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## 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**

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

# Technical glossary, analysis on capacity and error codes of the eTIR 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

[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 glossary, the analysis to determine the needs in terms of capacity and scalability of the eTIR international system and the list of error codes of the eTIR system. All these aspects will be part of the eTIR technical specifications document.

# II. The eTIR system

## A. Technical glossary

4. This section provides in the following table the definition of all technical terms that are used in the eTIR technical specifications.

Table 1
**Technical glossary**

| *Term* | *Definition* |
|---|---|
| Application programming interface | An application programming interface (API) is a software interface which is used for accessing an application or a service from a program. |
| Asymmetric encryption | A cryptographic system that uses two keys: a public key known to everyone and a private (or secret) key only known to the owner of the key pair. For example, when Alice wants to send a secured message to Bob, she uses Bob's public key to encrypt the message. Bob then uses his private key to decrypt it. RSA is an example of asymmetric algorithm. |
| Authentication | The process of verifying or testing that the claimed identity is valid. Authentication requires subjects to provide additional information that corresponds to the identity they are claiming. The most common form of authentication is using a password (this includes the password variations of personal identification numbers - PINs - and passphrases). Authentication verifies the identity of the subject by comparing one or more factors against the database of valid identities (that is, user accounts). |
| Certification authority | A certification authority (CA), is a recognized entity that holds a trusted position because the certificate that it issues binds the identity of a person or business to the public and private key pair (asymmetric cryptography) that are used to secure most transactions transmitted over the internet. For example, when a business or person wants to use these technologies, they request to a CA to issue them a certificate. The CA collects information about the person or business that it will certify before issuing the certificate. |
| Confidentiality | Confidentiality is the concept of the measures used to ensure the protection of the secrecy of data, objects, or resources. The goal of confidentiality protection is to prevent or minimize unauthorized access to data. Confidentiality focuses on security measures ensuring that no one other than the intended recipient of a message receives it or is able to read it. Confidentiality protection provides a means for authorized users to access and interact with resources, but it actively prevents unauthorized users from doing so. |
| Defect | The IT literature usually makes a distinction between the terms "bug" and "defect". Indeed, a "bug" is the result of a coding error and a "defect" is a deviation from the requirements. In the context of this document, only the term "defect" is used and encompasses both meanings. |
| Digital certificate | In cryptography, a digital certificate (or, simply, certificate in this document), is an electronic document used to prove the ownership of a public key. The certificate includes information about the key, information about the identity of its owner (called the subject), and the digital signature of an entity that has verified the certificate's contents (called the issuer). If the signature is valid, and the software examining the certificate trusts the issuer, then it can use that key to communicate securely with the certificate's subject. |

| *Term* | *Definition* |
|---|---|
| Digital signature | A digital code (chain of characters) that can be attached to an electronically transmitted message and that has two distinct goals: 1) Digitally signed messages assure the recipient that the message truly came from the claimed sender. They enforce non-repudiation (that is, they preclude the sender from later claiming that the message is a forgery) and 2) Digitally signed messages assure the recipient that the message was not altered while in transit between the sender and recipient (its integrity was preserved). This protects against both malicious modification (a third party altering the meaning of the message) and unintentional modification (because of faults in the communications process, such as electrical interference). |
| Environments | During its lifecycle, a piece of software is developed and maintained on several environments that serve different purposes. Some of them are used for development, some others for testing and, finally, another one, the production environment, is used to operate the system when it is “live” and is available as a service to its end users |
| Error | An error is a severe validation failure, which will cause the message to be rejected. |
| Front-end web servers | A web server that receives request messages from the web service endpoints of the eTIR international system (or sends request messages to web service endpoints of other eTIR stakeholders). |
| Git | Git is a version control system for tracking changes in any set of files, usually used for coordinating work among programmers collaboratively developing source code during software development. Its objectives include optimized performance, data integrity, and support for distributed, non-linear workflows. |
| Hash | A hash value (or simply hash), also called a message digest, is a value generated from a text. The hash is substantially smaller than the text itself, and is generated by a formula in such a way that it is extremely unlikely that any other text can produce the same hash value. |
| Integrity | Integrity is the concept of protecting the reliability and correctness of data. Integrity protection prevents unauthorized alterations of data. It ensures that data remains correct, unaltered, and preserved. Properly implemented integrity protection provides a means for authorized changes while protecting against intended and malicious unauthorized activities (such as viruses and intrusions) as well as mistakes made by authorized users (such as mistakes or oversights). |
| Java | Java is a class-based, object-oriented programming language that is designed to have as few implementation dependencies as possible. It is a general-purpose programming language intended to let application developers write once, run anywhere, meaning that compiled Java code can run on all platforms that support Java without the need for recompilation. |
| Keystore | A keystore is a database used to store the certificates of the information systems of the owner of the keystore, and may include the certificates of trusted parties (truststore), for use by a program. Through its keystore, an entity can authenticate itself to other parties and may authenticate other parties as well. |
| Load balancer | The load balancer is a software component that distributes a set of tasks over a set of resources (server nodes), with the aim of making their overall processing more efficient. |
| Non-repudiation | Non-repudiation ensures that the subject of an activity or who caused an event cannot deny that the event occurred. Non-repudiation prevents a subject from claiming not to have sent a message, not to have performed an action, or not to have been the cause of an event. It is made possible through identification, authentication, authorization, accountability, and auditing. Non-repudiation can be established using digital certificates, session identifiers, transaction logs, and numerous other transactional and access control mechanisms. |
| OASIS | The Organization for the Advancement of Structured Information Standards (OASIS) is a non-profit, international consortium whose goal is to promote the adoption of product-independent standards. |
| Public key infrastructure | A public key infrastructure (PKI) is a set of roles, policies, hardware, software and procedures needed to create, manage, distribute, use, store and revoke digital certificates and manage asymmetric encryption. |
| Receiver | In the context of this document, the "receiver" is the information system of the eTIR stakeholder which receives an eTIR message sent by another stakeholder, and processes it. |
| RSA | The RSA algorithm was invented by Ronald L. Rivest, Adi Shamir, and Leonard Adleman in 1977. It is an asymmetric encryption algorithm using two different keys with a mathematic relationship to each other. The public key and private keys are carefully generated using the RSA algorithm; they can be used to encrypt information or sign it. |
| Sender | In the context of this document, the "sender" is the information system of the eTIR stakeholder |

