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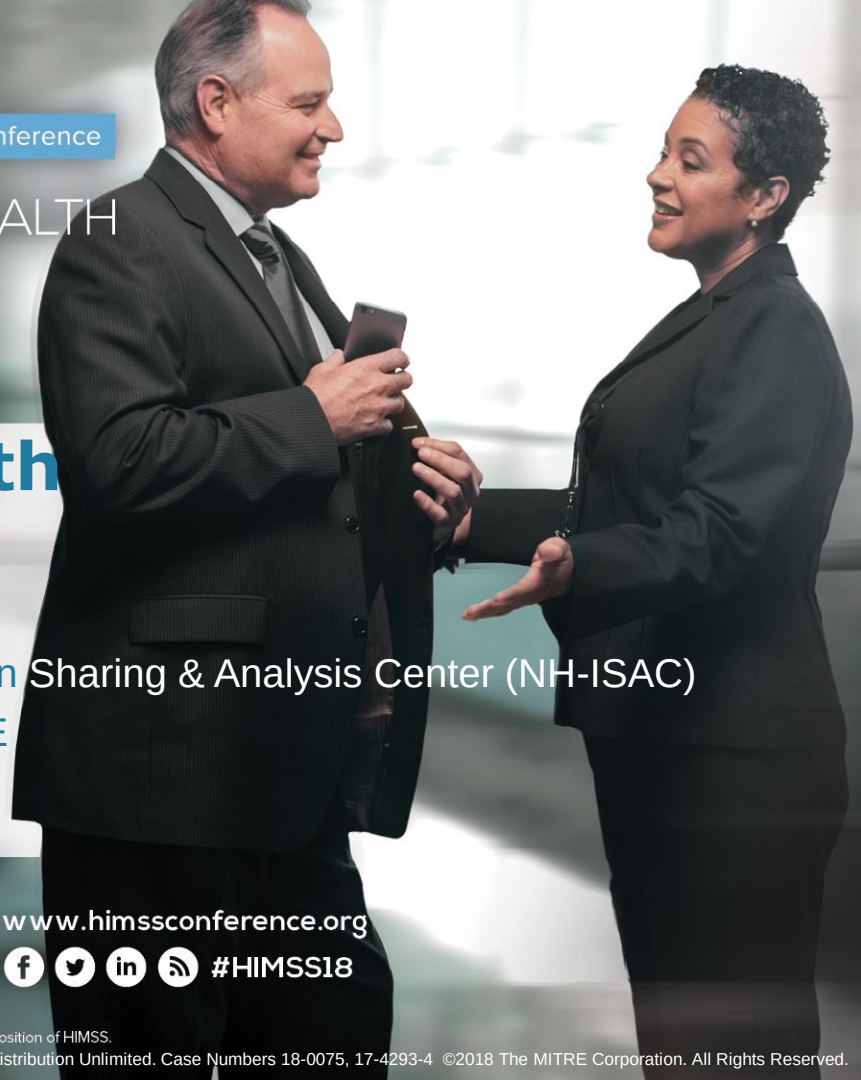
# Detecting Cyber Threats with ATT&CK™ Based Analytics

Session 123, March 7, 2018

Denise Anderson, President, National Health Information Sharing & Analysis Center (NH-ISAC)

Julie Connolly, Principal Cybersecurity Engineer, MITRE



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# Conflict of Interest

Denise Anderson, M.B.A.

Julie Connolly, B.S., CISSP

Have no real or apparent conflicts of interest to report.





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# Agenda

- The Threat Landscape
- Adversarial Tactics, Techniques, & Common Knowledge (ATT&CK™) family of models
- Using ATT&CK™
- Collaborative ATT&CK™ Analytics Development Effort




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# Learning Objectives

- Explain the Adversarial Tactics, Techniques, & Common Knowledge (ATT&CK™) for Enterprise framework, as well as the broader family of ATT&CK™ models, for characterizing post-compromise adversary behavior
- Describe how to use the ATT&CK™ family of models and the Cyber Analytics Repository (CAR) knowledge base to help identify and mitigate adversary behavior on an enterprise network
- Characterize the collaborative effort for developing ATT&CK™ - based analytics to detect post-compromise cyber attackers on healthcare systems and networks


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# Remember This?

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# Threat Landscape

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# Threat Actors

Nation State

Hactivist

Insiders/ Third Party Providers

Media/Vendors

Terrorists

Criminal





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# Motivation

- Advantage: IP Theft, Infiltration – create future vulnerabilities, Data Theft, Political Blackmail;
- Ego: Prowess, Revenge, Notoriety;
- Ideology: Religious, Cultural, Social, Political
- Greed: Money/Power

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# Motivation

Advantage/Greed

Ideology/Ego

Ideology/Ego

Greed

Ideology/Greed

Greed



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# Vectors



- Botnets: Phishing, Spearphishing
- Viruses, Worms
- Rootkits, Remote Access
- Ransomware
- Wipers
- Trojans
- DDoS
- Vulnerability Scanning, Exploit Kits – Zero Day
- Drive By Downloads, Watering Holes
- Browser exploits
- Point of Sale Malware
- Mobile
- Control Systems

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# Vectors - Actions



- Remote Access (Infiltration/resource)
- Resource Harvesting (Criminal - Bots)
- Extortion (Criminals)
- Credential Harvesting (Criminals)
- Data Exfiltration (Criminals, Nation State)
- Because it's there (Hacktivist/Terrorist - Defacement, Make Statement, Embarrass)
- Escalate Privilege (Nation State - Infiltration, Criminal)
- Geopolitical Fallout (Nation State – WannaCry, Petya)

