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Top Cybersecurity Threats Facing Nonprofits

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- US Army Veteran
- MS Physical Chemistry
- Serial Tech Entrepreneur
- Personal Interests
  - Rock Climbing
  - Bicycle Touring
  - Information Science
    - Thermodynamics

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Information Security Expertise

- BPM CyberSecurity Assessment (CSAS) personnel ***are not*** experts at planning, building, or managing information security controls
  - We are not here to endorse or sell any solutions

- BPM CSAS personnel ***are*** experts at compromising information security controls
  - We are ethical hackers who've performed thousands of penetration tests

- This introductory presentation will provide an **ethical hacker's perspective** on the current cybersecurity threat landscape

Questions and comments are encouraged

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Overview of the Threat Landscape

Threat Sources

Hacktivists	Monkeywrenching	Digital Vigilante Justice • Anonymous • Islamic Jihad
Foreign Nation-State Sponsored Entities	Espionage Time Bombs Extortion / Reprisal, *e.g.* Sony	Physical Damage • 2008 - Stuxnet destroyed Iranian uranium enrichment centrifuges with malware that may have been delivered via USB key • 2014 - German Steel Mill blast furnace meltdown and "massive damage" due to malware delivered via phishing email
Criminal Profiteers	Identity Fraud Credit Fraud Tax Return Fraud Medical Fraud • Post-mortem Medicare • Elective Surgery • Prescription • Record Tampering	Cryptocurrency Mining Corporate Fraud • Extortion, *e.g.* Ransomware • Account Takeover • Purchase Order • Real Estate Escrow • Intellectual Property Theft • Insider Trading • ACH / Check Transactions
Employees, Vendors & Contractors	Untrained Negligent	Disgruntled Malicious

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Hacktivists

Republican Governors Association Targeted in Exchange Attacks

Breach Notification Report Reveals Some PII Could Have Been Exposed

Scott Ferguson (Ferguson_Writes) • September 16, 2021

Anonymous says it will release massive trove of secrets from far-right web host

Move follows hack inspired by Texas abortion ban.

Claire Goforth Tech Published Sep 14, 2021 Updated Sep 18, 2021, 9:43 am CDT

Politically motivated hacks often focus on releasing embarrassing information into the public domain

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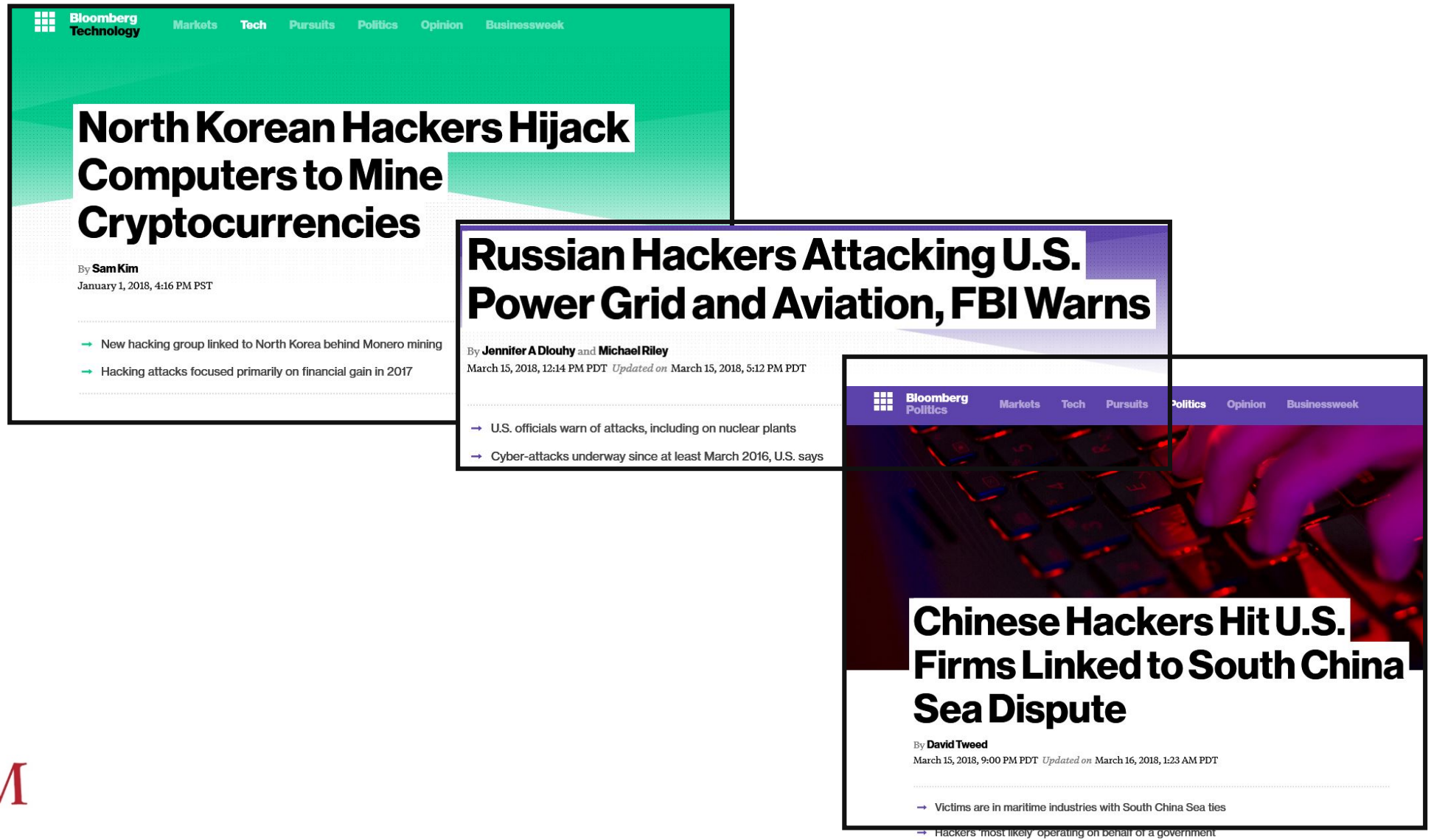
Nation State Threat Sources



