



Economic Commission for Europe**Inland Transport Committee****Working Party on Customs Questions affecting
Transport****Group of Experts on Conceptual and
Technical Aspects of Computerization of the TIR Procedure****Second session**

Geneva, 25–28 May 2021

Item 6 (d) of the provisional agenda

eTIR conceptual, functional and technical documentation version 4.3**eTIR technical specifications****General introduction, guiding principles and architecture 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. 84¹) 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 ToR² (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 terms of reference 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 terms of reference 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 Implementation Body (TIB). More specifically, the Group should (a) prepare

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 ECE

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



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 general introduction and the guiding principles, as well as the overall and detailed architecture of the eTIR international system. All these aspects will be part of the eTIR technical specifications document.

II. General introduction

A. Purpose

4. The purpose of the eTIR technical specifications is to translate the eTIR functional specifications into technical requirements, architectures, guidelines, procedures and detailed descriptions of all messages exchanged between the eTIR international system and the eTIR stakeholders.

5. This document is relevant for all eTIR stakeholders (customs authorities, guarantee chains and holders) which need to interconnect their information systems with the eTIR international system. All aspects of these specifications must be considered as mandatory, unless specified otherwise.

6. The main purpose of this document is twofold: to define the technical aspects of the eTIR international system and to define unambiguously how information is exchanged between the eTIR international system and the eTIR stakeholders.

B. Scope

7. This document is divided in five parts: the present general introduction, the eTIR international system, the communication between eTIR stakeholders and the eTIR international system, technical fallback procedures and annexes and appendices. This section defines the scope and content of these parts.

1. The eTIR international system

8. The eTIR international system is the cornerstone of the eTIR procedure as it receives and records information exchanged with customs authorities, guarantee chains and, possibly, holders. The eTIR international system is developed, maintained, hosted and administered under the auspices of ECE.⁴

9. This part starts by defining the three principles that were selected to guide the development activities of the eTIR international system, the rationale for the selection and the implications. It then details the overall architecture of the eTIR system⁵ and the detailed architecture of the eTIR international system, including its components and interfaces. It also details the technical requirements of the eTIR international system i.e. several aspects that are not directly linked with its functionality but that are at least as important to ensure that the system functions well. The development procedures including various guidelines and the list of environments and related procedures are also described to explain the methods followed by ECE for the development and maintenance of the eTIR international system. Finally, the last section is dedicated to the technical requirements related to information security and details the security model of the eTIR system.

⁴ As per paragraph 1 of Article 11 of Annex 11 of the TIR Convention.

⁵ See the definition of the «eTIR system» in section I.F

2. Communication between eTIR stakeholders and the eTIR international system

10. In the eTIR system, information systems of the eTIR stakeholders exchange information with the eTIR international system.

11. This part details the technical requirements of the interfaces between the information systems as well as several aspects that the information systems of the eTIR stakeholders will have to follow. It then describes the web services provided by the eTIR international system and the technical details needed to use them. It elaborates on the architecture and design principles of the implementation of the messages exchanged in the context of the eTIR procedure and provides all technical details. Finally, it explains the interconnection projects that have to be launched by the eTIR stakeholders to connect their information systems with the eTIR international system.

3. Technical fallback procedures

12. This part details the technical aspects of the fallback procedures, already detailed in the eTIR functional specifications, and that have to be followed in case of a problem with one or more components of the eTIR system.

4. Annexes and appendices

13. This final part features the technical glossary and details the notation used for the architecture diagrams. It also presents an analysis to determine the needs in terms of capacity and scalability of the eTIR international system. Finally, it introduces the structure and conventions used for the XSD files and the code lists used in various attributes of the eTIR messages.

C. Target audience

14. This document is prepared for the IT department and IT experts of the eTIR stakeholders that wish to use the eTIR procedure. In particular, this document contains all information needed for the eTIR stakeholders to interconnect their information systems with the eTIR international system.

D. Prerequisites

15. This document should be read after having studied the other documents of the eTIR specifications namely: the introduction, the eTIR concepts and the eTIR functional specifications. In addition, while several key terms and considerations are recalled in this document, a good understanding of the TIR Convention and, in particular, of its Annex 11 is important.

16. It is also assumed that readers have a good understanding of the IT concepts and terminology used in this document, especially related to software engineering. They should also know how web services work and be familiar with SOAP and XML.

E. Applicable documents

17. The following table lists and describes all documents that work in conjunction with the present document to guide the reader on where to find additional information.

Table 1

Applicable documents

<i>Title</i>	<i>Description</i>	<i>Version or date</i>
The TIR Handbook	This document contains the complete text of the TIR Convention, including its annexes (except Annex 11).	2018
Consolidated eTIR legal framework	Annex I of the report of the seventy-second session of the AC.2 details the adopted changes to the TIR	17 Feb. 2020

<i>Title</i>	<i>Description</i>	<i>Version or date</i>
	Convention and the text of the new Annex 11 which describes the eTIR procedure.	
Introduction to the eTIR conceptual, functional and technical documentation	This document introduces the conceptual, functional and technical documentation for the eTIR procedure.	4.3a
The eTIR concepts	This document describes the approach and core concepts used to support the business logic, and to implement the eTIR system.	4.3a
The eTIR functional specifications	The purpose of this document is to translate the eTIR concepts into specifications that enable software developers and message designers to further design the eTIR system.	4.3a