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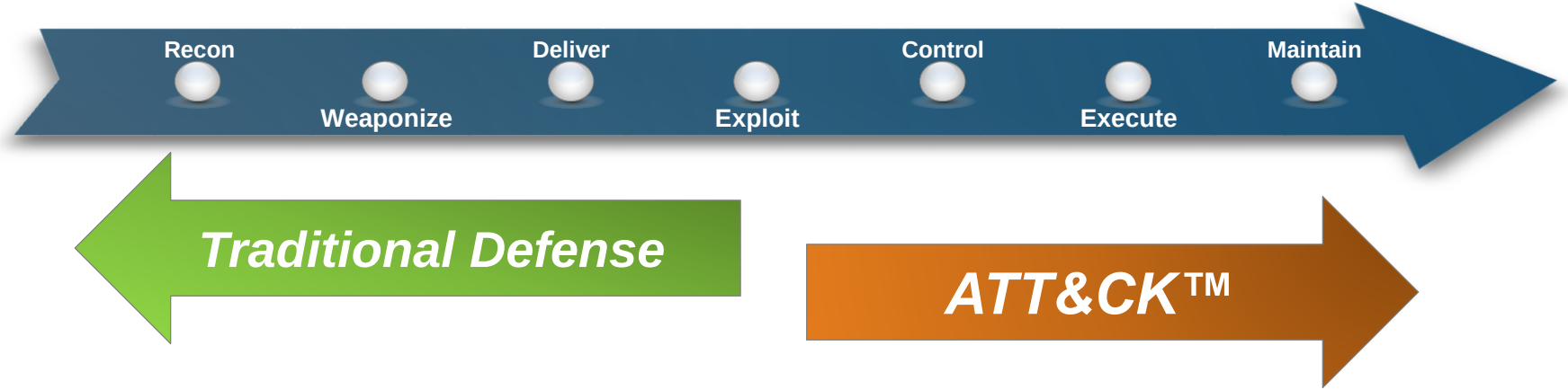
# The Cyber Attack Lifecycle: Where are we looking?






**99 days - The median time an adversary is in a network before being detected**

**-Mandiant, M-Trends 2017**

Cyber Attack Lifecycle: The MITRE Corporation https://www.mitre.org/capabilities/cybersecurity/threat-based-defense



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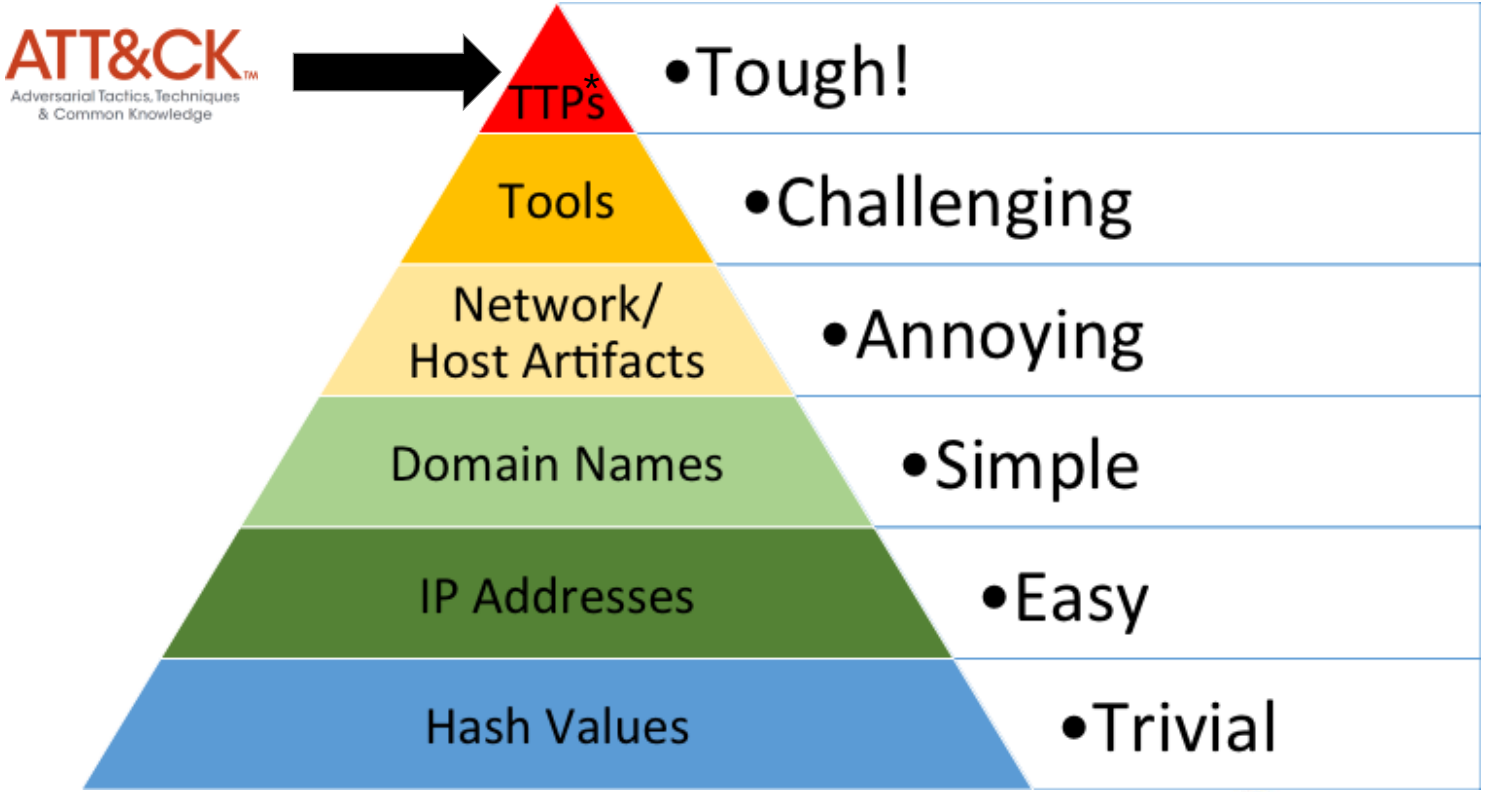
# Bianco's Pyramid of Pain






*TTPs= Tactics Techniques & Procedures



Source: David J. Bianco: http://detect-respond.blogspot.com/2013/03/the-pyramid-of-pain.html

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# Hard Questions



- How do I implement TTP-based detection?
- How effective is my defense?
- What is my detection coverage against APT29?
- Is the data I'm collecting useful?
- Do I have overlapping sensor coverage?
- Is the new product from vendor XYZ of any benefit to my organization?



