2013 Esri International User Conference
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Technical Workshop

Designing an Enterprise GIS Security Strategy

Michael E. Young

Agenda

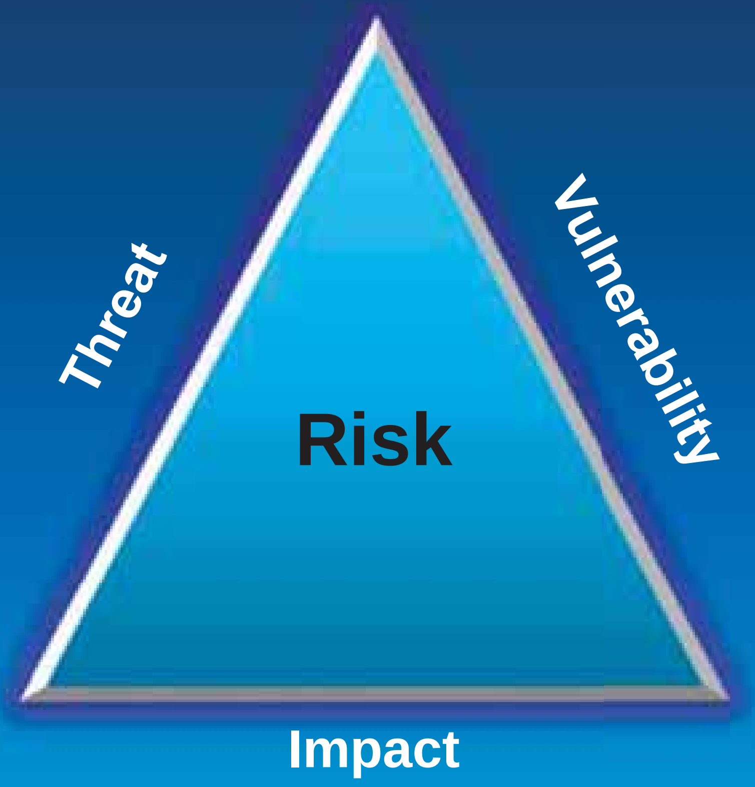
- Introduction
- Trends
- Strategy
- Mechanisms
- Server
- Mobile
- Cloud
- Compliance

Introduction

What is a secure GIS?

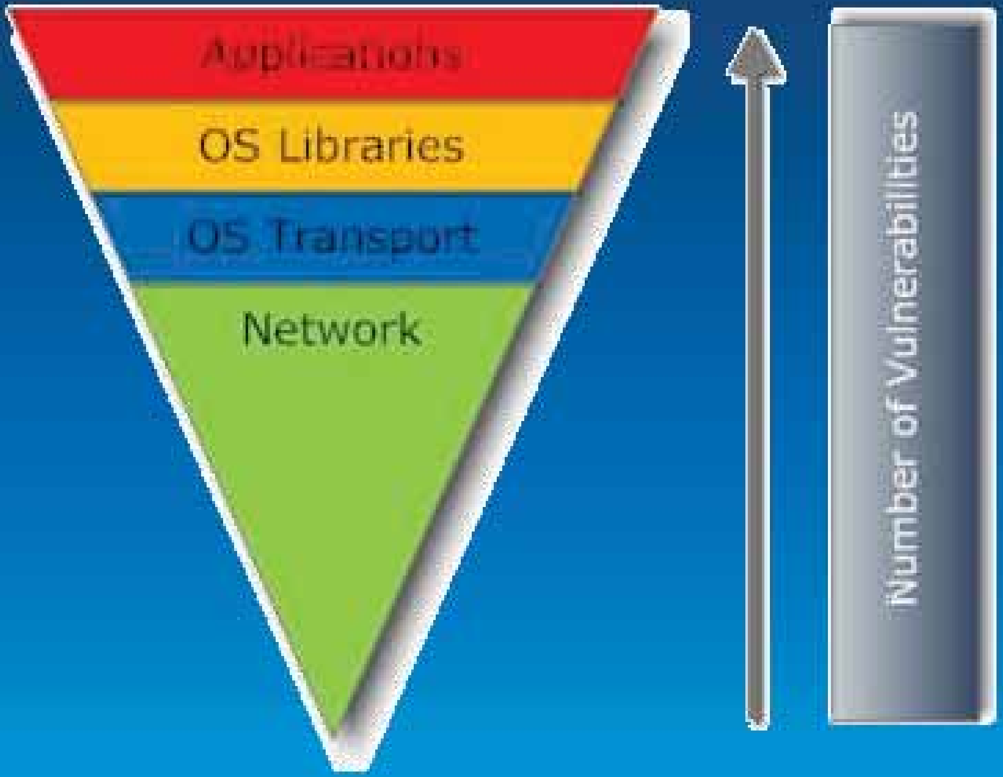
Introduction

What is “The” Answer?



Introduction

Where Are the Vulnerabilities?

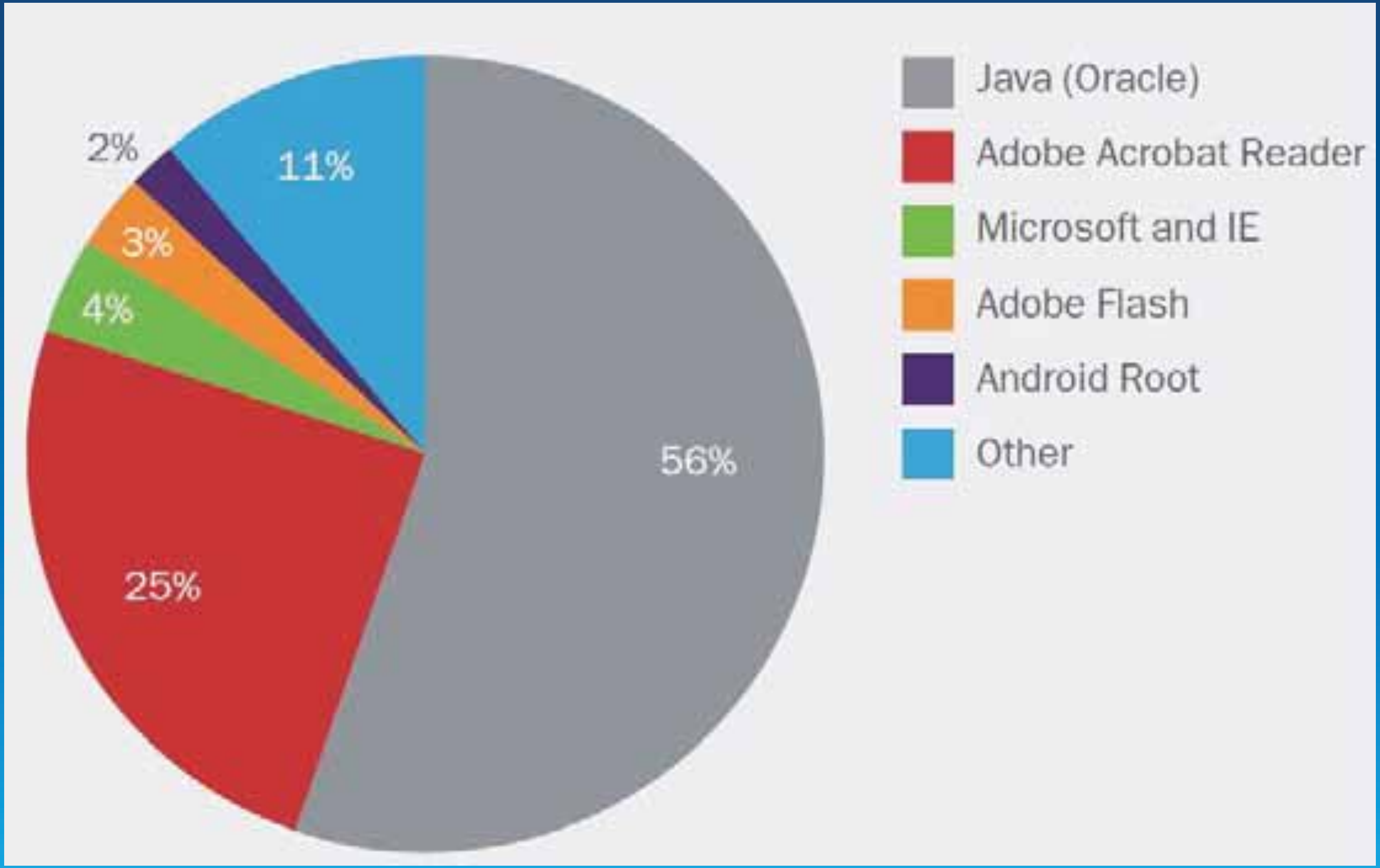


** SANS Relative Vulnerabilities*

Trends

Trends

Application Level Vulnerabilities – Really?



* Kaspersky Labs 2012: Why complexity is IT security's worst enemy

Trends

Game changed

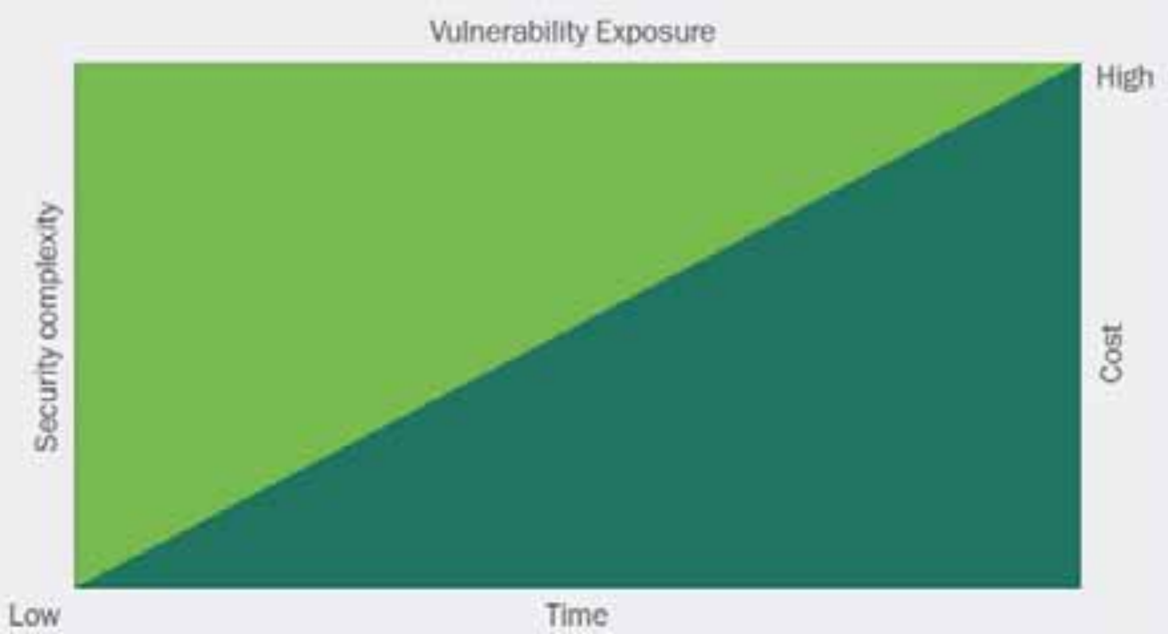
- Understand the security game has changed
  - Risks are continuous and evolving
  - All controls can be circumvented individually

- Initial response by most organizations
  - Add more security controls as quickly as possible
  - Drives complexity

Trends

Complexity Issues

- Complex security control consequences
  - More time to effect change
  - Higher security costs
  - Lower return on security investment



* Kaspersky Labs 2012: Why complexity is IT security's worst enemy

Trends

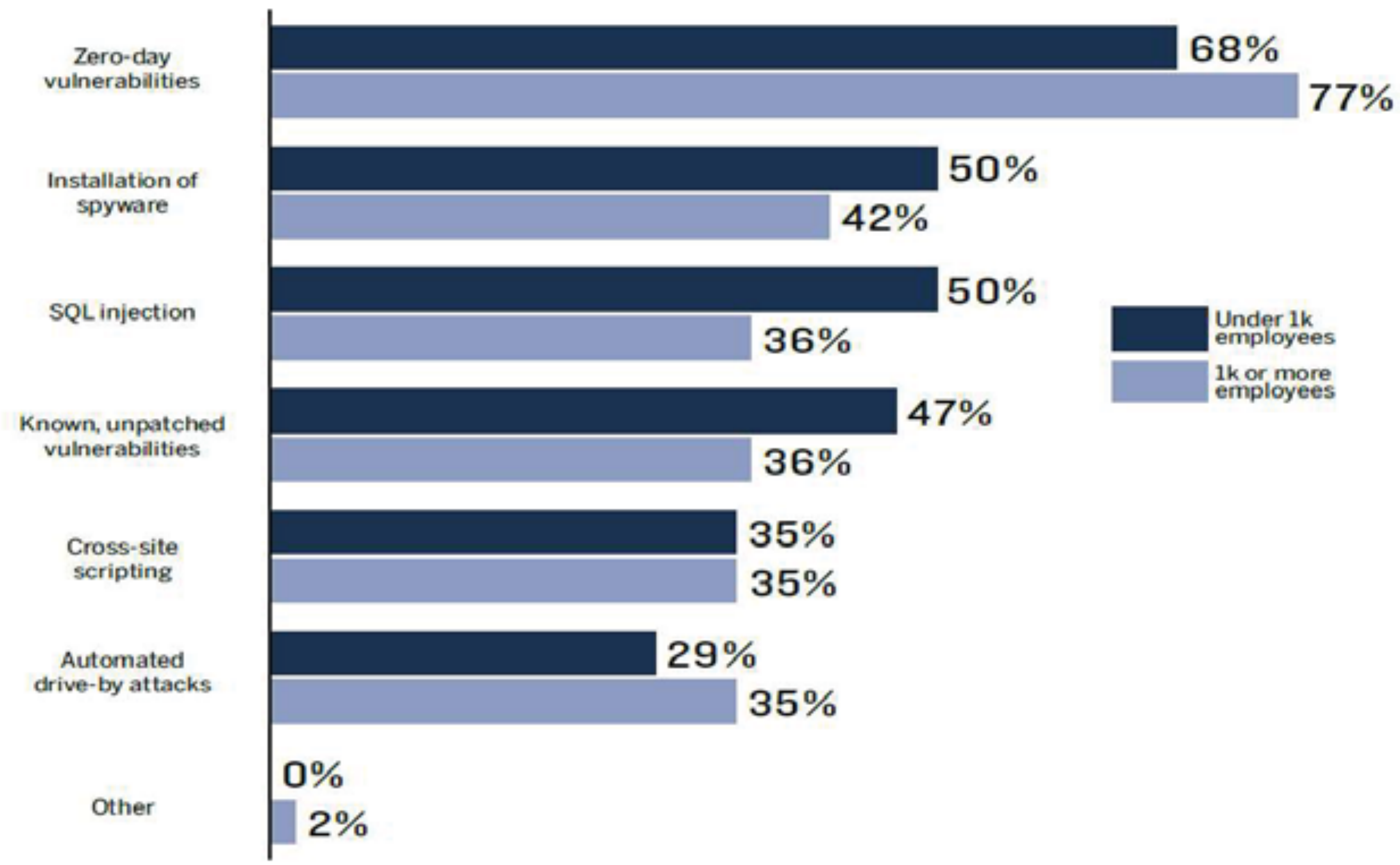
Result of complexity / expanding issues

- Claims of basic security models failing
  - Defense-In-Depth (DiD)

