Proposal for urban tracking of dangerous goods for Brazilian cities

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Summary **—** This article describes an innovative proposal for tracing dangerous products in Brazilian urban cities. For that uses the concept of electronic tax documents and tracking technologies.

Key-Words **—** *tracking, electronic tax documents, dangerous products, urban transit.*

I. Introduction of the Integration Scenario

The transportation of dangerous products, due to inherent characteristics as well as packaging and wrapping materials, carries risk for the environment, public safety and public health.

For this reason, the transportation of these products in Brazil, notably on the highway, must submit to rules and procedures established by the National Agency of Land Transport – ANTT, which controls the subject through Resolutions ANTT nº. 3665/11, complemented by the Instructions approved by ANTT Resolution nº. 420/04 and its bylaws, without modifying the specific norms of each product.

According to Decree nº 50.446, from 20 February, 2009, materials, substances or artifacts are considered dangerous products if they carry risk to human and animal health, or if the materials cause damage to the environment. In this case, the Numeric Relation of Dangerous Products is found in Chapter 3.2 of Resolution nº 420 from National Land Transport Agency (in Brazil has the following Acronym: ANTT), from 12/02/2004, and is composed of the following products: explosives, gases (flammable gases, non-flammable gases, non-toxic; toxic gases), flammable liquids, flammable solids, substances which may spontaneously combust, substances which, upon contact with water, emit flammable gases, oxidizing substances, organic peroxides, toxic substances (venomous), infecting substances, radioactive materials, corrosives, various dangerous substances.

Some cities, worried about the inherent risks of these products, restrict or prohibit the circulation of vehicles which transport dangerous products in urban zones. This is the case, for example, in the city of Sao Paulo, according to a warning advertised on the Traffic Engineering Company (CET) website.

(http://www.cetsp.com.br/consultas/transporte-de-produtos-perigosos.aspx) [6]:

> "The City of Sao Paulo, via the Department of Roadway Operating System (DSV), decided to prohibit the circulation of vehicles which transport dangerous products between 5 a.m. To 10 a.m. And 4 p.m. To 9 p.m. From Monday to Friday. (...)".

To illustrate the problematic nature involved in the circulation of these products, we present research on data regarding traffic accidents involving dangerous products in Brazil, between the years of 2006 and 2010, available in the following image 1.

The research reflects the proportion of accidents involving roadway transportation of dangerous products in relation to other modes or industries, reaching alarming numbers. This data is available on the Ministry of Environment website, at http://www.mma.gov.br/seguranca-quimica/emergencias-ambientais/estatisticas-de-acidentes [3].

For this reason, it has become necessary to develop effective controls and to integrate traffic control and urban safety, to identify dangerous cargo in order to prevent accidents and health dangers in the urban areas where these products circulate.

Therefore, the initial question becomes: how to discover that any specific vehicle is transporting cargo which is considered dangerous?

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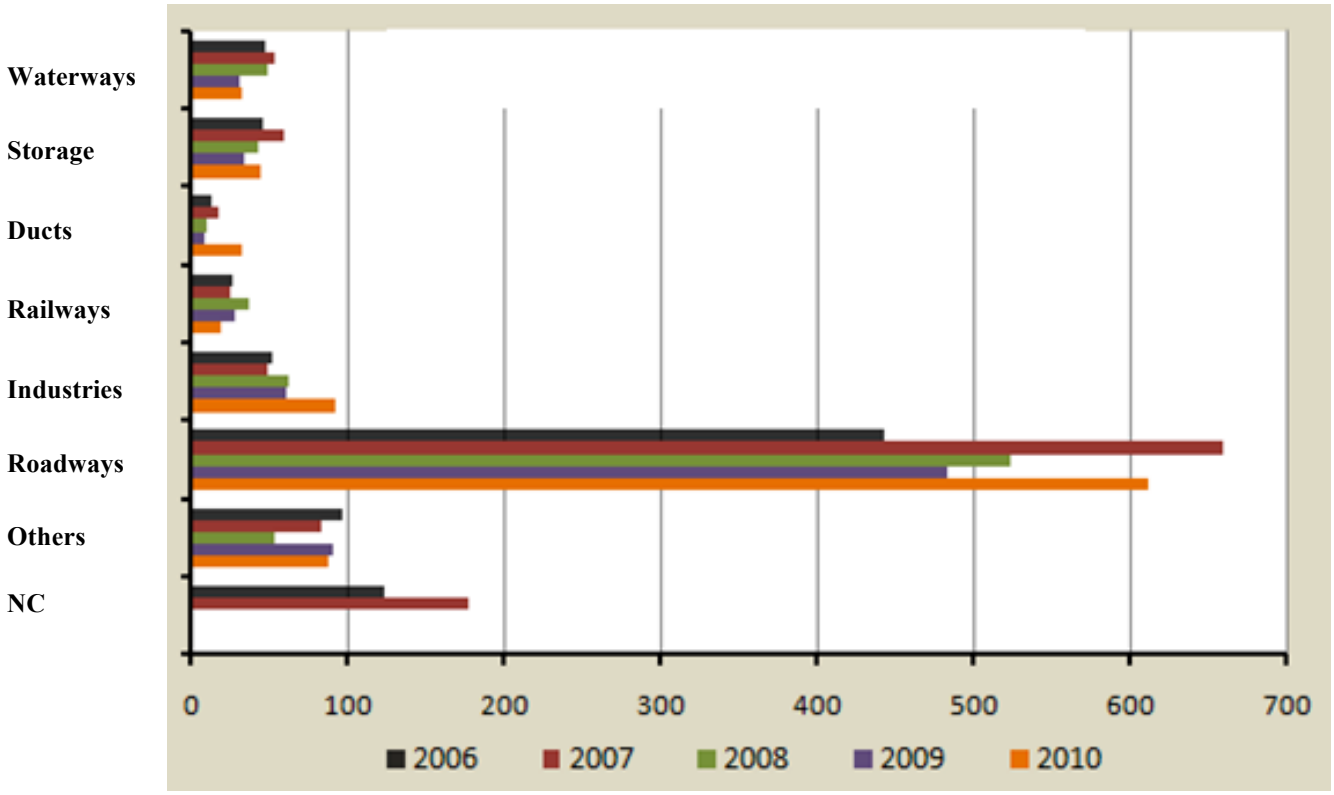
Accidents between 2006 and 2010 - Number of accidents per type/year



