

# CII status: Operation and Maintenance (OAM)

- Basics (12 Points)
- Change Control (9 Points)
- Reporting (8 Points)
- Quality (13 Points)
- Security (16 Points)
- Analysis (8 Points)

## Basics (12 Points)

(Result/Proof point (column A: enter Met/Unmet; Column B: enter relevant URLs/comments))

		Operation and Maintenance (OAM)
Criteria		Result / Proof point
<b>Identification</b>		
What is the human-readable name of the project?	met	<p><b>O-RAN SC's Operation and Maintenance (OAM)</b></p> <p>RAN = Radio Access Network</p> <p>O-RAN = Open RAN</p> <p>SC = software community</p>
What is a brief description of the project?	met	<p>According to the O-RAN-SC-OAM-Architecture document all ManagedElements (near-real-time-RIC, O-CU-CP, O-CU-UP, O-DU and O-RU) implement the O1-interface.</p> <p>The O-RAN-OAM-interface specification defines</p> <ul style="list-style-type: none"> <li>• a NetConf-Server for Configuration Management (CM) and</li> <li>• a http-client for Fault Management (FM), Performance Management (PM) and other events</li> </ul> <p>on each Management-Service-Provider (MnS-Provider) running on the ManagedElement (ME).</p> <p>The O-RAN-SC-OAM project provides reference implementation according to the O-RAN OAM (WG1) documents. In addition we provide a common MnS-Consumer for development and module test purposes. The assumption is that the projects for the ManagedElements can concentrate on the more important user-plane.</p> <p>Of course each project needs its own OAM repo to address the specific needs of the ManagedElement.</p>
What is the URL for the project (as a whole)?	met	<a href="#">Operations and Maintenance</a>
What is the URL for the version control repository (it may be the same as the project URL)?	met	<a href="https://gerrit.o-ran-sc.org/r/admin/repos/oam">https://gerrit.o-ran-sc.org/r/admin/repos/oam</a>
What programming language(s) are used to implement the project?	met	Java, Python
What is the <a href="#">Common Platform Enumeration (CPE)</a> name for the project (if it has one)?		no ID
<b>Basic project website content</b>		
The project website MUST succinctly describe what the software does (what problem does it solve)?	met	<p>Please see the scope of the O-RAN-SC OAM project:</p> <p><a href="#">Operations and Maintenance#Scope</a></p>
The project website MUST provide information on how to: obtain, provide feedback (as bug reports or enhancements), and contribute to the software.	met	<p>Please follow the links to LFN tool chain (Meeting, Jira, Confluence, gerrit, docs)</p> <p><a href="#">Operations and Maintenance</a></p>

The information on how to contribute MUST explain the contribution process (e.g., are pull requests used?) (URL required)	met	Please see <a href="https://wiki.o-ran-sc.org/display/ORAN/ORAN+Developer's+Guide+to+CI+Resources+and+Processes+at+the+LF">https://wiki.o-ran-sc.org/display/ORAN/ORAN+Developer's+Guide+to+CI+Resources+and+Processes+at+the+LF</a>
The information on how to contribute SHOULD include the requirements for acceptable contributions (e.g., a reference to any required coding standard). (URL required)		
<b>FLOSS license</b>		
What license(s) is the project released under?	met	Apache 2.0
The software produced by the project MUST be released as FLOSS.	met	Apache 2.0
It is SUGGESTED that any required license(s) for the software produced by the project be <a href="#">approved by the Open Source Initiative (OSI)</a> .	met	Apache 2.0
The project MUST post the license(s) of its results in a standard location in their source repository.	met	Available in root of the repo
<b>Documentation</b>		
The project MUST provide basic documentation for the software produced by the project.	met	<a href="https://docs.o-ran-sc.org/en/latest/projects.html#operations-and-maintenance-oam">https://docs.o-ran-sc.org/en/latest/projects.html#operations-and-maintenance-oam</a>
The project MUST provide reference documentation that describes the external interface (both input and output) of the software produced by the project.	not applicable	External interfaces are derived from yang models and "learned" on-the-fly. Please see O-RAN and 3GPP and IETF and ONF modeling pages.
<b>Other</b>		
The project sites (website, repository, and download URLs) MUST support HTTPS using TLS.	met	Thanks to LFN
The project MUST have one or more mechanisms for discussion (including proposed changes and issues) that are searchable, allow messages and topics to be addressed by URL, enable new people to participate in some of the discussions, and do not require client-side installation of proprietary software.	met	Discussions are possible by Confluence, O-RAN meetings, O-RAN-SC meetings and email.
The project SHOULD provide documentation in English and be able to accept bug reports and comments about code in English.	met	All documentation in English

## Change Control (9 Points)

(Result/Proof point (column A: enter Met/Unmet; Column B: enter relevant URLs/comments))