- Reality – Either the organization did not
  - Implement DiD
    - Or
  - Add/integrate/consolidate controls strategically

Trends

Most worrisome 3rd party application cyber attacks



*** SC – In the crosshairs (2013)**

Trends

Pop Quiz

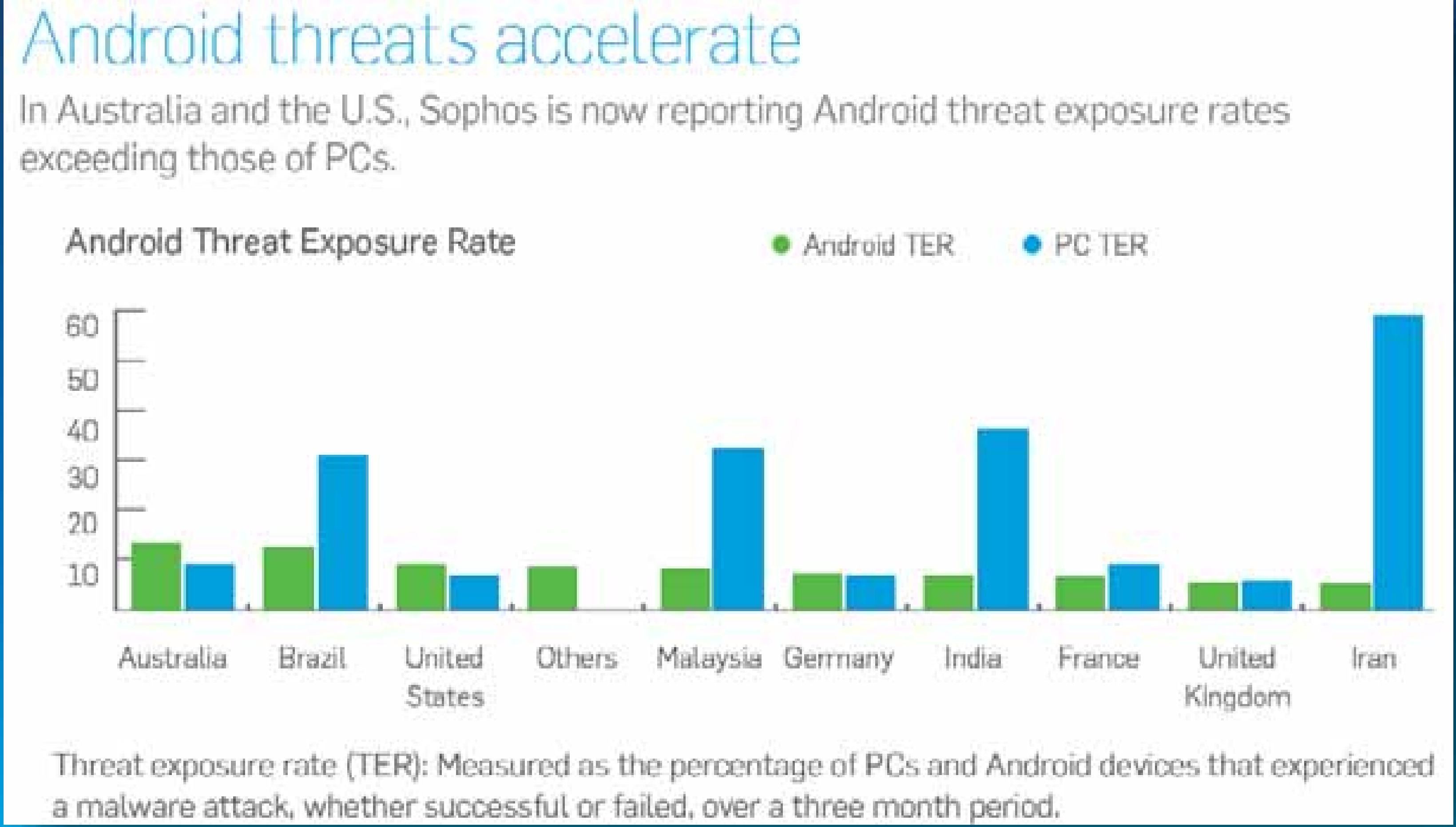
- Question:
  - Of 47,000+ security incidents analyzed in a 2013 report* what % of cases involved data **transit** vs. at rest or while being processed?
- Answer (Choose 1):
  - 67 % - At rest (DB / File Services)
  - 33 % - While being processed
  - 0 % - While data was in transit
- Question – Part 2
  - Which item above does HTTPS / SSL protect?
- Answer
  - Data in transit

Do your security strategy efforts reflect this?

* Verizon – 2013 Data Breach Investigations Report

Trends

Mobile



Android threats accelerate

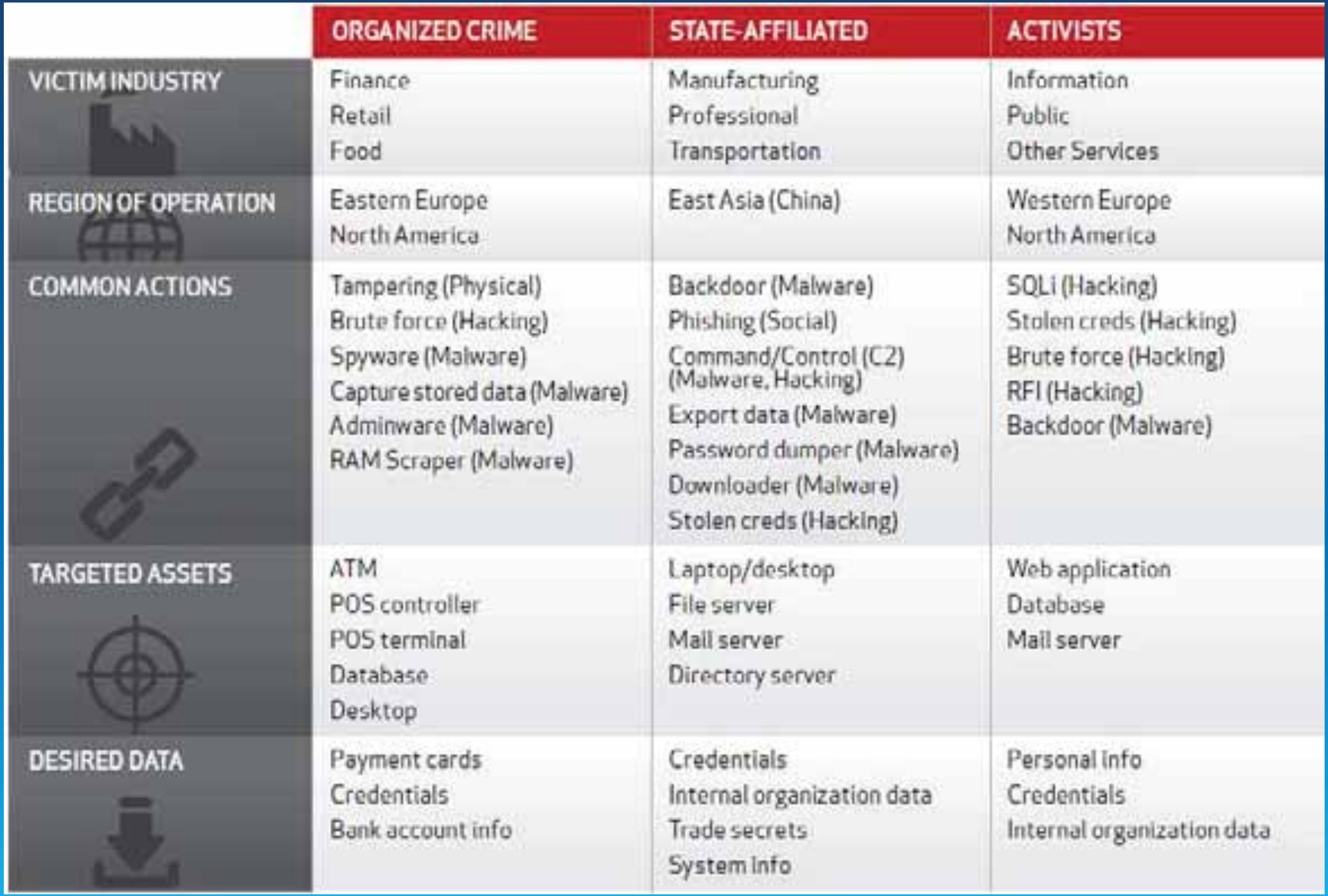
In Australia and the U.S., Sophos is now reporting Android threat exposure rates exceeding those of PCs.

Threat exposure rate (TER): Measured as the percentage of PCs and Android devices that experienced a malware attack, whether successful or failed, over a three month period.

*Sophos Security Threat Report 2013

Trends

Profiling threat actors



	ORGANIZED CRIME	STATE-AFFILIATED	ACTIVISTS
VICTIM INDUSTRY	Finance Retail Food	Manufacturing Professional Transportation	Information Public Other Services
REGION OF OPERATION	Eastern Europe North America	East Asia (China)	Western Europe North America
COMMON ACTIONS	Tampering (Physical) Brute force (Hacking) Spyware (Malware) Capture stored data (Malware) Adminware (Malware) RAM Scraper (Malware)	Backdoor (Malware) Phishing (Social) Command/Control (C2) (Malware, Hacking) Export data (Malware) Password dumper (Malware) Downloader (Malware) Stolen creds (Hacking)	SQLi (Hacking) Stolen creds (Hacking) Brute force (Hacking) RFI (Hacking) Backdoor (Malware)
TARGETED ASSETS	ATM POS controller POS terminal Database Desktop	Laptop/desktop File server Mail server Directory server	Web application Database Mail server
DESIRED DATA	Payment cards Credentials Bank account info	Credentials Internal organization data Trade secrets System info	Personal info Credentials Internal organization data

* Verizon – 2013 Data Breach Investigations Report

Strategy

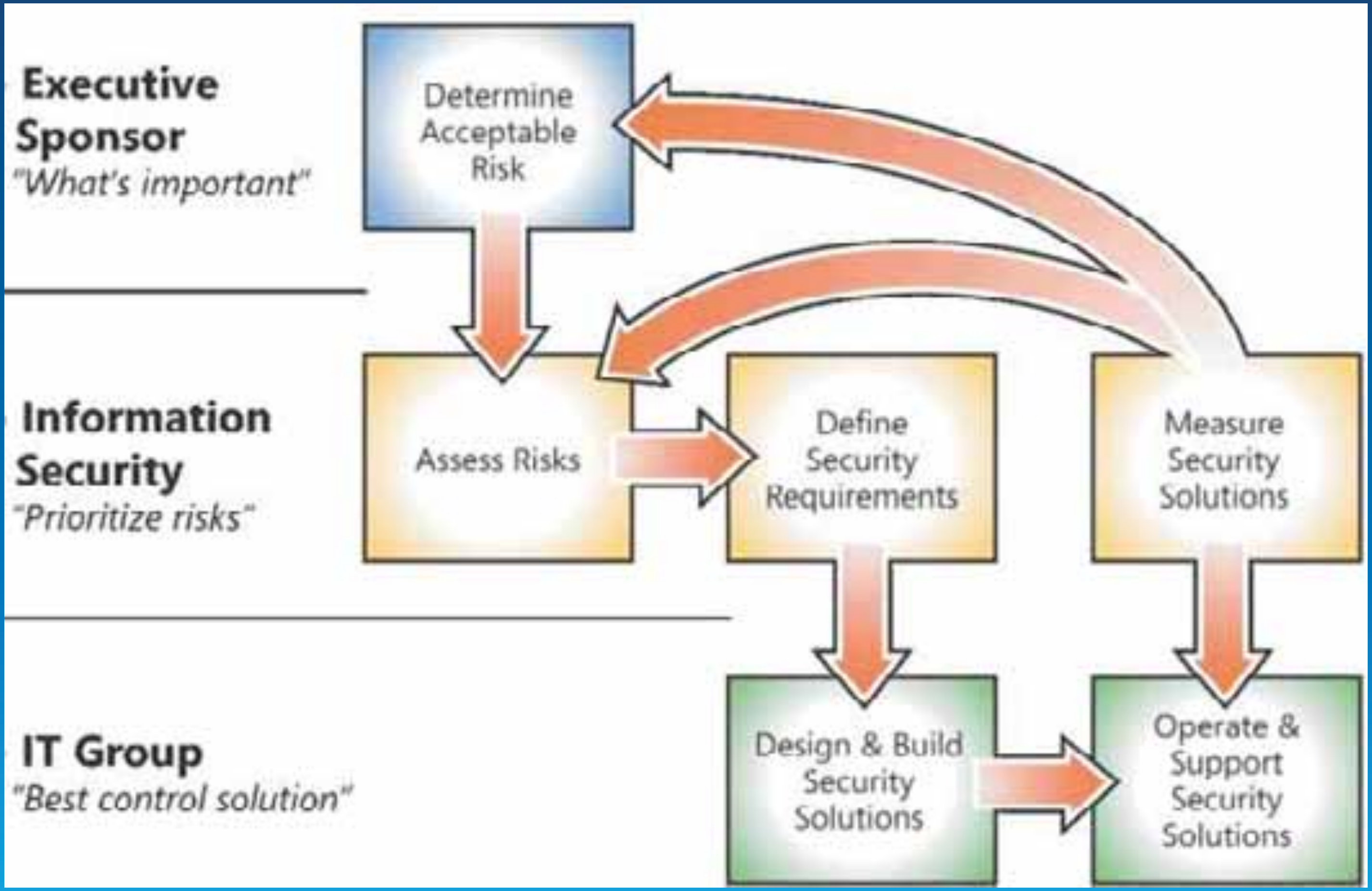
Strategy

A better answer

- Identify your Security Needs
  - Assess your environment
    - Datasets, Systems, Users
    - Sensitivity, Categorization
    - Understand attacker motivation
- Understand Security Options
  - ArcGIS for Professionals site
  - Enterprise-wide Security Mechanisms
  - Application Specific Options
- Implement Security as Business Enabler
  - Improve appropriate availability of information
  - Make attackers job more difficult, not your employee’s job