| *Term* | *Definition* |
|---|---|
| | which generates and sends an eTIR message to another eTIR stakeholder. |
| Single point of failure | A single point of failure (SPOF) is a part of a system that, if it fails, will stop the entire system from working. SPOFs are undesirable in any system with a goal of high availability or reliability, be it a business practice, software application, or other industrial system. |
| SOAP | Simple Object Access Protocol (SOAP) is a messaging protocol specification for exchanging information in the implementation of web services. It is an XML-based protocol consisting of three parts:<br>• an envelope, which defines the message structure (a header and a body) and how to process it;<br>• a set of encoding rules for expressing instances of application-defined data types;<br>• a convention for representing procedure calls and responses. |
| Software entropy | The second law of thermodynamics, in principle, states that a closed system's disorder cannot be reduced, it can only remain unchanged or increase. A measure of this disorder is entropy. According to studies, this law also seems plausible for software systems: as a system is modified, its disorder, or entropy, tends to increase. This is known as software entropy. The process of code refactoring can result in stepwise reductions in software entropy. |
| Token | A token (sometimes called a security token) is an object that controls access to a digital asset. Traditionally, this term has been used to describe a hardware authenticator, a small device used to create a one-time password that the owner types in a login screen along with an ID and a PIN. However, in the context of web services and with the emerging need for devices and processes to authenticate to each other over open networks, the term token has been expanded to include software mechanisms too. A token may be an X.509 certificate, that associates an identity to a public key for example. |
| Total cost of ownership | The total cost of ownership (TCO) represents the total amount of money that the owner of an information system had to spend during the life cycle of the latter. All costs (direct and indirect) are taken into account. |
| Truststore | A truststore is a keystore file that contains the certificates from other parties that you expect to communicate with, or from Certificate Authorities that you trust, to identify other parties. |
| Virtual server farm | A virtual server farm is a networking environment that employs multiple application and infrastructure servers running on two or more physical servers using a server virtualization program. This architecture offers several benefits, including server consolidation, redundancy, failover, high availability and optimized resource utilization. |
| Web service | Virtual service/function exposed over a network (private or internet) allowing for system to system communication using messages following a strict format. Machine-to-machine is another term to define this type of communication. |
| Web Services Security | The Web Services Security (WS-Security) specification describes enhancements to SOAP 1.1 that increase the protection (integrity) and confidentiality of the messages. These enhancements include functionality to secure SOAP messages through XML digital signature, confidentiality through XML encryption, and credential propagation through security tokens (e.g. X.509 token). |
| Web Service Description Language | Web Service Description Language (WSDL) is an XML-based interface description language that is used for describing the functionality offered by a web service. |
| X.509 certificate | X.509 is a common format for digital certificates, that is widely used on internet with the TLS protocol. An X.509 certificate specifies a binding between a public key and a set of attributes that includes (at least) a subject name, issuer name, serial number and validity interval. It is defined in the request for comments (RFC) document 5280.[4] |
| X.509 token | The X.509 token represents the digital signature generated using the X.509 certificate of the sender, and which will be used to authenticate the entity sending the message. It is therefore part of the message itself, in the header section of the SOAP envelope. |
| XML | XML stands for eXtensible Markup Language which is a language that defines a set of rules for encoding documents in a format that is both human-readable and machine-readable. It is used by SOAP to encode messages sent by web services. |
| XML signature | The XML signature specification is a joint effort between W3C and IETF. XML signatures provide integrity, message authentication and/or signer authentication services for data of any type, whether located within the XML that includes the signature or elsewhere. |

[4] See tools.ietf.org/html/rfc5280

| *Term* | *Definition* |
|---|---|
| XML Schema Definition | XML Schema Definition (XSD) is a W3C recommendation that describes how the elements in an XML document are structured and formatted. |

## B. Analysis to determine the needs in terms of capacity and scalability of the eTIR international system

### 1. Introduction

5. This section analyses, based on existing data (February 2021) and on experience acquired during the development of the eTIR international system, the requirements in terms of throughput of messages and volume of data to be handled by the eTIR international system.

