# Introduction

This guide describes how to use Baseline Tailor, a software tool for navigating the United States government’s Cybersecurity Framework Core [1] and tailoring the National Institute of Standards and Technology (NIST) Special Publication (SP) 800-53 Revision 4 [2] security controls. Baseline Tailor generates output in an Extensible Markup Language (XML) [3] format capturing the user’s tailoring choices.

NIST SP 800-53 provides a catalog of tailorable security controls organized into eighteen families. Each control has zero or more control enhancements, each of which adds additional functionality to and/or increases the strength of the control. The catalog specifies three security control baselines: for low, moderate, and high impact information systems. The baselines are suggested defaults for “typical” information systems. For example, an organization looking to select security controls for a low- impact system (where the consequences of compromised confidentiality, integrity, and availability of information are low) might begin with the controls in the baseline for the low impact level (or more succinctly, the low baseline) and tailor them as appropriate. In addition to baseline allocation, each security control is also assigned a priority code of P1, P2, P3, or P0. Controls with priority P1 should be implemented first, followed by those with priority P2, and finally those with priority P3. A P0 priority code indicates the security control is not assigned to a baseline.

NIST SP 800-53 includes guidance for creating and documenting *overlays* to encourage the sharing of best security practices. An overlay is a set of control customizations applicable to a group of organizations with common security requirements. For example, NIST SP 800-82 (Guide to Industrial Control System Security) [4] specifies an overlay for Industrial Control Systems, which are common in the utility, transportation, chemical, pharmaceutical, process, and durable goods manufacturing industries. Industrial Control Systems are vulnerable to many of the same security threats that affect traditional information systems, yet have unique needs requiring additional guidance beyond that offered by NIST SP 800-53.

The primary goals of the Baseline Tailor are to:

* Make it easier to create and document tailored baselines and overlays.
* Enforce constraints on tailoring operations, helping to ensure that the result follows NIST SP 800-53 guidelines.
* Generate XML valid with respect to a schema for tailored controls that can be used in conjunction with NIST SP 800-53 XML data and other XML-encoded security content to achieve security automation.

Baseline Tailor is a single-page web application [5]. Single-page applications, also known as AJAX (Asynchronous JavaScript [6] and XML) applications, run within a browser client such that the application’s user interface state can update itself without server-side processing or page reloading. As a result, Baseline Tailor does not require a high speed Internet connection. Baseline Tailor can even be run offline without a Hypertext Transfer Protocol (HTTP) [7] server in browsers that that do not block read access to local files.

The Baseline Tailor user interface (discussed in Section 4) provides context-sensitive search of the NIST SP 800-53 database [8], an online version of the NIST SP 800-53 Revision 4 security catalog. The search function enables the user to conveniently look up the definition and guidance for the currently selected security control, or for security controls referenced by the current Framework Core selection.

Baseline Tailor adopts a minimalist approach. The software neither creates nor modifies any files. Instead, Baseline Tailor displays its output in a multiple-line, resizable text field. The user can copy-paste this output into a third party XML editing application. Baseline Tailor’s inability to write or modify files may seem limiting to some users. But other users may see this “limitation” as an advantage in that it allows for easy installation – even on systems with stringent security policies.

# Disclaimers

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Baseline Tailor can be redistributed and/or modified freely provided that any derivative works bear some notice that they are derived from it, and any modified versions bear some notice that they have been modified. NIST would appreciate acknowledgement if the software is used.

# Getting Started

Baseline Tailor requires an Internet browser with support for JavaScript and the Extensible Stylesheet Language Transformations (XSLT) 1.0 standard [9]. Most of today’s common browsers meet these requirements. Although not required, software for editing XML documents is desirable. Although a user can copy-paste Baseline Tailor’s output into a plain text editor for further modification, software specifically designed for authoring XML data is easier to use, supports validation against a schema, and may also include other useful XML-specific functionalities.

This guide assumes the reader is already familiar with the content of NIST SP 800-53 Revision 4, *Security and Privacy Controls for Federal Information Systems and Organizations* [2]. NIST SP 800-53 and other information security standards, guidelines, and resources are available free of charge from NIST’s Computer Security Resource Center (<http://csrc.nist.gov>).