F. Definitions

18. The following table provides the definitions of several key terms used in this document.

Table 2
Definition of key terms

<i>Term</i>	<i>Definition</i>
Accompanying document	The printed document electronically generated by the customs system, after the acceptance of the declaration, in line with the guidelines contained in the eTIR technical specifications. The accompanying document can be used to record incidents en route and replaces the certified report pursuant to Article 25 of the TIR Convention and for the fallback procedure.
Actor	See “eTIR stakeholder”
Advance amendment data	The data submitted to the competent authorities of the country in which an amendment to the declaration data is requested, in accordance with the eTIR specifications, of the intention of the holder to amend the declaration data.
Advance TIR data	The data submitted to the competent authorities of the country of departure, in accordance with the eTIR specifications, of the intention of the holder to place goods under the eTIR procedure.
Customs office of departure	Any customs office of a contracting party where the TIR transport of a load or part load of goods begins.
Customs office of destination	Any customs office of a contracting party where the TIR transport of a load or part load of goods ends.
Customs office of entry	Any customs office of a contracting party through which a road vehicle, combination of vehicles or container enters this contracting party in the course of a TIR transport.
Customs office of exit	Any customs office of a contracting party through which a road vehicle, combination of vehicles or container leaves this contracting party in the course of a TIR transport.
Customs union	A customs or economic union is composed of two or more member states and form a unique customs territory in the context of the eTIR procedure, provided those member states are contracting party to the TIR Convention and apply Annex 11.
Customs union system	The central information system of the customs union which interconnects the national customs systems of its member states.
Declaration	The act whereby the holder, or his or her representative, indicates, in accordance with the eTIR specifications, the intent to place goods under the eTIR procedure. From the moment of acceptance of the declaration by the competent authorities, based on the advance TIR data or the advance amendment data, and the transfer of the declaration data to the eTIR international system it shall constitute the legal equivalent of an accepted

<i>Term</i>	<i>Definition</i>
	TIR Carnet.
Declaration data	The advance TIR data and the advance amendment data which have been accepted by the competent authorities.
eGuarantee	In the context of the eTIR procedure, the electronic version of the guarantee described in the TIR Convention and represented by a TIR Carnet in the TIR procedure.
eTIR international system	The Information and Communication Technology (ICT) system devised to enable the exchange of electronic information between the actors involved in the eTIR procedure
eTIR procedure	The TIR procedure, implemented by means of electronic exchange of data, providing the functional equivalent of the TIR Carnet. Whereas the provisions of the TIR Convention apply, the specifics of the eTIR procedure are defined in Annex 11.
eTIR service desk	One of the roles of ECE is to assist the eTIR stakeholders to interconnect their information systems to the eTIR international system.
eTIR specifications	The conceptual, functional and technical specifications of the eTIR procedure adopted and amended in accordance with the provisions of Article 5 of Annex 11.
eTIR stakeholder	An entity being part of the eTIR system and using the eTIR procedure as described in the Annex 11 of the TIR Convention. An eTIR stakeholder uses its information systems to be part of the eTIR system and can be any of the following entities: <ul style="list-style-type: none"> • ECE, with the eTIR international system; • Guarantee chains, with their information systems; • Customs authorities, with their information systems; • Holders, with their information systems.
eTIR system	The set of all eTIR stakeholders, along with their information systems which apply the eTIR procedure as described in Annex 11 of the TIR Convention.
Holder	TIR Carnet holders no longer hold a TIR Carnet in the context of the eTIR procedure, as the goal is precisely to replace the paper TIR Carnet by an electronic guarantee or eGuarantee. However, the term “holder” is retained in the context of the eTIR procedure and represents the same person as described in Article 1, paragraph (o) of the TIR Convention.
National customs system	The central information system of the customs authorities of a contracting party to the TIR Convention. In the context of Annex 11, this system should be connected to the eTIR international system.
Pre-declaration	Data sent by the holder to the appropriate customs office, prior to presenting the road vehicle, combination of vehicles or container. This can be the advance TIR data, the advance amendment data or the cancellation of previously sent advance TIR data or advance amendment data.
Query mechanism	Set of messages that can be used by eTIR stakeholders (I5/I6 for customs authorities and E5/E6 for guarantee chains) to retrieve information stored in the eTIR international system, related to an eGuarantee, its holder and TIR operations.
Technical Implementation Body	The Technical Implementation Body shall monitor the technical and functional aspects of implementing the eTIR procedure, as well as coordinate and foster the exchange of information on matters falling within its competence.

G. Abbreviations

19. The following table describes all abbreviations used in this document. The definition of several of these terms and expressions can be found in the technical glossary, available in the appendices of this document.

Table 3
Abbreviations

<i>Abbreviation</i>	<i>Description</i>
AC.2	Administrative Committee for the TIR Convention, 1975
API	Application Programming Interface
BGP	Border Gateway Protocol
CA	Certification Authority
CD	Continuous Deployment
CI	Continuous Integration
CL	Code List
CPU	Central Processing Unit
DBMS	Database Management System
DMR	Data Maintenance Request
DOD	Definition Of Done
ECE	United Nations Economic Commission for Europe
EDIFACT	Electronic Data Interchange for Administration, Commerce and Transport
GB	Gigabyte
HDD	Hard Disk Drive
IDS	Intrusion Detection System
IPS	Intrusion Prevention System
ID	Identifier
IDE	Integrated Development Environment
IT	Information Technology
ITDB	International TIR Data Bank
ISO	International Organization for Standardization
ITIL	Information Technology Infrastructure Library
KB	Kilobyte
KMS	Knowledge Management System
MB	Megabyte
MTO	Maximum Tolerable Outage
MTTR	Mean Time To Recovery
OSS	Open Source Software
OWASP	Open Web Application Security Project
PKI	Public Key Infrastructure
PRD	PRoDuction
PRINCE2	PRojects In Controlled Environments 2
RAID	Redundant Array of Independent Disks
SAN	Storage Attached Network
SSD	Solid-State Drive
SIT	System Integration Testing
SLA	Service Level Agreement
SOP	Standard Operating Procedure

<i>Abbreviation</i>	<i>Description</i>
SPOF	Single Point Of Failure
TB	Terabyte
TCO	Total Cost of Ownership
TIB	Technical Implementation Body
TIRExB	TIR Executive Committee
TOGAF	The Open Group Architecture Framework
WSDL	Web Service Description Language
UAT	User Acceptance Testing
UI	User Interface
UN	United Nations
UPS	Uninterruptible Power Supply
UTC	Coordinated Universal Time
UTF	Universal Character Set Transformation Format
VCS	Version Control System
WCO	World Customs Organization
XML	eXtensible Markup Language
XSD	XML Schema Definition

H. Availability

20. This document is available from the ECE web site and from the web site⁶ devoted to eTIR where the reader can always find the latest versions of all documents related to the eTIR system, including all technical guides used in the context of the interconnection projects.