Waterways = waterways + maritime
Others = airport + dam + commerce + port + platform + gas stations + refineries + urban streets
NC = Not Classified

Graphic 1. Number of accidents involving dangerous products in Brazil between 2006 and 2010

A possible source for this is the information from commercial operations and cargo transportation service providers, available in electronic invoices. The Secretaries of Treasury of the 26 States and the Federal District, as well as the Brazilian Internal Revenue Service, have been working since 2005 on the implementation of fiscal documents in electronic format, in order to replace the corresponding paper documents – these are the Electronic Invoice (NF-e), to document commercial operations between companies; the Electronic Acknowledgment of Transport (CT-e), to document cargo transportation services; The Electronic Manifesto of Fiscal Documents (MDF-e), to link transportation documents (NF-e and CT-e) with the respective vehicle. These documents as well as numbers which support their successful implementation will be detailed below.

Important Observations:

1. There are several aspects involved in transport and security. This article deals with one of these aspects, the transport of dangerous products. Other common elements such as vehicle quantity, speed limits, and maximum vehicle weight permitted on each street were not analyzed at this moment;

2. The use of the electronic fiscal document is subject to fiscal confidentiality, according to articles 198 and 199 of the National Tax Code. The use of this information is restricted to the Secretary of Treasury, and its usage, as described in this article, must be preceded by juridic analysis.

II. METHODOLOGY

The thesis of this article is that the integration of transport and security can be carried out via the vehicle's license plate, the identification of the related linked fiscal document, the verification of the existence of dangerous products within the identified document and the use of security systems as detours or blocks. The methodology involves the following steps:

- Define alternative solutions from identifying license plates. Naturally, there is not only one solution, allowing one or more alternatives to be used individually or jointly, according to the best cost-benefit;
- The identified license plates must be transmitted to a data processing center, which has access to a database (although only partially) that details the types of vehicles associated to the plate (ex: DETRAN) and the recent electronic fiscal documents (ex: Secretary of Treasury);
- If the presence of dangerous products is identified, the security systems must be activated, in the sense of alerting traffic teams in order to intercept and intervene the vehicle during transit, activating automatic detours, implementing gates, etc.

Alerts and restrictions: the following restrictions should be taken into consideration for the implementation of the proposal:

(i) The transport of dangerous products between states, in which the State of Sao Paulo merely grants passage but doesn't play the role of the following within its territory: emitter, recipient, expediter, or service provider. In this case, the State of transit may be unable to provide the electronic documents and the identification of cargo transport vehicles which have no associated electronic invoice could be an acceptable alternative;

(ii) Situations in which transportation is carried out without invoice. In this case, the procedure described in the previous item is possible; the identification of cargo transport vehicles which have no associated electronic invoice, in zones where transit is not common;

(iii) Situations in which the information regarding the dangerous products is not entered on the invoice. In this case, the taxpayer must be charged with previously described laws, according to infractions already described by judicial order;

(iv) Situations in which transport occurs by private vehicle;

(v) Failures in license plate identification: for example, cases in which the plate (or its corresponding chip, when installed) cannot be identified on account of dirt.

III. STUDY DETAILS

III.1. *Existing Electronic Invoices in Brazil*

Brazil has implemented, since 2005, electronic fiscal solutions. Since then, two more types of electronic documents were developed and implemented in Brazilian territory, currently aimed at transportation service providing and the identification of respective vehicles.

