



NIST Special Publication 800
NIST SP 800-61r3 ipd

Incident Response Recommendations and Considerations for Cybersecurity Risk Management

A CSF 2.0 Community Profile

Initial Public Draft

Alex Nelson
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April 2024



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National Institute of Standards and Technology
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Publication History

Approved by the NIST Editorial Review Board on YYYY-MM-DD [Will be added to final publication.]
Supersedes NIST Series XXX (Month Year) DOI [Will be added to final publication, if applicable.]

How to Cite this NIST Technical Series Publication

Nelson A, Rekhi S, Souppaya M, Scarfone K (2024) Incident Response Recommendations and Considerations for Cybersecurity Risk Management: A CSF 2.0 Community Profile. (National Institute of Standards and Technology, Gaithersburg, MD), NIST Special Publication (SP) NIST SP 800-61r3 ipd. <https://doi.org/10.6028/NIST.SP.800-61r3.ipd>

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NIST SP 800-61r3 ipd (Initial Public Draft)
April 2024

Incident Response Recommendations and
Considerations for Cyber Risk Management

Public Comment Period

April 3, 2024 – May 20, 2024

Submit Comments

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All comments are subject to release under the Freedom of Information Act (FOIA).

1 **Abstract**

2 This publication seeks to assist organizations with incorporating cybersecurity incident response
3 recommendations and considerations throughout their cybersecurity risk management
4 activities as described by the NIST Cybersecurity Framework (CSF) 2.0. Doing so can help
5 organizations prepare for incident responses, reduce the number and the impact of incidents
6 that occur, and improve the efficiency and effectiveness of their incident detection, response,
7 and recovery activities. Readers are encouraged to utilize online resources in conjunction with
8 this document to access additional information on implementing these recommendations and
9 considerations.

10 **Keywords**

11 cyber threat information sharing; Cybersecurity Framework; cybersecurity incident;
12 cybersecurity risk management; incident handling; incident management; incident response.

13 **Reports on Computer Systems Technology**

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21 information in federal information systems. The Special Publication 800-series reports on ITL’s
22 research, guidelines, and outreach efforts in information system security, and its collaborative
23 activities with industry, government, and academic organizations.

24

25 **Supplemental Content**

26 NIST has established an [Incident Response project page](#) that hosts links to resources with
27 additional information on incident response activities. By moving links from this document to a
28 website, NIST can update and expand them as needed without having to release a new version
29 of this publication.

30 For more information on CSF 2.0 Community Profiles, see the [Framework Resource Center](#).

31 **Audience**

32 The target audience for this publication includes cybersecurity program leadership,
33 cybersecurity personnel, and others who are responsible for preparing for, detecting,
34 responding to, or recovering from cybersecurity incidents. This publication is intended for use
35 by most organizations, regardless of sector, size, or other factors.

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59 assurances on its behalf) will include in any documents transferring ownership of patents
60 subject to the assurance, provisions sufficient to ensure that the commitments in the assurance
61 are binding on the transferee, and that the transferee will similarly include appropriate
62 provisions in the event of future transfers with the goal of binding each successor-in-interest.

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64 regardless of whether such provisions are included in the relevant transfer documents.

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90 **Executive Summary**

91 Incident response is a critical part of cybersecurity risk management and should be integrated
92 across organizational operations. The six CSF 2.0 Functions play vital roles in incident response:

- 93 • Govern, Identify, and Protect help organizations prevent some incidents, prepare to
94 handle incidents that do occur, reduce the impact of those incidents, and improve
95 incident response and cybersecurity risk management practices based on lessons
96 learned from those incidents.
- 97 • Detect, Respond, and Recover help organizations discover, manage, prioritize, contain,
98 eradicate, and recover from cybersecurity incidents, as well as perform incident
99 reporting, notification, and other incident-related communications.

100 Many individuals, teams, and third parties hold a wide variety of roles and responsibilities
101 across all of the Functions that support an organization's incident response. Organizations have
102 no direct control over the tactics and techniques used by their adversaries, nor are they certain
103 about the timing of a future incident other than knowing that another incident is inevitable.
104 However, organizations can use an incident response life cycle framework or model that best
105 suits them to develop strong cybersecurity risk management practices that reduce their risks to
106 acceptable levels.

107 This publication adopts the CSF 2.0 Functions, Categories, and Subcategories as its new high-
108 level incident response model. This provides a common taxonomy that is already widely used
109 for communicating about incident response and cybersecurity risk management and
110 governance. This also enables organizations to access a range of online resources mapped to
111 each Function, Category, and Subcategory through the NIST [Cybersecurity and Privacy](#)
112 [Reference Tool \(CPRT\)](#). These resources include mappings to other incident response and
113 cybersecurity risk management standards and guidance, as well as sources of implementation
114 guidance that organizations can choose to utilize as needed.

115 1. Introduction

116 Within this document, an *event* is any observable occurrence that involves computing assets,
117 including physical and virtual platforms, networks, services, and cloud environments. Examples
118 of events are user login attempts, the installation of software updates, and an application
119 responding to a transaction request. Many events focus on security or have security
120 implications. *Adverse events* are any events associated with a negative consequence regardless
121 of cause, including natural disasters, power failures, or cybersecurity attacks. This guide
122 addresses only *adverse cybersecurity events*. Additional analysis is often needed to determine
123 whether adverse cybersecurity events indicate that a cybersecurity incident has occurred.

124 A *cybersecurity incident* (or simply *incident*) is

125 ...an occurrence that actually or imminently jeopardizes, without lawful
126 authority, the integrity, confidentiality, or availability of information or
127 an information system; or constitutes a violation or imminent threat of
128 violation of law, security policies, security procedures, or acceptable use
129 policies. [FISMA2014]

130 Examples of incidents include an attacker:

- 131 • Employing a botnet to send high volumes of connection requests to an internet-facing
132 service, making it unavailable to legitimate service users
- 133 • Obtaining administrative credentials at a software-as-a-service provider, which puts
134 sensitive tenant data entrusted to that provider at risk
- 135 • Intruding upon an organization's business network to steal credentials and use them to
136 instruct industrial control systems to shut down or destroy critical physical components,
137 causing a major service disruption
- 138 • Deploying ransomware to prevent the use of computer systems and cause multiple data
139 breaches by copying files from those systems
- 140 • Using phishing emails to compromise user accounts and using those accounts to commit
141 financial fraud
- 142 • Identifying a new vulnerability in network management appliances and exploiting the
143 vulnerability to gain unauthorized access to network communications
- 144 • Compromising a vendor's software, which is subsequently distributed to customers in its
145 compromised state

146 Because of the damage that cybersecurity incidents can inflict on organizations and their
147 customers, business partners, and others, it is vital to respond quickly and effectively when an
148 incident occurs. Effective implementation of incident response processes enables systematic
149 responses to and recovery from incidents by analyzing information and taking appropriate
150 action. This reduces cybersecurity and enterprise risks by minimizing data loss or theft, the
151 disruption of services, and the overall impact of incidents. Lessons learned from incident
152 response activities and root cause analysis help improve cybersecurity risk management and

153 governance efforts and ensure that the organization is better prepared to identify its current
154 technology assets and cybersecurity risks, protect its assets, and detect, respond to, and
155 recover from future incidents.

156 **1.1. Purpose and Scope**

157 This publication seeks to help organizations incorporate cybersecurity incident response
158 recommendations and considerations throughout their cybersecurity risk management
159 activities. It also provides a common language that all organizations can use to communicate
160 internally and externally regarding their incident response plans and activities.

161 The scope of this publication differs significantly from previous versions. Because the details of
162 how to perform incident response activities change so often and vary so much across
163 technologies, environments, and organizations, it is no longer feasible to capture and maintain
164 that information in a single static publication. Instead, this version focuses on improving
165 cybersecurity risk management for all of the NIST Cybersecurity Framework (CSF) 2.0 Functions
166 [CSF2.0] to better support an organization's incident response capabilities.

167 Readers are encouraged to utilize other NIST resources in conjunction with this document,
168 including the [CSF 2.0 publication and supplemental resources](#), the [Incident Response project page](#),
169 and mappings to additional sources of information on implementing incident response
170 considerations available through the NIST [Cybersecurity and Privacy Reference Tool \(CPRT\)](#). An
171 example of a CPRT mapping is associating CSF 2.0 outcomes with NIST Special Publication (SP)
172 800-53 controls that can be implemented to help achieve the outcomes. In this way, CSF 2.0
173 provides a common language that facilitates access to a large number of other resources.

174 Once this publication is finalized, it will supersede SP 800-61r2 (Revision 2), *Computer Security*
175 *Incident Handling Guide* [SP800-61r2].