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# Adversarial Tactics, Techniques & Common Knowledge (ATT&CK™)

ATT&CK™

ATT&CK™ is a MITRE-developed, globally-accessible knowledge base of adversary tactics and techniques based on real-world observations of adversaries' operations against computer networks.

attack.mitre.org



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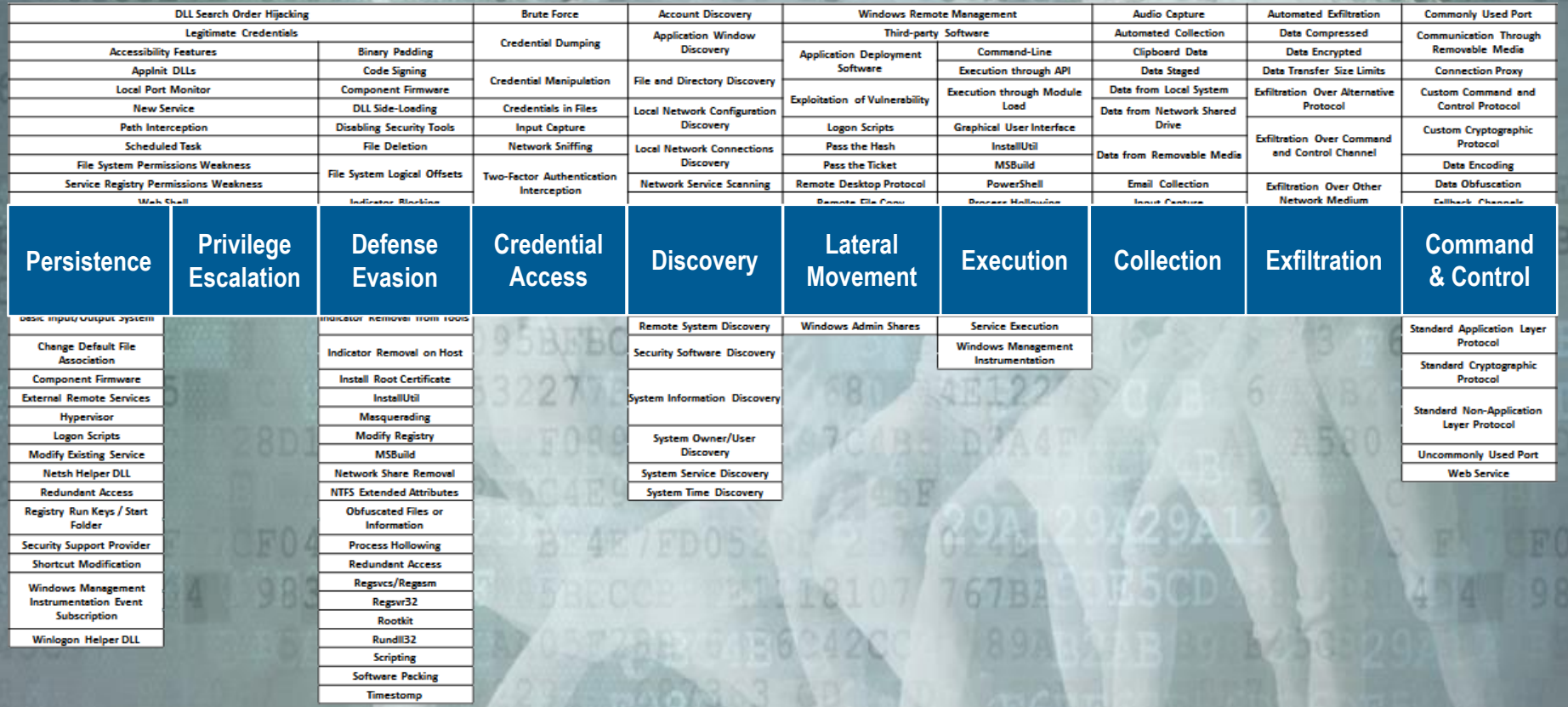


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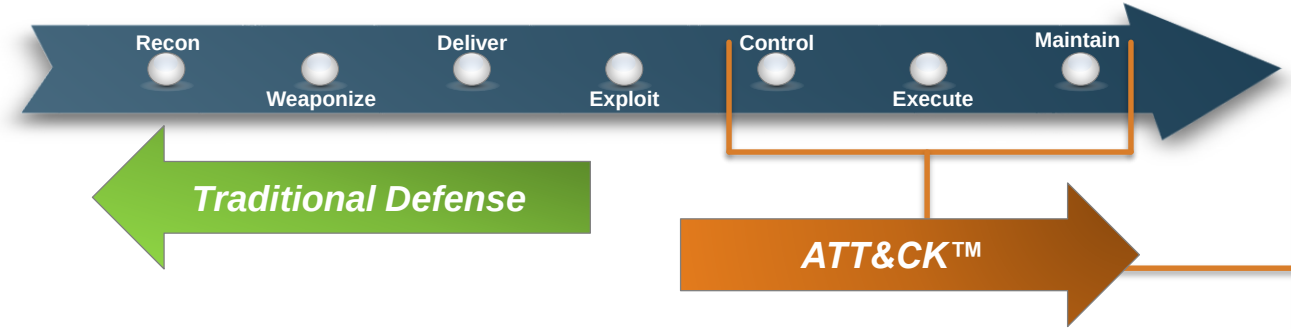
# Breaking Apart the ATT&CK™ Model






**Adversary Tactics**

- Persistence
- Privilege Escalation
- Defense Evasion
- Credential Access
- Discovery
- Lateral Movement
- Execution
- Collection
- Exfiltration
- Command and Control

## *What's in ATT&CK?*

- ***Tactics*** **– High level, time-agnostic adversary tactical goals**
- ***Techniques*** **– Methods that adversaries use to achieve tactical goals**
- ***Groups*** **– Threat actors, including techniques and software they use**
- ***Software*** **– Built-in utilities and custom malware, linked to techniques**