Strategy

Enterprise GIS Security Strategy

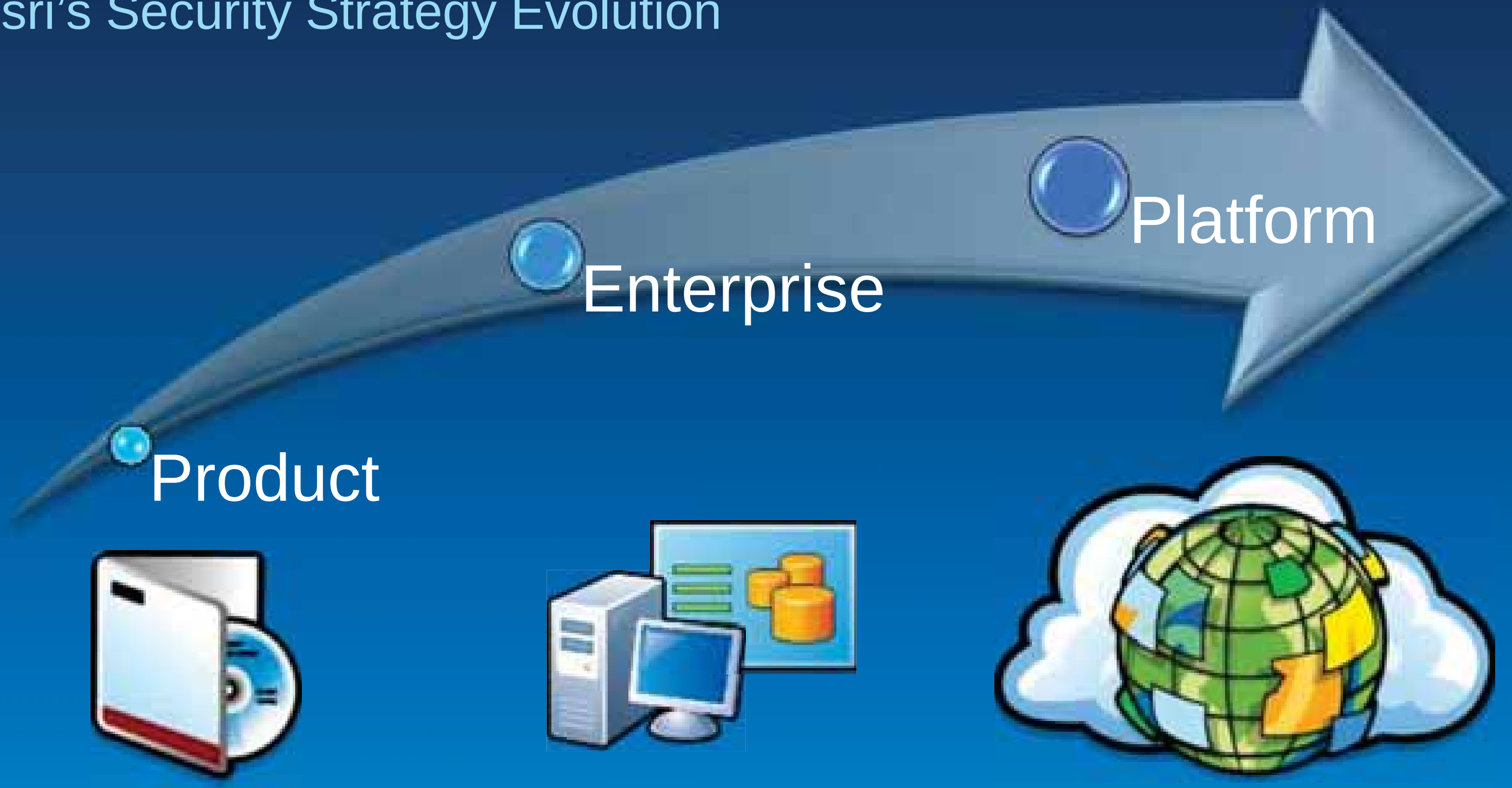


Executive Sponsor
"What's important"
Information Security
"Prioritize risks"
IT Group
"Best control solution"
Determine Acceptable Risk
Assess Risks
Define Security Requirements
Measure Security Solutions
Design & Build Security Solutions
Operate & Support Security Solutions

Security Risk Management Process Diagram - Microsoft

Strategy

Esri's Security Strategy Evolution



Product

Enterprise

Platform

Isolated Systems

3rd Party Security

Integrated Systems

Embedded Security

Cloud

Managed Security

Strategy

Esri Products and Solutions

- Secure Products
  - Trusted geospatial services
  - Individual to organizations
  - 3rd party assessments

- Secure Enterprise Guidance
  - ArcGIS for Professionals site
  - Online Help

- Secure Platform Management
  - SaaS Functions & Controls
  - ArcGIS Online Security Overview
  - Certifications / Accreditations

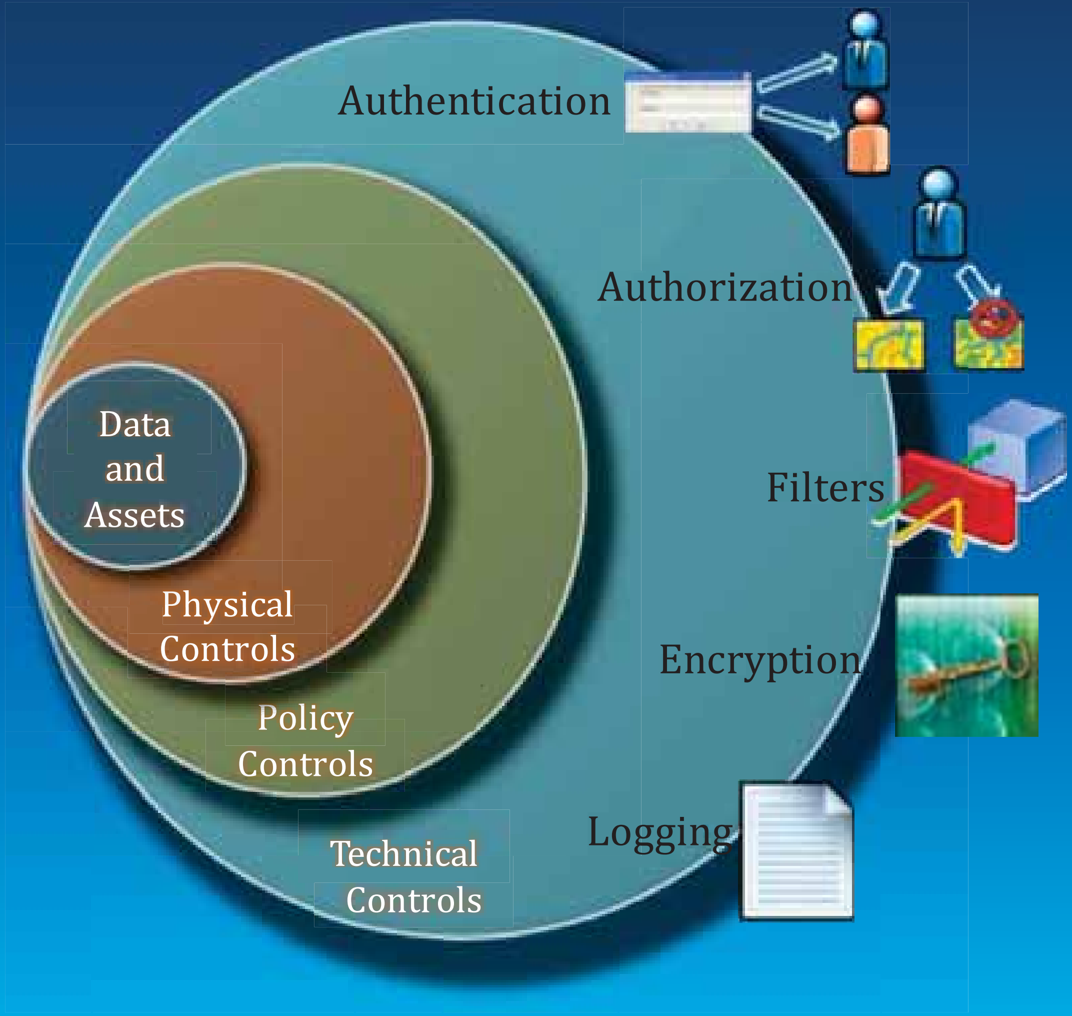
Strategy

Security Principles

- CIA Security Triad
- Defense in Depth

Strategy

Defense in Depth



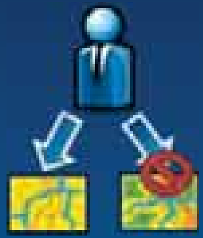
- More layers does NOT guarantee more security
- Understand how layers/technologies integrate
- Simplify
- Balance People, Technology, and Operations

Mechanisms

LDAP
Advanced
Non-Repudiation
SSL
TDE
Token
3rdParty
Web-Adapter
VPN
Encryption
DirectoryIntegrated
Logging
Authentication
Filters
COTS
Basic
HTTPS
WAF
SSO
SAML
Authorization

Mechanisms

Authentication



Authorization

Filters

Encryption

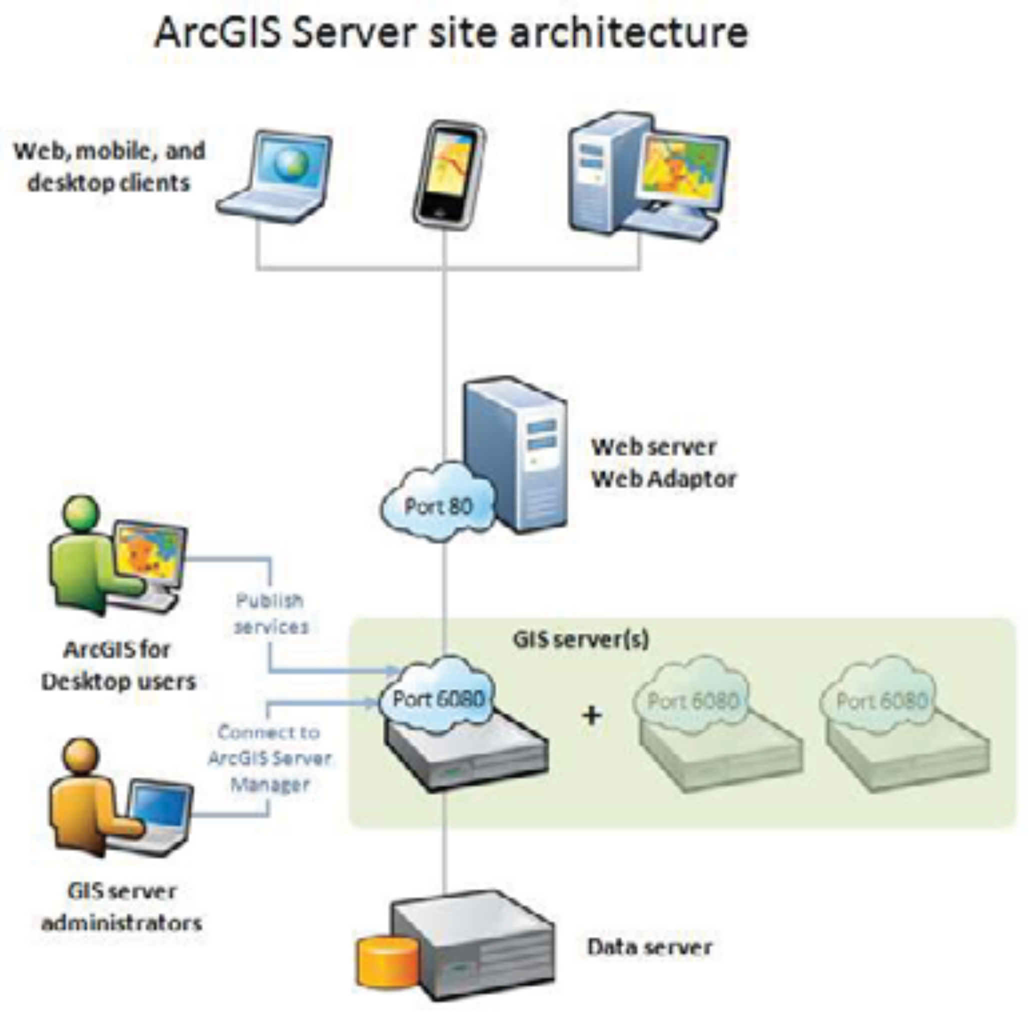
Logging/Auditing

Mechanisms

Authentication

- GIS Tier (Default)
  - Built-in User store
  - Enterprise (AD / LDAP)
  - ArcGIS Tokens

