International Plant Protection Convention

The global ePhyto solution
IPPC ePhyto Steering Group
v1.0 March 2016

PURPOSE

This document details the proposed specifications of a global ePhyto Hub and an accompanying generic national system. The specifications have been developed by the IPPC ePhyto Steering Group with the support of a Technical Working Group. This document provides the details to support project development, governance and pilot implementation of a global electronic phytosanitary certification (ePhyto) solution.

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DOCUMENT CONTROL

Version	Description	Author	Date
v0.1	First draft	P Neimanis& C Karunaratne	May 2015
v0.2	Inclusion of analysis of options	ePhyto Steering Group	June 2015
v0.3	Pilot approach	ePhyto Steering Group	July 2015
v0.4	Internal review and edit	ePhyto Steering Group	Sept 2015
v0.5	Technical review and edit	P Neimanis & C Karunaratne	Sept 2015
v0.6	ePhyto Steering Group meeting 4	ePhyto Steering Group	Oct 2015
v0.9	Revision of authentication and internal review	ePhyto Steering Group	Jan 2016
v0.1	Release version	ePhyto Steering Group	Mar 2016

APPROVAL AND RELEASE

Project Sponsor (s)		
Name	Position/title	Date
Nico Horn	Chair, ePhyto Steering Group	1 March 2016
Project Manager/Lead		
Name	Position/title	Date
Shane Sela	Project Manager, IPPC ePhyto	1 March 2016

APPROVAL

Committee	Date approved (if applicable)	Date to be reviewed (if applicable)
IPPC ePhyto Steering Group	February 2016	February 2017 (pilot review)
IPPC Bureau	February 2016	
IPPC Commission of Phytosanitary Measures (CPM)	CPM11 - 2016	

Approved budget

Funding from STDF proposal – pending release of funds after the approval of the STDF working group in October 2015.

Approved resourcing

To be confirmed

Agreed governance

To be confirmed – refer Roles and Responsibilities

OVERVIEW

Background

The ePhyto project is an initiative of the International Plant Protection Convention (IPPC) to assist countries in implementing electronic exchange (eCert) of phytosanitary certificates. The ePhyto initiative is looking to develop a standardised approach to the security and method of exchange, code sets and message mapping to ensure that all countries are able to easily participate in electronic certification. The IPPC is also seeking to support developing countries in the implementation of electronic certification by developing a 'generic' national system which will connect to a single-point exchange mechanism (called the Hub) that aims to allow all countries to exchange certificates.

Several National Plant Protection Organisations (NPPO) have been recently exploring and developing differing systems for the electronic exchange of phytosanitary certificates. It was identified at the Open Ended Working Group on Electronic Phytosanitary Certification in Paris in 2012 that this situation could create a multitude of exchange formats and mechanisms which would undermine some of the advantages of electronic exchange.

The Commission on Phytosanitary Measures (CPM) 8 established an ePhyto Steering Group (ESG) with representatives from all FAO regions which is overseen by the CPM Bureau to propose an internationally harmonised approach for electronic certification. The CPM Bureau, which provides guidance to the CPM on strategic direction and financial and operational management, oversees the ESG and reports on the progress of ePhyto matters to CPM.

The purpose of ESG is to provide oversight, guidance and advice on IPPC efforts to facilitate the international exchange of electronic phytosanitary certificates among contracting parties. The ESG aims at increasing understanding and awareness, supporting the implementation of ePhyto and monitoring the Hub feasibility study. For this purpose, ESG agreed on a work plan that will concentrate on harmonisation of terms, exchange options and awareness and capacity development. The ESG reports directly to the IPPC Secretariat and provides specialist input to other IPPC groups such as the Standards Committee. A member of the CPM Bureau was added to ESG, along with a member of the IPPC secretariat, with the aim of facilitating communication with the IPPC Secretariat and the Bureau.

CPM-9 (2014) approved Appendix 1 of International Standard for Phytosanitary Measures (ISPM) 12, Phytosanitary certificates which is titled "*Electronic certification, information on standard XML schemes and exchange mechanisms*" which describes the format and the contents of ePhytos and their exchanges between NPPOs.