In the following we present the summarized description of the operation model, the existing blocks of information and the data and numbers of each electronic document. The complete details are found in the Master's dissertation of this author, entitled "Avaliação da utilização de documentos fiscais eletrônicos na rastreabilidade de cargas (Evaluation of the usage of electronic invoices in cargo traceability)" [1] as well as the WSEAS article, presented November 2013, entitled "Documentos fiscais eletrônicos e o Rastreamento de Mercadorias e veículos" (Electronic invoices and the tracing of products and vehicles)[2].

III.1.1 *Electronic Invoice (NF-e)*

This substituted the sales invoices between companies. The operational model for the NF-e consists of (i) the generation of an XML format file for the taxpayer, containing all the information which reflects the commercial operation to be realized; (ii) a digital signature of the taxpayer within the file; (iii) transmission of the file to treasury organizations, through the Internet and WebService technology; (iv) authorization or rejection of the NF-e by the treasury organization and the respective response notified to the taxpayer; (v) if the commercial operation is authorized, an auxiliary document is printed only for transportation of the goods (DANFE - Auxiliary Document for the NF-e) and, finally (vi) the initiation of goods transportation.

Summary of information provided to the taxpayer in the NF-e: The NF-e is an XML file composed of groups of information. In the following, we highlight the fields which are useful for tracking products (the complete layout is available in the taxpayers manual, at the national project site - http://www.nfe.fazenda.gov.br [7] – or at the Paulista project site– https://www.fazenda.sp.gov.br/nfe [9]):

- Identification of Electronic Invoice: indicators which allow for the differentiation of one NF-e from another, such as serial numbers. Operational information exists, such as emission date and the date of products' release.
- Identification of NF-e emitter: Provides registration data on emitter and emitter's address.
- Identification of product destination: provides registration data and address.
- Identification of pick-up location of goods;
- Identification of delivery location.
- NF-e Products and services of NF-e: Provide all commercialized product information. Relevant Information:
- GTIN (Global Trade Item Number) – Barcode;
- Description of product or service;
- NCM Code (MERCOSUL Common Nomenclature) with 8 digits or 2 digits (generic).
- Incidental taxes on product or service;
- Total NF-e values;
- NF-e Transport Information. Relevant Information:
- Main License Plate;
- Information on Digital Signature.

There are two pieces of information which are of fundamental importance for traceability found in the NF-e layout: the products exit date and the transporter's data (such as the vehicles license plate and/or driver details).

Both pieces of information are optional in this layout, as they can be unknown by the emittor upon emission of the electronic document. This means that it is possible to not be contained within the NF-e, upon emission.

Obligation of use: Currently all industrial, wholesale commerce and taxpayers which carry out trade operations abroad, interstate or with public organizations are obligated to use the Electronic Invoice. This means that industrial production and wholesale commerce are already documented via NF-e, allowing for widespread use in tracking work. If a portion of commercial operations were to be documented by paper, this work would be damaged. More than 2.5 million NF-es are emitted per day in the state of Sao Paulo alone, involving more than 620 thousand industrial and commercial establishments. Within all of Brazil, there are 8.4 million NF-e daily, emitted by over 1 million establishments.

Contingency alternatives to NF-e

Whereas the turnover of the company will depend on external factors to it (such as the availability of internet and the correct operation of the Finance Department of the system), the study and the implementation of contingency alternatives assume a key role in this project model. There are three alternatives:

a) Virtual Environment (SVC):

- It is operational since June 2014;
- The authorizers environments of Rio Grande do Sul and the National Environment can be enabled by States to authorize NF-e in its name. Supply possible unavailability of states, and can only be accessed by taxpayers in these situations;
- No need to change the NF-e series to the SVC, or it can use the same number that you use to NF and normal issue. Is therefore less cost to the taxpayer, for the fact you can use the same document series simplifies your internal systems of control and generation of fiscal document;
- A change occurs in the access key and specific field of NF-e, in which the taxpayer must inform the "SVC" option as being the authorization environment;
- The cancellation of NF-e, when needed, can be done in the authorizing environment of contingency Virtual environment;
- The DANFE can still be printed on plain paper;
- Following the issuance of NF-e, the SVC performs the timing of the NF-e with its Secretariat of State Treasury, when it return to normal operation.

b) DPEC:

- This is a summary file of NF and also in XML format, submitted to the National Environment of the NF-e (for specific WebService or by uploading the national site of NF-e - www.nfe.fazenda.gov.br).
- The product would be accomplished, but its validity depends on the subsequent submission of the NF and the Secretariat of the taxpayer's State Treasury (ie the DPEC is transmitted to the domestic environment, and the NF-final and must be sent to treasury organization authorizing). This means that if the NF-e is not transmitted corresponding to the maximum period laid down in legislation (seven days), the operation may be seen unaccompanied by tax documents;
- The transit of the cargo will be accompanied by DANFE without the use of authorization protocol and should be printed on plain paper in at least two (2) copies, consisting in the body the expression "DANFE printed on contingency - DPEC regularly received by Revenue Federal Brazil", having the routes allocated as follows:
  - One of the routes will accompany the transit of the cargo and must be kept on file by the recipient, the statute of limitations;
  - The other route will be kept on file by the issuer by 5 years.