Full framework at attack.mitre.org



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# The ATT&CK™ Model



| Persistence | Privilege Escalation | Defense Evasion | Credential Access | Discovery | Lateral Movement | Execution | Collection | Exfiltration | Command and Control |
|---|---|---|---|---|---|---|---|---|---|
| DLL Search Order Hijacking | | | Brute Force | Account Discovery | Windows Remote Management | | Audio Capture | Automated Exfiltration | Commonly Used Port |
| Legitimate Credentials | | | Credential Dumping | Application Window Discovery | Third-party Software | | Automated Collection | Data Compressed | Communication Through Removable Media |
| Accessibility Features | | Binary Padding | | | Application Deployment Software | Command-Line | Clipboard Data | Data Encrypted | |
| AppInit DLLs | | Code Signing | Credential Manipulation | File and Directory Discovery | | Execution through API | Data Staged | Data Transfer Size Limits | Connection Proxy |
| Local Port Monitor | | Component Firmware | | | Exploitation of Vulnerability | Execution through Module Load | Data from Local System | Exfiltration Over Alternative Protocol | Custom Command and Control Protocol |
| New Service | | DLL Side-Loading | Credentials in Files | Local Network Configuration | | | Data from Network Shared | | |
| Path Interception | | Disabling Security Tools | Input Capture | Local Netw | | | | | |
| Scheduled Task | | File Deletion | Network Sniffing | | | | | | |
| File System Permissions Weakness | | File System Logical Offsets | Two-Factor Authentication Interception | Networ | | | | | |
| Service Registry Permissions Weakness | | | | | | | | | |
| Web Shell | | Indicator Blocking | | Peripheral De | | | | | |
| Authentication Package | Exploitation of Vulnerability | | | | | | | | |
| | Bypass User Account Control | | | Permission Groups Discov | Replication Through | Regsvr32 | Video Capture | Medium | Multiband Communication |
| Bootkit | DLL Injection | | | Proces | | | | | |
| Component Object Model Hijacking | | Component Object Model Hijacking | | | | | | | |
| Basic Input/Output System | | Indicator Removal from Tools | | Remote S | | | | | |
| Change Default File Association | | Indicator Removal on Host | | Security Softwar | | | | | |
| Component Firmware | | Install Root Certificate | | | | Instrumentation | | | Standard Cryptographic Protocol |
| External Remote Services | | InstallUtil | | System Inf Di | | | | | |
| Hypervisor | | Masquerading | | | | | | | |
| Logon Scripts | | Modify Registry | | Sys | | | | | |
| Modify Existing Service | | MSBuild | | | | | | | |
| Netsh Helper DLL | | Network Share Removal | | System Servi | | | | | |
| Redundant Access | | NTFS Extended Attributes | | System Time Discovery | | | | | |
| Registry Run Keys / Start Folder | | Obfuscated Files or Information | | | | | | | |
| Security Support Provider | | Process Hollowing | | | | | | | |
| Shortcut Modification | | Redundant Access | | | | | | | |
| Windows Management Instrumentation Event Subscription | | Regsvcs/Regasm | | | | | | | |
| | | Regsvr32 | | | | | | | |
| Winlogon Helper DLL | | Rootkit | | | | | | | |
| | | Rundll32 | | | | | | | |
| | | Scripting | | | | | | | |
| | | Software Packing | | | | | | | |
| | | Timestomp | | | | | | | |

***Grounded in real data from cyber incidents***

***Enables pivoting between red team and blue team***

***Decouples the problem from the solution***

***Transforms thinking by focusing on post-exploit adversary behavior***

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# Example of Technique Details – Persistence: New Service



**Description:** When operating systems boot up, they can start programs or applications called services that perform background system functions. … Adversaries may install a new service which will be executed at startup by directly modifying the registry or by using tools.

**Platform:** Windows

**Permissions required:** Administrator, SYSTEM

**Effective permissions:** SYSTEM

**Detection:**

- Monitor service creation through changes in the Registry and common utilities using command-line invocation
- Tools such as Sysinternals Autoruns may be used to detect system changes that could be attempts at persistence
- Monitor processes and command-line arguments for actions that could create services


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# Persistence: New Service example (Continued)



**Mitigation:**

Limit privileges of user accounts and remediate Privilege Escalation vectors
Identify and block unnecessary system utilities or potentially malicious software that may be used to create services

**Data Sources:** Windows Registry, process monitoring, command-line parameters

**Examples:** *Carbanak*, *Lazarus Group*, TinyZBot, Duqu, CozyCar, CosmicDuke, hcdLoader, …





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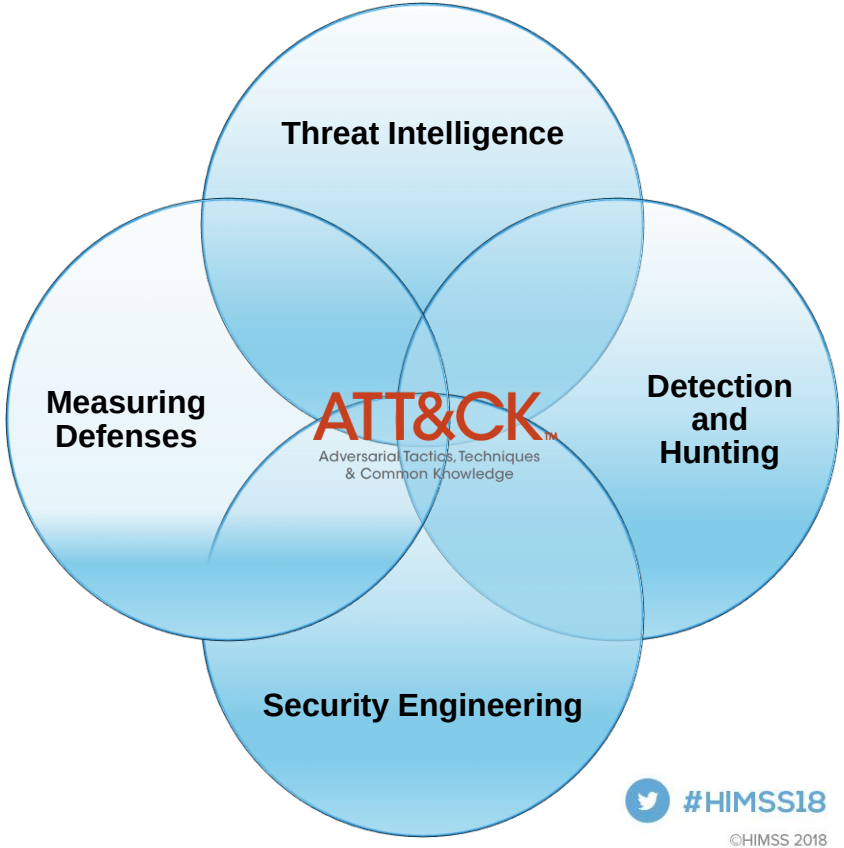
# ATT&CK™ Use Cases