- Web Tier (Add web adaptor)
  - Enterprise (AD / LDAP)
  - Any authentication supported by web server
    - HTTP Basic / Digest
    - PKI
    - Windows Integrated


ArcGIS Server site architecture
Web, mobile, and desktop clients
Web server
Web Adaptor
Port 80
ArcGIS for Desktop users
Publish services
GIS server(s)
Port 6080
+
Port 6080
Port 6080
Connect to ArcGIS Server Manager
GIS server administrators
Data server

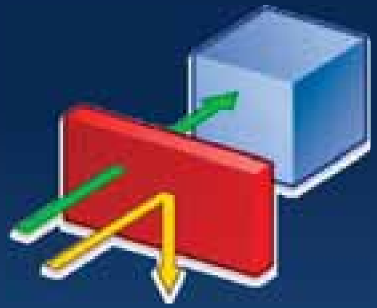
Mechanisms

Authorization – Role Based Access Control

- Esri COTS
  - Assign access with ArcGIS Manager
  - Service Level Authorization across web interfaces
  - Services grouped in folders utilizing inheritance
- 3rd Party
  - Web Services – Conterra’s Security Manager (more granular)
  - RDBMS – Row Level or Feature Class Level
    - Versioning with Row Level degrades RDBM performance
    - Alternative - SDE Views
- Custom - Limit GUI
  - Rich Clients via ArcObjects
  - Web Applications
    - Sample code Links in ERC
    - Microsoft’s AzMan tool

Mechanisms

Filters – 3rd Party Options

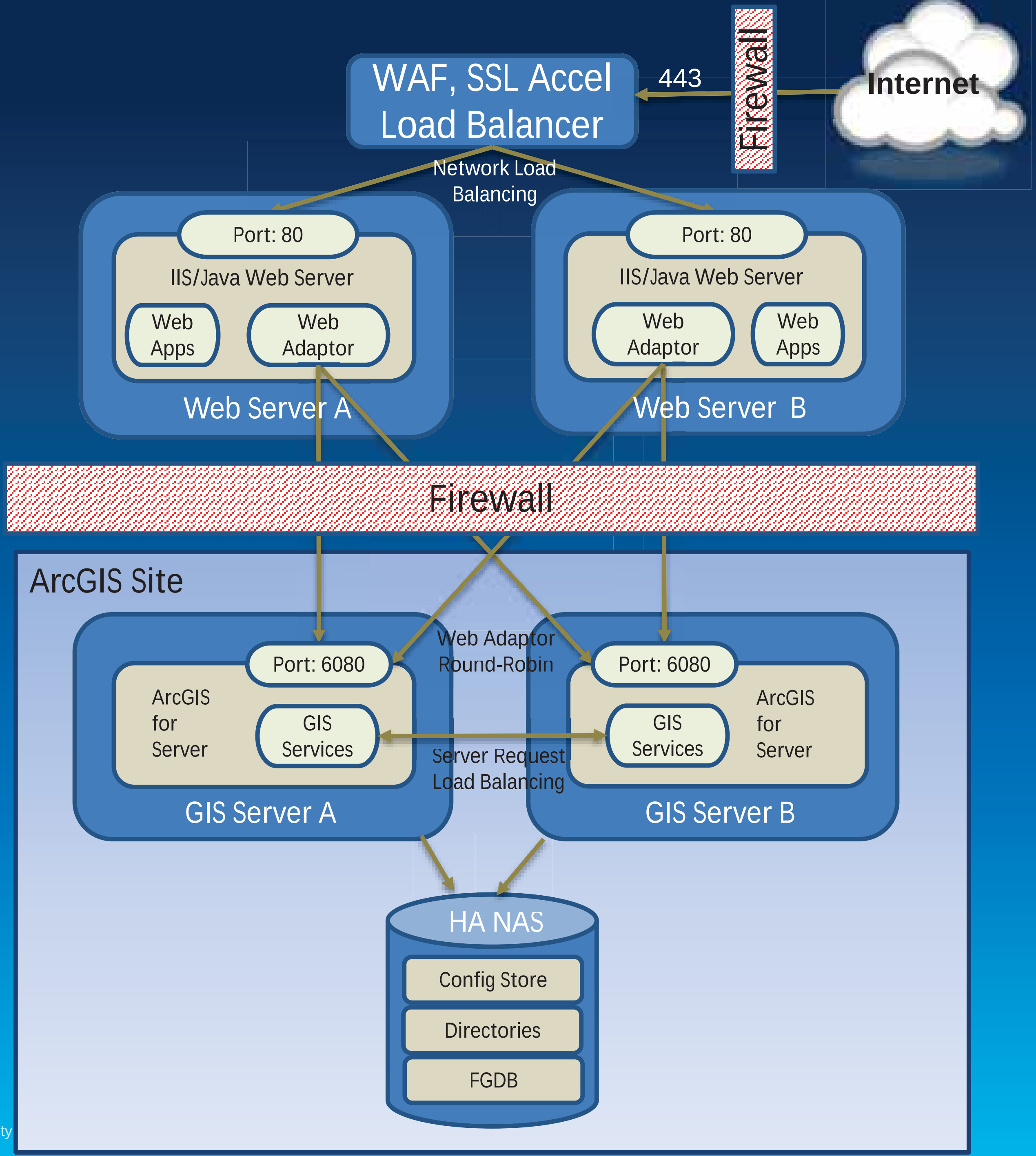


- Firewalls
- Reverse Proxy
- Web Application Firewall
  - Open Source option ModSecurity
- Anti-Virus Software
- Intrusion Detection / Prevention Systems
- Limit applications able to access geodatabase

Mechanisms

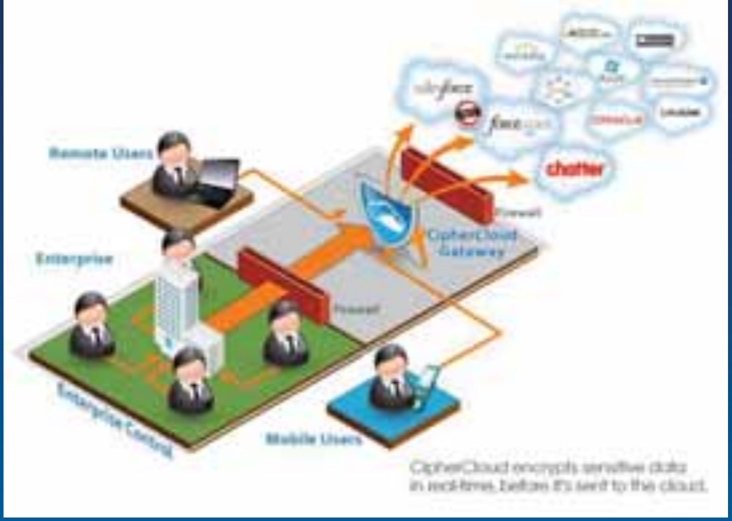
Filters – WAF

- High availability ArcGIS infrastructure
- Traffic filtered before accessed by web servers
- Internal users
  - Access GIS servers via port 6080 directly
- If need more encryption
  - Configure SSL across backend systems
- If want no web tier
  - Loadbalancer can hit GIS Servers directly



Mechanisms

Encryption – 3rd Party Options



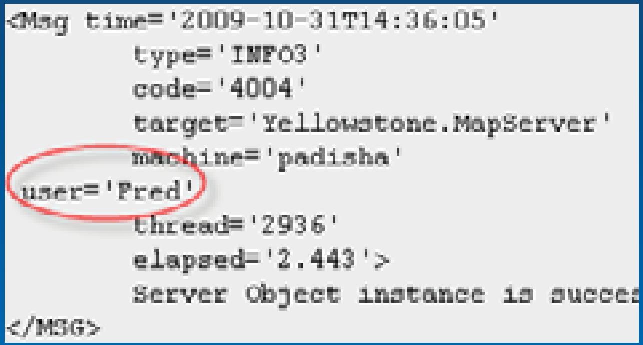
CipherCloud encrypts sensitive data in real-time, before it's sent to the cloud.

- Network
  - IPSec (VPN, Internal Systems)
  - SSL (Internal and External System)
  - Cloud Encryption Gateways
    - Only encrypted datasets sent to cloud
- File Based
  - Operating System – BitLocker
  - GeoSpatially enabled PDF’s combined with Certificates
  - Hardware (Disk)
- RDBMS
  - Transparent Data Encryption
  - Low Cost Portable Solution - SQL Express 2012 w/TDE

Mechanisms

Logging/Auditing

- Esri COTS
  - Geodatabase history
    - May be utilized for tracking changes
  - ArcGIS Workflow Manager
    - Track Feature based activities
  - ArcGIS Server 10+ Logging
    - “User” tag tracks user requests



```
<Msg time='2009-10-31T14:36:05'
        type='INFO3'
        code='4004'
        target='Yellowstone.MapServer'
        machine='padisha'
user='Fred'
        thread='2936'
        elapsed='2.443'>
        Server Object instance is succes
</MSG>
```

- 3rd Party
  - Web Server, RDBMS, OS, Firewall
  - Consolidate with a SIEM

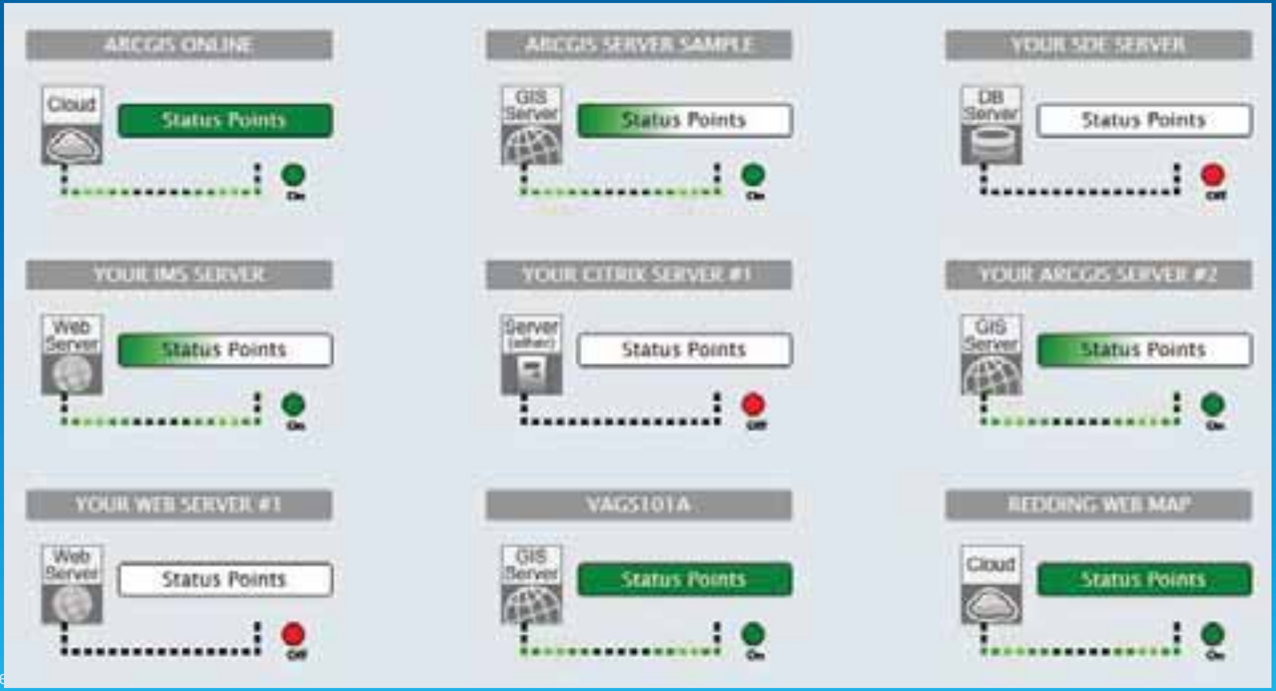
Question: Any geospatial service monitors?