6. Since the eTIR international system is not yet in operation, this analysis cannot use real data and, therefore, takes a cautious approach by always considering worst case scenarios and providing estimates based on maxima rather than averages. When the eTIR international system starts to be used in production, ECE will revisit this analysis to provide better forecasts in terms of capacity requirements for the coming years and link them with the number of eGuarantees sold.

### 2. Analysis on the number of messages

7. Based on the most recent statistics on sales of TIR Carnets (and on the number of eGuarantees issued in the context of the eTIR pilot projects), the following table shows an aggregated view of the past statistics, combined with estimates of sales of TIR Carnets and eGuarantees for the next five years.

Table 2
**Statistics and forecast of the sales of TIR Carnets and eGuarantees**

| *Year* | *Number of TIR Carnet sold* | *Number of eGuarantees sold* | *Increase of the number of eGuarantees sold per year* |
|---|---|---|---|
| 2001 | 2 707 950 | *N/A* | *N/A* |
| 2002 | 3 095 200 | *N/A* | *N/A* |
| 2003 | 3 298 000 | *N/A* | *N/A* |
| 2004 | 3 211 050 | *N/A* | *N/A* |
| 2005 | 3 240 650 | *N/A* | *N/A* |
| 2006 | 3 599 850 | *N/A* | *N/A* |
| 2007 | 3 076 250 | *N/A* | *N/A* |
| 2008 | 3 253 800 | *N/A* | *N/A* |
| 2009 | 2 230 400 | *N/A* | *N/A* |
| 2010 | 2 822 200 | *N/A* | *N/A* |
| 2011 | 3 074 500 | *N/A* | *N/A* |
| 2012 | 3 158 300 | *N/A* | *N/A* |
| 2013 | 2 920 150 | *N/A* | *N/A* |
| 2014 | 1 945 050 | *N/A* | *N/A* |
| 2015 | 1 500 450 | (eTIR pilot) 5 | *N/A* |
| 2016 | 1 223 400 | (eTIR pilot) 59 | *N/A* |
| 2017 | 1 154 650 | (eTIR pilot) 82 | *N/A* |
| 2018 | 1 020 650 | (eTIR pilot) 81 | *N/A* |
| 2019 | 858 100 | (eTIR pilot) 78 | *N/A* |
| 2020 | 679 300 | (eTIR pilot) 2 | *N/A* |
| 2021 | (estimate) 600 000 | (eTIR pilot) 63, (estimate) 5 000 | *N/A* |

| *Year* | *Number of TIR Carnet sold* | *Number of eGuarantees sold* | *Increase of the number of eGuarantees sold per year* |
|---|---|---|---|
| 2022 | (estimate) 550 000 | (estimate) 15 000 | 200% |
| 2023 | (estimate) 500 000 | (estimate) 60 000 | 300% |
| 2024 | (estimate) 450 000 | (estimate) 200 000 | 233% |
| 2025 | (estimate) 400 000 | (estimate) 400 000 | 100% |
| 2026 | (estimate) 300 000 | (estimate) 700 000 | 75% |

8. In order to calculate the estimates on eGuarantees sold, the following factors were taken into consideration:

(a) The number of countries that have initiated interconnection projects between their national customs system and the eTIR international system during 2020;

(b) The number of countries that have already expressed an interest to perform this interconnection for which projects should most likely start during 2021;

(c) The numbers of TIR Carnets issued in recent years along the corridors involving those contracting parties that have launched interconnection projects or will soon do so;

(d) The efforts undertaken or interest expressed by Regional Economic Organizations in order to prepare proofs of concept to interconnect their customs union system with the eTIR international system and the possible dates for these interconnections;

(e) The results of the "study on the reasons for the decline in the number of TIR Carnets used" document (hereafter "the study") prepared by the TIR Executive Board (TIRExB) in 2020 and, especially, the trends related to the TIR Carnets sales;

(f) The efforts that ECE and the international organization will make in the coming years in order to attract more countries and markets (intermodal, postal) and expand the TIR Convention to new regions as described in the study;

(g) Neither any sensitivity analysis nor other scientific forecasting method was used, so far, to prepare such estimations.

9. The estimates on the increase in the sale of eGuarantees on a yearly basis show that, after the first years of adoption, the long term increase in percentage tends to become linear and could remain that way if the number of contracting parties to the TIR Convention connected to the eTIR international system continue to increase as well. We should, therefore, design the eTIR international system so that it can easily scale with a steady yearly increase of 100% of TIR transports following the eTIR procedure.

10. The number of messages sent and received per TIR transport depends on several criteria: the number of TIR operations, the number of pre-declaration messages (advance TIR data, advance amendment data and cancel advance data messages) sent by the holder, the number of uses of the query mechanism, the number of times that seals are changed, whether any incident or accident occurs during the TIR transport, etc. The following table shows several scenarios of TIR transports and details, for each of them, the maximum number of messages received and sent by the eTIR international system (if the holder sends the pre-declaration messages via the eTIR international system) as well as the number of request messages only.