- The DPEC file must have the following information (are the minimum data that identify the commercial operations, as issuer, recipient, value of products and ICMS):
  - the issuer ID (CNPJ);
  - the state of the Issuer Description;
  - access key;
  - the recipient identification (CNPJ);
  - the total value of the NF-e;
  - Adress of receiver;
  - Value of ICMS;

c) Security Form (SF):

- There are alternatives that should be used when there is no prior authorization of the NF-e with the authorizer any environment (the state or the National Environment). This can occur when you cannot forward the NF-e file to the authorizing environment or, if sent, you cannot know the outcome of its processing;
- Security Form is a role built with intrinsic safety requirements (texture, layout, colors) and controlled numbering. The SF was ever produced before the advent of NF-e project, and it was this adopted as a contingency alternative. As the project advances, created a specific security form for use with electronic tax documents, the Security Form Printing Document Fiscal Electronic Document Assistant (FS-DA);
- In this case, the DANFE must be printed in at least two (2) counterparts on security paper called FS-DA (Security Form Printing Document Fiscal Electronic Document Assistant) consisting in the body the expression "DANFE in contingency - Printed due to technical problems", having the routes allocated as follows:
  - the one-way monitor the transit of the cargo and must be kept on file by the recipient by the statute of limitations;
  - the other line shall be kept on file by the issuer by 5 years.
- The product would be accomplished, but its validity depends on the subsequent submission of the NF and the Secretariat of contributors State Treasure. This means that if the NF-e is not transmitted corresponding to the maximum period laid down in legislation (seven days), the operation may be considered unaccompanied tax documentation.

Additional comments on the contingency of NF-e:

As noted above, one of the input causes a contingency is the lack of processing the response from the authorizing environment, ie, the file of the NF-e was received by the tax authorities, but this could not return the result of processing. If this occurs, and is transmitted new NF-e, the first should be canceled if it is already authorized (since it was not used to document a commercial operation). If the original file has not been authorized, the issuer should disable this number if you have already occurred issuing another NF-e.

Another possibility is that the NF and transmitted to the tax authorities after the start of commercial operation (DPEC and SF) will be rejected. In this case, the issuer taxpayer must regenerate the digital file of the NF-e, with the same number and serial, solving the error, and send it to the Department of Finance, requesting it, new use authorization of the NF-e, being forbidden to change: (i) the variables that determine the tax amount such as the calculation basis, tax, price difference, quantity, value of the operation or performance; (ii) registration data involving a change of the sender or recipient; and (iii) the date of issuance of NF-e or the date of export of the goods.

In this case, given the authorization to use the NF-e, the issuer should report it to the recipient, relating the changes made to the NF-e file, send the digital file of the NF-and authorized the recipient and print corresponding to DANFE NF and authorized in the type of paper used to print the original DANFE, in two (2) copies.

Events

They are aggregated information to NF-e, after his authorization of use. Whereas the NF-e is a digitally signed file, once issued it is not likely to change (so would invalidate the signature and therefore the legal validity of electronic documents).

It should be considered, however, that there are facts that influence (or modify) the history of the document.

Examples of events:

- When passing through a border inspection post the tax authority issue a "Pass Record" for the NF-e, that is, information recorded in system that will be linked to that particular NF-e. In internal treasury systems, to refer to it, there is also the location information and passing time;
- Cancellation of NF-e. This is a file issued by the issuer of the NF-e, which is authorized by the tax authorities and will be bound to NF-e original, own producing legal effects (in this case the cancel the document);
- Letter of electronic Correction (CC-e), issued to correct certain data of NF-e, as long as it did not change the issuer and the recipient of commercial operations or the variables and product values and taxes. Since July 1, 2012 is no longer permitted to use stationery in correction to correct mistakes in specific fields of NF-e;
- Recipient's demonstration with respect to the receipt or not of NF-e for your CNPJ. This event means an expanded use of electronic invoice as it now has the manifestation not only the issuer of the NF-e, but also the recipient of the commercial operation. In this sense, the recipient of the NF-e can tell it is confirmed or not receiving the NF-e, or if there

was return of the goods. This information is useful to the tax authorities detect undue emission NF-e, and for the taxpayer himself to ensure that your registration (CNPJ) is not being misused by third parties.

III.1.2 *Electronic Acknowledgment of Transport (CT-e)*

This has the goal of altering the systematic emission of invoices referring to cargo transport.