	Project Operation and Maintenance (OAM)	
Criteria	Result / Proof point	
<b>Public version-controlled source repository</b>		
The project MUST have a version-controlled source repository that is publicly readable and has a URL.	met	Please see project gerrit <a href="https://gerrit.o-ran-sc.org/r/admin/repos/oam">https://gerrit.o-ran-sc.org/r/admin/repos/oam</a>

The project's source repository MUST track what changes were made, who made the changes, and when the changes were made.	met	Please see project gerrit and Jira <ul style="list-style-type: none"> <li>• <a href="https://gerrit.o-ran-sc.org/r/admin/repos/oam">https://gerrit.o-ran-sc.org/r/admin/repos/oam</a></li> <li>• <a href="https://jira.o-ran-sc.org/projects/OAM">https://jira.o-ran-sc.org/projects/OAM</a></li> </ul>
To enable collaborative review, the project's source repository MUST include interim versions for review between releases; it MUST NOT include only final releases.		
It is SUGGESTED that common distributed version control software be used (e.g., git) for the project's source repository.	met	Please see project gerrit <a href="https://gerrit.o-ran-sc.org/r/admin/repos/oam">https://gerrit.o-ran-sc.org/r/admin/repos/oam</a>
<b>Unique version numbering</b>		
The project results MUST have a unique version identifier for each release intended to be used by users		
It is SUGGESTED that the <a href="#">Semantic Versioning (SemVer) format</a> be used for releases.		
It is SUGGESTED that projects identify each release within their version control system. For example, it is SUGGESTED that those using git identify each release using git tags.		
<b>Release notes</b>		
The project MUST provide, in each release, release notes that are a human-readable summary of major changes in that release to help users determine if they should upgrade and what the upgrade impact will be. The release notes MUST NOT be the raw output of a version control log (e.g., the "git log" command results are not release notes). Projects whose results are not intended for reuse in multiple locations (such as the software for a single website or service) AND employ continuous delivery MAY select "N/A". (URL required)	met	Please see <a href="https://docs.o-ran-sc.org/projects/o-ran-sc-oam/en/latest/release-notes.html">https://docs.o-ran-sc.org/projects/o-ran-sc-oam/en/latest/release-notes.html</a>
The release notes MUST identify every publicly known vulnerability with a CVE assignment or similar that is fixed in each new release, unless users typically cannot practically update the software themselves. If there are no release notes or there have been no publicly known vulnerabilities, choose "not applicable" (N/A).		

## Reporting (8 Points)

(Result/Proof point (column A: enter Met/Unmet; Column B: enter relevant URLs/comments))

Criteria	Result / Proof point
<b>Project Operation and Maintenance (OAM)</b>	
<b>Bug-reporting process</b>	
The project MUST provide a process for users to submit bug reports (e.g., using an issue tracker or a mailing list). (URL required)	met Please see <ul style="list-style-type: none"> <li>• <b>Jira:</b> <a href="https://jira.o-ran-sc.org/projects/OAM/issues">jira.o-ran-sc.org/projects/OAM/issues</a></li> <li>• <b>OSC Guidelines:</b> <a href="https://wiki.o-ran-sc.org/display/ORAN/Reporting+Bugs">https://wiki.o-ran-sc.org/display/ORAN/Reporting+Bugs</a></li> </ul>
The project SHOULD use an issue tracker for tracking individual issues.	met Please see <a href="https://jira.o-ran-sc.org/projects/OAM/issues">jira.o-ran-sc.org/projects/OAM/issues</a>

The project MUST acknowledge a majority of bug reports submitted in the last 2-12 months (inclusive); the response need not include a fix.	met	As can be seen on: <ul style="list-style-type: none"> <li>• <b>Email List:</b> <ul style="list-style-type: none"> <li>◦ OSC "discuss" mailing list: <a href="https://lists.o-ran-sc.org/g/discuss">https://lists.o-ran-sc.org/g/discuss</a>: <a href="mailto:discuss@lists.o-ran-sc.org">discuss@lists.o-ran-sc.org</a></li> <li>◦ Please use hashtag <b>#oam</b></li> </ul> </li> <li>• <b>JIRA:</b> <a href="https://jira.o-ran-sc.org/projects/OAM/issues">jira.o-ran-sc.org/projects/OAM/issues</a></li> </ul>
The project SHOULD respond to a majority (>50%) of enhancement requests in the last 2-12 months (inclusive).	met	As can be seen on: <ul style="list-style-type: none"> <li>• <b>Email List:</b> <ul style="list-style-type: none"> <li>◦ OSC "discuss" mailing list: <a href="https://lists.o-ran-sc.org/g/discuss">https://lists.o-ran-sc.org/g/discuss</a>: <a href="mailto:discuss@lists.o-ran-sc.org">discuss@lists.o-ran-sc.org</a></li> <li>◦ Please use hashtag <b>#oam</b></li> </ul> </li> <li>• <b>JIRA:</b> <a href="https://jira.o-ran-sc.org/projects/OAM/issues">jira.o-ran-sc.org/projects/OAM/issues</a></li> </ul>
The project MUST have a publicly available archive for reports and responses for later searching. (URL required)	unmet	
<b>Vulnerability report process</b>		
The project MUST publish the process for reporting vulnerabilities on the project site. (URL required)	unmet	
If private vulnerability reports are supported, the project MUST include how to send the information in a way that is kept private. (URL required)  Examples include a private defect report submitted on the web using HTTPS (TLS) or an email encrypted using OpenPGP. If vulnerability reports are always public (so there are never private vulnerability reports), choose "not applicable" (N/A).	unmet	
The project's initial response time for any vulnerability report received in the last 6 months MUST be less than or equal to 14 days.  If there have been no vulnerabilities reported in the last 6 months, choose "not applicable" (N/A).	unmet	

