# Extensible Visibility Reference Framework (eVRF) Program Guidebook

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# READER'S GUIDE

The purpose of the extensible Visibility Reference Framework (eVRF) is to provide a framework for organizations to identify visibility data that can be used to mitigate threats, understand the extent to which specific products and services provide that visibility data, and identify potential visibility gaps.

The eVRF document set consists of a guidebook and workbook(s). The *eVRF Guidebook* defines key concepts and workflows that support eVRF use. An eVRF workbook defines specific visibility surfaces and enables organizations to produce their own visibility coverage maps.

An eVRF Workbook can be implemented as a purpose-built software application, with a spreadsheet, or using tables. Ultimately, a purpose-built software application would offer the most flexible way to create and edit a visibility surface definition and coverage maps.

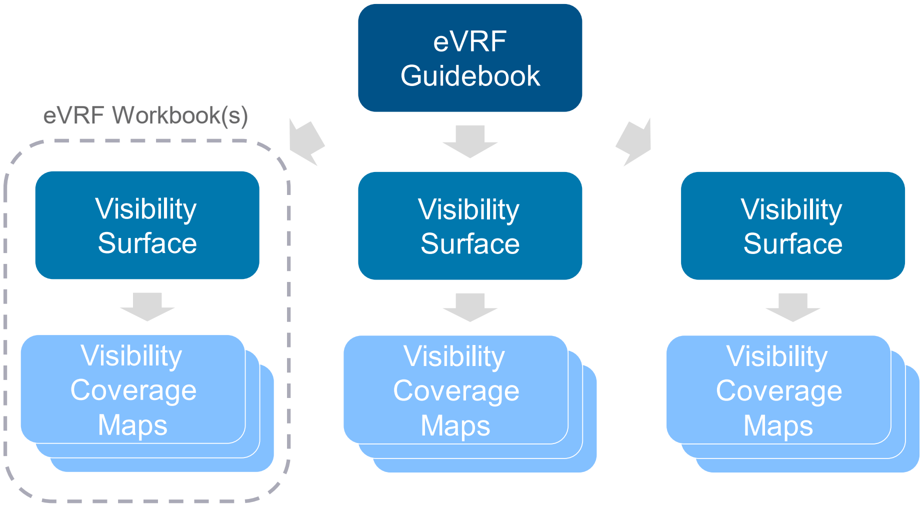

*Figure 1: eVRF Document Structure*

# EXECUTIVE SUMMARY

Executive Order 14028, “Improving the Nation’s Cybersecurity,” defines a prioritization of the Federal Government “to improve its efforts to identify, deter, protect against, detect, and respond to these actions and actors.” In order to achieve its mission and strengthen cybersecurity across the Federal Government, the Department of Homeland Security (DHS) Cybersecurity and Infrastructure Security Agency (CISA) requires visibility across various Federal Civilian Executive Branch (FCEB) agency domains. This visibility enables CISA to develop insights that can be shared across the FCEB, ensuring that CISA can identify threats, protect against potential attacks, and perform hunt, incident response, and analysis activities.

The purpose of the extensible Visibility Reference Framework (eVRF) is to provide a framework for organizations to identify visibility data that can be used to mitigate threats, understand the extent to which specific products and services provide that visibility data, and identify potential visibility gaps. This knowledge can then be used to direct resources to close visibility gaps and enhance overall visibility into potential threats.

The eVRF is divided into the *eVRF Guidebook* (this document) and eVRF workbooks. The Guidebook is an instruction manual for eVRF; it defines and describes key concepts, roles and responsibilities, and workflows. Each eVRF workbook defines a visibility surface and enables organizations to produce their own visibility coverage maps for as-planned or as-implemented system configurations. Additionally, organizations can use coverage maps to identify desired visibility or visibility requirements.

As organizations apply the workbooks, visibility coverage maps will be populated. These coverage maps can be combined into visibility coverage comparisons. These comparisons provide a quick visual reference that can help to identify where coverage gaps might exist. Visibility coverage comparisons can also be created to allow organizations to analyze and gain insights into their visibility across their enterprise.

The extensible Visibility Reference Framework is being developed for organizations to identify and evaluate visibility in digital environments. CISA will use this framework to communicate telemetry requirements with Federal Civilian Executive Branch Agencies.

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# 1 INTRODUCTION

## 1.1 eVRF Overview

In order to achieve its mission, CISA requires visibility across various Federal Civilian Executive Branch (FCEB) agency domains. This visibility enables CISA to develop insights that can be shared across the FCEB, ensuring that CISA can identify threats, protect against potential attacks, and perform hunt, incident response, and analysis activities.

### eVRF Purpose

The purpose of the extensible Visibility Reference Framework (eVRF) is to provide a framework for organizations to identify visibility data that can be used to mitigate threats, understand the extent to which specific products and services provide that visibility data, and identify potential visibility gaps.

### eVRF Goals

The eVRF has the following goals:

- **Goal 1:** Communicate requirements for FCEB agencies to provide CISA with the necessary data to protect agency networks, devices, cloud-based environments, data, and systems.
- **Goal 2:** Enable agencies to (a) evaluate their ability to collect relevant visibility data and (b) model their coverage of CISA's visibility requirements.
- **Goal 3:** Promote partners' ability to incorporate key visibility concepts into their own cyber practices.
- **Goal 4:** Provide a framework for agencies to evaluate visibility products' capabilities and features and to characterize the visibility gaps that various products can fill.

## 1.2 Benefits of eVRF

There are several benefits for organizations to adopt the eVRF:

1. eVRF provides a model to characterize visibility across a broad set of domains representative of an organization's modern enterprise.
2. eVRF informs an organization's situational awareness and enables organizations to prioritize the collection and analysis of visibility data across their enterprises to best mitigate the threat landscape and improve their risk posture.
3. eVRF allows for the identification of gaps in visibility coverage and enables the establishment of new targets and/or system configurations capable of addressing visibility needs.
4. eVRF informs procurement decisions, providing visibility and impact perspective prior to implementing the product and/or system configuration.
5. eVRF is not a static characterization of visibility, but rather it is a methodology, which can be used to include new domains and telemetry as ecosystems continue to evolve.

## 1.3 Document Organization

The *eVRF Guidebook* (this document) is part of the larger eVRF document set (see Reader's Guide). That document set is a library, and it will continue to grow over time as new domains are identified.

The Guidebook identifies the demand for visibility as a unique characteristic of cybersecurity, with a structure and workflow identified to characterize visibility for different portions of a cyber system. The Guidebook is an instruction manual for eVRF; key concepts, roles and responsibilities, and workflows are defined and described for users.

This document is separated into five sections and three appendices:

- Section 1 provides basic scoping information that articulates the intention and focus of the document.
- Section 2 discusses the key concepts about visibility that were used to create the eVRF.
- Section 3 provides generalized guidance about how to apply an eVRF workbook.
- Section 4 explains how agencies and CISA will apply an eVRF workbook.
- Section 5 provides conclusions.
- Appendix A discusses how the eVRF relates to other CISA programs.
- Appendix B identifies key terms used throughout the document.
- Appendix C discusses key background documents.

## 1.4 Intended Audience

The *eVRF Guidebook* is designed for CISA to define concepts, requirements, and mechanisms for collecting, evaluating, and analyzing telemetry for communication with federal civilian agencies, service providers, and other public and private sector partners. Agencies may also leverage the *eVRF Guidebook*, analysts, solution architects, and cybersecurity acquisition decision-makers to make threat-informed decisions on visibility and improve their ability to hunt for threats and investigate incidents across their enterprise. Agencies can use this document to evaluate technology solutions (including both open-source and for-profit vendors) to express the visibility that such products offer, as well as identify the product tiers, add-on capabilities, and configuration settings needed to meet CISA requirements. Finally, even though this framework is being developed for CISA and CISA stakeholders, the concepts and workflow in eVRF can be utilized by any organization that is interested in incorporating visibility into their cybersecurity practices or identifying communicating visibility requirements and gaps.

## 1.5 Assumptions and Constraints

This Guidebook describes the concepts, processes, and scope of eVRF. Individual eVRF workbooks, produced on a case-by-case basis, will describe specific visibility requirements. Currently, this Guidebook recognizes that as-built agency systems may not fully align with visibility requirements, but that agencies will satisfy the various roles and responsibilities of eVRF over time. Full implementation of eVRF may require updates to products, services, or service level agreements, as well as additional expertise or training. Agencies will need to work with their solution providers and CISA while service and product providers evolve and extend their services and capabilities to accommodate the customer need for visibility. This Guidebook does not constitute a request for product proposals or solicitations;

nor should this Guidebook be seen as detailed specifications or formal requirements for vendors or service providers.  The terms and details of eVRF are subject to change at any time.

Furthermore, this Guidebook does not supplant or supersede any previously issued CISA guidance, government-wide policies, or applicable law.  Agencies should continue to comply with telemetry and logging requirements, including those that require agencies to provide network visibility or allow agencies to provide cloud telemetry.  Agencies remain the sole data owners for all telemetry data that they generate; agencies are merely sharing visibility of that data with CISA.  eVRF will utilize the MITRE ATT&CK Framework to develop specific threat models and methodologies; the MITRE ATT&CK Framework is developed and maintained outside the scope of eVRF activities.  Agencies can use eVRF to characterize visibility and completeness of observation coverage; but realizing the full benefit of eVRF depends on employing other systems, methods, and platforms for attacker countermeasures, determining the efficacy of mitigations, and collecting/processing the sensor data to derive value from the observations.

# 2 VISIBILITY

Key concepts are defined and introduced to ensure a common understanding by users of the eVRF. To promote understanding, the scenario of a high value physical asset will be utilized throughout to draw parallels with cyber systems and assets.

## 2.1 Key Visibility Concepts

### Visibility

In its most general sense, the term “visibility” is an abstract noun describing something that is visible. CISA applies the term visibility to refer to (a) the observable artifacts of digital events and (b) the characteristics of the digital environment in which those events take place. By collecting and analyzing the observable artifacts and characteristics of an environment, organizations will have the data necessary to conduct forensic investigations into threat activity and maintain better awareness of activity on an ongoing basis. Desired qualities for visibility data include the cost-effective and scalable collection of relevant data, the ability to receive data at cyber-relevant speeds, etc. The more in-depth and extensive the technical visibility, the greater opportunity an organization has to detect high-priority threats to networks, devices, and data.

Visibility provides context-specific insights about the activity taking place within a given environment. Because it is context-specific, the types of data that provide visibility will vary across the enterprise. For instance, within a cloud-centric context, the most useful visibility may come from cloud API activity logs, but to get visibility into mobile device behaviors, biometric event logs may be preferable. This heterogeneity of data types across contexts can make obtaining consistent visibility across an entire enterprise difficult. The eVRF facilitates dividing the enterprise into multiple visibility surfaces, each centered around a different type of system with a unique context. Visibility surfaces are discussed in more detail in the next section below.

Similar in concept to the layered protections afforded an organization through implementing a Defense-in-Depth approach for cyber security, Visibility-in-Breadth for the Enterprise (ViBE) can provide insights into potential malicious actions across the organization’s enterprise architecture. Many visibility mechanisms have already been deployed across the enterprise architecture through implementation of security controls associated with standards like NIST 800-53. While implementing eVRF across all domains within an organization’s enterprise could be a lengthy effort, capturing the visibility associated with existing security control requirements can improve familiarity with the workflow and increase efficiency for subsequent analysis. This would also enable an organization to begin documenting and understanding the visibility that currently exists and where they may focus initial efforts to identify gaps in visibility so that a good ViBE can be achieved across all domains.

Visibility refers to the observable artifacts of digital events and the characteristics of the digital environment in which those events take place. Visibility provides context-specific insights about activity within a given environment.