Baseline Tailor users may also wish to read the *Framework for Improving Critical Infrastructure Cybersecurity* [1], also available from the Computer Security Resource Center, for guidance on using the Framework Core in conjunction with NIST SP 800-53.

Baseline Tailor is distributed as a zip file, downloadable from [URL here]. To install, unzip the zip file. To run Baseline Tailor, open the file bt.xml in an Internet browser.

Users running Baseline Tailor from a local non-HTTP installation should follow instructions specific to their browser, if applicable, for allowing read access to files from the Baseline Tailor installation. For example, Chrome users running Baseline Tailor from a local non-HTTP installation should start up Chrome with the --allow-file-access-from-files option. Baseline Tailor runs locally in Firefox without any specialized browser configuration or startup options.

Baseline Tailor does not require a connection to the Internet to run. However, the NIST SP 800-53 database search function is unavailable without Internet access. As a workaround, a user can instead refer to the security control catalog in Appendix F of the NIST SP 800-53 document.

# User Interface

The Baseline Tailor user interface has three tabs:

* A Security Control Editor tab for navigating the NIST SP 800-53 security control catalog and tailoring controls.
* A Cyber Framework Browser tab for navigating the Framework Core.
* A Cross References tab shows all references from the Framework Core to the control currently selected in the Security Control Editor tab.

A user may switch from one tab to another at any given time by clicking on the desired tab.

The following subsections describe each of these tabs in detail, using as an example the tailoring of security control IA-3 (Device Identification and Authentication) from the Identification and Authentication control family. IA-3 pertains to identifying and authenticating devices prior to connecting to them. In the example, IA-3 is tailored for Industrial Control Systems as specified in the NIST SP 800-82 overlay.

## Security Control Editor

The Security Control Editor tab supports the following operations in accordance with NIST SP 800-53 tailoring guidelines:

* Adding or removing controls or control enhancements to/from a baseline, and documenting the rationale for doing so as SP 800-53 requires.
* Adding additional supplemental guidance to a control or control enhancement.

Figure 1 shows the upper portion of the Security Control Editor tab after the user has selected security control IA-3, but before any tailoring has been initiated. The two drop-down lists in the upper right hand corner are for choosing an individual control from a control family. The checkboxes and buttons to the left are for restricting the choices in the control drop-down list based on the NIST SP 800-53 baseline impact and/or priority. By default, the control drop-down list contains all controls assigned to a NIST SP 800-53 baseline.

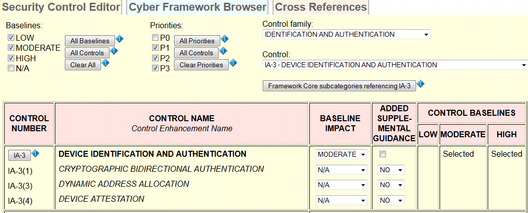


Figure 1. Security control IA-3.

The user's choice of IA-3 from the control drop-down list causes display of a table listing IA-3 with its control enhancements. The two leftmost columns contain the identifier and name for the control and each of its enhancements. The control identifier appears as a button that the user can click to look up the control in the NIST SP 800-53 database. The third column has drop-down lists for tailoring the baseline impact levels. A drop-down value of LOW indicates the control or enhancement is included in all baselines. MODERATE indicates moderate and high baselines only. HIGH indicates high baseline only. N/A indicates the control or enhancement is excluded from all baselines.

The values shown in Figure 1 are the defaults from the NIST SP 800-53 catalog, which includes IA-3 in the moderate and high baselines but not the low baseline, and excludes IA-3's enhancements from all three default baselines. IA-3 is not in the low baseline because NIST SP 800-53 assumes that low-impact systems are unlikely to have a need to connect directly to devices external to the organization. The checkbox in the fourth column allows the user to provide additional supplemental guidance, beyond that given in NIST SP 800-53, for the control.

The ADDED SUPPLEMENTAL GUIDANCE drop-down list for each enhancement allows the user to either

1. Provide no additional supplemental guidance (NO),
2. Provide additional supplemental guidance (YES), or
3. Cross-reference supplemental guidance already added for another enhancement (cross-referenced enhancement number).

