Security Basics

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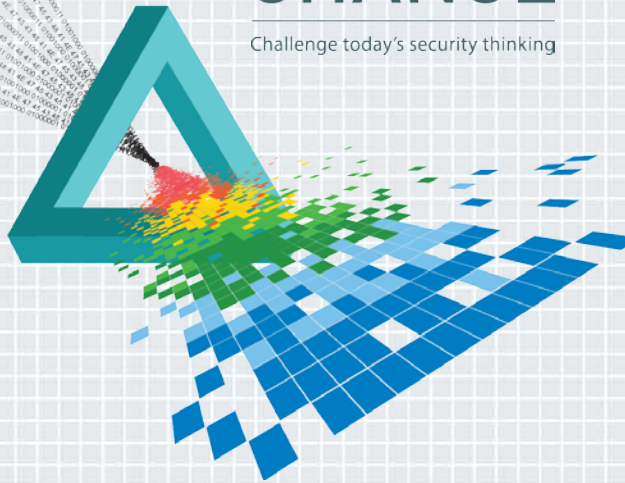
CHANGE
Challenge today's security thinking



SESSION ID: SEM-M01

Introduction and A Look at Security Trends

Hugh Thompson, Ph.D.

Program Committee Chairman, RSA Conference
Twitter: @DrHughThompson


WELCOME TO THE PADANGTEGAL
MANDALA WISATA WANARA WANA
SACRED MONKEY FOREST SANCTUARY
DEAR VISITORS,
ON BEHALF OF THE VILLAGE OF PADANGTEGAL AND THE WANARA WANA FOUNDATION WE WISH YOU AN ENJOYABLE AND EDUCATION VISIT TO OUR FOREST SANCTUARY AND TEMPLE COMPLEX. TO ENSURE A TRULY PLEASURABLE VISIT PLEASE OBSERVE THE FOLLOWING:
1. THIS IS A SACRED AREA. PLEASE COMFORT YOURSELF WITH RESPECT FOR THE PEOPLE WHO WORSHIP HERE, THE TEMPLES AND THE MONKEYS AND OTHER PLANTS AND ANIMALS THAT RESIDE IN THE FOREST
2. THE MONKEYS OF THIS FOREST ("KERA" OR "MACAQUES") ARE FREE LIVING WILD ANIMALS PLEASE REFRAIN FROM TOUCHING OR PLAYING WITH THEM AS THEY MAY REACT IN AN UNPREDICTABLE MANNERS. DO NOT PROVIDE PEANUTS FOR THE MONKEYS AS THEY ARE A POTENTIAL HEALTH RISK. SEEK OUT A STAFF MEMBER (GREEN SARONGS) FOR ANY ASSISTANCE REGARDING THE MONKEYS
3. PLEASE READ THE BROCHURE PROVIDED WITH THE ENTRANCE TICKET FOR FURTHER INFORMATION ABOUT THIS SANCTUARY
WE THANK YOU FOR FOLLOWING THESE REGULATIONS AND WE TRUST THAT YOUR VISIT WILL BE A MEMORABLE ONE
SINCERELY,
WANARA WANA FOUNDATION

Agenda

- Intro to Information Security
- Economics of Information Security
- Security Trends

The Shifting IT Environment

(…or why security has become so important)

Shift: Compliance and Consequences

- The business has to adhere to regulations, guidelines, standards,…
  - SAS 112 and SOX (U.S.) – upped the ante on financial audits (and supporting IT systems)
  - PCI DSS – requirements on companies that process payment cards
  - HIPAA, GLBA, BASEL II, …, many more
- Audits have changed the economics of risk and create an "impending event"

Hackers *may* attack you but auditors *will* show up

- Disclosure laws mean that the consequences of failure have increased
  - Waves of disclosure legislation

Shift: Technology

- Many applications/transactions now operate over the web
- Cloud is changing our notion of a perimeter
- Worker mobility is redefining the IT landscape
- Shadow IT is becoming enterprise IT
- Majority of web transactions are now encrypted (SSL)
- The security model has changed from good people vs. bad people to enabling partial trust
  - There are more “levels” of access: Extranets, partner access, customer access, identity management, …

Shift: Attackers

- Cyber criminals are becoming organized and profit-driven
  - An entire underground economy exists to support cybercrime
- Attackers are shifting their methods to exploit both technical and human weaknesses
- Attackers after much more than traditional monetizable data (PII, etc.)
  - Hacktivism
  - State-sponsored attacks
  - IP attacks/breaches

Shift: Customer expectations

- Customers, especially businesses, are using security as a discriminator
- In many ways security has become a non-negotiable expectation of businesses
- Security being woven into service level agreements (SLAs)
- The “average person” is now familiar with security

Big Questions

- How do you communicate the value of security to the enterprise (and management)?
- How do you measure security?
- How do you rank risks?
- How do you reconcile security and compliance?
- How can you be proactive and not reactive? What is “security intelligence” and how would you actually consume, act on or share it?
- What changes are likely in privacy laws, data sovereignty, trust?
- What about big issues in the news like APT’s, hacktivism, leaks, DDoS attacks, …? How should/can we adapt what we do based on them?
- How do you adapt to new paradigms like IoT?

The Economics of Security

Hackernomics (*noun*)

A social science concerned chiefly with description and analysis of attacker motivations, economics, and business risk. Characterized by

5 fundamental immutable laws and 4 corollaries

Law 1

Most attackers aren't evil or insane; they just want something

Corollary 1.a.:
We don't have the budget to protect against evil people but we *can* protect against people that will look for weaker targets

Law 2

Security isn't about security. It's about mitigating risk at some cost.

Corollary 2.a.:
In the absence of metrics, we tend to over focus on risks that are either familiar or recent.

Law 3

Most costly breaches come from simple failures, not from attacker ingenuity

Corollary 3.a.:
Bad guys can, however, be VERY creative if properly incentivized.

The CAPTCHA Dilemma

Completely

Automated

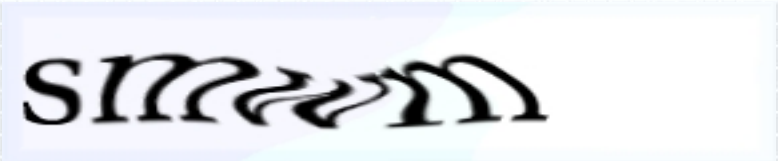
Public

Turing test to tell

Computers and

Humans

Apart



Law 4

In the absence of security education or experience, people (employees, users, customers, …) naturally make poor security decisions with technology

Corollary 4.a.:

Systems needs to be **easy to use securely and difficult to use insecurely**


Messana
GRATED
PARMESAN
CHEESE
Comet
MULTI-ROOM

Law 5

Attackers usually don't get in by cracking some impenetrable security control, they look for weak points like trusting employees

A Visual Journey of Security Trends

2008


Development
Cyber
Integration
Solving
Using
Technology
Case
Defense
Intelligent
Time
Breaking
Strategies
Software
Control
Implementing
Generation
Privacy
Information
Consumer
Experience
Access
Electronic
World
Identity
Protection
Law
Digital
Risk
Challenges
Lessons
Architecture
Biometrics
Signatures
Best
Business
Hacked
Anatomy
Operations
Mobile
Contracts
Management
Data
Vulnerabilities
Authentication
Analysis
Based
Threat
New
Enterprise
Assessment
Solutions
vs
Techniques
Federated
Services
Online
Environment
Network
Compliance
Web
Standards
Attacks
SOA
Approach
Engines
Forensics
Model
Getting
Coming
Microsoft
event
Practices
Internet
Key
Government
Industry
Deployment
Bank
Infrastructure
Policy
Application
Real
Systems

2015


GENERATION
DEFENDING
MODEL
VULNERABILITY
SOLUTIONS
PRACTICAL
BEHAVIOR
CYBERSECURITY
FRAMEWORK
ORGANIZATION
LESSONS
PROGRAM
SERVICES
IMPROVING
TRUST
STUDY
DEVELOPMENT
RESPONSE
CYBER
MALWARE
MAKING
PASSWORDS
SYSTEMS
INFORMATION
BUSINESS
INCIDENT
MACHINE
COMPLIANCE
ATTACKS
COMPANY
DEVICE
INTELLIGENCE
NETWORK
SOFTWARE
BASED
DETECTION
APPLICATION
PREVENTING
SOCIAL
APPROACH
APPS
THREAT
DIGITAL
MOBILE
INNOVATION
HACKING
RISK
CLOUD
CASE
BIG
NEW
TECHNOLOGY
INSIDER
INDUSTRY
TRANSFORMING
USING
MANAGEMENT
DATA
EFFECTIVE
ENTERPRISE
WORLD
LEVERAGING
ENVIRONMENT
COMPROMISED
INFRASTRUCTURE
BUILDING
PROTECTING
THINGS
DEFENSE
CONTROL
FUTURE
TESTING
ENGINEERING
AUTHENTICATION
BREACH
ANALYSIS
CRITICAL
AWARENESS
GOVERNMENT
INTERNET
IDENTITY
ARCHITECTURE
STANDARDS
ADVANCED
HACKERS
AUTOMATION
SHARING
ANALYTICS
PRIVACY
LEARNING
ACCESS
ENCRYPTION
IMPLEMENTING
UNDERSTANDING
OPERATIONS
STRATEGY
MITIGATION
COMMUNICATING


12
11
1
10
2
9
3

Enjoy the rest of the conference!!

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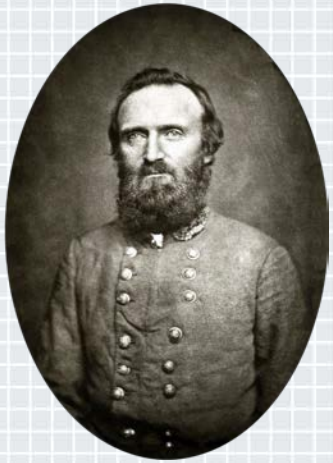
User Authentication Trends and Methods for Native Mobile Applications

Kayvan Alikhani

Senior Director of Technology
RSA

Authenticate:
Prove you are who you claim to be



Stonewall Jackson

…A Union cavalry force shouted "Halt, who goes there?", but fired before **evaluating** the reply. Frantic shouts by Stonewall Jackson's staff **identifying** the party were replied to:
"It's a damned Yankee trick! **Fire**!"
Jackson was severely wounded & ended up dying of the gun wound.

Worst. Authentication. Ever?
Did they use a Pass phrase?
If not, was it the environment that failed them?
Too Loud to recognize his voice? Too dark to identify him?
Or a simple case of Timeout!

Strong Auth

- **Strong Authentication** The requirement to use **multiple factors** for authentication… to verify an entity's identity

(National Information Assurance (IA) Glossary)

Strong Auth:
Multi-factor vs. Multi-layered

- **Multi-factor** auth: Authentication that requires the use of solutions from two or more of categories of factors

- **Multi-layered** auth: Using multiple solutions from varying (same/different) categories at different **points** in the process

Biometric Auth: Fingerprinting: 'Old' school method

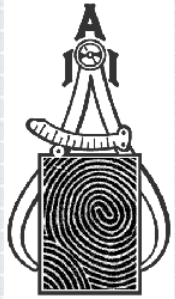
200 BC: China

Handprints used as evidence for burglaries

1892: UK

Galton: "Fingerprints": Individuality & permanence, introduced 'minutia'

1915: Oakland



International Association for Criminal Identification

2015: Everywhere

AADHAAR

Other Biometric auth methods for mobile apps

- Voice print
- Face print (including eye veins)
- Iris
- EKG: Heart-signature
- Behavioral patterns
- Ear pattern (no, this is not a typo)
- ….

Biometric auth: The Mobile advantage

- Modern devices now equipped with powerful sensors & radios:
  - Camera(s)
  - Microphone(s)
  - Fingerprint sensor
  - GPS/Wi-Fi/Bluetooth
  - Gyro/Accelerometer
  - IR Laser/LED

- Plus…We carry them everywhere!

Mobile biometrics for mobile apps: What to Watch Out For!

- Has to be easy for the user, as in: “Work all the time!” for the right user:
  - Tolerable False Acceptance & Rejection rates
  - Adapts to Environment: Too loud, Too dark, Too cold? No problem!
  - Matches user/organizational needs: Compliant

- Protect Data at rest:
  - Securely stores & protects sensitive data: Templates/hashes/keys
  - Takes advantage of hardware security when possible

- Protect Data being acquired:
  - Live-ness detection: Prevent spoofing

Mobile Auth trends and standards

- FIDO Alliance, Apple Touch ID, Windows 10 (TPM):
  - Auth on the device: Move from server based Auth to device-side Auth
  - Credentials/Biometric templates never leave the device
  - Device “signs” claims and assertions

- Use of HW to protect keys/processes:
  - Use of TEE, SE to store key data at rest
  - Use of TEE to run authentication process

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Multi-factor Auth makes sense!

Reality vs. Utopia

- **Utopia:**
  - Devices: All have well designed, easy to use, similar authenticators
  - Service providers: All support a common standard for authentication
  - Hackers: Leave device-side biometric authentication “alone”
- **Reality (for the next ~5 years):**
  - Devices: Growing mix of different capabilities, makes & models
  - Service providers: Hodgepodge of Auth protocols and standards
  - Hackers: Can’t wait…

Dos and Don’ts for mobile app auth solutions

- Don’t put all your eggs in one basket, throw a wider net:
  - Design around solutions that take advantage of **evolving** mobile auth methods
  - **Avoid** solely relying on a single:
    - Factor/Method
    - Vendor
    - Platform/OS
  - Look for standards support and compliance

- Determine Risk:
  - Take advantage of solutions that include “**User behavioral data**” to make better decisions. Data that includes:
    - User location, network, device registration, usage and activity pattern

Dos and Don’ts for mobile app auth solutions

- Survey your users with simple POCs to see what method ‘works’ for them
- Remember: Combining auth methods **lowers** the risk of each method:
  - Improves chance of information being accessed by the right person
- It’s a Balancing Act:
  - Decide when to use “step up” based on “role” & “action”, for example:
    - User is reviewing NBA game stats? Let them in, accept **Moderate risk**
    - Manager is Approving a players transfer? Step up & tolerate **Lower risk**

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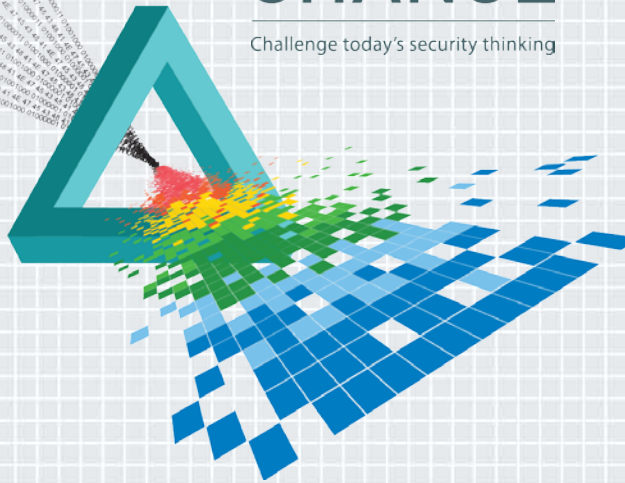

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Mobile & IoT Security: Will Big Data Make it Better or Worse?

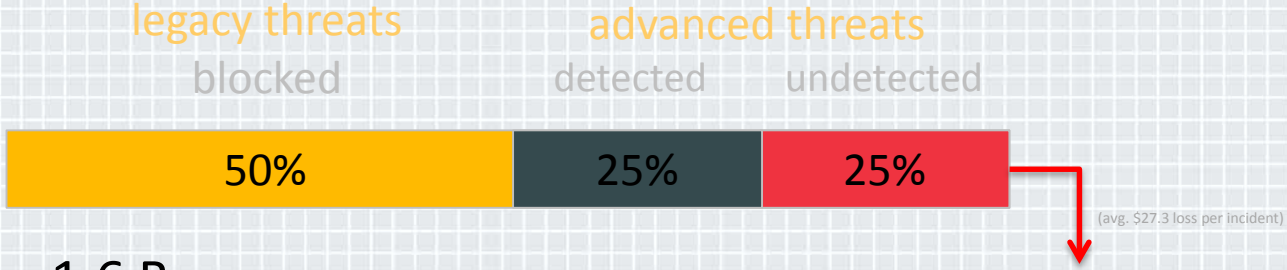
Hadi Nahari

Chief Security Architect
NVIDIA
@hadinahari

General Threat Landscape

>3,000,000,000,000

threats annually



1.6 B

number of records lost globally in 2014

$236 M

recovery cost of Target breach (so far)

15 B

connected devices in 2015

$110 BN

annual price tag of cybercrime

Motivation

- More connected devices → more value → added risk
- Security posture hasn't magically just improved
  - In many cases in fact it has regressed
- Heterogeneous security paradigms
  - Device-end data is dislodged and processed separately
  - Dubious security posture of the Big Data infrastructure itself
  - Unclear how it handles the security of the data it analyzes
- A massive digital orgy with no reliable membranes

Increasing Complexity

- Space Shuttle: ~400K LOC
- F22 Raptor fighter: ~2M LOC
- Linux kernel 2.2: ~2.5M LOC
- Hubble telescope: ~3M LOC
- Android core: ~12M LOC
- Future Combat System: ~63M LOC
- Connected car: ~100M LOC
- Autonomous vehicle: ~300M LOC

Mobile

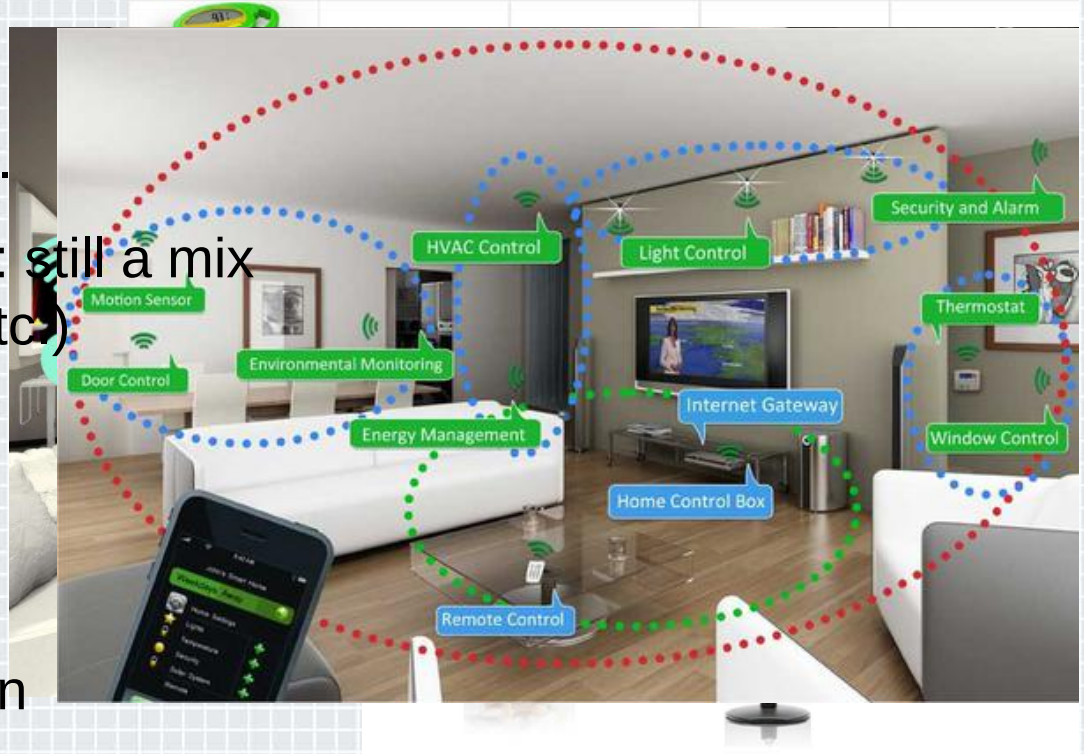
- Two-way radio
- Mobile phone
- 06/29/2007: iPhone
- !Smart phone
- Tablets/Phablets enter the party
- Everything starts looking alike
- Mobile is commoditized: transitioning out

Mobile Security

- Mobile security posture is [kind of] stabilizing
- Core framework and device technologies are finally maturing
  - ROT/COT, SEforAndroid, ARM TrustZone, Mobile TPM/HSM, e/SE, etc.
  - Foundation technologies have/are being commoditized
- Ecosystem(s) consolidating:
  - SoC, OEM/ODM, Stack/OS, MNO, SP, MDM
- Liability boundaries are clearer now than in early days
- More capable [& cheaper] devices → more value-added auxiliary services
- Mobile attack surface hardening → attackers transitioning to softer targets

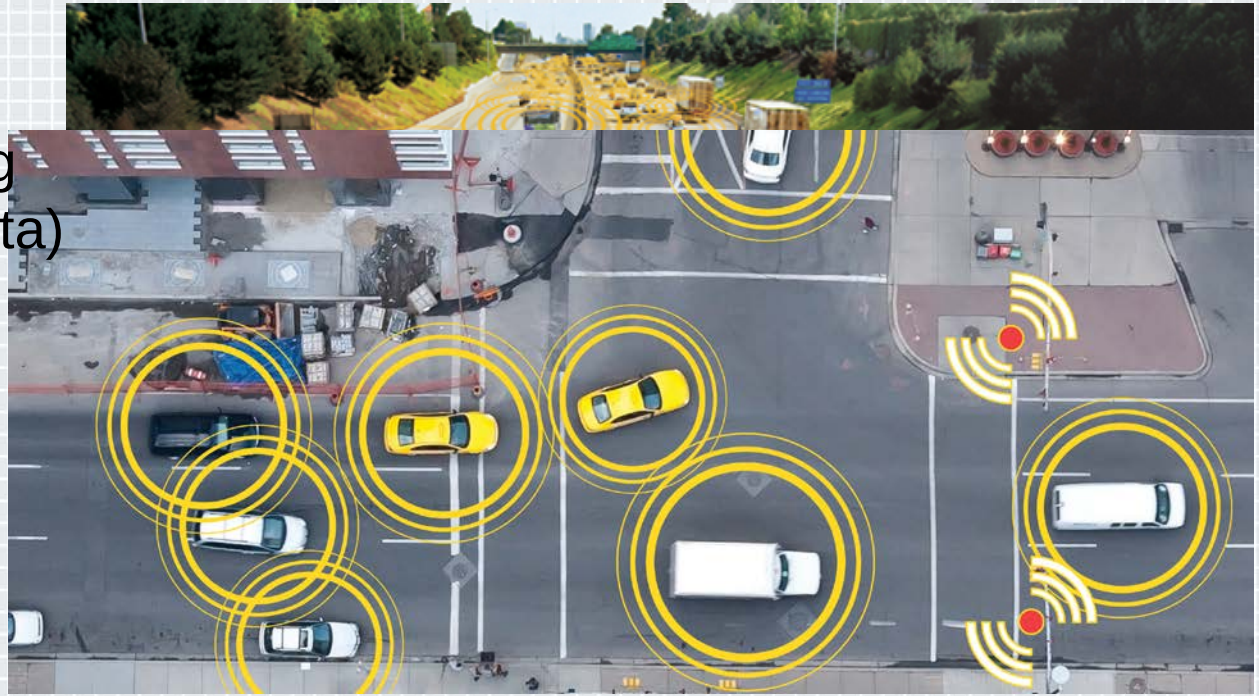
Thingsternet (IoT) Era

- Controllers, processors, CPUs. No standard comm.
- ~standard comm. stack(s): still a mix (WiFi, BT, NFC, ZigBee, etc.)
- Apps and ecosystem
- Transition to services
- Scaled-up connection
  → massive data generation



Connected Vehicle

- Basic connectivity
- Autonomous driving (connectivity→ +data)
- V2V(++data)
- V2I (+++data)



Connected Vehicles

- Can they be hacked?
- Concept hacks
- Drivetrain exploits
- Notice the speed and gea
- Infrastructure
  → VPN to backend
  → 1-N exploits

Incentives: Vehicle IoT

- Known vulnerabilities (phone era) softer target (Vehicle)
  - ATO, escalation of privileges, ROT/COT, collect PII, etc.
- Multi-device → multi-channel attack surface
- Counterfeit/black market: **$45B/Y** market (magic box via OBD-II)
- Odometer rollback: **€6B/Y** in Germany
- Roughly **$1T/Y** on a global basis
  - →Potential to exceed car crash, drug trafficking, and pilferage

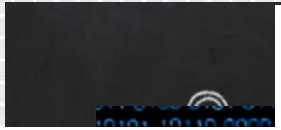
So, the Connected Vehicle Security…

IoT Security

- Lack of standardized (or well-defined) orchestration layer
- Heterogeneous security capabilities
- Multi device management
  - Prone to TOCTOU attacks, among others
- Dangerous “atomic” view of the IoT devices
  - False sense of security
- Technologies, usecases, actors, and attacks still evolving

Big Data

- More connectivity → more data
- It's not just the size
- Analytics
- Privacy concerns, scalable hacking
- "…your call maybe monitored for quality purposes…"



"Big data is like teenage sex:
everyone talks about it,
nobody really knows how to do it,
everyone thinks everyone else is doing it,
so everyone claims the are doing it…"

Dan Ariely, Duke University

Big Data Security

- Ok, what does it really mean?
  - Cloud/infrastructure?
  - Comm. channel?
  - Data (DAR/DIT)?
  - Stack (DAC/MAC)?
  - End point(s)?
- However you look
  - It’s not fully new
  - Nor is it secure

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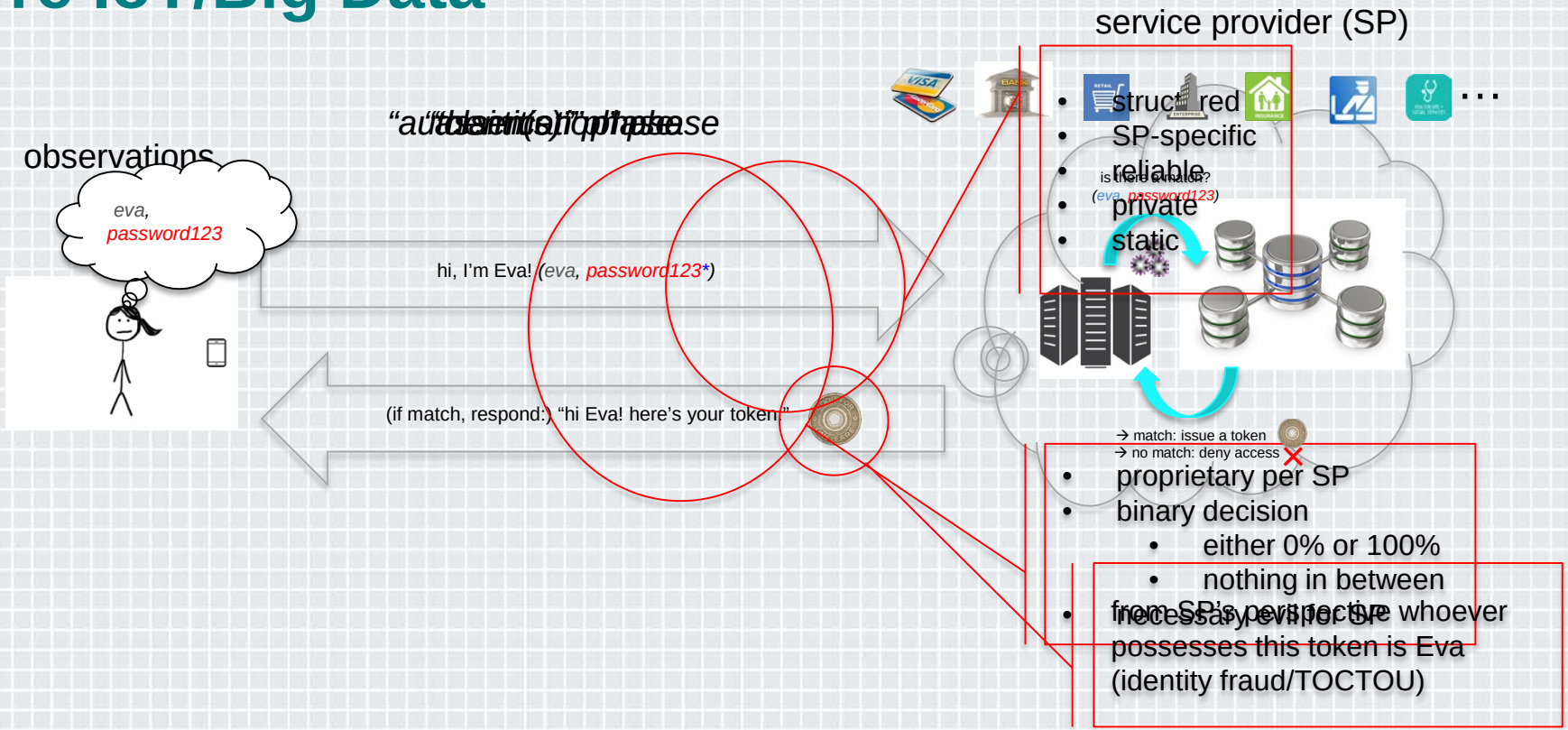
Case Study: Identity Assertion & Authentication

Digital Identity Assertion Dilemma

“On the Internet, nobody knows you’re a dog.” –Peter Steiner

Pre IoT/Big Data



IoT / Big Data Era

*on avg. only **five** passwords per user*

???

