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eTIR conceptual, functional and technical documentation version 4.3: eTIR technical specifications

Technical requirements of the eTIR international system

Note by the secretariat

I. Mandate

1. The Inland Transport Committee (ITC), at its eighty-second session (23–28 February 2020) approved (ECE/TRANS/294, para. 84[1]) the establishment of the Group of Experts on Conceptual and Technical Aspects of Computerization of the TIR Procedure (WP.30/GE.1) and endorsed its Terms of Reference (ToR)[2] (ECE/TRANS/WP30/2019/9 and ECE/TRANS/WP.30/2019/9/Corr.1), pending approval by the United Nations Economic Commission for Europe (ECE) Executive Committee (EXCOM). EXCOM during its Remote informal meeting of members of the Executive Committee (20 May 2020) approved the establishment of the Group of Experts on Conceptual and Technical Aspects of Computerization of the TIR Procedure (WP.30/GE.1) until 2022, based on the ToR included in document ECE/TRANS/WP.30/2019/9 and Corr.1, as contained in document ECE/TRANS/294 (ECE/EX/2020/L.2, para. 5(b)).[3]

2. The ToR of the Group stipulate that the Group should focus its work on preparing a new version of the eTIR specifications, pending the formal establishment of the Technical

[1] Decision of the Inland Transport Committee para. 84 / ECE/TRANS/294 www.unece.org/fileadmin/DAM/trans/doc/2020/itc/ECE-TRANS-294e.pdf

[2] Terms of reference of the newly established Group approved by the Inland Transport Committee and the Executive Committee (EXCOM) of UNECE www.unece.org/fileadmin/DAM/trans/bcf/wp30/documents/2019/ECE-TRANS-WP30-2019-09e.pdf and corrigendum www.unece.org/fileadmin/DAM/trans/bcf/wp30/documents/2019/ECE-TRANS-WP30-2019-09c1e.pdf

[3] Decision of EXCOM, ECE/EX/2020/L.2 / para. 5(b) www.unece.org/fileadmin/DAM/commission/EXCOM/Agenda/2020/Remote_informal_mtg_20_05_2020/Item_4_ECE_EX_2020_L.2_ITC_Sub_bodies_E.pdf

Implementation Body (TIB). More specifically, the Group should (a) prepare a new version of the technical specifications of the eTIR procedure, and amendments thereto, ensuring their alignment with the functional specifications of the eTIR procedure; (b) prepare a new version of the functional specifications of the eTIR procedure, and amendments thereto, ensuring their alignment with the conceptual specifications of the eTIR procedure; (c) prepare amendments to the conceptual specifications of the eTIR procedure, upon requests by WP.30.

3. This document presents the technical requirements of the eTIR international system. All these aspects will be part of the eTIR technical specifications document.

II. eTIR international system

A. Technical requirements

1. Introduction

4. This section describes the technical requirements – or non-functional requirements – which must be met by the eTIR international system. Technical requirements specify criteria that can be used to judge how well a system performs its operations and fulfils its mission. These criteria are as important as functional requirements and will drive the architecture and design principles of the system.

5. Each following sub-section describes the requirements of a particular non-functional criterion. These requirements can be qualitative (e.g. the source code must be versioned on Git) and/or quantitative (e.g. the eTIR international system must be available 24 hours per day and 365 days per year). All requirements are given a unique identifier for ease of reference.

6. Quantitative requirements need metrics to be collected to be able to assess whether these requirements are met. Provided these metrics can be revealed without posing a security issue, they may be communicated on a periodic basis to TIB for its information.

7. Given the fact that the eTIR system is based on an exchange of messages using web services and that no user interface is expected to be developed for the eTIR international system (except for internal purposes related to its administration), the following criteria are therefore not applicable and will not be described: accessibility, compatibility and usability.

8. Several quantitative targets will be periodically assessed by ECE and reported to TIB, along with proposals to correct potential deficiencies and further increase the targets. TIB shall then decide whether to apply these proposals or recommend their application to AC.2.