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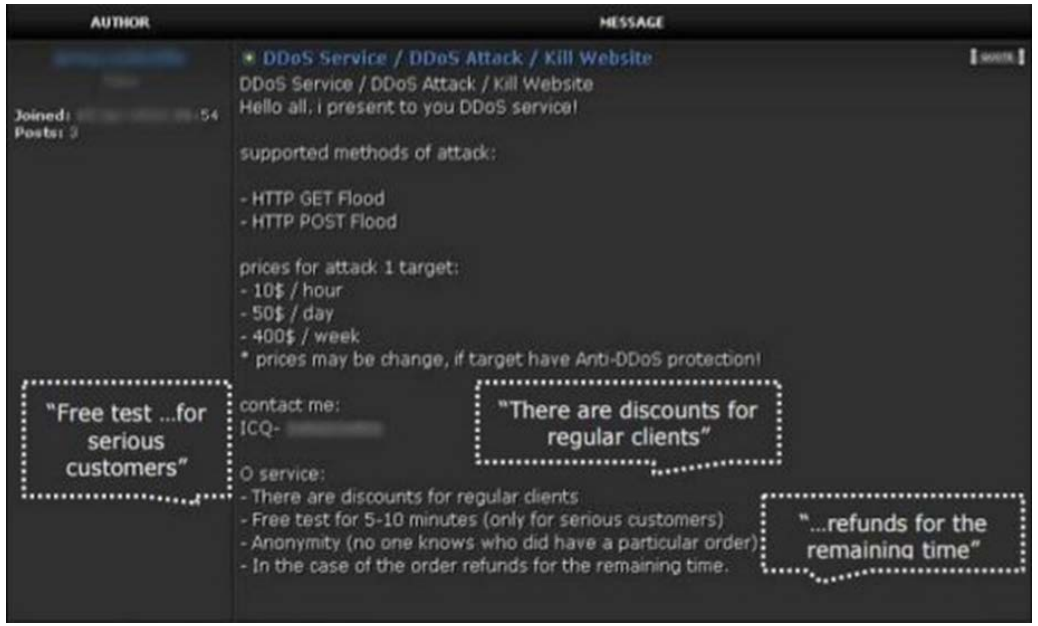
Cyber Crime Pays

Attack kits for sale on the dark web:
elite hacking skills not required



Negotiating with a dark web seller: note test options, repeat customer discounts & refunds for unused services

Hacked Instagram Accounts in Bulk	1,000 - 10,000 accounts $15 - $60
Botnet: Blow-Bot Banking Botnet	Monthly Basic Rental $750 | Monthly Full Rental $1,200 | Monthly Support $150
Disdain Exploit Kit	Day $80, Week $500, Month $1,400
Stegano Exploit Kit: Chrome , FireFox, Internet Explorer, Opera, Edge	Unlimited Traffic, Day $2,000 Unlimited Traffic, Month $15,000
Microsoft Office Exploit Builder	Lite exploit builder $650 Full Version $1,000
WordPress Exploit	$100
Password Stealer	$50
Android Malware Loader	$1,500
Western Union Hacking Bug For World Wide Transfer	$300
DDoS Attacks	Week long attack $500 - $1,200
ATM Skimmers: Wincor, Slimm, NCR, Diebold	$700 - $1,500
Hacking Tutorials	Multiple Tutorials $5 - $50

Cost of hacking tools and services on some underground cybercrime forums (Source: Armor)

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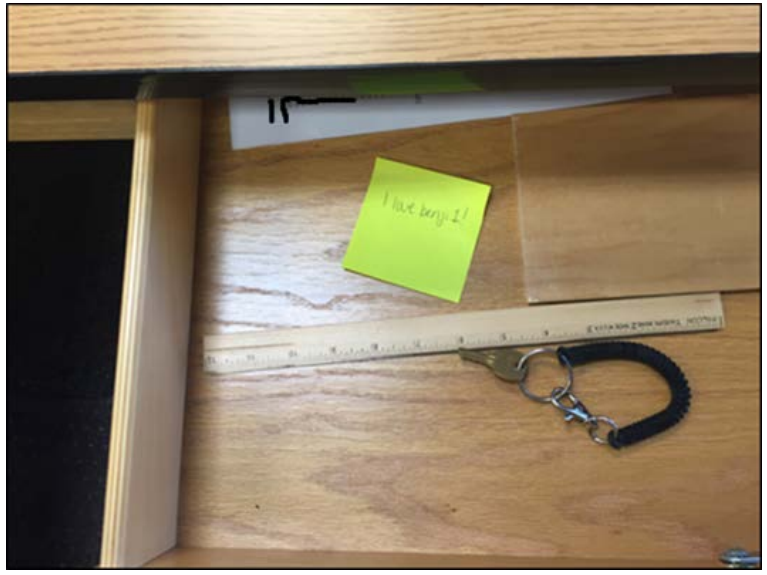
WARNING: Visit the Dark Web at Your Own Risk!

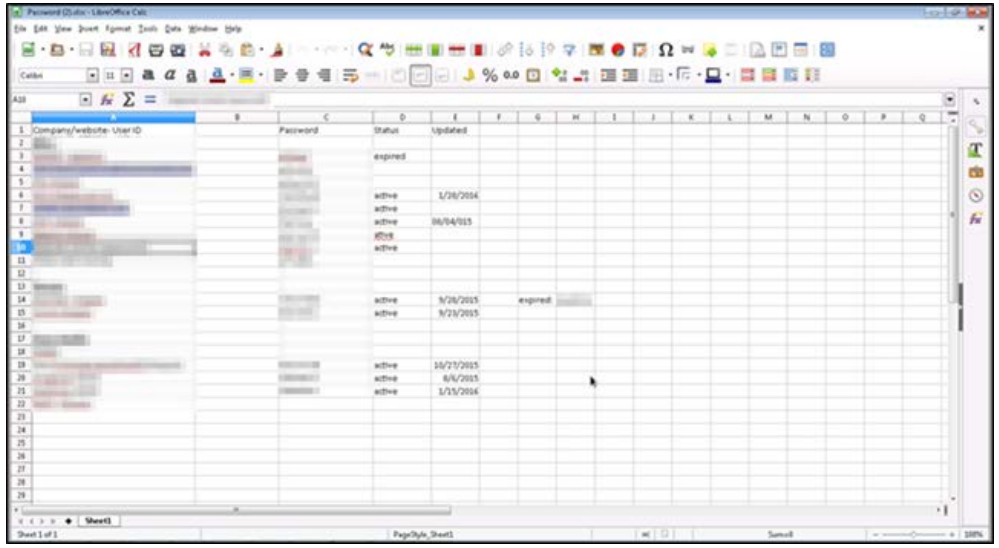
Malicious and/or Negligent Insiders

S.F. officials locked out of computer network

SAN FRANCISCO Engineer jailed after allegedly refusing to hand over password

By Jaxon Van Derbeken Published 4:00 am PDT, Tuesday, July 15, 2008





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Three Primary Attack Vectors

- Human

- Physical

- Technical

Alone *and* Combined

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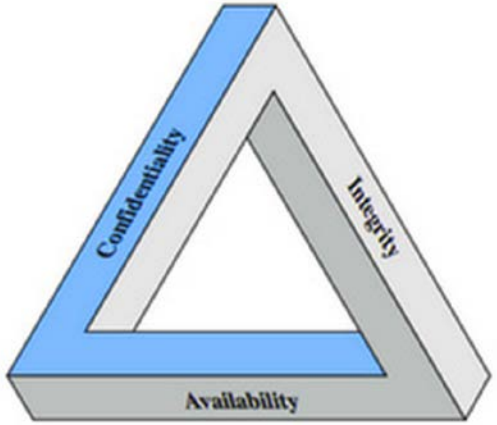
Infosec Concepts: Risk Assessment

Risk: A *measure* of the extent to which an organization is threatened by a potential circumstance or event (threat); a function of impact and likelihood

Risk = Likelihood * Impact



What is the likelihood of a threat agent exploiting a threat?