## Visibility Surface

A visibility surface refers to a digital environment for which cyber-observable data exists or should exist and is therefore an environment-specific instantiation of visibility. In the same way that an attack surface is comprised of many different points from which a system can be attacked, a “visibility surface” is made up of many observation points, or perspectives, from which a system can be observed. As detailed in the section below, observation points provide architectural context, which tightly couples visibility surfaces to real data common to the domain. The cyber-observable data – logs, configuration settings, packet data, and so on – that contributes to a visibility surface are essential for providing evidence of malicious activity.

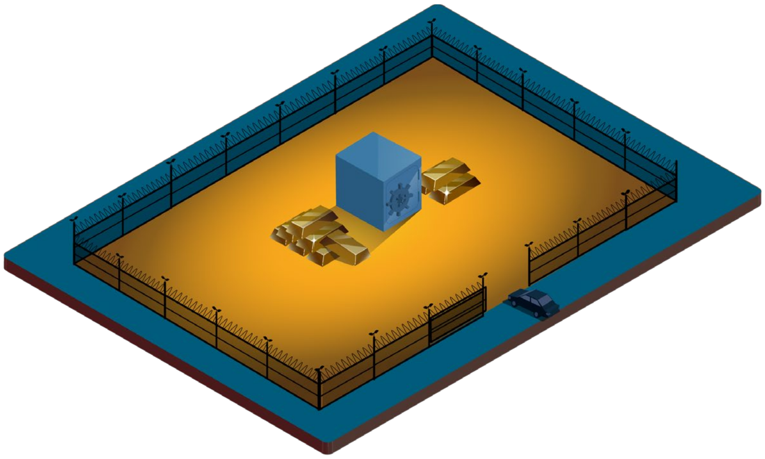


*Figure 2: Visibility Surface - environment for which data exists or should exist.*

Figure 2 displays the visibility surface of the target system through highlighting the space within the fenced in area in orange. The high-value assets are serving their business need and meet their design intent. An understanding of malicious actors and the anticipated approaches they’d bring to bear to gain access to the asset can be derived from the value of the asset and the context of its placement.

Within eVRF, visibility surfaces allow an organization to identify which data can be used to recognize threat actor tactics, techniques, and procedures (TTPs) within a system. In addition to identifying relevant data and TTPs, each eVRF visibility surface is scoped to a particular type of digital environment (e.g., cloud business applications, workstation operating systems, etc.). Once these parameters of a visibility surface are defined (see Section 3.1), organizations can overlay additional information to produce coverage maps that portray the visibility provided by one or more system configurations.

## Observation Point

An observation point defines the architecture location of a telemetry source in the given domain. For example, the following are all possible observation points in a cloud architecture: the Cloud Service Provider (CSP), the Cloud Access Security Broker (CASB), any Security-as-a-Service (SECaaS) solution, and virtual network locations throughout. An observation point may be the sensor positioning within a cloud or network topology or a specific host for endpoint visibility. An observation point can be in the same architecture location that policies are applied and is often associated with a policy enforcement point (PEP) and/or a policy decision point (PDP). Observation points may be in line with data, at data entry, or at data exit for a domain. Collecting telemetry from multiple observation points increases the breadth of visibility across a domain.

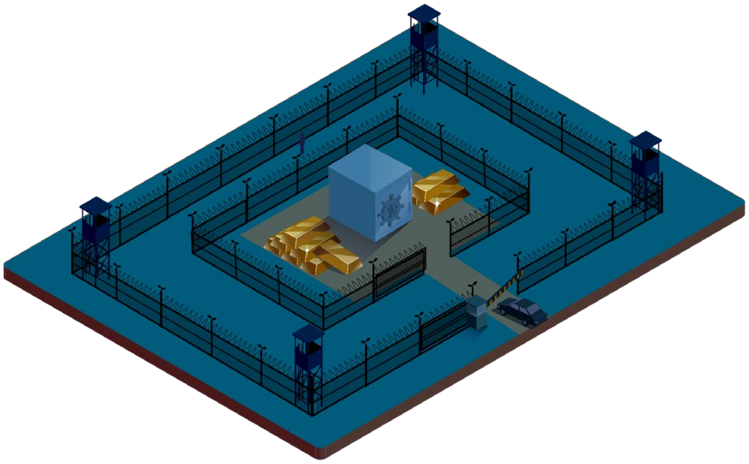


*Figure 3: Observation Points - architecture locations for telemetry sources*

In Figure 3, the concept of observation points is represented by guard towers in each corner of the fenced area. The observation points can host one or more sensors, which provide visibility into the visibility surface. The location of the observation point impacts the visibility available to sensors hosted at that location.

## Sensors

Sensors collect telemetry at observation points. Multiple sensors may be co-located at the same observation point. Sensors should be selected and deployed to provide unique insights. When they share an observation point, they ideally produce complementary data, which augment and enrich each other. For example, an organization may have both a Web Application Firewall (WAF) and a Next Generation Firewall at the same observation point (gateway) and both firewalls together may provide greater insight into network activity.

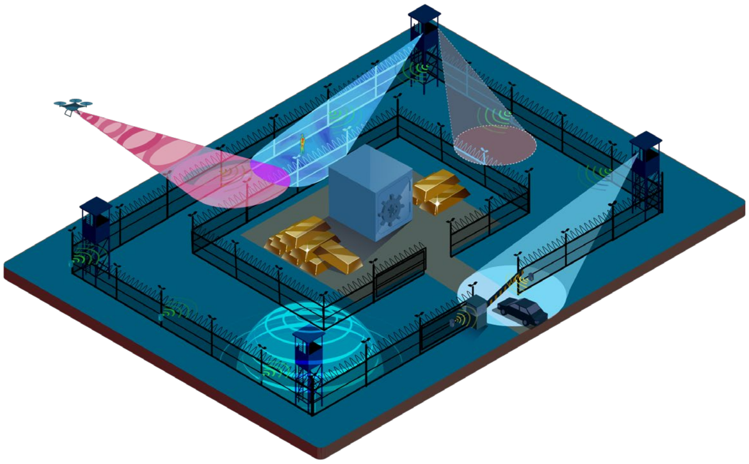


*Figure 4: Sensors - positioned at observation points and provide telemetry*

The various light sources shown in Figure 4 display different sensors that each observation point provides. Additional sensors can increase the amount and type of visibility an organization has on the asset, as well as an increase of visibility detail when coverage is overlapped, such as in the figure with the arial drone mounted purple sensor overlapping of tower sourced light blue and ground positioned neon green sensors.

## Visibility Coverage Maps

A visibility coverage map characterizes the ability of a product or organization to address a visibility surface by providing relevant cyber-observable data. Whereas a visibility surface describes the scope of the environment and its relevant data and TTPs, a visibility coverage map conveys the extent to which available data provides sufficient visibility into cyber threat activity.

Using eVRF, organizations create coverage maps by using an eVRF workbook to indicate the data currently or potentially available in the environment. A coverage map can be created for each actual or presumed logging level of a vendor's major product offering. Coverage maps should be updated periodically to accurately describe rapidly changing telemetry options. The workbook will use that input to produce a color-coded visualization that shows which MITRE ATT&CK techniques are addressed by the available data. Metrics can also be shown to indicate the quality of coverage for each technique. Bolstering an organization's coverage map in a visibility surface builds crucial security event context for detection and mitigation.

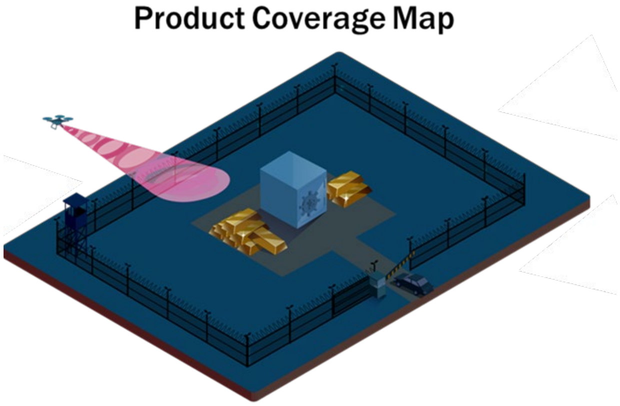


*Figure 5: Product Coverage Map - visibility from a single observation point and sensor type*

The purple light source shown in Figure 5 displays the coverage of the visibility surface provided by a sensor at a single observation point. The product coverage map can include in its description the limitations of the sensor, ideal usage characteristics, as well as any licensing details, sensor upgrade, or even complimentary enrichment options.

## Visibility Requirements Maps

A visibility requirements map is a special purpose coverage map used for the identification of cyber-observable data, which must be shared between parties for common situational awareness and use (for a given visibility surface). The visibility requirements map can identify the criticality of the sharing for given metadata, the diversity of observation points required, the diversity of sensor inputs required, or other "cyber-observable data quality" attributes.

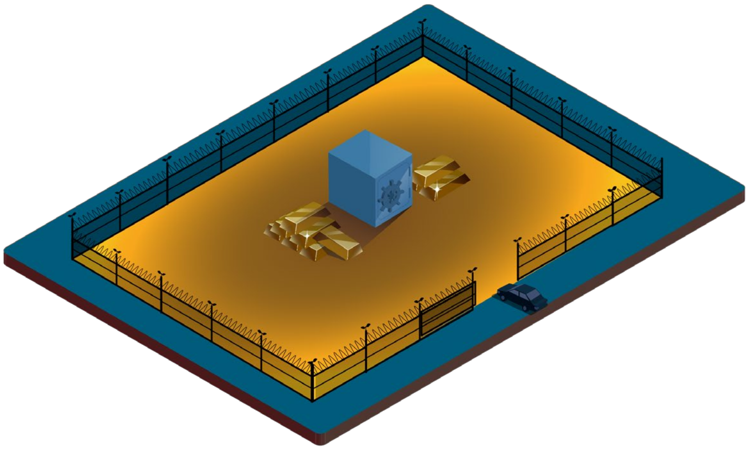


*Figure 6: Visibility Requirements coverage map - data sharing for common situational awareness*

The gold coloring throughout the fenced area within Figure 6 represents the visibility requirements. The requirements set is agnostic of the observation points and sensors offered by any given vendor, but instead can focus on the visibility surface – the use of the high value asset and its environment.

By utilizing visibility requirements maps, an authoritative organization (e.g., CISA) can communicate telemetry requirements to other participating organizations for a given visibility surface while staying agnostic to any particular vendor's implementation. The organization should update these requirements maps as their understanding of threats changes, as visibility capabilities within the domain evolve, and as other organizations mature in their own telemetry use (and rely less on the authoritative organization's supplemental protections).

## Visibility Coverage Comparisons

A visibility coverage comparison consists of two or more coverage maps overlaid simultaneously onto the MITRE ATT&CK framework for evaluation of competing or complementary products and services. It answers questions such as "For which ATT&CK techniques does combination Y of products/services produce telemetry?"

Visibility coverage comparisons can be treated as nominal stand-ins for organizations' as-built technologies or proposed architectures being considered for deployment. Organizations can create a visibility coverage comparison when considering competing products or multiple security architectures; in this case, a visibility coverage comparison can show a side-by-side comparison of available telemetry data in each solution. Visibility coverage comparisons are tools for determining the prioritization of telemetry and return on investment in telemetry options. They are the culmination of an eVRF workbook analysis and are used to produce high level insights.

## 2.2 Division of Enterprise into Domains

An organization's digital enterprise is extensive; it includes many different hardware devices, networks, virtual environments, operating systems, and applications. This means that there are many ways to categorize or scope visibility surfaces within an enterprise. Prior to defining a visibility surface, it is helpful to divide the enterprise into components in order to have a manageable scope for a visibility surface and to allow for repeatability and consistency across different organizations and vendor solutions. A decomposition of the enterprise into domains using formal definitions and a common language is desired. Additionally, there is likely some hierarchy or structure that shows relationships in the domain decomposition. For the purposes of eVRF, a domain is scoped by the collection of observation points and associated sensors, as well as the domain activity category, event(s), and associated metadata.