III. The eTIR international system

21. This part describes all the technical aspects of the eTIR international system, and the necessary information is provided to the reader to understand how this system is implemented, managed, hosted and maintained and how it should behave technically.

22. The level of details depends on the aspects being described and not all technical details may be provided for the following two reasons:

- As this document is publicly accessible, certain technical details are voluntarily not mentioned for security reasons. While ECE acknowledges that security through obscurity⁷ should not constitute the only security measure in place, it nonetheless does not wish to divulge too much information that could be used against the security of the eTIR system. Contracting parties wishing to learn more about these additional details can contact the TIR Secretary to organize a study visit of the ECE premises;
- Certain aspects related to the software or hardware products, frameworks or libraries used, as well as implementation facets are subject to regular changes as technology quickly evolves. Flexibility should be given to ECE to be able to freely change these aspects, so that it can address evolving technical requirements (e.g. capacity, scalability, performance) without having to provide an updated version of the technical specifications.

⁶ See www.etir.org/documentation

⁷ See www.etir.org/documentation

23. Given the fact that several technical details are not mentioned in this document, ECE wishes to remain transparent and demonstrate its professionalism to the contracting parties by detailing its ways of working, its guiding principles and development procedures.

A. Guiding principles

1. Introduction

24. The principles described in this section define the underlying general rules and fundamental values that will guide decision-making activities on the technical aspects of the eTIR international system (e.g. development, hosting, management, maintenance, etc.). The approach to define these three principles is based on the method for expressing architecture principles as detailed in the TOGAF Standard.⁸

2. Principle 1: Information security

(a) Statement

25. Information stored in the eTIR international system is considered confidential and shall be accessible at all times by authorized stakeholders only, by means of eTIR messages that shall be authenticated and secured.

(b) Rationale

26. Articles 7 and 8 of Annex 11 of the TIR Convention set up requirements for authentication and integrity of data.

27. Articles 11 and 12 of Annex 11 of the TIR Convention set up requirements regarding the availability and integrity of data.

(c) Implications

28. The confidentiality, integrity, availability and non-repudiation of information exchanged (data in transit) between the eTIR international system and eTIR stakeholders, and recorded on the eTIR international system (data at rest) should be ensured.

29. Information exchanged and recorded in the eTIR international system is classified as confidential information as per the dispositions of the Secretary-General's bulletin titled "Information sensitivity, classification and handling"⁹ and the relevant policies and measures apply.

3. Principle 2: High reliability and quality

(a) Statement

30. The eTIR international system shall be developed and maintained following high standards in terms of reliability and quality, and these standards shall be continuously reviewed and improved.

(b) Rationale

31. A high reliability minimizes the costs to develop, operate and maintain the eTIR international system.

32. A high reliability minimizes the resources required by eTIR stakeholders to develop, operate and maintain the interconnection between their information systems and the eTIR international system.

⁸ See the TOGAF ® Standard v9.2 : pubs.opengroup.org/architecture/togaf9-doc/arch/chap20.html

⁹ See undocs.org/st/sgb/2007/6

(c) Implications

33. Proven best practices from the information technology industry should be adopted for the development, operation and maintenance of the eTIR international system.

34. Emerging trends from the information technology industry should be regularly assessed to find ways to continuously improve the development, operation and maintenance of the eTIR international system.

4. Principle 3: Ease of connectivity for the eTIR stakeholders**(a) Statement**

35. The eTIR international system shall be designed and documented to facilitate the interconnection of eTIR stakeholders, including the upgrade to new versions.

(b) Rationale

36. Ease of connectivity minimizes the resources required by eTIR stakeholders to develop, operate and maintain the interconnection between their information systems and the eTIR international system.

37. Ease of connectivity minimizes the costs on the eTIR service desk to assist contracting parties in interconnecting their national customs systems to the eTIR international system.

(c) Implications

38. The eTIR international system, its interfaces and documentation should use, to the extent possible, worldwide renowned standards.

39. The necessary documentation should be produced, in addition to the eTIR specifications, to guide and accompany the eTIR stakeholders in their interconnection projects.

40. Thanks to the experience acquired and the feedback received while assisting eTIR stakeholders with their interconnection projects, additional enhancements should be included to continuously improve the documentation and assistance provided by the eTIR service desk.

B. Overall architecture of the eTIR system**1. Introduction**

41. This section presents the overall technical architecture of the eTIR system and, in particular, the interactions between the information systems of the different actors of the eTIR procedure. It also provides a more detailed view of each actor's information systems, including the interfaces and the messages exchanged.

42. The diagrams in this section follow the ArchiMate¹⁰ notations that are described in annex IV.A of the present document.