The IPPC Secretariat commissioned a feasibility study entitled *A Global ePhyto Feasibility Study*. This study conducted a detailed cost/benefit analysis of numerous exchange options (e.g. Point-to-Point or Single Point). It also considered technical issues, management considerations, legal questions, financial options and political concerns associated with electronic certificate exchange options.
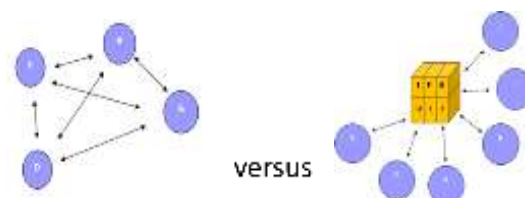

Fig 1: Decentralized Point-to-Point Bilateral Exchange versus Centralized Hub-managed Multilateral Exchange

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An Asia & Pacific Plant Protection Commission (APPPC) Workshop on Building Understanding and Preparedness for Electronic Phytosanitary Certification was convened in Bangkok, Thailand in October, 2014. This Workshop discussed the opportunities of ePhytos and provided information on the implementation of ePhytos in APPPC countries. The Workshop was well attended by officials from twenty two countries. A report on surveys undertaken by 20 APPPC and 3 non APPPC countries which examined countries preparedness was discussed. The workshop also covered infrastructure, legislative, regulatory, communication and capacity development issues associated with developing ePhyto frameworks. The participants established an APPPC ePhyto Working Group including Thailand, Philippines, South Korea, Indonesia, China, Japan, and Malaysia, with Australia as the Chair.

The APPPC ePhyto Working Group consolidated its country survey reports into a single document to capture the ePhyto status of its members. The working group also developed "Readiness and Assessment Documents" to capture information from APPPC members for ePhyto development as stipulated in its forward work plan. The forward work plan has been developed by the APPPC ePhyto working group in consultation with its members and the Chair of CPM bureau. This work plan was endorsed at the 29th session of the APPPC meeting in September 2015 in Indonesia.

In 2014, the IPPC Secretariat worked with the ESG and CPM Bureau to develop a project proposal for ePhyto funding. The IPPC presented this proposal to the Standards and Trade Development Facility (STDF) of the World Trade Organisation (WTO) seeking funding in support of capacity development of contracting parties in the development of a global ePhyto Hub which receives and transfers certificates from NPPOs and a generic web-based ePhyto system to access the Hub. In April 2015, the STDF provisionally approved US$1 million (cash) for the proposal provided a further funding for US $200,000 (in kind) is provided by the Food and Agriculture Organization (FAO), IPPC, Contracting Parties and/or Regional Plant Protection Organisations (RPPOs).

The ESG also has developed a proposal to promote ePhyto globally, which will be considered by the IPPC Capacity Development Committee (CDC). This proposal will consider input from regional ePhyto workshops and is based on the APPPC work plan.

The United Nations International Computing Centre (UNICC) has been proposed to lead the contract management and building of the global Hub for the IPPC. UNICC is the leading provider of Information Technology and Communications (ICT) services within the United Nations System for 35 agencies. The ESG has discussed with the UNICC to develop software for a generic system with server capacity for a global Hub in order to minimise costs by maximizing economies of scale.

A pilot with a limited number of countries is crucial to testing and validating the concept of a Hub. The results of the pilot will allow for proof of concept, testing, and for necessary adjustments required to expand the approach and make it available to all countries. It will also result in a practical demonstration of the readiness, utility, benefits and efficiency of a Hub-based approach.

In January 2016, the IPPC undertook a global survey to assess the readiness of various countries to participate in the ePhyto development, either as a pilot country in the pilot phase or for implementation over the next few years. This survey is a further extension of the readiness survey previously undertaken for the APPPC.

Electronic certification (eCert) is an increasingly important concept amongst numerous government to government (G2G) certification bodies. The development of the ePhyto Hub and generic national system is being watched and may well be a model that other international organizations can use or emulate.