Result

Breach count by victim industry and employee count*

	Agriculture (11)	Mining (21)	Utilities (22)	Construction (23)	Manufacturing (31)	Wholesale Trade (42)	Retail (44)	Transportation (48)	Information (51)	Finance (52)	Real Estate (53)	Professional (54)	Management (55)	Administrative (56)	Educational (61)	Healthcare (62)	Recreation (71)	Accommodation (721)	Food Services (722)	Other Services (81)	Public (92)	Unknown	Total
1 to 100		1		2	10	1	79		5	18		14		3	1	3		3	38	6	2	7	193
101 to 1,000					13		3	1	8	3		5		1	2	1			13	2	4	1	57
1,001 to 10,000			1		7	1	3	22	10	12		6		1	2	1			2	1	2		71
10,001 to 100,000			2		13	1	4		2	93		5				1					1		122
More than 100,000		1	4		2					31		1					2		1				42
Unknown					1		7	1	14	73	1	5		1				1	2	2	5	23	136
Total		2	7	2	46	3	96	24	39	230	1	36		6	5	6	2	4	56	11	14	31	621

* Industries based on NAICS

some noteworthy breaches since this report was released

Conclusion

- IoT without Big Data be like FB with no friends…
- IoT + Big Data: currently less secure than either one alone
- Security to system is like harmony to music: orchestration is key
- Non real-time && data-driven security solutions are already dead
- Getting distributed, heterogeneous security right is difficult
- IoT attacks ~~*are becoming*~~ have already become scalable
- Attackers will have advantage for sometime to come
- Increased threats → priority attention → scalable solutions

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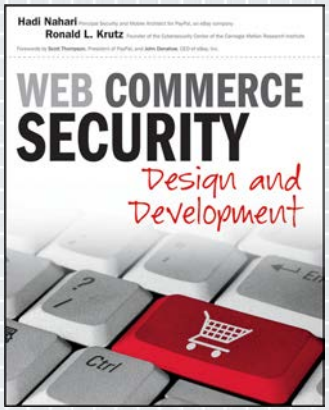
Thank You!



http://www.wiley.com/WileyCDA/WileyTitle/productCd-0470624469.html

Hadi Nahari
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hadinahari

#RSAC

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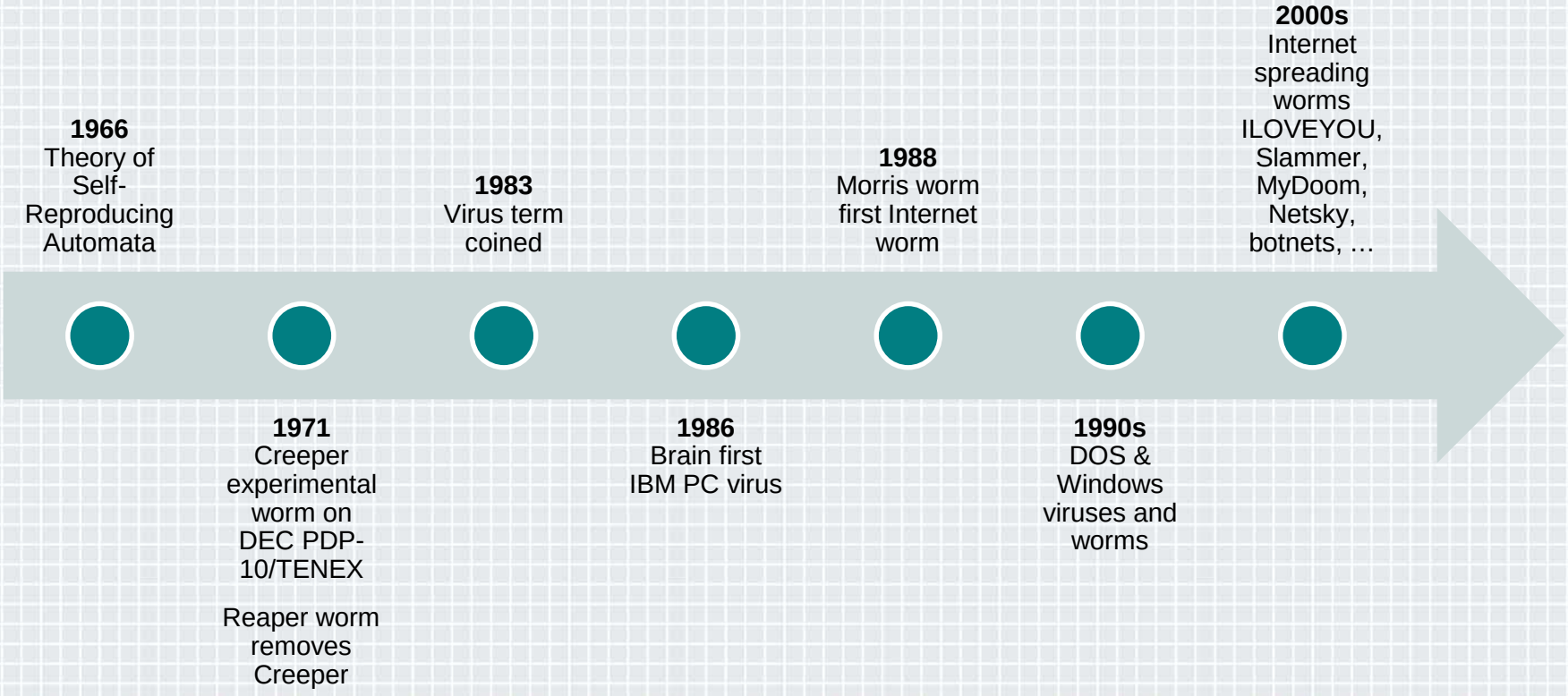
Security Basics Seminar
Viruses, Malware and Threats

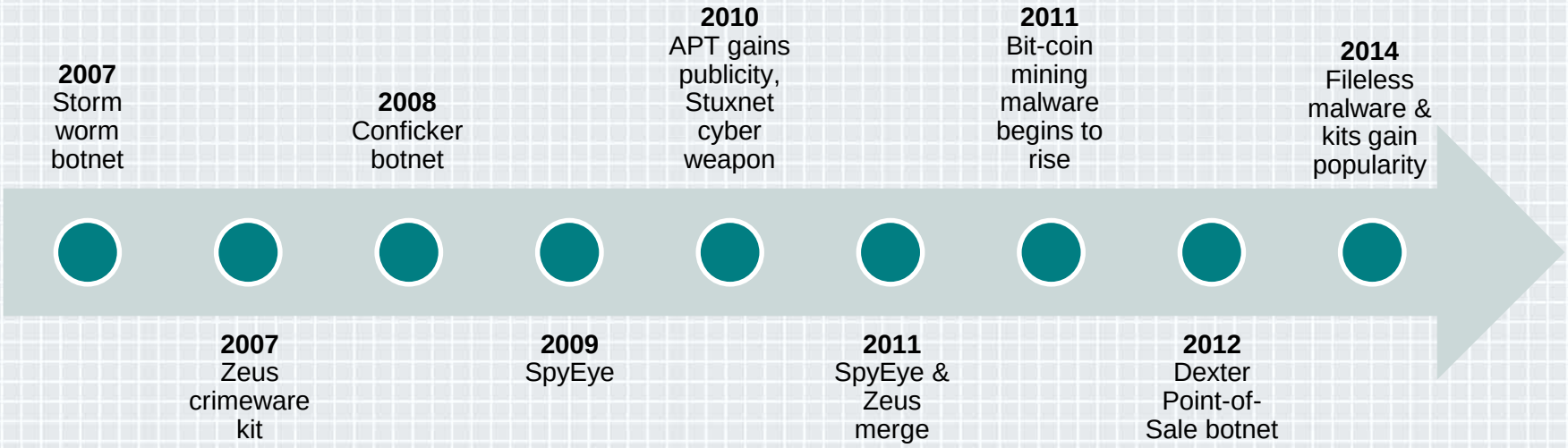
Tas Giakouminakis

Co-Founder & Chief Technology Officer
Rapid7

The Beginning

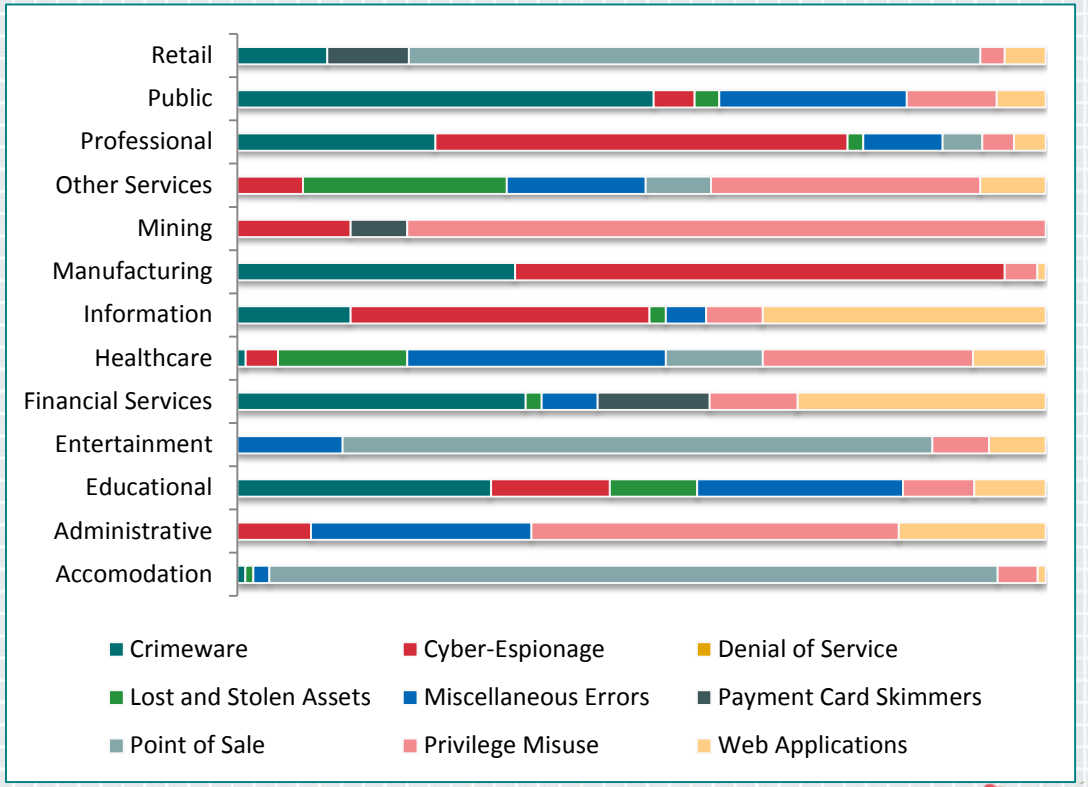


The Evolution



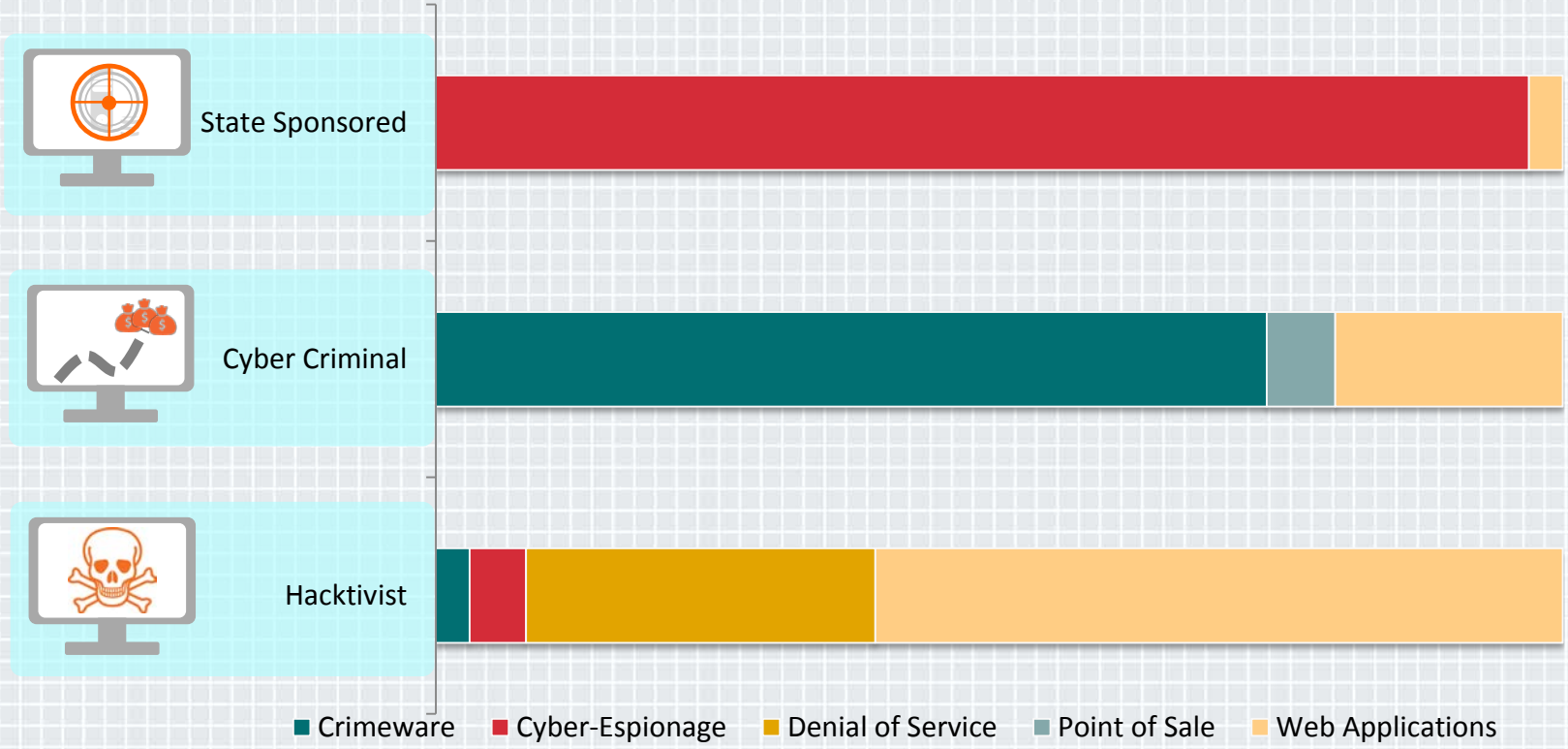
Threats, threats, everywhere

- Common threats impact everyone
  - Mass malware
  - “Unintentional” insiders
- Gain insight into industry specific threats
  - ISACs
  - Public/Private initiatives
  - Vendors



Source: Verizon 2015 Data Breach Investigations Report

Know Your Enemy



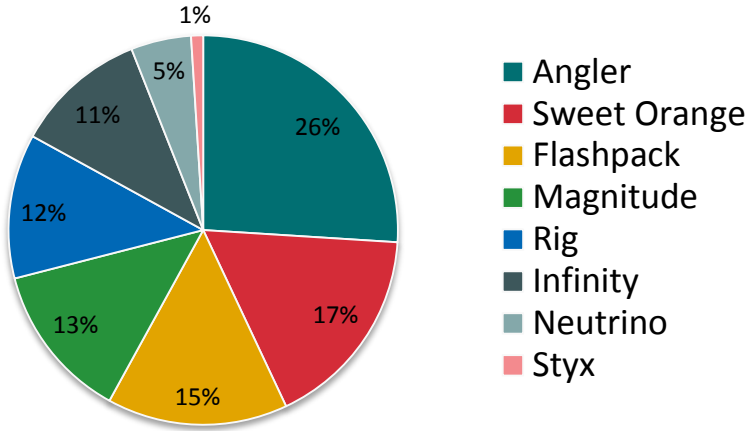
Source: Verizon 2015 Data Breach Investigations Report

Professions in Cyber Crime

- Intruders
- Malware Developers
- Exploit Kits Developers
- Bulletproof Hosting
- Money Laundering Providers
- Traffic Brokers
- …

Malware: There's an App For That

Exploit Kit Prevalence in 2014



Source: http://www.mcafee.com/us/resources/reports/rp-quarterly-threat-q4-2014.pdf

Goal: Making Money

Profits remain high

- Credit card numbers & CVV – US$0.50 to $20
- Fullz (identity and financial info) – US$30 to $45
- Cloud Accounts – US$7 to $8
- Healthcare Information – US$20

Costs are declining

- Exploit Kits – US$100 to US$700/week
- DDoS Attacks – US$10 to $1000/day
- Infected Computers – US$140 to $190/1,000

Dec 2014 - Source: http://www.symantec.com/connect/blogs/underground-black-market-thriving-trade-stolen-data-malware-and-attack-services
Dec 2014 - Source: http://www.secureworks.com/resources/articles/featured_articles/whitepaper-underground-hacking-markets-report

Not Just Endpoints

- Stuxnet made targeted SCADA/ICS attacks infamous

- BlackEnergy variant fueling long running ICS campaign

Not Just Endpoints

- PCI requires encrypting card data, criminals respond with RAM-scraping malware
- 2014 continued to see Point-of-Sale malware evolving
- Default, weak and stolen credentials are a major part of Point-of-Sale breaches

Not Just Endpoints

- ATMs are Windows machines filled with cash
- Attacks using malware on USB sticks or bootable CDs
- Estimated 75% of ATMs still run Windows XP, even after Microsoft ended support
- NCR launches Kalpana – Android based ATMs

Not Just Endpoints

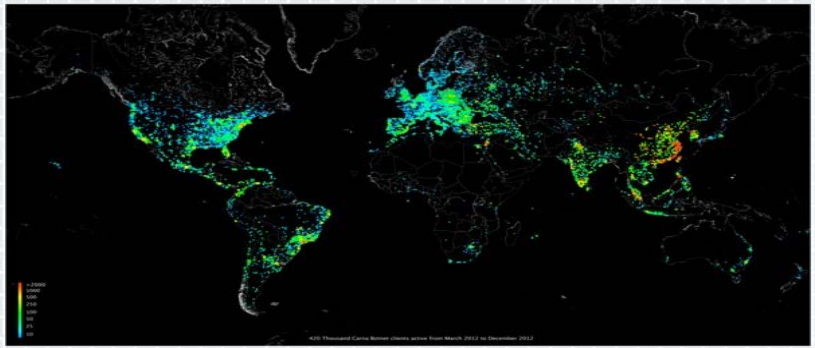
- Android remains the uncontested malware leader
- Malvertisements have become the primary distribution model
- But we're still waiting for the mobile malware explosion…

0.03%
OUT OF TENS OF MILLIONS OF MOBILE DEVICES, THE NUMBER OF ONES INFECTED WITH TRULY MALICIOUS EXPLOITS WAS NEGLIGIBLE.

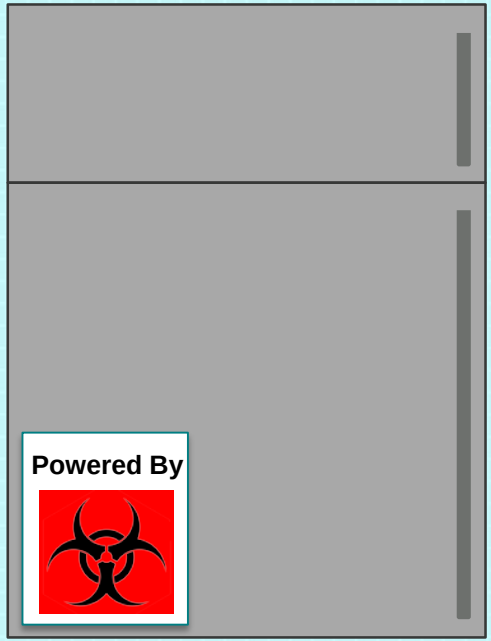
Source: Verizon 2015 Data Breach Investigation Report

Not Just Endpoints

- Internet-of-Things botnets devolving from Internet Census to DDoS and spam
- Always on devices ripe for hijacking
- Patching is rarely a priority



http://internetcensus2012.bitbucket.org/paper.html



Understanding Today's Attacks

- The economics of security favor the criminals
- Attackers increasingly rely on deception and the human element
- State-sponsored APTs are not the only targeted attacks
- Once inside, attackers become insiders
- Intrusion Kill Chains – understand attackers methodology and apply corresponding defensive measures to increase cost and complexity to the attacker

http://www.lockheedmartin.com/content/dam/lockheed/data/corporate/documents/LM-White-Paper-Intel-Driven-Defense.pdf

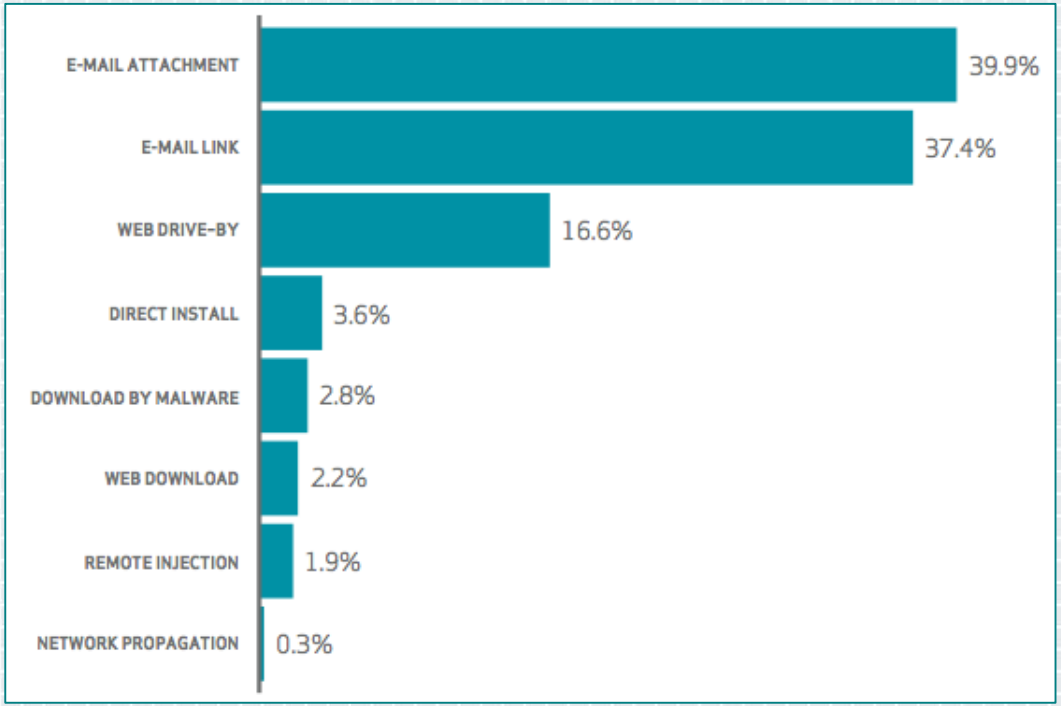
The Intrusion Kill Chain

- Identify methods to detect, deny, disrupt, degrade, deceive, or destroy the attack within each phase

Reconnaissance	• Web Analytics, Firewall ACL
Weaponization	• NIDS, NIPS
Delivery	• Vigilant user, Proxy filter, Inline AV, Queueing
Exploitation	• HIDS, Patch, DEP
Installation	• HIDS, Sandbox/Jail, AV
Command & Control (C2)	• NIDS, Firewall ACL, NIPS, Tarpit, DNS redirect
Actions on Objectives	• Audit log, QoS, Honeypot

http://www.lockheedmartin.com/content/dam/lockheed/data/corporate/documents/LM-White-Paper-Intel-Driven-Defense.pdf

Malware Infection Points

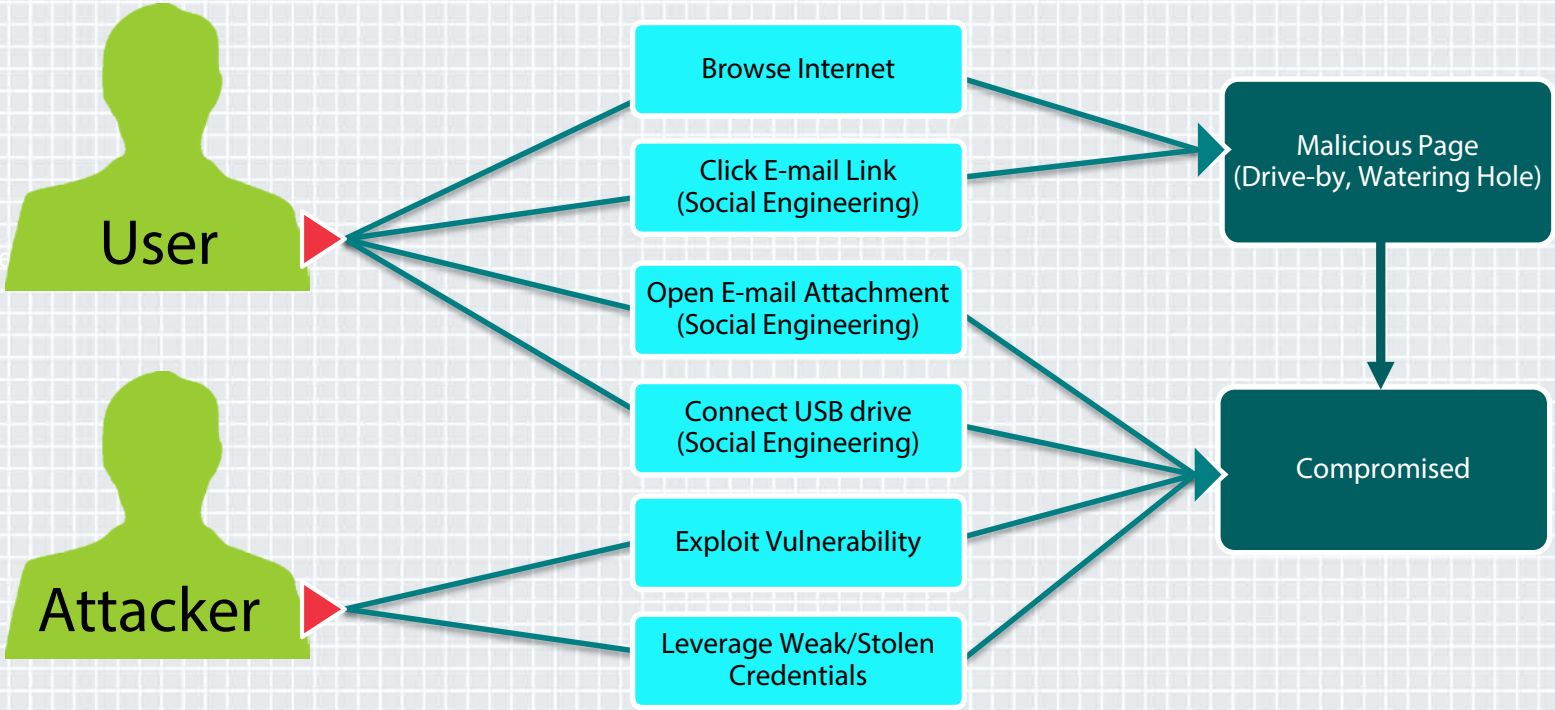


23%
OF RECIPIENTS NOW OPEN PHISHING MESSAGES AND 11% CLICK ON ATTACHMENTS.

