CACAO BoF
IETF 104 Prague
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IETF Note Well

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• Definitive information is in the documents listed below and other IETF BCPs. For advice, please talk to WG chairs or ADs:
  – BCP 9 (Internet Standards Process)
  – BCP 25 (Working Group processes)
  – BCP 25 (Anti-Harassment Procedures)
  – BCP 54 (Code of Conduct)
  – BCP 78 (Copyright)
Agenda

• Administrivia [5 min]
• Problem Statement Presentation and Discussion [45 min]
• Charter Discussion [40 mins]
Problem - Why we need CACAO

• Threats
  – Threat Actors and Intrusion Sets are advancing in speed and sophistication
  – Number of attacks are increasing and attack surface is growing
  – Time available to adequately respond and remain effective is decreasing
    • Automation and a standards-based machine-readable solution is needed

• Defense
  – Manual, slow, reactive, and siloed
  – Many disparate systems are usually involved
  – Many different groups are part of the response
  – Need to respond across multiple coordinated systems
  – No easy way to share threat response expertise
Problem & Pain Points – Why we need CACAO
What is CACAO?

• Collaborative Automated Course of Action Operations for Cyber Security

• A solution that defines structured and machine parsable playbooks
  – Creation of those playbooks
  – Distribution of those playbooks across systems
  – Monitoring the results of executed actions from those playbooks

• It includes documenting and describing the steps needed to prevent, mitigate, remediate, and monitor responses to a threat, an attack, or an incident

• It will build upon on existing underlying communication protocols and interfaces that enable the systems involved in CACAO
What CACAO is NOT!

• This is not a standard for sharing arbitrary content or data
• This is not about documenting an incident, indicators of compromise, or threat actor behavior
• This is not an effort to redefine standards like I2NSF, NetConf, STIX, TAXII, OpenC2, SUIT, etc.
What are Playbooks today?

• Documentation of security processes involving procedural, technical and human capabilities
• Defined and written procedures for operational security
• Typically kept in a binder on the shelf or in a KB article
• Used to orchestrate IT, cyber security, and physical security
  – For this work, physical security is out-of-scope
• Represented using manual and/or automated steps with conditional logic
• Used for prevention, mitigation, and remediation
Example Playbook
Windows Fuzzy PandaX

• **Security Operations Center**
  – Open ticket with priority level 2
  – Call level one network support
    • If they do not respond within 10 minutes
    • Escalate to level 2, then level 3, then management

• **Network Support**
  – Quarantine system to sandbox VLAN
Example Playbook – cont.

Windows Fuzzy PandaX

• **Security Operations Center**
  – Call level one desktop support
    • If they do not respond within 30 minutes
    • Escalate to level 2, then level 3, then management
Example Playbook – cont.

Windows Fuzzy PandaX

• **Desktop Support**
  – Delete run at start reg keys and triggers
  – Reboot into SafeMode
  – Kill process sysmg.exe then winsrvx.exe then xnc.exe
  – Delete temp files
  – Delete compromised files defined in KB article 311
  – Delete other registry keys defined in KB article 312
  – Reboot system in to safe mode
Example Playbook – cont.
Windows Fuzzy PandaX

• **Desktop Support**
  – Verify processes do not restart after cleanup
    • If this does not work, escalate
  – Patch AV system and run updated AV scan
  – Patch OS
  – Run additional on-demand special AV scanners
  – Reboot system to normal mode
  – Update ticket
Example Playbook – cont.