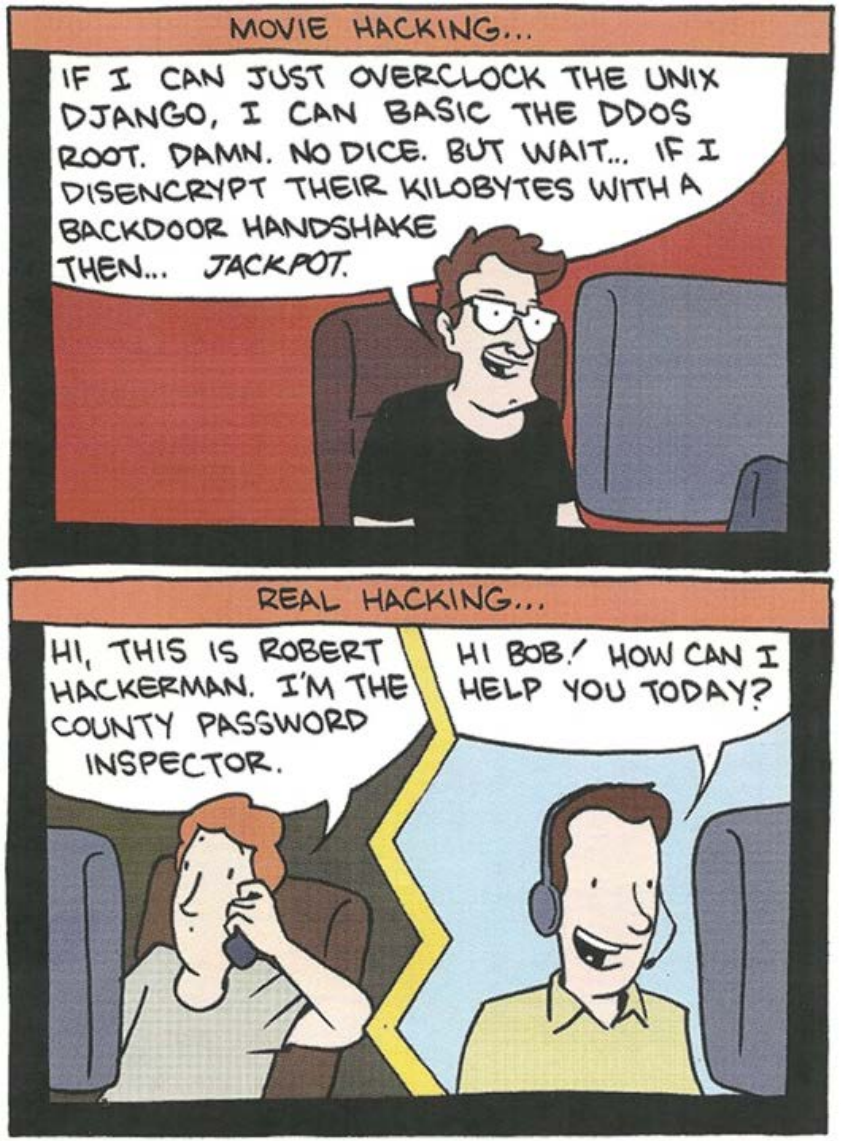
- High Likelihood: Facing the Internet, Technically easy to defeat
- Low Likelihood: Hidden within network, Technically challenging

What is the impact of a successful exploit?

- Low Impact: Inconvenience
- High Impact: Disruption of service, Disclosure of sensitive customer information, and/ or fraudulent transaction

See NIST Special Publication 800-30, Guide for Conducting Risk Assessments

Why Is Social Engineering So Likely To Succeed?



- Societies couldn't exist without an innate "assumption of truth"
- Human cognitive abilities generally decline when faced with unusual circumstances

Statistics suggest the average employee fails four social engineering attacks before becoming "inoculated"

Source:
Saturday Morning Breakfast Cereal
www.smbc-comics.com

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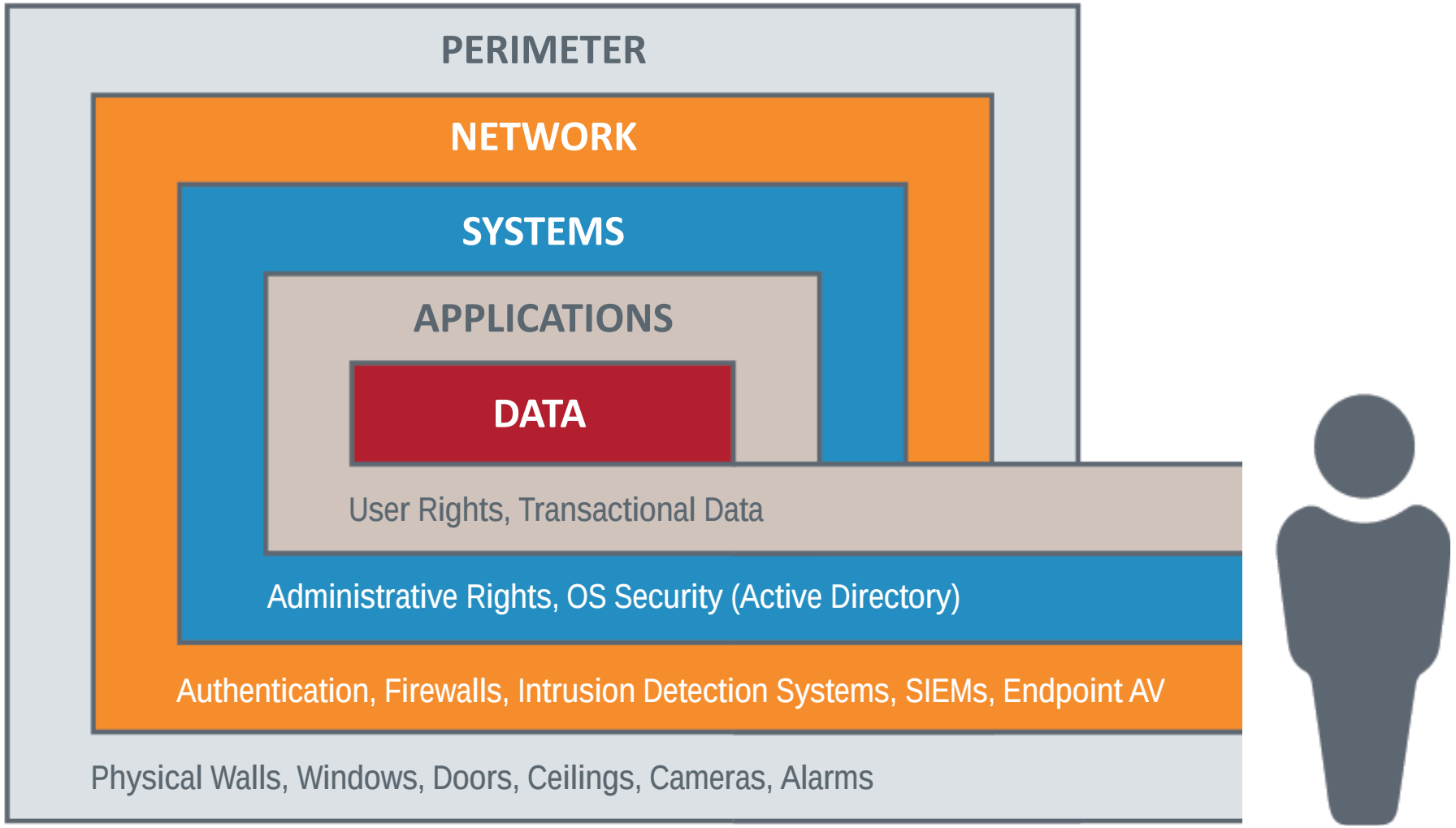
Why Is Social Engineering So High Impact?