9. Finally, when products, software, frameworks and libraries used to fulfil the requirements, are mentioned, ECE reserves the right to modify its selection later on, as long as there are no costs implications, in order to accrue additional benefits for the eTIR system. The information about these new selections would be communicated to TIB and the next version of the eTIR specifications would be updated accordingly.

2. Availability

10. The availability of the eTIR international system represents the state when it is fully accessible and operable by its authorized users (ECE and all eTIR stakeholders connected to it).

11. The availability of the eTIR international system will be critically important for the proper functioning of the whole eTIR system from the beginning and even more when the number of TIR transports carried under the eTIR procedure will increase. The following tables describe both the qualitative and quantitative aspects of the availability requirements. Several of them will be part of the service level agreement (SLA) to be signed with the United Nations hosting provider (hereafter the hosting entity) which will be selected to host the eTIR international system.

Table 1
Qualitative availability requirements

Identifier	*Description and objective*	*How to fulfil the requirement*
AV.1	Normal maintenance operations for the software and systems components of the eTIR international system are performed transparently as the service remains available.	Design the eTIR international system in a way that avoids single points of failure (SPOF), using several front-end web servers to share the workload, database clustering, duplication of application components, and by possibly using high-availability proxies and orchestration of containers

Table 2
Quantitative availability requirements

Identifier	*Description*	*How to achieve the target*	*Target value*
AV.2	General availability of the eTIR international system	Host the eTIR international system in a UN organization that proposes this level of availability and include it in the SLA.	24 hours per day, each day of the year.
AV.3	Percentage of uptime of the eTIR international system	Normal maintenance operations for the software and systems components of the eTIR international system are performed transparently as the service remains available. Issues with the system are quickly identified and dealt with using SOPs and escalation mechanism.	Greater than 99% (i.e. a maximum of 3d 15h 39m 29s of downtime per year).
AV.4	Maximum consecutive eTIR international system downtime in case of a major issue	Monitoring of services, software components and virtual servers is configured and agreed with the hosting provider. Procedures are prepared and agreed in the SLA.	4 hours during weekdays and 24 hours during weekends, per occurrence.

12. Once the eTIR international system starts to be used in production, following the study on measures collected and on the feedback from eTIR stakeholders, ECE or TIB may wish to propose to improve the target values of requirements AV.3 and AV.4 to increase the availability of the service. In this case, ECE would submit to TIB a proposal to improve the above-mentioned target values, along with possible budget implications.

3. Backup

13. A backup is a copy of eTIR related data made and stored elsewhere, in a secured location, so that it can be used to restore them after a data loss event.

14. Each storage location (i.e. eTIR database, eTIR logs and eTIR documents) will be backed up to ensure the requirements are met. The ones indicated in the following table will be part of the SLA to be signed with the hosting entity.

Table 3
Backup requirements

Identifier	*Description*	*How to achieve the target*	*Target value*
BK.1	Frequency of backup of eTIR data	Information stored in the eTIR database, the eTIR logs and the eTIR documents is backed up twice per day and this backed up data is stored in a secured location.	12 hours
BK.2	Maximum time to restore backed up data following a data loss event	Restore procedures are prepared and agreed in the SLA with the hosting provider. Tests are regularly carried out.	6 hours

15. Once the eTIR international system starts to be used in production, ECE or TIB may wish to propose to improve the target values of requirements BK.1 and BK.2. In this case, ECE would submit to TIB a proposal to improve the above-mentioned target values, along with possible budget implications.

4. Capacity and scalability

16. There are basically two aspects to take into consideration regarding capacity management: the throughput of the system (i.e. its ability to process incoming messages and send responses) and the storage of the various pieces of information received. The scalability of the eTIR international system is its capability to handle a growing amount of workload by adding resources to the system.