According to the master's dissertation of this author, the operational model of the CT-e follows the same model applied to the Electronic Invoice (NF-e), previously explained, including the emission of the auxiliary paper document used to follow the transportation service (DACTE – Documento Auxiliar do CT-e).

However, there are some differences for the transport sector regarding the people involved in transport services provided. In addition to the emitter of the document and the recipient of the good, the transport sector also involves a service receiver (responsible for service contracts and payments), goods expediter (who delivers the goods to the transporter in order to provide transportation services), and the product recipient (who should receive the goods from the transporter).

Each participant of the the transportation service must emit an electronic document in the appropriate moments, according to tax legislation, following the same operation model as the NF-e, as previously seen.

Summary of provided information: The "Conhecimento de Transporte Eletrônico" (Electronic Acknowledgement of Transport) is an XML file made of up the following groups of information (the complete layout is available in the taxpayers manual, at the national project site- http://www.cte.fazenda.gov.br [4] – or the project website in São Paulo – https://www.fazenda.sp.gov.br/cte [8]):

- Identification of CT-e: provide indicators which allow the differentiation of one CT-e from another, such as serial numbers. This group provides information on services provided, such as emission date and type of transport utilized (air, roadway, waterway, railway or pipeline).
- Identification of CT-e emitter: Provide registration data and address.
- Information on the sender of transported goods by CT-e: Provide registration data and address.
- NF-e Information (NF-e Access Key). Note that the CT-e also registers paper documents emitted by the sender, when this is the case.
- Information on the product expediter: Provide registration data on the expediter (when one exists) and address.
- Information on the product recipient: Provide registration data (when one exists) and address.
- Information on the CT-e recipient: Provide registration data and address.
- Values for services Provided;
- Information related to taxes;
- Group of CT Information- normal and substitute: provide details on transported products. Relevant Information:
  - Predominant Product;
  - Information on product quantity;
  - Container Information– Procedural group.
  - Documents of previous Transport;
  - Modal Information.

Regarding the layout of each modal, we present the most relevant portions of a rotational model which more easily relate to tracing technology below.

- Vehicle Data:
  - Vehicle license plate;
  - Weight in Kilograms;
  - Type of vehicle(traction or towing);
  - Seals.

Finally, there is a specific group with transport data for dangerous products, with the following fields:

- Risk Class and Subclass;
- UN Number;
- Packaging group;
- Proper name for product shipping;
- Quantity limited by vehicle.

Obligatory use: Currently all cargo transport in Brazil must be documented by CT-e. The State of Sao Paulo alone emits over 500 thousand CT-es per day, involving 63 thousand transportation service providers. In all Brazilian territory, there are over 120 thousand service providers.

Contingency alternatives to CT-e

Whereas the Department of Finance becomes part of the operational model of issue of the CT-e, and considering the use of the Internet and systems for billing the transport company, here too it is necessary to study and advance planning as the possible forms of contingency that the company will have at your disposal.

a) EPEC:

- It is an event linked to the CT-e, in XML format, broadcast on internet SVC Rio Grande do Sul or SVC São Paulo;
- The provision of shuttle service can be made, but its validity depends on the subsequent submission of the CT -e the Secretariat of contributors State Farm. This means that the corresponding CT -e is not transmitted to the maximum period laid down in legislation (seven days) the provision could be considered unaccompanied tax documentation;
- The transit of the cargo will be accompanied by DACTE without the use of authorization protocol and should be printed on plain paper in at least two (2) copies, consisting in the body the expression "DACTE in contingency - printed due to technical

problems", having the routes allocated as follows:
  - One of the routes will accompany the transit of the cargo and must be kept on file by 5 years;
  - the the The other route will be kept on file by the issuer, during 5 years.
- The EPEC must have the following information (minimum data identifying the provision of the service):
  - the issuer ID (CNPJ);
  - the state of the Issuer Description;
  - access key;
  - the recipient identification (CNPJ);
  - Adress of receiver;
  - the provision of the service value;
  - the ICMS value of the service;
  - the cargo value

b) Security Form (SF):
- There are alternatives that should be used when there is no prior authorization of the CT-e with the authorizer any environment (the state or the National Environment). This can occur when you cannot forward the CT-e file to the authorizing environment or, if sent, you cannot know the outcome of its processing;
- Security Form is a role built with intrinsic safety requirements (texture, layout, colors) and controlled numbering. The SF was ever produced before the advent of CT-e project, and it was this adopted as a contingency alternative. As the project advances, created a specific security form for use with electronic tax documents, the Security Form Printing Document Fiscal Electronic Document Assistant (FS-DA);
- In this case, the DACTE must be printed in at least two (2) counterparts on security paper called FS-DA (Security Form Printing Document Fiscal Electronic Document Assistant) consisting in the body the expression "DACTE in contingency - Printed due to technical problems", having the routes allocated as follows:
  - the one-way monitor the transit of the cargo and must be kept on file by the recipient by the statute of limitations;
  - the other line shall be kept on file by the issuer by 5 years.
- The product would be accomplished, but its validity depends on the subsequent submission of the CT-e and the Secretariat of contributors State Treasure. This means that if the NF-e is not transmitted corresponding to the maximum period laid down in legislation (seven days), the operation may be considered unaccompanied tax documentation.