50%
NEARLY 50% OPEN E-MAILS AND CLICK ON PHISHING LINKS WITHIN THE FIRST HOUR.

Source: Verizon 2015 Data Breach Investigations Report

Common Attack Paths



Establish Foothold, Obtain Objective

- Communication channels for Command & Control (C2) & Data Exfiltration
  - Common protocols often used: HTTP, HTTPS, DNS, FTP
  - Encryption often simplistic (XOR, Base64, Base32, …)
- Perform reconnaissance of internal environment
  - Identify targets and begin acquisition
- Continue lateral movement
  - Pass the hash, stolen credentials, privilege escalation

Combating Today's Attacks

- Determined adversaries can always get in
- Philosophy shifting from prevention to detection and containment
- That said, don't forget the basics!

Control & Monitor Traffic Flow

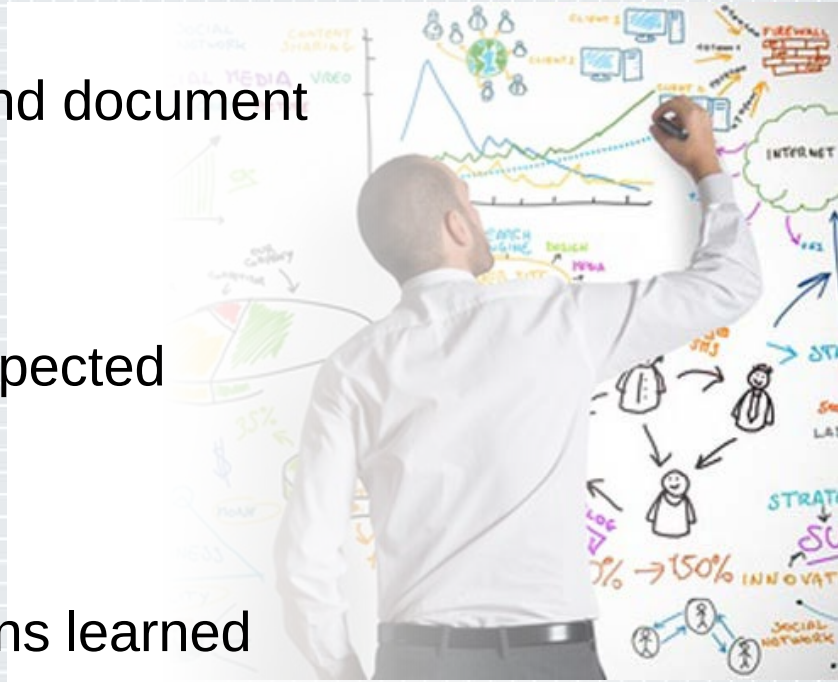
- Gain visibility & increase defensive/response capabilities
- Consolidate ingress & egress points – including VPN & Cloud Services
- Perimeter has expanded – apply security controls closest to resources
- Centralized & consistent logging for endpoints, services and security controls
  - Endpoints: AV/Malware Protection, FW, Authentication Logs
  - Network services: DNS, FW, VPN, Proxy, Web, Email, File, Directory, Database
  - Cloud services: Authentication & Activity Logs
  - Security controls: IDS/IPS, DLP, WAF, Malware Protection, Honeypot, Patch Management, etc.

Understand the Organization

- Correlate all activity back to users & service accounts
- Baseline the IT & user environments
  - Review inventory to identify outliers, gaps & appropriateness
- Baseline user behavior
  - Review assets users access or own for appropriateness & access patterns
- Baseline “normal” data flows
- Investigate changes, unknowns & anomalies
- Be prepared for false positives / spurious anomalies

Preparing for Containment

- Catalog sensitive data and assets and document lockdown protocol
- Identify all points of contact
- Quarantine/monitor assets/users suspected of compromise
- Protect evidence whenever possible
- Practice & review response for lessons learned
- Refine & iterate



The Basics: Limit User Temptation

- Rollout user awareness training, tips & advice
- Reduce spear phishing attacks – leverage Sender ID, Sender Policy Framework (SPF), DomainKeys Identified Mail (DKIM)
- Deploy network-based security controls
  - Whitelist/Blacklist, Malware Protection, IDS/IPS, Proxies, Content Filtering

The Basics: Reduce Exploit Exposure

- Automate deployment of software, patches, security controls & configurations
- Remove or patch commonly targeted applications
- Root out default/weak passwords
- Limit administrative privileges and password reuse, User Account Control (UAC)
- Enable exploit mitigations (DEP, ASLR, EMET, SEHOP)
- Deploy endpoint security controls
  - Application whitelisting, AV, FW, IPS

Additional Reading

Lockheed Martin Corp. - Intelligence-Driven Computer Network Defense Informed by Analysis of Adversary Campaigns and Intrusion Kill Chains

http://www.lockheedmartin.com/content/dam/lockheed/data/corporate/documents/LM-White-Paper-Intel-Driven-Defense.pdf

Contagio Malware Dump

http://contagiodump.blogspot.com/

Australian Signal Directorate – Strategies to Mitigate Targeted Cyber Intrusions

http://www.asd.gov.au/infosec/top35mitigationstrategies.htm

SANS/CSIS – Twenty Critical Security Controls for Effective Cyber Defense

http://www.sans.org/critical-security-controls/

Apply

- Determined adversaries will get in – increase your focus on detection and containment, but don't forget the basics
  - Understand your business, your IT environment, your users, & the threats you face
  - Prepare your people and processes, not just technology
- Every user is part of your perimeter, treat them accordingly
- Attacks will continue to evolve – stay current and focus efforts on highest return

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Thank You

Tas Giakouminakis

Rapid7

Co-founder & Chief Technology Officer

www.rapid7.com

tas@rapid7.com

Security Basics

Start Time	Title	Presenter
8:30 AM	Introduction	Hugh Thompson
8:45 AM	Security Industry and Trends	Hugh Thompson
9:30 AM	User Authentication Trends and Methods for Native Mobile Applications	Kayvan Alikhani
10:15 AM	BREAK	
10:30 AM	Mobile & IOT Security: Will Big Data Make it Better or Worse?	Hadi Nahari
11:15 AM	Viruses, Malware and Threats	Tas Giakouminakis
12:00 PM	LUNCH	
1:15 PM	Crypto 101: Encryption, Codebreaking, SSL, and Bitcoin	Benjamin Jun
2:00 PM	Security Enforcement Explained	Dana Wolf
2:45 PM	BREAK	
3:00 PM	Internet and Web Security Issues	Patrick Sullivan
3:45 PM	Network Security	Gary Sockrider

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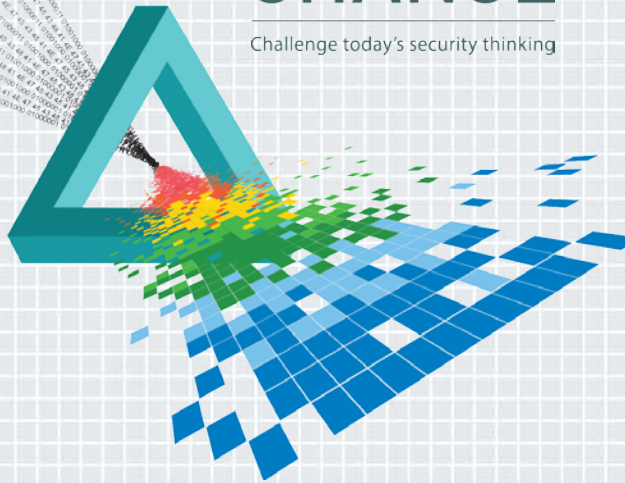
CHANGE
Challenge today's security thinking



SESSION ID: SEM-M01

Crypto 101:
Encryption, Codebreaking, SSL, and Bitcoin

Benjamin Jun

CTO
Chosen Plaintext Partners
@BenjaminJun

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#RSAC

Some material adapted from Ivan Ristic, Qualys (RSAC 2011)

Crypto 101

Cryptography is the art and science of keeping messages secure.

- Cryptography building blocks
- Cryptographic protocols
  - SSL / TLS
  - Bitcoin
- Attacks on cryptography

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Security \si-ˈkyu̇r-ə-tē\

the state of being free from danger or threat

Cryptography terms

- Confidentiality
- Integrity
- Authentication
- Access control
- Non-repudiation

Other criteria

- Interoperability
- Performance
- Usability

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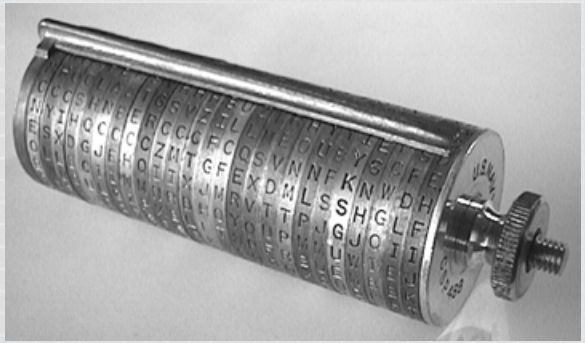
Crypto Building Blocks

Encryption

Obfuscation that is fast when you know the secrets, but impossible or slow when you don't.

Scytale
300BC



Jefferson Wheel (M94)
1900s

Enigma Machine
1920s

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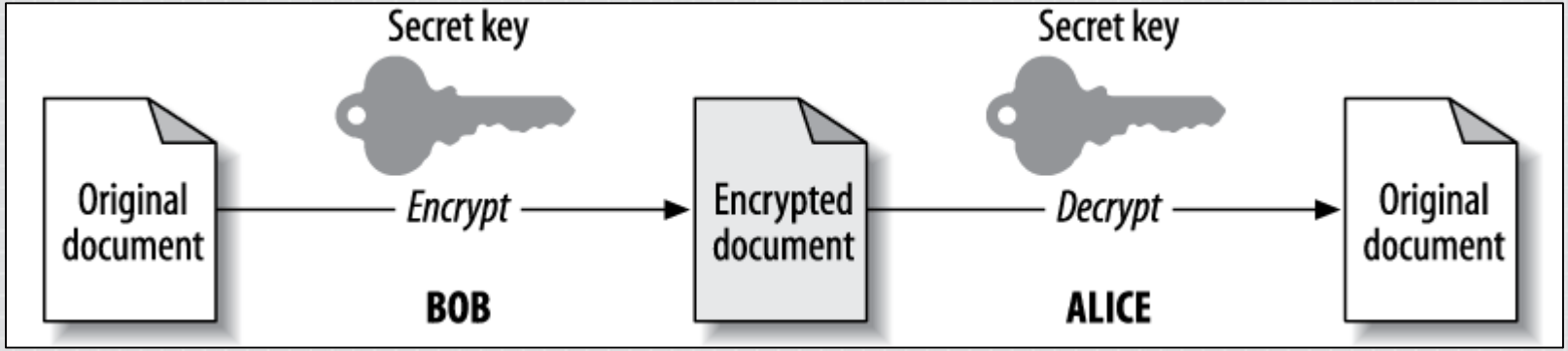
Image credit: Luringen, Sobebunny, R Booth

Symmetric encryption



- Use shared **key** to encrypt/decrypt
  - Algorithm does not need to be secret
  - Key must be agreed and communicated in advance
- Convenient and fast
- Examples: RC4, 3DES, AES

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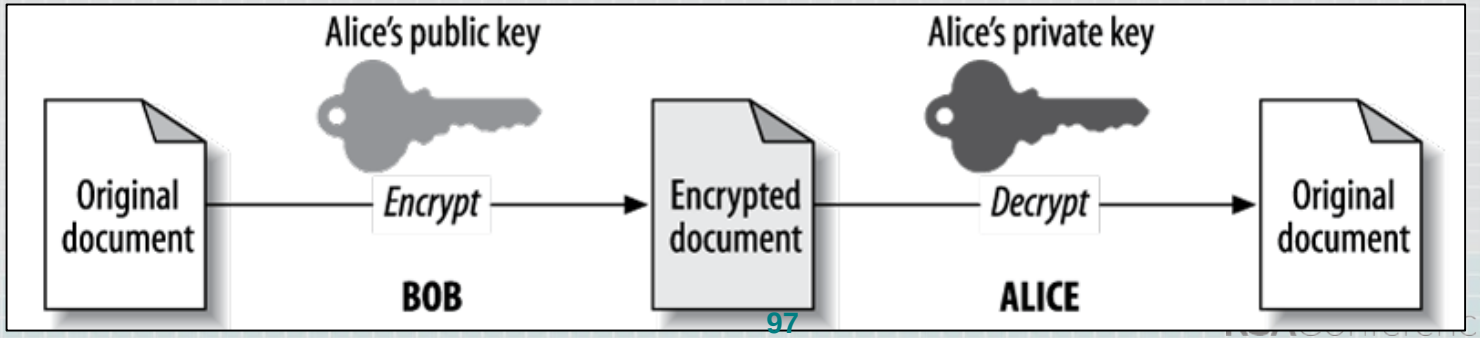
Asymmetric encryption

Two related keys: one private, one public

- Anyone with the public key can encrypt the message
- Only the private key holder can decrypt message
- Performs encryption, key exchange, and authentication
  - Examples: RSA, Diffie-Hellman, ElGamal, DSA, Elliptic curve (ECDH / ECDSA)
  - Significantly slower than symmetric encryption



Authentication

Confirm data integrity and message origin

Egyptian signet ring
(500BC)

Mark of the Fisherman
(1200AD)

On death, Cardinal Camerlengo to destroy

US nuclear “football”
(present day)

Keys roll at noon on inauguration day

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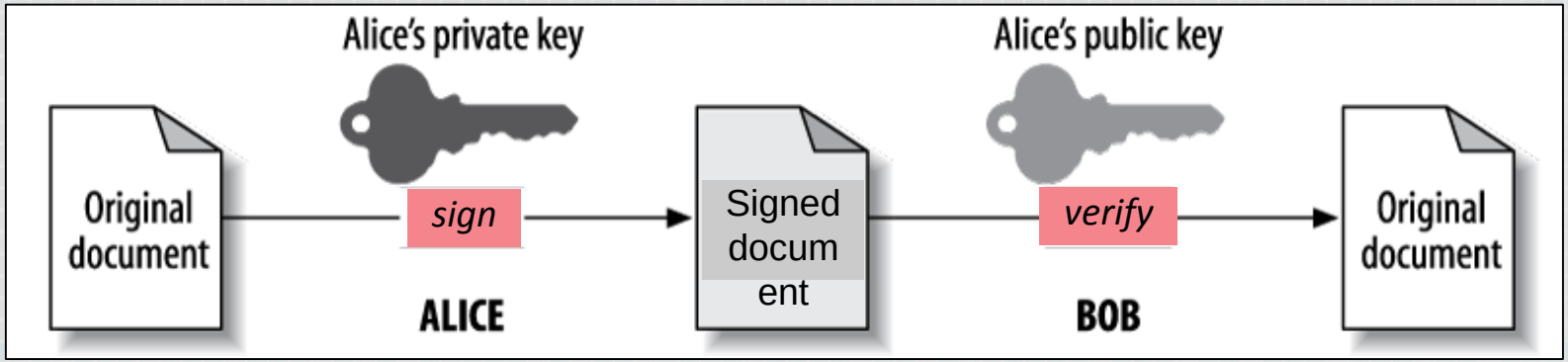
British Museum, flikr:favoritethings

Digital signatures

Asymmetric cryptography can authenticate messages

- Only the private key holder can generate a signature
- Anyone with the public key can validate the signature
- Signatures protect **digital certificates** from modification or forgery



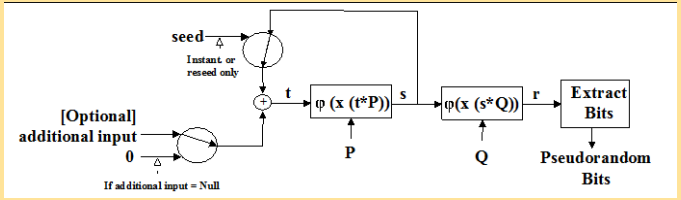
Digital certificates

- Digital ID can include public/private keypair
- **Digital certificate** conveys identity
  - Credential holder info (name, address, etc.)
  - Identity's public key
  - Validity period
  - Digital signature of Certificate Authority (CA)
- Authentication has 3 steps
  - CA signature confirms data is authentic, vouched for
  - Do we approve of data in the certificate?
  - Identity keypair validated to confirm ID holder has the private key

Randomness matters

- Random numbers at the heart of crypto
  - Used for key generation
  - Weak keys = weak encryption
- Random number generators
  - True random (TRNG) – *truly random*
  - Pseudorandom (PRNG) – *look random*
    - PRNGs fine <u>if properly seeded and properly designed</u>

NIST SP800-90A: Dual EC DRBG with ~~NIST~~ NSA constants*



(don't use these)

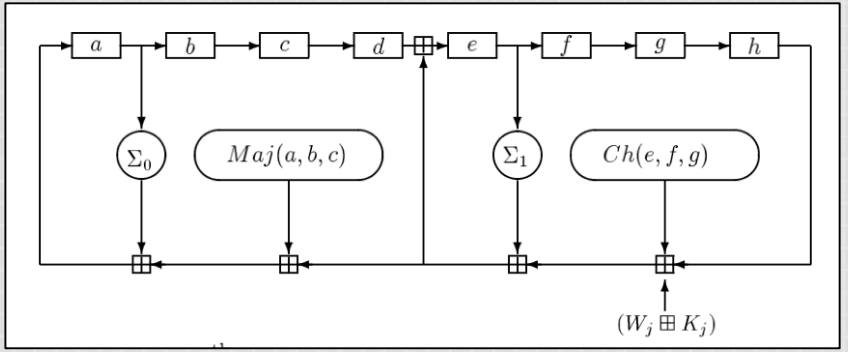
7c598 52018192

Q_y = b28ef557 ba31dfcb dd21ac46 e2a91e3c 304f44cb 87058ada 2cb81515 1e610046

* NYT Snowden memos, September 2013

Hash functions

- One-way transformation to generate *data fingerprints* for:
  - Digital signatures
  - Integrity validation
  - Tokenization (e.g., storing passwords)



SHA2 (SHA-256) compression function

- Examples
  - MD5 **considered broken**
  - SHA-1 (160) **some concerns**
  - SHA-2 (256) **ok**
  - Keccak and SHA-3

- Desirable qualities
  - Preimage resistance (one-wayness)
  - Collision resistance and birthday

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Stay humble

- Don’t roll your own crypto
  - Failure modes subtle, catastrophic
  - Standard crypto has been strongly vetted
- Avoid unnecessary complexity
  - System only as strong as its weakest link
  - Complexity = more stuff to go wrong
- Never rely on obscurity
  - “If I can barely understand it, then it must be strong!”
  - Kerckhoffs's principle: only the key should be secure

Auguste Kerckhoffs (1835-1903)

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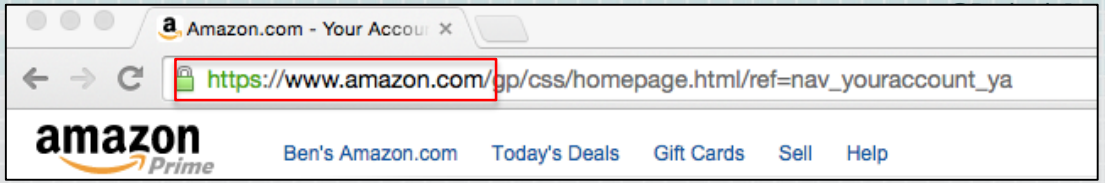
Putting It All Together

- SSL / TLS
- Bitcoin

TLS

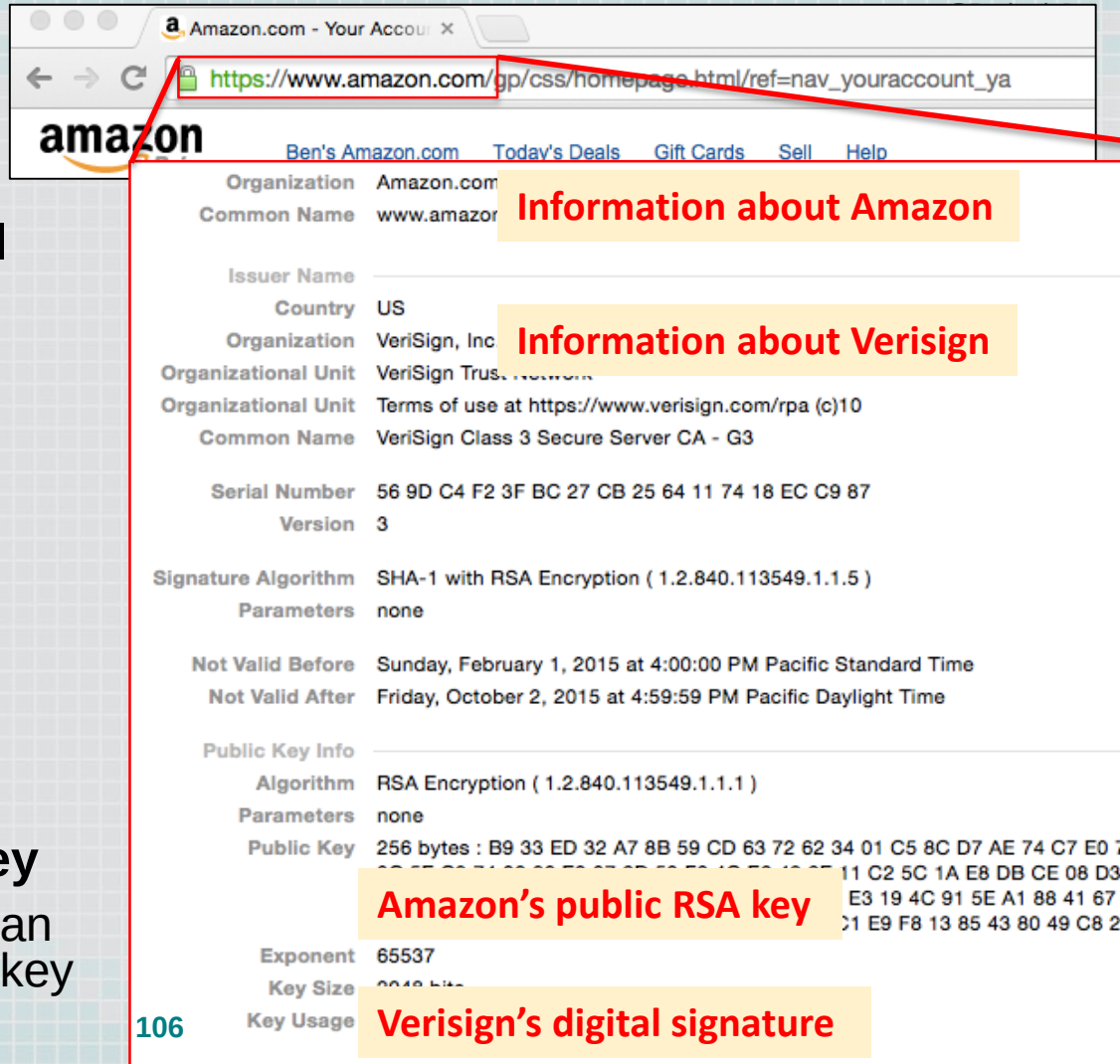


- Transport Layer Security
  - World's most widely used cryptographic protocol
  - From Netscape SSL3 (Kocher, 1995)

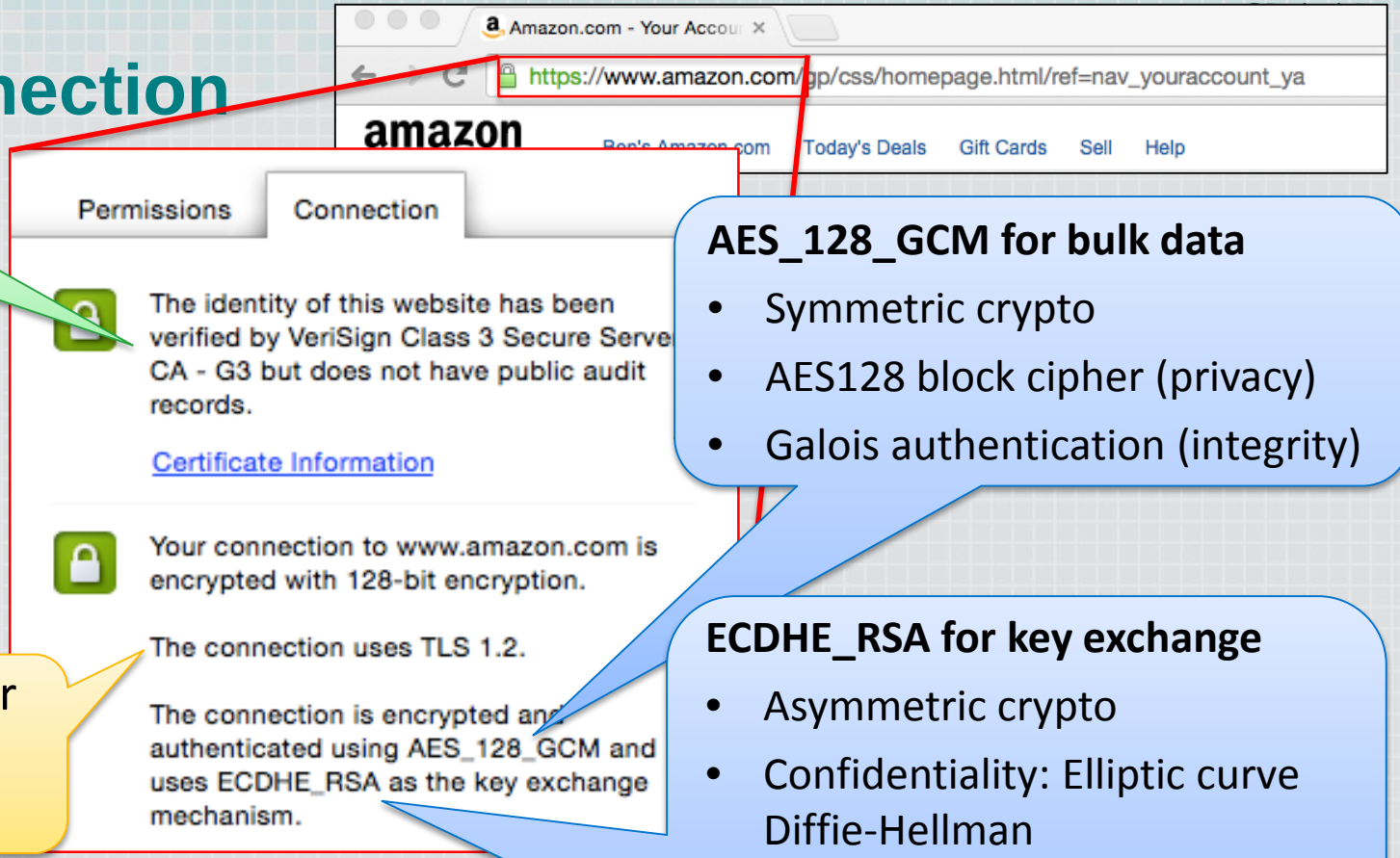
- Security requirements
  - Securely connect with someone you have never met
  - Data privacy, data integrity, no site impersonation, no man-in-middle

Getting to https

1. **Webserver provides digital certificate to browser**
   - "Amazon.com's passport"
2. **TLS layer + browser "authenticates passport"**
   - Confirms data fields in cert
   - Confirms digital signature
3. **TLS layer confirms that webserver holds private key**
   - Sends encrypted data that can only be decrypted w/private key



TLS: Connection



Certificate check passed!