Table 3
**Messages received and sent by the eTIR international system by scenarios**

| *Number of TIR Operations* | *Messages received and sent for the TIR operations* | *Messages received and sent for the pre-declaration* | *Total number of messages per scenario* | *Number of request messages only, per scenario* |
|---|---|---|---|---|
| 2 | E1/E2, I1/I2, I7/I8, (I15/I16) x 2, (I9/I10, I11/I12, I13/I14) x 2, (E7/E8) x 9, (E5/E6) x 9, (I5/I6) x 2 | E9/E10 | 64 | 21 |

| *Number of TIR Operations* | *Messages received and sent for the TIR operations* | *Messages received and sent for the pre-declaration* | *Total number of messages per scenario* | *Number of request messages only, per scenario* |
|---|---|---|---|---|
| 3 | E1/E2, I1/I2, I7/I8, (I15/I16) x 2, (I9/I10, I11/I12, I13/I14) x 3, (E7/E8) x 12, (E5/E6) x 12, (I5/I6) x 3 | E9/E10 | 88 | 28 |
| 4 | E1/E2, I1/I2, (I7/I8) x 2, (I15/I16) x 5, (I9/I10, I11/I12, I13/I14) x 4, (E7/E8) x 14, (E5/E6) x 14, (I5/I6) x 4 | E9/E10, E11/E12 | 110 | 36 |
| 4 | E1/E2, I1/I2, (I7/I8) x 2, (I15/I16) x 5, (I9/I10, I11/I12, I13/I14) x 4, (E7/E8) x 14, (E5/E6) x 14, (I5/I6) x 4 | E9/E10, E13/E14, E9/E10, E11/E12, E13/E14, E11/E12 | 118 | 40 |
| 5 | E1/E2, I1/I2, (I7/I8) x 2, (I15/I16) x 7, (I9/I10, I11/I12, I13/I14) x 5, (E7/E8) x 17, (E5/E6) x 17, (I5/I6) x 5 | E9/E10, E11/E12, E11/E12 | 136 | 44 |
| 6 | E1/E2, I1/I2, (I7/I8) x 2, (I15/I16) x 9, (I9/I10, I11/I12, I13/I14) x 6, (E7/E8) x 20, (E5/E6) x 20, (I5/I6) x 6 | E9/E10, E11/E12, E11/E12 | 160 | 51 |
| 7 | E1/E2, I1/I2, (I7/I8) x 3, (I15/I16) x 15, (I9/I10, I11/I12, I13/I14) x 7, (E7/E8) x 24, (E5/E6) x 24, (I5/I6) x 7 | E9/E10, E11/E12, E11/E12, E11/E12 | 198 | 61 |
| 8 | E1/E2, I1/I2, (I7/I8) x 3, (I15/I16) x 18, (I9/I10, I11/I12, I13/I14) x 8, (E7/E8) x 27, (E5/E6) x 27, (I5/I6) x 8 | E9/E10, E11/E12, E11/E12, E11/E12 | 224 | 68 |
| 9 | E1/E2, I1/I2, (I7/I8) x 3, (I15/I16) x 21, (I9/I10, I11/I12, I13/I14) x 9, (E7/E8) x 30, (E5/E6) x 30, (I5/I6) x 9 | E9/E10, E11/E12, E11/E12, E11/E12 | 250 | 75 |
| 10 | E1/E2, I1/I2, (I7/I8) x 4, (I15/I16) x 30, (I9/I10, I11/I12, I13/I14) x 10, (E7/E8) x 34, (E5/E6) x 34, (I5/I6) x 10 | E9/E10, E11/E12, E11/E12, E11/E12, E11/E12 | 292 | 85 |

11. In 2020, IRU reported the following sales[5]: 4,300 TIR Carnets of 4 vouchers (0.6%), 544,200 TIR Carnets of 6 vouchers (80%), 131,050 TIR Carnets of 14 vouchers (19.3%) and 0 TIR Carnets of 20 vouchers. Therefore, most of the TIR transports performed on that year had 3 TIR operations (6 vouchers). Given the previous table, and while taking a cautious approach with regard to the capacity of the eTIR international system, we will consider that the average total number of messages exchanged per TIR transport is 120 and that the average number of request messages is 40.

12. We will also assume that the average number of messages exchanged per TIR transport will also increase by 5% per year. This assumption is supported by the fact that more contracting parties will be connected to the eTIR international system over time, therefore increasing the possibilities for longer TIR transports following the eTIR procedure. Finally, new versions of the eTIR specifications could also contribute to this increase.

13. The following table gives estimates of the number of messages that the eTIR international system could send and receive, and should, therefore, be able to support, over the next years.

[5] See Informal document WP.30/AC.2 (2021) No.5

Table 4
**Estimated number of messages to be supported by the eTIR international system**

| *Year* | *A. Estimated number of eGuarantees sold* | *B. Estimated average number of all messages per TIR transport* | *C. Estimated average number of all messages per year in millions (A x B)* | *D. Estimated average number of requests messages per TIR transport* | *E. Estimated average number of request messages per year in millions (A x D)* |
|---|---|---|---|---|---|
| 2021 | 5 000 | 130 | 0.65 | 40 | 0.20 |
| 2022 | 15 000 | 137 | 2.06 | 42 | 0.63 |
| 2023 | 60 000 | 143 | 8.58 | 44 | 2.64 |
| 2024 | 200 000 | 150 | 30.00 | 46 | 9.20 |
| 2025 | 400 000 | 158 | 63.20 | 49 | 19.60 |
| 2026 | 700 000 | 166 | 116.20 | 51 | 35.70 |

14. We can then formulate, as a hypothesis, that the maximum number of messages would be between five and ten times the average number of messages. We can then produce the following two tables: one for the maximum number of messages received and sent by the eTIR international system and another for the maximum number of request messages received, both of them per minute.