176 **1.2. Document Structure**

177 The remainder of this document is organized into the following sections and appendices:

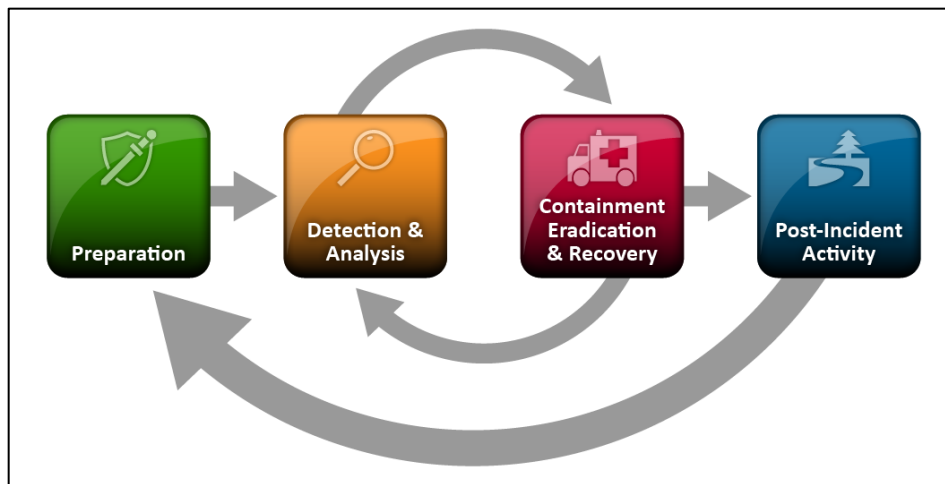
- 178 • Section 2 discusses how incident response has evolved to become a critical part of
179 cybersecurity risk management, as well as how the concept of the incident response life
180 cycle has changed to reflect that.
- 181 • Section 3 presents recommendations and considerations for an organization's
182 cybersecurity risk management practices. They are organized and documented as a CSF
183 2.0 Community Profile.
- 184 • The References section lists references cited throughout this publication.
- 185 • Appendices A and B provide an acronyms list and a glossary, respectively.
- 186 • Appendix C contains a change log of the major changes made since the previous
187 revision.

188 2. Incident Response as Part of Cybersecurity Risk Management

189 This section explains the fundamental concepts of incident response as an integral part of
190 cybersecurity risk management. Section 2.1 explores the incident response life cycle and
191 proposes a new life cycle model based on CSF 2.0 Functions. Section 2.2 discusses incident
192 response roles and responsibilities both inside and outside an organization. Finally, Section 2.3
193 briefly examines incident response policies, processes, and procedures.

194 2.1. Incident Response Life Cycle

195 Figure 1 depicts the incident response life cycle illustrated in the previous version of this
196 publication [SP800-61r2]. At that time, incidents were relatively rare, the scope of most
197 incidents was narrow and well-defined, and incident response and recovery was usually
198 completed within a day or two. Under those conditions, it was realistic to treat incident
199 response as a separate set of activities performed by a separate team of personnel and to
200 depict all incident response activities as part of a circular life cycle. Formal post-incident
201 activities would identify needed improvements and feed them into the preparation stage, thus
202 starting the cycle again. Incident response activities were typically intermittent rather than
203 continuous.



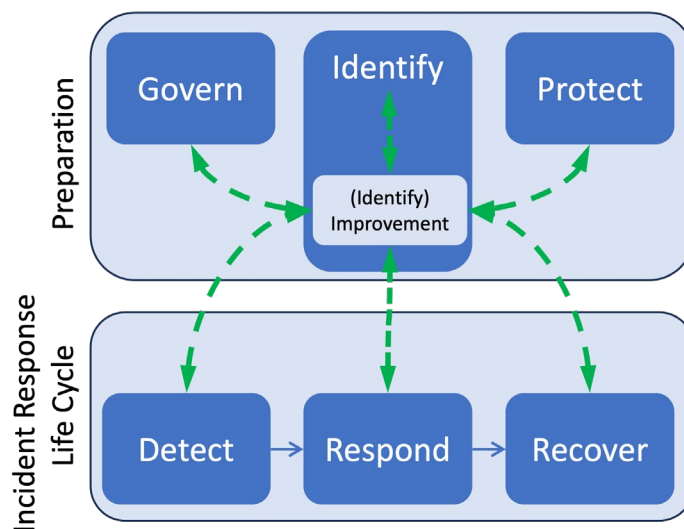
204
205 **Fig. 1. Previous incident response life cycle model**

206 However, this model no longer reflects the current state of incident response. Today, incidents
207 occur frequently and cause far more damage, and recovering from them often takes weeks or
208 months due to their breadth, complexity, and dynamic nature. Incident response is now
209 considered a critical part of cybersecurity risk management that should be integrated across
210 organizational operations. The lessons learned during incident response should often be shared
211 as soon as they are identified, not delayed until after recovery concludes. Continuous
212 improvement is necessary for all facets of cybersecurity risk management in order to keep up
213 with modern threats.

- 214 The CSF 2.0 Functions organize cybersecurity outcomes at their highest level:
- 215 • **Govern (GV):** The organization’s cybersecurity risk management strategy, expectations,
216 and policy are established, communicated, and monitored.
 - 217 • **Identify (ID):** The organization’s current cybersecurity risks are understood.
 - 218 • **Protect (PR):** Safeguards to manage the organization’s cybersecurity risks are used.
 - 219 • **Detect (DE):** Possible cybersecurity attacks and compromises are found and analyzed.
 - 220 • **Respond (RS):** Actions regarding a detected cybersecurity incident are taken.
 - 221 • **Recover (RC):** Assets and operations affected by a cybersecurity incident are restored.

222 All six Functions have vital roles in incident response. Govern, Identify, and Protect help
223 organizations prevent some incidents, prepare to handle incidents that do occur, reduce the
224 impact of those incidents, and improve incident response and cybersecurity risk management
225 practices based on lessons learned. Detect, Respond, and Recover help organizations discover,
226 manage, prioritize, contain, eradicate, and recover from cybersecurity incidents, as well as
227 perform incident reporting, notification, and other incident-related communications.

228 Figure. 2 shows the new incident response life cycle model based on the six CSF 2.0 Functions.



229

230

Fig. 2. Incident response life cycle model based on CSF 2.0 Functions

231 The top half reflects that the preparation activities of Govern, Identify, and Protect are not part
232 of the incident response life cycle. Rather, they are much broader cybersecurity risk
233 management activities that also support incident response. The new response life cycle for
234 each incident is shown in the bottom half of the figure: Detect, Respond, and Recover.
235 Additionally, the need for continuous improvement is indicated by the Improvement Category
236 within the Identify Function and the dashed green lines in Fig. 2. Lessons learned from
237 performing all activities in all Functions are fed into Improvement, and those lessons learned
238 are analyzed, prioritized, and used to inform all of the Functions. This reflects that organizations
239 should be learning new lessons at all times (e.g., detecting the presence of a new threat and

240 characterizing its behavior) and communicating those lessons to the appropriate personnel so
241 that the organization’s incident response and other cybersecurity risk management policies,
242 processes, and practices can be adjusted as needed.

243 Table 1 maps the previous SP 800-61 incident response life cycle’s phases to the corresponding
244 CSF 2.0 Functions used in this document.

245 **Table 1. Previous incident response life cycle phases and corresponding CSF 2.0 Functions**

Previous Incident Response Life Cycle Phase	CSF 2.0 Functions
Preparation	Govern Identify (all Categories) Protect
Detection & Analysis	Detect Identify (Improvement Category)
Containment, Eradication & Recovery	Respond Recover Identify (Improvement Category)
Post-Incident Activity	Identify (Improvement Category)

246 Organizations should use the incident response life cycle framework or model that suits them
247 best. The model in this document is based on CSF 2.0 to take advantage of the wealth of
248 resources available for CSF 2.0 and aid organizations that are already using the CSF. Regardless
249 of the incident response life cycle framework or model used, every organization should take
250 incident response into consideration throughout their cybersecurity risk management activities.

251 **2.2. Incident Response Roles and Responsibilities**

252 In the past, incident response activities were performed almost exclusively by incident handlers
253 from the organization’s own incident response team. Today, while incident handlers are still
254 critically important, most organizations increasingly recognize that the success of their incident
255 response efforts depend on the participation of many internal and external parties who hold a
256 wide variety of roles and responsibilities and may be spread around the world. Examples of
257 these roles and responsibilities include the following:

- 258 • **Incident handlers.** Incident handlers verify that an incident has occurred, collect and
259 analyze data and evidence, prioritize incident response activities, and act appropriately
260 to limit damage, find root causes, and restore operations. Incident handlers also often

261 provide input to others on mitigating cybersecurity issues and improving resiliency. An
262 organization's incident handlers might be:

- 263 ○ On staff (e.g., an incident response team),
- 264 ○ On contract (e.g., outsourcing a security operations center [SOC] to a managed
265 security services provider [MSSP] or leveraging a cloud service provider's
266 incident response team when an incident occurs within that provider's cloud),
267 and/or
- 268 ○ Available when needed (e.g., from a parent organization, a cybersecurity services
269 provider, a business partner, or a law enforcement agency).