17. The figures in the following table are based on an analysis performed to determine the needs in terms of capacity and scalability for the eTIR international system and available in annex V.C. As mentioned in its conclusions, the estimates and forecast in terms of throughput and volume of data are only as good as the various assumptions they are based on. Since the eTIR international system is not yet in operation, this analysis lacks actual data. For this reason, the eTIR international system should be designed while considering the capacity and scalability requirements for the first two years only, as there is a high probability that real data will correct several assumptions, which would change the calculation result and forecast for the next years.

Table 4
Capacity and scalability requirements

Identifier	*Description*	*How to achieve the target*	*Target value*
CP.1	Maximum number of messages to be processed	A queuing component stores incoming messages. Several front-end web servers then pop messages from the queue to be processed under timeout thresholds.	2021: 12 messages per minute 2022: 78 messages per minute 2023: 270 messages per minute 2024: 570 messages per minute 2025: 1200 messages per minute
CP.2	Maximum storage dedicated to the eTIR logs	eTIR logs are directly saved on the front-end web servers. On a daily basis, they are moved to a central, secured location which will have enough storage space to aggregate them all.	2021: 371 GB per year 2022: 1.2 TB per year 2023: 4.9 TB per year 2024: 17.1 TB per year 2025: 36.1 TB per year
CP.3	Maximum storage dedicated to the eTIR database	Depending on the actual data received and on regular performance measurements, only the most recent data (last six months for instance) may be kept in the clustered database (while older data is regularly offloaded to a secondary database) to ensure the size of the main database does not negatively impact its performance.	2021: 1.4 GB per year 2022: 4.3 GB per year 2023: 17.9 GB per year 2024: 62.6 GB per year 2025: 133.3 GB per year
CP.4	Maximum storage dedicated to the eTIR documents	eTIR Documents are not stored in the database but on a central, secured, file system which will have enough disk space to gather them all.	2021: 100 GB per year 2022: 315 GB per year 2023: 1.3 TB per year 2024: 4.6 TB per year 2025: 9.8 TB per year

18. As mentioned in the conclusions of the analysis presented in annex V.C, ECE shall perform the same analysis six months after the eTIR international system is deployed in production in order to submit to TIB a revision of the above mentioned target values, along with a possible budget proposal.

5. Configuration management

19. Configuration management is the process that tracks all of the individual configuration items of the eTIR international system. A configuration item is an IT asset or a combination of IT assets that may depend on and/or have relationships with other IT processes (e.g. source code, configuration files, procedures, internal documentation, etc.).

20. An appropriate number of measures and procedures related to configuration management is the only effective and sustainable way to develop and maintain a major information system like the eTIR international system and ECE will ensure that the following technical requirements are properly addressed.

Table 5
Configuration management requirements

Identifier	*Description and objective*	*How to fulfil the requirement*
CM.1	The source code of all modules of the eTIR international system should be versioned using a version control system (VCS) to allow for an effective management of this asset.	The source code of all modules of the eTIR international system is versioned using Git and hosted within UN premises.
CM.2	All changes related to the eTIR database should be versioned using a VCS to allow for an effective management of this asset.	All changes related to the eTIR database are versioned using Liquibase and Git and hosted within UN premises.
CM.3	All assets related to the documentation of the eTIR system should be versioned using a VCS to allow for an effective management of this asset.	All assets related to the documentation of the eTIR system are versioned using various VCS depending on their nature and hosted within UN premises.
CM.4	All assets related to the internal documentation of the eTIR system should be versioned and accessible to ECE using a collaboration software to allow for an effective sharing of knowledge and improved productivity.	All assets related to the internal documentation of the eTIR system are versioned and accessible to ECE on a knowledge management system (KMS) that acts as a secured and versioned collaboration platform hosted within UN premises.
CM.5	All bug reports, feature requests and other issues are logged, managed and eventually addressed using an issue tracking system to ensure that the issues raised by all eTIR stakeholders are properly evaluated and treated with the appropriate level of priority.	All bug reports, feature requests and other issues are logged, managed and eventually addressed using an issue tracking system hosted within UN premises.