- Vestra’s GeoSystems Monitor
- Geocortex Optimizer

Mechanisms

Logging/Auditing

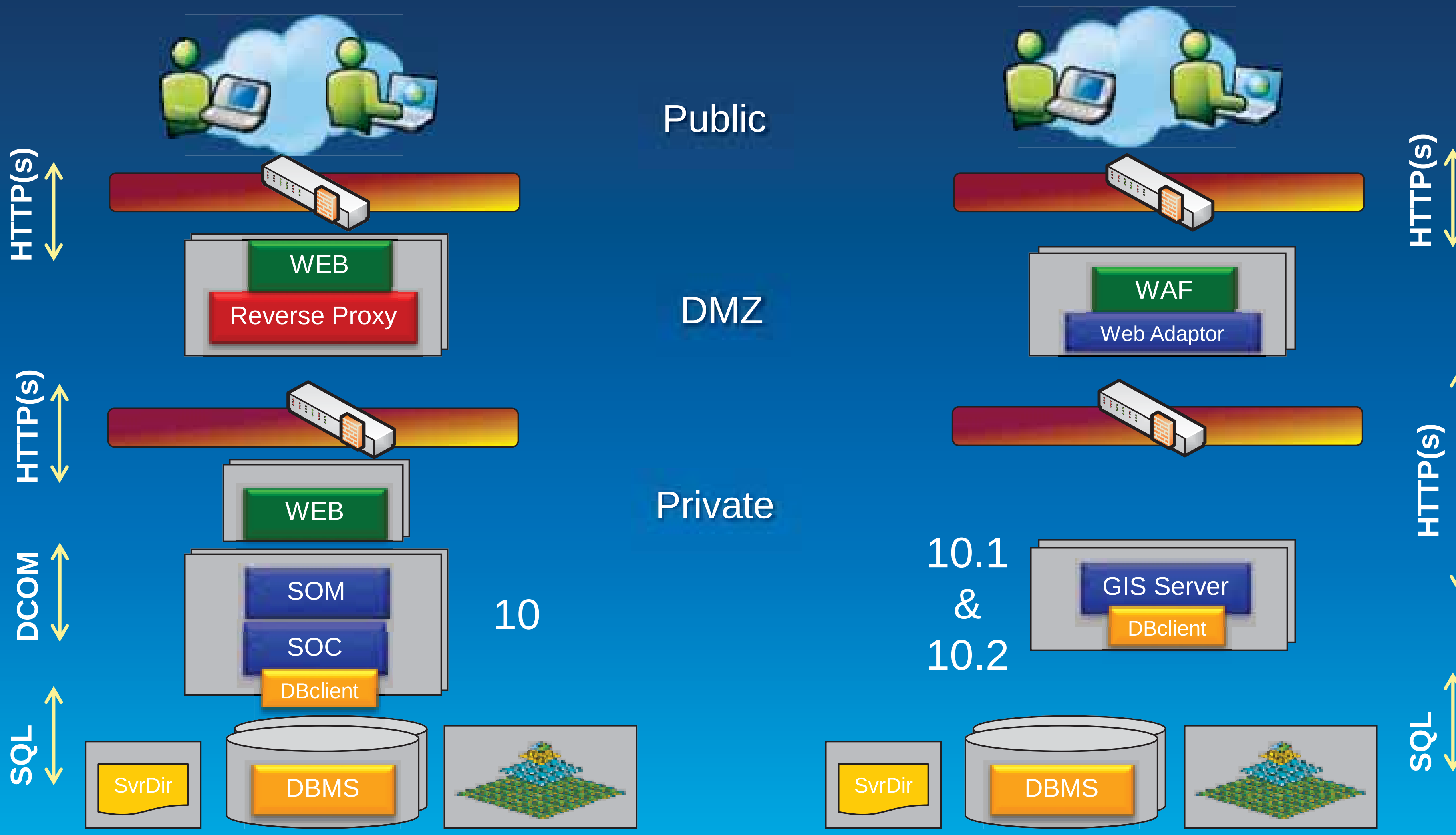
- Vestra GeoSystems Monitor
  - ArcGIS Platform access and availability awareness
  - New - User consumption metrics
    - SDE Table/Feature class (Who & Frequency)
    - ArcGIS Server Services & Apps (Who & Action)



ArcGIS Server

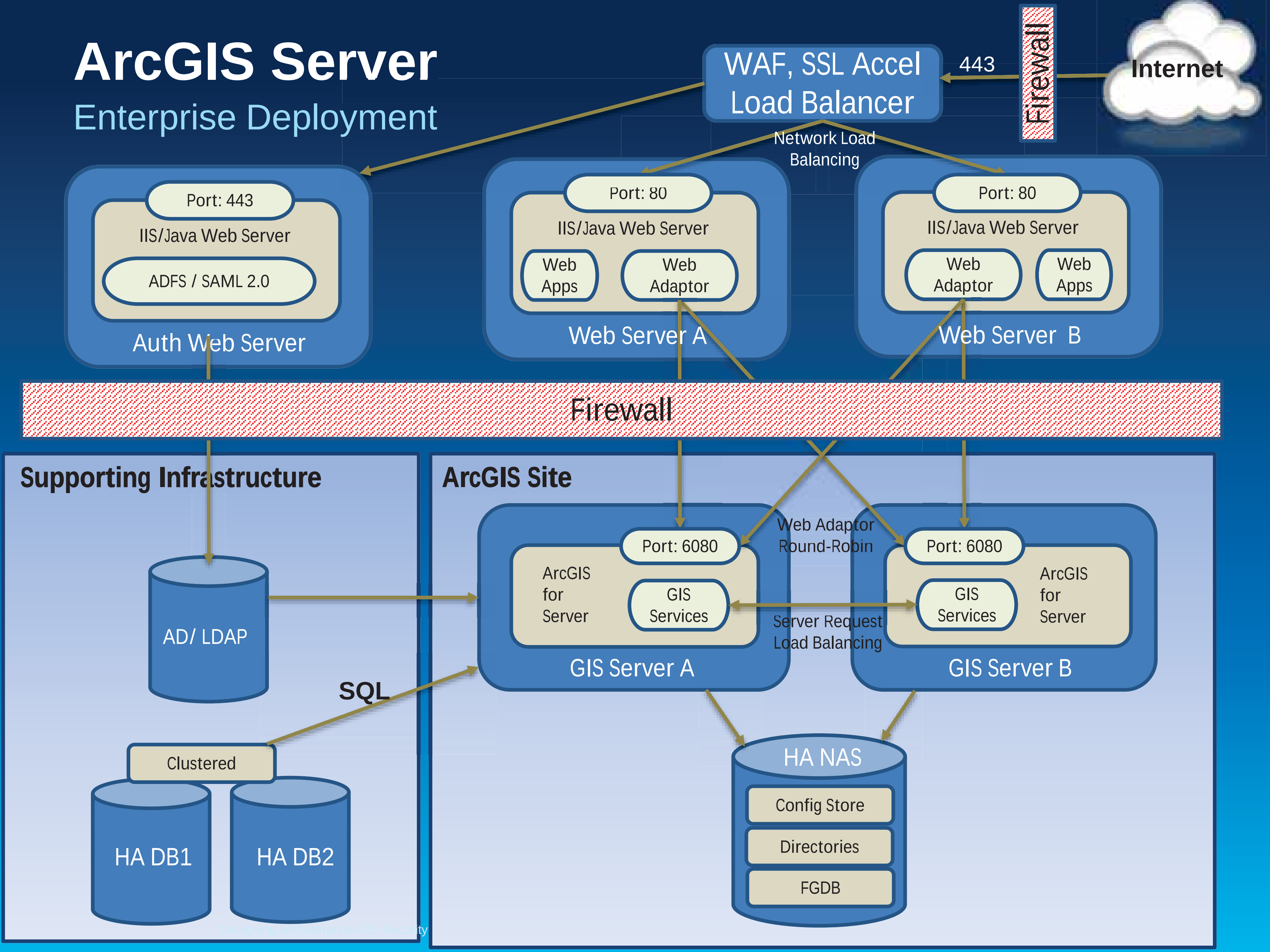
ArcGIS Server

Public Facing Architecture



ArcGIS Server

Enterprise Deployment



ArcGIS Server

Minimize Attack Surface

- Don’t expose Server Manager to public
- Disable Services Directory
- Disable Service Query Operation (as feasible)
- Enable Web Service Request Filtering
  - Windows 2008 R2+ Request Filtering
  - XML Security Gateway
  - Does not intercept POST requests
  - REST API only requires GET and HEAD verbs
    - Exception – Utilize POST for token requests
- Limit utilization of commercial databases under website
  - File GeoDatabase can be a useful intermediary
- Require authentication to services

ArcGIS Server

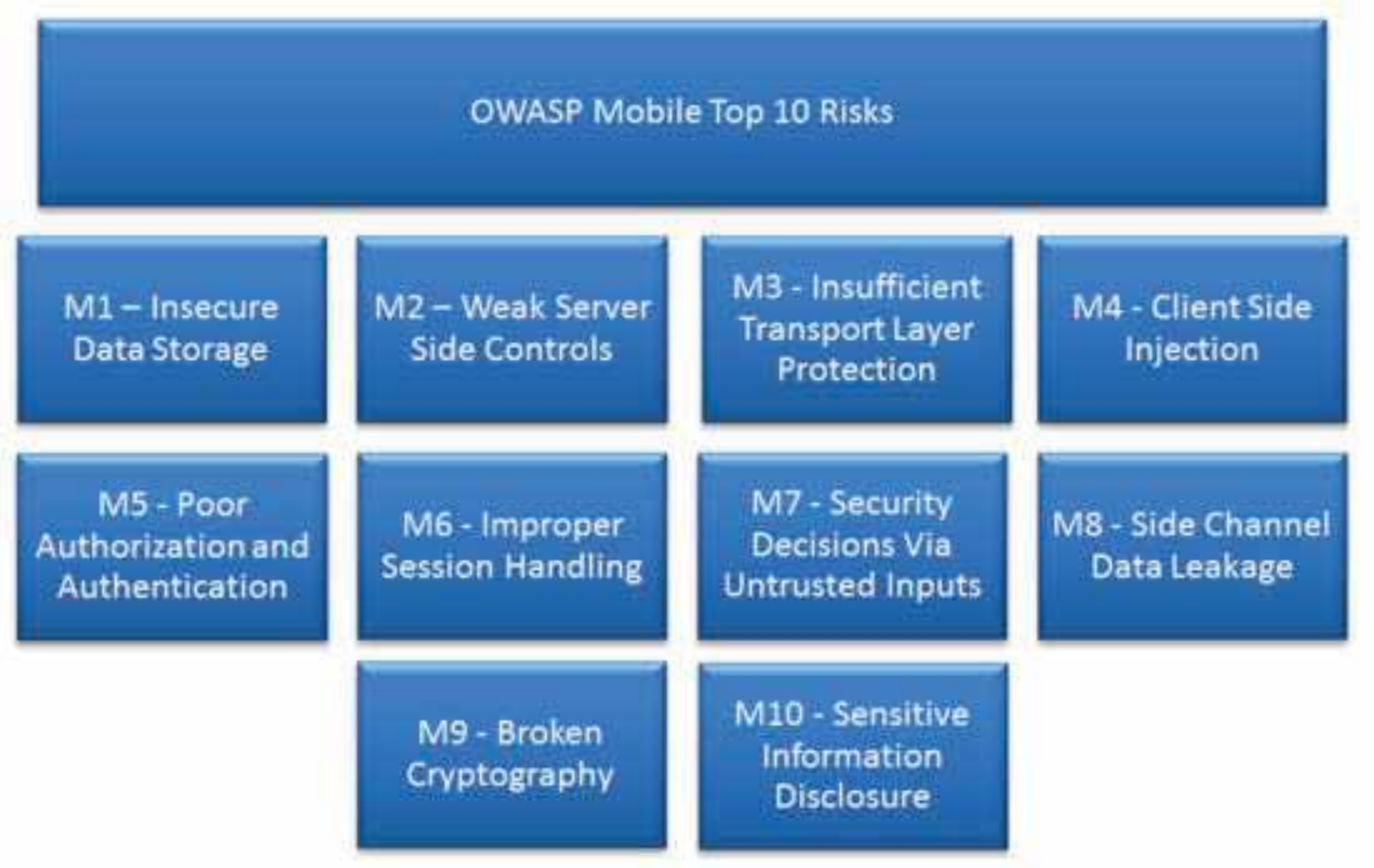
10.2 Enhancements

- Single-Sign-On (SSO) for Windows Integrated Authentication
  - Works across ArcGIS for Server, Portal, and Desktop
- Stronger PKI validation
  - Leverage multi-factor authentication when accessing applications, computers, and devices
  - Web adaptor deployed to web server forwards to AGS the request and username
- Integrated account management and publishing capabilities
  - Across ArcGIS for Server and Portal in a federated configuration
- Key SQL Injection vulnerabilities addressed
  - Changes made in 10.2 may affect some advanced users that were using database-specific SQL statements in their custom applications
- Add support for
  - Active Directory nested groups & domain forests
  - Configuring Private and Public services within the same ArcGIS Server site

Mobile

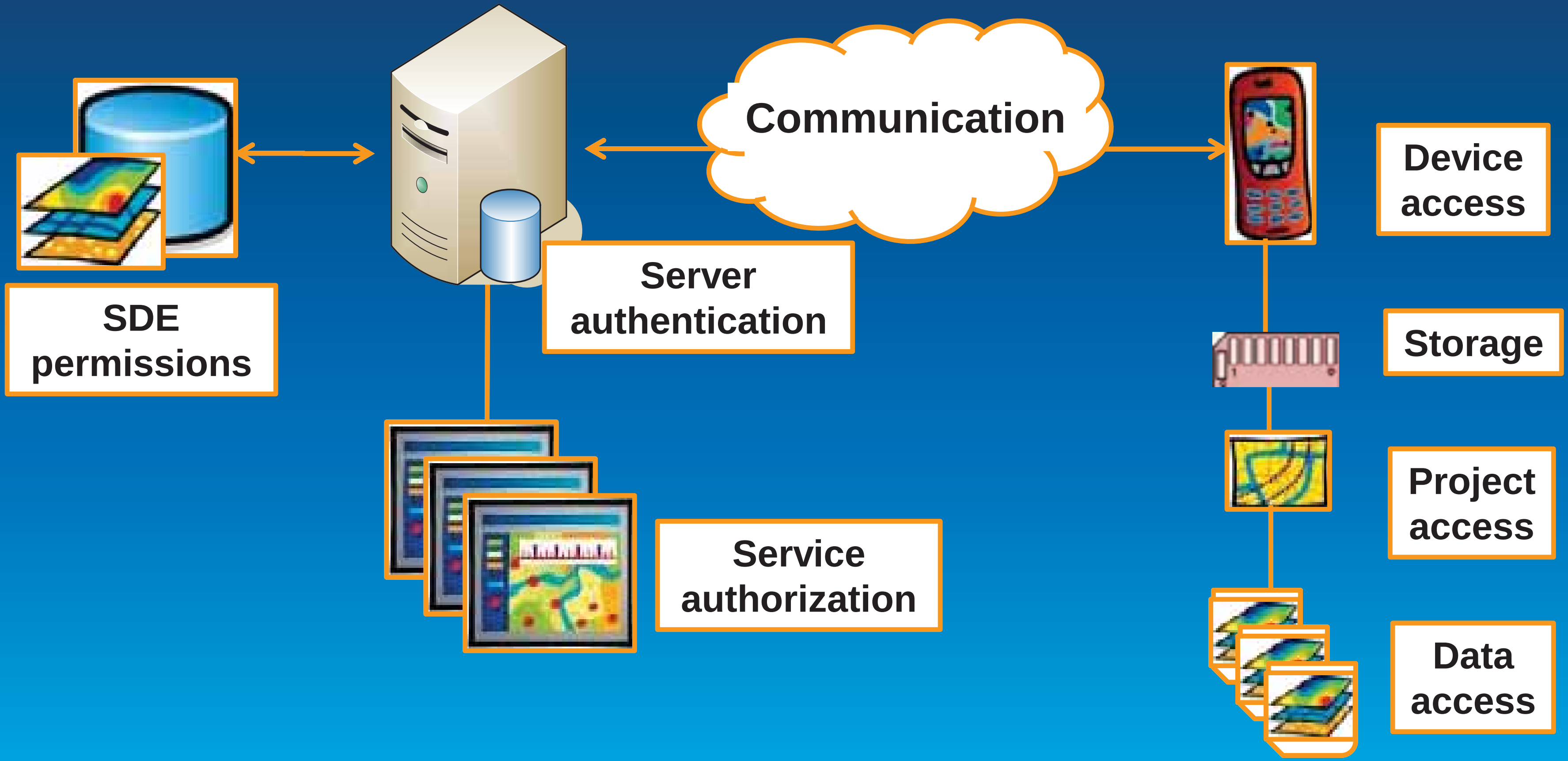
Mobile

What are the mobile concerns?