270 Many organizations use more than one of these approaches, such as internally
271 performing basic incident response and engaging third-party resources for assistance
272 with certain incidents. Larger organizations may have multiple incident response teams,
273 with each team responsible for a particular logical or physical segment of the
274 organization. When this model is employed, the teams should be part of a single
275 coordinated entity (e.g., a federation) to ensure that incident response processes,
276 procedures, and training are consistent across the organization and that information is
277 shared among teams.

- 278 ● **Leadership.** The organization's leadership team oversees incident response, allocates
279 funding, and may have decision-making authority on high-impact response actions, such
280 as shutting down critical services or rebuilding the organization's authentication
281 services.
- 282 ● **Technology professionals.** Cybersecurity, privacy, system, network, cloud, and other
283 technology architects, engineers, and administrators, as well as software developers,
284 may be involved in incident response and recovery efforts.
- 285 ● **Legal.** Legal experts can review incident response plans, policies, and procedures to
286 ensure compliance with applicable laws and regulations, including the right to privacy.
287 Legal experts can also review contracts with technology suppliers and other third parties
288 when there are incident response implications. In addition, incident responders can seek
289 guidance from the legal department if a particular incident may have legal ramifications,
290 such as prosecution of a suspect, lawsuits, or situations that require a memorandum of
291 understanding (MOU) or other binding agreement.
- 292 ● **Public affairs and media relations.** Depending on the nature and impact of an incident,
293 it may be necessary to inform the media and, by extension, the public. Sometimes, the
294 media learns of incidents through alternate sources (i.e., not through public affairs
295 personnel). Having a media engagement strategy in place can greatly aid in this
296 situation.
- 297 ● **Human resources.** Certain human resources practices should consider cybersecurity risk
298 management, including pre-employment screening and employee onboarding,
299 offboarding, and position changes. Human resources may also be involved if an
300 employee is suspected of intentionally causing an incident.

301 • **Physical security and facilities management.** Some computer security incidents occur
302 through physical security breaches or involve coordinated logical and physical attacks.
303 The incident response team may also need access to facilities during incident handling
304 (e.g., to access a compromised workstation in a locked office).

305 • **Asset owners.** Asset owners (e.g., system owners, data owners, and business process
306 owners) may have valuable insights on response and recovery priorities for their
307 affected assets. They also need to be kept up to date on the status of response and
308 recovery efforts.

309 Third parties may be under contract with an organization to help perform incident response
310 activities. Some third parties may fill a primary role (e.g., a managed security service provider
311 [MSSP] performing incident detection, response, and recovery activities), while other parties
312 (e.g., cloud service providers [CSPs] and internet service providers [ISPs]) may be involved in
313 certain incident response activities for particular types of incidents. This is a shared
314 responsibility model, where the organization transfers some of its responsibilities to a provider.
315 These responsibilities should be clearly defined in a contract, and the incident response team
316 should be aware of the division of responsibilities, including information flows and coordination
317 and the authority to act on behalf of the organization. This also includes restrictions on what
318 the service provider can do, such as sharing sanitized incident information with other
319 customers or making and implementing operational decisions (e.g., immediately deactivating
320 certain services to contain an incident).

321 Service providers often have privileged access to organizational systems and may also have
322 access to sensitive organizational data. Accordingly, the risk of malicious insiders or the service
323 provider being compromised should be considered and addressed. Non-disclosure agreements
324 (NDAs) and contracting clauses are options for deterring the unauthorized disclosure of
325 sensitive data.

326 A service provider may detect malicious activity sooner than individual organizations would
327 because it can correlate events across its customers. In some situations, a service provider
328 might be able to use knowledge of an incident with one customer to proactively prevent similar
329 incidents with its other customers.

330 **2.3. Incident Response Policies, Processes, and Procedures**

331 Organizations should have policies that govern their cybersecurity incident response. While a
332 policy is highly individualized to the organization, most incident response policies include the
333 same key elements:

- 334 • Statement of management commitment
- 335 • Purpose and objectives of the policy
- 336 • Scope of the policy (i.e., to whom and what it applies and under what circumstances)
- 337 • Definition of events, cybersecurity incidents, investigations, and related terms

- 338 • Roles, responsibilities, and authorities, such as which roles have the authority to
339 confiscate, disconnect, or shut down technology assets
 - 340 • Guidelines for prioritizing incidents, estimating their severity, initiating recovery
341 processes, maintaining or restoring operations, and other key actions
 - 342 • Performance measures
- 343 Processes and procedures should be based on the incident response policy and plan.
344 Documented procedures should explain how technical processes and other operating
345 procedures should be performed. Procedures can be tested or exercised periodically to verify
346 their accuracy and can be used to help train new personnel. While it is impossible to have
347 detailed procedures for every possible situation, organizations should consider documenting
348 procedures for responding to the most common types of incidents and threats. Organizations
349 should also develop and maintain procedures for particularly important processes that may be
350 urgently needed during emergency situations, like redeploying the organization’s primary
351 authentication platform.
- 352 Many organizations choose to create playbooks as part of documenting their procedures.
353 Playbooks provide actionable steps or tasks for people to perform during various scenarios or
354 situations. Formatting procedures within a playbook instead of another format can improve
355 their usability. See the Cybersecurity and Infrastructure Security Agency (CISA) *Cybersecurity*
356 *Incident & Vulnerability Response Playbooks* [CISA-PB] for incident response playbook
357 examples.

358 **3. CSF 2.0 Community Profile for Incident Response**

359 A *CSF Community Profile* is a baseline of CSF outcomes that is created and published to address
360 shared interests and goals for reducing cybersecurity risk among a number of organizations. A
361 Community Profile is typically developed for a particular sector, subsector, technology, threat
362 type, or other use case [CSF2.0].

363 This section defines NIST’s CSF 2.0 Community Profile for incident response. It uses the CSF
364 Core as the basis for highlighting and prioritizing cybersecurity outcomes that are important for
365 incident response, makes recommendations, and provides other supporting information for
366 certain CSF outcomes within the context of incident response [CSWP32]. The Community
367 Profile is split into two tables: Table 2 covers Preparation (Govern, Identify, and Protect), while
368 Table 3 covers the Incident Response Life Cycle (Detect, Respond, and Recover).

369 Each CSF 2.0 Function, Category, and Subcategory has its own row in one of the two tables.
370 Each row’s relative priority within the context of incident response is indicated by one of the
371 following:

- 372 • **High:** Functions as a core incident response activity for most organizations
- 373 • **Medium:** Directly supports incident response activities for most organizations
- 374 • **Low:** Indirectly supports incident response activities for most organizations

375 The last column may contain one or more items that recommend what to do or describe
376 additional considerations or supporting information for some rows. Each item in that column
377 has an ID starting with one of the following:

- 378 • “R” (recommendation: something the organization should do)
- 379 • “C” (consideration: something the organization should consider doing)
- 380 • “N” (note: additional information besides recommendations and considerations)

381 An R, C, or N designation and its number can be appended to the row’s CSF ID to create an
382 identifier that is unique within the Community Profile (e.g., “GV.OC-03.R1” is recommendation
383 1 for CSF Subcategory GV.OC-03).

384 The recommendations, considerations, and notes supplement what the CSF 2.0 already
385 provides through its documents and online resources. The recommendations, considerations,
386 and notes are not comprehensive, and not all of them will be applicable to every organization.

387 The Community Profile is intended for use by most organizations regardless of sector, size, or
388 other factors. Additional versions of this Community Profile could be developed for narrower
389 audiences, such as federal agencies, small businesses, or educational institutions. For more
390 information on CSF 2.0 Community Profiles, see the [Framework Resource Center](#).

391 **3.1. Preparation**

392 Table 2 contains the first part of the Community Profile. Most of the CSF elements in this part
393 are not specific to incident response, so they have lower priorities with respect to incident

394 response and do not contain recommendations or considerations. This does not imply that they
 395 are unnecessary for organizations to achieve, but rather that they are outside of the scope of
 396 incident response.

397

Table 2. CSF 2.0 Community Profile for incident response, Part 1: Preparation

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
GV (Govern)	The organization’s cybersecurity risk management strategy, expectations, and policy are established, communicated, and monitored	Low	
GV.OC (Organizational Context)	The circumstances — mission, stakeholder expectations, dependencies, and legal, regulatory, and contractual requirements — surrounding the organization’s cybersecurity risk management decisions are understood	Low	
GV.OC-01	The organizational mission is understood and informs cybersecurity risk management	Low	
GV.OC-02	Internal and external stakeholders are understood, and their needs and expectations regarding cybersecurity risk management are understood and considered	Low	
GV.OC-03	Legal, regulatory, and contractual requirements regarding cybersecurity — including privacy and civil liberties obligations — are understood and managed	Medium	R1: Cybersecurity requirements should include all requirements related to incident notifications, data breach reporting, and other aspects of incident response.
GV.OC-04	Critical objectives, capabilities, and services that external stakeholders depend on or expect from the organization are understood and communicated	Medium	N1: Understanding critical external dependencies on the organization’s operations can aid in prioritizing response and recovery efforts.
GV.OC-05	Outcomes, capabilities, and services that the organization depends on are understood and communicated	Medium	N1: Understanding critical dependencies on external resources (e.g., cloud-based hosting providers and managed service providers) can aid in prioritizing response and recovery efforts.