TLS 1.2 protocol for secure socket & session mgmt

AES_128_GCM for bulk data

- Symmetric crypto
- AES128 block cipher (privacy)
- Galois authentication (integrity)

ECDHE_RSA for key exchange

- Asymmetric crypto
- Confidentiality: Elliptic curve Diffie-Hellman
- Authentication: RSA2048
- “Perfect forward secrecy”

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Bitcoin (1/2)

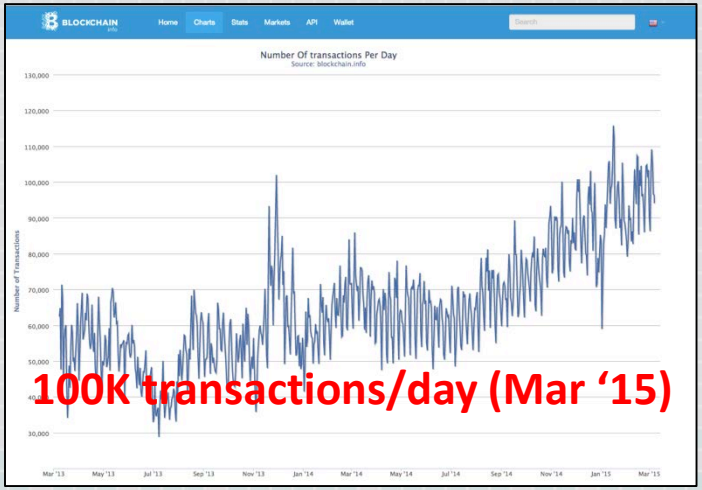
A peer-to-peer, decentralized currency

- Not underwritten by any entity
- "Satoshi Nakamoto" paper (2008)

Bitcoin: A Peer-to-Peer Electronic Cash System

Satoshi Nakamoto
satoshin@gmx.com
www.bitcoin.org

Abstract. A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing



100K transactions/day (Mar '15)

$3.8B US in circulation (Mar '15)
(US M0 Supply: $3,200B, Jan '15)

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Diagrams from blockchain.info

Bitcoin (2/2)

Characteristic	What happens	Cryptography
Value creation	Mined by searching for magic values *KWh → BTC !*	**Proof-of-work** method uses **SHA-256 hash function**
Coin transfers	Digital signatures	**ECDSA digital signature**
Recordkeeping (no double-spending)	Distributed ledger with financial incentive for a "single view"	**Block chain** uses **SHA-256 hash function**
Backing entity	NONE!	*Everything regulated by **market forces** + **math**!*

A great technical resource: Bitcoin Developer Reference by Krzysztof Okupski

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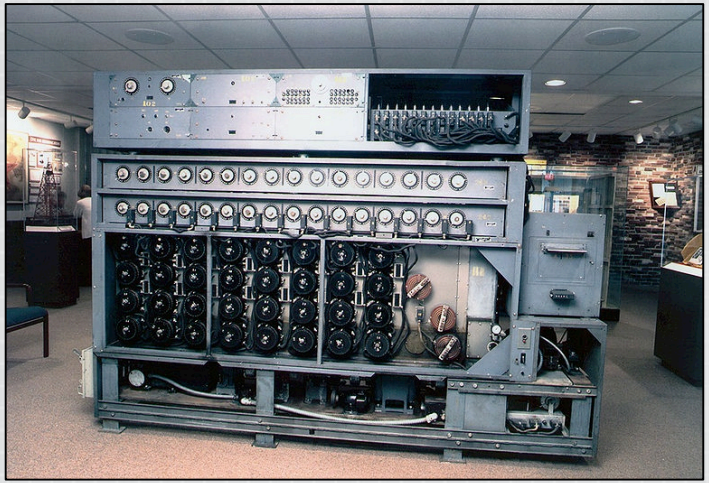
Attacks on Cryptography

Brute force



US Navy Bombe, 1943

Contains 16 four-rotor Enigma equivalents to perform exhaustive key search

DES Keysearch Machine, 1998

Tests 90 billion keys/sec, average time to crack 56-bit DES: **5 days**

(Cryptography Research, AWT, EFF)

Cryptanalysis

- HDCP = “High Bandwidth Digital Copy Protection”
- Protects digital content, interoperability
  - Fast, offline, any-to-any negotiation
  - Encryption and authentication
- “Clever” key management
  - No one device contains global secret
  - HDCP master key published (2010)
  - **Unlicensed implementations cannot be revoked**

Number of KSVs	40	42	44	46	48	50
Prob. of Spanning M	.295	.773	.940	.982	.997	.999

A Cryptanalysis of the High-bandwidth Digital Content Protection System (Crosby, Goldberg, Johnson, Song, Wagner)

But keys from ~40 devices can reveal the master key

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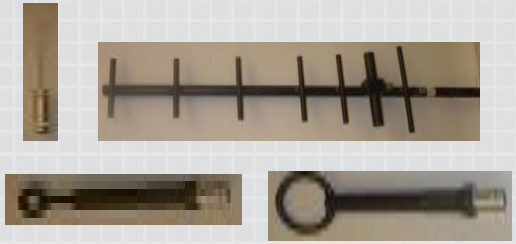
image from www.hdmi.org

Implementation: Side Channel (1/2)

Simple EM attack with radio at distance of 10 feet

Devices

Antennas



Digitizer,
GNU Radio peripheral
($1000)

Receiver ($350)

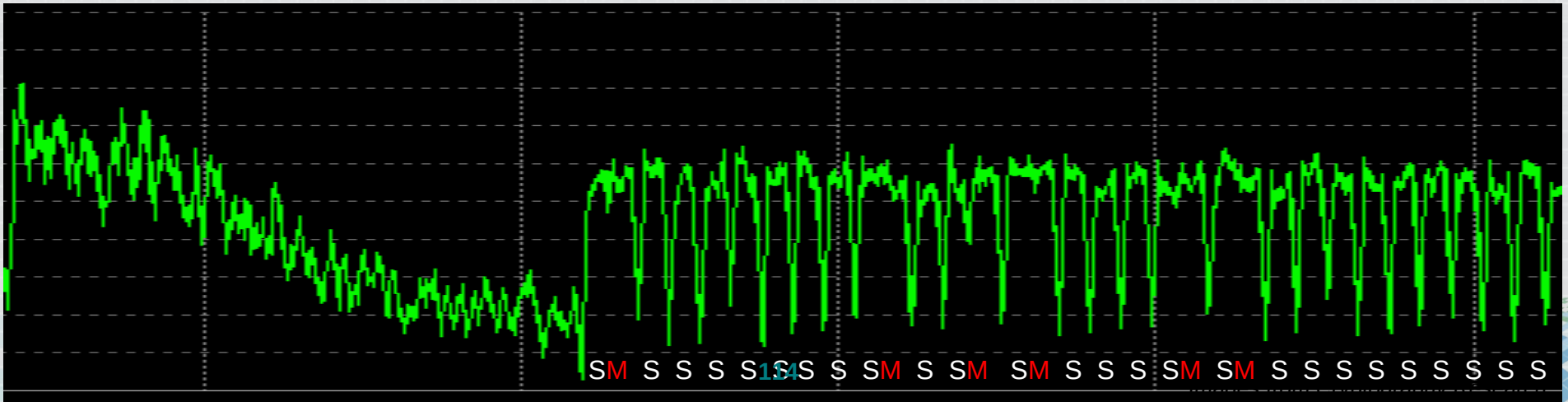
Signal Processing
(demodulation, filtering)

Images from Cryptography Research

Implementation: Side Channel (2/2)

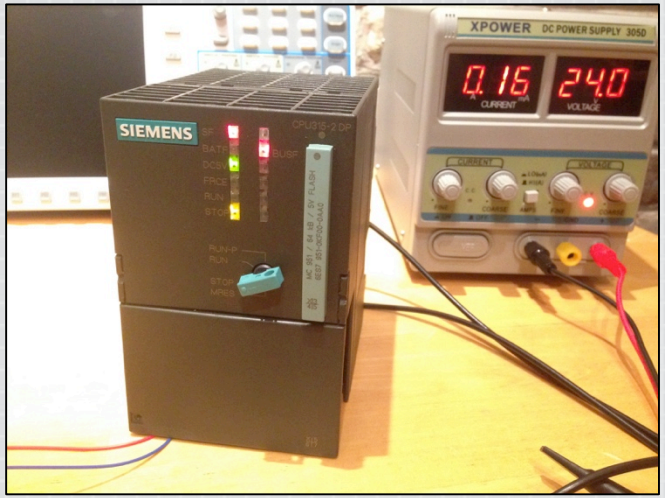
- Focus on Mp^{dp} mod p calculation (Mq^{dq} mod q similar)

```
For each bit i of secret dp
   perform "Square"
   if (bit i == 1)
     perform "Multiply"
   endif
endfor
```



Crypto necessary, but not sufficient

Game King poker (2014)
Bug allows user to adjust bet
after hand played



Siemens Simatic S7-315
Target of ~~Stuxnet~~
Operation Olympic Games

CHOSE
NPLAI
NTEXT

http://www.wired.com/2014/10/cheating-video-poker/

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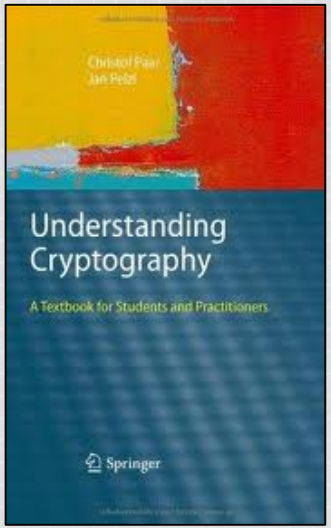
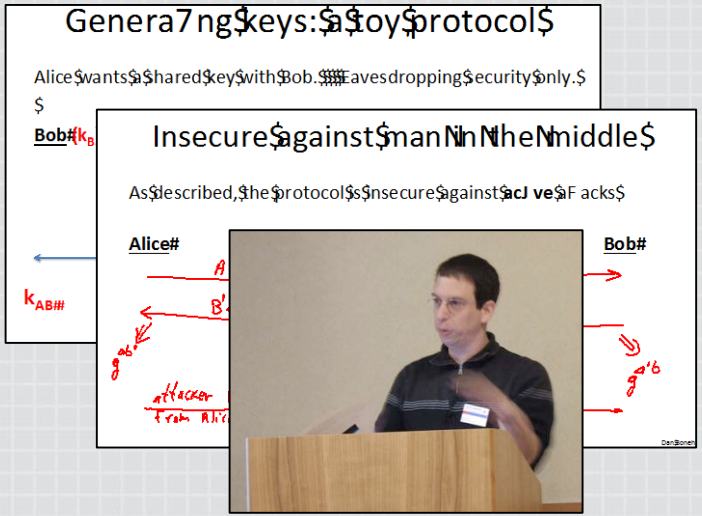
Learn More!

Resources



Understanding Cryptography
Christof Paar and Jan Pelzl
(Springer, 2009)



Cryptography online course
Dan Boneh, Stanford University

How to apply what you have learned

- In the first three months:
  - Identify where cryptography is used in your organization
  - Identify infrastructure required (key management, certificates)

- Within six months:
  - Know what crypto **can** do. Explain the different security properties.
  - Know what crypto **can't** do. Understand basic implementation security issues.

CHOSE
NPLAI
NTEXT

@Benjamin Jun

ben@ChosenPlaintext.com

Questions?

My talks this week:

Endpoints in the New Age:
Apps, Mobility, and the Internet of Things

Securing the Ecosystem ECO-T07R
Tuesday 1:10pm, Thursday 10:20am

Supply Chain as an Attack Chain:
Key Lessons to Secure Your Business

Security Strategy STR-F03
Friday 11:20am

Security Basics

Start Time	Title	Presenter
8:30 AM	Introduction	Hugh Thompson
8:45 AM	Security Industry and Trends	Hugh Thompson
9:30 AM	User Authentication Trends and Methods for Native Mobile Applications	Kayvan Alikhani
10:15 AM	BREAK	
10:30 AM	Mobile & IOT Security: Will Big Data Make it Better or Worse?	Hadi Nahari
11:15 AM	Viruses, Malware and Threats	Tas Giakouminakis
12:00 PM	LUNCH	
1:15 PM	Crypto 101: Encryption, Codebreaking, SSL, and Bitcoin	Benjamin Jun
2:00 PM	Security Enforcement Explained	Dana Wolf
2:45 PM	BREAK	
3:00 PM	Internet and Web Security Issues	Patrick Sullivan
3:45 PM	Network Security	Gary Sockrider

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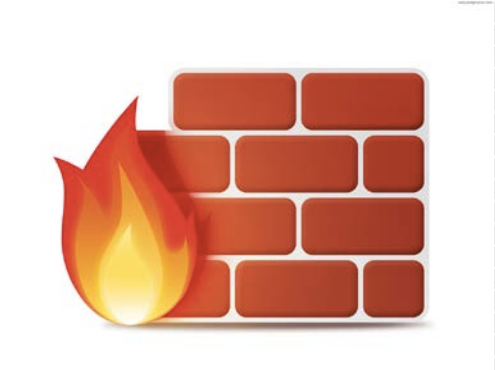
SESSION ID: SEM-M01

Security Enforcement Explained

Dana Elizabeth Wolf

Sr. Director of Products
OpenDNS
@dayowolf

What do we need to run a successful security program?



FIREWALL (NETWORK)

ANTI-VIRUS (ENDPOINT)

Done. Right?

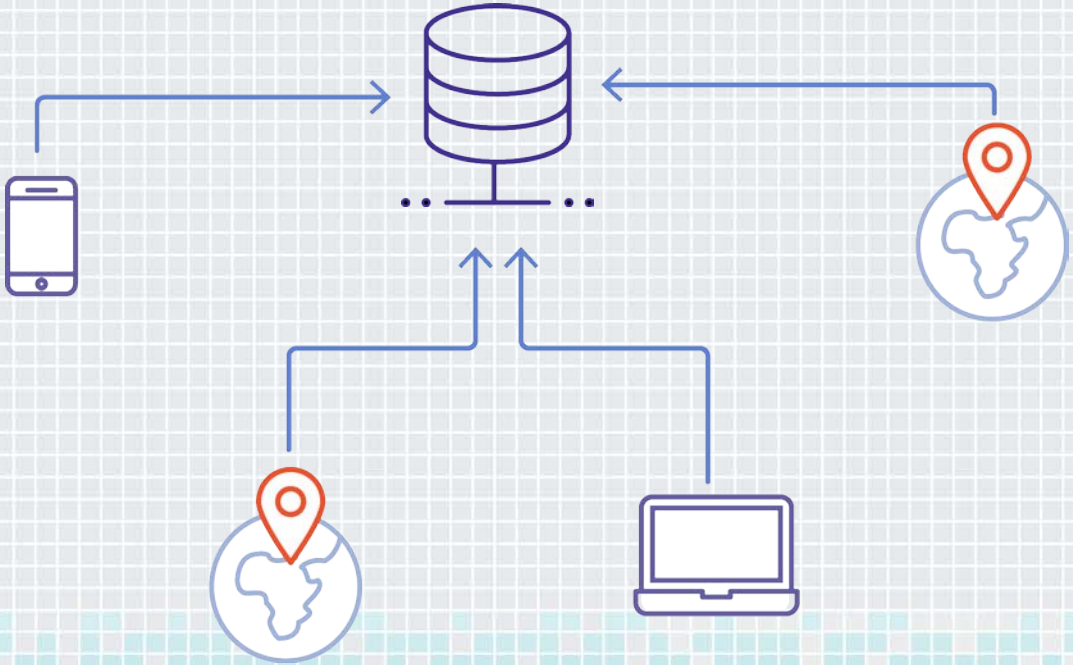
IT Infrastructure is Changing

Elastic Process Power Due to Cloud & Virtualization

OpenDNS

Information Access is Changing

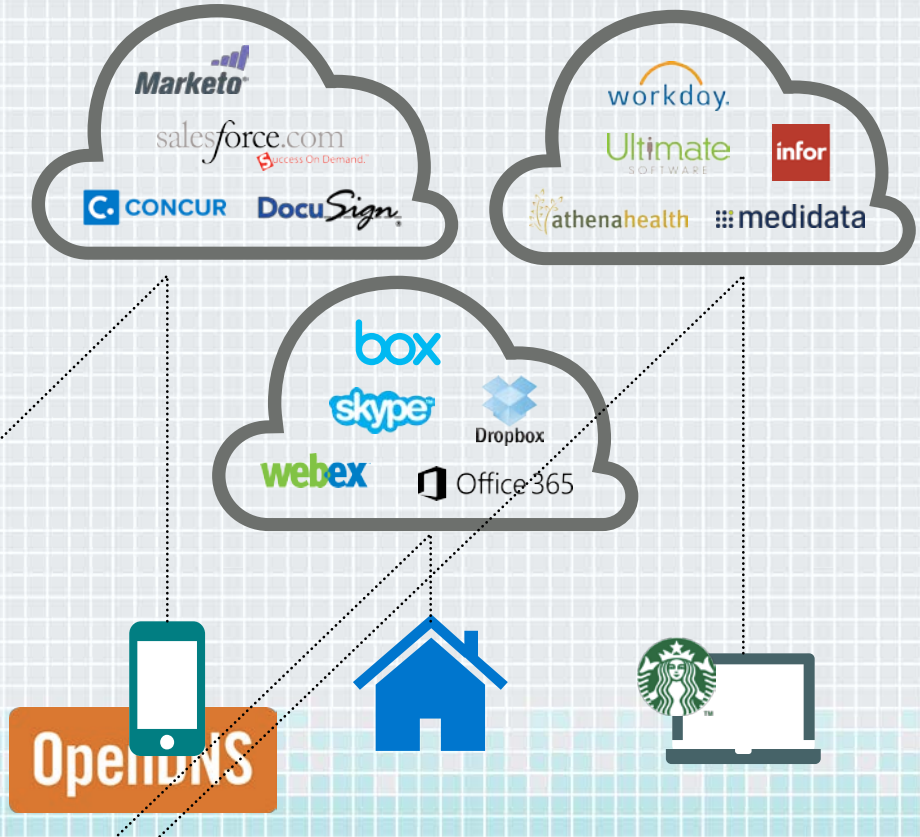
BYOD, Mobile, Work@Home



OpenDNS

Time to upgrade your thinking

...and security approach.



AV + FW != foolproof security

Security is Changing

and how we enforce policies

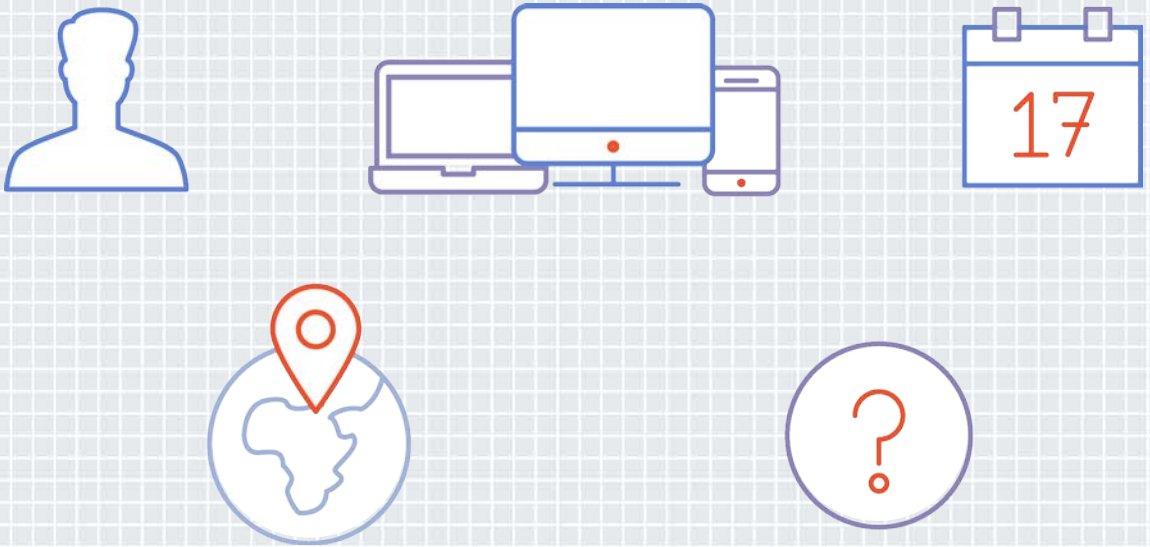
OpenDNS

What are we talking about?

- Key tenants of policy writing
- Policy Lifecycle or Information Security Program
- Traditional enforcement technologies
  - Endpoint
  - Network
- Challenges / Gaps
- Cloud security enforcement: emerging options

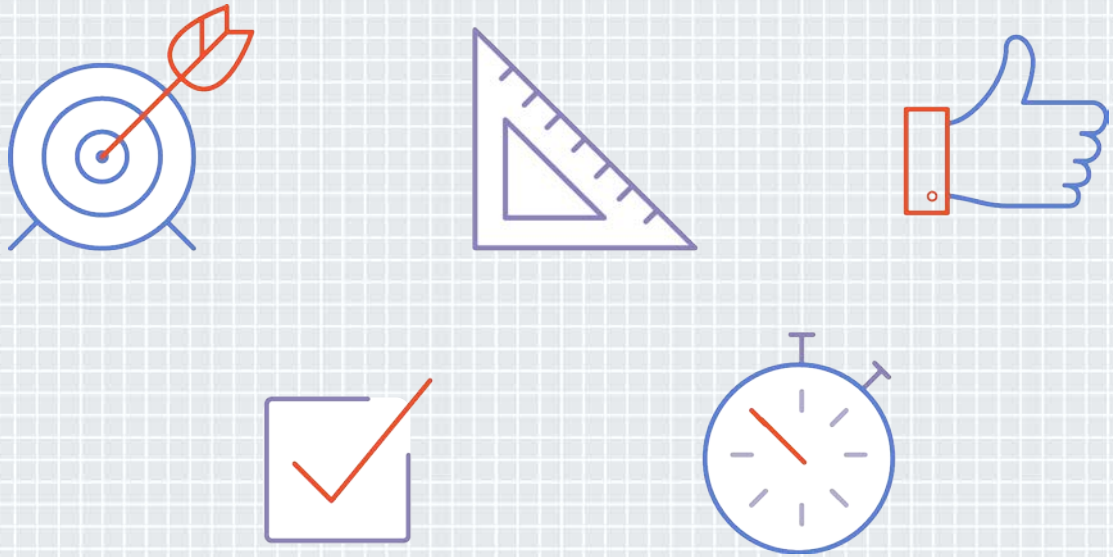
Policy Creation

Who, What, When, Where, and Why



Policy Creation

SMART: Specific, Measurable, Agreeable, Realistic, Time-Bound



Security Policy Standards

Examples

- **ISO 27001:** information security management system standard
- **Standard of Good Practice (SoGP):** business-focused, practical and comprehensive guide to identifying and managing information security risks in organizations and their supply chains
- **NIST 800-12:** helps readers understand security needs and develop sound selection of security controls

Policy Creation & Enforcement Rules

Positive

Whitelist

- Default: do not allow anything to pass
- Rules: what you want to permit to pass
- Typically used by: Firewalls
- Pros: More secure; can stop newer/advanced attacks
- Cons: More work to manage
- Example: Application on iPhone