Table 5
**Estimated maximum number of messages received and sent**

| *Year* | *A. Estimated average number of all messages per year in millions* | *B. Estimated average number of all messages per minute (A/(365x24x60))* | *Estimated lower bound of maximum number of all messages per minute (Bx5)* | *Estimated upper bound of maximum number of all messages per minute (Bx10)* |
|---|---|---|---|---|
| 2021 | 0.65 | 1.24 | 6.2 | 12.4 |
| 2022 | 2.06 | 3.92 | 20.0 | 39.2 |
| 2023 | 8.58 | 16.32 | 81.6 | 163.2 |
| 2024 | 30.00 | 57.23 | 286.2 | 572.3 |
| 2025 | 63.20 | 120.57 | 602.9 | 1 205.7 |
| 2026 | 116.20 | 221.69 | 1 108.5 | 2 216.9 |

Table 6
**Estimated maximum number of request messages received**

| *Year* | *A. Estimated average number of request messages per year in millions* | *B. Estimated average number of request messages per minute (A/(365x24x60))* | *Estimated lower bound of maximum number of request messages per minute (Bx5)* | *Estimated upper bound of maximum number of request messages per minute (Bx10)* |
|---|---|---|---|---|
| 2021 | 0.20 | 0.38 | 1.9 | 3.8 |
| 2022 | 0.63 | 1.20 | 6.0 | 12.0 |
| 2023 | 2.64 | 5.02 | 25.1 | 50.2 |
| 2024 | 9.20 | 17.50 | 87.5 | 175.0 |
| 2025 | 19.60 | 37.29 | 186.5 | 372.9 |
| 2026 | 35.70 | 67.92 | 339.6 | 679.2 |

## 3. Analysis on the throughput of messages

15. The throughput of messages to be supported by the eTIR international system is defined as the number of request messages to be received and processed for a given unit of time. Based on the previous analysis, the average and the upper bound of the maximum number of request messages per minute, are selected.

Table 7
**Estimated average and maximum requirements for the throughput of messages**

| *Year* | *Estimated average number of request messages per minute* | *Estimated maximum number of request messages per minute* |
|---|---|---|
| 2021 | 0.38 | 3.8 |
| 2022 | 1.20 | 12.0 |
| 2023 | 5.02 | 50.2 |
| 2024 | 17.50 | 175.0 |
| 2025 | 37.29 | 372.9 |
| 2026 | 67.92 | 679.2 |

## 4. Analysis on the volume of data

16. In addition to the estimates on the throughput of messages that would need to be supported by the eTIR international system, it is also important to take into consideration the factor of the size of these messages and the total volume of data that would need to be exchanged, processed and recorded by the eTIR international system.

17. Based on the experience acquired during the development of the eTIR international system, the size of 70% of the messages is under 10 KB, the size of 25% of the messages is between 11KB and 50 KB and the size of the remaining 5% of the messages is between 51KB and 20 MB (the maximum size allowed). We assume that 5% of the messages would embed additional documents (which significantly increases the size of the message).

18. Therefore, we can assume that the average size of a message would be (90% x 5KB) + (9% x 25 KB) + (1% x 5 MB) = 57 KB. Building on previous results, we can deduce an estimate on the maximum total volume of data that would need to be handled by the eTIR international system and, in particular, to be stored in the eTIR logs.

Table 8
**Estimated maximum volume of data to be stored in the eTIR logs**

| *Year* | *A. Estimated upper bound of maximum number of all messages per minute* | *B. Estimated maximum volume of data per minute in MB (Ax0.057)* | *C. Estimated maximum volume of data per year in TB (Bx60x24x365)* |
|---|---|---|---|
| 2021 | 12.4 | 0.7 | 0.371 |
| 2022 | 39.2 | 2.2 | 1.174 |
| 2023 | 163.2 | 9.3 | 4.889 |
| 2024 | 572.3 | 32.6 | 17.146 |
| 2025 | 1 205.7 | 68.7 | 36.121 |
| 2026 | 2 216.9 | 126.4 | 66.417 |

19. Only a small subset of this volume is stored in the eTIR database. First, only the request messages are processed and recorded in this storage location. Then, the additional documents are not stored in the database, so we can remove the 1% largest messages, which gives the following new average size for a message: (91% x 5KB) + (9% x 25 KB) = 6.8 KB. Then, in each message, its header is not stored in the database and only the values of the body of the message are stored, which represent between 3% and 10% of the size of the message, therefore a maximum of 0.68 KB.