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
GV.RM (Risk Management Strategy)	The organization’s priorities, constraints, risk tolerance and appetite statements, and assumptions are established, communicated, and used to support operational risk decisions	Low	
GV.RM-01	Risk management objectives are established and agreed to by organizational stakeholders	Low	
GV.RM-02	Risk appetite and risk tolerance statements are established, communicated, and maintained	Low	
GV.RM-03	Cybersecurity risk management activities and outcomes are included in enterprise risk management processes	Medium	R1: Have processes in place so that incident-related decision-making will be informed by other types of risks that the organization faces (e.g., privacy, operational, safety, reputational) and not just cybersecurity risks in isolation.
GV.RM-04	Strategic direction that describes appropriate risk response options is established and communicated	Low	
GV.RM-05	Lines of communication across the organization are established for cybersecurity risks, including risks from suppliers and other third parties	Low	
GV.RM-06	A standardized method for calculating, documenting, categorizing, and prioritizing cybersecurity risks is established and communicated	Medium	N1: Having a standardized method for calculating cybersecurity risks can aid in prioritizing response and recovery efforts.
GV.RM-07	Strategic opportunities (i.e., positive risks) are characterized and are included in organizational cybersecurity risk discussions	Low	
GV.RR (Roles, Responsibilities, and Authorities)	Cybersecurity roles, responsibilities, and authorities to foster accountability, performance assessment, and continuous improvement are established and communicated	Medium	R1: Cybersecurity roles, responsibilities, and authorities should include incident response.
GV.RR-01	Organizational leadership is responsible and accountable for cybersecurity risk and fosters a culture that is risk-aware, ethical, and continually improving	Low	

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
GV.RR-02	Roles, responsibilities, and authorities related to cybersecurity risk management are established, communicated, understood, and enforced	Medium	<p>N1: Roles and responsibilities that involve cybersecurity incident response typically exist throughout an organization and often include third parties (e.g., those under contract) to help perform incident response activities for the organization.</p> <p>R1: All roles and responsibilities involving cybersecurity incident response should be documented in an organization’s policies.</p> <p>R2: All appropriate individuals or parties should be designated the authority necessary to fulfill their incident response-related responsibilities.</p>
GV.RR-03	Adequate resources are allocated commensurate with the cybersecurity risk strategy, roles, responsibilities, and policies	Low	
GV.RR-04	Cybersecurity is included in human resources practices	Low	
GV.PO (Policy)	Organizational cybersecurity policy is established, communicated, and enforced	High	R1: Cybersecurity policies should include an incident response policy.
GV.PO-01	Policy for managing cybersecurity risks is established based on organizational context, cybersecurity strategy, and priorities and is communicated and enforced	Low	
GV.PO-02	Policy for managing cybersecurity risks is reviewed, updated, communicated, and enforced to reflect changes in requirements, threats, technology, and organizational mission	Low	
GV.OV (Oversight)	Results of organization-wide cybersecurity risk management activities and performance are used to inform, improve, and adjust the risk management strategy	Low	
GV.OV-01	Cybersecurity risk management strategy outcomes are reviewed to inform and adjust strategy and direction	Low	

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
GV.OV-02	The cybersecurity risk management strategy is reviewed and adjusted to ensure coverage of organizational requirements and risks	Medium	R1: Take past cybersecurity incidents into account when reviewing the organization’s cybersecurity risk management strategy.
GV.OV-03	Organizational cybersecurity risk management performance is evaluated and reviewed for adjustments needed	Low	
GV.SC (Cybersecurity Supply Chain Risk Management)	Cyber supply chain risk management processes are identified, established, managed, monitored, and improved by organizational stakeholders	Low	
GV.SC-01	A cybersecurity supply chain risk management program, strategy, objectives, policies, and processes are established and agreed to by organizational stakeholders	Low	
GV.SC-02	Cybersecurity roles and responsibilities for suppliers, customers, and partners are established, communicated, and coordinated internally and externally	Low	
GV.SC-03	Cybersecurity supply chain risk management is integrated into cybersecurity and enterprise risk management, risk assessment, and improvement processes	Low	
GV.SC-04	Suppliers are known and prioritized by criticality	Low	
GV.SC-05	Requirements to address cybersecurity risks in supply chains are established, prioritized, and integrated into contracts and other types of agreements with suppliers and other relevant third parties	Medium	R1: Cybersecurity supply chain risk management requirements should include cybersecurity performance and vulnerability, threat, and incident disclosure and information sharing.
GV.SC-06	Planning and due diligence are performed to reduce risks before entering into formal supplier or other third-party relationships	Low	

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
GV.SC-07	The risks posed by a supplier, their products and services, and other third parties are understood, recorded, prioritized, assessed, responded to, and monitored over the course of the relationship	Low	
GV.SC-08	Relevant suppliers and other third parties are included in incident planning, response, and recovery activities	Medium	N1: The GV.SC-08 Subcategory is specific to incident response and recovery. N2: See ID.IM-02 for more information on tests and exercises.
GV.SC-09	Supply chain security practices are integrated into cybersecurity and enterprise risk management programs, and their performance is monitored throughout the technology product and service life cycle	Low	
GV.SC-10	Cybersecurity supply chain risk management plans include provisions for activities that occur after the conclusion of a partnership or service agreement	Low	
ID (Identify)	The organization’s current cybersecurity risks are understood	Medium	N1: All Identify Categories are beneficial for preventing, responding to, and recovering from incidents.
ID.AM (Asset Management)	Assets (e.g., data, hardware, software, systems, facilities, services, people) that enable the organization to achieve business purposes are identified and managed consistent with their relative importance to organizational objectives and the organization’s risk strategy	Medium	N1: All asset management information can be helpful to incident responders in many ways, such as understanding the impact of an incident, identifying other assets that may be targeted, and prioritizing response and recovery efforts.
ID.AM-01	Inventories of hardware managed by the organization are maintained	Medium	R1: Make current and automatically updated inventories of the internal and external hardware used by the organization available for use in finding and addressing vulnerabilities, monitoring operations and usage to detect adverse cybersecurity events, and identifying “shadow IT” usage.

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
ID.AM-02	Inventories of software, services, and systems managed by the organization are maintained	Medium	R1: Make current and automatically updated inventories of the internal and external software, services, and systems used by the organization available for use in finding and addressing vulnerabilities, monitoring operations and usage to detect adverse cybersecurity events, and identifying “shadow IT” usage.
ID.AM-03	Representations of the organization’s authorized network communication and internal and external network data flows are maintained	Medium	N1: Maintaining network data flow representations can improve the accuracy of detecting malicious data flows and communication. C1: Consider leveraging automation and zero trust architectures to automatically create and maintain network data flow representations.
ID.AM-04	Inventories of services provided by suppliers are maintained	Medium	R1: Current and automatically updated inventories of the services provided by the organization’s suppliers should be available for use in finding and addressing vulnerabilities, monitoring operations and usage to detect adverse cybersecurity events, and identifying “shadow IT” usage.
ID.AM-05	Assets are prioritized based on classification, criticality, resources, and impact on the mission	Medium	R1: Prioritizing the organization’s assets — including hardware, software, services, systems, and data — and being aware of the dependencies between those and other assets should help indicate where the organization should focus its resources in terms of protection, detection, response, and recovery.
ID.AM-07	Inventories of data and corresponding metadata for designated data types are maintained	Medium	R1: Having data inventories that include data classifications, owners, and logical and physical locations should provide valuable information on what data may have been involved in an incident.
ID.AM-08	Systems, hardware, software, services, and data are managed throughout their life cycles	Medium	R1: Managing hardware, software, services, and systems throughout their life cycles should take cybersecurity into consideration, such as configuring them securely, reducing attack surfaces, and updating inventory information as assets are transferred or relocated.