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Definitions

ePhyto: is short for "electronic phytosanitary certificate". An ePhyto is the electronic version of a phytosanitary certificate. All the information contained in a paper phytosanitary certificate is also detailed in the ePhyto and is in XML format (as per Appendix 1 to ISPM12).

ePhyto Steering Group (ESG): The ePhyto Steering Group is a group of representatives of the National Plant Protection Organisations of member countries to the IPPC representing the FAO regions selected by the CPM to provide oversight, guidance and advice on IPPC efforts to facilitate the international exchange of electronic phytosanitary information among contracting parties.

ePhyto system: is the IT system by which electronic phytosanitary certificates are produced and exchanged electronically between NPPOs. ePhyto exchange means the sending and receiving of ePhytos between two countries. Part of the ePhyto system may fit into a larger national system that also contains elements for listing importing country requirements, inspection records, planning, training, invoicing and reporting functions as the individual NPPO deems appropriate.

Global ePhyto Hub: is a single point, multilateral electronic certification exchange system which facilitates single point exchange. It establishes common transmission/retrieval requirements that all participating NPPOs accept. An exporting NPPO can send an ePhyto certificate via a secured system to the importing country's mailbox and the importing country can then retrieve the ePhyto.

Generic national system: is a basic, secure web based system that will allow countries with limited IT capacity to participate in ePhyto exchanges.

Point-to-point exchange: ePhyto exchange directly between the exporting country and the importing country.

Single point exchange: ePhyto exchange between several exporting countries and several importing countries through a single point (referred to as the "Hub").
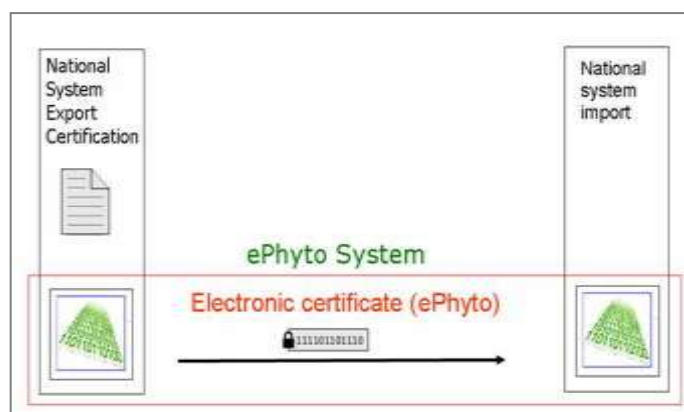
Fig 2: How the ePhyto System links two national systems through the standards of electronic certificate exchange.

Strategic fit

This project produces results that relate to the pre-defined organisational goals/requirements of IPPC stipulated in the ISPM 12 Appendix 1. IPPC work includes standards on plant health which provide specific guidance to countries on topics related to the SPS Agreement. The development of a Global ePhyto solution by the ESG, complementing requirements specified in the ISPM 12, will align with the IPPC's corporate/strategic plan.

Project objectives

The objectives of this project are

1. to develop and implement a Global Hub ensuring that IPPC contracting countries are able to exchange phytosanitary certificates in trade in an innovative, cost effective and globally harmonised way using a global framework; and
2. to develop and implement a generic system that is web based to ensure that countries, that do not have a national system to produce and receive ePhytos, can easily participate in an ePhyto system. This will especially enable developing countries to also join the electronic exchange of phytosanitary certificates

Project outputs

The major outputs of this project are to

- provide a globally harmonised exchange tool (Hub) for electronic phytosanitary certificates
- facilitate ePhyto exchange with other "Hub" countries without requiring each country to negotiate an individual bilateral access agreement with each of its trading partners
- minimise the technical adjustments required between trading partners to exchange electronic phytosanitary certificates
- ensure a redundancy of hard drives and servers which is undertaken by a third party vendor
- facilitate the movement of a large number of ePhytos within real time and has the capacity that would have the potential for further expansion
- provide system security, data security and exchange security for ePhytos during Hub transmission
- establish a Hub system where no data is stored and that data will be transmitted in a secure form between participating NPPOs
- establish on-going governance and management structures for the effective running of the Hub
- establish on-going governance for the harmonised terms and codes that will support ePhyto.