## Quality (13 Points)

(Result/Proof point (column A: enter Met/Unmet; Column B: enter relevant URLs/comments)

		Project Operation and Maintenance (OAM)
Criteria		Result / Proof point
<b>Working build system</b>		
If the software produced by the project requires building for use, the project MUST provide a working build system that can automatically rebuild the software from source code.	met	maven, docker
It is SUGGESTED that common tools be used for building the software.	met	maven, docker, docker-compose

The project SHOULD be buildable using only FLOSS tools.	met	maven, docker, docker- compose
<b>Automated test suite</b>		
The project MUST use at least one automated test suite that is publicly released as FLOSS (this test suite may be maintained as a separate FLOSS project).	unmet	
A test suite SHOULD be invocable in a standard way for that language. For example, "make check", "mvn test", or "rake test" (Ruby).	unmet	
It is SUGGESTED that the test suite cover most (or ideally all) the code branches, input fields, and functionality.	unmet	
It is SUGGESTED that the project implement continuous integration (where new or changed code is frequently integrated into a central code repository and automated tests are run on the result).	unmet	
<b>New functionality testing</b>		
The project MUST have a general policy (formal or not) that as major new functionality is added to the software produced by the project, tests of that functionality should be added to an automated test suite. As long as a policy is in place, even by word of mouth, that says developers should add tests to the automated test suite for major new functionality, select "Met."	n/a	
The project MUST have evidence that the <a href="#">test_policy</a> for adding tests has been adhered to in the most recent major changes to the software produced by the project. Major functionality would typically be mentioned in the release notes. Perfection is not required, merely evidence that tests are typically being added in practice to the automated test suite when new major functionality is added to the software produced by the project.	n/a	
It is SUGGESTED that this policy on adding tests (see <a href="#">test_policy</a> ) be <i>documented</i> in the instructions for change proposals. However, even an informal rule is acceptable as long as the tests are being added in practice.	n(a)	
<b>Warning flags</b>		
The project MUST enable one or more compiler warning flags, a "safe" language mode, or use a separate "linter" tool to look for code quality errors or common simple mistakes, if there is at least one FLOSS tool that can implement this criterion in the selected language.	unmet	
The project MUST address warnings.	unmet	
It is SUGGESTED that projects be maximally strict with warnings in the software produced by the project, where practical.  Some warnings cannot be effectively enabled on some projects. What is needed is evidence that the project is striving to enable warning flags where it can, so that errors are detected early.	unmet	

## Security (16 Points)

(Result/Proof point (column A: enter Met/Unmet; Column B: enter relevant URLs/comments))

	Project Operatio n and Maintena nce (OAM)
<b>Criteria</b>	<b>Result / Proof point</b>