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Worsening Threat Landscape

- Evolving Social Engineering Techniques
  - Headline Opportunism, *e.g.* Pandemic
- Releases of sophisticated, formerly secret hacker's tools into the public domain are rampant, and lead to common ransomware and related attacks
  - Equation Group
  - Hacking Team
- Boundaries are blurred between systems with different responsible parties
- The 'Internet of Things' continues to increase the Internet's attack surface area
- Newly documented vulnerabilities are being released at a dizzying rate
- Software vendor supply chain related vulnerabilities

Threat Scenario I: Payables Fraud – Fictitious Vendor Scenario

Payables Fraud - Fictitious Vendor Scenario

- Targets accounts payable personnel
  - Change of vendor payables address or bank routing
  - Urgent payment/expense
- Most commonly occurs via email…
  - Perform Prior Reconnaissance
    - ID target with accounts payable responsibilities
      - LinkedIn, Facebook, Instagram, etc.
    - Name dropping
  - Probe Email for Weaknesses
    - Address spoofing
    - Attachment and link controls
  - Attack
    - Groom
    - Pressure
    - & Close
- …or via phone

  same recon & attack modes as above, plus
  - Caller ID spoofing
  - Even Artificial Intelligence-aided voice “deep-fakes”

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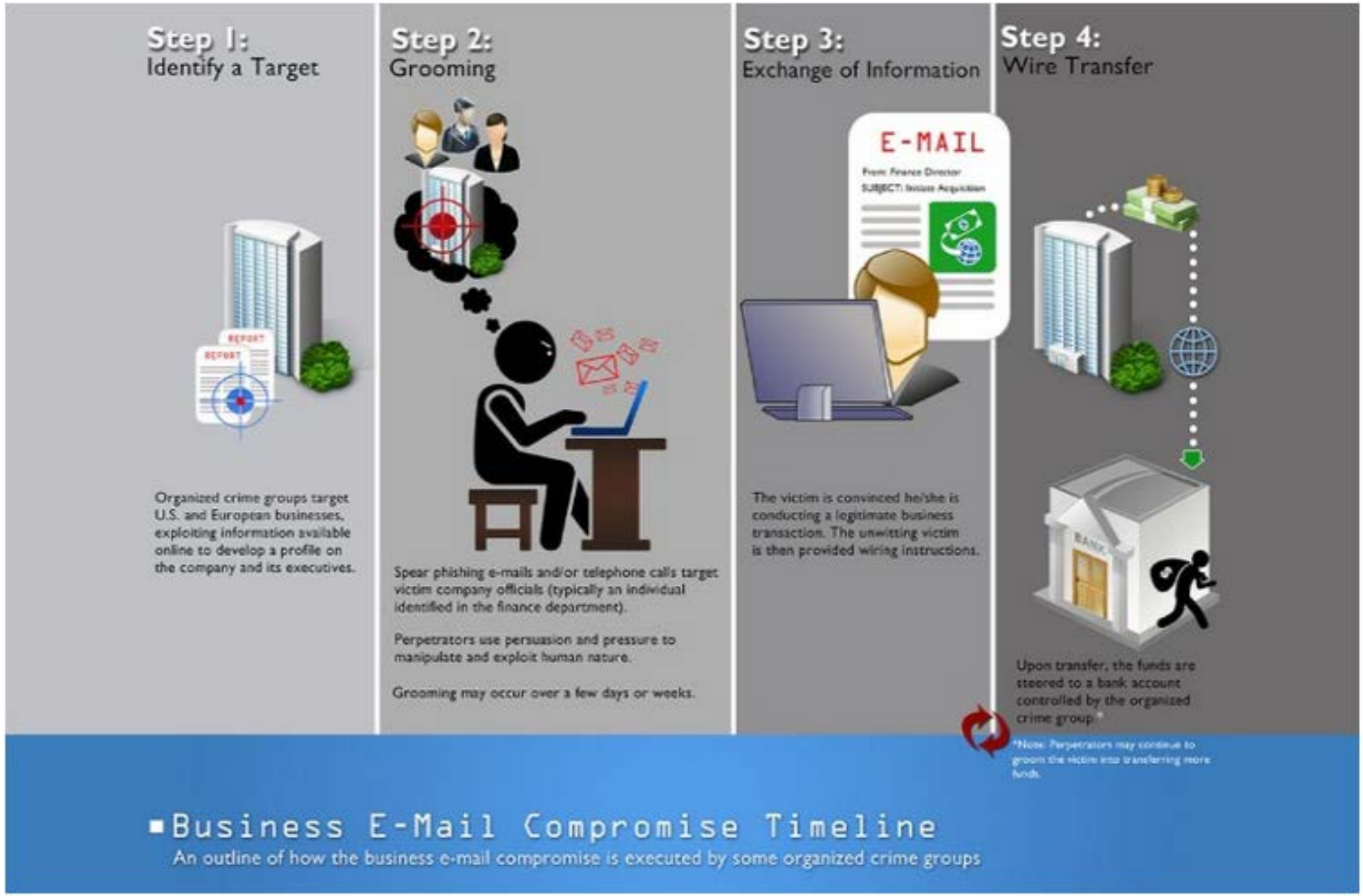