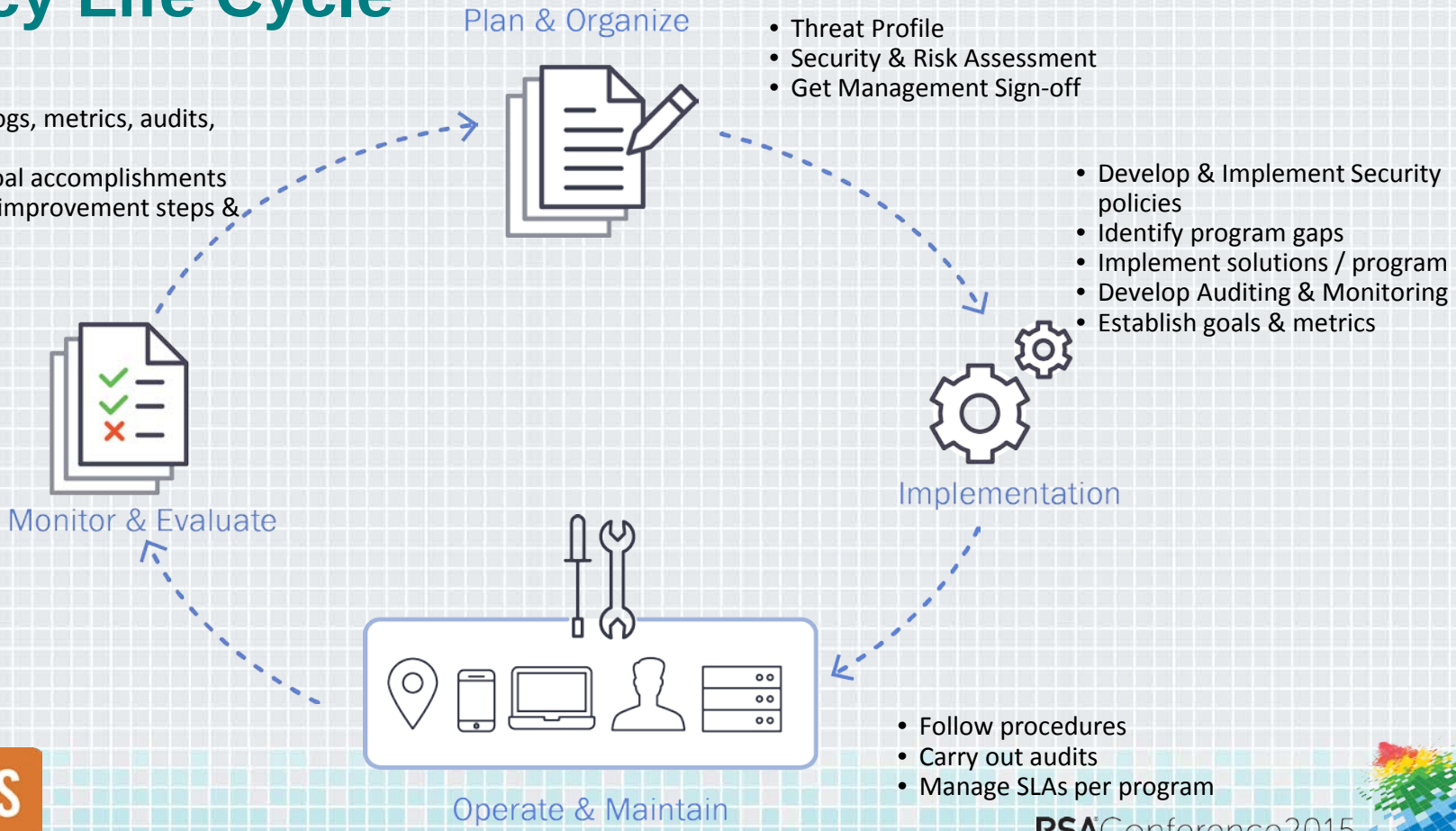
Policy Creation & Enforcement Rules

Negative

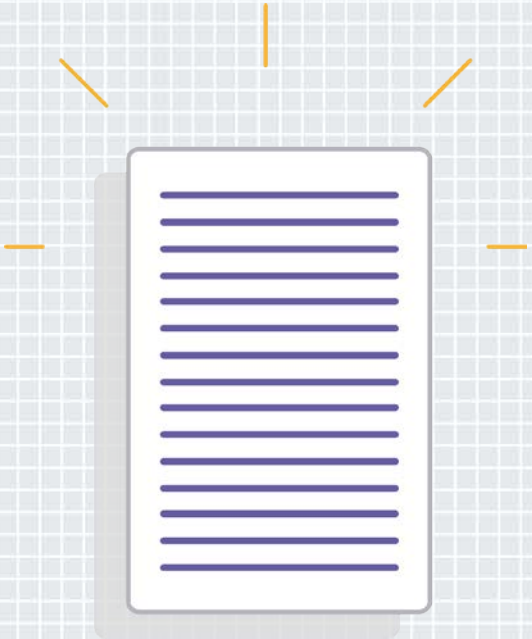
Blacklist

- Default: allow everything to pass
- Rules: what you want to block
- Typically used by: Anti-Virus; Web Proxies
- Pros: Less work from management POV
- Cons: Less secure
- Example: No fly-list

Policy Life Cycle



A policy, without the lifecycle



- Written and not implemented
- Disconnect & confusion around ownership
- No ROI assessment
- Missing improvement strategies
- No assurance of compliance to regulations
- Relying fully on technology as the only security solution

Implementing Security Enforcement

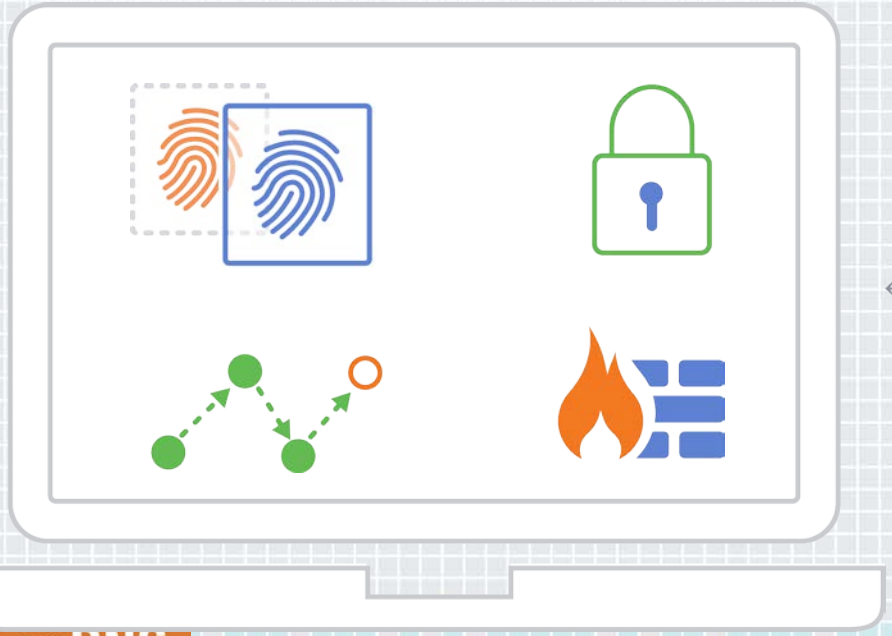
- Goal
  - Consistent enforcement everywhere. No matter what!
- Challenges
  - Attackers look for (and expect) gaps in policy management & enforcement
  - Threat analysis needing more processing power

Endpoint Security

How Agents Work

How it works

- Two Modes
  - Interactive
  - Scan
- Signature/Rules reside on endpoint
- Stops file from doing something “bad”



Endpoint Security Enforcement

Strength/Weakness

-- Devices covered wherever they roam

-- Visibility of inter-process communications

-- Performance (policy decision & enforcement in same place)

-- Deployment / Coverage

-- No real-time centralized monitoring

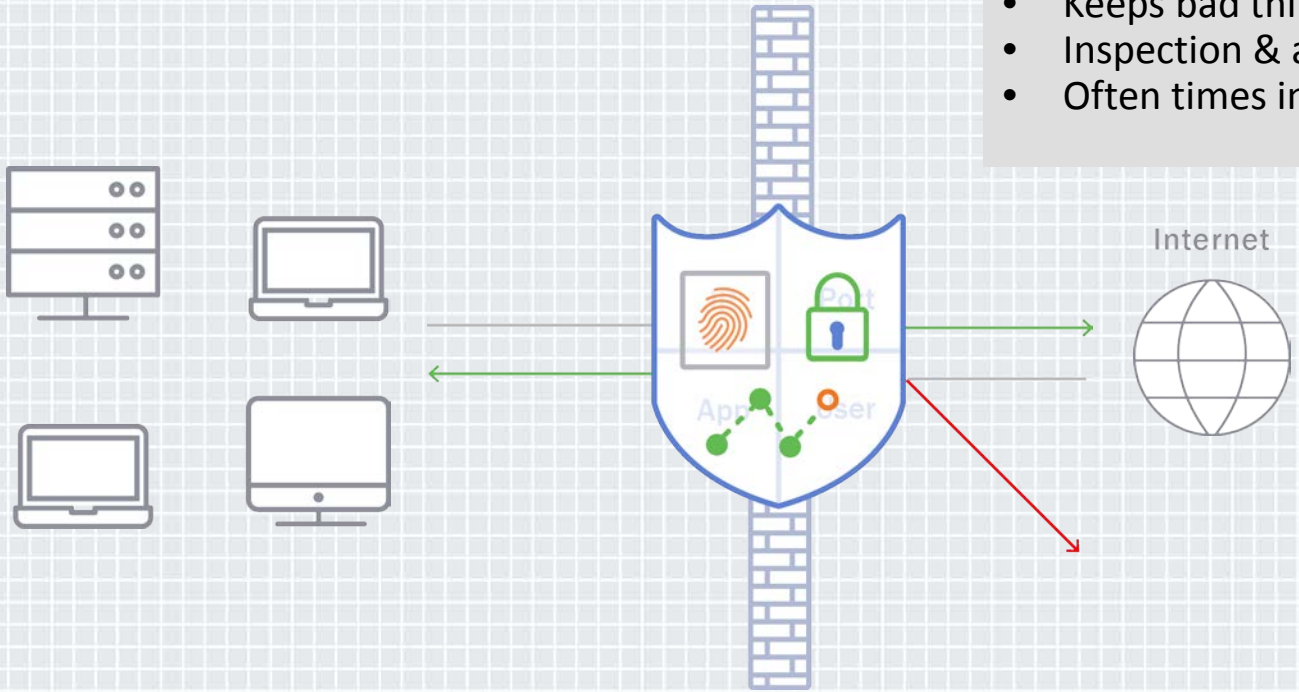
-- Manipulation by malware

Network Security

How Firewalls Work

How it works

- Restricts access in/out of a system
- Keeps bad things from “spreading”
- Inspection & application based
- Often times integrating proxy



OpenDNS

Network Security Enforcement

Strength/Weakness

-- Hardened appliance

-- Ability to segment the network into trusted zones

-- Cannot protect what it cannot see

-- Performance with backhauling

-- Availability issues are the customer's responsibility

OpenDNS

In Summary

- Endpoint enforcement has limitations with management & performance
- Network enforcement has limitations with visibility & performance

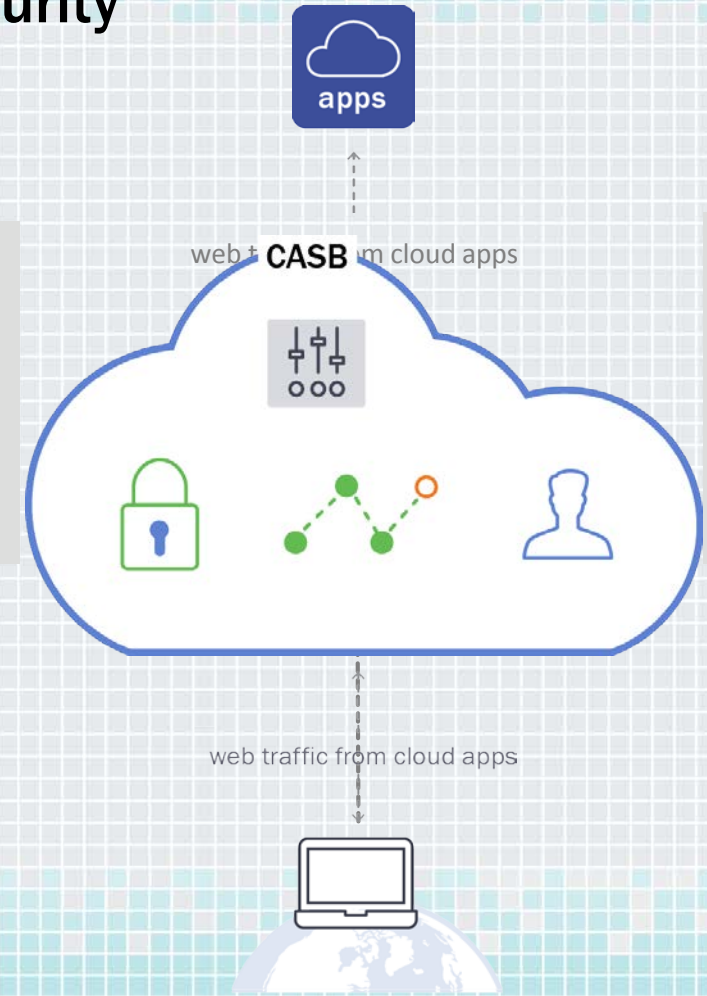
Cloud-Delivered Security

How CASB Works

(Cloud Access Security Broker)

Problem It Solves

- Visibility as workloads move to cloud
- Protect application/data that is in the cloud
- Performance & processing



How It Works

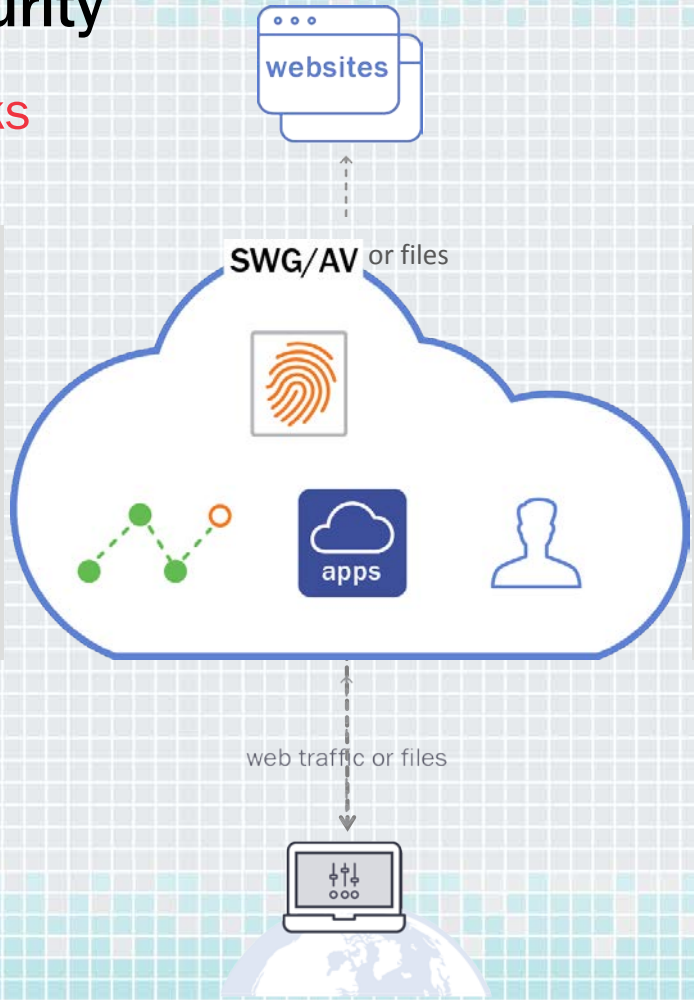
- SAML integration or reverse proxy directs traffic to cloud servers
- Traffic is inspected and policies reviewed & enforced
- DLP, Encryption, Access Control

Cloud-Delivered Security

How Cloud SWG/AV Works

Problem It Solves

- Lack of visibility when users are off-network
- Performance from advanced analytic capabilities
- Performance issues from backhauling
- Manageability of intelligence updates



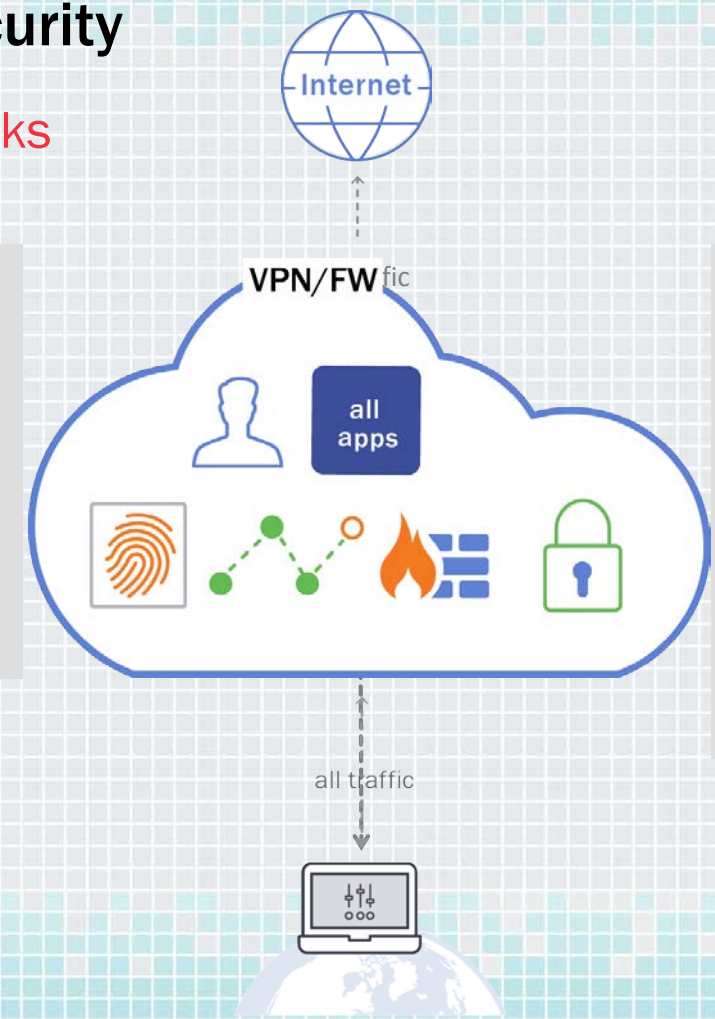
How It Works

- PAC file or small agent deployed on endpoint
- Selective information or traffic sent to cloud
- All processing, policy application in the cloud
- Centralized management & reporting in the cloud
- Global network: cloud is closer to customer

OpenDNS

Cloud-Delivered Security

How Cloud VPN/FW Works



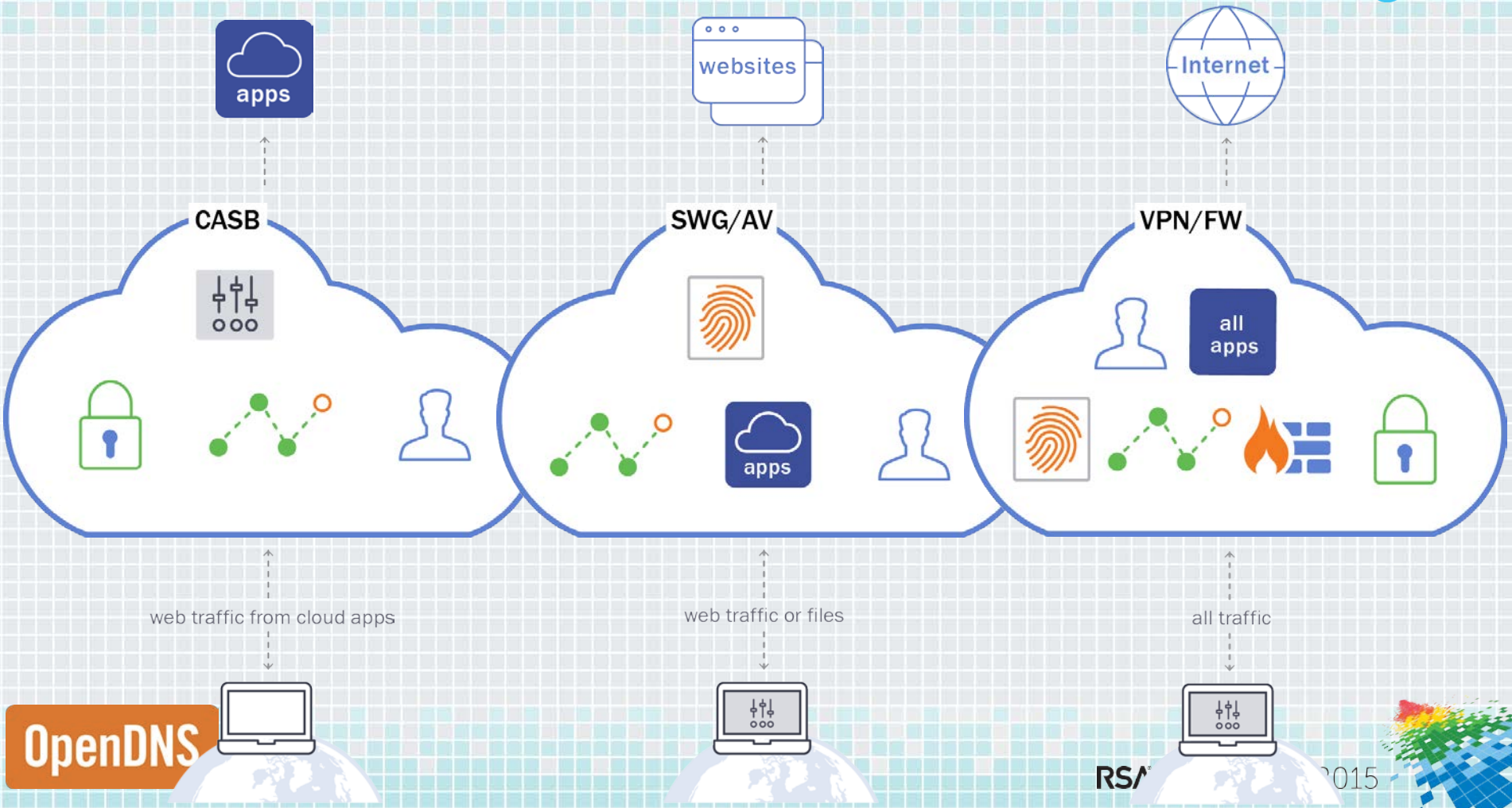
Problem It Solves

- Visibility on & off-network and all packets
- Encryption of all traffic
- Performance from advanced analytic capabilities
- Performance issues from backhauling
- Manageability of intelligence updates

How It Works

- Small Cloud VPN on endpoint or router
- Intelligently routes traffic
- Encrypts traffic as necessary
- All processing, policy application in the cloud
- Centralized management & reporting in the cloud
- Move all network security into the cloud
- Global network: cloud is closer to customer

OpenDNS


apps
websites
Internet
CASB
SWG/AV
VPN/FW
all apps
apps
web traffic from cloud apps
web traffic or files
all traffic
OpenDNS

Challenges still exist

- Management: Endpoint deployment
- Management: BYOD device management

Tying it together

- Implement a lightweight policy life cycle process
  - Do the security & risk assessment
  - Determine the gaps
- Work with IT and business unit managers to understand adoption of cloud and usage of roaming devices
- Assess performance of your existing security enforcement technologies
- Consider limited adoption of cloud enforcement security technologies to cover gaps

Security Basics

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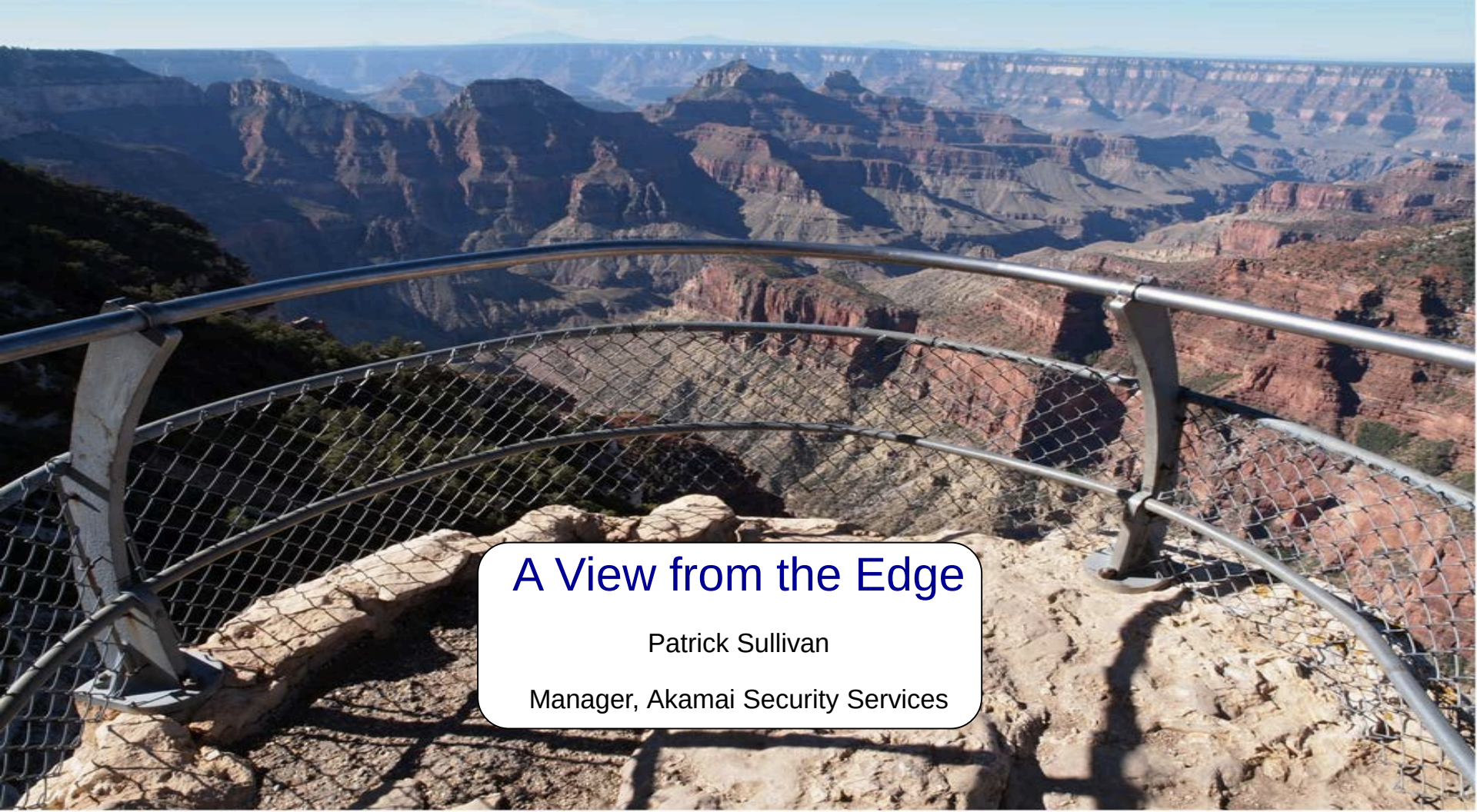
Internet and Web Security Issues