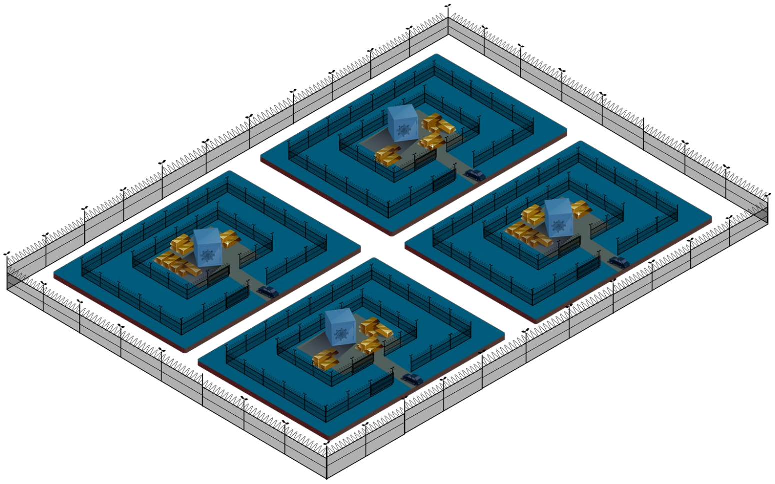


*Figure 7: Enterprise Decomposition into Domains*

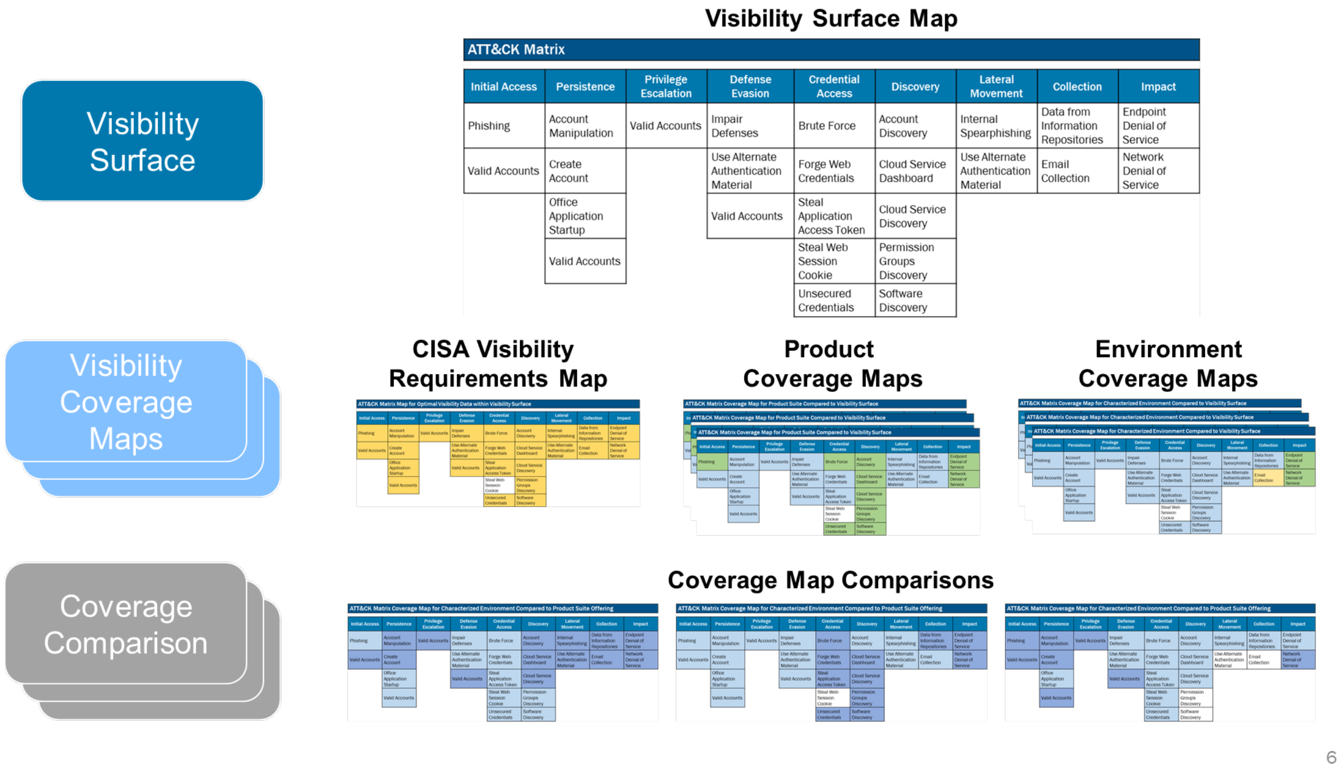
Figure 7 demonstrates an organizations full set of high value assets being decomposed into distinct domains. Each domain has its own assets, interaction methods, and systems to secure, but all are part of the same organization. The enterprise is represented by the fence around all four domains.

# 3 GENERATING AN EVRF WORKBOOK

An eVRF workbook defines specific visibility surfaces and enables organizations to produce their own visibility coverage maps for as-planned or as-implemented system configurations. By using the workbook to identify what visibility data is available in their environment, organizations can identify visibility gaps and set visibility requirements. Vendors may also provide product-specific visibility coverage maps to indicate the visibility offered by individual products or product tiers.

An eVRF workbook offers a flexible way to create and edit a visibility surface definition and coverage maps. An interactive workbook application is currently in development.

As organizations develop each workbook, visibility coverage maps will be populated within the workbook. These maps will provide a quick visual reference showing potential gaps in coverage.



ATT&CK Matrix

| Initial Access | Persistence | Privilege Escalation | Defense Evasion | Credential Access | Discovery | Lateral Movement | Collection | Impact |
|---|---|---|---|---|---|---|---|---|
| Phishing | Account Manipulation | Valid Accounts | Impair Defenses | Brute Force | Account Discovery | Internal Spearphishing | Data from Information Repositories | Endpoint Denial of Service |
| Valid Accounts | Create Account |  | Use Alternate Authentication Material | Forge Web Credentials | Cloud Service Dashboard | Use Alternate Authentication Material | Email Collection | Network Denial of Service |
|  | Office Application Startup |  | Valid Accounts | Steal Application Access Token | Cloud Service Discovery |  |  |  |
|  | Valid Accounts |  |  | Steal Web Session Cookie | Permission Groups Discovery |  |  |  |
|  |  |  |  | Unsecured Credentials | Software Discovery |  |  |  |

*Figure 8: eVRF Workbook Structure*

Figure 8 shows how several types of visibility coverage maps are developed for each visibility surface and how each layer provides unique insights.[1] The color-coding provides a visual reference of how well each MITRE ATT&CK technique is addressed within the workbook.

- **CISA Visibility Requirements Map**: The CISA visibility requirements coverage map is developed by CISA to show telemetry generation, collection, and processing requirements.

[1] The visibility surface map used in this figure is one example of how a visibility surface map can be derived from MITRE ATT&CK to represent a specific domain. Different combinations of ATT&CK tactics and techniques will be used for different domains.

- **Product Coverage Maps**: Product coverage maps can be developed by vendors or service providers to show how the visibility of their solutions informs ATT&CK TTPs.
- **Environment Coverage Maps**: Environment coverage maps characterize the organization's as-built or to-be-built environments and may be produced using one or more product coverage map(s). Environment coverage maps consider factors like product configuration and licensing level to accurately reflect the visibility provided by the organization's implementation of visibility products.

After deriving the coverage maps, a visibility coverage comparison can be generated by combining multiple coverage maps. The visibility coverage comparison can be used for analysis and to generate insights.

The eVRF workflow defined in this Guidebook refers to a complete workflow process. In practice, some visibility artifacts will exist and will not need to be recreated. Hence, as organizations employ this workflow and a library of artifacts grows, some of the steps may be bypassed.

## 3.1 eVRF Workflow

The eVRF workflow describes the process for establishing a visibility surface and building coverage maps to evaluate the extent of visibility available in an environment. The process is separated into three phases:

- **Phase 1: Define a Visibility Surface:** In this phase, a visibility surface definition is created, which establishes the surface boundaries and identifies the required visibility data. A visibility surface can be defined with one or more observation points containing one or more sensors each. Many organizations will choose to use an existing visibility surface definition instead of creating a custom or new definition.
- **Phase 2: Produce Visibility Coverage Maps:** In this phase, a coverage map is produced to characterize a selected environment to indicate whether available data provides the desired visibility. Some organizations may choose to produce multiple coverage maps to indicate varying levels of visibility in different parts of the environment. Many organizations will choose to develop coverage maps based on vendor-provided coverage information.
- **Phase 3: Generate Visibility Coverage Comparisons for Analysis & Insights:** In this phase, the coverage maps are analyzed to identify gaps in coverage, to establish targets for new visibility data that must be collected, or to generate other operational or business insights. A consolidated visibility coverage comparison for multiple parts of the environment can be produced by combining coverage maps from more than one visibility surface.

These phases are shown below and described in more detail in the following sections.

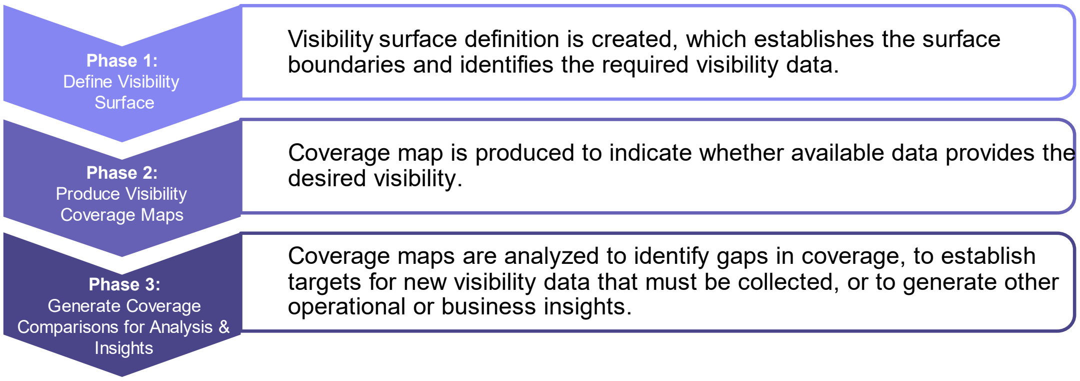

Phase 1:
Define Visibility Surface
Visibility surface definition is created, which establishes the surface boundaries and identifies the required visibility data.
Phase 2:
Produce Visibility Coverage Maps
Coverage map is produced to indicate whether available data provides the desired visibility.
Phase 3:
Generate Coverage Comparisons for Analysis & Insights
Coverage maps are analyzed to identify gaps in coverage, to establish targets for new visibility data that must be collected, or to generate other operational or business insights.

*Figure 9: eVRF Workflow*

## Phase 1: Define a Visibility Surface

Organizations may choose to use an existing visibility surface definition, such as one published by CISA, or they may choose to create a new definition. In practice, a visibility surface can be defined with one or more observation points, containing one or more sensors each. Every eVRF workbook will need to define the visibility surface that will be examined in that workbook.

Each visibility surface definition identifies the following:

1. **Scope:** Identifies the bounds of the digital environment included in the visibility surface.
2. **Relevant Data:** Identifies which types of data are needed to provide evidence of threat actor TTPs.
3. **ATT&CK Matrix:** Identifies the ATT&CK techniques that are relevant for the environment.
4. **ATT&CK-to-Data Overlay:** Identifies which ATT&CK techniques are addressed by the relevant data types.
5. **Create Templates for Coverage Maps:** Prepares for subsequent phases by generating templates for data entry to characterize systems.

To use an existing visibility surface definition, locate the relevant eVRF workbook (e.g., cloud business applications) and skip to Phase 2. To create a new visibility surface definition, begin with a blank eVRF workbook template and conduct five sequential activities to fill required information into the workbook.