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
ID.RA (Risk Assessment)	The cybersecurity risk to the organization, assets, and individuals is understood by the organization	Medium	<p>N1: Risk assessment practices are critical for reducing the number of incidents that occur and the impacts they cause. Risk assessment is a vast topic that is outside of the scope of this Profile other than to summarize its importance for incident response.</p> <p>N2: See [SP800-37r2] for more information on cybersecurity risk.</p> <p>N3: See [SP800-30r1] for more information on cybersecurity risk assessment.</p>
ID.RA-01	Vulnerabilities in assets are identified, validated, and recorded	Medium	<p>R1: Understand current known cybersecurity vulnerabilities to make informed decisions when assessing risks. This should include all types of known cybersecurity vulnerabilities, such as flaws in software (including firmware and software-based services) developed by the organization and third parties, software misconfigurations, network and system design and implementation weaknesses, physical vulnerabilities and resilience issues in facilities that house computing assets, and integrity violations in hardware and software (e.g., counterfeit, evidence of tampering).</p> <p>N1: NIST’s National Vulnerability Database (NVD) is a publicly available repository of standards-based vulnerability management data.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
ID.RA-02	Cyber threat intelligence is received from information sharing forums and sources	High	<p>N1: Cyber threat intelligence (CTI) is threat information that has been aggregated, transformed, analyzed, interpreted, or enriched to provide the necessary context for decision-making processes. Organizations can receive CTI from automated CTI feeds, information sharing forums, and other sources.</p> <p>N2: CTI is useful for incident response and recovery in several ways, including obtaining information on new threats, improving the accuracy of cybersecurity technologies with incident detection or response capabilities, and understanding the tactics, techniques, and procedures (TTPs) used by attackers. TTPs describe the behavior of an actor. Information on threats and their TTPs is widely available through repositories and knowledge bases.</p> <p>N3: [SP800-150] provides guidelines on consuming, using, and storing CTIs, as well as establishing CTI relationships.</p>
ID.RA-03	Internal and external threats to the organization are identified and recorded	Medium	<p>R1: Identify internal and external threats during routine operations and from cyber threat intelligence.</p> <p>N1: Other possible methods that organizations could consider for identifying threats include threat hunting and the use of deception technologies.</p>
ID.RA-04	Potential impacts and likelihoods of threats exploiting vulnerabilities are identified and recorded	Medium	<p>N1: Recording the potential impacts and likelihoods of threats exploiting vulnerabilities is necessary for determining risk.</p>
ID.RA-05	Threats, vulnerabilities, likelihoods, and impacts are used to understand inherent risk and inform risk response prioritization	High	<p>R1: Organizations with mechanisms in place for estimating cybersecurity risk as part of their cybersecurity risk management programs should use those mechanisms for incident response purposes.</p> <p>C1: Consider using threat modeling and other methods to inform the understanding of attack vectors, attack surfaces, and lateral paths through organizational assets, among other factors that contribute to risk.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
ID.RA-06	Risk responses are chosen, prioritized, planned, tracked, and communicated	High	<p>N1: Risk responses are needed to prevent future incidents from occurring and existing incidents from reoccurring.</p> <p>R1: The organization’s policies, processes, and procedures should provide guidance (e.g., criteria) for making decisions regarding appropriate risk responses in various situations.</p> <p>N2: The four types of risk responses are 1) Accept (accept the risk as is), 2) Mitigate (reduce the risk by eliminating the vulnerabilities and/or deploying additional security controls to reduce vulnerability exploitation), 3) Transfer (reduce the risk by sharing some of the consequences with another party), and 4) Avoid (ensure that the risk does not occur by eliminating the attack surface).</p> <p>N3: See [IR8286] for more information on risk responses.</p>
ID.RA-07	Changes and exceptions are managed, assessed for risk impact, recorded, and tracked	Medium	
ID.RA-08	Processes for receiving, analyzing, and responding to vulnerability disclosures are established	Medium	<p>N1: A vulnerability disclosure is when a third party reports a suspected vulnerability in one of the organization’s systems to the organization.</p> <p>N2: See [SP800-216] for more information on vulnerability disclosure.</p>
ID.RA-09	The authenticity and integrity of hardware and software are assessed prior to acquisition and use	Medium	
ID.RA-10	Critical suppliers are assessed prior to acquisition	Low	
ID.IM (Improvement)	Improvements to organizational cybersecurity risk management processes, procedures and activities are identified across all CSF Functions	Medium	
ID.IM-01	Improvements are identified from evaluations	Medium	<p>R1: Periodically evaluate incident response program performance to identify problems and deficiencies that should be corrected.</p> <p>N1: Possible evaluation forms include self-assessments, third-party assessments, and independent audits.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
ID.IM-02	Improvements are identified from security tests and exercises, including those done in coordination with suppliers and relevant third parties	High	<p>N1: Incident response exercises and tests may provide helpful information for program evaluation and prepare staff and involved third parties (e.g., critical service providers and product suppliers) for future incident response activities.</p> <p>N2: See [SP800-84] for more information on simulations, tabletop discussions, and other forms of exercises.</p>
ID.IM-03	Improvements are identified from execution of operational processes, procedures, and activities	High	<p>N1: The execution of operational processes, procedures, and activities includes all incident response and recovery efforts.</p> <p>N2: Improvements that affect incident response can be made to the incident response program itself (e.g., plan, policy, processes, procedures) or to other aspects of the organization’s cybersecurity risk management activities (e.g., identifying TTPs that are not currently being blocked by safeguards or flagged by detection technologies).</p> <p>N3: Improvements are often identified when creating follow-up reports for incidents or holding “lessons learned” meetings when an incident’s recovery efforts are concluding, especially if the incident was major. This provides an opportunity to review what happened, what actions were taken, and how effective those actions were, as well as hear from all parties involved in the incident. Such a meeting can help identify and prioritize potential improvements to the organization’s incident response program and cybersecurity risk management efforts.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
<p>ID.IM-04</p>	<p>Incident response plans and other cybersecurity plans that affect operations are established, communicated, maintained, and improved</p>	<p>High</p>	<p>N1: Several types of cybersecurity plans are relevant to incident response, including 1) incident response plans, which provide the roadmap for implementing the incident response capability; 2) vulnerability management plans, which help identify and assess all types of vulnerabilities and prioritize, test, and implement risk responses; and 3) business continuity plans.</p> <p>R1: Synchronize business continuity plans with incident response plans since incidents can undermine business resilience.</p> <p>R2: Review and update all cybersecurity plans periodically or when a need for significant improvements is identified.</p> <p>R3: Base each cybersecurity plan on the organization’s unique requirements, mission, size, structure, and functions.</p> <p>R4: Each cybersecurity plan should identify the resources and management support needed to carry it out successfully.</p> <p>N2: Business continuity planning professionals who are made aware of cybersecurity incidents and their impacts can fine-tune business impact assessments, risk assessments, and continuity of operations plans. Further, because business continuity planners have extensive expertise in minimizing operational disruption during severe circumstances, they may be valuable in planning responses to specific incident types, such as denial-of-service (DoS) conditions.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
PR (Protect)	Safeguards to manage the organization’s cybersecurity risks are used	Medium	<p>N1: Lowering the number of incidents shortens operational disruptions, allows response teams to focus on high-impact situations, and reduces the impact of incidents that do occur (e.g., by making it harder for attackers to move laterally throughout an environment and thus slowing them down).</p> <p>N2: Understanding the protection mechanisms in place can help personnel deploy methods to detect protection failures and bypasses.</p> <p>N3: It is outside of the scope of this Profile to provide recommendations and considerations on protecting assets, other than a few notes of practices that specifically benefit incident response activities.</p>
PR.AA (Identity Management, Authentication, and Access Control)	Access to physical and logical assets is limited to authorized users, services, and hardware and managed commensurate with the assessed risk of unauthorized access	Medium	
PR.AA-01	Identities and credentials for authorized users, services, and hardware are managed by the organization	Medium	
PR.AA-02	Identities are proofed and bound to credentials based on the context of interactions	Medium	
PR.AA-03	Users, services, and hardware are authenticated	Medium	
PR.AA-04	Identity assertions are protected, conveyed, and verified	Medium	
PR.AA-05	Access permissions, entitlements, and authorizations are defined in a policy, managed, enforced, and reviewed, and incorporate the principles of least privilege and separation of duties	Medium	
PR.AA-06	Physical access to assets is managed, monitored, and enforced commensurate with risk	Medium	

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
PR.AT (Awareness and Training)	The organization’s personnel are provided with cybersecurity awareness and training so that they can perform their cybersecurity-related tasks	Medium	
PR.AT-01	Personnel are provided with awareness and training so that they possess the knowledge and skills to perform general tasks with cybersecurity risks in mind	Medium	
PR.AT-02	Individuals in specialized roles are provided with awareness and training so that they possess the knowledge and skills to perform relevant tasks with cybersecurity risks in mind	Medium	R1: Role-based training should include incident-related responsibilities.
PR.DS (Data Security)	Data are managed consistent with the organization’s risk strategy to protect the confidentiality, integrity, and availability of information	Medium	
PR.DS-01	The confidentiality, integrity, and availability of data-at-rest are protected	Medium	
PR.DS-02	The confidentiality, integrity, and availability of data-in-transit are protected	Medium	
PR.DS-10	The confidentiality, integrity, and availability of data-in-use are protected	Medium	
PR.DS-11	Backups of data are created, protected, maintained, and tested	Medium	N1: Backups can be particularly important for recovery purposes when data integrity or availability is affected.
PR.PS (Platform Security)	The hardware, software (e.g., firmware, operating systems, applications), and services of physical and virtual platforms are managed consistent with the organization’s risk strategy to protect their confidentiality, integrity, and availability	Medium	
PR.PS-01	Configuration management practices are established and applied	Medium	
PR.PS-02	Software is maintained, replaced, and removed commensurate with risk	Medium	
PR.PS-03	Hardware is maintained, replaced, and removed commensurate with risk	Medium	

