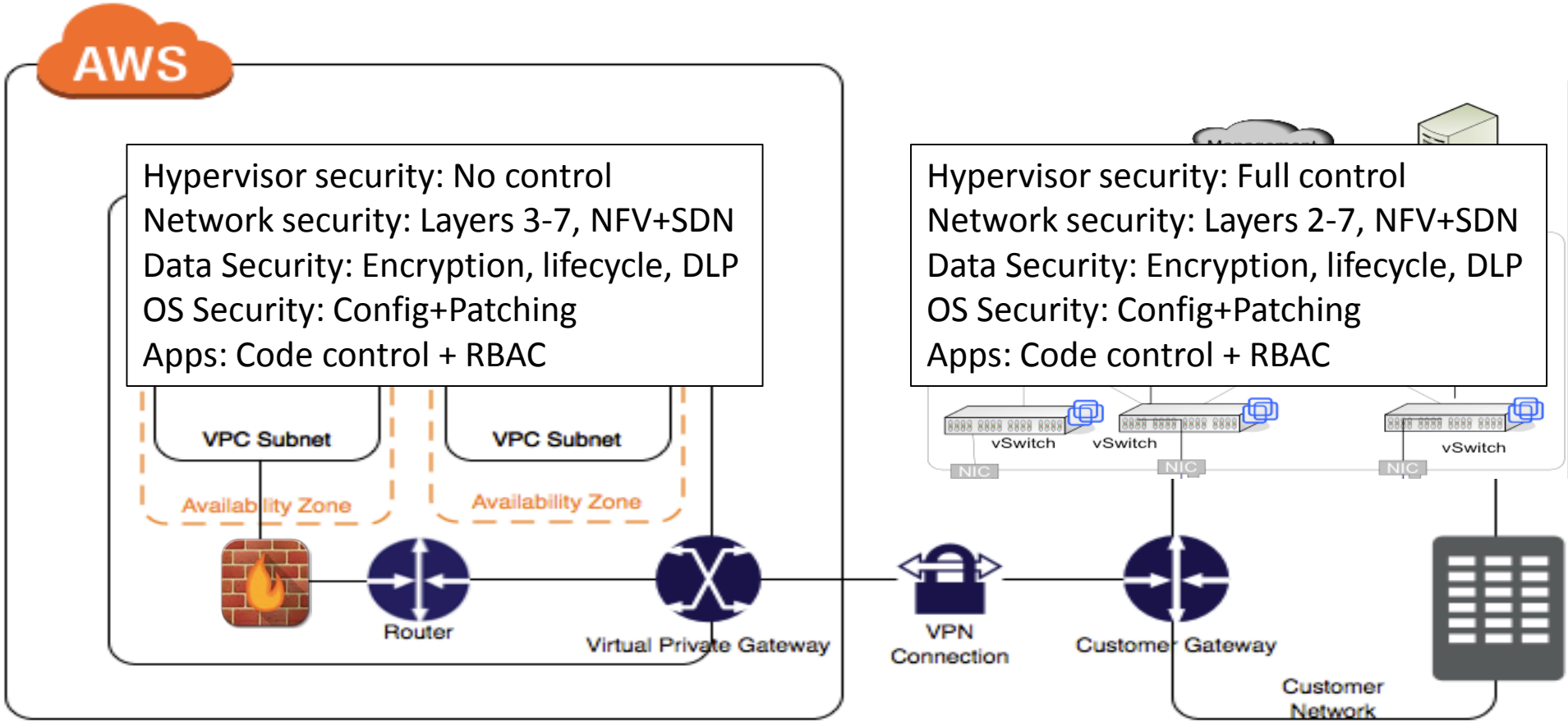
Operating Systems
Data
Network
Hypervisor