Table 9
**Estimated maximum volume of data to be stored in the eTIR database**

| *Year* | *A. Estimated upper bound of maximum number of request messages per minute* | *B. Estimated maximum volume of data per minute in KB (Ax0.68)* | *C. Estimated maximum volume of data per year in GB (Bx60x24x365)* |
|---|---|---|---|
| 2021 | 3.8 | 2.6 | 1.36 |
| 2022 | 12.0 | 8.2 | 4.29 |
| 2023 | 50.2 | 34.1 | 17.94 |
| 2024 | 175.0 | 119.0 | 62.55 |
| 2025 | 372.9 | 253.6 | 133.28 |
| 2026 | 679.2 | 461.9 | 242.75 |

20. Documents embedded in the messages are stored separately, in the eTIR documents system. As for the eTIR database, only the request messages are considered. Based on previous assumptions, we can, therefore, only keep the 1% largest messages holding embedded documents, which gives the following new average size for a message: 1% x 5 MB = 50 KB. Similarly, we can, therefore, infer an estimate on the maximum total volume of data that would need to be stored in the eTIR documents.

Table 10
**Estimated maximum volume of data to be stored in the eTIR documents**

| *Year* | *A. Estimated upper bound of maximum number of request messages per minute* | *B. Estimated maximum volume of data per minute in MB (Ax0.05)* | *C. Estimated maximum volume of data per year in TB (Bx60x24x365)* |
|---|---|---|---|
| 2021 | 3.8 | 0.2 | 0.100 |
| 2022 | 12.0 | 0.6 | 0.315 |
| 2023 | 50.2 | 2.5 | 1.319 |
| 2024 | 175.0 | 8.8 | 4.599 |
| 2025 | 372.9 | 18.6 | 9.800 |
| 2026 | 679.2 | 34.0 | 17.849 |

### 5. Conclusions

21. The estimations and forecasts in terms of throughput of messages and volume of data are only as good as the various assumptions are correct. 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 adjust several assumptions, which will totally change the calculations and forecasts for the next years.

22. For this reason, it is strongly advised to perform this analysis again, six months after the eTIR international system is deployed in production in order to review the assumptions, redo the calculations and conclude with more reliable estimates and forecasts for the future needs in terms of capacity and scalability of the eTIR international system. Then, it will also be advised to review this analysis on a yearly basis to continuously refine it.

## C. Error codes

23. This section provides additional details on the error codes used in the context of the eTIR system.

24. The code list 99 defines all error codes that can be used in response messages to indicate problems that occurred while processing the corresponding request message. This code list is specific to the eTIR system and ECE has been continuously updating this list presented in the following table.

Table 11
**Error code list (CL99)**

| *Code* | *Name* | *Description* |
|---|---|---|
| 100 | Invalid message | The message is invalid, and no additional details are available for this error |
| 101 | Missing parameter | A required parameter is missing in the message |
| 102 | Invalid domain value parameter | A parameter value is out of a defined list of acceptable values |
| 103 | Malformed date | A parameter holding a date cannot be properly converted |
| 104 | Not an integer | A numeric field is containing data that is not numeric |
| 105 | Parameter length exceeded | A String field contains too many characters |
| 106 | Invalid pattern | A String field does not match the pattern defined in the XML Schema Definition of the message |
| 151 | Condition C001 failure | The condition C001 is not fulfilled |
| 152 | Condition C002 failure | The condition C002 is not fulfilled |
| 153 | Condition C003 failure | The condition C003 is not satisfied |
| 154 | Condition C004 failure | The condition C004 is not fulfilled |
| 155 | Condition C005 failure | The condition C005 is not fulfilled |
| 158 | Condition C008 failure | The condition C008 is not fulfilled |
| 168 | Rule R008 failure | The rule R008 is not satisfied |
| 200 | Invalid state | The state of an internal object is invalid, and no additional details are available for this error |
| 201 | Guarantee not acceptable | The guarantee is not in a state that allows to accept it |
| 203 | Guarantee not cancellable | The guarantee is not in a state that allows to cancel it |
| 204 | Guarantee already registered | The guarantee has already been registered |
| 205 | Guarantee already cancelled | The guarantee is already cancelled or the request to cancel it has already been sent |
| 210 | Operation already started | The operation is already started |
| 211 | Operation already terminated | The operation has already been completed |
| 212 | Operation already discharged | The operation is already discharged |
| 213 | Operation not yet started | The operation is not yet started |
| 214 | Operation ID already registered | The “refusal to start” is an operation on its own and must have a unique operation ID |
| 215 | Operation sequence already registered | The “refusal to start” is an operation on its own and must have a unique operation sequence |
| 216 | Refusal to start not authorized | The "refusal to start" cannot be performed because of the current guarantee status or because it is the first operation for this transport |
| 220 | Declaration not yet received | The operation cannot be started because the declaration was not received |
| 299 | Duplicate message | The same message was already received from the same source |
| 300 | Invalid operation | An invalid operation was performed, and no additional details are available for this error |
| 301 | Guarantee not found | The guarantee was not found in the database |
| 302 | Guarantee chain not found | The guarantee chain was not found in the database |
| 303 | Guarantee type not found | The guarantee type was not found in the database |
| 304 | Customs office not found | This error code is not used in the eTIR specifications v4.3 |
| 305 | Country not found | The country was not found in the database |
| 306 | Control type not found | The control type was not found in the database |
| 320 | Holder/Guarantee mismatch | The holder id parameter and the guarantee reference parameter do not match what is recorded in the database |
| 321 | Holder not authorized | The holder is not authorized in the International TIR Data Bank (ITDB) |
| 322 | Holder not found | The holder is not found in ITDB |
| 330 | Guarantee chain not authorized | The guarantee chain is not authorized in the database |

| *Code* | *Name* | *Description* |
|---|---|---|
| 331 | Guarantee chain/Guarantee mismatch | The guarantee chain code parameter and the guarantee reference parameter do not match what is recorded in the database |
| 332 | Guarantee type/Guarantee mismatch | The guarantee type parameter and the guarantee reference parameter do not match what is recorded in the database |
| 400 | eTIR problem | An internal error in the eTIR international system occurred and no additional details are available for this error |

25. Not all error codes can be indicated in response messages and the following table displays which error codes can be referenced in response messages. This information is useful for the IT experts of the eTIR stakeholders to properly implement the follow-up actions when receiving specific error codes. This list is presented as it is at the time of the preparation of this document. Kindly check on the eTIR web site[6] to consult its latest version.