6. Data Retention

21. Data Retention defines the policies related to persistent data and records management for meeting legal and business data archival requirements, such as the ones listed in Annex 11. The following table lists the requirements in terms of data retention for the eTIR international system.

Table 6
Data Retention requirements

Identifier	*Description*	*How to achieve the target*	*Target value*
RE.1	Availability of the information stored in the eTIR international system	Information stored in the eTIR database, the eTIR logs and the eTIR documents are backed up on a daily basis and additional copies are made and kept on tapes stored in a separate, secured location, resistant to most disasters.	10 years[4]

[4] As per paragraph 1 of article 12 of Annex 11 of the TIR Convention

Identifier	*Description*	*How to achieve the target*	*Target value*
RE.2	Retrieval of information requested by contracting parties for verification purposes[5]	Retrieval procedures are prepared and agreed in the SLA with the hosting provider.	Maximum of three days to retrieve the information

7. Disaster recovery

22. Disaster recovery involves a set of policies, tools and procedures to enable the recovery or continuation of the eTIR international system following a natural or human-induced disaster. Disaster recovery focuses on the IT or technology systems supporting critical business functions and can therefore be considered as a subset of business continuity planning.

23. Usually, disaster recovery assumes that the primary site is not recoverable (at least for some time) and represents the set of processes needed to restore the services to a secondary site. In the scope of version 4.3 of the eTIR specifications, it is assumed that only a secondary site of type "warm site" is available for disaster recovery purposes, principally for costs reasons.

24. A "warm site" contains the equipment and data circuits necessary to rapidly establish operations. This equipment is usually preconfigured and ready to install appropriate applications to support an organization's operations. However, is this secondary site is to be used because the primary site is no longer available because of a disaster, all software components still have to be installed and configured on the servers of the "warm dite". Furthermore, live data from the primary site is not replicated on this type of secondary site in real time but data transactions are only copied on a regular basis.

25. The impact of a disaster is high because it brings the eTIR international system down for an unusual long period of time (typically more than one day). However, the probability of such a disaster occurring is extremely low. The resulting risk is minor in the context of version 4.3 of the eTIR specifications as the number of TIR transports using the eTIR procedure will be low at first and only progressively increase as additional contracting parties interconnect their national customs systems to the eTIR international system. Furthermore, the fallback procedures described in the eTIR functional specifications act as mitigating measures for this risk.

26. The following table lists the disaster recovery requirements for the eTIR international system.

Table 7
Disaster recovery requirements

Identifier	*Description*	*How to achieve the target*	*Target value*
DR.1	The recovery time objective (RTO)[6] of the eTIR international system, after a disaster.	Prepare a disaster recovery plan with all procedures detailing how to recover the eTIR international system and execute regular tests of this plan.	48 hours
DR.2	The recovery point objective (RPO)[7] of the eTIR international system.	Regularly and securely send copies of eTIR related data to the warm site. Perform recovery tests.	4 hours

27. Once the eTIR international system starts to be used in production, ECE or TIB may wish to propose to improve the target values of requirements DR.1 and DR.2. In this case,

[5] As per paragraph 3 of article 12 of Annex 11 of the TIR Convention

[6] The RTO is the amount of time in which it should be feasibly to recover the IT service in the event of a disaster.

[7] The RPO is the maximum targeted period in which data (transactions) might be lost from an IT service due in the event of a disruption.

ECE would submit to TIB a proposal to improve the above-mentioned target values, along with possible budget implications.

8. Fault tolerance

28. Fault tolerance is the property that enables a system to continue operating properly in the event of the failure of (or one or more faults within) some of its components. Modern information systems architectures and infrastructure take into account usual technical failures of components like hard disk drives, network connections, power failures and can provide a level of fault tolerance which is transparent to the end users.