The Technology Stack

- **Appsec + WAFs + CASBs + IAM + ???**

Application Logic + Presentation
Operating Systems
Data
Network
Hypervisor

A Basic Reference Architecture



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Hypervisor Security

Hypervisor and Virtualization Security

- **Virtualization platforms are often in use within cloud environments**
- **Once you have an idea of your technology and some of the gaps, take a look at:**
  - Operational practices and gaps
  - Gaps in policy and standards (example: hardening guidance for hypervisors)
  - Gaps in security products within the virtual environment (example: antivirus tools or identity management)
- **Your first area of focus should be the main components: hypervisors, virtual networks, storage and management tools**

Hypervisor Security Controls

- **Foundational controls**
  - NTP, SNMP,etc
- **Local firewall/network access controls**
- **Hardening and configuration**
- **Users and Groups**
- **Patching**
- **Logging and Monitoring**
- **SELinux and/or multitenant isolation measures**

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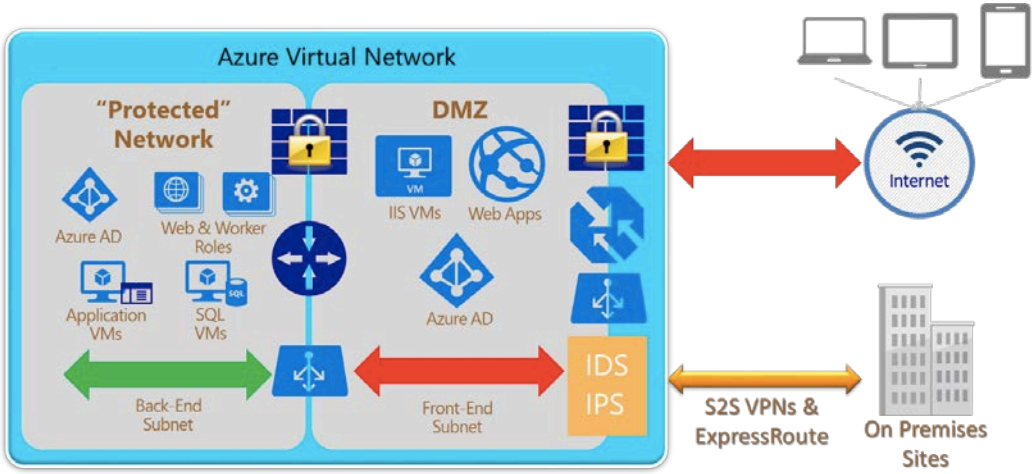
Virtual Network + SDN Security

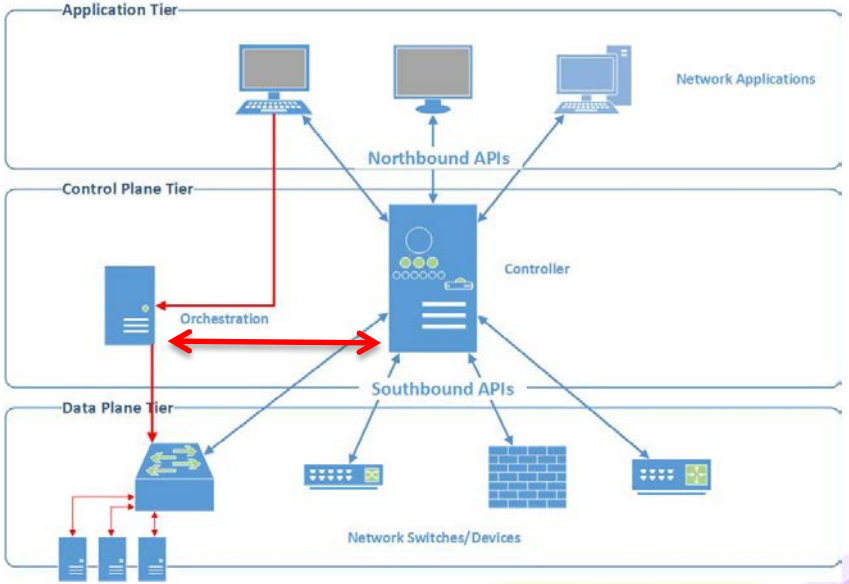
Network Security

- **Critical areas to focus on for security:**
  - Ensuring confidentiality and integrity of data movement
  - Access controls to resources
  - Network protection (Layers 2-7)
  - Availability
  - Segregation/zones/domains