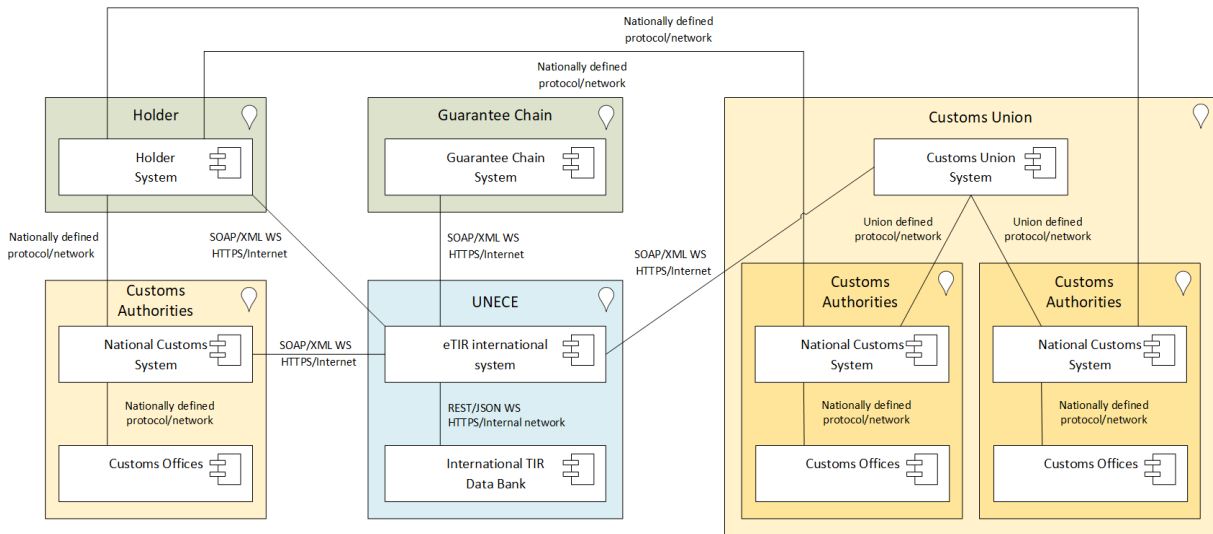
2. Overview

43. The eTIR system is composed of the interconnection of the information systems of the various actors involved in the eTIR procedure: customs authorities, holders, guarantee chains and ECE. The overall technical architecture presented in the figure below shows the interconnection between the information systems of all actors, including the case of

¹⁰ ArchiMate® 3.0.1 Specification. See: pubs.opengroup.org/architecture/archimate3-doc/

customs unions. The latter could take advantage of information systems and interconnections already set up in the framework of the customs union.¹¹

Figure I
Overall technical architecture of the eTIR system



44. The following sections provide more details of the information systems of each actor, in particular its interfaces and the messages exchanged. In order to avoid repetitions, the interfaces between two information systems are only detailed in the section devoted to the actor that initiates most of the transactions.

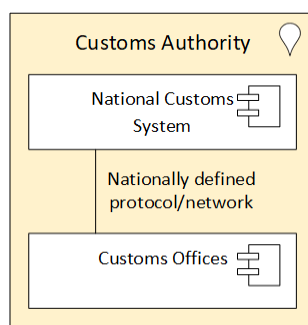
3. Customs authorities

45. Customs authorities use information systems to manage customs procedures, such as import, export and transit. The design and architecture of these information systems is the sole decision of each and every customs authority and can therefore greatly vary from one contracting party to another. It is assumed that all customs offices are connected with the central information system of the customs authorities, hereafter called: the national customs system.

46. In order to properly implement the provisions of Annex 11 of the TIR Convention and adapt their information systems to the eTIR procedure, customs authorities must connect their national customs system to the eTIR international system. In the context of the eTIR procedure, the main actors on the side of customs authorities are customs officers (located in customs offices) who process TIR transports. While it is necessary that all customs offices approved to carry out TIR transports under the eTIR procedure are connected to the national customs system, the way in which these connections are established is defined by each customs authority. Similarly, the user interfaces used by customs officers to handle the eTIR procedure are designed and implemented by each customs authority.

¹¹ As proposed in Explanatory Note to article 3, paragraph 2 of Annex 11 of the TIR Convention

Figure II
Interactions between the national customs system and the customs offices



47. The customs officers, via their national customs system, exchange information with the eTIR international system using the following messages which allow to:

- accept the guarantee assigned to a TIR transport using the request message “I1 – Accept Guarantee” and its response “I2 – Acceptance Results”;
- query all information related to an existing guarantee using the request message “I5 – Query Guarantee” and its response “I6 – Query Results”;
- record the declaration data of a TIR transport using the request message “I7 – Record Declaration Data” and its response “I8 – Record Declaration Data Results”;
- start a TIR operation for the TIR transport using the request message “I9 – Start TIR Operation” and its response “I10 – Start Results”;
- terminate the TIR operation for the TIR transport using the request message “I11 – Terminate TIR Operation” and its response “I12 – Termination Results”;
- discharge the TIR operation for the TIR transport using the request message “I13 – Discharge TIR operation” and its response “I14 – Discharge Results”;
- refuse to start a TIR operation for the TIR transport using the request message “I17 – Refuse to Start TIR Operation” and its response “I18 – Refusal to Start Results”.

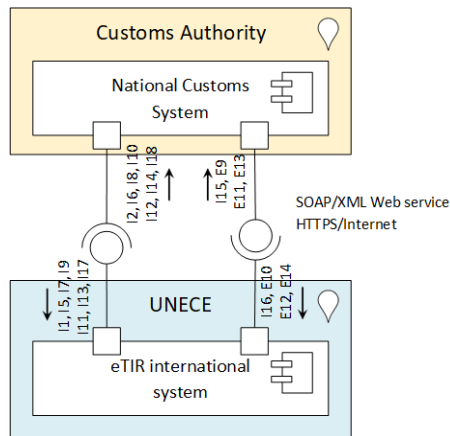
48. In addition, the eTIR international system can notify the national customs system, on specific events related to a TIR transport, using the request message “I15 – Notify Customs” and its response “I16 – Notification Confirmation”.

49. Finally, the eTIR international system can forward information from the holder related to the advance TIR data and the advance amendment data¹² to the relevant customs authorities using the following messages which allow to:

- receive the advance TIR data sent by the holder via the eTIR international system using the request message “E9 – Advance TIR Data” and its response “E10 – Advance TIR Data Results”;
- receive the advance amendment data sent by the holder via the eTIR international system using the request message “E11 – Advance Amendment Data” and its response “E12 – Advance Amendment Data Results”;
- receive the cancellation of a previously sent advance TIR data or advance amendment data using the request message “E13 – Cancel Advance Data” and its response “E14 – Cancel Advance Data Results”.

¹² As per paragraphs 2 and 3 of article 6 of Annex 11 of the TIR Convention.