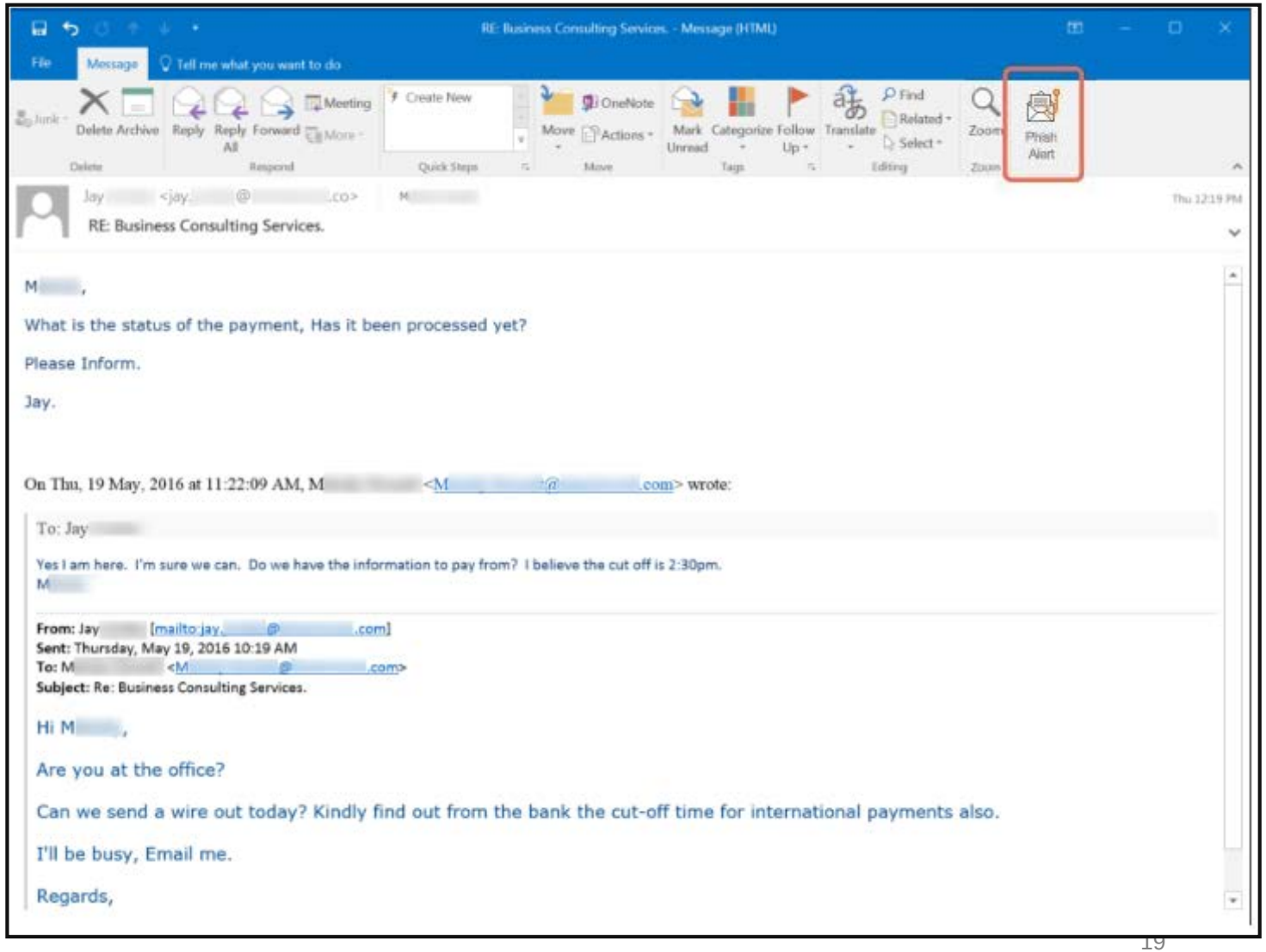
Business email compromise attack timeline (Image source: FBI)

CEO Impersonation email

Recent Fictitious Vendor breach investigation

-Over 20 emails were exchanged between attacker and victim

- -Reconnaissance & initial hack
  - -Learn all the players
    - -Target Accounts Payable employee
  - -Executive email account takeover
    - - via password breach
- -Grooming via
  - -email spoofing
  - -Executive impersonation
- -Flattery
  - -"we know we can rely on you…"
- -Persuasion
  - -"time is short"
- -Pressure & Close the deal!



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Email Technical Risk Management Controls

- Email Platform Configuration
  - Implement 2FA/MFA
  - Prohibit MX gateway bypass
  - Disable/restrict EWS access
  - Prohibit enumeration
- Inbound email Controls
  - Filter Attachments & URLs
    - Gateway
    - Email client
    - End point
  - Prohibit Spoofing
    - Valid domains & subdomains
    - Alternate domains
    - Invalid domains
  - Rate Limit
- Prohibit macros in document and spreadsheet files
- Outbound email
  - Data Loss Prevention

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Fictitious Vendor Email Risk Management

Train Users

- Always confirm sender - hit “reply” to see if return address matches (alleged) sender
- Do not open suspicious attachments
- Hover over links, and verify destination URL, before clicking
- Never enter credentials on a foreign site – without an explicit IT directive
  - Whenever in doubt, check with IT first!

Fictitious Vendor Phone Risk Management

Train Users

- Verify the purpose of the call
  - Have a prepared denial response
- Verify the phone number
  - Caller ID check via dial-back
- No payables changes should be executed or changed without internal (2nd party) approvals
  - Outbound call to known-good phone #

Threat Scenario II: Ransomware

Ransomware: A Cyber Pandemic

- Often delivered via email attachment/link
  - May lure users to malicious web destination
  - May include malicious attachment
- Sometimes performed via the phone
  - Lure users to malicious web destination
- Sometimes via app/code download sites
  - Masquerading as legitimate application or patch/update for legit app
- And also via document portals
  - Misc. file upload services
    - HR resumes
    - Other application portals
  - Box, Dropbox, et al

Ransomware: A Cyber Pandemic

- High-Profile Examples
  - CNA Insurance - Top 10 Insurance Firm
    - Fake Browser “update” delivered via legitimate site
    - Paid $40 million
  - Colonial Pipeline - Houston-NY petroleum transport
    - Paid $4.4million, but much of it returned by FBI
  - Accenture - Large professional services organization
    - Declined to pay
      - Sensitive client data stolen and posted
- Smaller organizations don’t make headlines