29. The requirements listed in the following table provide a first level of technical fallback which does not need to be activated by the eTIR stakeholders. These requirements are mostly fulfilled by the underlying infrastructure and will be part of the SLA to be signed with the hosting entity.

Table 8
Fault tolerance requirements

Identifier	*Description and objective*	*How to fulfil the requirement*
FT.1	Handle gracefully the failure of a physical server, which can be due to a piece of equipment (CPU, memory, motherboard, HDD, network card, etc.) to avoid the eTIR international system becoming unavailable.	An infrastructure based on a virtual server farm relying on several physical servers which manage hot swapping of virtual machines to mitigate such a failure. Architecture based on computer cluster to avoid any SPOF.
FT.2	Handle gracefully the failure of a piece of equipment used by the storage locations (HDD, SSD) to avoid the eTIR international system becoming unavailable.	An infrastructure based on a SAN using a redundant architecture for the disk drives (RAID). Architecture based on computer cluster to avoid any SPOF.
FT.3	Handle gracefully the loss of internet connectivity to avoid the eTIR international system becoming unavailable.	Double internet connection with two different providers.
FT.4	Handle gracefully power failures to avoid the eTIR international system becoming unavailable.	Racks of uninterruptible power supplies (UPS) and emergency fuel generators to power the data centre with enough fuel in reserve to wait for the power to come back to be refilled with more fuel.

9. Internationalization and localization

30. Internationalization and localization are means of adapting computer software to different languages, regional peculiarities and technical requirements of a target locale. Internationalization is the process of designing a software application so that it can be adapted to various languages and regions without engineering changes. Localization is the process of adapting internationalized software for a specific region or language by translating text and adding locale-specific components.

31. Since the eTIR international system does not have a user interface, the requirements in terms of internationalization are limited to the eTIR messages and how data is stored in the various storage locations. Several approaches have been taken to limit the needs in terms of localization:

- Most of the attributes in the eTIR messages are using code lists. These code lists detail all the possible codes that an attribute can take, which facilitates the transfer of information from one system to another, since all systems are aligned on the same set of code lists. Furthermore, this method avoids having to translate values which therefore do not need to be localized;
- Numbers are expressed using fixed patterns which are clearly defined in the XML Schema Definitions of the eTIR messages. This approach clears any potential ambiguity related to decimal and thousands separators;

- Dates are also expressed using specific patterns either for a date only or for a date and time, including a Coordinated Universal Time (UTC) offset;
- Text fields are kept to a minimum and are used most of the time to represent words that are usually not translated like: identifiers, proper nouns and addresses. A few text fields are used to hold sentences in a given language and the sub attribute "Language, coded" can be used to define the language of the values stored in these text fields.

32. The following table lists the requirements in terms of internationalization and localization

Table 9
Internationalization and localization requirements

Identifier	*Description and objective*	*How to fulfil the requirement*
IL.1	The eTIR messages should be able to handle text values in French, English and Russian.	The character set of the eTIR messages exchanged in SOAP/XML is UTF-8, the content type is "application/soap+xml".
IL.2	The eTIR database should be able to store text values (from the eTIR messages) in French, English and Russian.	The character set of the eTIR database is UTF-8.
IL.3	The eTIR logs should be able to store the entire eTIR messages as they are received.	The character set of the files stored in the eTIR logs is UTF-8.
IL.4	The eTIR documents should be able to store the attached documents in various languages in addition to French, English and Russian.	The character set of the files stored in the eTIR documents is UTF-8.
IL.5	The language of the text values held in the eTIR messages should be identifiable.	The text values are characterized with the "Language, coded" sub attribute which uses a code list to specify the language name.

10. Interoperability

33. Interoperability is a characteristic of a system, whose interfaces are comprehensively detailed, to work with other systems, at present or in the future, in either implementation or access, with full compatibility.