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
PR.PS-04	Log records are generated and made available for continuous monitoring	Medium	N1: Logs are particularly important for recording and preserving information that is vital to incident detection, response, and recovery activities. N2: For more information on log management, see [SP800-92r1].
PR.PS-05	Installation and execution of unauthorized software are prevented	Medium	
PR.PS-06	Secure software development practices are integrated, and their performance is monitored throughout the software development life cycle	Medium	N1: For more information on secure software development practices, including responding to vulnerabilities or incidents that involve released software, see [SP800-218].
PR.IR (Technology Infrastructure Resilience)	Security architectures are managed with the organization’s risk strategy to protect asset confidentiality, integrity, and availability, and organizational resilience	Medium	
PR.IR-01	Networks and environments are protected from unauthorized logical access and usage	Medium	
PR.IR-02	The organization’s technology assets are protected from environmental threats	Medium	
PR.IR-03	Mechanisms are implemented to achieve resilience requirements in normal and adverse situations	Medium	
PR.IR-04	Adequate resource capacity to ensure availability is maintained	Medium	

398 **3.2. Incident Response Life Cycle**

399 Table 3 contains the second part of the Community Profile. All of its CSF elements are specific
 400 to incident response, so they have higher priorities with respect to incident response than
 401 those in the first part. Accordingly, all CSF elements in this part have recommendations or
 402 considerations.

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Table 3. CSF 2.0 Community Profile for incident response, Part 2: Incident Response Life Cycle

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
DE (Detect)	Possible cybersecurity attacks and compromises are found and analyzed	High	N1: The Detect Function encompasses all of the monitoring and analysis activities performed to find and characterize potentially adverse events and, in turn, find cybersecurity incidents.
DE.CM (Continuous Monitoring)	Assets are monitored to find anomalies, indicators of compromise, and other potentially adverse events	High	R1: Continuous monitoring for unauthorized activity, deviations from expected activity, and changes in security posture should involve the following types of assets at all times: networks and network services; computing hardware and software, runtime environments, and their data; the physical environment; personnel activity and technology usage; and external service provider activities. C1: Consider using cyber threat information with continuous monitoring to help identify potentially malicious activities that may have otherwise been considered benign. R2: Tune the continuous monitoring technologies to reduce false positives and false negatives to acceptable levels.
DE.CM-01	Networks and network services are monitored to find potentially adverse events	High	R1: Monitoring should include wired and wireless networks, network communications and flows, network services (e.g., DNS and BGP), and the presence of unauthorized or rogue networks within facilities.
DE.CM-02	The physical environment is monitored to find potentially adverse events	High	R1: Monitoring the physical environment should include humans' successful and failed access attempts, the movement of people into and out of secure areas of facilities, and signs of tampering with physical access controls.
DE.CM-03	Personnel activity and technology usage are monitored to find potentially adverse events	High	R1: Monitoring personnel activity and technology usage should include anomalous user activity or unusual patterns of activity, authentication and logical access attempts, and the use of deception technology.
DE.CM-06	External service provider activities and services are monitored to find potentially adverse events	High	R1: Monitoring external service provider activities and services should include remote and on-site administration and maintenance activities that providers perform on organizational systems and deviations from expected behavior by cloud-based services, internet service providers, and other service providers.