Figure III
Interactions between the national customs system and the eTIR international system



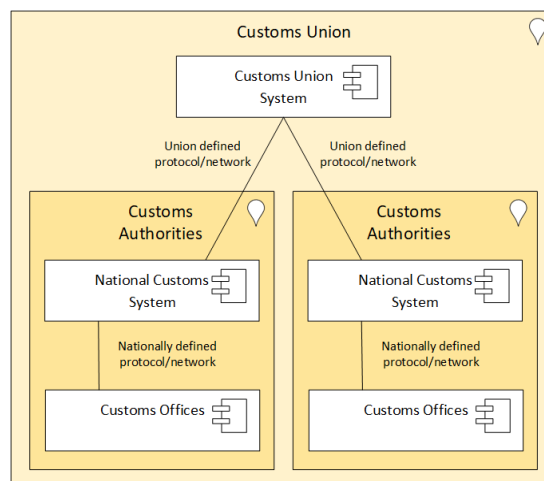
50. These messages (I1, I2, I5, I6, I7, I8, I9, I10, I11, I12, I13, I14, I15, I16, I17, I18, E9, E10, E11, E12, E13 and E14) are transmitted via HTTPS over the Internet using SOAP web services and the data transferred is formatted in XML.

4. Customs unions

51. Customs unions may have put in place an overarching customs union system to facilitate the exchanges of information between the national customs systems of their member states. The design and architecture of these overarching customs union systems is the sole decision of the customs unions so they can vary from one customs union to another.

52. In order to properly implement the provisions of Annex 11 of the TIR Convention and to adapt their information systems to the eTIR procedure, member states of a customs union may wish to interconnect their national customs systems to the eTIR international system via the customs union system. In such case, the customs union system would then dispatch the messages to the appropriate recipients and, possibly, also act as a converter if the messages exchanged between the customs union system and the national customs system do not follow the eTIR specifications.

Figure IV
Interactions between the customs union system and the national customs systems



53. For the rest of this document, we will consider that the interface between the eTIR international system and a customs union system is the same as between the eTIR international system and a national customs system, unless otherwise specified.

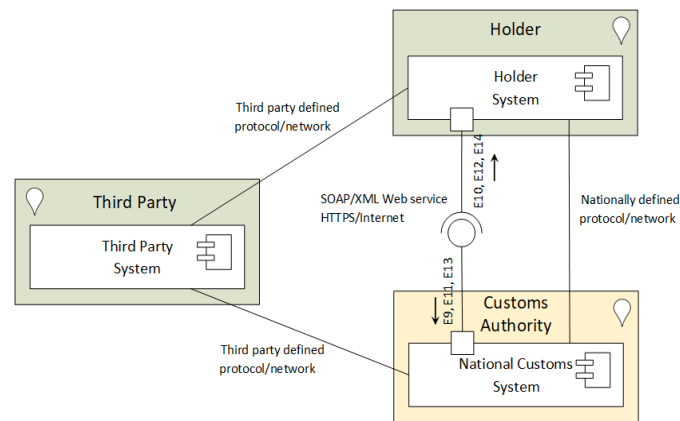
5. Holders

54. Holders have the responsibility to submit to the customs office of departure the advance TIR data of the TIR transport they wish to initiate. The holder can always cancel previously sent advance TIR data and they can resubmit new advance TIR data. Once the declaration has been accepted by the customs office of departure, the holder can send an “advance amendment data” to the next customs office of entry or departure to request the declaration to be amended. The holder can then cancel a previously sent advance amendment data, as long as it has not yet been accepted by customs.

55. Submitting this information to the customs authorities can be done using several electronic means: from a web portal managed by the customs authorities, using web services following the eTIR specifications, from a web portal managed by a third party, etc. Each and every customs authority shall publish a complete list of the ways of submitting this information.¹³ All these electronic means shall submit the information needed in the respective eTIR messages: E9, E11 and E13.

Figure V

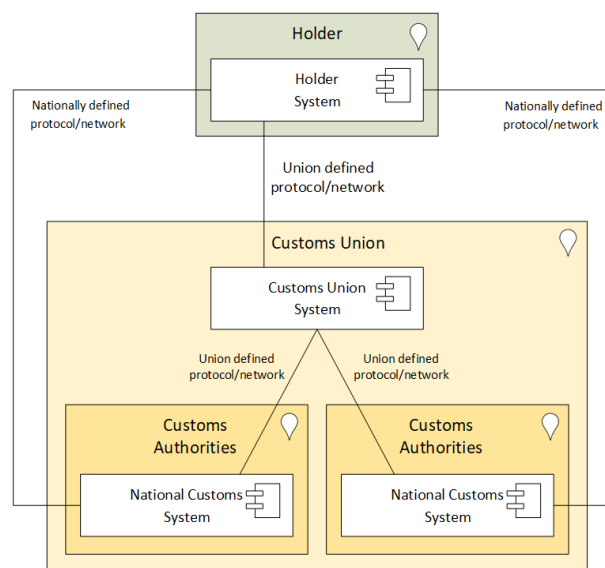
Possible interactions between the holder system and the national customs system



56. In the case of customs unions, the same approaches exist for holders to submit pre-declaration information to the relevant customs authorities of the member states that compose this customs union. In addition to the means already detailed in the previous paragraph, an additional portal provided at the customs union level might also be available.

Figure VI

Interactions between the holder system and the systems of a customs union



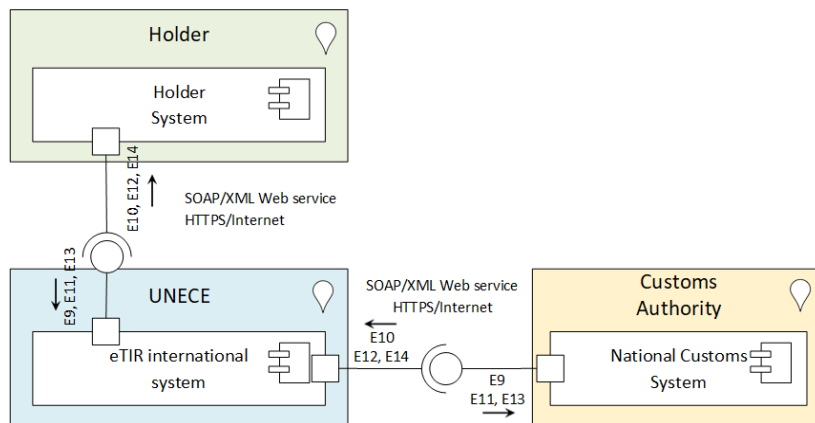
¹³ As per paragraph 4 of Article 6 of Annex 11 of the TIR Convention.