- **Improve security posture through gap analysis, prioritization, and remediation**
  - Use ATT&CK to guide threat hunting campaigns
  - Emulate adversaries to measure defenses against relevant threats
  - Leverage *threat intelligence* to prioritize technique detection
  - Remediate gaps by mapping solutions back to the ATT&CK threat model





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# Threat Intel: What do you need to worry about? (NOTIONAL)



| Persistence | Privilege Escalation | Defense Evasion | Credential Access | Discovery | Lateral Movement | Execution | Collection | Exfiltration | Command and Control |
|---|---|---|---|---|---|---|---|---|---|
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| New Service | | DLL Side-Loading | Credentials in Files | Local Network Configuration Discovery | | InstallUtil | | | Custom Cryptographic Protocol |
| Path Interception | | Disabling Security Tools | Input Capture | | Logon Scripts | PowerShell | Data from Removable Media | Exfiltration Over Command and Control Channel | |
| Scheduled Task | | File Deletion | Network Sniffing | Local Network Connections Discovery | Pass the Hash | Process Hollowing | | | Data Obfuscation |
| Service File Permissions Weakness | | File System Logical Offsets | Two-Factor Authentication Interception | | Pass the Ticket | Regsvcs/Regasm | Email Collection | | Fallback Channels |
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| Web Shell | | Indicator Blocking | | Peripheral Device Discovery | Remote File Copy | Rundll32 | Screen Capture | | Multiband Communication |
| Basic Input/Output System | Exploitation of Vulnerability | | | | Remote Services | Scheduled Task | | Exfiltration Over Physical Medium | |
| | Bypass User Account Control | | | Permission Groups Discovery | Replication Through Removable Media | Scripting | | | Multilayer Encryption |
| Bootkit | DLL Injection | | | | | Service Execution | | Scheduled Transfer | Peer Connections |
| Change Default File Association | | Indicator Removal from Tools | | Process Discovery | Shared Webroot | Windows Management Instrumentation | | | Remote File Copy |
| Component Firmware | | | | Query Registry | Taint Shared Content | | | | Standard Application Layer Protocol |
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| Modify Existing Service | | Masquerading | | System Information Discovery | | | | | Standard Non-Application Layer Protocol |
| Redundant Access | | Modify Registry | | | | | | | |
| Registry Run Keys / Start Folder | | NTFS Extended Attributes | | System Owner/User Discovery | | | | | Uncommonly Used Port |
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| | | Scripting | | | | | | | |
| | | Software Packing | | | | | | | |
| | | Timestomp | | | | | | | |

White-shaded cells have no usage; darker cells have more.

Based on threat intelligence (internal, government-source, open-source).



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# Measuring Defense: What can you cover? (NOTIONAL)

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| | | Timestomp | | | | | | | |
| | | MSBuild | | | | | | | |
| | | Network Share Removal | | | | | | | |
| | | Install Root Certificate | | | | | | | |

| High Confidence | Med Confidence | No Confidence |
|---|---|---|



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# Prioritized ATT&CK Coverage Matrix (NOTIONAL)

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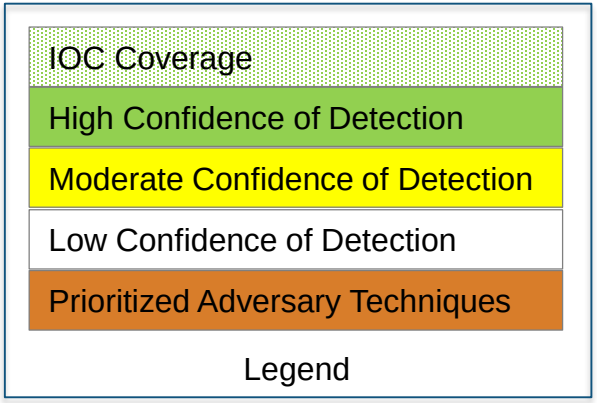




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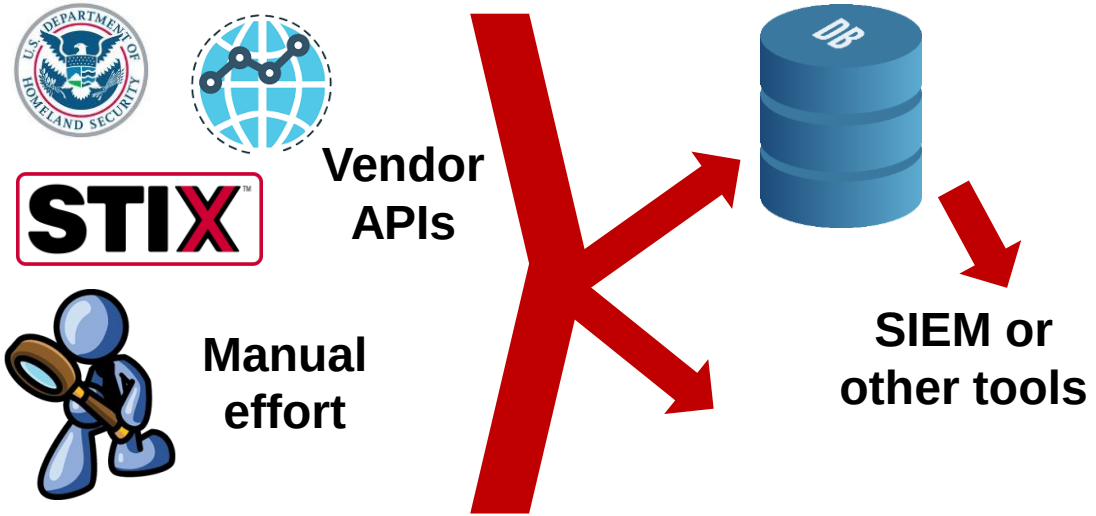
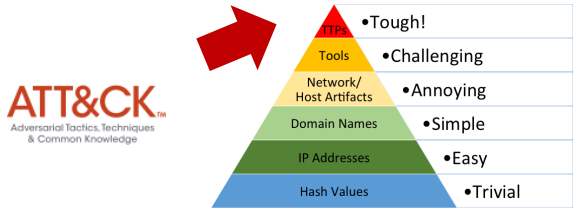
# Using ATT&CK™ to Improve Threat Intelligence-based Cyber Defense




https://detect-respond.blogspot.com/2013/03/the-pyramid-of-pain.html

## Challenges

- Indicators without context are almost useless
  - Provide context!
- Manual effort makes analysts miserable
  - Automate your feeds!
- Adversaries switch indicators constantly, detecting TTPs is more resilient
  - Add analytic sharing

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# Sounds great, but how do I do this?