The three rightmost columns show the baseline selections for IA-3 and its enhancements. “Selected” indicates the control or enhancement is in the NIST SP 800-53 baseline and has not been tailored out. “Added” indicates the user has tailored in the control or enhancement. “Removed” indicates the control or enhancement has been tailored out. No entry indicates that the control or enhancement is not in the NIST SP 800-53 baseline and has not been tailored in.

The Security Control Editor displays appropriately worded alert messages if a user violates a tailoring constraint. For example, Figure 2 shows the result when attempting to add enhancement IA-3(1) to all baselines. This operation is illegal because it violates the constraint that an enhancement cannot be added to a baseline unless its parent control is added first. Thus, IA-3(1) cannot be added to the LOW baseline without first adding IA-3. Figure 3 shows the result when a control enhancement attempts to cross-reference another control enhancement, but the cross-referenced control enhancement lacks added supplemental guidance. Figure 4 shows the result when a user attempts to add supplemental guidance to a control enhancement before adding the control enhancement to a baseline.

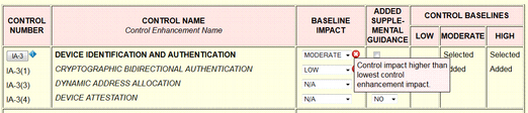


Figure 2. Violation of baseline impact constraint.

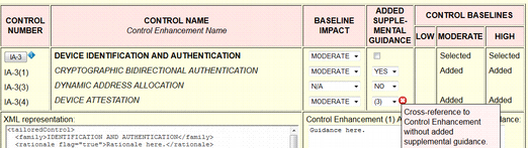


Figure 3. Violation of cross-reference constraint.

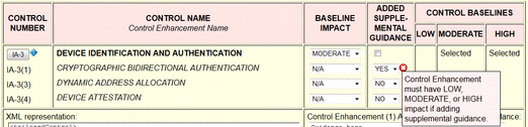


Figure 4. Violation of baseline constraint.

Now suppose a user tailors IA-3 for Industrial Control Systems as per the NIST SP 800-82 overlay. Since an Industrial Control System may need to connect directly to devices belonging to and authorized by third parties outside the organization, and these external devices need to be identified and authenticated, the user adds IA-3 to the low baseline. Additionally, the user adds control enhancements IA-3(1) and IA-3(4) to the moderate and high baselines in order to strengthen identification and authentication of external devices connected to by moderate and high-impact Industrial Control Systems. Finally, the user chooses YES from IA-3(1)' s ADDED SUPPLEMENTAL GUIDANCE drop-down list and (1) from IA-3’s ADDED SUPPLEMENTAL GUIDANCE drop-down list to add additional supplemental guidance to IA-3(1) and have IA-3(4) cross-reference that guidance.

Figure 5 shows the result. Changing IA-3's baseline impact from MODERATE to LOW causes “Added” to appear in the LOW column. Changing the baseline impact for control enhancements IA-3(1) and IA-3(4) from N/A to MODERATE causes “Added” to appear in the MODERATE and HIGH control baseline columns. The baseline changes generate an editable text field for providing a rationale. Choosing YES from IA-3(1)' s ADDED SUPPLEMENTAL GUIDANCE drop-down list generates an editable text field for adding IA-3(1) supplemental guidance. Cross-referencing IA-3(1)'s added supplemental guidance from IA-(4) does not trigger an alert because IA-3(1)'s drop-down is set to YES. The non-editable “XML representation” text field on the lower left shows XML generated on the fly based on the drop-down and checkbox settings and editable text field contents.

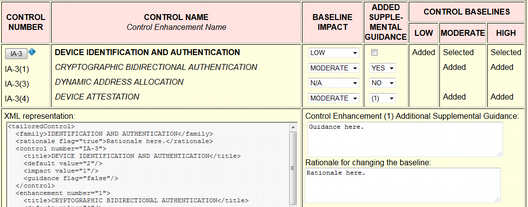


Figure 5. IA-3 tailored for an Industrial Control System.

Modifying the editable text fields causes the contents of the “XML representation” text field to update in real time. Figure 6 shows the result after adding supplemental guidance for IA-3(1) and providing a rationale for changing the IA-3 baseline. Notice that the rationale element content was updated to match that of the “Additional Supplemental Guidance” text field.