<b>Secure development knowledge</b>		
The project MUST have at least one primary developer who knows how to design secure software. (See 'details' for the exact requirements.)		
At least one of the project's primary developers MUST know of common kinds of errors that lead to vulnerabilities in this kind of software, as well as at least one method to counter or mitigate each of them.		
<b>Use basic good cryptographic practices</b>		
The software produced by the project MUST use, by default, only cryptographic protocols and algorithms that are publicly published and reviewed by experts (if cryptographic protocols and algorithms are used). These cryptographic criteria do not always apply because some software has no need to directly use cryptographic capabilities.	met	As defined by O-RAN specification (http/TLS, NetConf/TLS)
If the software produced by the project is an application or library, and its primary purpose is not to implement cryptography, then it SHOULD only call on software specifically designed to implement cryptographic functions; it SHOULD NOT re-implement its own.	met	The project uses existing open-source cryptographic libraries are used.
All functionality in the software produced by the project that depends on cryptography MUST be implementable using FLOSS. See the <a href="#">Open Standards Requirement for Software by the Open Source Initiative</a> .	met	The project uses existing open-source cryptographic libraries are used.
The security mechanisms within the software produced by the project MUST use default keylengths that at least meet the NIST minimum requirements through the year 2030 (as stated in 2012). It MUST be possible to configure the software so that smaller keylengths are completely disabled. These minimum bitlengths are: symmetric key 112, factoring modulus 2048, discrete logarithm key 224, discrete logarithmic group 2048, elliptic curve 224, and hash 224 (password hashing is not covered by this bitlength, more information on password hashing can be found in the <a href="#">crypto_password_storage</a> criterion). See <a href="https://www.keylength.com">https://www.keylength.com</a> for a comparison of keylength recommendations from various organizations. The software MAY allow smaller keylengths in some configurations (ideally it would not, since this allows downgrade attacks, but shorter keylengths are sometimes necessary for interoperability).		
The default security mechanisms within the software produced by the project MUST NOT depend on broken cryptographic algorithms (e.g., MD4, MD5, single DES, RC4, Dual_EC_DRBG), or use cipher modes that are inappropriate to the context, unless they are necessary to implement an interoperable protocol (where the protocol implemented is the most recent version of that standard broadly supported by the network ecosystem, that ecosystem requires the use of such an algorithm or mode, and that ecosystem does not offer any more secure alternative). The documentation MUST describe any relevant security risks and any known mitigations if these broken algorithms or modes are necessary for an interoperable protocol.		
The default security mechanisms within the software produced by the project SHOULD NOT depend on cryptographic algorithms or modes with known serious weaknesses (e.g., the SHA-1 cryptographic hash algorithm or the CBC mode in SSH).		

The security mechanisms within the software produced by the project SHOULD implement perfect forward secrecy for key agreement protocols so a session key derived from a set of long-term keys cannot be compromised if one of the long-term keys is compromised in the future.		
If the software produced by the project causes the storing of passwords for authentication of external users, the passwords MUST be stored as iterated hashes with a per-user salt by using a key stretching (iterated) algorithm (e.g., Argon2id, Bcrypt, Scrypt, or PBKDF2). See also <a href="#">O WASP Password Storage Cheat Sheet</a> ).		
The security mechanisms within the software produced by the project MUST generate all cryptographic keys and nonces using a cryptographically secure random number generator, and MUST NOT do so using generators that are cryptographically insecure.		
<b>Secured delivery against man-in-the-middle (MITM) attacks</b>		
The project MUST use a delivery mechanism that counters MITM attacks. Using https or ssh+scp is acceptable.	met	As defined by O-RAN specification (http/TLS, NetConf/TLS)
A cryptographic hash (e.g., a sha1sum) MUST NOT be retrieved over http and used without checking for a cryptographic signature.	?	Such requirement must be fulfilled by the deployment process.
<b>Publicly known vulnerabilities fixed</b>		
There MUST be no unpatched vulnerabilities of medium or higher severity that have been publicly known for more than 60 days.		
Projects SHOULD fix all critical vulnerabilities rapidly after they are reported.		
<b>Publicly known vulnerabilities fixed</b>		
is intended to limit public access. A project MAY leak "sample" credentials for testing and unimportant databases, as long as they are not intended to limit public access.	met	The deployment process will overwrite all "sample" credentials.

## Analysis (8 Points)

(Result/Proof point (column A: enter Met/Unmet; Column B: enter relevant URLs/comments)

	Project Operation and Maintenance (OAM)
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Criteria	Result / Proof point	
<b>Static code analysis</b>		
At least one static code analysis tool (beyond compiler warnings and "safe" language modes) MUST be applied to any proposed major production release of the software before its release, if there is at least one FLOSS tool that implements this criterion in the selected language.		
It is SUGGESTED that at least one of the static analysis tools used for the static_analysis criterion include rules or approaches to look for common vulnerabilities in the analyzed language or environment.		
All medium and higher severity exploitable vulnerabilities discovered with static code analysis MUST be fixed in a timely way after they are confirmed.		
It is SUGGESTED that static source code analysis occur on every commit or at least daily.		
<b>Dynamic code analysis</b>		
It is SUGGESTED that at least one dynamic analysis tool be applied to any proposed major production release of the software before its release.		
It is SUGGESTED that if the software produced by the project includes software written using a memory-unsafe language (e.g., C or C++), then at least one dynamic tool (e.g., a fuzzer or web application scanner) be routinely used in combination with a mechanism to detect memory safety problems such as buffer overwrites. If the project does not produce software written in a memory-unsafe language, choose "not applicable" (N/A).		
It is SUGGESTED that the software produced by the project include many run-time assertions that are checked during dynamic analysis.		
All medium and higher severity exploitable vulnerabilities discovered with dynamic code analysis MUST be fixed in a timely way after they are confirmed.		