Symantec Official Blog

+6
6 Votes

## Sowbug: Cyber espionage group targets South American and Southeast Asian governments

Group uses custom Felismus malware and has a particular interest in South American foreign policy.

Symantec Security Response
View Profile

By: Symantec Security Response SYMANTEC EMPLOYEE

Created 07 Nov 2017 | 0 Comments | : 简体中文 日本語

**Data Compressed**

**Data from Network Shared Drive**

They attempted to extract all Word documents stored on a file server belonging to this division by bundling them into a RAR archive by running the following command:

**Command-Line Interface**

```
cmd.exe /c c:\windows\rar.exe a -m5 -r -ta20150511000000 -v3072 c:\recycler\[REDACTED].rar "\\[REDACTED]\*.docx"
\\[REDACTED]\*.doc.
```

**File and Directory Discovery**



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# Implementation Tips



- **Tailor your existing threat intel repository**
  - The MISP threat sharing platform has an ATT&CK taxonomy http://www.misp-project.org
  - ATT&CK API
  - ATT&CK in Structured Threat Information eXpression 2.0 (STIX) : https://github.com/mitre/cti
- **Have the threat intel originator do it**
- **Start at the tactic level**
- **Use existing website examples**
- **Choose appropriate information**
- **Work as a team**
- **Remember it's still human analysis**



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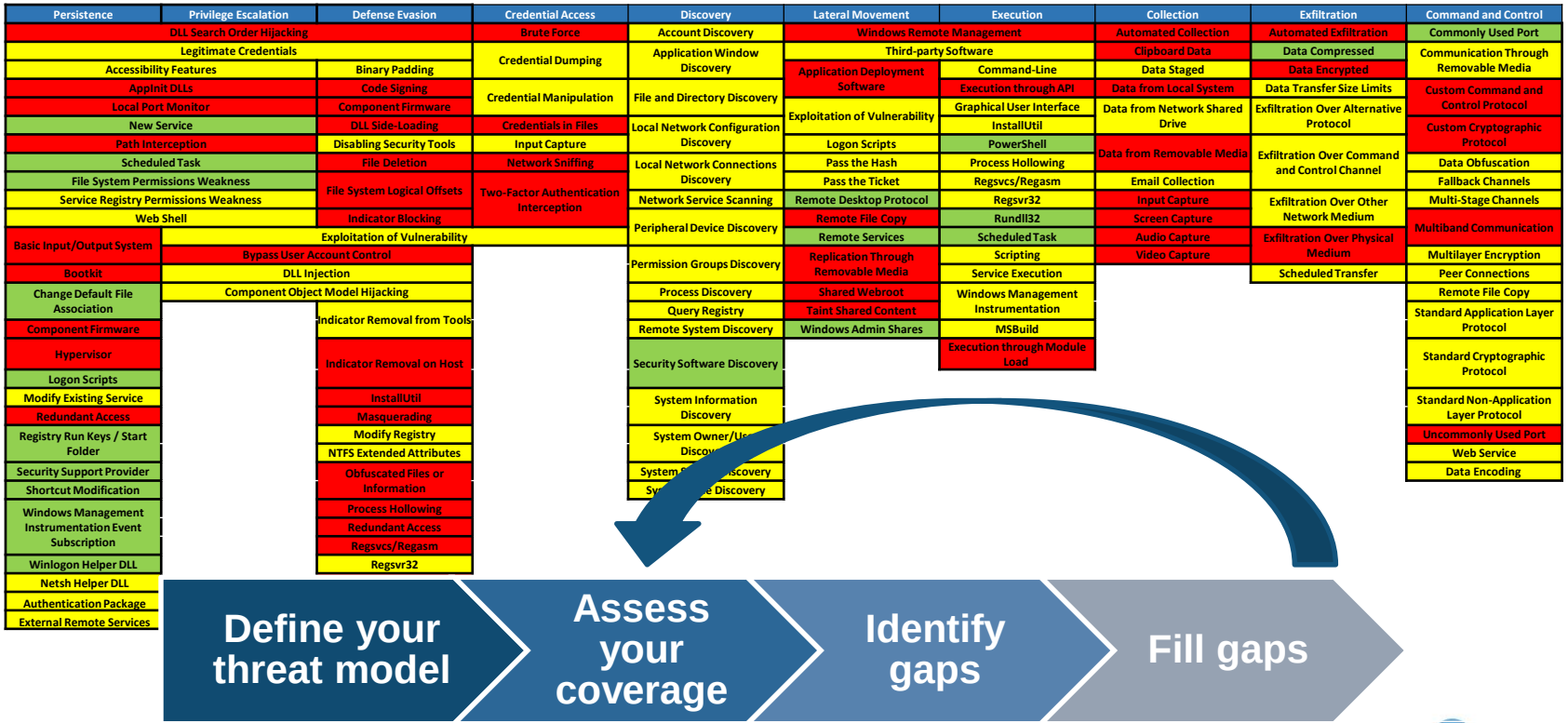
# Look at all those gaps!