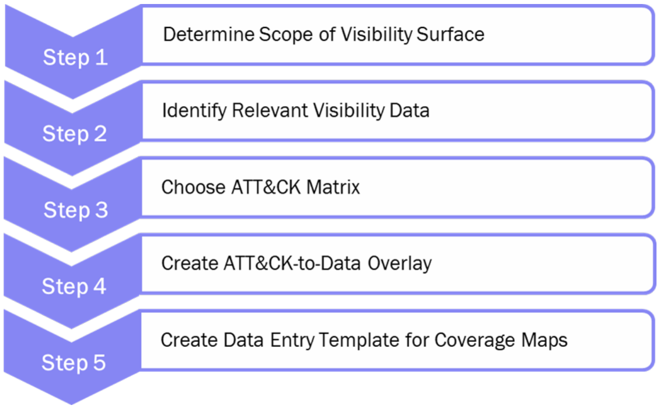

Step 1
Determine Scope of Visibility Surface
Step 2
Identify Relevant Visibility Data
Step 3
Choose ATT&CK Matrix
Step 4
Create ATT&CK-to-Data Overlay
Step 5
Create Data Entry Template for Coverage Maps

*Figure 10: eVRF Workflow Phase 1*

### *Phase 1, Step 1: Determine Scope of Visibility Surface*

Establish the scope of the theoretical environment to be captured by the visibility surface definition. Consider both the type of environment (e.g., cloud business applications, endpoint detection and response capabilities, etc.) and the appropriate level of granularity within the technology stack (see Figure 11). Each increment down the technology stack provides an increased level of detail and greater reliability when evaluating visibility. However, it also limits the scope of the visibility surface, requiring additional visibility surfaces to be defined for full ecosystem awareness.

The scope of the visibility surface may limit the number of ATT&CK sub-techniques considered. All ATT&CK sub-techniques should be considered when creating the visibility surface.

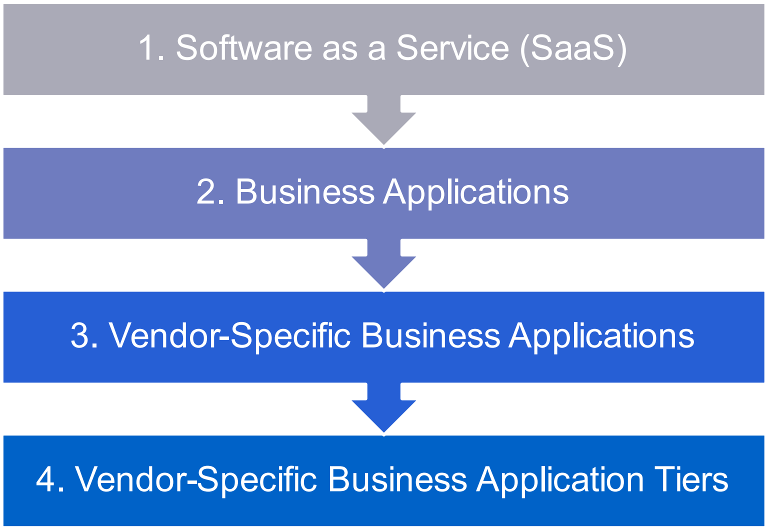

1. Software as a Service (SaaS)
2. Business Applications
3. Vendor-Specific Business Applications
4. Vendor-Specific Business Application Tiers

*Figure 11: Visibility Surface Scoping Example*

Care should be taken to ensure auxiliary or supporting infrastructure is also considered when determining the scope of the visibility surface.

### *Phase 1, Step 2: Identify Relevant Visibility Data*

Create a listing of the data that applies to the visibility surface. In order to produce an effective visibility surface definition, it is important that this activity identifies all of the data desired for visibility into the technology domain. Organizations may need to engage several experts to participate in this activity to ensure identification of the necessary data. Include experts who have comprehensive experience with the technologies that are in scope as well as cybersecurity experts who can identify the types of data used to conduct forensic analysis of those technologies. As changes to the technology and threat environment occur over time, this list should be updated.

The list of data should be organized into four sets with increasing levels of detail:

- **Category:** Identifies a component (i.e., application, software, service, etc.) of a system in which cyber-observable data exists (e.g., email, document management, etc.).

- **Event:** Identifies a process that occurs within the defined component (e.g., receive incoming email, sending outgoing email, etc.).
- **Metadata:** Lists individual data objects or information elements that document the state of the system, an event that occurred, and/or how it may have occurred (e.g., sender, recipient, subject, etc.).
- **Description:** Provides additional details or notes about the activity or data being logged.

### *Phase 1, Step 3: Choose ATT&CK Matrix*

Determine the ATT&CK techniques that are relevant for the environment, potentially using a pre-defined MITRE ATT&CK Matrix (e.g., traditional, cloud, etc.).

Optionally, organizations may choose to increase the fidelity of their eVRF evaluation by conducting the evaluation at the level of “sub-technique” instead of “technique.” If an organization chooses to evaluate sub-techniques, only the relevant sub-techniques need to be included. In this way, the fidelity of visibility assessments can be scaled to accommodate each organization’s needs and risk posture.

### *Phase 1, Step 4: Create ATT&CK-to-Data Overlay*

Review the visibility data that was identified in Step 2 and determine whether the data can provide visibility into each of the ATT&CK techniques. Capture these assessments and use them to create an ATT&CK-to-Data overlay. As with Step 2, organizations may need to engage technology and cybersecurity experts to participate in this activity.

The completed overlay identifies the relevant visibility data for the visibility surface. Even without creating the visibility coverage maps and visibility coverage comparisons described in Phases 2 and 3 of the eVRF workflow, this overlay can provide valuable insight to guide decisions and awareness about how log data can be used to identify threat activity.

### *Phase 1, Step 5: Create Data Entry Template for Coverage Maps*

Create the templates for Phase 2, which organizations will use to characterize their environment and identify the visibility data that is available.

In Phase 2, organizations will use this data entry table to indicate whether each service or application in their environment provides the desired visibility data. The resulting information will be displayed as a visibility coverage map.

## Phase 2: Produce Visibility Coverage Maps

Visibility coverage maps enable organizations to analyze and communicate information about the visibility provided by the data in a given environment. An eVRF workbook can be used to produce coverage maps.

Organizations may choose to repeat Phase 2 to create multiple coverage maps (for example, to examine different implementations of a visibility surface or to detail visibility coverage provided by different products).

Visibility coverage maps may take many forms, including:

- **CISA Visibility Requirements Coverage Map:** For each visibility surface, CISA may choose to create a coverage map that reflects requirements for FCEB agencies to share visibility data with CISA on an ongoing or by request basis and establish priorities for collecting and using telemetry.
- **Product Coverage Maps:** Vendors may choose to create coverage maps indicating which product tiers and configuration settings can provide visibility into the ATT&CK techniques for a given visibility surface.
- **Environment Coverage Maps:** An organization may choose to create coverage maps to understand what data is currently available to support internal cybersecurity operations or to set goals for improved visibility coverage.
- **Comparison Coverage Maps:** An FCEB Agency may create coverage maps indicating what data they plan to share with CISA to support CISA mission objectives.

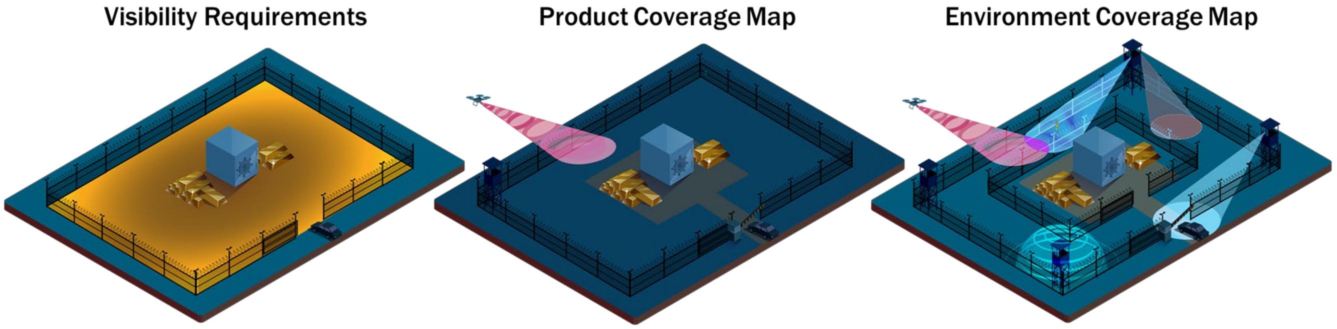


*Figure 12: Visibility Requirements, Product, and Environment Coverage Maps*

In Figure 12 the visibility requirements are represented in the far left by the orange layer within the fenced in area. This represents what is required by an organization to have visibility of, displayed through higher fidelity observation closer to the asset, or the vault and gold. The product coverage map is shown in the middle depiction by the single visibility coverage provided by the drone. Lastly, in the far right the environment coverage map shows the visibility provided by a combination of all sensors currently deployed or planned for deployment.

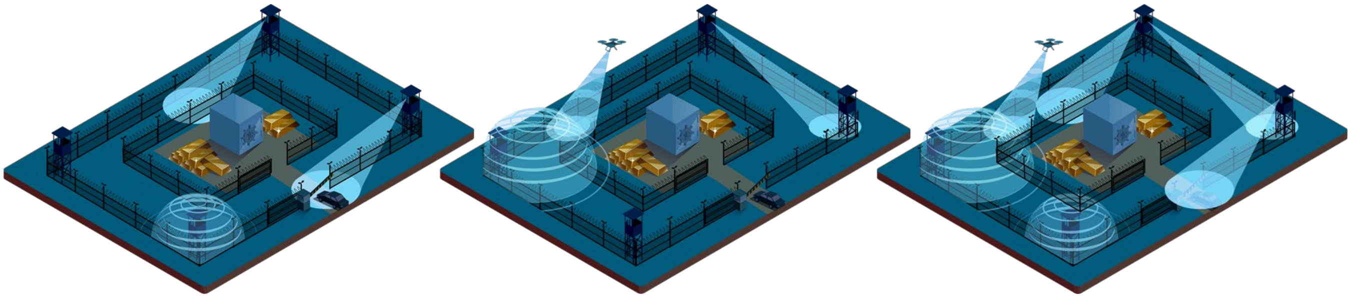


*Figure 13: Coverage Comparison Map*

Figure 13 displays the environment coverage map combined with candidate product coverage maps for planning and what-if scenario consideration, thus creating a variety of coverage comparison maps. In this way an organization can evaluate the variations in visibility offered by different combinations of observation points, sensors, and products.

As with earlier activities in the eVRF workflow, it may be helpful to engage a team of specialists to participate in this phase of producing visibility coverage maps. In order to produce accurate coverage maps and derive valuable insights, it is essential that the technology within the environment is accurately captured in an eVRF workbook. Include people from the organization who have expertise in configuring the relevant technologies.

To create a visibility coverage map, begin with an eVRF workbook that contains a complete visibility surface definition (see Phase 1). Creation of a visibility coverage map involves four steps:

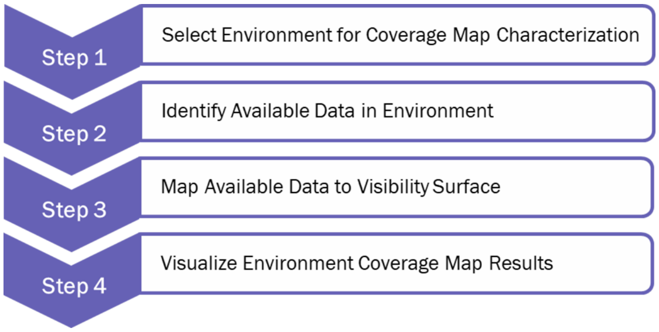

Step 1
Select Environment for Coverage Map Characterization
Step 2
Identify Available Data in Environment
Step 3
Map Available Data to Visibility Surface
Step 4
Visualize Environment Coverage Map Results

*Figure 14: eVRF Workflow Phase 2*

### *Phase 2, Step 1: Select Environment for Coverage Map Characterization*

Start with the results from Phase 1, Step 5, and identify which services or applications support the visibility surface.