c) Virtual Environment (SVC):
- The authorizers environments of Rio Grande do Sul and São Paulo can be enabled by States to authorize CT -e on their behalf. Settle possible unavailability of states, and can only be accessed by taxpayers in these situations.
- The taxpayer can use the same number you use for CT -e normal issue. Thus, the change occurs in the access key and specific field of CT -e in which the taxpayer must inform the "SVC-SP" or "SVC-RS" as being the authorization environment;
- Cancellation of CT -e, when needed, can be done in the authorizing environment of contingency Virtual environment;
- DACTE can be printed on plain paper;
- After the issue of CT -e the SVC performs the timing of CT -e with its Secretariat of State Treasury, when this return to normal operation.

Additional comments on the contingency of the CT-e:
- As noted above, one of the input causes a contingency is the lack of processing the response from the authorizing environment, ie, the file CT -e was received by the tax authorities, but this could not return the result of processing. If this occurs, and is transmitted new CT-e the first to be canceled if it is already authorized (as it was not used to document the provision of the service). If the original file has not been authorized, the issuer should disable this number if you have already occurred issuing another CT-e;
- Another possibility is that the CT -e transmitted to the tax authorities after the start of service delivery (EPEC and FS-DA) will be rejected. In this case, the issuer taxpayer must regenerate the digital archive of CT, and with the same number and serial, solving the error, and send it to the Department of Finance, requesting thereby new Use Authorization of CT -e being forbidden to change: (i) the variables that determine the tax amount such as the calculation basis, tax, price difference, quantity, value of the operation or performance; (ii) registration data involving a change of the issuer, borrower, sender or recipient; and (iii) the date of issuance of NF-e or cargo departure date.
- In this case, given the Use Authorization of CT -e the issuer should report it to the service taker, listing the changes made in the CT-e file, send the CT-authorized digital file and print the corresponding DACTE the authorized CT-e in the same type of paper used to print the original DACTE, in two (2) copies.

Events

It has the same concept used for the NF-e, ie they are aggregated information to CT -e after his authorization of use. Whereas the CT-e is a digitally signed file, once issued it is not likely to change (so would invalidate the signature and therefore the legal validity of electronic documents).

In the case of CT -e we have the following events planned:

- Cancellation;
- Electronic Correction Letter;
- EPEC, as explained above.

It should be noted that the issue of CT-e also generates events in the NF-e that are mentioned in it, ie, the NF-and become marked from the issuance of the CT-e. In addition to linking a transport information to the NF-(for example, the modal and the type of vehicle), the marking prevents the removal of NF-e because there is already an indication that there exit merchandise category.

III.1.3 *Electronic Invoice Manifest (MDF-e)*

This document has the function of relating the electronic invoices emitted by the shipper and the transporter, which are all the NF-es and CT-es. According to Brazilian legislation, the electronic manifest must be emitted by companies providing transport services that offer more than one mode of transportation or for other companies involved in operations with goods, who uses their own vehicles for transportation, either leased or through the hiring of third-party goods transporters, with more than one invoice.

According to the operational model, an XML file should be generated and signed digitally. The particulars of this document are the following:

- It will contain all the information regarding the goods, driver, itinerary, value and weight of the goods and invoices;
- As opposed to the NF-e and CT-e, the company which emits the MFD-e must finalize it at the end of the route. While any documents are pending closure, it will be impossible to authorize a new one relating to the same loading and unloading pair of the same vehicle.
- This guarantees that the information from the beginning and end of the transportation service provided will be recognized for fiscal tax purposes. This also ensures that if, during transport, there is any alteration in the electronic documents information (vehicle, goods, documentation, driver, etc.), this must first be closed, followed by the emission of a new document with the updated configuration.

Summary of provided information: The Electronic Invoice Manifest is an XML file composed of the following groups of information. (The entire layout is available in the taxpayer's manual, available at the site https://mdfe-portal.sefaz.rs.gov.br/ [5]):

- Identification of MDF-e: provides indications which allow for the differentiation of one MDF-e and another, for example, serial numbers. This group has information on services provided, such as emission dates.
- Identification of Manifest Emitter: Provide registration data and address.
- Information on fiscal documents linked to the Manifest: Provide invoice information which accompanies transportation and goods. Relevant information:
  - CT-e Access key;
  - NF-e Access Key.
- Totals for transported goods and tax documents. Relevant Information:
  - Total amount of CT-es related in the Manifest;
  - Total amount of paper acknowledgment related in the MDF-e;
  - Total amount of NF-es related in the Manifest;
  - Total amount of paper invoices related in the MDF-e;
  - Total value of transported goods;
  - Total brute weight of transported goods.
- MDF-e seals.
- Roadway layouts. Relevant Information:
  - Main vehicle license plate – obligatory
  - Vehicle weight in kilograms– obligatory.