34. The eTIR system is based on machine to machine communication triggered by specific events. Therefore, the interfaces between the various eTIR stakeholders must be clearly defined to ease the interconnection between the systems. Also, in order to further facilitate this interconnection, the interfaces should be based on worldwide renowned standards.

Table 10
Interoperability requirements

Identifier	*Description and objectives*	*How to fulfil the requirement*
IT.1	The eTIR data model should be aligned with a worldwide renowned data model to facilitate the connection between the eTIR international system and the information systems of the other eTIR stakeholders.	The eTIR Data Model is fully aligned with the World Customs Organization (WCO). Data maintenance requests (DMR) are submitted by ECE to continuously adapt the WCO data model to the needs of the eTIR procedure.
IT.2	The format and technical specifications of the eTIR messages are following strict guidelines to ensure the electronic exchange of messages is interoperable between information systems.	The eTIR message specifications are following the WCO XML guidelines. Automated compliance tests are also performed to validate this aspect.
IT.3	Information exchanged in the eTIR messages is standardized as much as possible to facilitate their processing by all eTIR stakeholders.	The attributes of the eTIR messages rely as much as possible on code lists from renowned standards (UN/EDIFACT and

Identifier	*Description and objectives*	*How to fulfil the requirement*
		ISO).
IT.4	eTIR stakeholders should have sufficient time to migrate to the next version of the eTIR specifications while continuing to use the current version of the eTIR specifications.	The eTIR international system will be able to receive, process and send eTIR messages using two versions of the eTIR specifications: the current one and the next one proposed for implementation to all eTIR stakeholders during a specific migration time window which details are described in the release management processes.

11. Maintainability

35. Maintainability is the ease with which a product can be maintained in order to (inter alia): correct defects[8], meet new requirements, make future maintenance easier and cope with a changing environment.

36. A usual pitfall in software engineering and software management is to underestimate the need to continuously invest a reasonable amount of money to maintain and upgrade an information system, in order to prevent having to pay a very high amount of money to refactor it completely because it has not been properly maintained over the years.

37. The IT industry also recognizes that a large portion of the total cost of ownership (TCO) of an information system is spent during the maintenance phase of its lifecycle: usually between 50% to 80%. This highlights the importance of taking the appropriate preventive measures to keep the costs of maintenance of an information system to a reasonable level while ensuring that all exigencies on maintainability are met.

38. In particular, measures should be taken to avoid building a technical debt. Technical debt is a concept in software development that reflects the implied cost of additional rework caused by choosing a poor decision that might yield benefits in the short-term but will increase the costs of maintenance in the long term. Indeed, as with monetary debt, if technical debt is not repaid, it can accumulate 'interest', making it harder to implement changes in the future.

39. The following table lists the requirements in terms of maintainability.

Table 11
Maintainability requirements

Identifier	*Description and objective*	*How to fulfil the requirement*
MT.1	Technical debt should not accumulate on the programming languages, frameworks and libraries used to build the eTIR international system.	The latest stable versions of the underlying programming languages, frameworks and libraries used to build the eTIR international system are regularly reviewed and updates or upgrades are regularly planned. Recurrent reviews of the emerging trends are also performed, and appropriate actions are taken to migrate to better options before a component becomes deprecated.
MT.2	Technical debt should not accumulate on the source code of the eTIR international system.	A static code analysis tool is used to measure the maintainability index of the source code and regular attention is given to reduce the number of issues flagged by this tool. Regular code refactoring activities are also performed to reduce the *software entropy*[9] of the source code.
MT.3	Knowledge is retained to properly maintain and improve the eTIR international system	The internal documentation of the eTIR international system is managed on a KMS that acts as a secured and versioned collaboration platform between the members of ECE. One of the roles of the IT coordinator is to ensure that the appropriate level

[8] See the definition of « defect » in the technical glossary
[9] See a definition in the Technical Glossary.

	of documentation (including SOPs) is prepared and remains updated on the KMS in order to mitigate the risks of turnover and key person.[10]

12. Performance

40. Performance is the numerical indication, measuring the maximum or optimal possibilities of a hardware, software, system or technical process to perform a given task. In the case of the eTIR international system, the requirements are focused on the response time and the throughput characteristics.