Services identified in this step will be the basis for characterizing coverage of the entire visibility surface, so it is important to carefully consider what sources of visibility to include in the coverage maps.

### *Phase 2, Step 2: Identify Available Data in Environment*

For each service or application, identify what logs are produced that may provide visibility into system-level and user-level events. A service or application will include an observation point, with one or more sensors. For example, within the visibility surface definition for cloud business applications, relevant services and applications may include an Email Application, which includes mail flow logs, mailbox audit logs, and so on; an Antivirus service, which includes malware protection logs; a cloud access service, which may include identity protection logs and cloud access security broker logs; and underlying cloud platform services, which include distinct event logs.

### *Phase 2, Step 3: Map Available Data to Visibility Surface*

Now that the available log sources have been identified, review the actual log data to verify whether the logs provide the metadata specified by the visibility surface. For each log source in the environment, enter the coverage for each piece of metadata to indicate whether the log provides that data. Continue until all log sources have been addressed.

When this step is complete, the resulting work product provides detailed, application-level visibility coverage for the entire visibility surface.

### *Phase 2, Step 4: Visualize Environment Coverage Map Results*

In this step, the coverage map is produced. This coverage map is derived from the environment characterization provided in the previous steps of Phase 2, and it represents a summary view of the visibility coverage for all services and applications in the environment for the visibility surface.

Color-coding can be used to indicate visibility coverage for each ATT&CK technique:

*Table 1: Visibility Coverage Rubric*

| Color | Description |
|---|---|
| N/A | Technique is not applicable to this map's scope |
| None | Technique is applicable but there is not visibility coverage within this map's scope |
| Partial | There is partial visibility coverage for the metadata events and techniques within this map's scope |
| Complete | There is complete visibility coverage for the metadata events and techniques within this map's scope |

In the next phase of the eVRF workflow, the results provided by the Phase 2, Step 4 coverage map will be analyzed and compared with additional coverage maps to identify insights about existing coverage or answer questions related to business decisions or operational visibility.

## Phase 3: Generate Visibility Coverage Comparisons for Analysis and Insights

In the final phase of the eVRF workflow, organizations create a visibility coverage comparison by combining multiple coverage maps for analysis and to generate insights. Visibility coverage comparisons may be used to:

- Identify gaps in visibility coverage
- Establish targets for new visibility data to collect
- Identify potential updates to system configurations
- Inform procurement decisions
- Perform "what if" scenarios prior to implementation
- Augment product offerings to provide increased breadth of visibility
- Identify redundancies or duplication of visibility

To generate valuable insights, begin with an eVRF workbook that contains both a complete visibility surface definition (see Phase 1) and a complete visibility coverage map (see Phase 2). The recommended process for generating analysis and insights from coverage map results involves five steps:

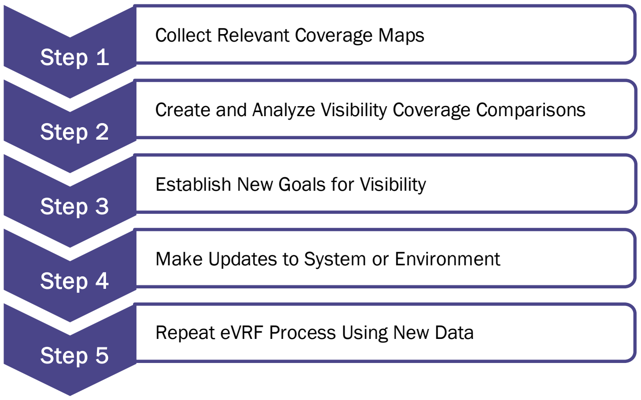

Step 1
Collect Relevant Coverage Maps
Step 2
Create and Analyze Visibility Coverage Comparisons
Step 3
Establish New Goals for Visibility
Step 4
Make Updates to System or Environment
Step 5
Repeat eVRF Process Using New Data

*Figure 15: eVRF Workflow Phase 3*

### *Phase 3, Step 1: Collect Relevant Coverage Maps*

Collect the coverage maps to be examined or compared in the analysis. Visibility coverage comparisons allow an organization to aggregate or compare multiple coverage maps for analysis; two or more coverage maps are required for each visibility coverage comparison.

Many types of coverage maps may be available from which to choose, as described in Phase 2.

Coverage maps selected for this activity may be created by the organization doing the analysis or may be provided from vendors or partners to support comparison or goal setting.

Organizations should customize their selection of coverage maps to suit their use case. For example, an organization seeking to understand trade-offs for an acquisition decision may choose to combine a coverage map that describes the organization's as-implemented environment with a second coverage map that describes the available coverage for a new product. This would produce a visibility coverage comparison that highlights potential visibility improvements offered by the product as well as remaining gaps in coverage.

The coverage maps selected for this step will be used to create a visibility coverage comparison overlay that will be analyzed throughout the rest of the eVRF workflow.

### *Phase 3, Step 2: Create and Analyze Visibility Coverage Comparisons*

Create one or more visibility coverage comparisons by comparing two or more coverage maps. Creating a visibility coverage comparison is currently a manual process, which may be updated and streamlined in future versions of an eVRF workbook. The easiest way to create a visibility coverage comparison currently is to arrange each coverage map side by side to compare the color-coded visibility coverage maps.

Next, when analyzing the visibility coverage comparison, it is visually obvious which ATT&CK techniques are covered by none, all, or a subset of the log sources in each individual coverage map. For organizations seeking to compare the visibility of multiple product suites, for example, the visibility coverage comparison can show where a coverage gap exists by highlighting instances where some or none of the log sources offer visibility. Also apparent are instances where more complete visibility is offered for some products and not others.

To illustrate additional potential use cases for analysis:

- An organization may use visibility coverage comparisons to understand the effect of adding a product or service to an as-implemented environment. The comparison may illustrate redundant visibility or the need for one or more additional products to address remaining coverage gaps.
- An organization may use visibility coverage comparisons to compare an as-implemented product configuration to the optimal product configuration (e.g., as described by a vendor-provided coverage map). The comparison could inform decisions about changes to configuration settings, upgrades to products, or acquisition of new products to address coverage gaps.
- A department or agency may use visibility coverage comparisons to better understand the coverage provided by their as-implemented environment compared to CISA's visibility requirements. This may inform decisions about new products that could address coverage gaps and mitigation strategies.
- CISA or another organization may want to use visibility coverage comparisons to compare the same visibility surface across coverage maps from many organizations. This may inform decisions about new analytical toolsets or incident response activities that CISA may want to prioritize.

With the visibility coverage comparisons created and analyzed, new goals to update the system can be established.

### *Phase 3, Step 3: Establish New Goals for Visibility*

Goal setting should be driven by opportunities to improve or resolve any visibility gaps that were identified when analyzing the visibility coverage comparisons for the environment. Some goals may be also driven by identification of redundant visibility and opportunities to improve the use of resources. In this case, organizations should consider the details of logs that appear to provide redundant coverage for the same technique—they may in fact not be as redundant as they seem.

In addition, new goals for visibility may be initiated by changes to the threat landscape, which introduce new techniques and sub-techniques being leveraged by attackers. As these new approaches are adopted by adversaries, organizations should react accordingly to ensure ongoing relevant visibility is maintained.

### *Phase 3, Step 4: Make Updates to System or Environment*

In general, the solutions to visibility goals typically involve identifying new configuration settings, product upgrades, feature enhancements, or additional products or business partners that can provide the visibility desired to address gaps in coverage.

In cases of redundant or duplicative visibility or service utilization, the solution may be a reduction in licensing, product use, or even simplified architectures.

### *Phase 3, Step 5: Repeat eVRF Process Using New Data*

When the characterized environment is modified, the threat environment evolves, or other changes impacting the utilized coverage maps occurs, revisions should be made to the relevant visibility surface definitions, visibility coverage maps, and visibility coverage comparisons. These eVRF components should be living artifacts that, if reexamined on a regular basis, can continue to provide valuable insights into an organization's current visibility posture and opportunities to improve that visibility posture.

# 4 CISA USE OF EVRF

The CISA use case captured in this section pertains to how CISA will use eVRF with FCEB agencies and provides an example of the activities and interactions between CISA, vendors or service providers, and agencies as they work through the process described in the general workflow with this Guidebook. This section focuses on the specific nature of this process where there is a need for agencies to provide visibility for government systems so that CISA could execute its role in cybersecurity.

Ideally each party would develop an iterative process between organizations to provide for productive dialog and shared maturity. This will enhance the collaboration for improved feedback and refinement of requirements, products, and systems over time.

CISA can use eVRF to define visibility requirements for FCEB agencies for select visibility surfaces.

## 4.1 Agency and CISA Benefits of eVRF

FCEB agencies will derive all of the benefits of eVRF mentioned in Section 1.2 as they adopt this framework. Additionally, agencies will benefit from using eVRF to meet CISA’s visibility requirements in the following ways:

1. Agencies will gain better insights into their overall security posture through the enablement of enhanced visibility-informed risk analyses.
2. Agencies will be better able to analyze where gaps in visibility exist within their enterprise environment.
3. Greater understanding of gaps in coverage and potential risks can be used to inform decision making processes for allocation of resources. As an agency’s visibility is better understood, they will be better postured to identify and mitigate potential threats.
4. The inclusion of additional telemetry across domains enhances incident response and persistent hunt capabilities. All agencies and CISA benefit from extended visibility.
5. By using this model, CISA will be able to aggregate and correlate threat data to aid in the timely discovery of attack campaigns facing federal enterprise systems, benefitting all agencies.
6. The frequency and availability of indicators of compromise is driven by more threat-informed and available data sets. Therefore, alignment with eVRF visibility requirements coverage maps will result in better situational awareness and availability of indicators of compromise from CISA.

## 4.2 Roles and Responsibilities

CISA-required visibility within FCEB Agency domains ensures that CISA can identify threats, protect against potential attacks, and perform hunt, incident response, and analysis activities. Furthermore, this visibility enables CISA to develop and share valuable insights across the FCEB Agency domains, which provides individual agencies valuable cybersecurity benefits. In order to ensure the success of the eVRF, CISA, agencies, and vendors/service providers each have roles and responsibilities.

## CISA Role

First and foremost, CISA is responsible for developing the eVRF and communicating resultant guidance to other agencies, including specifications of the telemetry needs determination process and telemetry data requirements for FCEB Agency domains. CISA has the responsibility to analyze the FCEB security events and telemetry. This responsibility guides the development of eVRF visibility requirements coverage map definitions; CISA supplies eVRF visibility surface definitions for FCEB Agency consideration on solution development and desired telemetry sharing. This ensures that the FCEB Agencies can understand the CISA eVRF visibility objectives and limitations. CISA is also responsible for updating visibility requirements to reflect changes to the threat landscape, evolution of solution offerings, FCEB Agency feedback regarding technical capabilities, and others to align to current and future telemetry needs.