OWASP Mobile Top 10 Risks
M1 – Insecure Data Storage
M2 – Weak Server Side Controls
M3 - Insufficient Transport Layer Protection
M4 - Client Side Injection
M5 - Poor Authorization and Authentication
M6 - Improper Session Handling
M7 - Security Decisions Via Untrusted Inputs
M8 - Side Channel Data Leakage
M9 - Broken Cryptography
M10 - Sensitive Information Disclosure

Mobile

Security Touch Points



Mobile

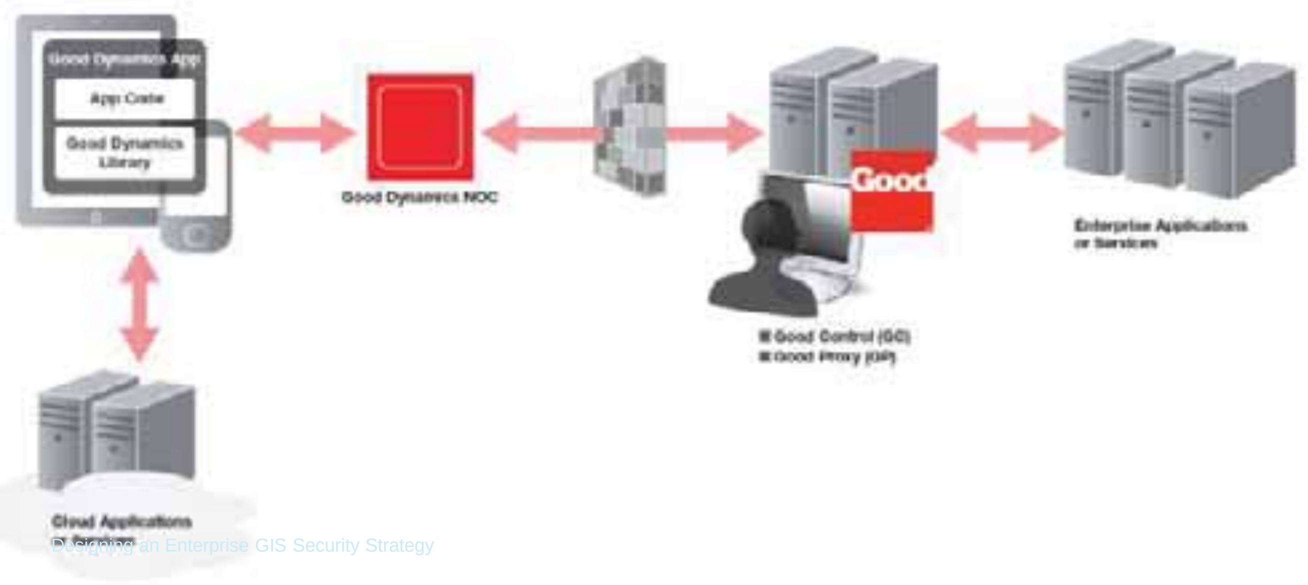
Authenticating to ArcGIS Services

- GIS Tier Auth - ArcGIS Tokens
  - Pass credentials through UserCredentials / AGSCredential object
  - Hardcode long-term token into layout XML (Ideally avoid)
- Web Tier Auth – HTTP Basic/Digest
  - Pass credentials through UserCredentials object
  - PKI Support 10.1.1
    - Android OS version dependent
    - Not available on Windows phone yet
- SSL Support
  - Certificates issued by trusted cert authority
  - Self-signed certificates (Dev environment)

Mobile

Enterprise Mobile Security

- Built-in device capabilities
  - Can store features iOS5 encrypted with Flex 3.0 API
- Enterprise device solutions (InTune, AirWatch, Good, MaaS360)
  - Benefits: Secure email, browser, remote wipe, app distribution
- Application specific solutions
  - Benefits: Secure connections and offline device data
  - Esri iOS SDK + Security SDK



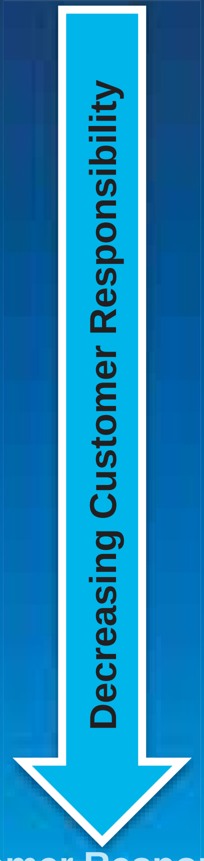
Cloud

Cloud

Service Models

- Non-Cloud
  - Traditional systems infrastructure deployment
  - Portal for ArcGIS & ArcGIS Server
- IaaS
  - Portal for ArcGIS & ArcGIS Server
  - Some Citrix / Desktop
- SaaS
  - ArcGIS Online
  - Business Analyst Online

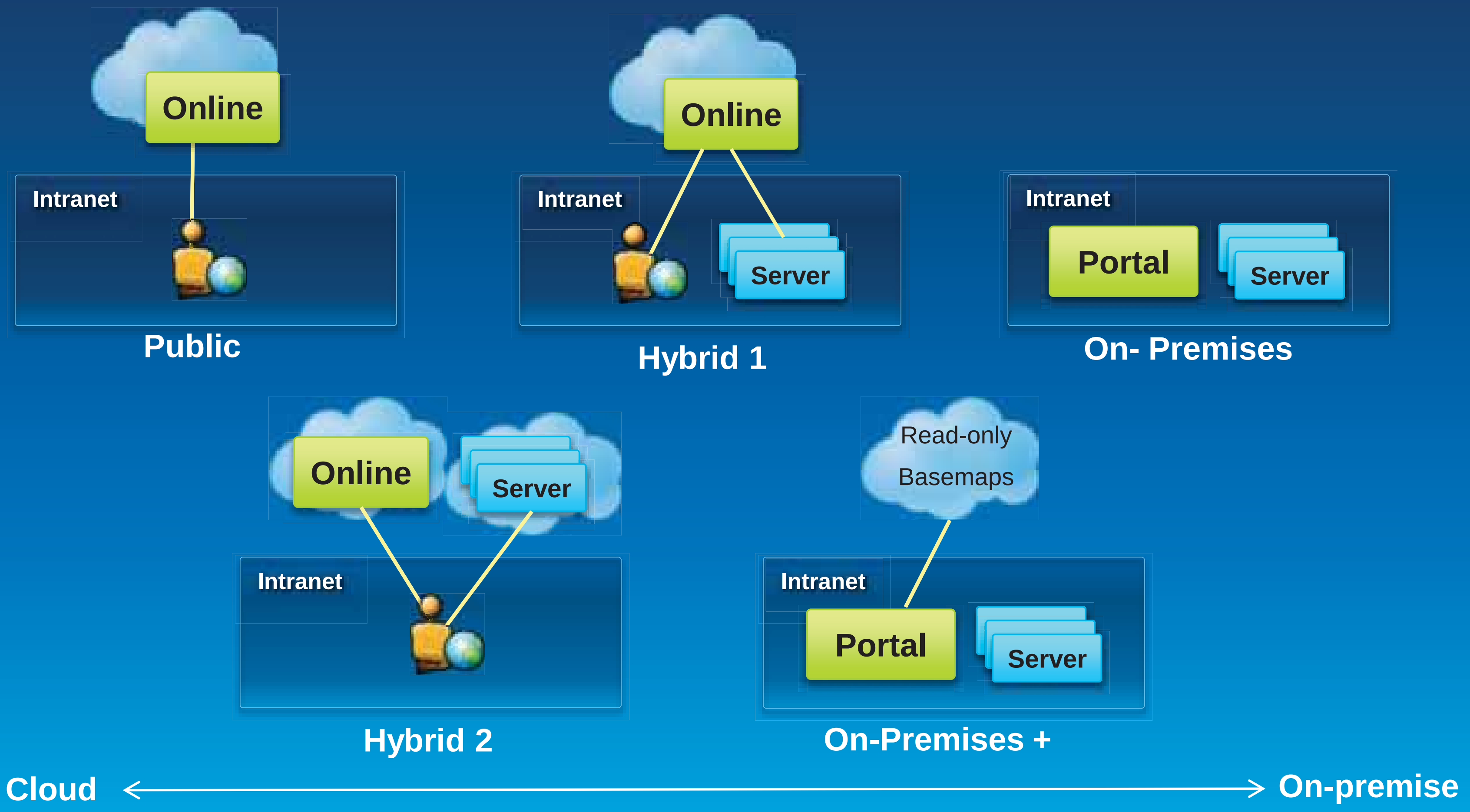
Customer Responsible
End to End



Customer Responsible
For Application Settings

Cloud

Deployment Models



Cloud

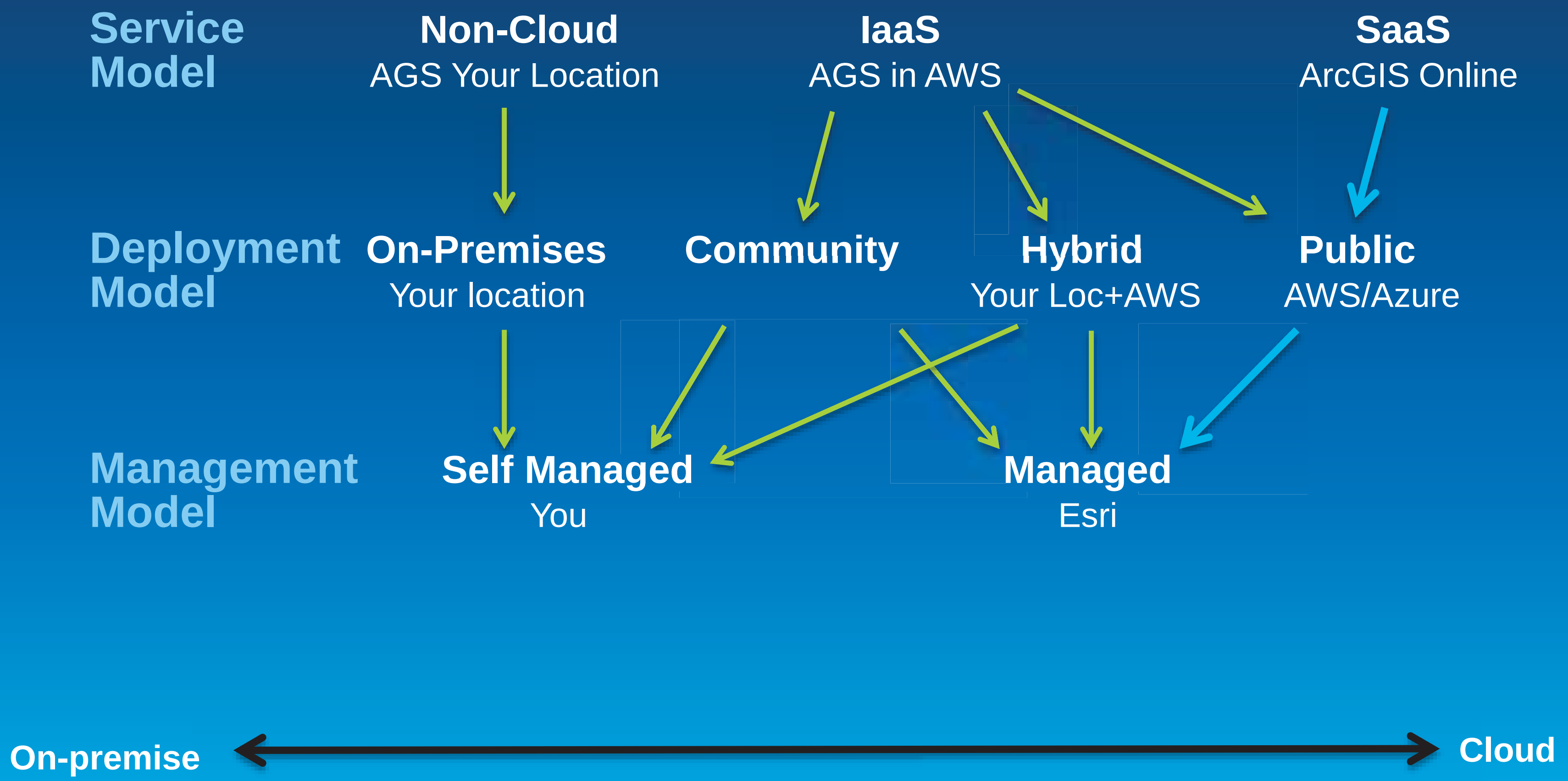
Management Models

- Self-Managed
  - Your responsibility for managing IaaS deployment security
  - Security measures discussed later

- Esri Managed
  - Managed Services
  - Starting work on FedRAMP compliant environment capabilities