41. Requirements on the throughput of the eTIR international system are already detailed in the section devoted to capacity, respectively with CP.1 and CP.2. Requirements on the response times are detailed in the following quantitative table, while additional requirements related to performance are listed in the qualitative table below.

Table 12
Quantitative performance requirements

Identifier	*Description*	*How to achieve the target*	*Target value*
PE.1	Average response time involving short messages (up to 10KB) measured by the sender from sending the request message to receiving the response message.	The eTIR international system is properly designed and free of any logical or technical bottlenecks that could be a performance issue. The management of the eTIR database, writing information to the eTIR logs and connecting to the ITDB are all optimized operations.	1 second
PE.2	Maximum response time involving short messages (up to 10KB) measured by the sender from sending the request message to receiving the response message.	Enough nodes are provisioned for the eTIR web services software components to be able to cope with all requests. Enough nodes are provisioned for the eTIR database to be able to cope with all requests.	10 seconds
PE.3	Maximum response time measured by the sender from sending the request message to receiving the response message.	The maximum size of the eTIR messages is set to 20 MB. The connection of the eTIR international system to the Internet has a high bandwidth (over 100 megabits per second).	The timeout is set to 60 seconds

Table 13
Qualitative performance requirements

Identifier	*Description and objective*	*How to fulfil the requirement*
PE.4	Performance metrics of the eTIR international system should be monitored to identify any potential problem.	Metrics related to performance are logged at different key points during the reception of a request message, its processing, recording and sending of the response message. These metrics are monitored to raise an issue for ECE to investigate when their values increase above specific thresholds.
PE.5	Performance metrics of the eTIR international system remain stable or get better over time.	A load testing tool is used to perform automated load tests when new developments are introduced in the eTIR international system to ensure no sensible regression – in terms of performance – is introduced.

[10] Key person risk: risk carried by an organization that depends to a great extent on one individual for its success.

13. Reliability

42. Reliability is the ability of an information system to cope with errors during execution and cope with erroneous input. It also encompasses the set of practices followed to ensure that the objectives in terms of quality are met. Maximizing the reliability of the eTIR international system is the essence of the second guiding principle that is followed by ECE.

43. In order to ensure this objective and a high overall quality for the eTIR international system, the following proactive practices are put in place:

- Guidelines are established within ECE on the following aspects of the eTIR international system: development, deployment, operation and maintenance. These guidelines form a common set of rules and practices that ensure predictable, high-quality results;
- Strict versioning procedures exist to ensure that all changes brought to the source code of the eTIR international system and the structure and contents of the eTIR database can be traced back to a requirement entered in the issue tracking system;
- Code reviews are performed to decrease the probability of adding unwanted side-effects (defects) to the source code and to ensure that the coding guidelines are followed;
- All changes to the source code (either to introduce a feature or correct a defect) are accompanied by the appropriate automated tests to ensure that no regression is introduced in the source code;
- The source code is regularly checked by a static code analysis tool to determine several indicators related to maintainability, reliability, security, code coverage and code duplication. The issues raised by this tool are addressed by ECE to meet quality objectives (quality gates) previously set;
- A continuous integration pipeline is in place to automatically perform several operations during the development of the eTIR international system to ensure a high level of reliability and quality.

44. In addition to proactive practices, the following reactive practice is also put in place to be able to identify issues and solve them as soon as possible:

- The monitoring system continuously watches several indicators and metrics associated with the software and systems components of the eTIR international system to detect any issue and raise the appropriate alerts for a quick resolution of the issue (depending on its severity).