Patrick Sullivan

Manager, Akamai Security Services

What we'll talk about today

- Web Application Attacks
- DDoS Attacks
- DNS Attacks

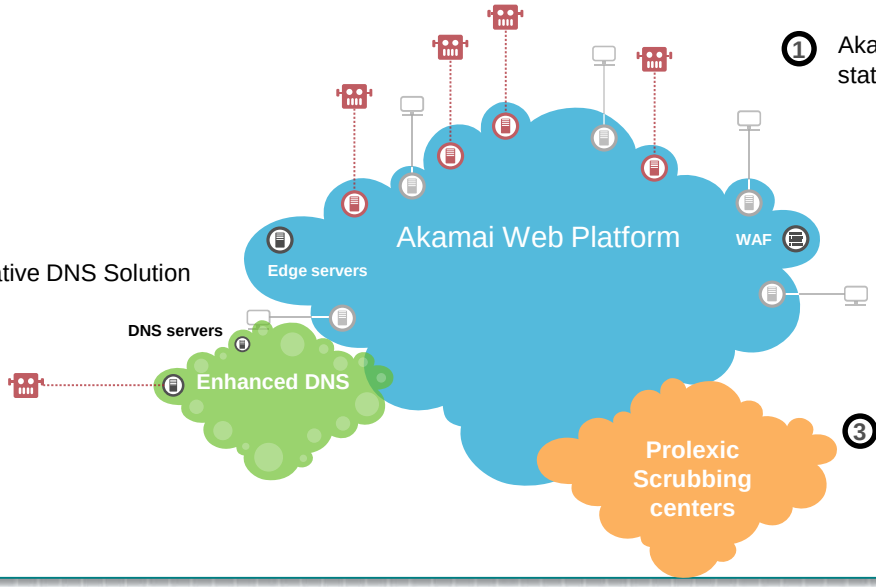


A View from the Edge

Patrick Sullivan

Manager, Akamai Security Services

Akamai has unique insight into Web/DDoS Traffic



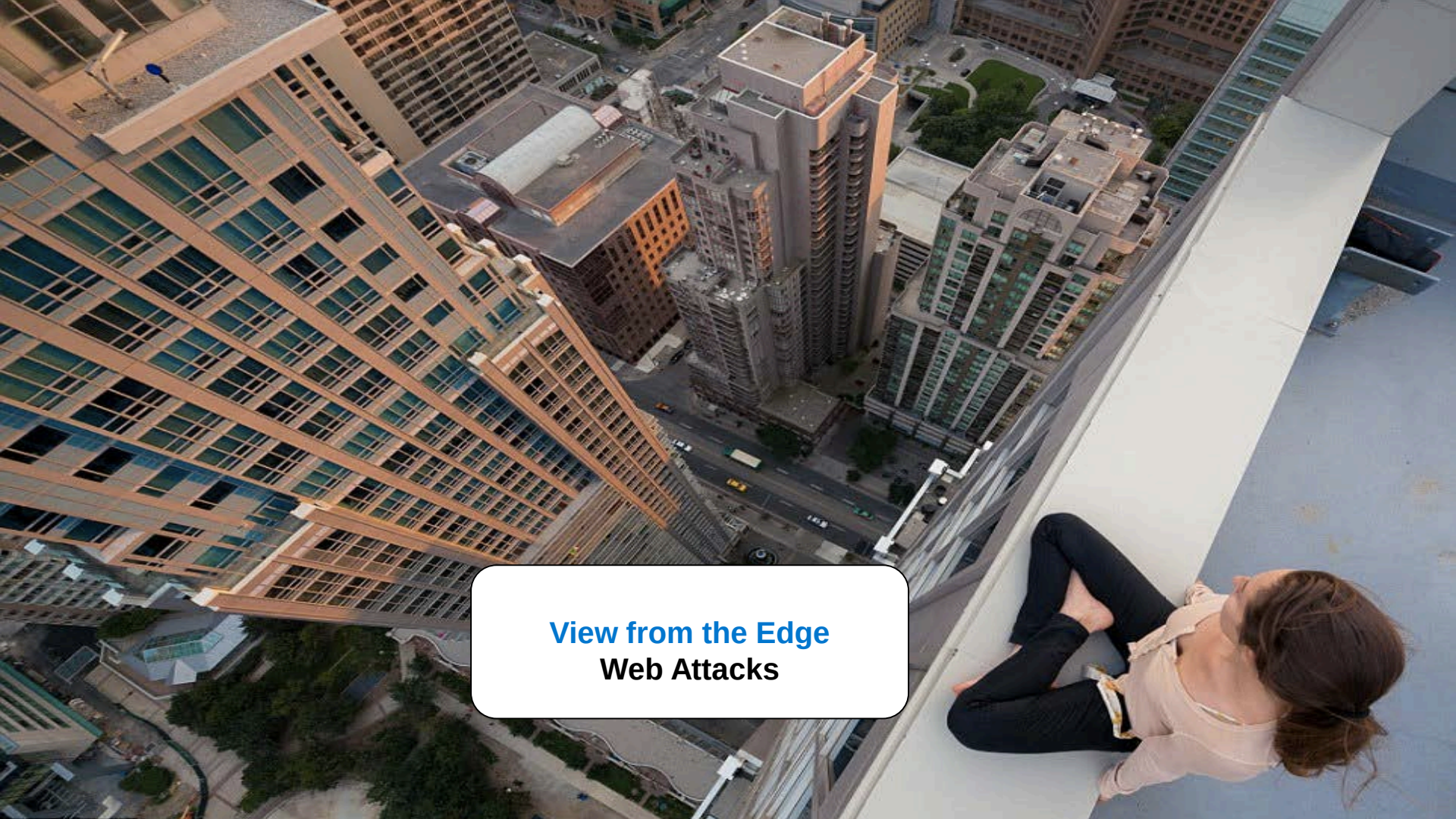
1. Akamai's Edge carries ~ 20Tbps of Web Traffic at steady state with bursts to 30+Tbps
2. Enhanced DNS Authoritative DNS Solution
3. Prolexic BGP-Based DDoS Mitigation
4. Akamai Customer Base.

- 98 of top 100 Commerce Sites
- All Braches of US Military
- All Agencies of the US Gov't
- 10 of top 10 Banks
- 30 of top 30 Media Sites
- 10 of top 10 Asset Managers
- 10 of top 10 P&C Companies
- 8 of top 10 Auto Manufacturers

Akamai CSI Platform Statistics

2 Petabytes of security data stored

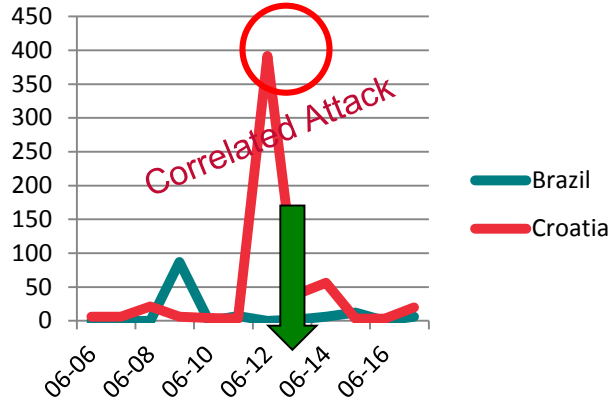
10 Terabytes of daily attack data

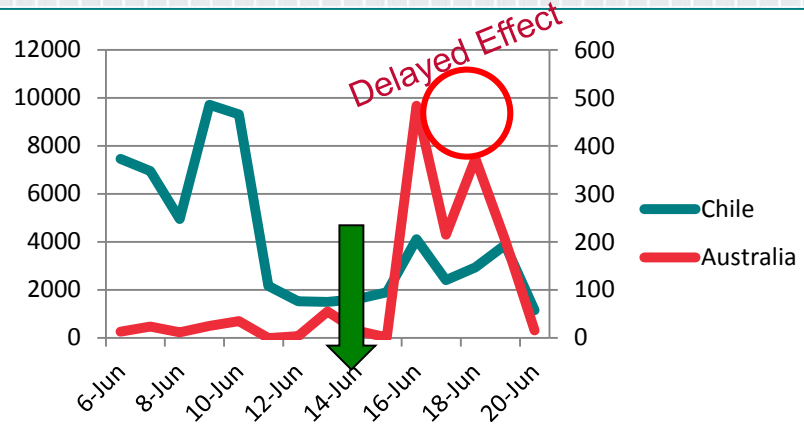


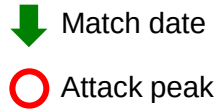
View from the Edge
Web Attacks

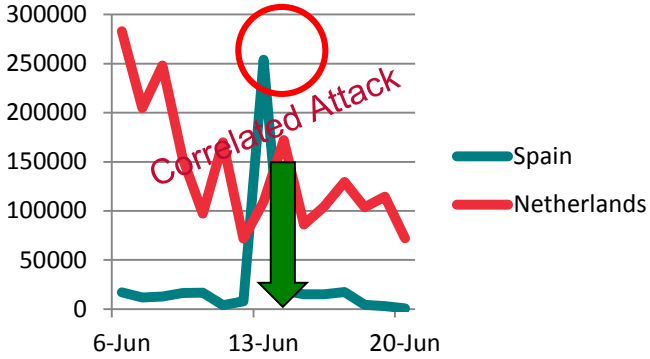
World Cup Attack Trend: Retribution Cyber Attacks

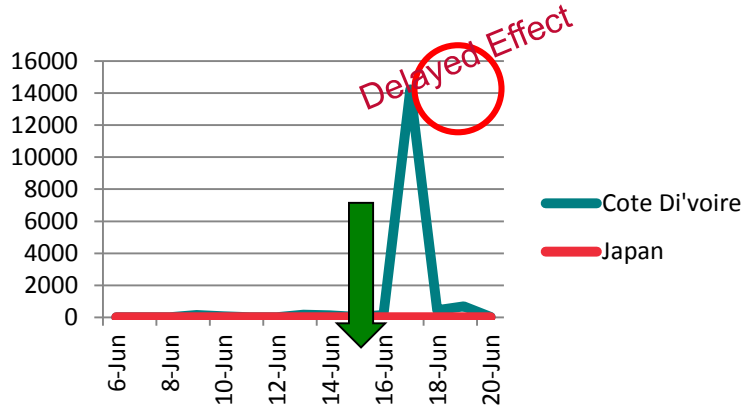
World Cup – Correlated Events







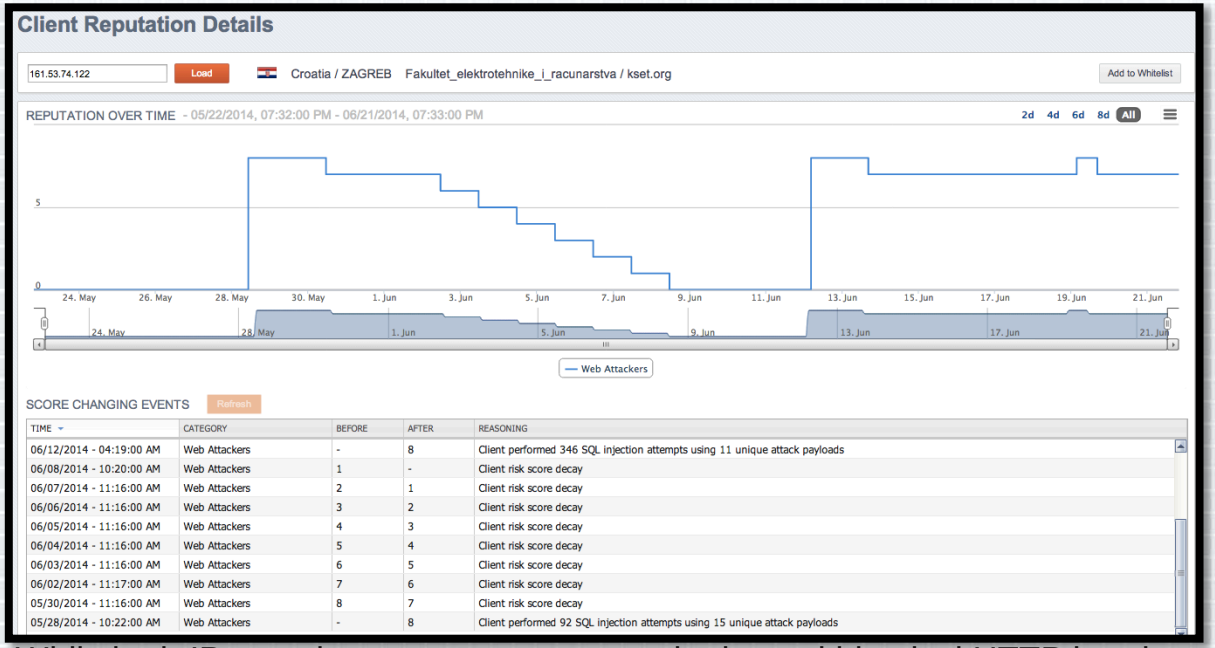




Source: Akamai CSI

Croatia vs. Brazil (June 12th)

- Croatian hacker decides to retaliate – using 2 Offending IP addresses – All attacks are **real** SQL Injection attempts



EdgeScape information	
ip	217.14.208.233
country_code	HR
region_code	
county	
city	ZAGREB
zip	
timezone	GMT+1
areacode	
georegion	
network	
network_type	
company	Metronet_Telekomunikacije_d.d.
domain	vodatel.hr
fips	
lat	45.80
long	16.00
dma	
pmsa	
asnum	25528
throughput	vhigh
proxy	anonymous

EdgeScape information	
ip	161.53.74.122
country_code	HR
region_code	
county	
city	ZAGREB
zip	
timezone	GMT+1
areacode	
georegion	
network	
network_type	
company	Fakultet_elektrotehnike_i_racunarstva
domain	kset.org
fips	
lat	45.80
long	16.00
dma	
pmsa	
asnum	2108
throughput	vhigh
proxy	anonymous

While both IPs used an anonymous proxy, both used identical HTTP headers and attack payloads – making it highly probable that both are the same person or organization

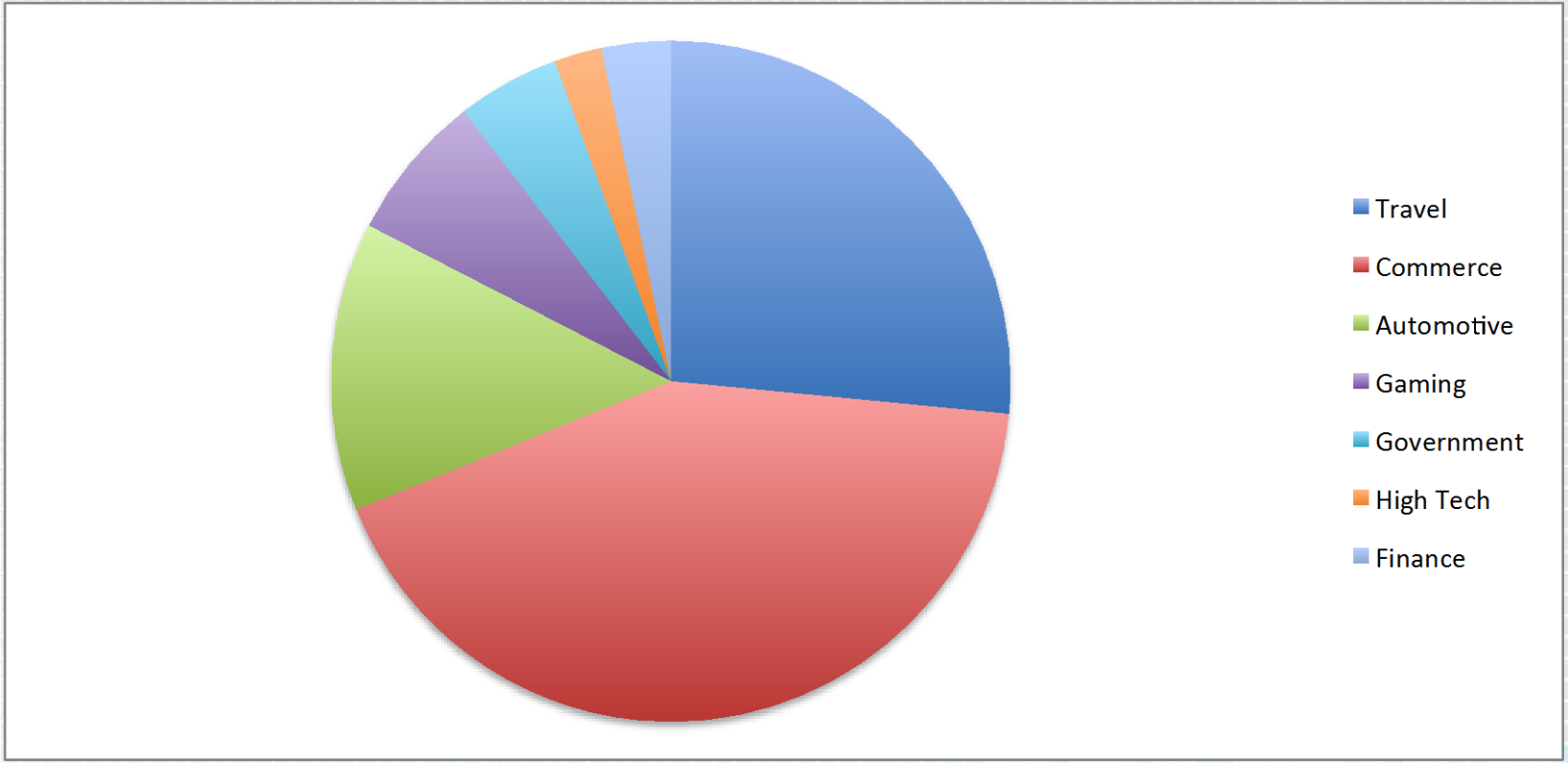
Source: Akamai CSI

Spain vs. Netherland

- Spanish hacker decides to retaliate with an App-layer DoS attack, targeting a major Dutch media/news site Referring page for the attack ➔
- Most attacks came from a single IP (no proxy used): 80.244.*.*
- Target page was /ad/article/detail/live/introduction.do with 98% of the hits – a total of 232,498
- All 232,498 request were identical
- Looking at the HTTP headers – it's obvious the attacker knew exactly what he/she was doing - they created an HTTP request that included: cookies, valid browser headers (mimic a real browser), including "X-Requested-With: XMLHttpRequest" to mimic an AJAX request. Only "flaw" was that session cookies never refreshed throughout the entire attack

Source: Akamai CSI

SQL Injection: Top 50 customers attacked by volume



SQL Injection Analysis of 2000 customers over one week

Protocol Breakdown

	SQL Injection Attacks	%
HTTP	8,137,681	96.6
HTTPS	287,808	3.4
Total	8,425,489	100

Breakdown by Intent

Malicious Intention	Malicious Transactions	%
Login bypass & privilege escalation	5,467	0.0649
Data Corruption	2,238	0.0266
Content Injection	8,156	0.0968
Remote Command Execution	794	0.0094
Environment probing & recon.	1,306,681	15.5087
Credential Theft	1,950,749	23.1529
Database content retrieval	129,814	1.5407
SQL Injection Probing	5,021,240	59.5958
File Exfiltration	24	0.0003
Denial of Service	326	0.0039
Total	8,425,489	100

Source: Akamai CSI

SQL Injection Breakdown: SQL injection probing

- This step represents 60% of SQLi Traffic
- As a first step, attackers will usually perform an assessment of the web application to see if it is vulnerable to SQL Injection.
- Sample payloads include: sequences of SQL-sensitive characters like:
  - apostrophe ('),
  - semicolon (;)
  - Modern approaches use Blind SQL injection techniques such as forming Boolean conditions - AND 1=1, AND 1=0, as well as “timed attacks” such as those using the WAITFOR or sleep() functions.

SQL Injection Breakdown: Environment probing & reconnaissance

- Makes up 16% of SQL Injection Traffic
- After the attacker concludes that the application is vulnerable to SQL Injection, he/she will take the attack a step further, by trying to learn the type & structure of the database, its tables, columns, users and permissions.
- Common Payload Example:
  - Extraction of information from the MySQL INFORMATION_SCHEMA table, for example: UNION SELECT group_concat(COLUMN_NAME) FROM INFORMATION_SCHEMA.COLUMNS—

SQL Injection Breakdown: Credential Theft

- 23% of SQL Injection traffic
- Attempts to steal user credentials through SQL Injection
- These attacks included attempts to retrieve data from tables and views such as:
  - mysql.user (Mysql)
  - master.syslogins (MS-SQL)
  - master.dbo.sysxlogins (MS-SQL)
  - ALL_USERS (Oracle)

SQL Injection Breakdown:
Database Content Retrieval

- Makes up 1.5% of SQL Injection Attack Traffic
- Once the attacker has a clear understanding of the type and structure of the database and its tables, he/she can start retrieving contents remotely by using several techniques such as data extraction using UNION SELECT statements, or by using Blind SQL Injection techniques (using Boolean expressions).

SQL Injection Breakdown:
Login Bypass and Privilege Escalation

- Makes up .06% of SQL Injection Traffic
- The Majority of Web Apps use a SQL back end to check user credentials
- This provides hackers with a simple yet extremely effective method of bypassing the login mechanism using SQL Injection attacks.
- Sample Payload
  - ' OR 1=1-- as the user name.
  - In cases where the hacker knows the user name of the administrator (e.g. “admin”), he/she could attempt to elevate their privileges by logging in with the user name: admin' or 1=1--

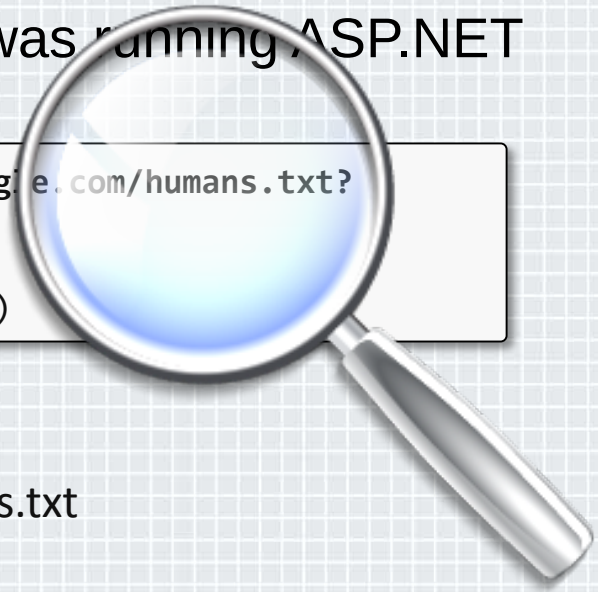
SQL Injection Breakdown: Denial of Service

- 0.0039% of the malicious requests were classified as attempts to deny service from other users by either overloading or shutting down the database server.
- The most observed vectors were:
  - Excessive use of timed queries with extremely high value of time intervals
  - Attempts to use the MS-SQL SHUTDOWN management command

Application Scanning

An attempt to exploit an old (2007) WordPress Remote File Inclusion vulnerability. The victim application was running ASP.NET

```
GET /wp-content/wordtube-button.php?wpPATH=http://www.google.com/humans.txt?
HTTP/1.1
Host: www.vulnerable.site
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_8_4)
```



Attacked parameter : wpPATH

Malicious payload: http://www.google.com/humans.txt

What Else Did This Attacker Do On This Site?

Same attacker Sent 2122 different RFI exploit attempts

Was There Similar Activity Going On At The Same Time?

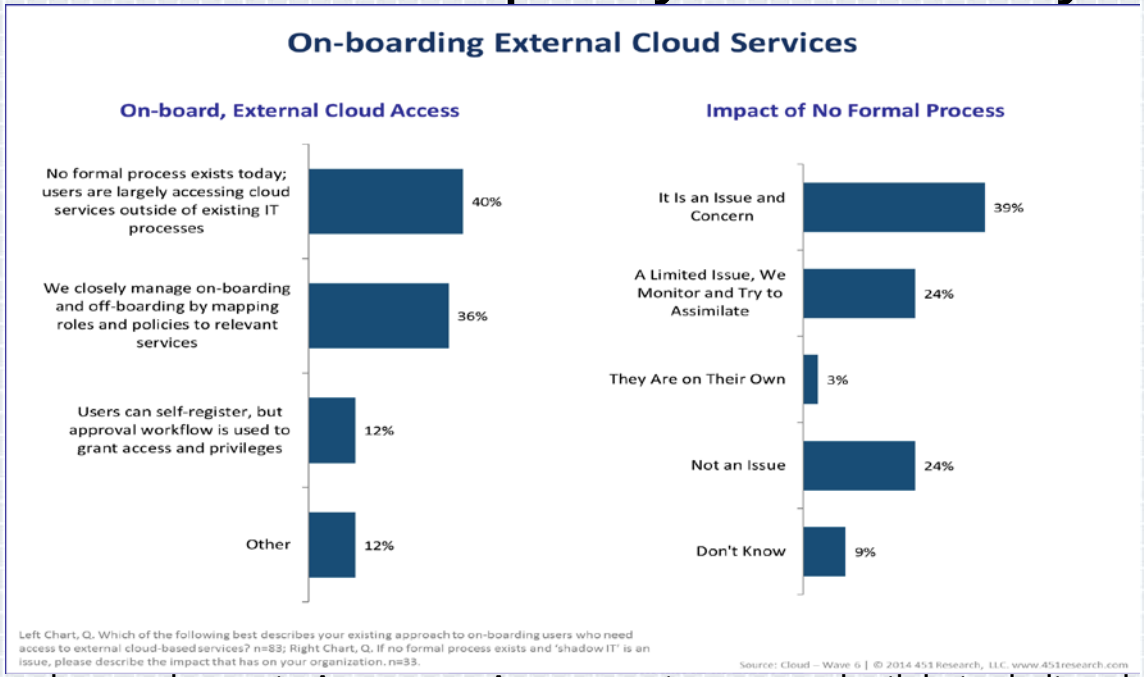
Attacks originated from a botnet containing 272 attacking machines

1696 victim applications were targeted

1,358,980 attacks were launched during the campaign

The campaign lasted for 2 weeks

Shadow IT: “It’s pretty loose today”



“People can sign up to Amazon or Azure, create user credentials to do it and spin stuff up. That hasn’t been completely reeled in yet. We want an internal group that brokers cloud services. Establishes guidelines and preferred providers they would leverage and anything else around that. It’s pretty loose today.” – LE, Financial Services

Source: 451 Group

Implications of Shadow IT growing so quickly

Traditional IT

- Full lifecycle costs are considered
  - Application Creation
  - Software Patching
  - Auditing/Scanning
  - Vulnerability remediation
  - Application Decommissioning

Shadow IT

- Fast, Cheap, and Easy
  - Software Patching?
  - Scanning?
  - Application End of Life?

Easy-to-use CMS's Power Shadow IT

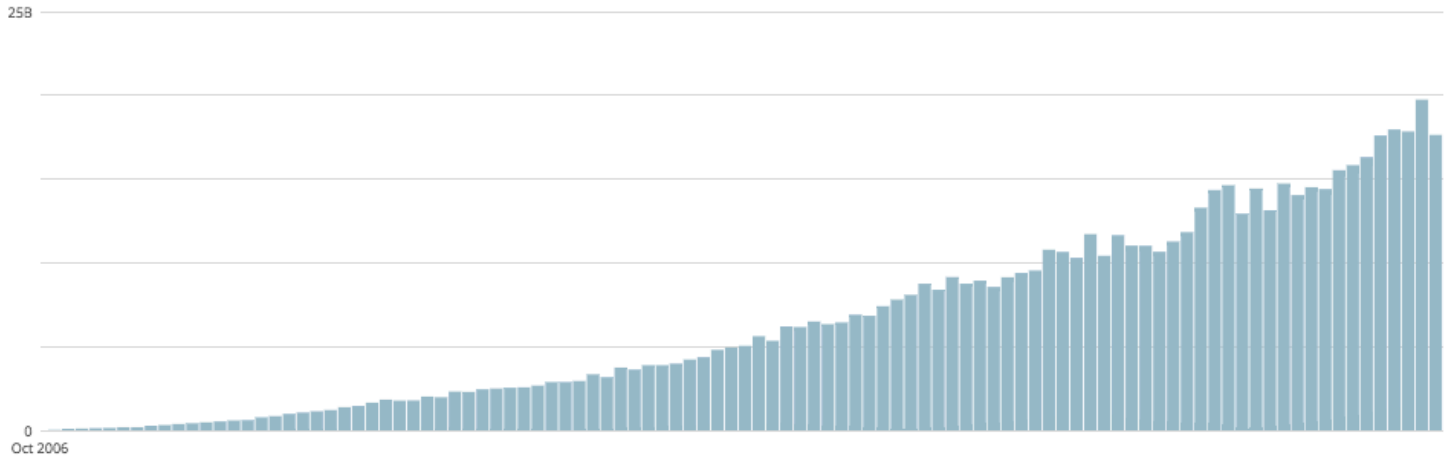
~ 20% of sites on the Web use WordPress

Traffic

WordPress.com

Views

The number of pageviews across blogs we host here on WordPress.com, both on subdomains and their own domains, or externally-hosted blogs that use our Jetpack plugin and are part of our network.