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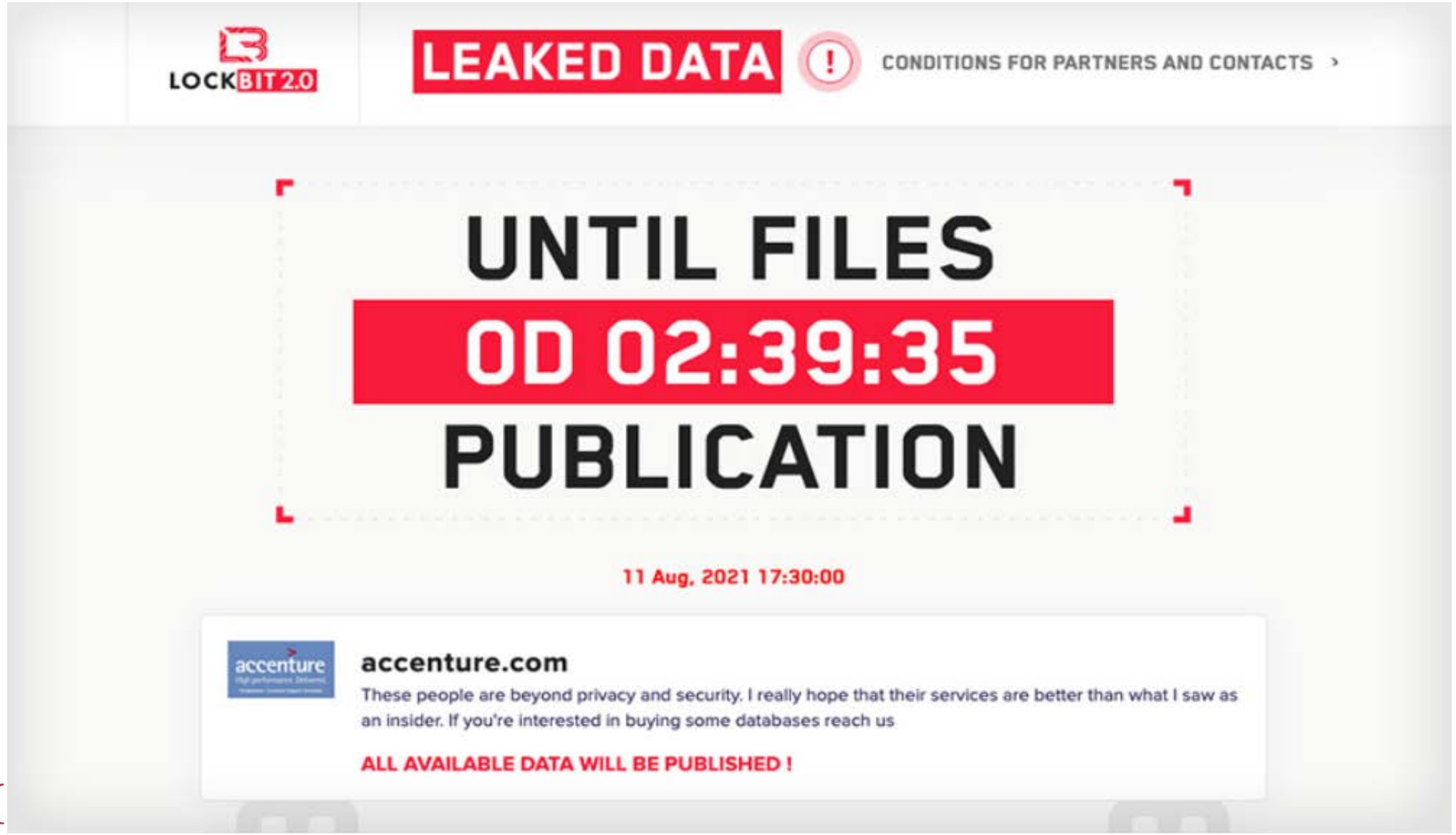
Ransomware: A Cyber Pandemic



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Prepare to Respond to Ransomware

Do they likely have our sensitive data?
How long can we afford to be down?
How quickly can we restore from bare metal?

- Fight
  - Removal Software
    - AVG, Trend Micro, BitDefender, Kaspersky, et al
  - Decryption Keys
    - FBI REvil key
    - Trustwave Blackbyte key
  - Offline Backups
    - Air-Gapped – physically disconnected from network after backup
    - Cloud/Hosted – logically disconnected, hardened authentication
- Pay
  - Have a cryptocurrency wallet set up
    - No guarantees
    - Legal gray area

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Configure A Breach Laptop

- Disconnected From Network
- System Administration Tools
  - System/Domain Administrator Privilege Levels
  - Wireshark
  - Microsoft SysInternals
- Password Database(s)
  - All critical systems and applications
- Backup/Restore Software
- Critical Application License Keys
- Key Contact Info
  - Internal staff
  - IT & security vendors
  - Legal counsel & law enforcement
- Ransomware Eradication Tools & Decryption Keys

Threat Scenario III:
Work From Home Exploits

Common Remote Work Vulnerabilities

- Increased organizational attack surface
- Consumer-grade network infrastructure
- BYOD equipment
- Local storage
- Physical security
- Email and chat to perform communications previously performed in person
- Web meetings
  - Increased third party dependencies, *e.g.* web conference apps
  - Insecure meeting information distribution
  - Insecure meeting credentials
- Distractions & social engineering
  - Work and personal computing intermingled
  - Work-from-home scripts
  - Pandemic scripts

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A Few Telework Security Controls

- Understand & enforce your organization's telework policies & procedures
- Control authentication
  - Dual-factor
  - Use long, difficult to guess passwords
  - Encrypt credential storage
- Ensure smart home devices, *e.g.* virtual assistants, smart TVs, *etc.*, are not activated when discussing sensitive information
  - "Texas" & "Lexus" sound a lot like "Alexa"
  - "Seriously" sounds a lot like "Siri"
- Enhance endpoint protections
  - Anti-virus/anti-malware
  - Browser controls, *e.g.* script prohibitions
- Issue organization-owned hardware
  - Encrypt all end-user hard drives
    - Turn computers off evenings/weekends
  - Lock (Win + L) computers when taking a break
- Secure web meetings
  - Passphrases
  - Waiting rooms
  - Don't email all meeting information, use out-of-band method (text, call, or chat) to deliver meeting information
- Make sure home networks are configured securely
  - Change default passwords on ISP routers/modems, and patch them
  - Make sure home WiFi is not using WEP or WPA1/WPA2 – use WPA3
- Use a VPN/Cloud applications for communications with office systems
  - Secure logins with multi-factor authentication
  - Single Sign-On improves convenience

A Few Mobile Device Security Safeguards

- Be an aware mobile device user
  - Practice safe application storefront protocols
  - Be cognizant of QR code dangers
  - Inspect all links before clicking
  - Consider banning mobile phones from sensitive conversations
    - Use a specialized camera/mic cover
- Limit mobile device malware attacks
  - Keep O/S & browser current via updates/patches
  - Anti-virus/malware
- Apply the concept of “Least Privilege”
  - Does your phone need to do everything your laptop does?
- Apply session controls
  - Logout when done
- Apply the concept of “Least Functionality” to mobile devices
  - Turn off location services, bluetooth, personal hotspot, & WiFi when not in use
  - Do not use public WiFi if not fully trusted (stick to the LTE network, when feasible)

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Threat Scenario IV: Vendor Supply-Chain Exploits

Many Breaches That Make Headlines

Occur after the system or application already exists via one, or a combination of, the following techniques:

- Social Engineering
  - Use email, text, chat, phone, snail mail, and/or in-person interactions to get employees to do and/or reveal things they shouldn't
- Credential Compromise
  - Find, intercept, guess, crack, bypass, spoof, and/or request credentials
- Patch Exploit
  - Exploit vulnerabilities on systems missing critical patches
- Misconfiguration Breach
  - Take advantage of weak configurations, often vendor default configurations
- Boundary Incursion
  - Trespass across interconnected system boundaries, typically from a less-secure system to a more-secure one
- Code Logic Abuse
  - Direct information gathering, session hijacking, scripting, injection, and/or privilege escalation attacks against application logic