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
DE.CM-09	Computing hardware and software, runtime environments, and their data are monitored to find potentially adverse events	High	<p>R1: Monitor email, web, file sharing, collaboration services, and other common attack vectors to detect malware, phishing, data leaks, exfiltration, and other adverse events.</p> <p>R2: Monitor authentication attempts to identify attacks against credentials and unauthorized credential use.</p> <p>R3: Monitor software and hardware configurations for deviations from security baselines.</p> <p>R4: Monitor hardware and software, including cybersecurity protection mechanisms, for signs of tampering, failure, or compromise.</p> <p>R5: Monitor endpoints for cyber health issues (e.g., missing patches, malware infections, or unauthorized software), and redirect endpoints with issues to a remediation environment before access is authorized.</p>
DE.AE (Adverse Event Analysis)	Anomalies, indicators of compromise, and other potentially adverse events are analyzed to characterize the events and detect cybersecurity incidents	High	<p>N1: Adverse event analysis involves studying the data on potentially adverse events collected by continuous monitoring to find possible attacks and compromises and declaring when an incident has occurred so as to initiate incident response activities.</p> <p>R1: The volume of potentially adverse events to be analyzed is generally quite high, so organizations should rely on technical solutions that filter large event datasets down to a subset that is suitable for human viewing and analysis.</p> <p>N2: The fidelity of events varies based on many factors. Anomalies may have benign or malicious foundations. Some incidents are relatively easy to find amid the noise, while others require deep, specialized technical knowledge and experience.</p> <p>N3: CTI can be invaluable in detecting malicious activity early, reducing its impact, and shortening recovery time. Signs of an incident may be more obvious later in the attack life cycle, but the incident’s impact and scope may be much larger.</p> <p>R2: Organizations should strive to find incidents earlier in the attack life cycle and take a proactive approach to incident detection and response.</p>
DE.AE-02	Potentially adverse events are analyzed to better understand associated activities	High	<p>R1: Use tools (e.g., SIEM, SOAR) to continuously monitor log events for known malicious and suspicious activity and to generate reports on their findings.</p> <p>R2: Utilize up-to-date cyber threat intelligence in log analysis tools to improve detection accuracy and characterize threat actors, their methods, and indicators of compromise.</p> <p>R3: Regularly conduct manual reviews of log events for technologies that cannot be sufficiently monitored through automation.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
DE.AE-03	Information is correlated from multiple sources	High	<p>R1: Constantly transfer log data generated by other sources to a relatively small number of log servers.</p> <p>R2: Use event correlation technology (e.g., SIEM, SOAR) to gather pieces of related data captured by multiple sources.</p> <p>R3: Utilize cyber threat intelligence to help correlate events among log sources.</p>
DE.AE-04	The estimated impact and scope of adverse events are understood	High	<p>R1: Estimate the impact and scope of adverse events through automated (e.g., SIEM, SOAR) and/or manual means, and review and refine the estimates.</p>
DE.AE-06	Information on adverse events is provided to authorized staff and tools	High	<p>R1: Generate alerts, and provide them to cybersecurity and incident response tools and staff (e.g., the SOC and incident responders).</p> <p>R2: Make log analysis findings accessible to incident responders and other authorized personnel at all times.</p> <p>R3: Consider automatically creating and assigning tickets in the organization’s ticketing system when certain types of alerts occur.</p>
DE.AE-07	Cyber threat intelligence and other contextual information are integrated into the analysis	High	<p>R1: Integrate up-to-date CTI and other contextual information (e.g., asset inventories) into adverse event analysis to improve detection accuracy and characterize threat actors, their methods, and indicators of compromise.</p> <p>R2: Rapidly acquire and analyze vulnerability disclosures for the organization’s technologies from suppliers, vendors, and third-party security advisories.</p> <p>N1: See [SP800-150] for guidelines on consuming, using, and storing CTIs, as well as establishing CTI relationships.</p>
DE.AE-08	Incidents are declared when adverse events meet the defined incident criteria	High	<p>R1: Apply incident criteria to known and assumed characteristics of analyzed activity, and consider known false positives to determine whether an incident should be declared.</p>
RS (Respond)	Actions regarding a detected cybersecurity incident are taken	High	<p>N1: The Respond Function is at the core of incident response activities.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
RS.MA (Incident Management)	Responses to detected cybersecurity incidents are managed	High	<p>N1: Incident management involves overseeing responses to all incidents and shifting priorities and resources as needed. Evaluating the overall risk from an incident and applying the appropriate prioritization are perhaps the most critical decision points in the incident response process.</p> <p>R1: Because of resource limitations, incidents should not be handled on a first-come, first-served basis.</p> <p>R2: Incident triage, prioritization, escalation, and elevation and decisions regarding when to initiate recovery processes should all be based on a set of risk evaluation factors. This set can range from simple to incredibly complex, depending on the needs and maturity of an organization.</p> <p>N2: For more information on possible risk evaluation factors, see CISA's National Cyber Incident Scoring System. Examples include asset criticality, functional impact of the incident, data impact of the incident, stage of observed activity, threat actor characterization, and recoverability.</p> <p>R3: The incident response status should be tracked for each incident along with pertinent information, such as an incident summary, indicators of compromise related to the incident, the status and expected time frame for each assigned action, and next steps to be taken.</p>
RS.MA-01	The incident response plan is executed in coordination with relevant third parties once an incident is declared	High	<p>R1: Detection technologies should automatically report confirmed incidents.</p> <p>C1: Consider designating an incident lead for each incident.</p> <p>R2: If appropriate, contact the organization's incident response outsourcer to request assistance.</p> <p>R3: Initiate execution of other cybersecurity plans as needed (e.g., business continuity and disaster recovery plans) to support incident response.</p>
RS.MA-02	Incident reports are triaged and validated	High	<p>R1: Perform a preliminary review of a new incident report to verify that a cybersecurity incident has occurred and estimate the severity of the incident and the level of urgency needed to respond to it.</p> <p>R2: Have mechanisms in place for third parties to report possible incidents involving the organization. Reports should be carefully monitored and taken seriously. For example, the organization might be contacted by a party claiming that its systems are being attacked by a system at the organization. External users may report other indicators, such as an unavailable service. Other incident response teams may also report incidents to the organization.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
RS.MA-03	Incidents are categorized and prioritized	High	<p>R1: Perform a more detailed review of incidents to help categorize them by incident type (e.g., data breach, ransomware, account takeover, denial of service).</p> <p>R2: Prioritize how quickly incident response should be performed for each incident based on its scope, likely impact, time-critical nature, and resource availability.</p> <p>R3: Select incident response strategies for active incidents by balancing the need to quickly recover from an incident with the need to observe the attacker or conduct a more thorough investigation.</p> <p>N1: Every response strategy decision has trade-offs. For example, a strategy that supports observing the attacker’s behavior or conducting a more thorough investigation may be at odds with the need to quickly return to normal operations.</p>
RS.MA-04	Incidents are escalated or elevated as needed	High	<p>N1: <i>Escalation</i> generally refers to increasing resources or time frames, while <i>elevation</i> usually indicates involving a higher level of management in the response efforts.</p> <p>R1: Track and validate the status of all ongoing incidents so that incidents in need of more response resources or a change in response strategy can be identified and the necessary changes initiated rapidly.</p>
RS.MA-05	The criteria for initiating incident recovery are applied	High	<p>R1: Apply incident recovery criteria to known and assumed characteristics of the incident to determine when an incident’s recovery processes should be initiated.</p> <p>R2: Take the possible operational disruption of incident recovery activities into account for determining when recovery should be initiated.</p>
RS.AN (Incident Analysis)	Investigations are conducted to ensure effective response and support forensics and recovery activities	High	<p>N1: The Incident Analysis Category focuses on investigating, determining, and documenting what has happened during an incident, as well as how and why it happened.</p>
RS.AN-03	Analysis is performed to establish what has taken place during an incident and the root cause of the incident	High	<p>R1: Determine the sequence of events that have occurred during the incident and which assets and resources were involved in each of those events.</p> <p>R2: Attempt to determine what vulnerabilities, threats, and threat actors were directly or indirectly involved in the incident.</p> <p>R3: Analyze the incident to find the underlying or systemic root causes.</p> <p>R4: Check any deployed cyber deception technology for additional information on attacker behavior.</p> <p>N1: This information may also be helpful for identifying weaknesses in cybersecurity risk management that should be addressed to prevent similar incidents from occurring in the future.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
RS.AN-06	Actions performed during an investigation are recorded, and the records' integrity and provenance are preserved	High	<p>N1: Facts discovered and actions taken during incident response tasks can be recorded by many means, including a paper logbook, audio/video recordings, or automatic session monitoring and logging, as permitted by the organization's incident response plan and policy.</p> <p>R1: Safeguard the confidentiality and integrity of incident response records, and ensure that only authorized personnel have read access.</p> <p>N2: Incident response records can contain sensitive information, such as data on exploited vulnerabilities, recent data breaches, and users who may have performed inappropriate actions. The incident lead is often responsible for ensuring that incident response records are properly safeguarded.</p>
RS.AN-07	Incident data and metadata are collected, and their integrity and provenance are preserved	High	<p>N1: Many incident responses involve the collection of incident data and metadata. Formal evidence gathering and handling using chain-of-custody procedures might not be performed for every incident that occurs (e.g., most malware incidents will not result in prosecution). However, collected incident data is still considered evidence, which is defined as "grounds for belief or disbelief; data on which to base proof or to establish truth or falsehood" [SP800-160v1].</p> <p>R1: Collect and retain evidence from an incident in accordance with the organization's evidence preservation procedures and data retention policies, and consider factors such as the possibility of prosecution and the cost of retaining the data and the hardware and software needed to access the data in the future.</p>
RS.AN-08	An incident's magnitude is estimated and validated	High	<p>N1: Determining the incident's magnitude is often one of the most challenging aspects of incident response.</p> <p>R1: Look for indicators of compromise, evidence of persistence, and other signs of an incident on both the assets known to be targeted and other potential targets. Skipping this activity or performing it in a superficial way may cause underestimation of the incident's magnitude, thus allowing the incident to continue indefinitely on other targets without the organization's knowledge or monitoring.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
RS.CO (Incident Response Reporting and Communication)	Response activities are coordinated with internal and external stakeholders as required by laws, regulations, or policies	High	<p>N1: Incident response reporting and communication activities tend to fall into four categories. <i>Incident coordination</i> involves communicating current and planned incident response activities for a particular incident among the internal and external parties who have incident response roles and responsibilities. <i>Incident notification</i> involves formally informing affected customers, employees, partners, regulators, or others about a data breach or other incident. <i>Public communication</i> involves communicating to the public about the status of a particular incident, such as responding to media inquiries. <i>Incident information sharing</i> involves sharing cybersecurity threat information with others, usually voluntarily, based on activity observed within the organization’s technology assets.</p> <p>R1: Organizations should be prepared in advance to coordinate with affected parties about incidents when needed.</p>
RS.CO-02	Internal and external stakeholders are notified of incidents	High	<p>R1: When an incident is analyzed and prioritized, the incident response team should coordinate with the appropriate individuals inside and outside of the organization so that all who need to be involved will play their roles.</p> <p>R2: Incident response policies should include provisions concerning incident coordination — at a minimum, what must be reported to whom and at what times (e.g., initial notification, regular status updates).</p> <p>R3: Stay up-to-date on incident notification-related laws and regulations that pertain to the organization’s sectors, geographic locations, customer locations, and any other characteristics that may affect the incident notification requirements applicable to the organization. Incident notification is an evolving topic, and new laws and regulations are being established frequently.</p> <p>R4: Notify affected third parties of data breaches and other cybersecurity incidents in accordance with regulatory, legal, and contractual requirements.</p> <p>R5: Notify law enforcement agencies and regulatory bodies of incidents based on criteria in the incident response plan and management approval. Designated individuals should contact these parties in a manner consistent with the requirements of the law and the organization’s policies and procedures.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
RS.CO-03	Information is shared with designated internal and external stakeholders	High	<p>N1: Voluntary incident information sharing is often mutually beneficial because the same threats and attacks simultaneously affect multiple organizations. An example is sharing information about observed TTPs with a sector-specific Information Sharing and Analysis Center (ISAC).</p> <p>N2: Sharing defensive tactics between organizations can enhance overall situational awareness and increase the resiliency of all. There is a cost to threat actors to develop or purchase and to deploy exploits. The effective identification and dissemination of detection techniques lowers the attackers' return on investment and increases their costs.</p> <p>N3: Incident handlers might coordinate their efforts with colleagues at partner organizations to share tactical, technical information on mitigating an attack spanning those organizations. The organizations participating in this type of relationship are usually peers without authority over each other. In addition to choosing to share information, they may also pool resources to solve common problems.</p> <p>R1: Securely share information with stakeholders consistent with the organization's response plans and information sharing agreements, including contracts with suppliers.</p> <p>R2: Regularly update senior leadership on the status of major incidents.</p> <p>R3: Notify human resources when malicious insider activity has occurred.</p> <p>R4: Establish and follow media communications procedures for incident response that comply with the organization's policies on media interaction and information disclosure.</p>
RS.MI (Incident Mitigation)	Activities are performed to prevent expansion of an event and mitigate its effects	High	<p>N1: Manually selecting containment and eradication actions may be easier and faster if the organization has criteria and procedures in place. Criteria could take the incident type into account (e.g., a cloud-based services compromise or a user endpoint ransomware infection) and use some of the risk evaluation factors in RS.MA. Another factor to consider is the duration of the containment measure (e.g., an emergency workaround that must be removed within hours, a temporary workaround to be removed within two weeks, or a permanent solution). The eradication measure's duration could be similarly evaluated.</p> <p>R1: In some instances, organizations redirect an attacker to a sandbox so that they can monitor the attacker's activity, usually to gather additional evidence. This delays containment and eradication activities. The incident response team should first discuss the feasibility of this strategy with the legal department before executing it. The intentional delay can be dangerous because an attacker could escalate unauthorized access or compromise other systems.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
RS.MI-01	Incidents are contained	High	<p>N1: <i>Containment</i> refers to preventing the expansion of an incident. Containment can prevent additional damage and avoid overwhelming the organization’s resources. Most incidents require some form of containment.</p> <p>C1: Consider configuring cybersecurity technologies (e.g., antivirus software) and cybersecurity features of other technologies (e.g., operating systems, network infrastructure devices) to automatically perform some containment actions, like quarantining malware, transferring a compromised endpoint to an isolated remediation network, or halting the execution of an infected container.</p> <p>C2: Consider authorizing third parties (e.g., the organization’s internet service providers and cloud service providers) to automatically act to contain certain types of incidents (e.g., large-scale DDoS attacks) on behalf of the organization.</p> <p>R1: Allow incident handlers to manually select and perform containment actions instead of or in addition to automated containment measures.</p>
RS.MI-02	Incidents are eradicated	High	<p>N1: <i>Eradication</i> refers to mitigating an incident’s effects. After containment, eradication may be necessary to eliminate persistence mechanisms and entry points, such as deleting malware, disabling breached user accounts, and identifying and mitigating all exploited vulnerabilities.</p> <p>R1: Identify all affected hosts and services within the organization so all flaws and weaknesses can be remediated.</p> <p>C1: Consider configuring cybersecurity technologies and cybersecurity features of other technologies (e.g., operating systems, network infrastructure devices) to automatically perform some eradication actions.</p> <p>C2: Consider authorizing third parties (e.g., the organization’s internet service providers and cloud service providers) to automatically act to eradicate certain types of incidents on behalf of the organization.</p> <p>R2: Allow incident handlers to manually select and perform eradication actions instead of or in addition to automated eradication measures.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
RC (Recover)	Assets and operations affected by a cybersecurity incident are restored	High	<p>N1: During incident recovery, personnel restore systems to normal operation, confirm that the systems are functioning normally, and (if applicable) remediate vulnerabilities to prevent similar incidents.</p> <p>N2: Recovery operations include restoring systems from clean backups, rebuilding systems from scratch, replacing compromised files with clean versions, installing patches, changing passwords, and tightening security controls. In intrusions where the threat actor is highly sophisticated and the full scope of the tactics used are not revealed, it may be necessary to go as far as replacing the hardware (e.g., bare metal) of all of the compromised systems.</p> <p>N3: For more information on incident recovery, see [SP800-184].</p>
RC.RP (Incident Recovery Plan Execution)	Restoration activities are performed to ensure operational availability of systems and services affected by cybersecurity incidents	High	<p>N1: Executing the incident recovery plan involves selecting, prioritizing, and performing recovery actions in a secure manner; verifying the integrity of recovered assets; declaring the end of incident recovery; and completing incident documentation.</p> <p>N2: For more information on incident recovery plans and plan execution, see [SP800-184].</p>
RC.RP-01	The recovery portion of the incident response plan is executed once initiated from the incident response process	High	<p>R1: Begin recovery procedures during or after incident response processes.</p> <p>R2: Inform all individuals with recovery responsibilities about the plans for recovery and the authorizations required to implement each aspect of the plans.</p>
RC.RP-02	Recovery actions are selected, scoped, prioritized, and performed	High	<p>R1: Recovery actions should take timeliness, precision, and reliability (e.g., restoring only the affected files versus restoring all files) into account.</p> <p>R2: Select recovery actions based on the criteria defined in the incident response plan and available resources.</p> <p>R3: Change planned recovery actions based on a reassessment of organizational needs and resources.</p>
RC.RP-03	The integrity of backups and other restoration assets is verified before using them for restoration	High	<p>R1: Check restoration assets for indicators of compromise, file corruption, and other integrity issues before use.</p>