Windows Fuzzy PandaX

- **Network Support**
  - Monitor traffic from system for 90 minutes
  - If no abnormal behavior is detected move system out of sandbox VLAN in to a restricted watch VLAN for 24 hours
  - If no user issues or abnormal behavior is detected move system to production VLAN
  - Update and close ticket
Playbooks Can Span Groups & Technologies

• Many different groups are needed to respond to an attack
  – SOC / NOC / Network Support / Desktop Support / Mobile Support / Application Support

• Attack can span business units and enclaves

• Attack can target an entire industry sector requiring coordinated response

• Attacks can occur across multiple technologies in the same campaign and/or intrusion
How We Get There - Coordinated Response

**Define**
Playbook is defined based on various automated and manual inputs

**Verify**
Playbook is reviewed for accuracy and correctness. It is optionally verified in a test or sandbox environment

**Distribute**
Playbook actions are distributed to the systems that will execute them. Distribution includes checking that the playbook has been deployed correctly and follows rules defined within the playbook

**Execute**
Playbook is evaluated by one or more systems and execution events are communicated to the monitoring step

**Monitor**
Playbook execution is monitored and metrics are determined on the playbook to enable further refinement or improvement
How - Industry Response Example
Security Knowledge

- Analysts / SOC
- Vendors
- National Certs
- ISACs / ISAOs

Security Operation Center

Phase 1 Goals
- Playbook Creation
- JSON Data Model
- Multiple Actions
- Temporal Logic
- Conditional Logic
- Versioning
- Targeting
- Syntax Verification

Phase 1 Stretch Goal
- Partial Automation
- Digital Signatures
- Distribution Protocol

Phase 2 Goal
- Partial Automation + Reporting
- Execution Interface
- Action Resource
- Response Resource
- Execution Verification
- Reporting Protocol

Phase 3 Goal
- Full automation

Crawl  Walk  Jog  Run
Key Requirements

This solution needs to support the following:
Key Requirements - Summary

• Multiple Actions (Sequencing and Backout)
• Decision Logic (Temporal and Conditional)
• Unique Identifiers
• Versioning and Targeting
• Testing, Verification, and Reporting
• Digital Signatures, Security, and Transport
• Management Separation
Charter Review
Detailed Key Requirements

This solution needs to support the following:
Actions

• Single Atomic Actions

• Multiple Actions
  – To respond to threats one must often perform many steps across many different pieces of infrastructure

• Sequencing of Actions
  – Actions often have to be done in a very specific order

• Back Out Steps
Decision Logic

• Temporal Logic
  – Sometimes actions can only be performed at certain times or after a certain amount of time has passed after the previous action

• Conditional Logic
  – Often actions need to be performed based on environmental data or outcomes of previous actions
Unique Identifiers

• System Integration
  – Needs to integrate with other systems globally
  – Support a globally unique ID like a UUIDv4 for projects and individual actions

• All transactions need to be able to be monitored
  – This means responses and notifications need a way to be tied back to the original request
Versioning and Targeting

• Versioning
  – Allow actions, projects, and templates to be versioned
  – Support both incremental and semantic versioning

• System Targeting
  – Identify specific machines, devices, & software
  – Identify general classes of systems (e.g., Windows 10)
Use Cases and Testing

• Scope
  – Machine automation
  – Human actions / intervention
  – High level conceptual actions

• Testing
  – Provide dry run capabilities and what-if deployments
Reporting

• Provide full reporting on the processing of each action

• Accommodate mandatory reporting and auditing

• Must have a timestamp and information about original request or rule that caused the event

• Could be either synchronously requested or an asynchronous event (syslog) with periodic updates
Digital Signatures

- Ability to digitally sign COAs and their parts
- Ability to support multiple digital signatures
- Ability for multiple independent organizations to sign and verify the correctness, accuracy, and validity of the COA
Security

• Security
  – Support full data protection, integrity and authentication
  – Support data markings like TLP

• Transport
  – Encrypted and authenticated
  – Both direct delivery and publish/subscribe solutions
Management Separation

• COAs may be defined in one environment and executed or deployed to a different operational environment

• For a COA to execute correctly must have authorization in the operational environment where it is executed

• Security environment executing the COA will likely be different from where the COA was defined
Milestones
Major Milestones

• Refine requirements and use cases
  – Achieve WG consensus on requirements

• Define JSON data model
  – Simple actions and action groups
  – Temporal and conditional logic
  – Reporting, monitoring, and response

• Identify signature and encryption solution

• Identify protocols to layer on and interact with
  – Define specification for MTI protocol(s)