NFV, SDN, and Service Chaining

- With NFV and SDN, the concept of "service chaining" in security is important
- A single platform can accommodate:
  - Anti-malware
  - Network access controls
  - Anomaly detection
  - Intrusion prevention
  - Etc

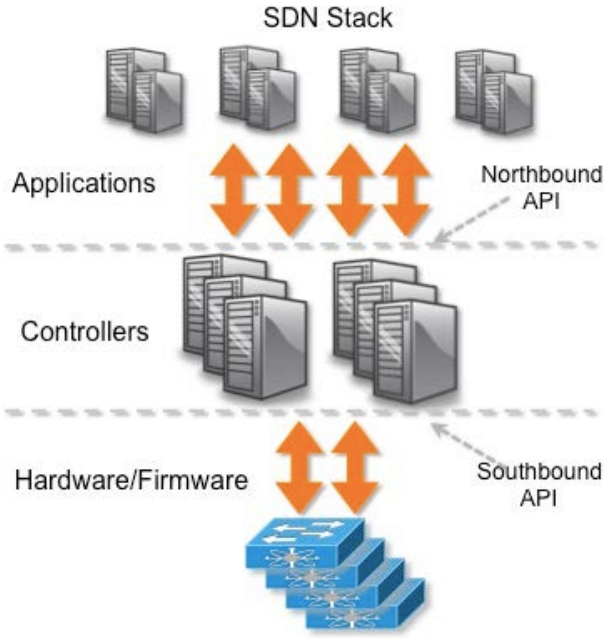


NFV Security Considerations

- **NFV platforms have many capabilities, but new risks:**
  - Resource sharing, role/privilege models, encryption exposure,etc
- **Look into the following:**
  - Vendor code review and security
  - APIs exposed and used by NFV platforms
  - Security configuration settings and patching for NFV solutions
- **Perform regular scans and assessments of NFV tools and components**

SDN and Controller Security

- **Controllers are the "brains" of SDN**
  - Centralized
  - Programmable
  - Attackable
- **Focus on: patching and basic service security (HTTPS, SSH)**
- **Focus on: role-based access and authentication/authorization**



It’s time to shift…

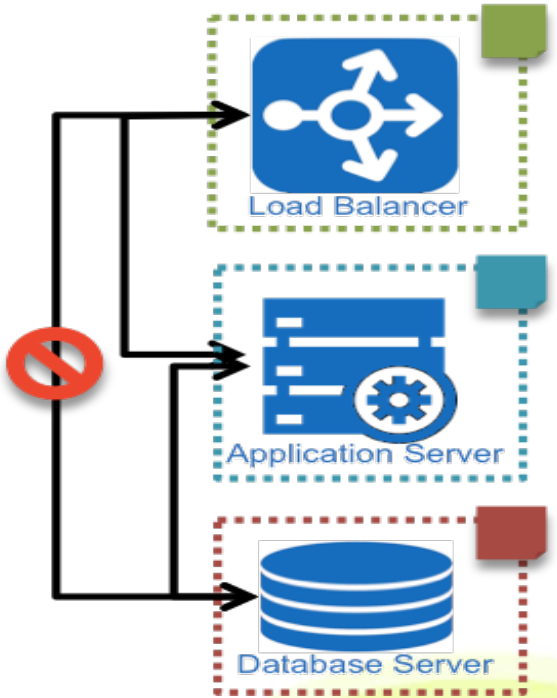
- From THIS:

- To THIS:

Type: "AWS::EC2::SecurityGroupIngress"
Properties:
- **CidrIp: *String***
- **CidrIpv6: *String***
- **FromPort: *Integer***
- **GroupId: *String***
- **GroupName: *String***
- **IpProtocol: *String***
- **SourceSecurityGroupName: *String***
- **SourceSecurityGroupId: *String***
- **SourceSecurityGroupOwnerId: *String***
- **ToPort: *Integer***

New architecture options: Focus on microsegmentation

- **Each cloud instance adopts a “zero trust” policy model for granular network interaction controlled at the virtual machine NIC(s)**
- **Network policy can “travel” with each instance**



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Management + Storage Security

Cloud+Virtual Management Tools

- Management tools and bastion hosts are critical aspects of a secure software-defined architecture
- Controls include:
  - Platform hardening
  - Access restriction and role-based access control
  - Continuous logging+monitoring
- Common tools include VMware vCenter, Microsoft SCVMM, and Citrix XenCenter
- Cloud management tools like OpenStack are common, too

Storage+Data Security

- For software-defined storage instantiation, there are three major considerations:
  - Type of storage and tactical aspects (size, scale, location, etc)
  - Encryption or other data protection controls
  - Access controls
- Logging and monitoring of storage access and operations is critical, as well

Example: S3 Bucket Creation

- Create an S3 bucket at the command line:
  $ **aws s3 mb s3://*bucket-name***
- Add bucket access controls:
  $ **aws s3api put-bucket-acl --bucket BucketName --grant-full-control 'emailaddress="dave@sans.org"' --grant-read 'uri="http://acs.amazonaws.com/groups/global/AllUsers"'**
- Encryption in REST headers:
  x-amz-server-side-encryption

S3 Logging Policy (example)


```
{
  "LoggingEnabled": {
    "TargetBucket": ”BucketName",
    "TargetPrefix": ”BucketLogs/",
    "TargetGrants": [
          {
       "Grantee": {
         "Type": "AmazonCustomerByEmail",
         "EmailAddress": ”dave@sans.org"
              },
       "Permission": "FULL_CONTROL"
          },
]
    }
}
```

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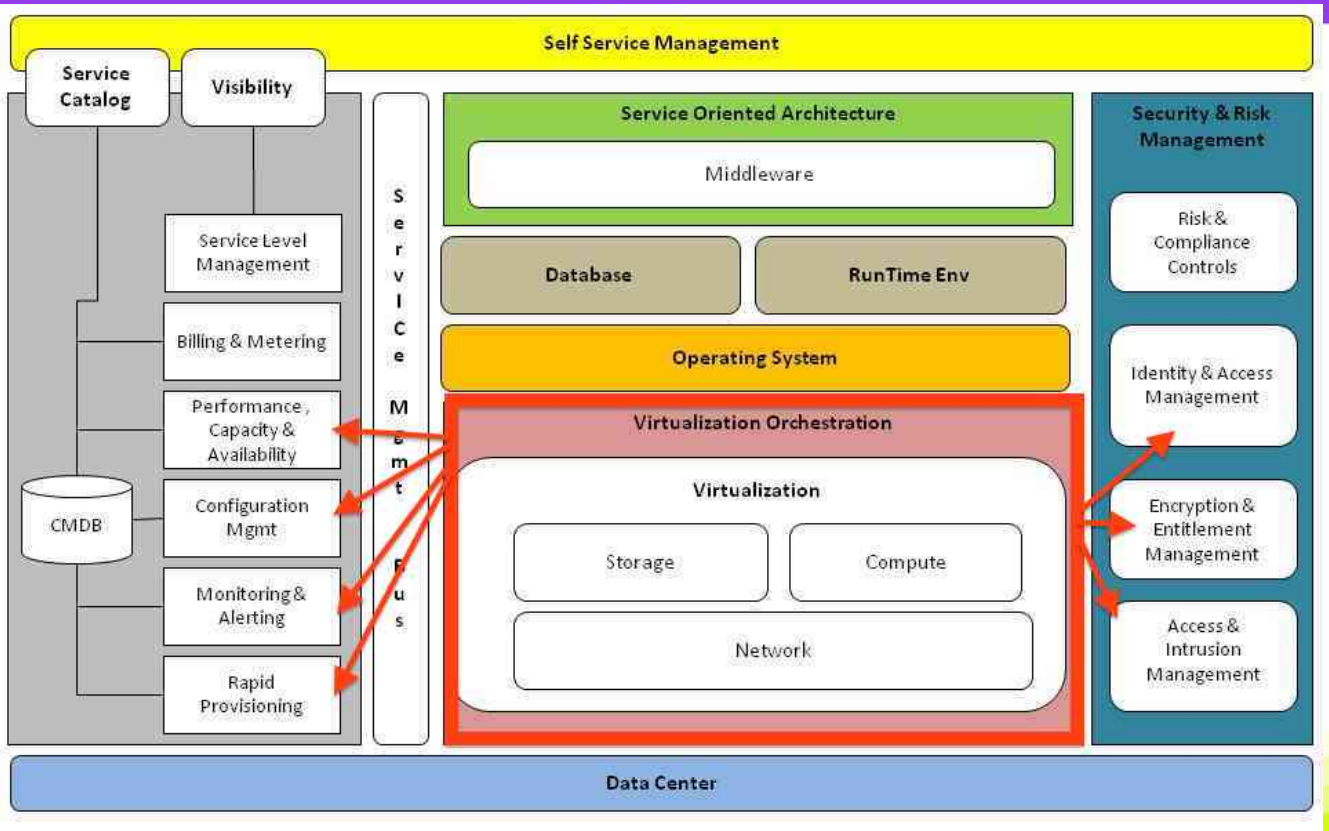
Orchestration + Automation