57. Finally, holders always have the possibility to submit pre-declaration information to the appropriate customs offices via the eTIR international system¹⁴ using the following messages which allow to:

- send the advance TIR data to the customs office of departure via the eTIR international system using the request message “E9 – Advance TIR Data” and its response “E10 – Advance TIR Data Results”;
- send the advance amendment data to the appropriate customs office via the eTIR international system using the request message “E11 – Advance Amendment Data” and its response “E12 – Advance Amendment Data Results”;
- send the cancellation of a previously sent advance TIR data or advance amendment data to the appropriate customs office via the eTIR international system using the request message “E13 – Cancel Advance Data” and its response “E14 – Cancel Advance Data Results”.

Figure VII

Interactions between the holder system and the national customs system via the eTIR international system



58. These messages (E9, E10, E11, E12, E13 and E14) are transmitted via HTTPS over the internet using SOAP web services and the data transferred is formatted in XML.

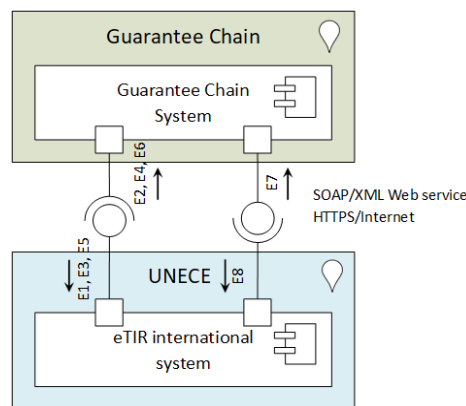
6. Guarantee chains

59. Guarantee chains manage the information systems used for the management of electronic guarantees (or eGuarantees) and the exchange of the required data with the eTIR international system using the following messages:

- register a new guarantee using the request message “E1 – Register Guarantee” and its response “E2 – Registration Results”;
- cancel an existing guarantee using the request message “E3 – Cancel Guarantee” and its response “E4 – Cancellation Results”;
- query all information related to an existing guarantee using the request message “E5 – Query Guarantee” and its response “E6 – Query Results”;
- be notified by the eTIR international system on specific events related to an existing guarantee using the request message “E7 – Notify Guarantee Chain” and its response “E8 – Notification Confirmation”.

¹⁴ As per paragraphs 2 and 3 of Article 6 of Annex 11 of the TIR Convention.

Figure VIII

Interactions between the guarantee chain system and the eTIR international system

60. These messages (E1, E2, E3, E4, E5, E6, E7 and E8) are transmitted via HTTPS over the internet using SOAP web services and the data transferred is formatted in XML.

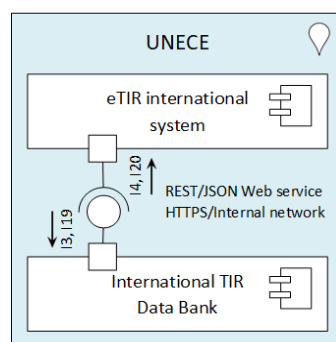
7. United Nations Economic Commission for Europe

61. ECE manages two information systems: the eTIR international system and the International TIR Data Bank (ITDB). The eTIR international system is the cornerstone of the eTIR system and its main role is to receive, validate, record and send data exchanged between the various actors during TIR transports following the eTIR procedure. The ITDB is an information system developed under the purview of TIRExB and its main roles, in the context of the eTIR system, are to manage the list of approved TIR Carnet holders and the list of approved customs offices for accomplishing TIR operations.

62. In the context of processing information received in eTIR messages, the eTIR international system queries the ITDB (when applicable) to:

- verify the authorization of the holder using the request message “I3 – Get Holder Information” and its response “I4 – Holder Information”;
- verify the existence of the customs offices using the request message “I19 – Check Customs Offices” and its response “I20 – Customs Offices Validation”.

Figure IX

Interactions between the eTIR international system and the ITDB

63. These messages (I3, I4, I19 and I20) are transmitted via HTTPS over the secured network of the data centre hosting both information systems, using RESTful web services and the data transferred is formatted in JSON.

C. Detailed architecture of the eTIR international system**1. Introduction**

64. This section describes the software and hardware aspects of the architecture of the eTIR international system. In order to remain technology agnostic, this section does not

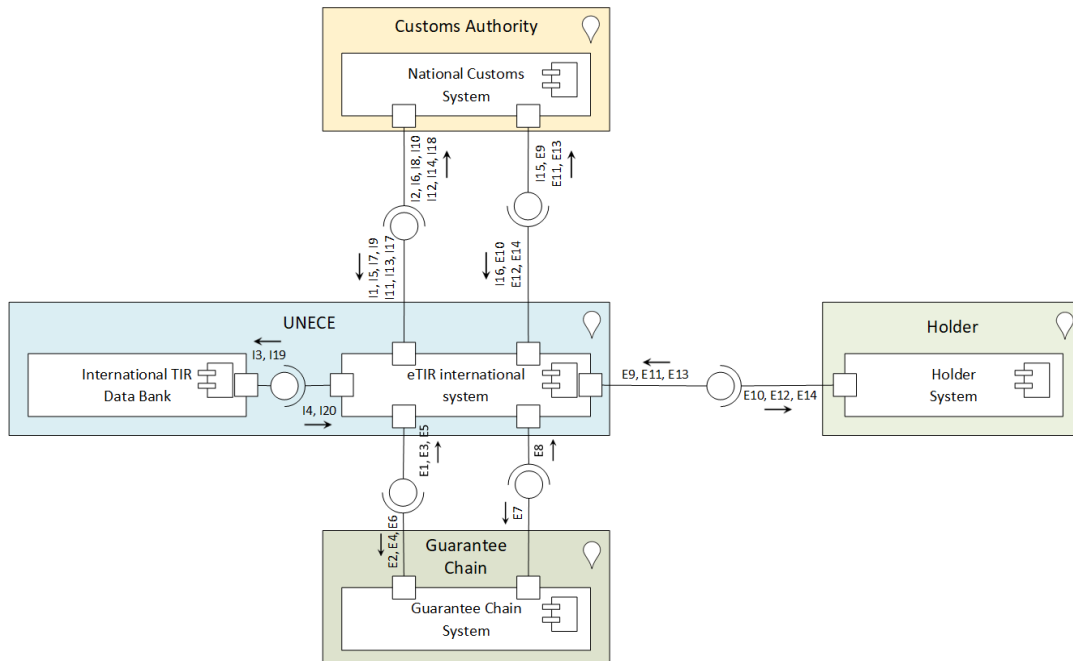
provide information on products, frameworks or libraries used to implement the functions needed by the components. Indeed, as technology quickly evolves, ECE will continuously monitor the available options and perform changes as it sees fit so that the components of the eTIR international system can continue to perform their functions and properly scale over time to match the capacity and performance requirements (see the next section on technical requirements).