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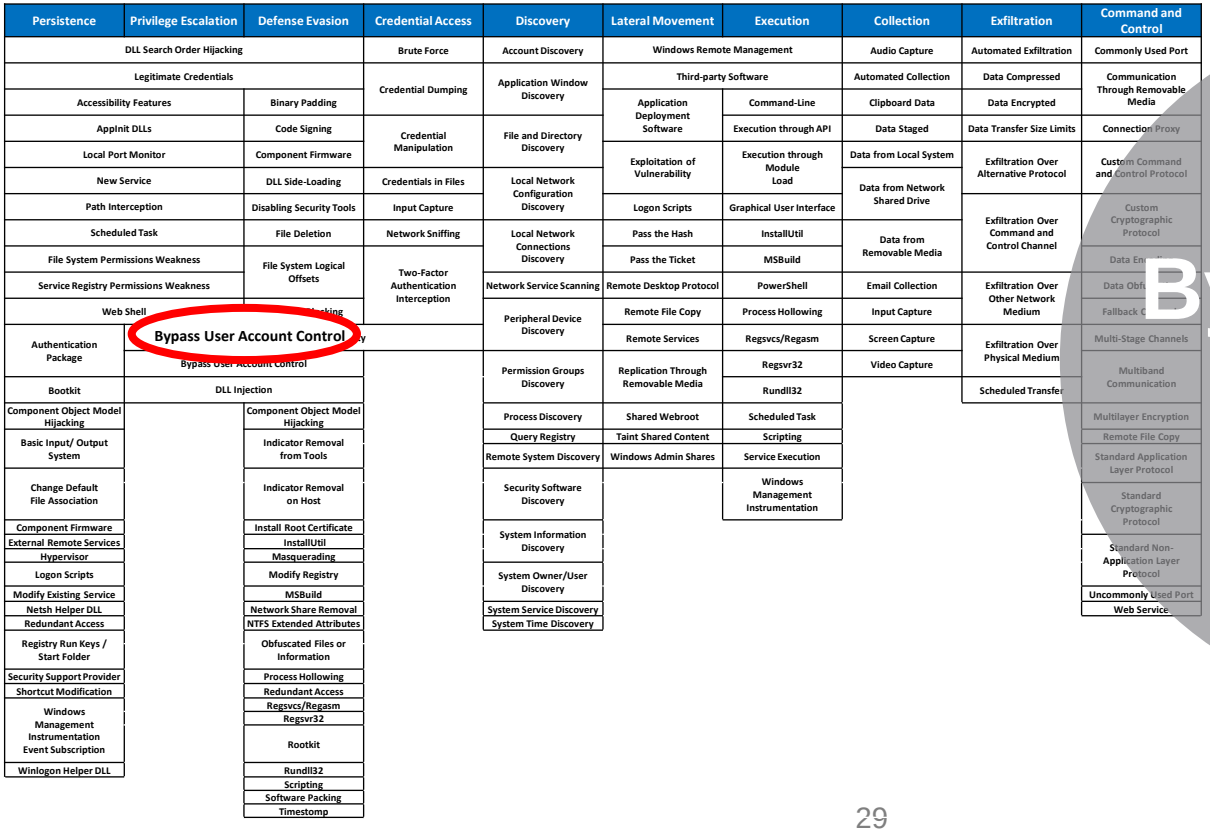
# Start somewhere






**Example: Bypass User Account Control (T1088)**



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# Use what you have



- **You probably already have a SIEM platform**
  - Think back: where does ATT&CK focus? Where can we get the most gain?
  - What logs do you already have that can help?
- **Can you collect more? What's the biggest bang for your buck?**
  - Don't turn on everything at once – focus on filling those gaps
- **Read, talk, and work together**



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# Building an analytic



- **Read the ATT&CK page and understand the attack**
  - Look at references for who's using it and how
  - Think from an adversary perspective
  - Try to mentally separate legitimate usage from malicious usage
- **Try it**
  - Focus on detection
  - Carry out the attacks via your own testing or pre-written scripts
  - What does it look like in the logs?
- **Write and iterate**
  - Write your first search, narrow down false positives, and iterate
  - Keep testing – make sure you check for a variety of ways it can be used, not just the easiest



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# Filling the gaps is hard, time-consuming, and expensive.

- There are a lot of prevalent techniques
- Adversary practices are always evolving
- Techniques have a wide set of procedures
- We all have limited resources
- Requires in-depth expertise of system internals

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# Make it a team sport



Tackling the problem **together** is the only way we can keep up

- More brainpower = faster progress
- A broader array of expertise = broader coverage

**Multi-faceted approach**

- Start out in small working groups
- Not everyone is a producer, feedback is just as important
- Combined with public, open-source, sharing



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# NH-ISAC Working Group:

Building out and sharing analytics to cover techniques in the **ATT&CK™** matrix

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# NH-ISAC Analytics Working Group

- **January 2017 kickoff**
- **Mission: Work together to develop analytics to detect ATT&CK techniques**
- **How it works:**
  - Each organization commits to
    - developing analytics and sharing them *or*
    - testing and providing feedback on shared analytics



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# NH-ISAC Analytics Working Group (Continued)



- **Regular interactions:**
  - Teleconference every 2 weeks to talk about an analytic
  - Annual face-to-face meetings
  - Meet-ups during NH-ISAC summits
- **How it's going:**
  - Shared analytics
  - Shared best practices and tips on how to better collect data required for analytics



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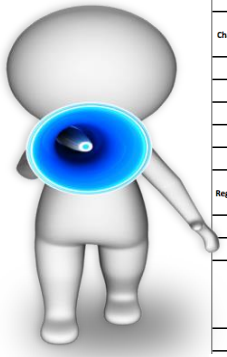
# NH-ISAC Analytics Working Group Next Steps