45. The following tables list the requirements in terms of reliability.

Table 14
Quantitative reliability requirements

Identifier	*Description*	*How to achieve the target*	*Target value*
RL.1	Number of remaining issues with the highest severities found by the static analysis tool	Check the source code using the static analysis tool on a regular basis and correct any issue with the highest severities as a high priority.	0 (all issues of this kind should be corrected)
RL.2	Number of remaining issues with a normal severity found by the static analysis tool	Include checking the source code using the static analysis tool in the continuous integration pipeline to provide a quick feedback and improve the ways of working.	Less than 150
RL.3	Percentage of functional source code covered by automated tests (code coverage)	Code reviews and development guidelines ensure that any change to the source code is accompanied by the appropriate number of automated tests.	More than 60%

Identifier	*Description*	*How to achieve the target*	*Target value*
RL.4	Percentage of duplicated source code (code duplication)	Regular reviews of the code to ensure no code duplication is introduced.	Less than 3%

46. ECE will regularly review and restrict the targets set for the quantitative reliability requirements listed in the above table to continuously increase the overall quality of the source code of the eTIR international system.

Table 15
Qualitative reliability requirements

Identifier	*Description and objective*	*How to fulfil the requirement*
RL.5	All changes to the source code are made in a way that decreases the probability to introduce issues.	Specific guidelines and best practices are followed by ECE while developing the eTIR international system. Automated tests allow to immediately flag any regression introduced. Commits which do not pass specific quality gates are rejected.
RL.6	All changes to the source code are linked to a requirement to ensure proper traceability.	The VCS used for the source code and the issue tracking system are connected. It is possible to find the issue related to a specific commit in the VCS and all commits need to reference an issue.
RL.7	Eliminate as many redundant, manual and error-prone tasks from the development procedures.	Put in place a continuous integration pipeline that relieves IT experts from mundane tasks and allow to give them a quick feedback on the quality of the change they bring to the source code.

14. Reusability

47. Reusability is the use of existing assets in some form within the software product development process. These assets are products and by-products of the software development life cycle and include code, software components, test suites, designs and documentation.

48. The main objective of reusability is to stop “reinventing the wheel”. In modern software engineering and with the use of object-oriented programming languages, it is easy to reuse existing software components. In addition, this approach is pertinent not only for software components but also for methods and frameworks as a lot of experience and good practices have been used to formulate these standard approaches. Here are the ones used in the development of the eTIR system:

- Project management: The UN secretariat has selected the PRojects IN Controlled Environments - PRINCE2® project methodology and ECE has tailored this method to apply it to the management of its projects;
- Enterprise architecture: ECE is using several aspects of The Open Group Architecture Framework - TOGAF® for its needs in terms of architecture;
- Software development: ECE is following an Agile methodology to develop and maintain the eTIR international system and apply several DevOps practices;
- Service management: ECE is using several aspects of the Information Technology Infrastructure Library - ITIL® for its procedures related to the eTIR service desk and its relationship with the UN entity hosting the eTIR international system;
- Security awareness: ECE is using several aspects of the Open Web Application Security Project - OWASP® to learn about the latest security threats and best practices.

49. Most of the times, selecting an element to be reused should be preferred rather than develop it oneself. Indeed, if the scope of functionality matches the requirements, it is usually quicker and less costly to select an existing element to be reused. In terms of

software component or product, this can either be a piece of Open Source Software (OSS) or some proprietary software. In the decision-making process, the following aspects should be considered: TCO (including training and support), maturity and sustainability of the solution, advantages and disadvantages.

50. The following table lists the requirement in terms of reusability.

Table 16
Reusability requirement

Identifier	*Description and objective*	*How to fulfil the requirement*
RU.1	Reuse existing methods, frameworks, software and systems components to save time and achieve higher quality outputs	In case of a new requirement or during the regular assessment performed on currently reused elements, ECE looks for available options and applies its decision-making approach to select the best option.

15. Security

51. All security related aspects and technical requirements of the eTIR international system are described in the dedicated part “Security of the eTIR system” later in the document.