2. Interfaces with eTIR stakeholders

65. The interfaces between the eTIR international system and other eTIR stakeholders are already detailed in the previous section. The following figure summarizes them all, by mentioning the message codes and the flow of information.

Figure X

Interfaces of the eTIR international system



3. Storage locations

66. Messages are processed by the eTIR international system and parts of them are recorded in three different storage locations:

- All incoming and outgoing messages are entirely recorded in the **eTIR logs** to save the data needed to ensure non-repudiation and to provide the information that may be requested by contracting parties;
- Data extracted from the messages is recorded in the **eTIR database** to be used by the query mechanism and for statistical purposes;
- If “attached documents” and “certificates of approval” are embedded into messages (which can be the case in E6, E9, I6, I7 and I15), they are extracted and saved as files in the **eTIR documents**, a separate centralized and secured file system.

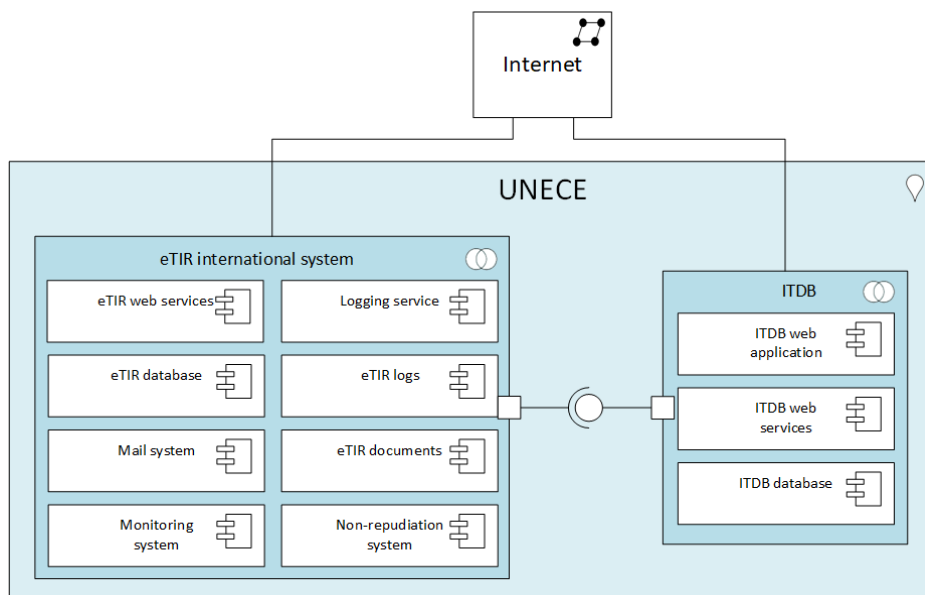
4. Software architecture

67. The eTIR international system relies on the following software components:

- The **eTIR web services** are the core of the eTIR international system where messages are received, validated, processed, recorded and sent;
- The **logging service** is used to record all messages sent and received by the eTIR international system, as well as all information logged by its other software components, frameworks and libraries.

68. The eTIR international system also relies on the following systems:
- The **mail system** is used to send email messages to eTIR stakeholders on specific occasions, principally during fallback procedures;
 - The **monitoring system** is used to observe the resources and performance of the virtual servers, as well as the availability and performance of the services of the eTIR international system;
 - The **non-repudiation system** will extract data stored in the eTIR logs, index them and feature a user interface only accessible by IT administrators from ECE. This user interface will allow querying the logs to find a particular message (using the unique “Message Identifier”), a pair of request/response messages, and to provide all information needed by contracting parties for verification purposes.¹⁵
69. The following diagram presents the software architecture of the eTIR international system. The interfaces exposed and consumed by the eTIR international system are not represented, as they are already listed and described in the sections above.

Figure XI

Software architecture of the eTIR international system

70. The technical requirements of the software components of the eTIR international system are listed in the following section. The software components of the ITDB are listed for informational purposes as they are managed by ECE, under the purview of the TIRExB.

5. Systems architecture

71. The United Nations entity that hosts the eTIR international system (hereafter the hosting entity) has its own private data centre which is located in a United Nations compound and thus benefits from the privileges and immunities enshrined in the United Nations Charter¹⁶ and further detailed in the Convention on the privileges and immunities of the United Nations.¹⁷

72. The hosting entity uses a virtual server farm to provide virtual servers that form the various systems components of the eTIR international system and at the moment, each node corresponds to a virtual server. In a near future, ECE will consider using containers and container orchestration techniques to further ensure the scalability requirements of the eTIR international system while keeping the hosting costs to an acceptable level.

¹⁵ As per paragraph 3 of article 12 of Annex 11 of the TIR Convention

¹⁶ See www.un.org/en/charter-united-nations/

¹⁷ See treaties.un.org/doc/Treaties/1946/12/19461214%2010-17%20PM/Ch_III_1p.pdf

73. The eTIR international system is designed and implemented in a way that limits single points of failure (SPOF) to meet its availability objectives (as detailed in the next section). This architecture also allows to intervene in systems components without having to stop the eTIR international system. This is particularly important to perform regular maintenance activities like replacing defective hardware parts, updating software components and applying security patches.