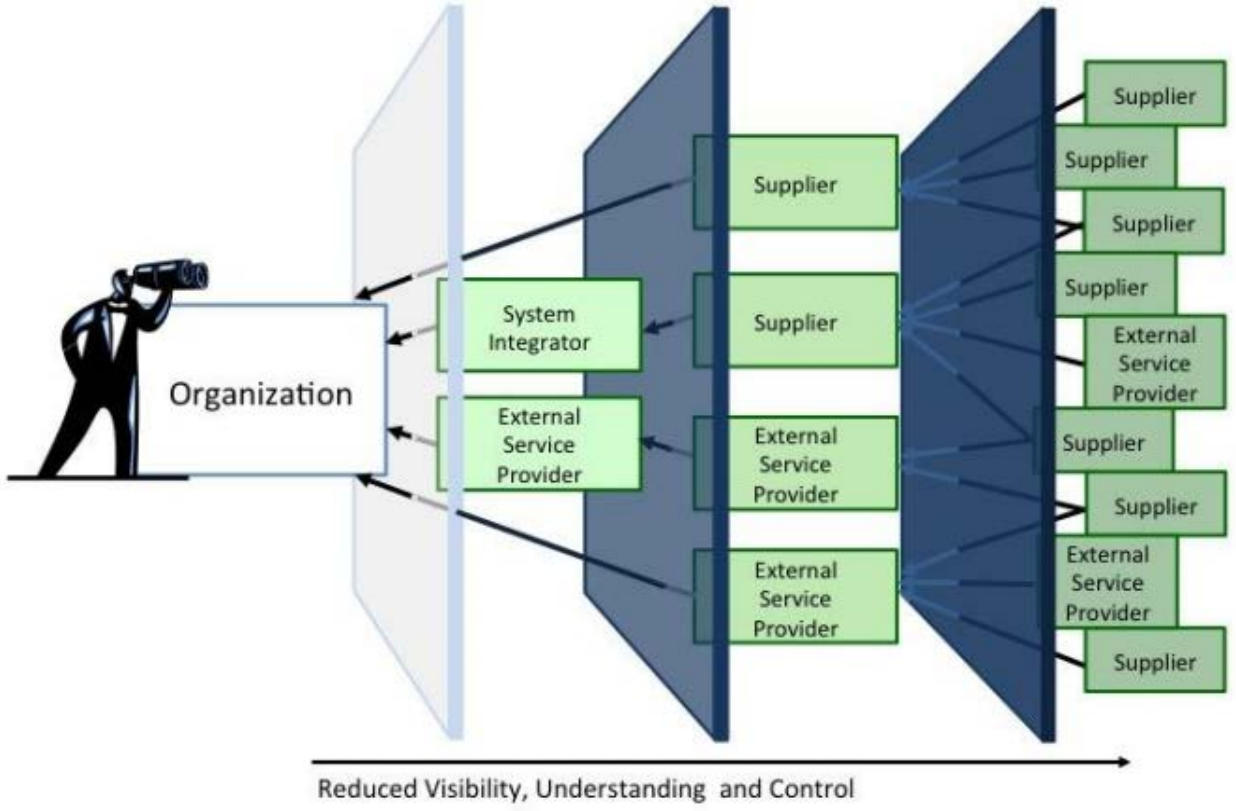
What makes The SolarWinds Breach Different?

Occurred during the application development phase

- One of the a growing number of compromises that occurred during the development lifecycle
  - The affected code was part of a trusted, digitally signed piece of commercial software
- SolarWinds software is an industry-leading suite of network management applications
  - Operates at an elevated privilege level
  - Estimated to have been deployed to over 18,000 businesses and federal agencies
- The SUNBURST “Trojan” did not interfere with normal application functionality
  - It tested its environment first, to make sure the application was actually deployed on an enterprise network
  - Code strings were purposely obfuscated & communications traffic was designed to mimic expected traffic patterns
  - Backdoor connectivity provided attackers with “hands-on-keyboard” remote access
- SUNBURST likely has been in production since March 2020
  - Consider the impact of, and recovery process for, a system compromise that’s was ongoing for 9 months!
- There is significant risk that other industry-leading software development firms have suffered similar development cycle compromises
  - We probably know this Trojan exists today, and many details of how it operates, only because the attackers targeted a security research firm
  - There is some evidence suggesting SolarWinds used popular software development tools that may have played a role in the breach

Securing the Unknown

We face an ever-increasing reliance on complex pieces of software that cannot be fully validated



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Source: **Supply Chain Risk Management Practices for Federal Information Systems and Organizations**
https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-161.pdf

Supply Chain/Vendor Risk Management

- Assume Confidentiality, Integrity, and Availability (CIA) are your problem
  - It’s your organization, but you’re just one more client to the vendor
- Periodically demand evidence of due care and due diligence
  - Hosting/Cloud Provider Certifications
    - Current SOC II/Type II for hosting, application, & cloud vendors
  - Evidence of Insurance
  - Evidence of Testing

Does the vendor exhibit a culture of cybersecurity?

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Pre-Purchase Vendor Due Diligence

- Disclosure of ***All*** Development Supply Chain Risks
  - What portions, if any, of the design and development process was/is outsourced?
    - What controls does the vendor have in place to manage their 3rd-party outsourcing risk?
    - What controls are in place to secure access to source code repositories?
    - Have any elements of the code base been re-used from code-sharing resources?
- Disclosure of ***All*** Support and Patch/Update Requirements
  - How is remote access for support handled?
  - How is patching/updating/change management handled?
  - What ports are listening for remote support & patching?
    - Can handshake attempts be restricted?
      - By source IP address, certificate, MAC address, etc.
- Disclosure of ***All*** Communications Protocols
  - What type (by protocol) and volume of internal traffic is expected?
  - What inbound/outbound ports will be used?
    - Can communications be restricted by source address, certificate, MAC address, etc.?
    - How much traffic is expected over these ports?
- Disclosure of ***All*** Required Accounts
  - What are all the accounts, e.g. user, admin, supervisor, etc.?
  - Are there any undocumented accounts?
  - What are the privilege levels for all the different accounts?

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Pre-Purchase Vendor Due Diligence, cont.