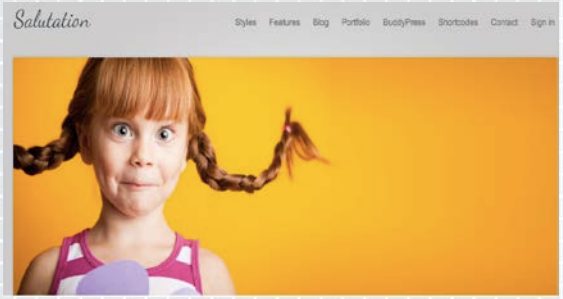
Source: Wordpress.com

CMS Plugins: Summary of 1 day's Attack Traffic

1134 customers probed
Source IP's:17

1028 customers probed
Source IP's:107

963 customers probed
Source IP's: 7



711 customers probed
Source IP's:42

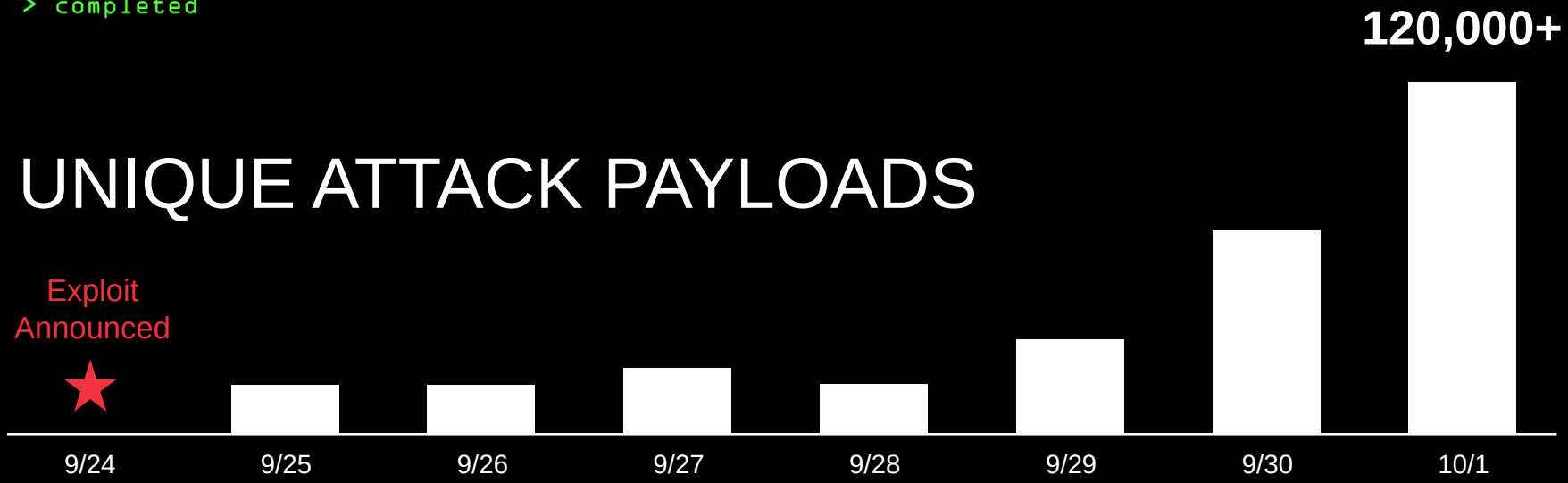
653 customers probed
Source IP's:19

#!/bin/bash_

```
~root: env X="() { :;} ; echo shellshock" /bin/sh -c "echo completed"

> shellshock
> completed
```

UNIQUE ATTACK PAYLOADS



Typical Shellshock Probe

Attack Request

Client IP	91.121 [redacted]
Source Port	36107
User-Agent	() { :; }; echo Content-type:text/plain;echo;echo;echo M`expr 1330 + 7`H;/bin/uname -a;echo @
Method	GET
Scheme	http
Host	[redacted]
Port	80
Path	/
Path Parameters	
Query	x=()?x=() { :; }; echo Content-type:text/plain;echo;echo;echo M`expr 1330 + 7`H;/bin/uname -a;echo @
Request headers	Host [redacted]

Client Info

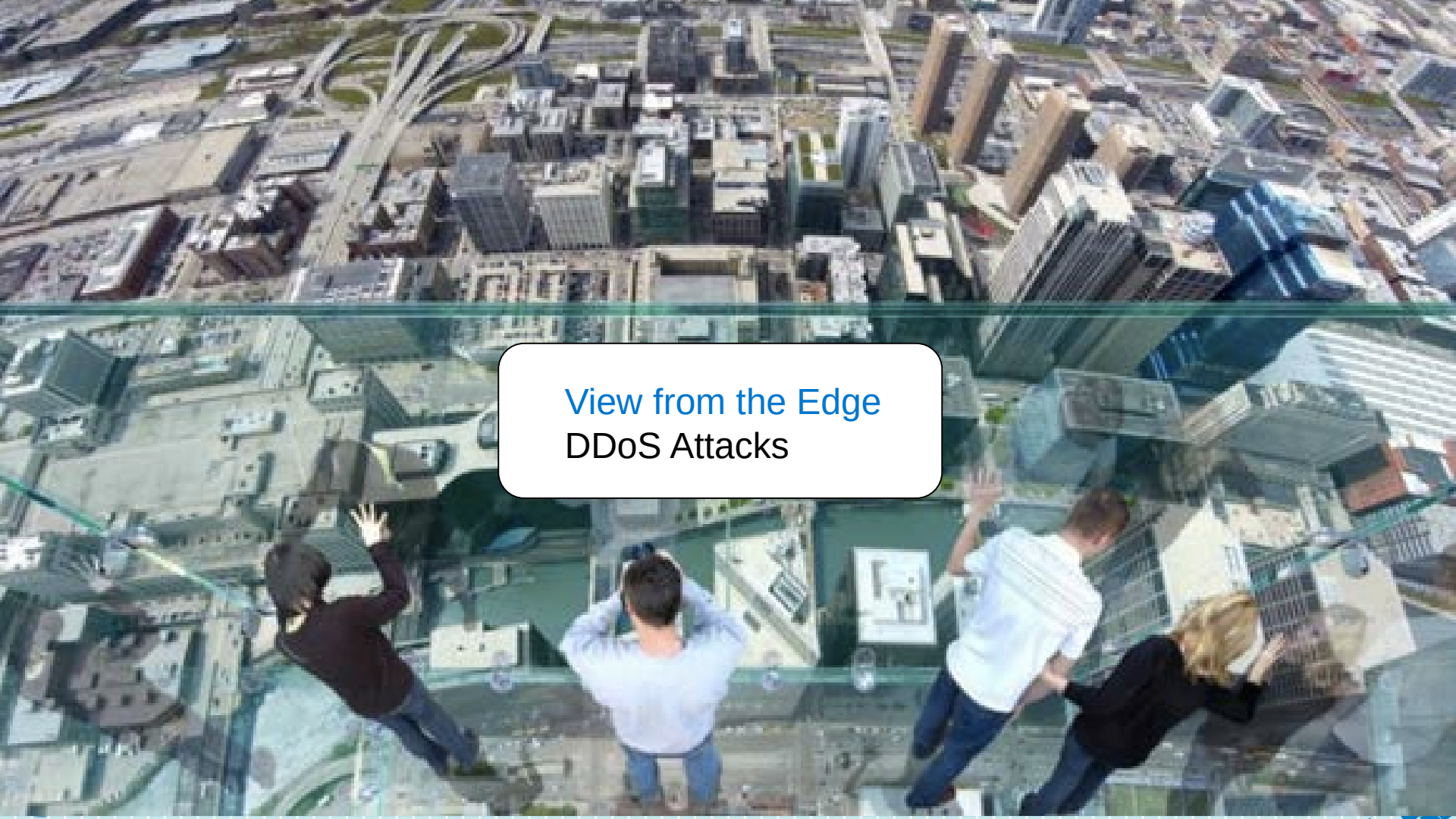
Country	FR
County	
City	PARIS
Region code	
Throughput	vhigh
ASNUM	16276
Bandwidth	5000
Network code	
Time zone	GMT+1
Network type	
Company Name	OVH_SAS
Domain Name	kimsufi.com

Shellshock/Bash Probing: One week's summary

Country	Total Triggers	Source Ips
US	146272	273
GB	96816	50
FR	29791	19
DE	28416	31
JP	27790	12
KR	26447	7
UA	23510	2
AT	21192	1
CN	16038	81
IT	5830	5
GR	3830	4
CZ	3738	4
CA	1711	7
PL	937	1
NL	881	22
AU	605	4
IN	575	15
BR	422	14

Vertical	Num. Attacks
Media & Entertainment	150325
Software as a Service	96222
Business Services	45586
High Technology	39586
Retail	36461
Hotel & Travel	24429
Financial Services	22412
Consumer Goods	10194
Real Estate	4188
Gaming	2501
Public Sector	1387
Foundation-Not for Profit	1027
Pharma/Health Care	567
Energy & Utilities	566
Manufacturing	498
Consumer Services	433
Automotive	189
Education	8

Total source attacking IPs: 656
Total targeted customers: 2,570
Total attack transactions: 436,641

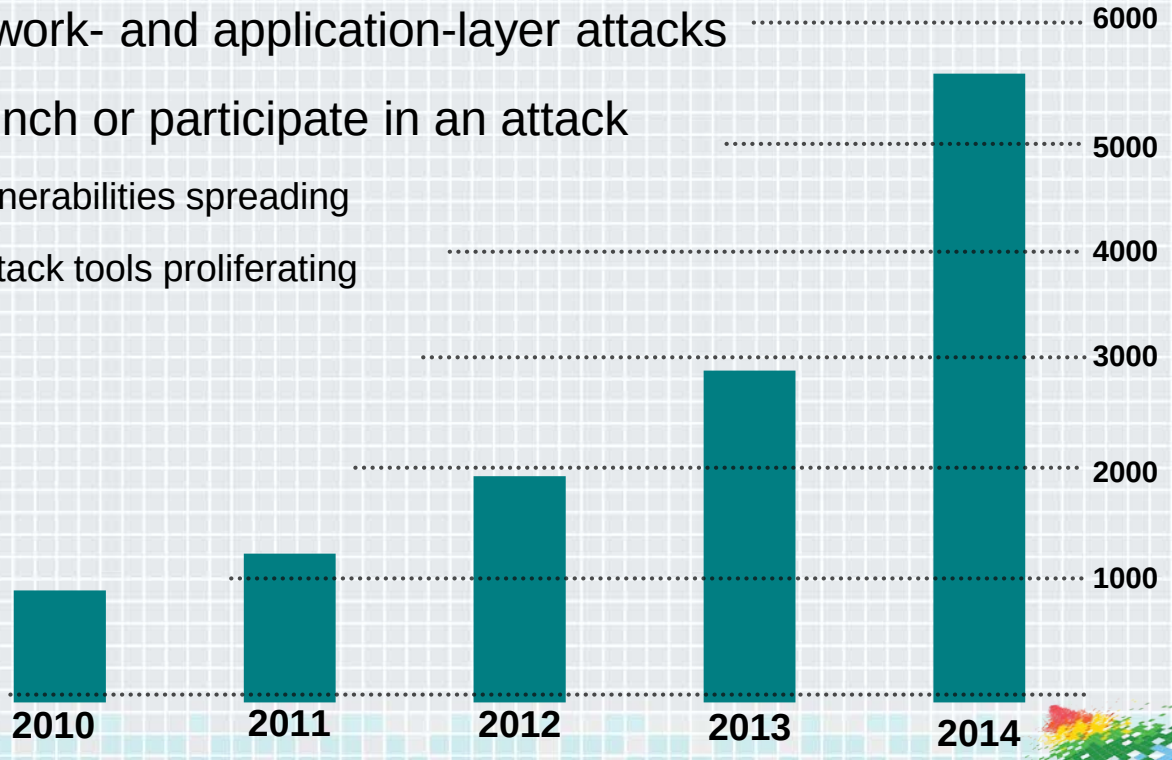

View from the Edge
DDoS Attacks

Even if your Security Practice is Perfect: You share the Internet with others

Avoid da
security
protect f
sophistic

Frequency of DDoS Attacks Continues to Increase

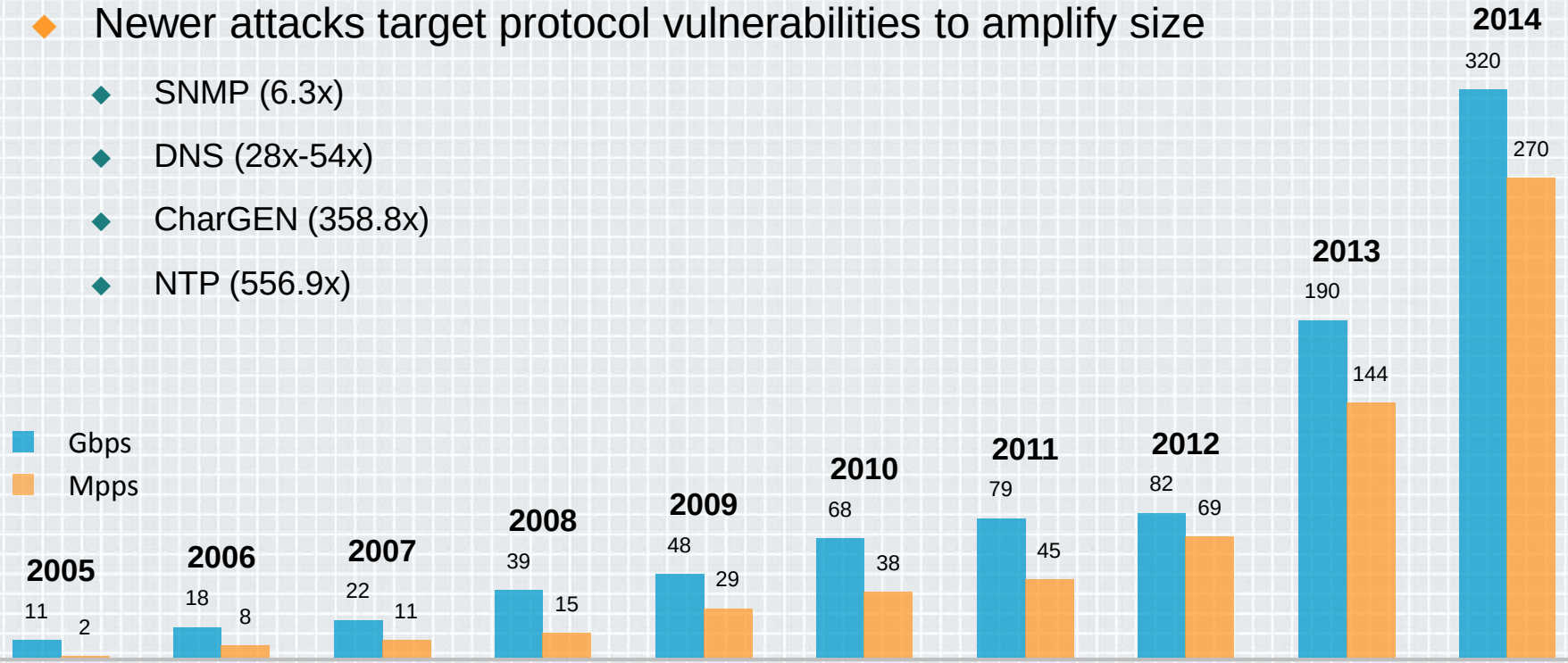
- Increasing number of network- and application-layer attacks
- Easier for attackers to launch or participate in an attack
  - Knowledge of application vulnerabilities spreading
  - Number and availability of attack tools proliferating



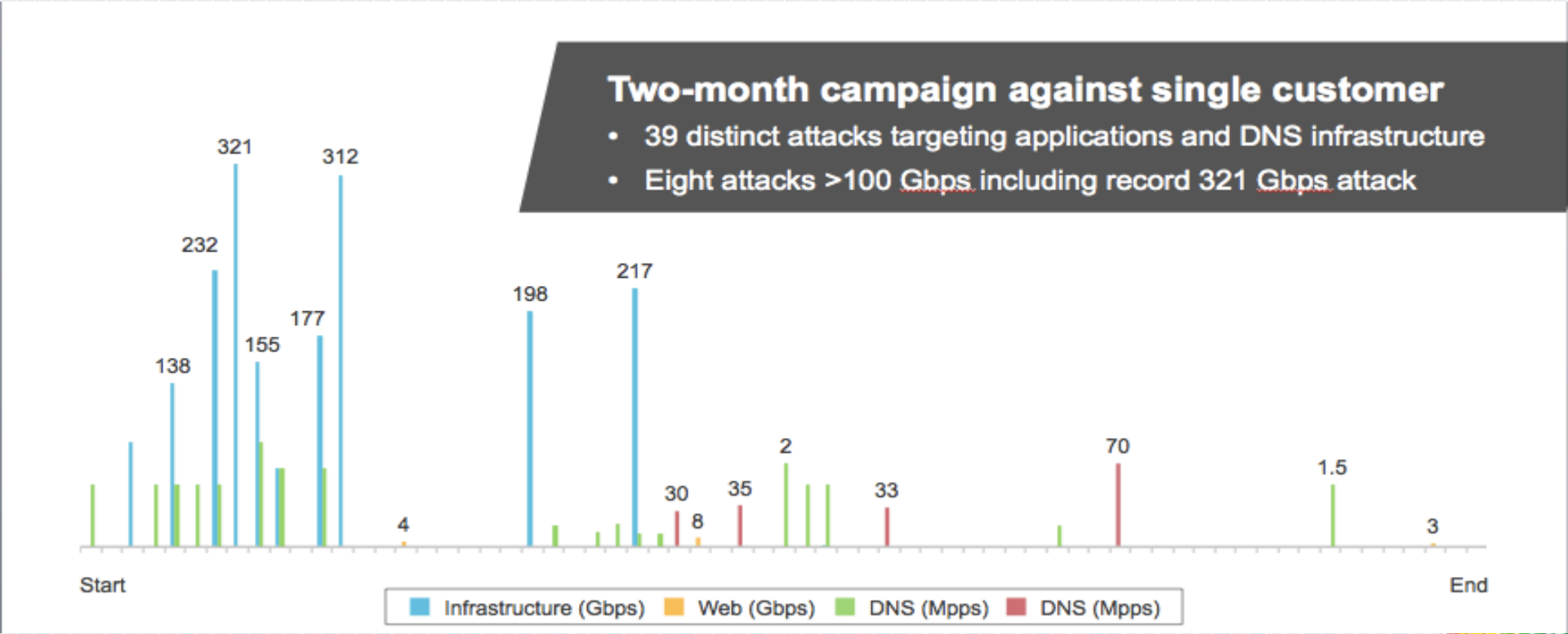
Source: Akamai

DDoS Attacks Are Growing in Size

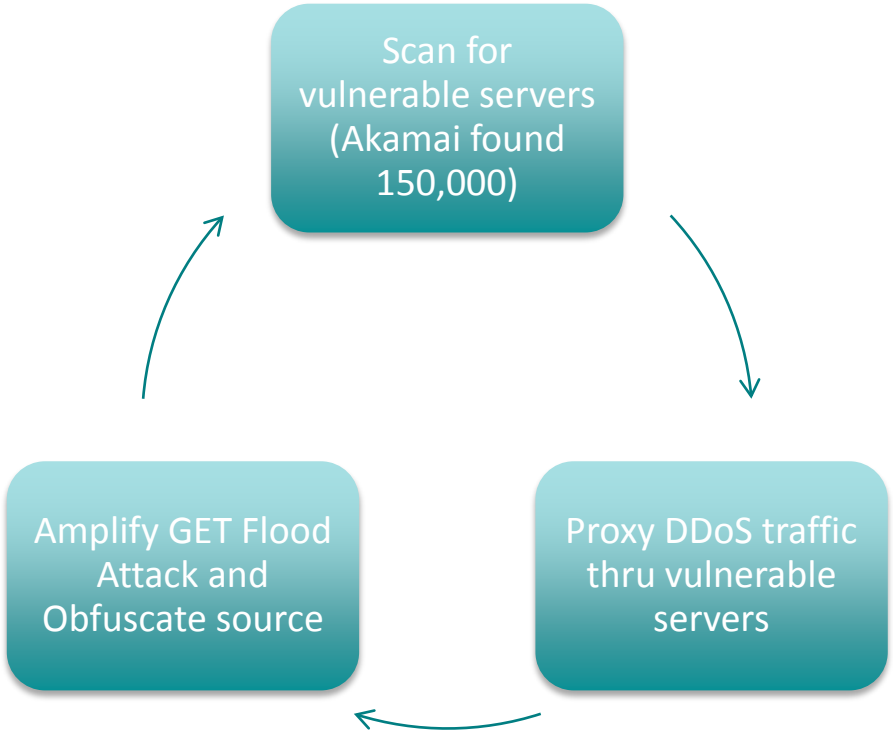
- Newer attacks target protocol vulnerabilities to amplify size
  - SNMP (6.3x)
  - DNS (28x-54x)
  - CharGEN (358.8x)
  - NTP (556.9x)



Multi-Vector Attacks are the Norm



Vulnerability in Google Maps plugin for Joomla enables DDoS attacks



Tools such as DavoSet/UFONet are leveraging the Proxy Vulnerability

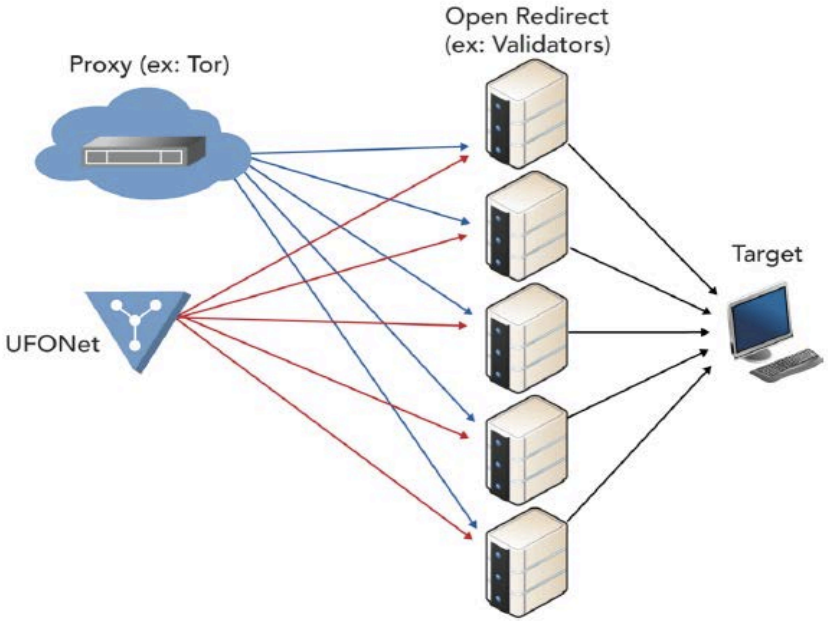


Figure 2: How a UFOnet attack works with a proxy (SourceForge)

UFONet UI

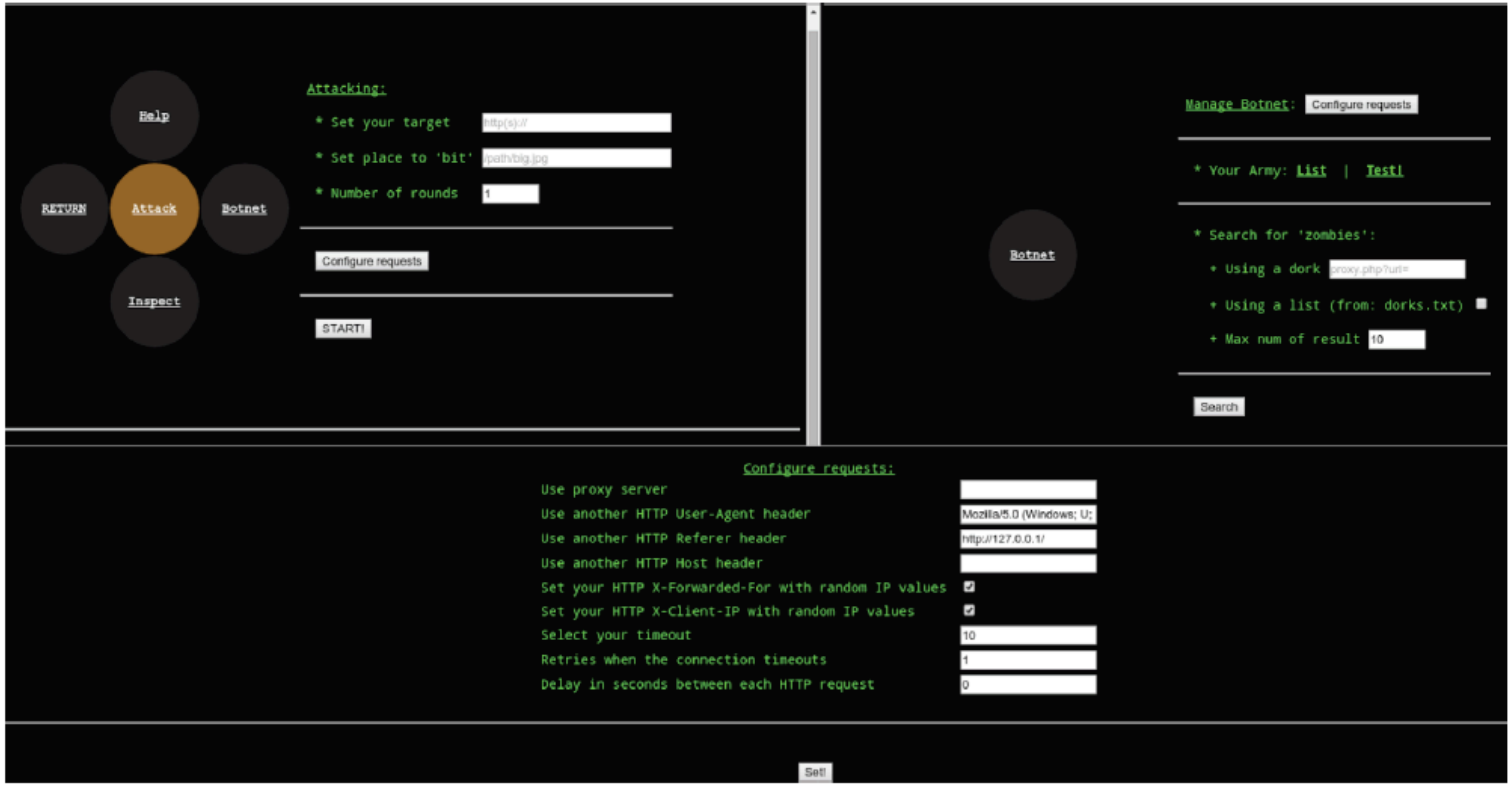


Figure 3: The UFONet web interface allows users to quickly configure and launch DDoS attacks