Table 12
**List of possible error codes by response message**

| *Error code* | *I2* | *I4* | *I6* | *I8* | *I10* | *I12* | *I14* | *I16* | *I18* | *I20* | *E2* | *E4* | *E6* | *E8* | *E10* | *E12* | *E14* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 101 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 102 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 103 | X | | | X | X | X | X | | | | X | | | | X | | |
| 104 | | | | X | | | | | | | | | | | X | X | X |
| 105 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 106 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 151 | | | | X | | | | | | | | | | | X | | |
| 152 | | | | X | | | | | | | | | | | X | | |
| 153 | | | | X | | | | | | | | | | | X | | |
| 154 | | | | X | | | | | | | | | | | X | | |
| 155 | | | | X | | | | | | | | | | | X | | |
| 158 | | | | X | | | | | | | | | | | X | X | |
| 168 | | | | X | | | | | | | | | | | | | |
| 200 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 201 | X | | | | | | | | | | | | | | | | |
| 203 | | | | | | | | | | | | X | | | | | |
| 204 | | | | | | | | | | | X | | | | | | |
| 205 | | | | | | | | | | | | X | | | | | |
| 210 | | | | | X | | | | | | | | | | | | |
| 211 | | | | | | X | | | | | | | | | | | |

[6] See www.etir.org/error-codes-list

| *Error code* | *I2* | *I4* | *I6* | *I8* | *I10* | *I12* | *I14* | *I16* | *I18* | *I20* | *E2* | *E4* | *E6* | *E8* | *E10* | *E12* | *E14* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 212 | | | | | | | X | | | | | | | | | | |
| 213 | | | | | | X | X | | | | | | | | | | |
| 214 | | | | | X | X | X | | X | | | | | | | | |
| 215 | | | | | X | X | X | | X | | | | | | | | |
| 216 | | | | | | | | | X | | | | | | | | |
| 220 | | | | | X | | | | | | | | | | | | |
| 299 | | | | | X | X | X | | | | | | | | | | |
| 300 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 301 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 302 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 303 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 304 | | | | | | | | | | | | | | | | | |
| 305 | | | | X | X | X | X | | | | | | | | X | | |
| 306 | | | | | X | X | X | | | | | | | | | | |
| 320 | X | | | X | | | | | | | | X | | | X | X | X |
| 321 | X | | | | X | X | X | | | | X | | | | | | |
| 322 | X | X | X | | X | X | X | | | | X | | X | | | | |
| 330 | X | | | | | | | | | | X | | X | | | | |
| 331 | X | | | | | | | | | | | X | | | | | |
| 332 | X | | | | | | | | | | | X | | | | | |
| 400 | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X |

26. Finally, the following table gathers a set of recommended actions for consideration of the IT experts of the information system, when receiving a response message with one or more error codes.

Table 13
**Recommended actions when receiving error codes**

| *Code* | *Name* | *Recommended actions* |
|---|---|---|
| 100 | Invalid message | Kindly check the message itself and its format as it is not recognized by the eTIR international system. **Kindly contact the eTIR service desk sending the content of the message communicated, the timestamps and the steps to reproduce this issue in order to address it.** |
| 101 | Missing parameter | Kindly check the message parameters, in particular the parameters marked as mandatory in the message description section of this document, and make sure that all mandatory parameters are part of the message. |
| 102 | Invalid domain value parameter | Kindly check the coded parameter, its values and corresponding code lists. Make sure that each coded parameter is using one of the values of the corresponding code list. |
| 103 | Malformed date | Kindly check the date parameters and their format. Make sure that each date format has the format indicated, that the value follows the format/pattern and that the “formatCode” attribute is set to the correct value. |