- Disclosure of ***All*** Encryption Controls
  - Are all data encrypted in transit?
    - Any unsigned or misconfigured certs?
    - Any weak ciphers or hashing algorithms?
  - Are all sensitive data encrypted at rest, considering Hypervisor, Container, OS, DB, & File levels?
    - Database data?
    - Backup files?
    - Credentials in process memory, e.g. RAM?
    - Windows registry, e.g LSA Secrets?
    - Session keys?
    - Are passwords hard-coded into the application?
    - Configuration files, e.g. .config, .ini, etc.?
    - Log files?
- Disclosure of ***All*** Access Controls
  - What are minimum password requirements and are they configurable?
  - Is Multi-factor Authentication supported?
  - Is Single Sign-On supported?
- Disclosure of ***All*** Integrity Controls
  - Is SMB signing supported?
  - Is LDAP signing supported?
  - Does the development process implement code signing?
- Permission to Include the Vendor's System in the Organization's Testing Regimen?
  - Or demand evidence of the vendor's ongoing test regimen

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Additional Risk Management Guidance

Transferring Risk & Cyber Liability Insurance

- What Systems Are Covered?
  - Mobile devices?
  - Vendor owned/managed systems?
  - Contractor hosts?
  - Cloud systems and applications?
  - Biomedical & Industrial Control systems?
- Are There Exceptions to Coverage Related to Inadequate Due Diligence/Due Care?
  - Inadequate vendor management?
  - Inadequate patch & configuration management?
  - Inadequate risk assessment/penetration test program?
  - Inadequate program documentation?
  - Inadequate employee awareness & board/executive governance training?
- What Constitutes a Covered Data Security Breach?
  - Is a social engineering attack covered?
  - Is a ransomware attack covered?
  - Is a physical attack covered?
  - Is an inadvertent PII disclosure covered?
  - Is a state-sponsored act covered?
  - Is a prior act covered?
  - Are losses outside the breach event covered, e.g. client-led class-action suit?
- What Will the Policy Pay For?
  - Business interruption costs?
  - Reputation loss costs?
  - Legal fees?
  - Regulatory claims & fines?
  - Forensics & recovery costs?
- Are There Any Overlapping Provisions, *e.g.* business interruption also covered by property policy?
- Be Brutally Honest Filling Out the Application/Questionnaire
  - Your claim may be denied for a fraudulent application

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Safe Computing Tools & Techniques

Password Management

- Use strong passwords
  - Length is the most important criterion for a strong password
  - It must also be difficult to guess
- Store them in password vault applications
  - KeePass, RoboForm, etc.
  - Or at least password protect that Excel file you're using…☺
- Put up with the hassle of multi-factor authentication
  - Google Authenticator, Duo, RSA, etc.

Email

- Don't use email for sensitive information!
  - Many message/chat platforms use end-to-end encryption
  - Password protect attachments
  - Sanitize the contents of your inbox, sent, trash, etc.
  - Use inbound mail filter tools to pre-examine attachments and links
    - For personal email, see apps like Hushmail
- If you must use email for sensitive data, use encryption tools
  - GPG
  - Zixmail

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Safe Computing Tools & Techniques

Browsing

- Before logging in, confirm the word immediately preceding the .com, .org, .net, etc. and the .com itself

  https://www.**chase**.com vs. https://www.**chase.bank**.com

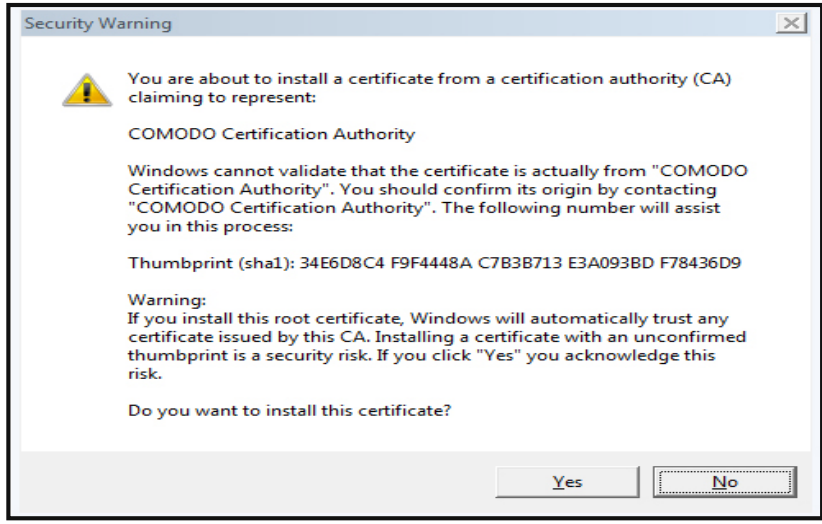
  https://www.chase.**com** vs. https://www.chase.**net**

- Logout when you're done

- Secure your browser settings, *e.g.*
  - Firefox with
    - No-Script (prohibits a startling number of scripts running in the background)
    - Privacy Badger (restricts ads, cookies, tracking)
    - Foxy Proxy (hides your point of origin)

- Limit sharing & post anonymously, whenever possible
  - Yelp & Google Review Scams

- Be suspicious of all popups & dialog boxes



A common online banking attack toolkit asks the user to install a malicious root certificate

Social Engineering Warning Signs

- Requests anything out-of-the-ordinary
  - Offer to help with problem you didn't know you had
  - Offer that sounds too good to be true
- Name-drops, claims of authority, or urgency
  - Cavalier or superior attitude
- Compliments, flatters, or flirts
- Promises reward or threats for non-compliance
- Refuses, or gets uncomfortable, when asked to provide supporting information
  - Government-issued ID (never trust a business card)
  - Callback # (never trust CallerID)

Review of Social Engineering Defenses

- Establish a Culture of Cybersecurity
  - Security starts at the top, but it is everyone's job
  - Test, train, repeat
- Telephone Attacks
  - Train live receptionists to recognize suspicious and repeat calls
  - Verify purpose of the call and permission to disclose
    - Have a prepared response
  - Verify the phone number
    - Caller ID check via dial-back
  - No sensitive information should be disclosed
    - Learn what is sensitive information and where it resides
- Email Attacks
  - Always confirm sender - hit "reply" to see if return address matches (alleged) sender
  - Never enter credentials on an unrecognized URL - without an explicit IT directive
  - Do not open suspicious attachments – have IT examine them first
  - Hover over links, and verify destination URL, before clicking – do not click on unrecognized URLs
- Onsite Attacks
  - Challenge unknown persons politely, or report them!
    - Collect business card - inquire purpose of visit
    - Check driver's license as positive photo ID
    - Verify purpose and scope of visit with appropriate managers
    - Log visit
    - Escort visitors at all times

Parting Shot:
Everyone Is the Security Officer

- Follow secure practices
  - Passwords
  - Email
  - Browser
  - Remote Access
  - etc.
- Make Cybersecurity part of the conversation
- Thank employees, customers, and business associates for putting up the inconvenience of Infosec safeguards and remind them we're all in this together

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Conclusions

- The cybersecurity threat landscape is worsening
  - Threat sources include hacktivists, cyber criminals, nation-state sponsored entities, and insiders
  - Hackers employ a combination of human, physical, and technological attacks
    - Many current and evolving threat scenarios involve social engineering and/or sophisticated technical supply chain attacks
  - Effective Risk Management requires awareness and strong controls – balanced against convenience and user satisfaction

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Thank You!