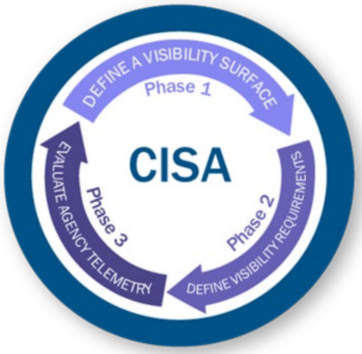

DEFINE A VISIBILITY SURFACE
Phase 1
CISA
Phase 2
DEFINE VISIBILITY REQUIREMENTS
Phase 3
EVALUATE AGENCY TELEMETRY

*Figure 16: CISA Role in eVRF Workflow*

## Agency Role

FCEB Agencies are responsible for utilizing eVRF-based guidance to inform their internal policies and provide alignment to agency cybersecurity needs and/or risk management planning, as appropriate. The FCEB Agencies are responsible for adopting the visibility surface definitions established by CISA and ensuring that visibility data is available to support CISA as needed. Telemetry data considerations shall be inclusive of both an ongoing reporting nature and agency-retained data to support future potential CISA investigative needs. The FCEB Agencies have the responsibility to evaluate their ability to collect relevant visibility data and develop a plan to address CISA's visibility requirements. The FCEB Agencies have the responsibility to ensure configuration of telemetry generation within each domain in accordance with eVRF inputs supplied by CISA; this will ensure that the FCEB Agency security event and telemetry reported meet the CISA requirements. FCEB Agencies have a responsibility to update their as-built visibility coverage maps to reflect changes to their environment.

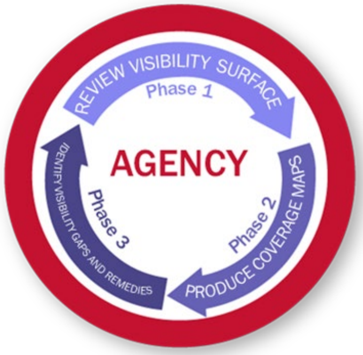

REVIEW VISIBILITY SURFACE
Phase 1
AGENCY
Phase 2
PRODUCE COVERAGE MAPS
Phase 3
IDENTIFY VISIBILITY GAPS AND REMEDIES

*Figure 17: Agency Role in eVRF Workflow*

### Vendor and/or Service Provider Role

Vendors and/or service providers may elect to produce visibility coverage maps for their products and services, as well as update their visibility maps to reflect changes in their offerings over time.

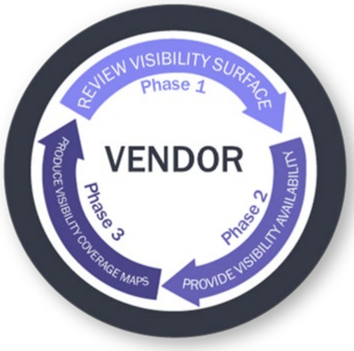

REVIEW VISIBILITY SURFACE
Phase 1
VENDOR
Phase 2
PROVIDE VISIBILITY AVAILABILITY
Phase 3
PRODUCE VISIBILITY COVERAGE MAPS

*Figure 18: Vendor Role in eVRF Workflow*

## 4.3 CISA Workflow Example

Figure 19 shows the three entities within this example. As each entity works through the process and generates data, each interacts with the other entities to refine and improve the data. Additional telemetry may become available or change over time and all parties should update their data as technology, implementation, and target needs change.

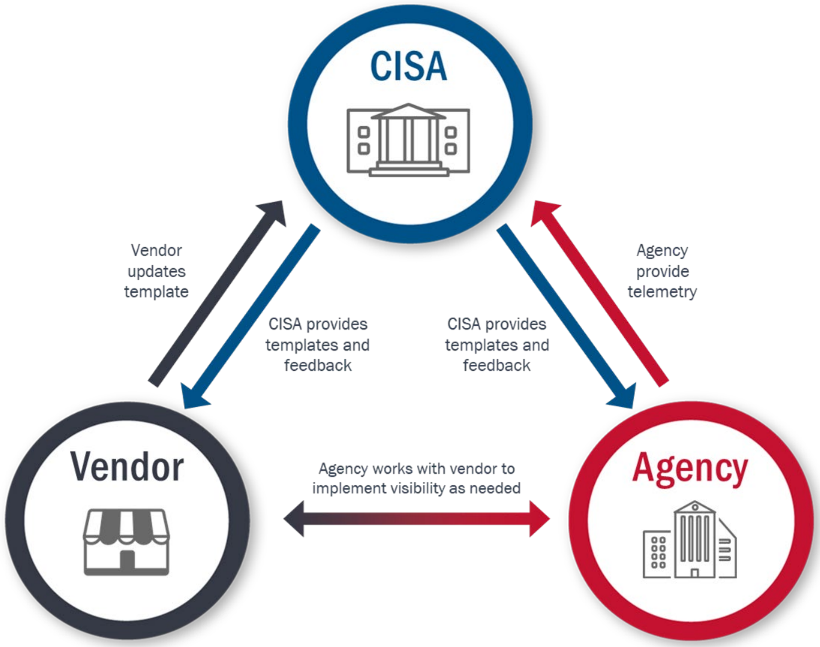

CISA
Vendor updates template
CISA provides templates and feedback
CISA provides templates and feedback
Agency provide telemetry
Vendor
Agency works with vendor to implement visibility as needed
Agency

*Figure 19: CISA Workflow Cycle*

CISA provides its requirements for the visibility surface definition within each workbook. Agencies can work with their vendors to provide inputs for visibility telemetry that exists within each environment. This information goes to CISA for review and feedback.

Vendors (or service providers) may populate the relevant data for their product offerings to identify the available telemetry. Vendors may provide this data to CISA in order to allow CISA to evaluate the product's telemetry with respect to CISA requirements.

FCEB Agencies use the workbook to capture the current state of the system for existing telemetry and provide CISA with the telemetry required. Agencies may work with CISA and vendors to identify visibility gaps and how to improve areas with limited visibility. When one product offering might not completely provide the needed visibility, layering another product could help fill the gap. Agencies may be able to use the products and services of multiple vendors to assist with understanding potential solutions.

## Workflow

The CISA workflow follows the tasks shown in Figure 20. This workflow represents tasks specific to CISA, Vendors, and FCEB Agencies within the eVRF workflow described previously and how their specific portions align with the eVRF workflow.

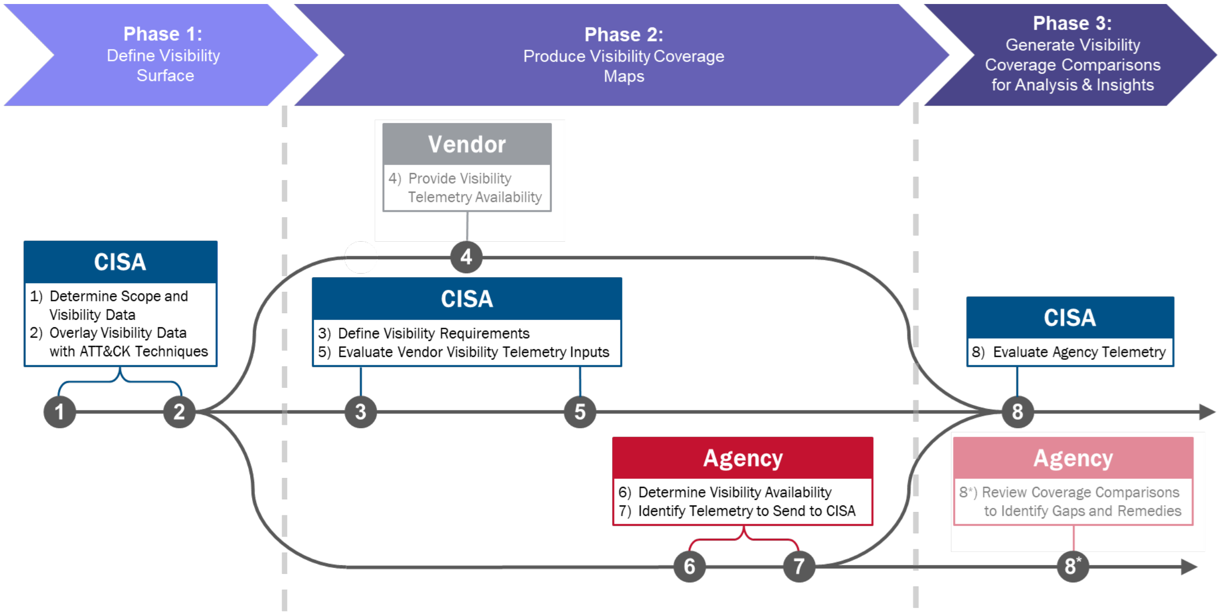

Phase 1:
Define Visibility Surface
Phase 2:
Produce Visibility Coverage Maps
Phase 3:
Generate Visibility Coverage Comparisons for Analysis & Insights
Vendor
4) Provide Visibility Telemetry Availability
CISA
1) Determine Scope and Visibility Data
2) Overlay Visibility Data with ATT&CK Techniques
CISA
3) Define Visibility Requirements
5) Evaluate Vendor Visibility Telemetry Inputs
CISA
8) Evaluate Agency Telemetry
Agency
6) Determine Visibility Availability
7) Identify Telemetry to Send to CISA
Agency
8*) Review Coverage Comparisons to Identify Gaps and Remedies
1
2
3
4
5
6
7
8
8*

*Figure 20: CISA Workflow Tasks*

### CISA – Phase 1, Step 1: Determine Scope of Visibility Surface

CISA will first define the scope of the visibility surface and complete the description of the level of detail desired for this domain.

### CISA – Phase 1, Step 2: Identify Relevant Visibility Data

CISA determines what metadata is needed for each event and category. Table 2 shows an example of a portion of the visibility surface data that is captured within a workbook or tool for a generic business application suite.

*Table 2: Visibility Surface Example*

| Visibility Data | | | |
|---|---|---|---|
| Category | Event | Metadata | Description/Example Activities |
| Email | Email Received | Sender | Emails received, either from internal or external to the organization |
| | | Receiver | |
| | | Subject | |
| | | Other Headers | |
| | | URLs | |
| | | Body | |
| | | Message Trace | |

| | | | |
|---|---|---|---|
| | | Attachments | |
| | Email Sent | Sender | Emails sent, either internal or external to the organization. |
| | | Receiver | |
| | | Subject | |
| | | Other Headers | |
| | | URLs | |
| | | Body | |
| | | Message Trace | |
| | | Attachments | |

## CISA – Phase 1, Step 3: Choose ATT&CK Matrix

With the visibility data defined, CISA then selects the desired mapping to a set of MITRE ATT&CK techniques for the given application. A MITRE ATT&CK matrix may already exist for the given product. CISA may choose to use existing matrices at MITRE, make its own, or choose a different mapping altogether to a different set of criteria. Table 3 provides a sampling of the tactics, techniques, and sub-techniques captured.

*Table 3: ATT&CK Tactics, Techniques, and Sub-Techniques Example*

| ATT&CK Techniques | | |
|---|---|---|
| Tactic | Technique | Sub-Technique |
| Initial Access | Phishing | Other Unspecified Sub-Technique |
| | | Spear phishing Link |
| | Valid Accounts | Other Unspecified Sub-Technique |
| | | Default Accounts |
| | | Cloud Accounts |
| Persistence | Account Manipulation | Other Unspecified Sub-Technique |
| | | Exchange Email Delegate Permissions |
| | | Add Bus. Suite Global Admin Role |
| | Create Account | Other Unspecified Sub-Technique |
| | | Cloud Account |
| | Office Application Startup | Other Unspecified Sub-Technique |
| | | Add-ins |
| | | Office Template Macros |
| | | Outlook Forms |
| | | Outlook Rules |
| | | Outlook Home Page |
| | | Office Test |
| | Valid Accounts | Other Unspecified Sub-Technique |
| | | Default Accounts |
| | | Cloud Accounts |
| Privilege Escalation | Valid Accounts | Other Unspecified Sub-Technique |
| | | Default Accounts |
| | | Cloud Accounts |

## CISA – Phase 1, Step 4: Create ATT&CK-to-Data Overlay

CISA then determines the visibility mapping to the ATT&CK techniques for the given products. For each event, CISA determines whether each event and associated data would provide visibility for each element of the ATT&CK techniques and sub-techniques within each tactic. If the metadata provides visibility, 'Yes' is input into the associated field for this example. The right side of Table 4 shows the mapping.