Orchestration: Single Point of Failure?



Reference: http://inthepassing.files.wordpress.com/2010/01/cloud-ref-arch.jpg

Orchestration and Automation Risks

- **Control of and interaction with automation platforms can be very risky**
  - Poor development, scripting, resource design and instantiation
  - System availability issues or resource hijack/compromise
  - Malicious insiders or lack of “least privilege”
  - Vendor lock-in (architecture, language, etc.)
  - Poor authentication/credential management
  - Weak or non-existent integration with security products
- **Configuration management and access control are critical**

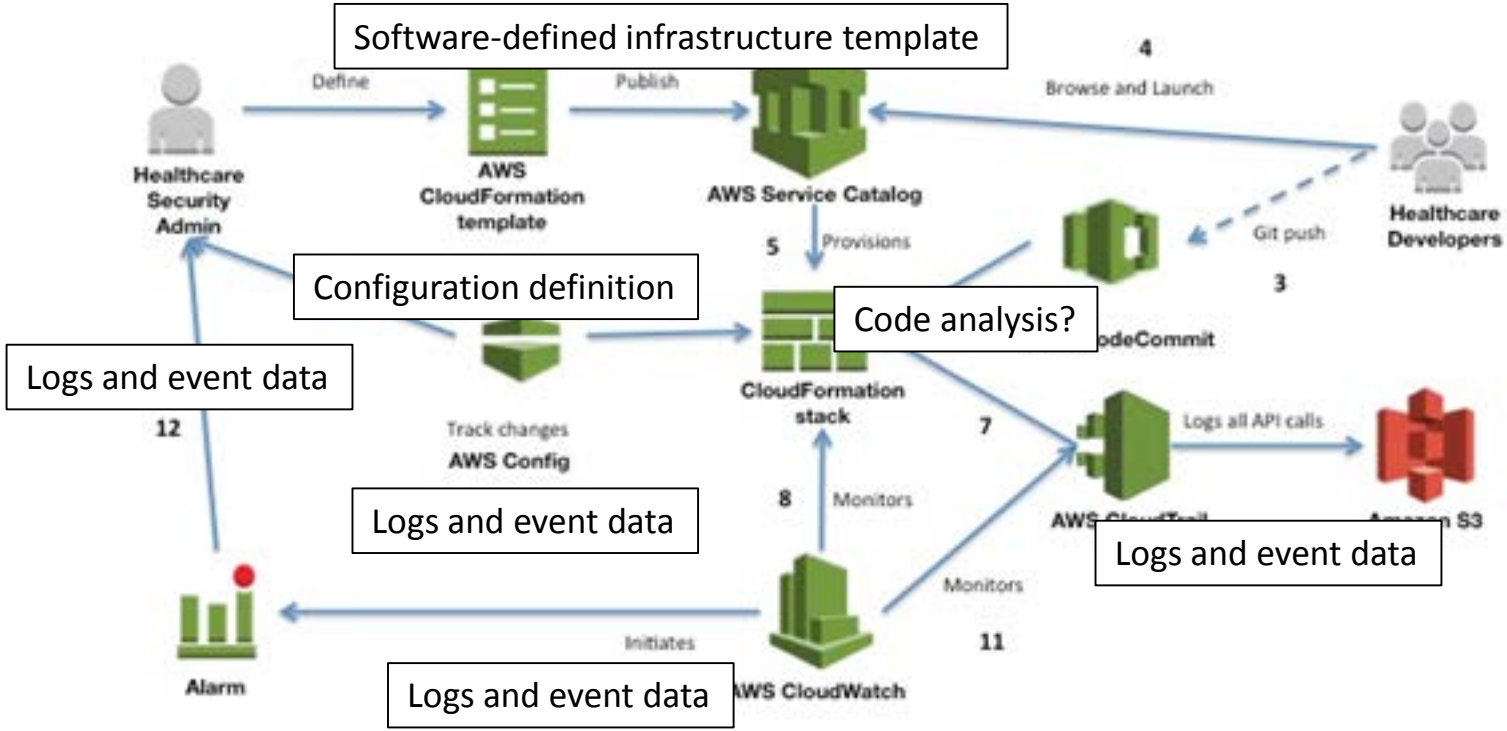
Orchestration/Automation Security

- **Orchestration Platforms**
  - Often multi-tiered
  - Focus on code/data repos, master servers, and client configs
- **Databases**
  - Usernames and passwords, config files containing sensitive data
- **Automation platforms**
  - Separate repos used for configuration and resource management

Orchestration/Automation Security

- **Operations teams**
  - Social engineering attacks targeting orchestration and automation teams - more focus on security awareness
- **API calls and logging**
  - Local access and calls of APIs
  - Remote API logging at nodes and infrastructure
- **“Failsafes” – affected platforms and systems**
  - “Deny All” stance and “triggers”/”tipping point” fallbacks

An AWS Example: Pulling it all Together



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Additional Security Considerations

IaaS and PaaS: Focus on config and patch management

- **Define configuration items and baselines**
- **Approve configuration templates and controls**
- **Embed configuration standards in builds**
- **Automate patch management as much as possible**
- **Monitor everything. Constantly.**

IaaS and PaaS: Focus on vulnerability scanning

- **Check for scanning products that have been adapted to cloud**
  - Some have strong API support and integration
- **Also consider host-based assessment**

All cloud models: Focus on privilege management

- **Carefully limit and control the accounts and privileges assigned to resources**
- **All users, groups, roles, and privileges should be carefully discussed and designated to resources on a “need to know” basis**
- **Assign “least privilege” and monitor carefully**
- **Consider IDaaS options that can mandate strict central control and monitoring (and API integration)**
- **Check for keys and credentials in code!**

“Apply” Slide

- Next week you should:
  - Evaluate all stack layers and components, and ensure you know what you have
- In the first three months following this presentation you should:
  - Look at/for software versions of your current hardware security platforms
  - Discuss internal use cases for software-defined security and SDN
- Within six months you should:
  - Possibly have software definitions for system builds and architecture models
  - Consider how automation and orchestration of security functions might work in your environment…and to the cloud.