| *Code* | *Name* | *Recommended actions* |
|---|---|---|
| 104 | Not an integer | Kindly check the integer parameters. Make sure that each integer parameter has a value that can successfully be casted as an integer. |
| 105 | Parameter length exceeded | Kindly check the parameter value lengths. Make sure that each parameter length does not exceed the max length as defined in the documentation in the Format column. |
| 106 | Invalid pattern | Kindly check the pattern of the parameter value as it does not match the requirements set for this attribute in XML Schema Definition of the message. |
| 151 | Condition C001 failure | Kindly check the parameters constrained by the condition C001 and make sure their values respect the pseudo code of the condition. |
| 152 | Condition C002 failure | Kindly check the parameters constrained by the condition C002 and make sure their values respect the pseudo code of the condition. |
| 153 | Condition C003 failure | Kindly check the parameters constrained by the condition C003 and make sure their values respect the pseudo code of the condition. |
| 154 | Condition C004 failure | Kindly check the parameters constrained by the condition C004 and make sure their values respect the pseudo code of the condition. |
| 155 | Condition C005 failure | Kindly check the parameters constrained by the condition C005 and make sure their values respect the pseudo code of the condition. |
| 158 | Condition C008 failure | Kindly check the parameters constrained by the condition C008 and make sure their values respect the pseudo code of the condition. |
| 168 | Rule R008 failure | Kindly check the parameters constrained by rule R008 and make sure their values respect the conditions set by the rule. |
| 200 | Invalid state | Kindly check the state of the referred object (transport, guarantee, ...) and make sure it is consistent with the eTIR international system requested web service called. |
| 201 | Guarantee not acceptable | Kindly check the state of the guarantee you tried to accept, and make sure it is correct according to the workflow described in the guarantee state diagram. |
| 203 | Guarantee not cancellable | Kindly check the state of the guarantee you tried to cancel, and make sure it is correct according to the workflow described in the guarantee state diagram. |
| 204 | Guarantee already registered | Kindly check the state of the guarantee you tried to register as it seems to be already registered. You may use Query guarantee web service to check its existence in the eTIR international system. |
| 205 | Guarantee already cancelled | Kindly check the state of the guarantee you tried to register as it seems to be already cancelled. You may use Query guarantee web service to check its existence in the eTIR international system. |
| 210 | Operation already started | This message tries to start a TIR operation which has already been started. Make sure that this message is not a duplicate of a previously sent message and verify the values set in its parameters. |
| 211 | Operation already terminated | This message tries to terminate a TIR operation which has already been terminated. Make sure that this message is not a duplicate of a previously sent message and verify the values set in its parameters. |
| 212 | Operation already discharged | This message tries to discharge a TIR operation which has already been discharged. Make sure that this message is not a duplicate of a previously sent message and verify the values set in its parameters. |
| 213 | Operation not yet started | This message tries to perform an operation on a TIR operation which should be started and that is not yet started. Make sure that this message is sent in the right order and verify the values set in its parameters. |
| 214 | Operation ID already registered | Kindly check the message ID and that it is not conflicting with another operation ID. |
| 215 | Operation sequence already registered | Kindly check the last operation’s sequence number for this transport and increment it |
| 216 | Refusal to start not authorized | A refusal to start cannot take place if this the first operation registered or if the guarantee has not been accepted. Kindly check that your guarantee reference is also correct. |
| 220 | Declaration not yet received | This message tries to perform an operation whereas the Declaration has not yet been received. Make sure that this message is sent in the right order and verify the values set in its parameters. |
| 299 | Duplicate message | Kindly check the message already sent to this endpoint as this message has already been |

| *Code* | *Name* | *Recommended actions* |
|---|---|---|
| | | received by the eTIR international system. |
| 300 | Invalid operation | Kindly check the message content as it triggered a technical error in the eTIR international system but this one could not identify the source of the issue. |
| 301 | Guarantee not found | Kindly check the value of the guarantee reference ID in the message and make sure it matches the value received in previous messages. |
| 302 | Guarantee chain not found | Kindly check the value of the guarantee chain ID in the message and make sure it matches the value received in previous messages. |
| 303 | Guarantee type not found | Kindly check the value of the guarantee type in the message and make sure it belongs to the code list "Guarantee type code (eTIR)" (CL12), and that it matches the value received in previous messages. |
| 304 | Customs office not found | This error code is not used in the eTIR specifications v4.3. |
| 305 | Country not found | Kindly check the value of the country code in the message and make sure it matches the value received in previous messages and that it belongs to the code list "Country name code (ISO 3166-1-alpha-2)" (CL04). |
| 306 | Control type not found | Kindly check the value of the control type in the message and make sure it matches the value received in previous messages and that it belongs to the code list "Control type code (eTIR)" (CL25). |
| 320 | Holder/Guarantee mismatch | Kindly check the format and value of the TIR carnet holder in the message and make sure it matches the value received in previous messages. If it does, kindly check the existence of the holder and its status using either "I3 - Get holder information" message, ITDB dedicated web services or ITDB web application. |
| 321 | Holder not authorized | Kindly check the value of the TIR carnet holder in the message and make sure it matches the value received in previous messages. If it does, kindly check the status of the holder using either eTIR I3 message, ITDB web service or ITDB web application. |
| 322 | Holder not found | Kindly check the value of the TIR carnet holder in the message and make sure it matches the value received in previous messages. If it does, kindly double check the id of the holder using either eTIR I3 message, ITDB web service or ITDB web application. |
| 330 | Guarantee chain not authorized | Kindly check the value of the guarantee chain ID in the message and make sure it matches the value received in previous messages. |
| 331 | Guarantee chain/Guarantee mismatch | Kindly check the value of the guarantee chain ID in the message and make sure it matches the value received in previous messages. |
| 332 | Guarantee type/Guarantee mismatch | Kindly check the value of the guarantee type ID in the message and make sure it matches the value received in previous messages. |
| 400 | eTIR problem | **Kindly contact the eTIR service desk sending the content of the message communicated, the timestamps and the steps to reproduce this issue in order to address it.** |