*Table 4: Overlay Visibility Data with ATT&CK Techniques Example*

| | | ATT&CK Overlay Technique | Initial Access | | | | |
|---|---|---|---|---|---|---|---|
| | | | Phishing | | Valid Accounts | | |
| | | Sub-Technique | Other Unspecified Subtechnique | Spearphishing Link | Other Unspecified Subtechnique | Default Accounts | Cloud Accounts |
| Visibility Data | | | | | | | |
| Category | Event | Metadata | | | | | |
| Email | Email Received | Sender | Yes | Yes | No | No | No |
| | | Receiver | Yes | Yes | No | No | No |
| | | Subject | Yes | Yes | No | No | No |
| | | Other Headers | Yes | Yes | No | No | No |
| | | URLs | Yes | Yes | No | No | No |
| | | Body | Yes | Yes | No | No | No |
| | | Message Trace | Yes | Yes | No | No | No |
| | | Attachments | Yes | Yes | No | No | No |
| | Email Sent | Sender | No | No | No | Yes | Yes |
| | | Receiver | No | No | No | Yes | Yes |
| | | Subject | No | No | No | Yes | Yes |
| | | Other Headers | No | No | No | Yes | Yes |
| | | URLs | No | No | No | Yes | Yes |
| | | Body | No | No | No | Yes | Yes |
| | | Message Trace | No | No | No | Yes | Yes |
| | | Attachments | No | No | No | Yes | Yes |

## CISA - Phase 2, Step 2: Define Visibility Requirements

CISA will determine the visibility requirements for the visibility data. The periodicity and priority for each set of metadata for each event will be decided. Telemetry provided to CISA will be stipulated based upon the periodicity and priority that has been set.

The values in the example are input as placeholders and are not intended to represent any analysis of this set of information.

Periodicity options are ongoing or by request. “Ongoing” defines metadata that should be provided to CISA on a regular interval that will be negotiated with the agencies. This telemetry would be either an automated feed or provided at a regular frequency based on the data. CISA will perform ongoing analysis on this information with advanced analytics to aid in identifying malicious activity within the agency’s implemented architecture. “By request” telemetry will be maintained by the agencies and will be provided at CISA’s discretion. When circumstances warrant, based on analysis findings or other indicators, a request would be made to the agency to provide the additional information needed. This will allow CISA to aid the agency in performing deeper analysis in looking for additional indicators of compromise of its systems.

The priority levels are 0, 1, and 2 with 0 being the highest and 2 being the lowest. This will aid CISA and agencies in determining how best to prioritize resources to accommodate data requests. CISA may want to consider the visibility target mapping to the visibility surface in determining the priority of each event. Based on the OMB logging requirements document, prioritization should focus on high-impact systems and high-value assets. With this in mind, there may be additional prioritization needed depending on an agency’s specific architecture. Efforts should be focused on accommodating priority 0 requests. If a specific set of metadata cannot be provided, the agency should coordinate with CISA to implement a working solution.

The right side of Table 5 shows the visibility requirements within the workbook with the associated visibility surface information. This portion of the workbook would be prepopulated with CISA's requirements prior to providing to agencies. This constitutes a special purpose coverage map unique to CISAs visibility requirements regarding the subject visibility surface.

*Table 5: CISA Visibility Requirements Example*

| Visibility Data | | | CISA Visibility Requirements | |
|---|---|---|---|---|
| Category | Event | Metadata | Ongoing or By Request | Priority |
| Email | Email Received | Sender | By Request | 1 |
| | | Receiver | By Request | 1 |
| | | Subject | By Request | 1 |
| | | Other Headers | By Request | 1 |
| | | URLs | By Request | 1 |
| | | Body | By Request | 1 |
| | | Message Trace | By Request | 1 |
| | | Attachments | By Request | 1 |
| | Email Sent | Sender | By Request | 1 |
| | | Receiver | By Request | 1 |
| | | Subject | By Request | 1 |
| | | Other Headers | By Request | 1 |
| | | URLs | By Request | 1 |
| | | Body | By Request | 1 |
| | | Message Trace | By Request | 1 |
| | | Attachments | Ongoing | 0 |

## Vendor – Phase 2, Step 1: Select Environment for Coverage Map Characterization

The vendor may identify which services or applications support the visibility surface.

## Vendor – Phase 2, Step 2: Identify Available Data in Product

With the visibility mapping completed and CISA visibility requirements defined, CISA provides the workbook to the vendor (CISA – Phase 1, Step 5) to determine the visibility mapping to the ATT&CK techniques for its products. For each event, the vendor may indicate whether metadata exists that would provide visibility for each element of the ATT&CK technique and sub-technique within each tactic by writing '*Yes*' into the associated field within the workbook. As eVRF processes and tools mature, vendors may be able to provide more information, such as the level of visibility (limited/some/most).

When complete, the vendor can provide completed workbooks to CISA for adjudication. CISA will review the provided information, seek clarity on any questions, and update its processes to incorporate the vendors' input.

*Table 6: Product Visibility Mapping Example*

| Product Visibility | | Vendor Service | Platform Logs | | Email Application | | | |
|---|---|---|---|---|---|---|---|---|
| | | Telemetry Source | Event Log (Tier 1) | Event Log (Tier 2) | Mailbox Logs (Tier 1) | Mailbox Logs (Tier 2) | Mail Flow Logs (Tier 2) | Phishing Protections (Tier 2) |
| Visibility Data | | | | | | | | |
| Category | Event | Metadata | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Email | Email Received | Sender | | | Yes | Yes | | |
| | | Receiver | | | Yes | Yes | | |
| | | Subject | | | Yes | Yes | | |
| | | Other Headers | | | Yes | Yes | | |
| | | URLs | | | | Yes | | |
| | | Body | | | | Yes | | |
| | | Message Trace | | | | | Yes | |
| | | Attachments | | | | Yes | | |
| | Email Sent | Sender | | | | | | |
| | | Receiver | | | | | | |
| | | Subject | | | | | | |
| | | Other Headers | | | | | | |
| | | URLs | | | | | | |
| | | Body | | | | | | |
| | | Message Trace | | | | | | |
| | | Attachments | | | | | | Yes |

## CISA – Phase 1, Step 5: Create Data Entry Template for Coverage Maps

CISA may use vendor submitted information to update and improve CISA's visibility requirements. CISA then creates the templates for Phase 2, which agencies will use to characterize their environment and identify the visibility data that is available.

## Agency – Phase 2, Step 1: Select Environment for Coverage Map Characterization

The agency identifies which services or applications support the visibility surface.

## Agency – Phase 2, Steps 2 & 3: Identify & Map Available Data to Visibility Surface

The agency will use the workbook to determine the visibility available within its system architecture. This will be a review of all the agency's systems and vendor products associated with each visibility surface. Within each domain, the agency will determine what observation points and sensors are deployed and what telemetry they have available and how it is currently being captured. If the agency is not currently collecting the telemetry, efforts to refine the architecture to either capture the telemetry or provide a CISA approved alternative should be considered. In cases where the agency is unable to provide telemetry, they should work with CISA on an agreed path forward.

### *Identify Telemetry to Send to CISA*

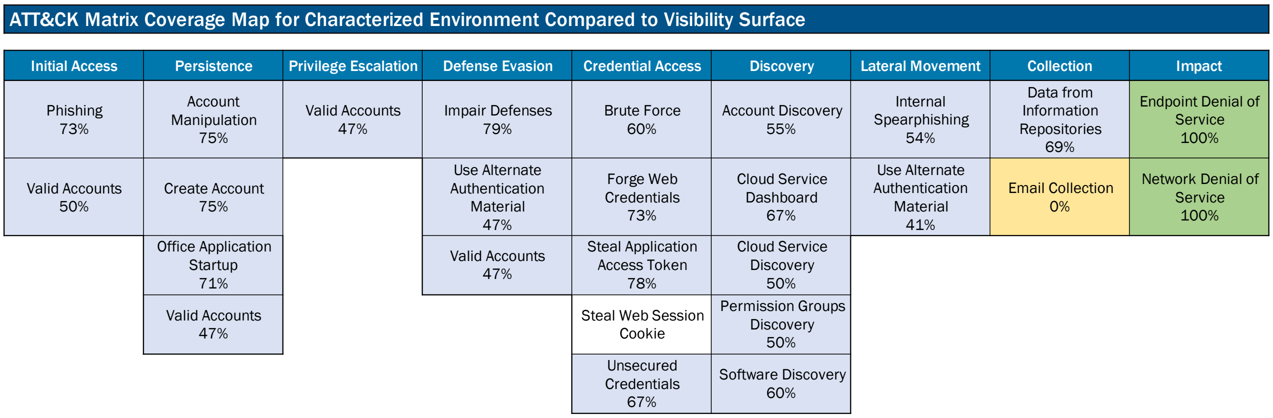
Based upon the agency's architecture and visibility determination, the agency will identify appropriate telemetry associated with Visibility Surfaces and requirements that will be sent to CISA.

Agencies within the Federal Civilian Executive Branch (FCEB) may want to refer to CISA Visibility Requirements Coverage Maps for agencies to provide visibility data. For each piece of visibility data, the table includes a priority ranking and indicates whether the data should be provided on an ongoing basis or whether the data should be available to CISA upon request. Agencies may also refer to NCPS Cloud Interface Reference Architecture Volumes 1 and 2 for details about telemetry generation, processing, and reporting to CISA.

## Agency – Phase 2, Step 4: Visualize Environment Coverage Map Results

Coverage maps can be generated specific to the agency as part of Phase 2. The telemetry availability as implemented is based on the product software selection, mapped to the ATT&CK overlay. This will represent any gaps that exist due to applications that either aren't used or haven't been fully implemented.

In the example map shown in Figure 21, techniques where implemented coverage is not present when CISA has specified a tie to the event metadata for the technique will be shaded yellow to indicate the deviation from the defined visibility surface.



ATT&CK Matrix Coverage Map for Characterized Environment Compared to Visibility Surface

| Initial Access | Persistence | Privilege Escalation | Defense Evasion | Credential Access | Discovery | Lateral Movement | Collection | Impact |
|---|---|---|---|---|---|---|---|---|
| Phishing 73% | Account Manipulation 75% | Valid Accounts 47% | Impair Defenses 79% | Brute Force 60% | Account Discovery 55% | Internal Spearphishing 54% | Data from Information Repositories 69% | Endpoint Denial of Service 100% |
| Valid Accounts 50% | Create Account 75% | | Use Alternate Authentication Material 47% | Forge Web Credentials 73% | Cloud Service Dashboard 67% | Use Alternate Authentication Material 41% | Email Collection 0% | Network Denial of Service 100% |
| | Office Application Startup 71% | | Valid Accounts 47% | Steal Application Access Token 78% | Cloud Service Discovery 50% | | | |
| | Valid Accounts 47% | | | Steal Web Session Cookie | Permission Groups Discovery 50% | | | |
| | | | | Unsecured Credentials 67% | Software Discovery 60% | | | |

*Figure 21: Coverage Comparison - Environment to Product* [2]

## CISA – Phase 3: Analyze Agency Telemetry

CISA will perform a verification of the telemetry received to ensure alignment with information specified by the agency. CISA will work with the agency to resolve any issues in transmission. This will be an ongoing verification to ensure ingoing telemetry is arriving as it should.

CISA will then review the telemetry inputs provided by the agency to identify discrepancies and work with the agency to resolve gaps in telemetry to ensure CISA is getting required visibility telemetry. This will be a recurring process as the agency updates the information available to provide to CISA and makes modifications to its architecture.

## Agency – Phase 3: Generate Visibility Coverage Comparisons for Analysis and Insights

The coverage maps generated in Phase 2 will aid in building broader visibility coverage comparisons to identify opportunities to close those gaps with other products.

[2] The percentages in the figure represent the fraction of the required telemetry within the visibility surface that is satisfied by the organization's identified telemetry availability for each technique.