Continue Development



| Persistence | Privilege Escalation | Defense Evasion | Credential Access | Discovery | Lateral Movement | Execution | Collection | Exfiltration | Command and Control |
|---|---|---|---|---|---|---|---|---|---|
| DLL Search Order Hijacking | | | Brute Force | Account Discovery | Windows Remote Management | | Automated Collection | Automated Exfiltration | Commonly Used Port |
| Legitimate Credentials | | | Credential Dumping | Application Window Discovery | Third-party Software | | Clipboard Data | Data Compressed | Communication Through Removable Media |
| Accessibility Features | | Binary Padding | | | Application Deployment Software | Command-Line | Data Staged | Data Encrypted | |
| AppInit DLLs | | Code Signing | Credential Manipulation | File and Directory Discovery | | Execution through API | Data from Local System | Data Transfer Size Limits | Custom Command and Control Protocol |
| Local Port Monitor | | Component Firmware | | | Exploitation of Vulnerability | Graphical User Interface | Data from Network Shared Drive | Exfiltration Over Alternative Protocol | |
| New Service | | DLL Side-Loading | Credentials in Files | Local Network Configuration Discovery | | InstallUtil | | | Custom Cryptographic Protocol |
| Path Interception | | Disabling Security Tools | Input Capture | | Logon Scripts | PowerShell | Data from Removable Media | Exfiltration Over Command and Control Channel | |
| Scheduled Task | | File Deletion | Network Sniffing | Local Network Connections Discovery | Pass the Hash | Process Hollowing | | | Data Obfuscation |
| File System Permissions Weakness | | File System Logical Offsets | Two-Factor Authentication Interception | | Pass the Ticket | Regsvcs/Regasm | Email Collection | | Fallback Channels |
| Service Registry Permissions Weakness | | | | Network Service Scanning | Remote Desktop Protocol | Regsvr32 | Input Capture | Exfiltration Over Other Network Medium | Multi-Stage Channels |
| Web Shell | | Indicator Blocking | | Peripheral Device Discovery | Remote File Copy | Rundll32 | Screen Capture | | Multiband Communication |
| Basic Input/Output System | Exploitation of Vulnerability | | | | Remote Services | Scheduled Task | Audio Capture | Exfiltration Over Physical Medium | |
| Bootkit | Bypass User Account Control | | | Permission Groups Discovery | Replication Through Removable Media | Scripting | Video Capture | | Multilayer Encryption |
| Change Default File Association | DLL Injection | | | | | Service Execution | | Scheduled Transfer | Peer Connections |
| Component Firmware | Component Object Model Hijacking | Indicator Removal from Tools | | Process Discovery | Shared Webroot | Windows Management Instrumentation | | | Remote File Copy |
| Hypervisor | | | | Query Registry | Taint Shared Content | | | | Standard Application Layer Protocol |
| Logon Scripts | | Indicator Removal on Host | | Remote System Discovery | Windows Admin Shares | MSBuild | | | |
| Modify Existing Service | | InstallUtil | | Security Software Discovery | | | | | Standard Cryptographic Protocol |
| Redundant Access | | Masquerading | | System Information Discovery | | | | | Standard Non-Application Layer Protocol |
| Registry Run Keys / Start Folder | | Modify Registry | | System Owner/User Discovery | | | | | Uncommonly Used Port |
| | | NTFS Extended Attributes | | System Service Discovery | | | | | Web Service |
| Security Support Provider | | Obfuscated Files or Information | | System Time Discovery | | | | | |
| Shortcut Modification | | | | | | | | | |
| Windows Management Instrumentation Event Subscription | | Process Hollowing | | | | | | | |
| | | Redundant Access | | | | | | | |
| Winlogon Helper DLL | | Regsvcs/Regasm | | | | | | | |
| | | Regsvr32 | | | | | | | |
| | | Rootkit | | | | | | | |
| | | Rundll32 | | | | | | | |
| | | Scripting | | | | | | | |
| | | Software Packing | | | | | | | |
| | | Timestomp | | | | | | | |
| | | MSBuild | | | | | | | |
| | | Network Share Removal | | | | | | | |

KEY

- Development
- Peer Review
- Partial Protection
- Full Protection

**Development – 19**

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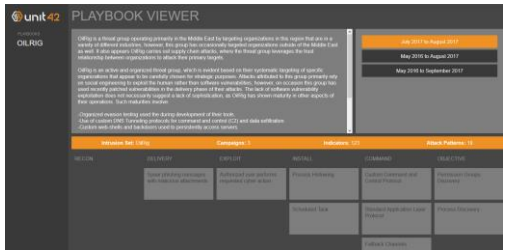
# Future Vision: Threat-Informed Defense

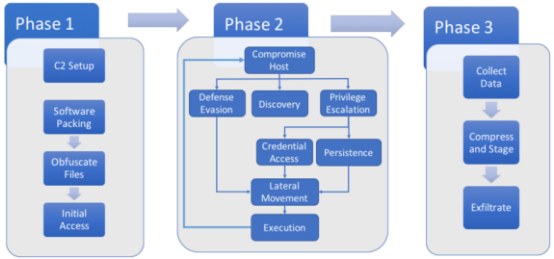


### CTI in ATT&CK

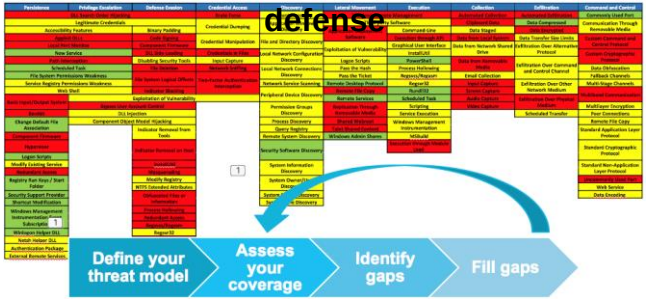



### Realistic Threat Model

### Intelligence-Driven Adversary Emulation




### An ever-improving and well-validated defense

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# Take action

## Figure out where you are

- Define your threat model in ATT&CK™.
- Assess your gaps. Ask your vendors.
- Are you where you want to be?

## Figure out where to go and how to participate

- Can you use analytics now?
- Can you create analytics yourself?

## Find a community to join

- Talk to your Information Sharing Analysis Organization/Center (ISAO/ISAC), vendors, partners, friends
- Find open source analytics

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# Resources



**https://attack.mitre.org**
**attack@mitre.org**
**Twitter: @MITREAttack**

**What's next for ATT&CK™**
https://www.mitre.org/capabilities/cybersecurity/overview/cybersecurity-blog/whats-next-for-attck™

**Analytic Repositories**

- MITRE Cyber Analytic Repository: https://car.mitre.org
- ThreatHunter-Playbook: https://github.com/Cyb3rWard0g/ThreatHunter-Playbook
- Sigma: https://github.com/Neo23x0/sigma

**Validation and Testing**

- Atomic Red Team: https://github.com/redcanaryco/atomic-red-team
- Adversary Emulation Plans: https://attack.mitre.org/wiki/Adversary_Emulation_Plans



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# Questions

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