Usage obligation: the obligation for MDF-e emission will be imposed on taxpayers according to the following timetable:

- For businesses which transport goods, interstate transport on parceled goods, with the following starting dates:
  - January 2nd, 2014, for 200 largest roadway contributors, as well as rail and air contributors;
  - July 1st, 2014, for roadway contributors, which haven't opted for simple tax regimes, and for sea contributors;
  - October 1st, 2014, for roadway contributors subject to simple tax regimes;
- For contributors which supply goods via their own transportation, MDF-es must be emitted starting 03/02/2014 (if the simple tax regime was not opted for) or 01/10/2014 (otherwise).

Contingency MDF–e

Contingency is a bit simpler than the documents examined previously, consisting of simple issue of DAMDFE on plain paper accompanied the transmission of MDF-e when the technical problems have been overcome.

In this case, the logistics functionality will be impaired (for the passing record will be made by the NF-e and CT-e) in favor of not requiring greater formalities of the taxpayer in the case of technical problems.

Events

There are two events:

- Cancellation;
- Closing of MDF-e (The MDF-e should be terminated after the end of the route described in

the document and whenever transhipment, re-dispatch, subcontracting or replacement vehicle, the driver, container, as well as unforeseen retention hypothesis of the cargo through record this event as provided in Taxpayer Guidance Manual - MDF -e).

There is still an internal event to the tax administrations systems linked to the MDF -e: once issued, all CT-e and all NF-e linked to the MDF -e receive an event of this issue, indicating that there was the start of service delivery transporting the goods.

All these events should be synchronized with the tax administrations involved in the operation and service provision.

III.2.*Examples of technologies which identify license plates*

In the following, we present types of technology which may be used for the identification of license plates and/or vehicles, which can be utilized in conjunction with one another or independently.

Regarding the exchange of information, the use of the XML standard and WebService technology may be the most recommend, if they are amply utilized by models of electronic invoices. This will depend on how the platforms which operate the traffic and security controls work.

III.2.1. *OCR*

OCR (Optical Character Recognition) is a non-obtrusive technology which allows for the capture of license plate images from vehicles via cameras and post-haste recognition of license plate characters.

If the license plate is identified, the information may be utilized to cross reference an electronic document database. When a vehicle with dangerous products is identified, the security system should be informed.

III.2.1. *RFID Technology in the vehicle*

This is a radio frequency technology linked to an object and signal-receiving equipment installed on highways or strategic points for passing vehicles. It is a technology that depends on the installation of a transponder (chip) board, or tracked object (in this case, the vehicle); which makes it an intrusive solution. However, once installed, the gathered information can be made with the vehicle in motion, preventing delays with stops on highways or roads.

The reflected response can contain pre-recorded information on the transponder, such as its ID number, chassis information, cargo or transported invoice. The reach of the antenna depends on the potency installed, allowing for up to hundreds of meters.

III.2.3. *RFID Technology in the product*

This technology involves the installation of radio frequency tags on objects giving them a "fingerprint", readable whenever it passes an antenna with the capability to scan it.

The solution is similar to the previously described item, with the difference that the tag will contain information on the product, fabrication date and producer. If it contains a tag, the product will be detected by passing a gate or portal with antennas that capture the signal. This has the following advantages: (i) the fact that it is a solution which allows, under certain conditions, the identification of the product from a distance, with the necessity of stopping or analyzing the cargo; (ii) the tags are read even if they are piled on top of one another.

III.2.4. *Trackers*

This technology has information obtained by providers of cargo tracking service companies and/or risk management. This solution offers the ability to obtain route information, vehicle stops and corresponding times, providing the ability to check any route deviations. Depending on the accuracy of the solution adopted, it is possible to have more or less number of positions per minute.

Different features can be offered, depending on the service, for example, location features (real time or periodic) and the corresponding transmission for capturing points (both should be used for GPS, satellite, cellular or other form of data communication), opening of control compartments or vehicle doors of the vehicle and even issuing commands to the vehicle.

IV. ENVISIONED ARCHITECTURE

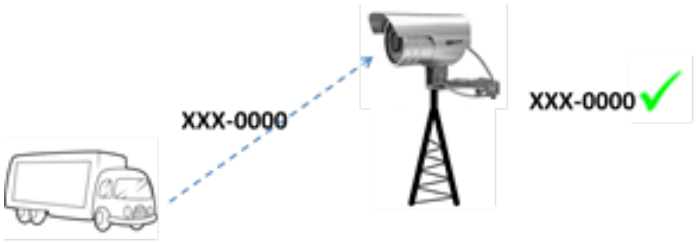
The architecture initially involves the traffic system identifying license plates and cross-referencing this information with DETRAN databases (to identify if it is a cargo vehicle or not) and the Secretary of Treasury (to identify if it has declared dangerous cargo or not). We re-emphasize the initial question on the necessity of juridic research to develop the viability of this cross-reference.