## 4.4 CISA Use of Visibility Coverage Comparisons

Each stakeholder will use visibility coverage comparisons differently. Fundamentally, each visibility coverage comparison shows a summation of coverage maps, representing the telemetry of multiple products or services.

The versatility of visibility coverage comparisons allows for the evaluation of both agencies' telemetry as well as telemetry sources as offered by vendors. Visibility coverage comparisons can be used to compare the relative strength of two different collections of services or two different agencies. Ultimately, wide usage of visibility coverage comparisons will more easily inform decision-making to maximize breadth and depth of telemetry coverage across the FCEB.

### Agencies

There are multiple ways an agency can use visibility coverage comparisons to analyze and improve its defensive posture. An agency will internally maintain a comprehensive gold version of a single or multiple visibility coverage comparisons to evaluate its cybersecurity posture as an organization or in a division. A simple analysis of the agency's visibility coverage comparison quickly conveys gaps and overlaps in telemetry. Each agency will provide CISA with a visibility coverage comparison with at least the minimum required details on ATT&CK framework coverage. An agency can internally or, in coordination with CISA, compare its current visibility coverage comparison with CISA's recommended telemetry coverage.

Gaps in an agency's visibility coverage comparisons reflect gaps in the implementing agency's applications. Some may be covered under CISA's supported service offerings. CISA recommends using its eVRF insights into visibility to determine which products/strengthen the agency's overall posture the most. Even if CISA's federal service offerings are redundant with an agency's current coverage, the benefits associated with using CISA's services will be made clear, such as federated threat sharing or more seamless integration with other CISA-supported offerings.

Not all the data the agency has available will be exported to CISA but working through this process will help them identify where they have telemetry available to provide insights into potential malicious activity on their networks. It will also aid in identifying where gaps may exist through the generated coverage maps within the workbooks. This will identify areas where the agency may want to focus on shoring up their architectures.

This represents the difference between what is available within the product suite and what has been implemented. Techniques where implemented coverage is not present when the product suite does provide telemetry options will be shaded red to indicate the agency may likely have a mechanism to fill those gaps.

### CISA

CISA will use visibility coverage comparisons to empirically inform the list of telemetry it requires agencies to provide to CISA on an ongoing or on-demand basis. Organizations within CISA will use visibility coverage comparisons to inform which telemetry to prioritize in its analytical toolsets or incident response engagement activities. Over time, CISA will build recommended visibility coverage comparisons based on profiles of certain combinations of products or services. CISA will be able to objectively demonstrate differences between ideal visibility coverage comparisons and an agency's current visibility coverage comparison as well as make specific mitigation recommendations.

## Vendors

Vendors of enterprise business applications or cloud security software will benefit from clear security evaluation criteria of their products. Leveraging the methodology, vendors can complete eVRF workbooks to describe the telemetry made available by their products and services.

As part of the iterative and ongoing improvement process, vendors can work with CISA to determine how to satisfy information needs in cases where metadata are unavailable.

# 5 CONCLUSION

The eVRF defines the concepts, requirements, and mechanisms for CISA, FCEB Agencies, and other partners to identify, characterize, collect, and apply visibility data to mitigate threats. The eVRF uses multiple work products to define and describe key concepts, roles and responsibilities, and workflows, identifies mechanisms to define a visibility surface, and enables organizations to produce their own visibility coverage maps and visibility coverage comparisons.

# APPENDIX A: RELATIONSHIP OF EVRF TO CISA PROGRAMS

This appendix describes the relationship between eVRF and other CISA programs.

**Trusted Internet Connections (TIC)**

The goal of the Trusted Internet Connections (TIC) initiative[3] is to secure federal data, networks, and boundaries, and to provide visibility into agency "traffic", including both network traffic and traffic between designated trust zones in a particular use case. The scope of TIC includes cloud, mobile, encrypted applications, services, and environments, and thus, this overlaps with the scope of eVRF. TIC use cases provide guidance on the implementation of security capabilities, but this guidance does not prescribe what telemetry an agency should collect and maintain. Additionally, a TIC use case identifies *where* CISA telemetry may be required for the use case; however, a use case does *not* identify what telemetry is required.

**National Cybersecurity Protection System (NCPS)**

The National Cybersecurity Protection System (NCPS)[4] is an integrated system-of-systems that delivers a range of capabilities, such as intrusion detection, analytics, information sharing, and intrusion prevention. These capabilities provide a technological foundation that enables CISA to secure and defend the FCEB agencies' information technology infrastructure against advanced cyber threats.

The NCPS Program is evolving to ensure that security information about cloud-based traffic can be captured and analyzed. In order to support this goal, CISA is piloting a cloud-based architecture, the Cloud Log Aggregation Warehouse (CLAW), to collect and analyze agency cloud security data. The *NCPS Cloud Interface Reference Architecture* (NCIRA) explains how agencies can create reporting patterns to describe their process for providing cloud-generated security information to CLAW. The reporting pattern has an attribute for "telemetry type," with several options to categorize common types of cloud telemetry. The NCIRA documents describe multiple options for sharing cloud telemetry with CISA but do *not* define specific requirements for what cloud telemetry is shared. eVRF will be used as a framework for CISA to define telemetry requirements.

**Continuous Diagnostics and Mitigation (CDM)**

The Continuous Diagnostics and Mitigation (CDM)[5] program provides cybersecurity tools, integration services, and dashboards to participating agencies to support them in improving their respective security posture. Future CDM requirements may specify collection of internal telemetry in accordance with Section 7(f) of Executive Order 14028.[6] There may be overlap of CDM telemetry with the CISA Visibility Requirements.

[3] https://www.cisa.gov/trusted-internet-connections

[4] https://www.cisa.gov/national-cybersecurity-protection-system-ncps

[5] https://www.cisa.gov/cdm

[6] Executive Order 14026, "*Improving the Nation's Cybersecurity*", (May 2021). https://www.whitehouse.gov/briefing-room/presidential-actions/2021/05/12/executive-order-on-improving-the-nations-cybersecurity/.

**govCAR (Cybersecurity Architecture Review)**

CISA uses the .govCAR methodology to conduct threat-based assessments of cyber capabilities for the Federal Civilian Executive Branch (.gov domain). Viewing a target architecture, the way an adversary does provides a threat-informed approach to identify where mitigations could be applied to provide the best defense against all phases of a cyberattack. Similarly, eVRF is a threat-based framework for identifying visibility data that can address adversarial attacks.

# APPENDIX B: KEY TERMS

The eVRF utilizes key terms, which are summarized here for reference.

| Term | Description |
|---|---|
| **Category** | A component (application, software, service, etc.) of a system of which cyber-observable data exists. |
| **Coverage Map** | See Visibility Coverage Map(s). |
| **Cyber Observable Data** | The data elements or artifacts, e.g., configurations or configuration settings, data flows, logs, packet data, etc., which describe an event (benign or malicious) or the state on a network or system, and which contribute to a visibility surface. |
| **Domain** | A platform specific environment, e.g., cloud, mobile, on-site, etc., which may represent a component of the cybersecurity scope within an agency's modern enterprise. |
| **Event** | A process that occurs within a defined component (of a visibility surface). |
| **Metadata** | The data or information elements (within a visibility surface) that documents the state of a system, that an event occurred, and/or how it may have occurred. |
| **Observation Point** | An observation point defines the architecture location of a telemetry source in the given domain. |
| **Telemetry** | Artifacts derived from security capabilities that provide visibility into security posture, often through automated collections. |
| **TTPs** | Threat actor tactics, techniques, and procedures (TTPs); typically, as they relate to visibility surfaces that may enable an organization to identify them. |
| **Visibility** | Visibility provides context-specific insights about the activity taking place within a given environment. CISA uses the term visibility to refer to:<br>a) the observable artifacts of digital events, and<br>b) the characteristics of the digital environment in which those events take place. |
| **Visibility Coverage Map** | A visibility coverage map characterizes the ability of a product or organization to sufficiently address a visibility surface through available cyber-observable data. |
| **Visibility Coverage Comparison** | Overlay of one or more coverage maps applied simultaneously to the MITRE ATT&CK framework to better understand the holistic cybersecurity posture of a group of deployed products and services. |
| **Visibility Surface** | A visibility surface refers to a digital environment for which cyber-observable data exists or should exist. A visibility surface is made up of many different points from which a system can be observed and describes the scope of the environment and its relevant data and TTPs. |

# APPENDIX C: KEY DOCUMENTS

The eVRF leverages concepts presented in several key documents sets.

## MITRE ATT&CK

The MITRE ATT&CK framework categorizes the tactics and techniques employed by attackers in compromising computing infrastructure. Tactics refer to objectives an attacker tries to achieve, and techniques refer to how an attacker pursues a given tactic. ATT&CK has been specialized for cloud environments in the form of the Cloud Matrix. The matrix identifies ten tactics: initial access, persistence, privilege escalation, defense evasion, credential access, discovery, lateral movement, collection, exfiltration, and impact. Each of these tactics consists of individual techniques that may be employed by the attacker and that often results in visible signs contained in telemetry. eVRF will provide mappings between telemetry and the visibility they provide on adversary tactics and techniques.

## NCPS Cloud Interface RA

The NCPS Cloud Interface Reference Architecture, or NCIRA, provides a framework of "reporting patterns" that agencies can use for sending cloud telemetry to CISA. Each reporting pattern consists of choices around how telemetry is generated, how telemetry is processed, and how telemetry is delivered to CISA. NCIRA is therefore a guide for agencies on *how* to share telemetry with CISA, and eVRF is a guide for *what* telemetry agencies should share to begin with.

## Zero Trust Maturity Model

CISA has released a *Zero Trust Maturity Model*[7] in response to the Executive Order 14028, *Improving the Nation's Cybersecurity.*[8] The maturity model describes a gradient of implementation across five distinct pillars: Identity, Device, Network, Application Workload, and Data. The maturity model includes very high-level guidance regarding "Visibility and Analytics" for each pillar. eVRF can be used by agencies to continually incorporate visibility as they evolve their zero trust architectures over time.

## OMB Memo M-21-31

OMB has released a memorandum[9] ("Improving the Federal Government's Investigative and Remediation Capabilities Related to Cybersecurity Incidents") on logging, log retention and log management for FCEB Agencies in support of the *Executive Order on Improving the Nation's Cybersecurity*.[10] The memo includes a maturity model for event log management and logging requirements for many log categories across an enterprise.

[7] https://www.cisa.gov/sites/default/files/publications/CISA%20Zero%20Trust%20Maturity%20Model_Draft.pdf

[8] https://www.whitehouse.gov/briefing-room/presidential-actions/2021/05/12/executive-order-on-improving-the-nations-cybersecurity/

[9] https://www.whitehouse.gov/wp-content/uploads/2021/08/M-21-31-Improving-the-Federal-Governments-Investigative-and-Remediation-Capabilities-Related-to-Cybersecurity-Incidents.pdf

[10] https://www.whitehouse.gov/briefing-room/presidential-actions/2021/05/12/executive-order-on-improving-the-nations-cybersecurity/

## Cloud Technical Reference Architecture

The *Cloud Security Technical Reference Architecture (TRA)*[11] provides strategic and technical guidance to agencies as they adopt cloud technology. The TRA focused on shared services, designing software in the cloud, and cloud security posture management (CSPM). The CSPM discussion includes considerations for visibility and sensor positioning, and cloud telemetry and logs.

## OMB Memo M-22-09

OMB Memo M-22-09, the *OMB Zero Trust Strategy*[12] ("Moving the U.S. Government Toward Zero Trust Cybersecurity Principles"), clarifies priorities for federal civilian agencies as they transition to zero trust architectures. The strategy recognizes that this is a paradigm shift for agencies, and that agencies and CISA must have visibility beyond an agency's perimeter. Enterprise-wide logging is a key component to how agencies deploy zero trust architectures.

[11] https://www.cisa.gov/publication/cloud-security-technical-reference-architecture
[12] https://zerotrust.cyber.gov/federal-zero-trust-strategy/