Cloud

Model relationships



Service Model

Non-Cloud
AGS Your Location

IaaS
AGS in AWS

SaaS
ArcGIS Online

Deployment Model

On-Premises
Your location

Community

Hybrid
Your Loc+AWS

Public
AWS/Azure

Management Model

Self Managed
You

Managed
Esri

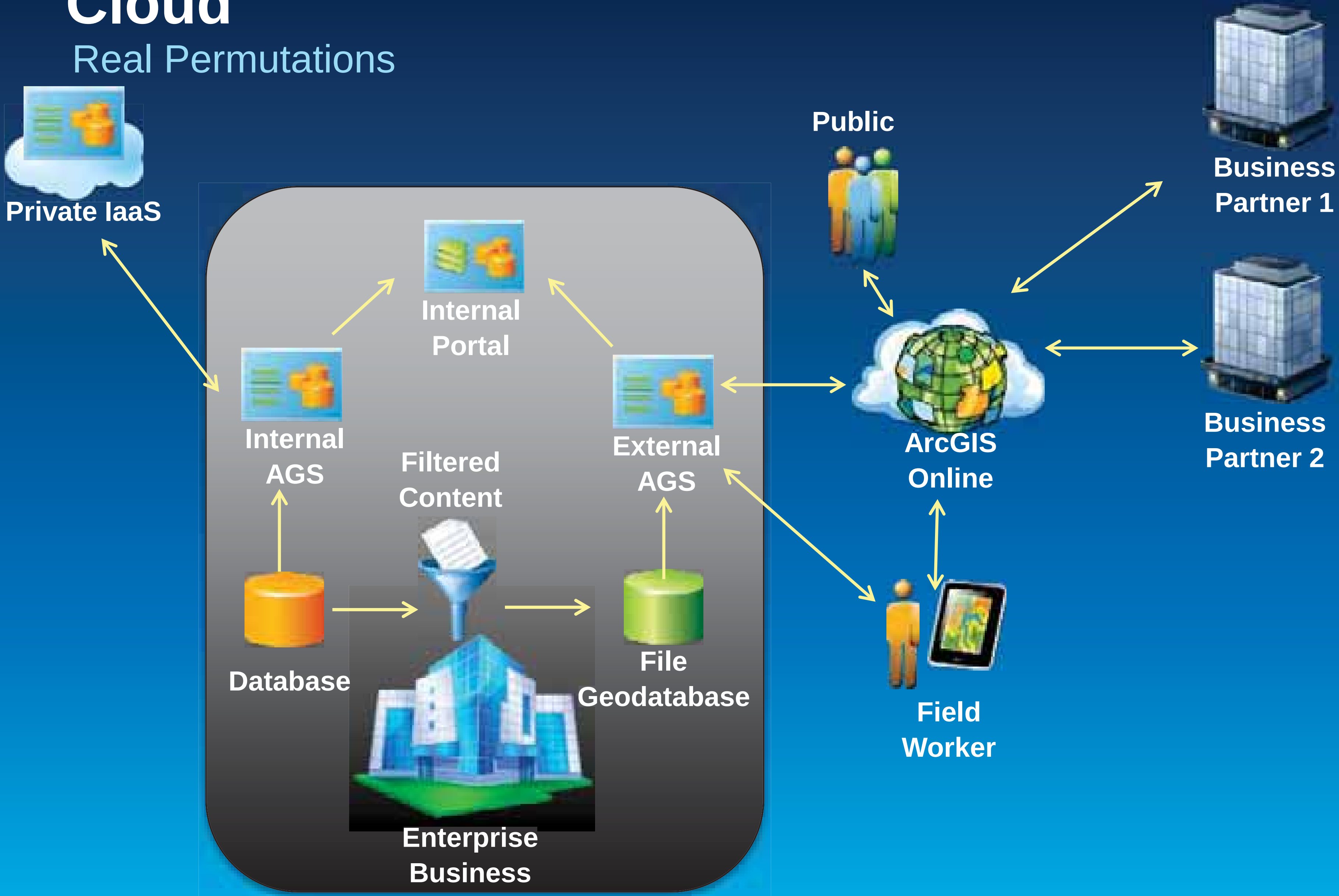
On-premise

Cloud

***AWS is a placeholder on this slide for any cloud provider such as Azure, CGI, or Terremark**

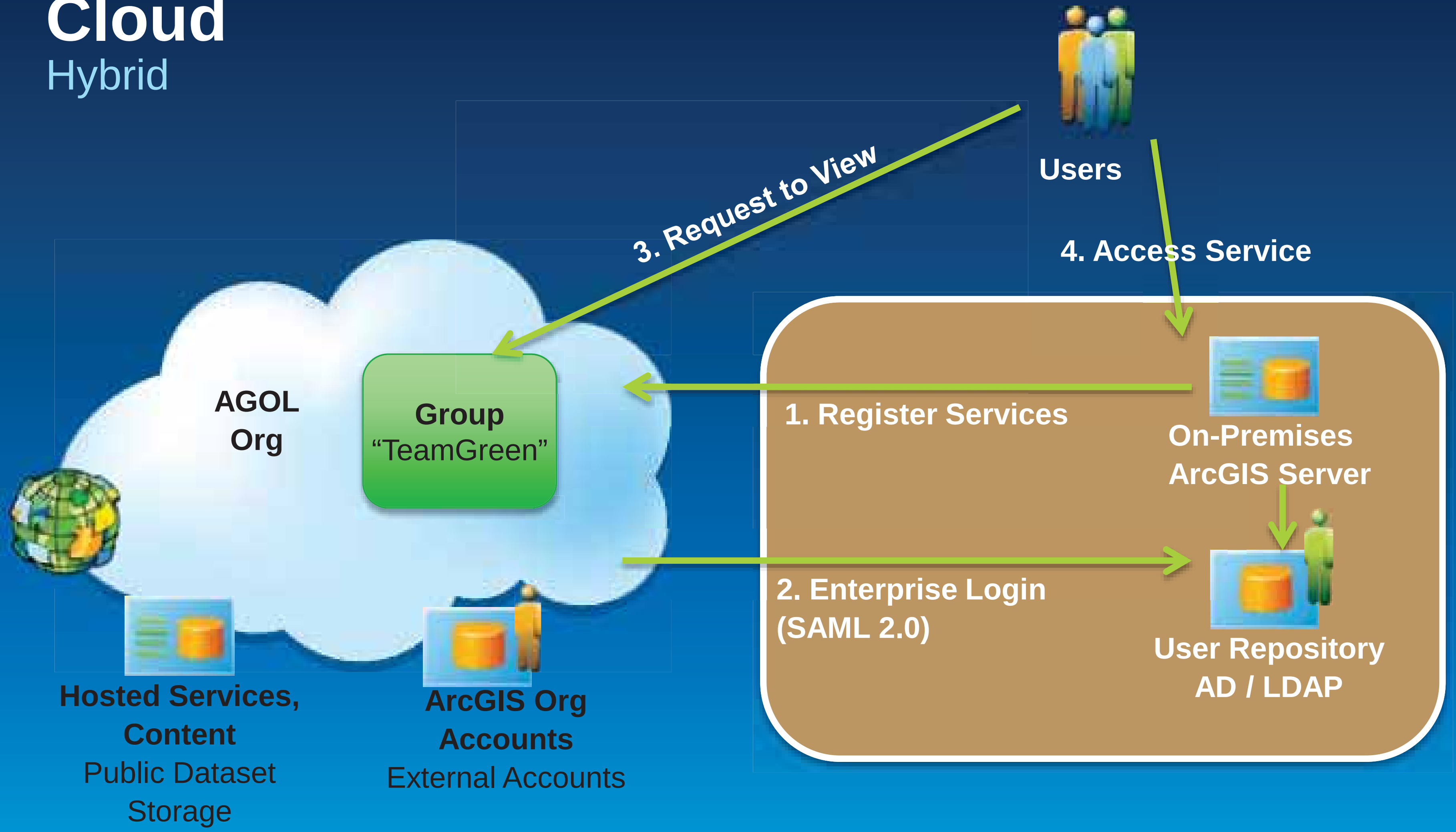
Cloud

Real Permutations



Cloud

Hybrid



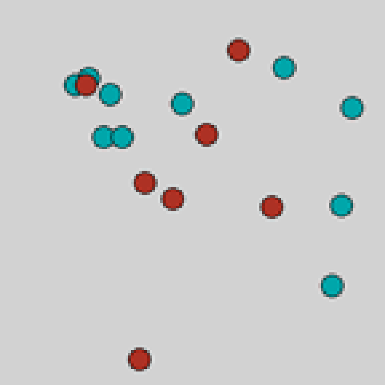
Segment sensitive data internally and public data in cloud

Cloud

Hybrid – Data sources

- Where are internal and cloud datasets combined?
  - At the browser
  - The browser makes separate requests for information to multiple sources and does a “mash-up”
  - Token security with SSL or even a VPN connection could be used between the device browser and on-premises system

On-Premises Operational Layer Service



https://YourServer.com/arcgis/rest...

+

Cloud Basemap Service ArcGIS Online

Pleasant Valley
Happy Valley
Wilson Corner
Damascus
212

http://services.arcgisonline.com...

=

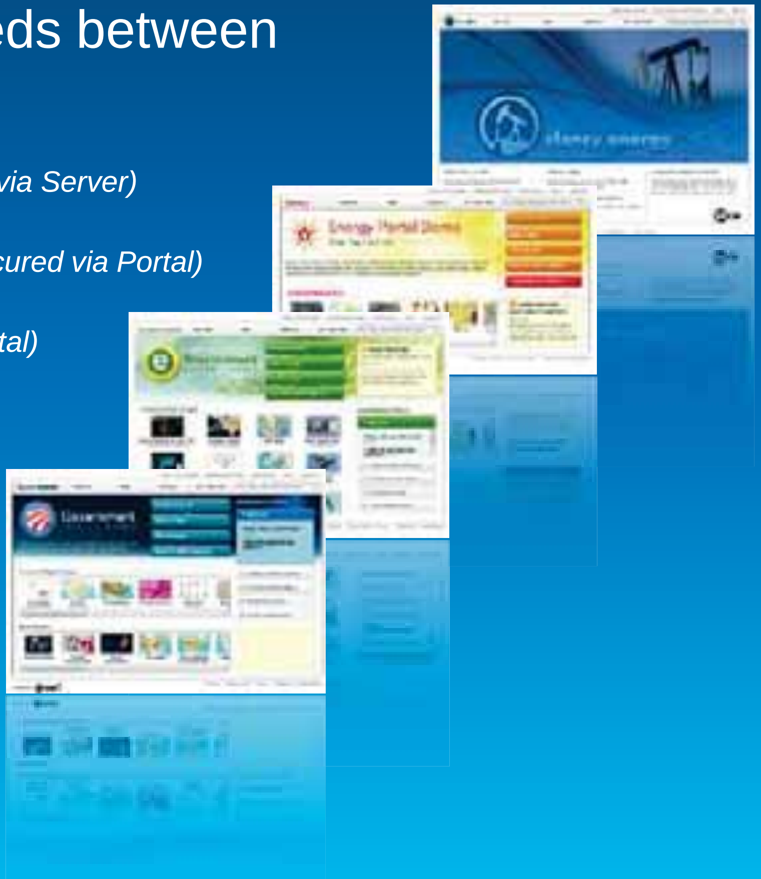
Browser Combines Layers

Cloud

On-premises

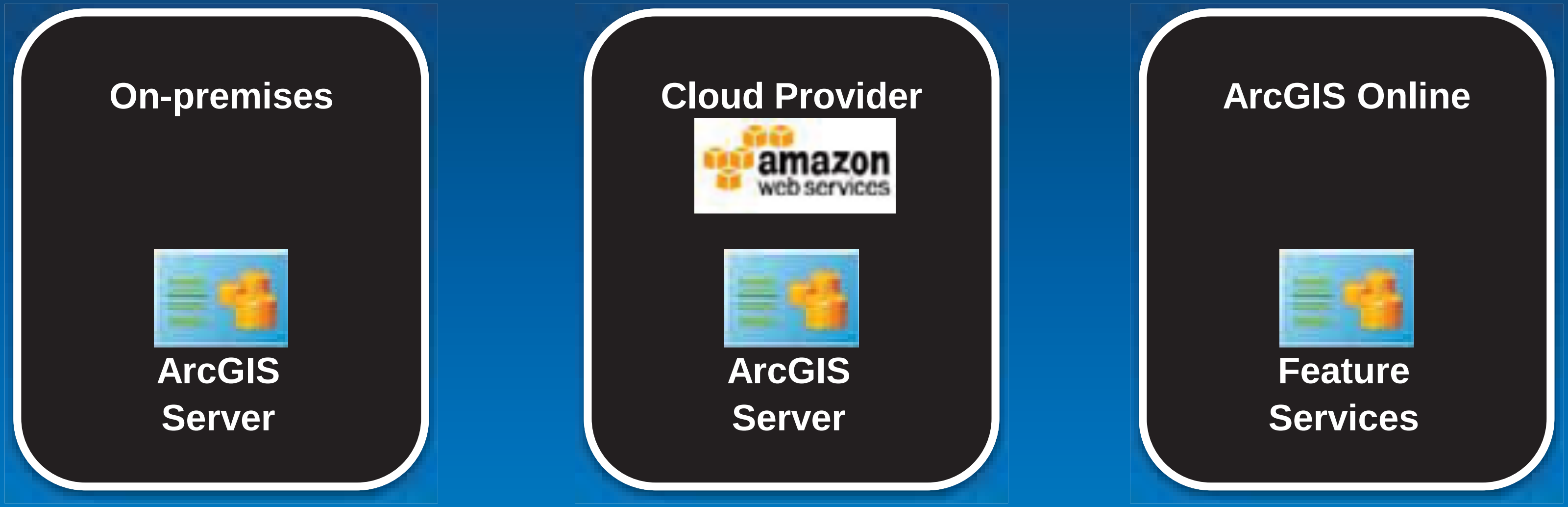
- Why?
  - Additional security demands
  - Federated account management needs between ArcGIS Server and Portal
    - Registered services *(managed and secured via Server)*
    - Federated services *(managed via Server, secured via Portal)*
    - Hosted services *(managed and secured via Portal)*

- Requires
  - Infrastructure
  - Portal & System Administration



Cloud

Data Locations



On-premises

ArcGIS Server

Cloud Provider

ArcGIS Server

ArcGIS Online

Feature Services

Typically utilized for sensitive data & services

Commonly utilized to reduce management costs

Commonly utilized for mildly sensitive information and public data/services

Cloud

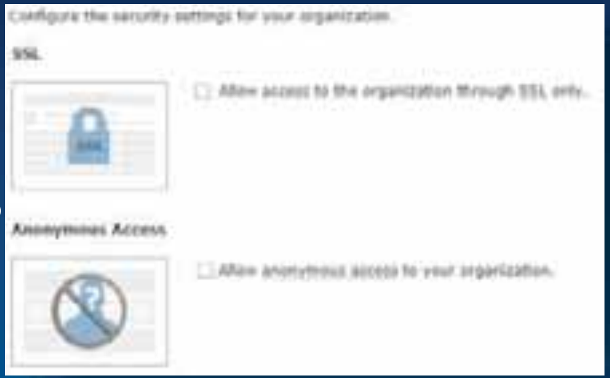
ArcGIS Online – Standards

- New Enterprise Logins
  - SAML 2.0
  - Provides federated identity management
  - Integrate with your enterprise LDAP / AD
- New API's to Manage users & app logins
  - Developers can utilize OAuth 2-based API's
  - https://developers.arcgis.com/en/authentication/

Cloud

ArcGIS Online - Settings

- Organization administrator options
  - Require SSL encryption
  - Allow anonymous access to org site



Configure the security settings for your organization.