If the presence of dangerous cargo is identified, the security system will be activated through detours and roadblocks.

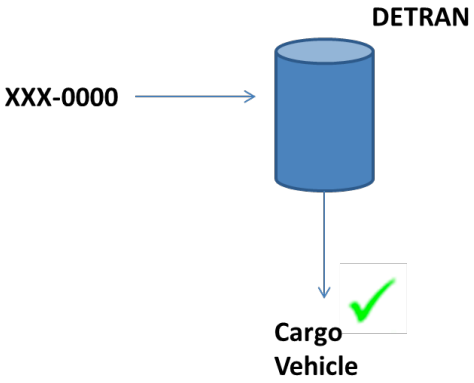
We will have:

(i) The definition of alternative technology for the identification of vehicle license plates;

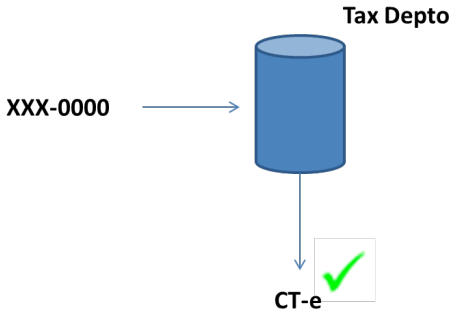
(ii) The installation of gates or posts with OCR cameras or antennas in strategic locations which aim to impede vehicle traffic including dangerous cargo, in order to record these vehicles license plates.



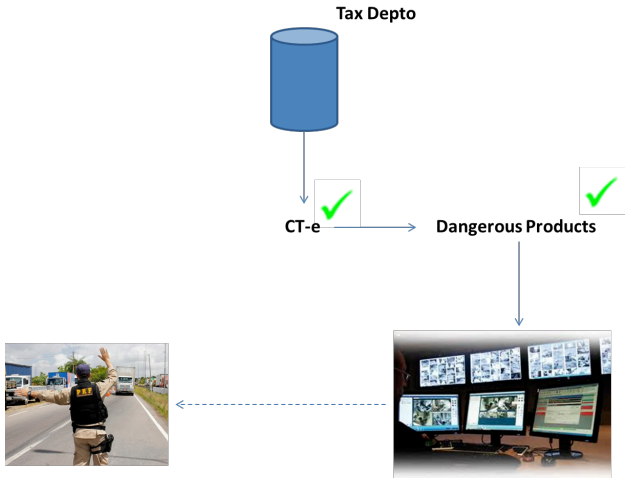
(iii) The information of the identified license plate should be cross-referenced against a database showing types of vehicles (ex: Traffic Department, called, in Brazil, by DETRAN).



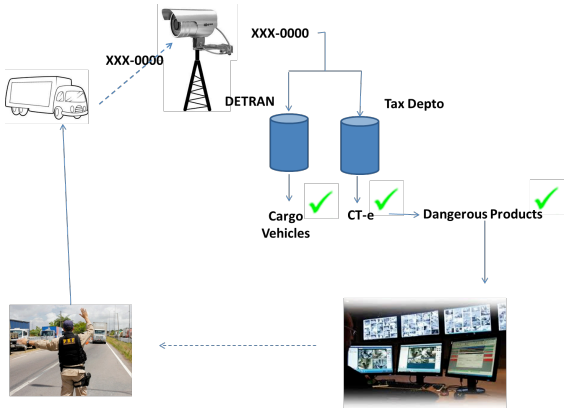
(iv) If it is a cargo vehicle, crosscheck the information with electronic invoices (MDF-e and/or CT-e), seeking to identify a CT-e whose deadline for transport would be condemned by the date upon which the license plate information is captured.



(v) Identify the CT-e, verify if the transport group for Dangerous Products has been filled out. If so, alert a center of operations, which should act to intercept the vehicle, impeding its entrance or transit in areas or hours in which dangerous products should not pass through.



In summary, we can conclude, graphically:



V. EXPECTED RESULTS

The final expected result, in the sense of reaching the initial desired result, hopes to integrate traffic monitoring systems with electronic invoices in order to identify the transit of dangerous products and act in a way which prohibits the transit of these materials in undesired locations (integration with security systems).

There are numerous available types of technology, both for traffic monitoring and for integration among databases. In the case of electronic documents, both the XML standard and WebService technology are amply utilized.

However, the result depends on the extension of the area which wishes to be monitored, from infrastructure to data communication, as well as systems which cross-reference databases.

As a benefit, we have the possibility of reducing, avoiding or controlling the transit of dangerous products in urban areas and the respective risk of accidents.

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