Joomla GET Flood DDoS Attacks

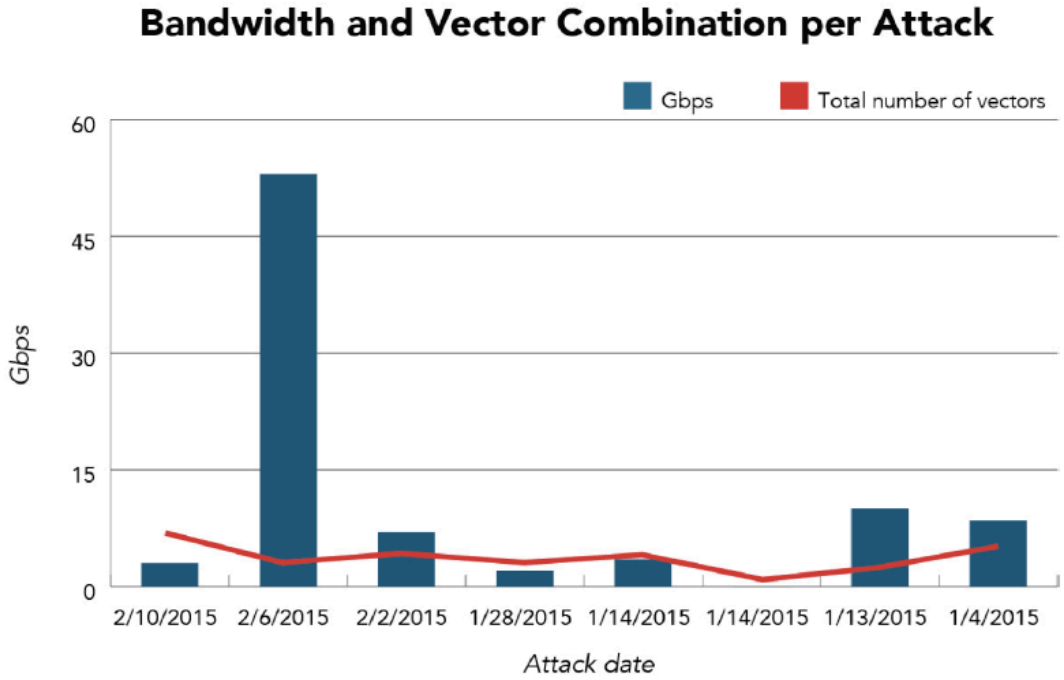
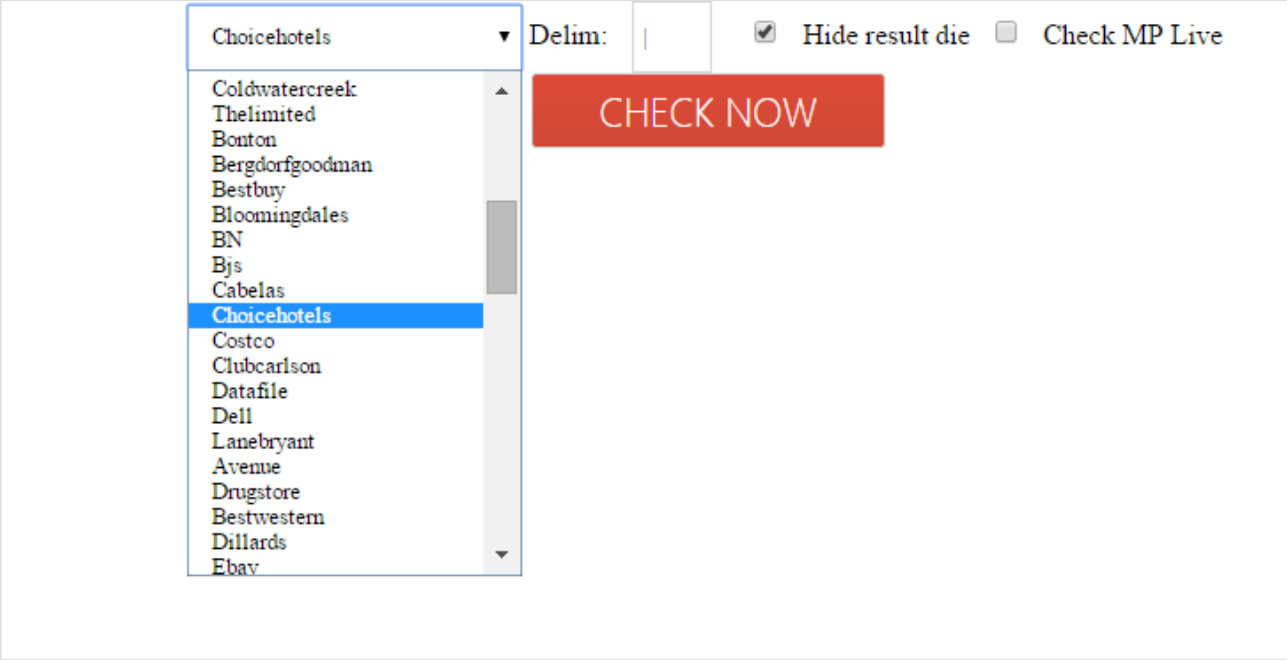


Figure 7: Dates, peak bandwidth and total vectors per attack

Account Checkers as a service

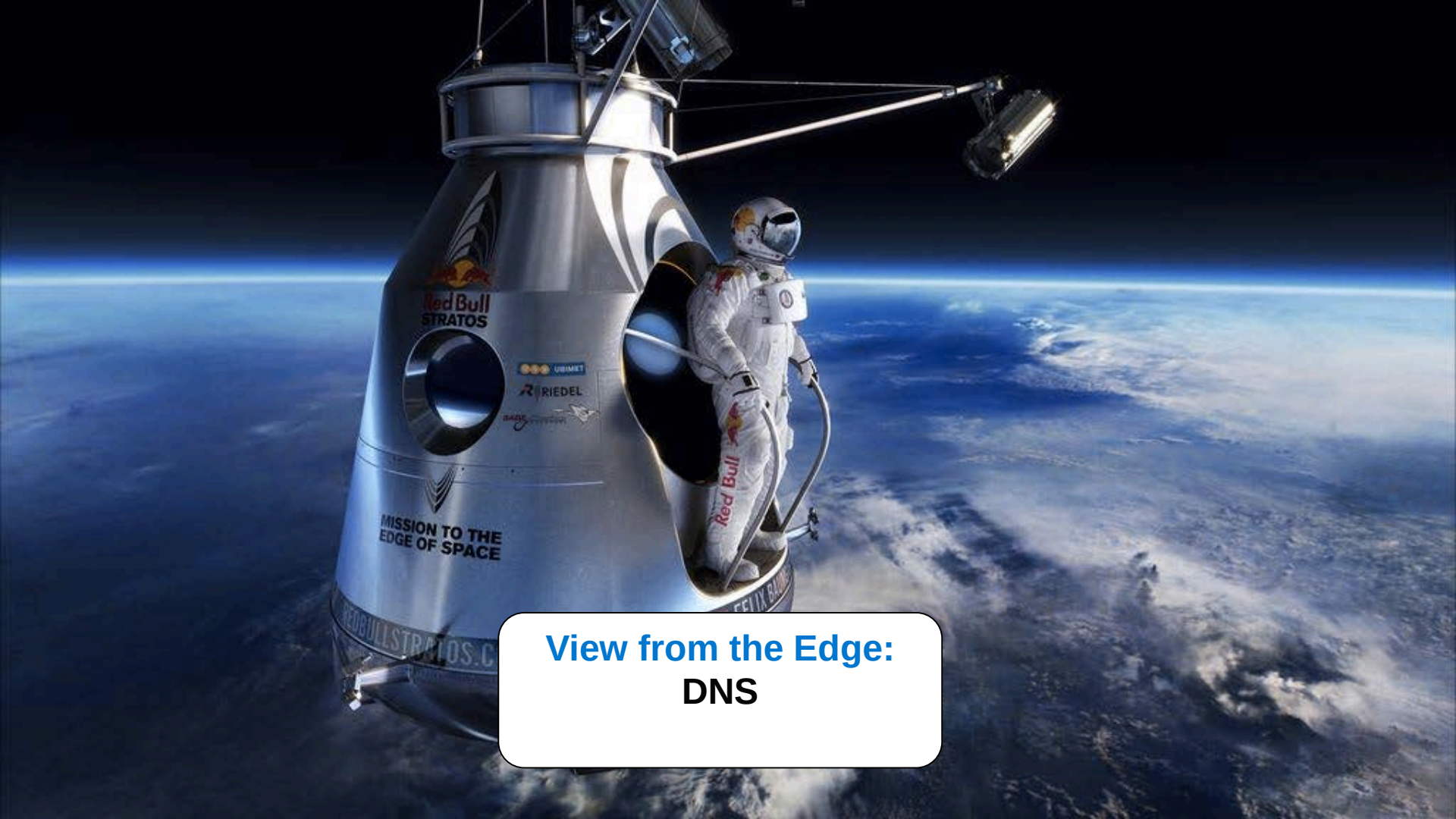


Account Checking Tool - Internals

After Credential Matching: Script to Match on Credit Card in Account

```
preg_match_all('/name="([^"]+creditCardId)"[^>]*value="([^"]+)"/si', $page, $matches);
                    $cardIDs = $matches[2];
                    $ccCount = count($cardIDs);

                    foreach ($cardIDs as $cid)
                    {
                        $url = "https://m.<site>.com/account/wallet";
                        $post = 'action=EDIT&creditCardVB.creditCardId=' . $cid .'&validationCheck=false';
                        $page = $curl->post($url, $post, 1, 1, 0);
```



View from the Edge:

DNS

DNS Hijacks

You lock your car

You lock your home

You should lock your DNS

Apply This: Best Practice DNS Locks

Client DNS Locks

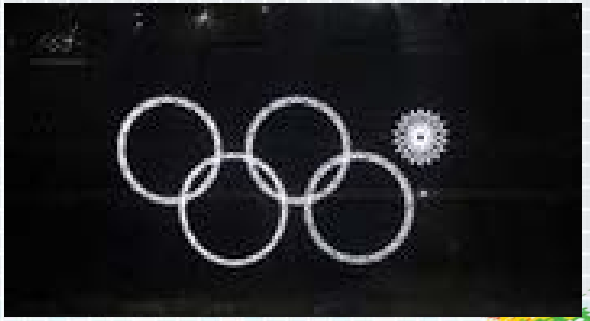
- clientUpdateProhibited
- clientTransferProhibited
- clientDeleteProhibited

Registrar locks

- serverUpdateProhibited
- serverTransferProhibited
- serverDeleteProhibited

Multi-Vector Attacks: 2014 Sochi Olympics

- 3.5 Tbps event
  - 50% Growth in Average User Connection Speed Compared to 2012.
  - More than a Million Malicious Requests Blocked
- Multi-Vector Attacks Detected Again in 2014
  - Application DDoS
  - RFI
  - Command Injection
  - Requests from Anonymous Proxy
- Attacks Again Spiked During Major Events
  - Opening Ceremonies
  - Hockey Semi-Final(US v. Canada)



Summary

- Web Applications are under constant scanning for vulnerabilities
- How long do you have to patch a new vulnerability like ShellShock?
  - Hours, up to a week if you are really lucky
- DDoS Attacks continue to increase in complexity and scale
  - Driven by servers commandeered by Web Application Vulnerabilities
  - Also driven by reflection attacks
- Please lock your DNS at your registrar
- Multi-Vector Attacks are the norm

Security Basics

Start Time	Title	Presenter
8:30 AM	Introduction	Hugh Thompson
8:45 AM	Security Industry and Trends	Hugh Thompson
9:30 AM	User Authentication Trends and Methods for Native Mobile Applications	Kayvan Alikhani
10:15 AM	BREAK	
10:30 AM	Mobile & IOT Security: Will Big Data Make it Better or Worse?	Hadi Nahari
11:15 AM	Viruses, Malware and Threats	Tas Giakouminakis
12:00 PM	LUNCH	
1:15 PM	Crypto 101: Encryption, Codebreaking, SSL, and Bitcoin	Benjamin Jun
2:00 PM	Security Enforcement Explained	Dana Wolf
2:45 PM	BREAK	
3:00 PM	Internet and Web Security Issues	Patrick Sullivan
3:45 PM	Network Security	Gary Sockrider

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SESSION ID: SEM-M01

Network Security 101

Gary Sockrider

Solutions Architect
Arbor Networks
@arbornetworks

Last Session of the Day!

What to Expect from this Session

- No “Death by Powerpoint”
- Interactive Discussion
- Audience Participation
- Learn Something!

What is Network Security?

- What is most important?
- Define your network?
- Where do I start?
- Who is in control?

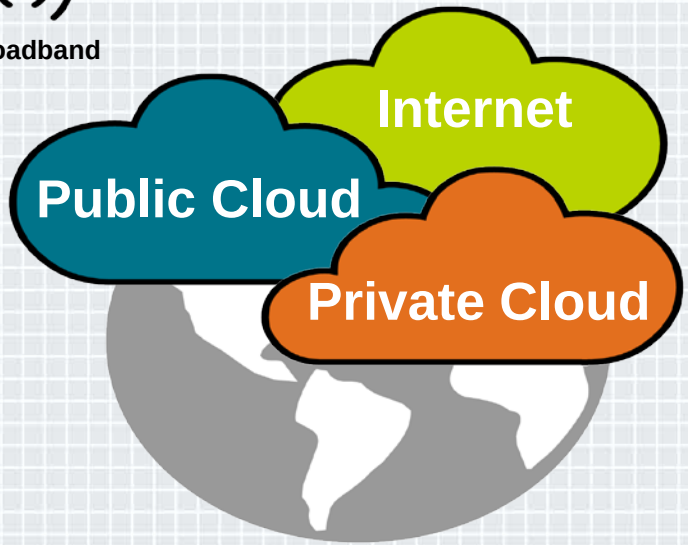
The Global Network is Your Business

Diverse end-points are accessing your network from anywhere.

Corporate Offices

Mobile

Broadband



A Global, Hybrid infrastructure

Your assets are distributed everywhere.

Content

SaaS

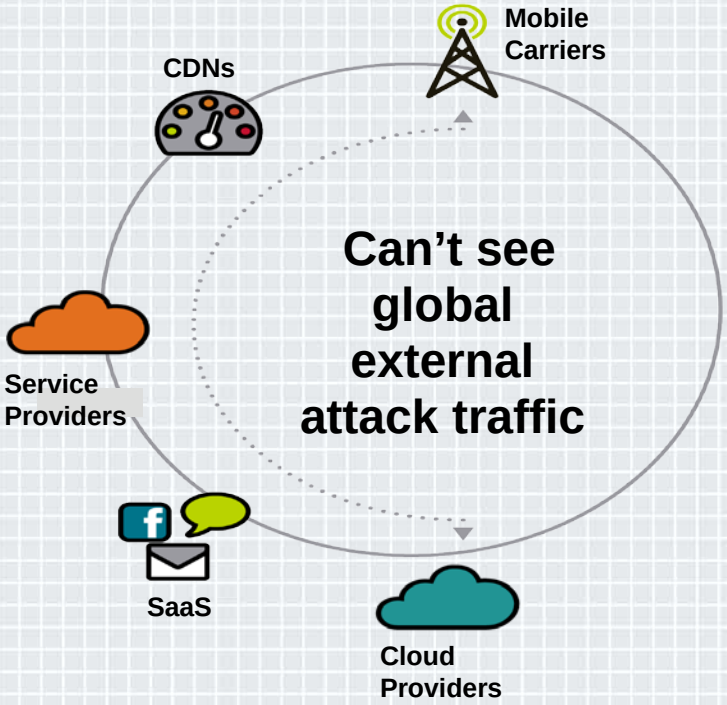
Corporate Servers & Applications

Network Perimeter Security

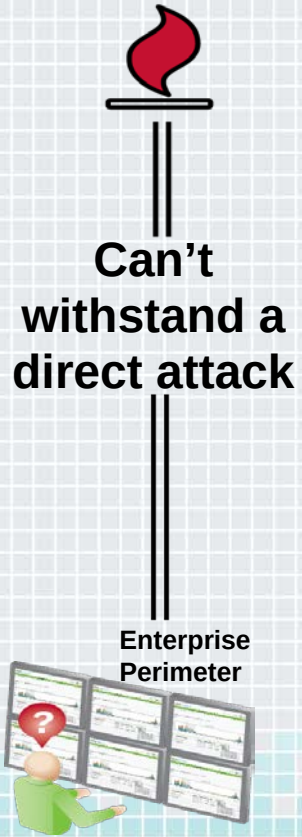
Problem Fueling $1Billion+ In Security Spend

#RSAC

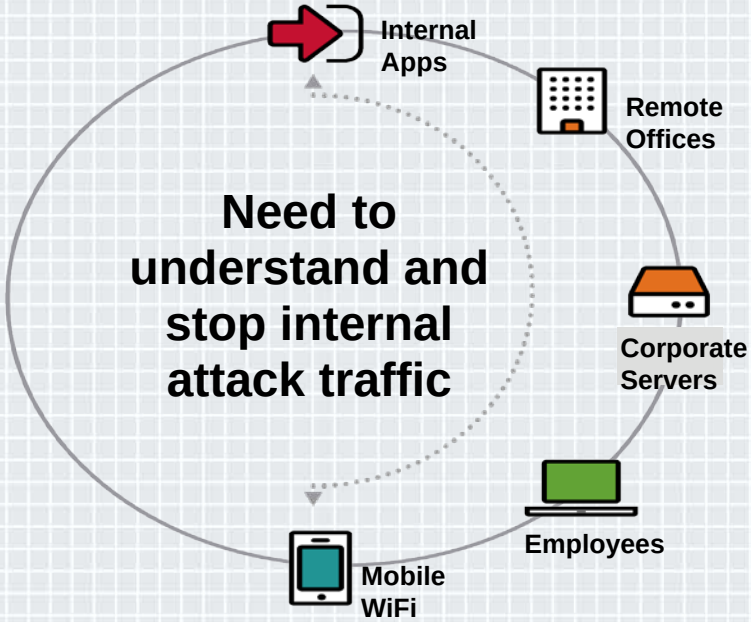
Global Traffic Visibility



Availability Protection



Internal Traffic Visibility



ARBOR NETWORKS

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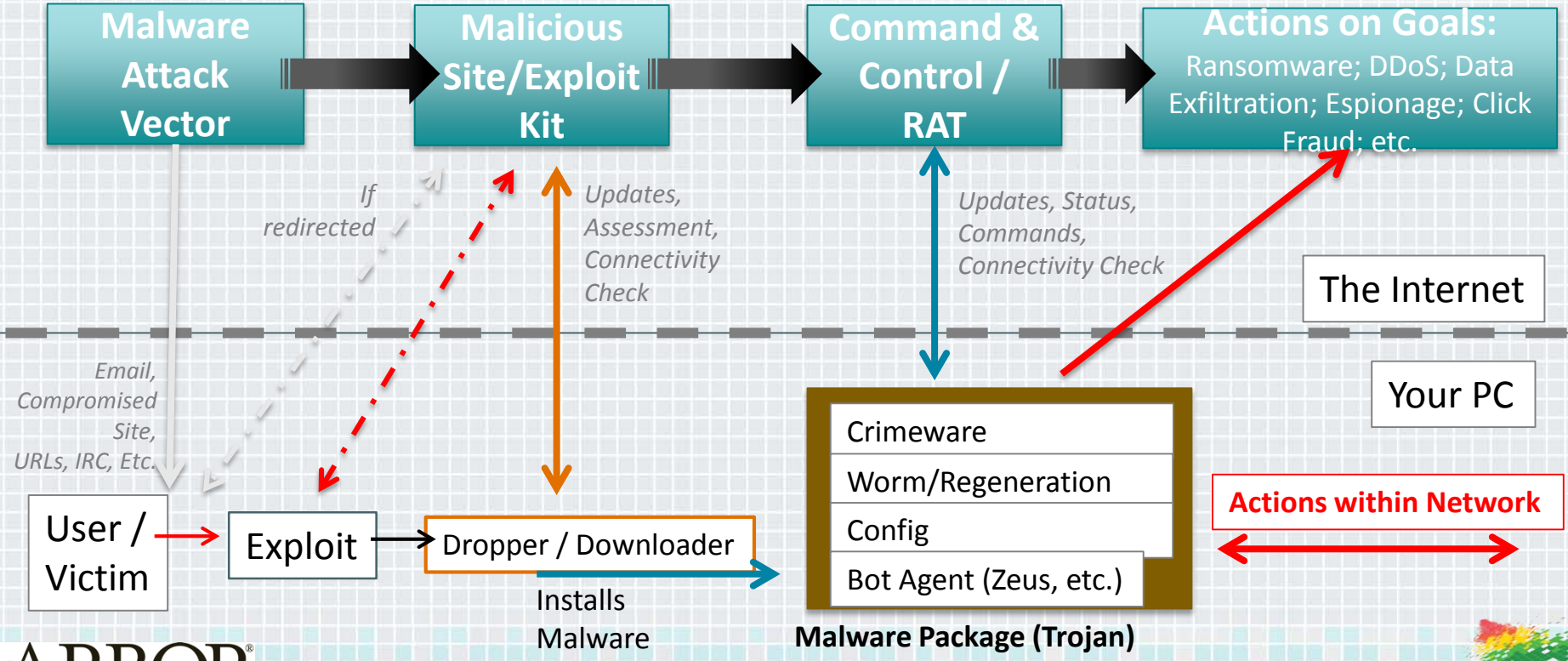
Malware Is An *Ecosystem*, Not Just a Sample or Simple Signature

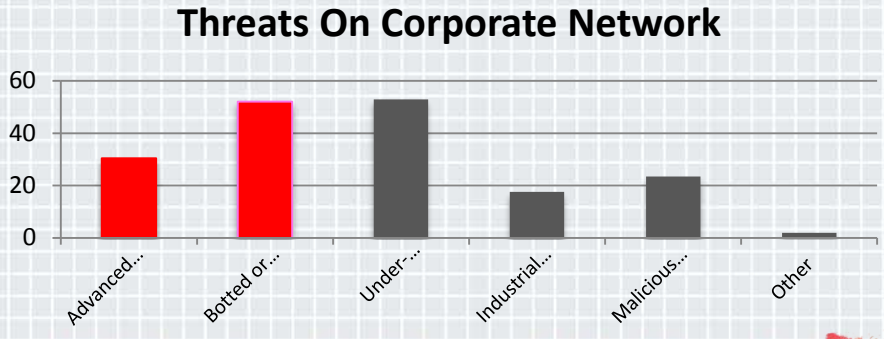


ARBOR NETWORKS

Source: Emerging Threats Pro

How are threats getting through?

- Huge number of ‘ways in’
  - Drive By Download
  - SPAM/Phishing
  - Watering Hole
  - USB
- Many threat vectors
  - New AND Old
  - IPS / AV Limited coverage
  - Patching lag
- Leverage vulnerabilities
  - Zero Day
  - Java, Adobe, etc.
  - Compound Documents



So, how do we get 'better' at this?

- **Actionable Threat Intelligence**
  - Use the expertise within vendors, integrators to maximize your effectiveness
- **Broad Visibility**
  - Monitor within your network, not just at the perimeter
- **Deep Visibility & Context**
  - Full packet capture and threat detection at key network locations
- **Improved Workflow**
  - Invest in solutions that fit into an Incident Response workflow and enable personnel and processes

Actionable Threat Intelligence

Threat intelligence is a top priority for 75% of firms

"Which of the following initiatives are likely to be your firm's/organization's top IT security priorities over the next 12 months?"

COMPUTER RCRIMES

U.S. DEPARTMENT OF HOMELAND SECURITY

RED SKY® ALLIANCE

ARBOR® NETWORKS

Broad Visibility - Flow

Leverage Flow technologies for

- Cost-effective, scalable visibility
- Layer 3/4 picture of internal network

Understand who talks to who, when and how much

- Develop a model of normal network / user behavior
- Build policy/visibility around user-identity

Correlate with ***actionable threat intelligence***

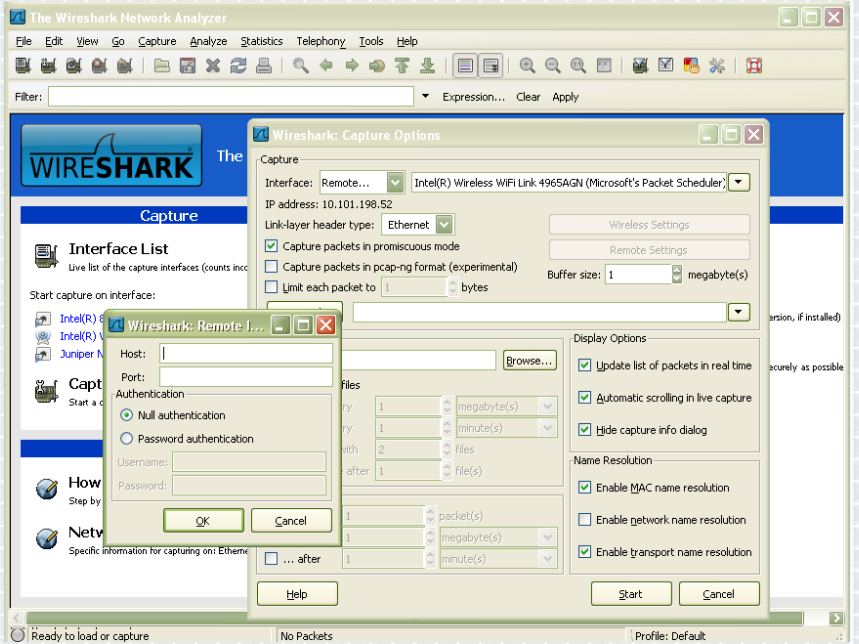
Detect suspicious or malicious activities wherever they occur

Deep Visibility & Context – Packet Capture

Use high-speed packet capture for deeper visibility

- Monitor for specific threats at network / data-centre edge(s)
- Full-fidelity storage of forensic data *for interactive, retrospective analysis*
- Investigate scope of compromise / kill chain

Correlate (continuously)



Improved Workflow

Put the power back in the hands of the analysts

- Network & Threat Visibility, *in context*
- Improve the Incident Response workflow
  - Make drastic improvements to Detection/Analysis
  - Enhance Containment, Eradication and Recovery timelines

Technology should **enable** personnel & process investment

- Regardless of how many you have or skillset

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What Now?

How to apply what you have learned

- Understanding
  - Identify Knowledge Gaps
  - Plan for the Future
  - Collaborate with Colleagues
- Continuous Development
  - Keep Asking Questions
  - Join a Network or Security Organization
  - Participate/Sponsor War Games

Questions?

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