SSL

☐ Allow access to the organization through SSL only.

Anonymous Access

☐ Allow anonymous access to your organization.

- Consume Token secured ArcGIS Server services
  - 10 SP1 and later
  - User name and password prompts upon adding the service to a map, and viewing

- Transparency
  - Status.ArcGIS.com

ArcGIS Online Health Dashboard

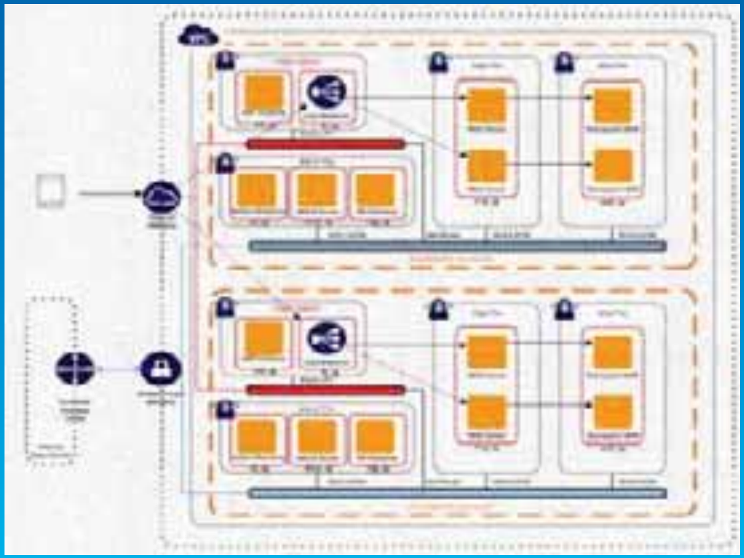
Current Status

Cloud

IaaS

- Common ArcGIS IaaS Deployments
  - ArcGIS Server Windows AMI to AWS
  - ArcGIS Server via Cloud Builder to AWS

- ArcGIS AWS Security Best Practices
  - 8 main areas
  - 5 minute minimum



Cloud

IaaS – AWS

- 8 Security Areas to Address
  - Virtual Private Cloud (VPC)
  - Identity & Access Management (IAM)
  - Administrator gateway instance(s) (Bastion)
  - Reduce attack surface (Hardening)
  - Security Information Event Management (SIEM)
  - Patch management (SCCM)
  - Centralized authentication/authorization
  - Web application firewall (WAF)

Cloud

IaaS - AWS

- Question
  - What is the most common mechanism utilized to compromise AWS instances running Windows?
- Answer
  - Remote Desktop Protocol (RDP)

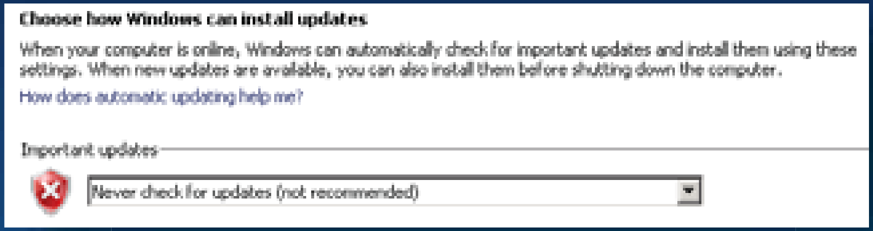
- Question – Part 2
  - Is the problem typically with the RDP protocol or configuration?
- Answer
  - Configuration.
  - Specifically entering 0.0.0.0 for RDP security group allowing all Internet users to attempt access

Cloud

IaaS – AWS – 5 minute minimum

1. Minimize RDP surface
   - Update OS patches
     - Many AMI's disable automatic updates
   - Enable NLA for RDP
   - Set AWS Firewall to Limit RDP access to specific IP's

2. Minimize Application Surface
   - Disable ArcGIS Services Discovery
   - Don't expose ArcGIS Manager web app to Internet



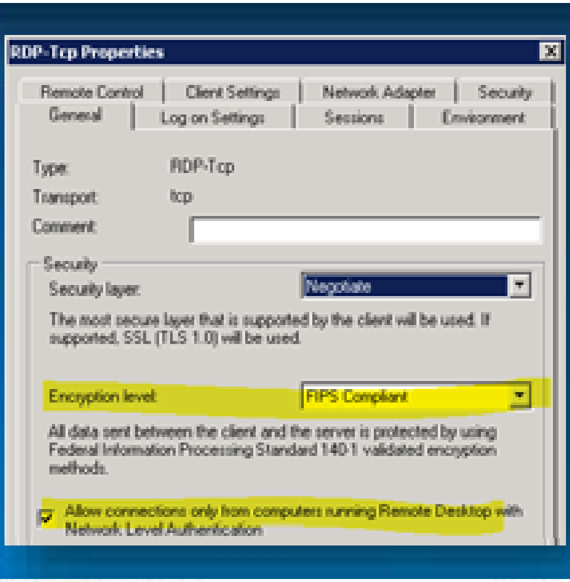
Choose how Windows can install updates

When your computer is online, Windows can automatically check for important updates and install them using these settings. When new updates are available, you can also install them before shutting down the computer.

How does automatic updating help me?

Important updates

Never check for updates (not recommended)



RDP-Tcp Properties

Type: RDP-Tcp

Transport: tcp

Comment:

Security

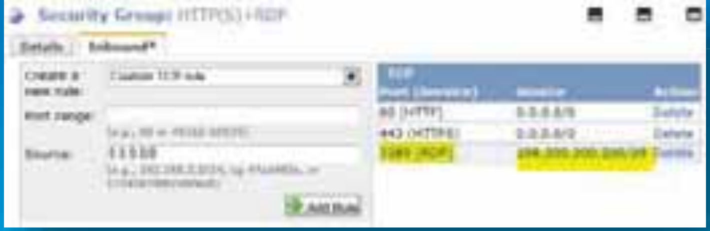
Security layer: Negotiate

The most secure layer that is supported by the client will be used. If supported, SSL (TLS 1.0) will be used.

Encryption level: FIPS Compliant

All data sent between the client and the server is protected by using Federal Information Processing Standard 140-1 validated encryption methods.

☑ Allow connections only from computers running Remote Desktop with Network Level Authentication



Security Group: HTTP(S)+RDP

Create a new rule: Custom TCP rule

Port range:

(e.g., 80 or 49152-65535)

Source: 0.0.0.0/0

(e.g., 192.168.2.0/24, sg-47ad482e, or 1234567890/default)

TCP		
Port (Service)	Source	Action
80 (HTTP)	0.0.0.0/0	Delete
443 (HTTPS)	0.0.0.0/0	Delete
3389 (RDP)	[illegible]	Delete

These steps can be completed within 5 minutes – Do them!

Compliance

Compliance

ArcGIS Online

- In-Place Now
  - Safe Harbor Self-Certification
  - TRUSTed Cloud Certified
- Expected in 2013
  - FISMA Low Accreditation
- Future
  - FedRAMP Moderate

Compliance

Beyond ArcGIS Online

- FDCC
  - Desktop products 9.3-10

- USGCB
  - Desktop products 10.1

NIST National Institute of Standards and Technology
Information Technology Laboratory
United States Government Configuration Baseline
USGCB

- SSAE 16 Type 1 – Previously SAS 70
  - Esri Data Center Operations
  - Expanded to Managed Services in 2012

SSAE-16
AUDITED
✓

Summary

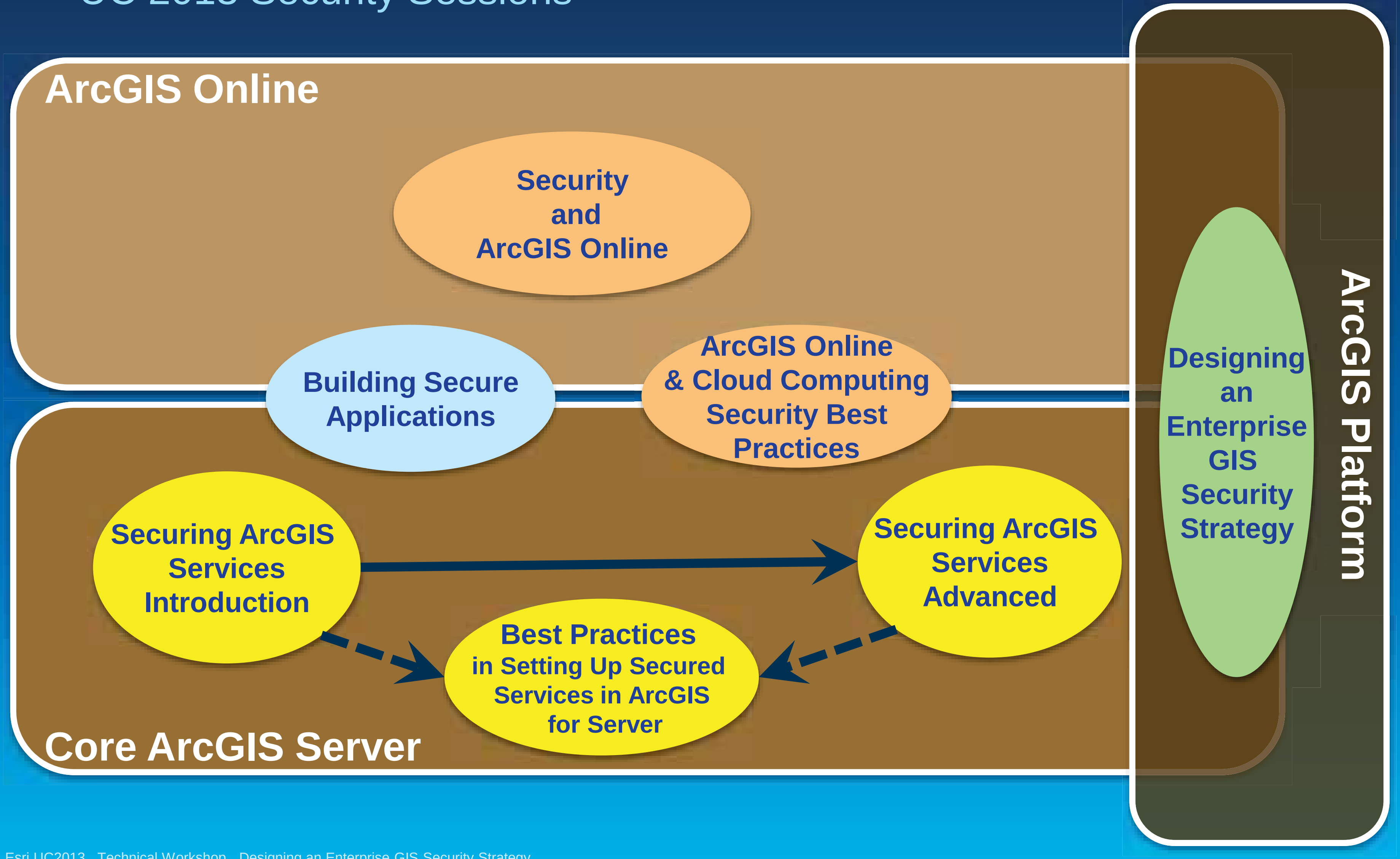
Summary

- Security is NOT about just a technology
  - Understand your organizations GIS risk level
  - Realize the game has changed and prioritize efforts accordingly
  - Don’t just add components, simplify!

- Secure Best Practice Guidance is Available
  - Check out the ArcGIS for Professionals site!
  - Drill into details by mechanism or application
  - Look for ArcGIS Online Cloud Security Alliance security control documentation soon

Summary

UC 2013 Security Sessions



ArcGIS Online
Security and ArcGIS Online
Building Secure Applications
ArcGIS Online & Cloud Computing Security Best Practices
Securing ArcGIS Services Introduction
Securing ArcGIS Services Advanced
Best Practices in Setting Up Secured Services in ArcGIS for Server
Core ArcGIS Server
Designing an Enterprise GIS Security Strategy
ArcGIS Platform

Thank you…

Please fill out the session evaluation

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Paper – pick up and put in drop box

Questions?

Trends
Strategy
Mechanisms
Server
Mobile
Cloud
Compliance

Web
Devices
Desktop
Online
Server
Content & Services

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Understanding our world.