74. The eTIR international system relies on the following systems components (their technical requirements are listed in the next section):

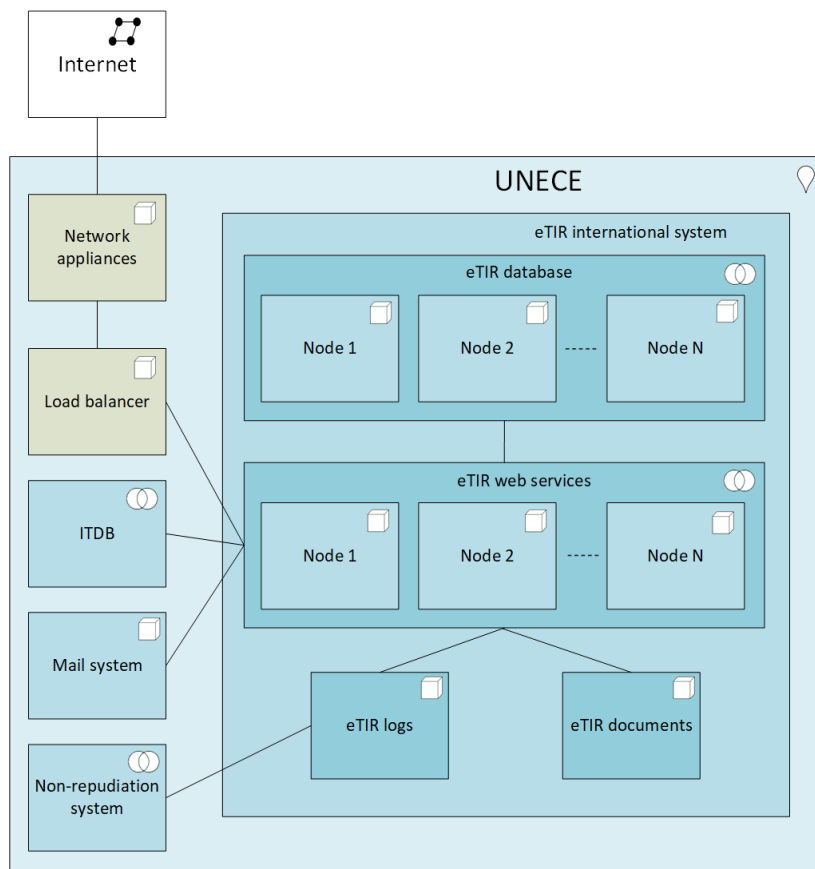
- The **eTIR web services** are the core of the eTIR international system where messages are received, validated, processed, recorded and sent. It consists of several front-end web server nodes to which messages are distributed by the load balancer;
- The **eTIR database** is the core storage location and consists of a clustered database management system (DBMS) using several virtual server nodes and high-performance disk storage;
- The **eTIR logs** is the storage location to which logs are transferred on a daily basis and consists of a virtual server with enough disk space to store all logging information;
- The **eTIR documents** is the storage location to which attached documents are saved and consists of a virtual server with enough disk space to store all documents.

75. The eTIR international system also relies on the following external systems components:

- The **ITDB** which has its own systems architecture to meet its availability objectives. In case of unavailability of the ITDB, the eTIR international system follows a failover procedure which is described later in the document;
- The **mail system** is provided by the hosting entity and consists of a virtual server only used for sending email messages. The eTIR international system principally uses this external system in case of fallback procedures;
- The **non-repudiation system** is an external administration system which is not directly needed for the proper functioning of the eTIR international system and thus consists of a unique virtual server.

76. The following diagram presents the systems architecture of the eTIR international system.

Figure XII
Systems architecture of the eTIR international system



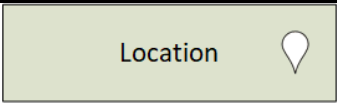

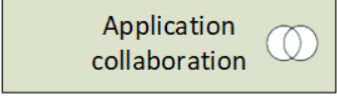
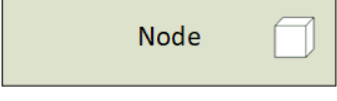
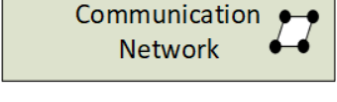
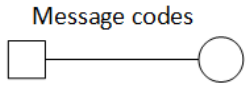
77. With the following sample scenario, we wish to illustrate the usual exchange of information between systems components. An incoming message sent from an eTIR stakeholder over the internet first gets to the network appliances (BGP router and firewall) of the hosting entity. The message is then transferred to the load balancer system which forwards it to the appropriate node of the eTIR web services (front end web server) which validates and processes the message. This web server then stores relevant data in the eTIR database, in the eTIR logs and, if applicable, in the eTIR documents. Finally, the same web server prepares the response message and sends it back to the eTIR stakeholder who initially sent the request message. For the sake of clarity, additional systems related to network routing and security are not shown in this diagram (routers, switches, firewalls, IDS, IPS, etc.).

Annex

Diagram notation

The ArchiMate (ArchiMate® 3.0.1 Specification. See: pubs.opengroup.org/architecture/archimate3-doc/) notation is used to represent the various architectural viewpoints in the diagrams of this document. Only the ArchiMate concepts used in the diagrams are described in the table below. Note that the colours used in the background of the shapes represent different actors or systems, not a particular ArchiMate concept.

Table 1
ArchiMate diagram notation

Concept	Description	Symbol
Location	A location is used to model the places where other concepts are located.	
Application Component	A modular, deployable, and replaceable part of a software system that encapsulates its behaviour and data and exposes these through a set of interfaces.	
Application collaboration	An application collaboration represents an aggregate of two or more application components that work together to perform collective application behaviour.	
Node	A node represents a computational or physical resource that hosts, manipulates, or interacts with other computational or physical resources.	
Communication Network	A communication network represents a set of structures that connects computer systems or other electronic devices for transmission, routing, and reception of data.	
Interface provided	Represents a point of access where application services are made available to another application component. The codes of the messages provided by this interface can be listed on top of the symbol.	
Interface required	Represents a need to connect to application services that are made available by another application component. The codes of the messages sent back through this interface can be listed on top of the symbol.	