CSF Element	CSF Element Description	Priority	Recommendations, Considerations, and Notes Specific to Incident Response
RC.RP-04	Critical mission functions and cybersecurity risk management are considered to establish post-incident operational norms	High	R1: Validate that essential services are restored in the appropriate order. R2: Work with system owners to confirm the successful restoration of systems and the return to normal operations. R3: Monitor the performance of restored systems to verify the adequacy of the restoration.
RC.RP-05	The integrity of restored assets is verified, systems and services are restored, and normal operating status is confirmed	High	R1: Check restored assets for indicators of compromise and remediate the root causes of the incident before production use. R2: Verify the correctness and adequacy of the restoration actions taken before putting a restored system online.
RC.RP-06	The end of incident recovery is declared based on criteria, and incident-related documentation is completed	High	R1: Prepare an after-action report that documents the incident itself, the response and recovery actions taken, and lessons learned.
RC.CO (Incident Recovery Communication)	Restoration activities are coordinated with internal and external parties	High	N1: Incident recovery communication is a continuation of the communication activities in RS.CO.
RC.CO-03	Recovery activities and progress in restoring operational capabilities are communicated to designated internal and external stakeholders	High	R1: Securely share recovery information, including restoration progress, consistent with response plans and information sharing agreements. R2: Regularly update senior leadership on recovery status and restoration progress for major incidents. R3: Follow the rules and protocols defined in contracts for incident information sharing between the organization and its suppliers. R4: Coordinate crisis communication between the organization and its critical suppliers.
RC.CO-04	Public updates on incident recovery are shared using approved methods and messaging	High	R1: Follow the organization’s breach notification procedures for recovering from a data breach incident. R2: Explain the steps being taken to recover from the incident and to prevent a recurrence.

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472 **Appendix A. List of Symbols, Abbreviations, and Acronyms**

- 473 **CISA**
474 Cybersecurity and Infrastructure Security Agency
- 475 **CSF**
476 Cybersecurity Framework
- 477 **CSP**
478 Cloud Service Provider
- 479 **CTI**
480 Cyber Threat Intelligence
- 481 **ISAC**
482 Information Sharing and Analysis Center
- 483 **ISP**
484 Internet Service Provider
- 485 **MOU**
486 Memorandum of Understanding
- 487 **MSSP**
488 Managed Security Services Provider
- 489 **NDA**
490 Non-Disclosure Agreement
- 491 **SOC**
492 Security Operations Center
- 493 **SOP**
494 Standard Operating Procedures
- 495 **TTPs**
496 Tactics, Techniques, and Procedures

- 497 **Appendix B. Glossary**
- 498 **adverse cybersecurity event**
499 Any event with a potentially negative impact on cybersecurity.
- 500 **computer security incident**
501 See *cybersecurity incident*.
- 502 **cyber threat intelligence**
503 Cyber threat information that has been aggregated, transformed, analyzed, interpreted, or enriched to provide the
504 necessary context for decision-making processes. [SP800-150, adapted]
- 505 **cybersecurity incident**
506 An occurrence that actually or imminently jeopardizes, without lawful authority, the integrity, confidentiality, or
507 availability of information or an information system; or constitutes a violation or imminent threat of violation of
508 law, security policies, security procedures, or acceptable use policies. [FISMA2014]
- 509 **event**
510 Any observable occurrence involving computing assets, including physical and virtual platforms, networks, services,
511 and cloud environments.
- 512 **incident**
513 See *cybersecurity incident*.
- 514 **incident response**
515 The remediation or mitigation of violations of security policies and recommended practices. [FISMA2014]
- 516 **indicators of compromise**
517 Technical artifacts or observables that suggest an attack is imminent or is currently underway or that a
518 compromise may have already occurred. [SP800-150, adapted]
- 519 **tactics, techniques, and procedures**
520 The behavior of an actor. A tactic is the highest-level description of this behavior, while techniques give a more
521 detailed description of behavior in the context of a tactic, and procedures an even lower-level, highly detailed
522 description in the context of a technique. [SP800-150]
- 523 **threat**
524 Any circumstance or event with the potential to adversely impact organizational operations (including mission,
525 functions, image, or reputation), organizational assets, individuals, other organizations, or the Nation through an
526 information system via unauthorized access, destruction, disclosure, or modification of information, and/or denial
527 of service. [SP800-30r1]
- 528 **vulnerability**
529 A weakness in a system, system security procedures, internal controls, or implementation by which an actor or
530 event may intentionally exploit or accidentally trigger the weakness to access, modify, or disrupt the normal
531 operations of a system, resulting in a security incident or violation of the system's security policy. [CNCSS-4009,
532 adapted]

533 **Appendix C. Change Log**

534 In April 2024, the following changes were made to this publication:

- 535 • Performed a full rewrite of the previous content to improve clarity and usability and to
536 remove outdated material and material addressed in more depth in other NIST
537 publications and other federal agency content
- 538 • Shifted the focus of the document from guidelines on detecting, analyzing, prioritizing,
539 and handling incidents to recommendations and considerations for incorporating
540 cybersecurity incident response considerations throughout an organization's
541 cybersecurity risk management activities
- 542 • Reorganized the contents to comprise a CSF 2.0 Community Profile
- 543 • Moved most hyperlinks to a new SP 800-61 project website to facilitate their
544 maintenance
- 545 • Reformatted all content to follow the latest NIST technical report template