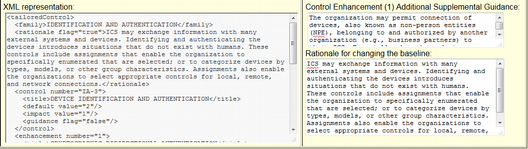


Figure 6. IA-3 Rationale and guidance text added.

Paragraph.

<tailoredControl>

<family>IDENTIFICATION AND AUTHENTICATION</family>

<rationale flag="true">ICS may exchange information with many external systems and devices. Identifying and authenticating the devices introduces situations that do not exist with humans. These controls include assignments that enable the organization to specifically enumerated that are selected; or to categorize devices by types, models, or other group characteristics. Assignments also enable the organizations to select appropriate controls for local, remote, and network connections.</rationale>

<control number="IA-3">

<title>DEVICE IDENTIFICATION AND AUTHENTICATION</title>

<default value="2"/>

<impact value="1"/>

<guidance flag="false"/>

</control>

<enhancement number="1">

<title>CRYPTOGRAPHIC BIDIRECTIONAL AUTHENTICATION</title>

<default value="4"/>

<impact value="2"/>

<guidance flag="true">The organization may permit connection of devices, also known as non-person entities (NPE), belonging to and authorized by another organization (e.g., business partners) to their ICS. Especially when these devices are non-local, their identification and authentication can be vital. Organizations may perform risk and impact analysis to determine the required strength of authentication mechanisms. Example compensating controls for devices and protocols which do not provide authentication for remote network connections, include implementing physical security measures.</guidance>

</enhancement>

<enhancement number="4">

<title>DEVICE ATTESTATION</title>

<default value="4"/>

<impact value="2"/>

<guidance flag="1"/>

</enhancement>

</tailoredControl>

Figure 9. Full XML data generated by the Security Control Editor.

Paragraph.

## Cybersecurity Framework Browser

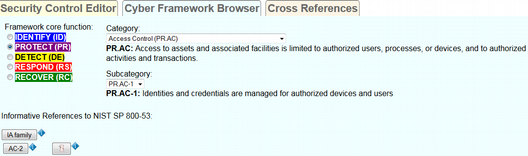


Figure 8. Framework Core subcategory referencing the IA control family.

## Cross References

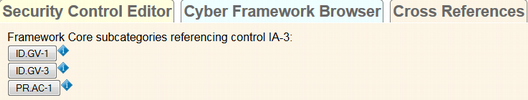


Figure 9. IA-3 cross references to Framework Core.

# XML Format for Tailored Control

# References

[1] National Institute of Standards and Technology (NIST) and United States of America, “Framework for Improving Critical Infrastructure Cybersecurity,” 2014.

[2] Joint Task Force Transformation Initiative, “Security and Privacy Controls for Federal Information Systems and Organizations,” National Institute of Standards and Technology, NIST SP 800-53r4, Apr. 2013.

[3] “Extensible Markup Language (XML) 1.0 (Fifth Edition),” *W3C Recommendation*, 26-Nov-2008. [Online]. Available: http://www.w3.org/TR/xml/.

[4] K. Stouffer, V. Pillitteri, S. Lightman, M. Abrams, and A. Hahn, “Guide to Industrial Control Systems (ICS) Security,” *NIST Special Publication 800-82 Revision 2*, May 2015.

[5] A. Mesbah and A. van Deursen, “Migrating Multi-page Web Applications to Single-page AJAX Interfaces,” *Software Maintenance and Reengineering, 2007. CSMR ’07. 11th European Conference on*, pp. 181–190, Mar. 2007.

[6] “ECMAScript 2015 Language Specification,” Ecma International, Standard ECMA-262, Jun. 2015.

[7] “Hypertext Transfer Protocol - HTTP/1.1,” Internet Engineering Task Force, RFC 2616, Jun. 1999.

[8] “NVD - 800-53.” [Online]. Available: https://web.nvd.nist.gov/view/800-53/home.

[9] “XSL Transformations (XSLT) Version 1.0,” *W3C Recommendation*, 16-Nov-1999. [Online]. Available: http://www.w3.org/TR/xslt.