Project inputs	

The ePhyto Steering Group (ESG) members are
- Nico Horn – chair (Europe region, The Netherlands)
- Diego Quiroga (Bureau member, Argentina)
- Walter Fabián Alessandrini (Latin America region, Argentina)
- Christian B. Dellis (North America region, United States of America)
- Chen Maoyu (Asia region, China)
- Peter Neimanis (Southwest Pacific region, Australia)
- Mostafa Abedelaziz (Near East Plant Protection Organization, Egypt)
- Josiah Syanda (Africa region, Kenya)
- Craig Fedchock (IPPC Secretariat)
- Shane Sela (IPPC Secretariat)

Former Members
- Peter Thomson (Bureau member, New Zealand)
- Marie-Pierre Mignault (IPPC Secretariat, in-kind contribution from Canada)

The ESG used the following input, in developing this project
- the output of a consultancy entitled *"A Global ePhyto Feasibility Study"*
- the Technical Working Group on ePhyto Development

The Technical Working Group consisted of
- Christian Dellis, USA
- Walter Alessandrini, Argentina
- Matthew Moore, Australia
- Peter Johnston, New Zealand
- Steve Wilkinson, USA
- Guy Watt, England

Related links

- [A Global ePhyto Feasibility Study](#)
- [IPPC ePhyto - home page](#)
- [IPPC ePhyto – schema and codes](#)

Project scope

The ESG will limit its work to building a cost effective Global Hub and generic national system that will facilitate ePhyto exchange in a secure environment.

Exclusions (out of scope)

Phytosanitary measures such as "phytosanitary certification" undertaken by NPPOs are out of scope and will not be considered by the ESG in this project.

Expected benefits

The use of a single global, internationally harmonized standard, ISPM 12:2011 (Phytosanitary Certificates), for electronic phytosanitary certification (ePhyto) provides a number of benefits, in comparison to paper-based phytosanitary certification, to both exporting and importing countries.

The following outcomes and benefits will be obtained after the implementation of this project:

- data is easily exchanged between NPPOs through the Hub by participant countries agreeing to a standardised transmission protocols
- maintenance costs associated with the exchange of electronic certificates are reduced since only one system is maintained
- a single set of Hub protocols minimizes the required support staff and improves trade facilitation by allowing all countries to cost-effectively participate
- fosters co-operation between NPPOs through quick information sharing between participants
- increased harmonisation of exchange of phytosanitary certificates through the implementation of Appendix 1 to ISPM 12 by way of a Global Hub in accordance with IPPC strategic goals.
- reduces the possibilities for fraudulent documentation
- reduces the data entry and validation functions by NPPO staff
- reduces the costs associated with printing and transmitting paper certificates, and reduces the costs associated with sorting, distributing, retrieving and archiving paper documents
- expedites the communication of phytosanitary information between exporting and importing NPPOs, including transparency and added convenience for the reissue of certificates
- improves the security of transmission of documentation
- improves planning for the pre-arrival planning/risk assessments and clearance of plants and plant products at customs
- reduces the delays in receiving replacement phytosanitary certificates
- minimizes the investment costs by building on existing IT infrastructure initiatives
- potential to link to the World Customs Organization "One Window" initiative and harmonize codes and processes

The implementation of a Global ePhyto Hub will strengthen these benefits and will deliver the following additional benefits to participating countries

- reduce expenditure associated with ongoing and costly bilateral arrangements required by point to point systems
- accelerate the harmonisation and implementation of the use of ePhyto
- reduce costs to developing countries by providing a simple, harmonised mechanism for the certification of plants and plant products; and
- strengthen trade by expediting and protecting phytosanitary information;

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Risks

Key Risks					Current Controls and their Effectiveness (I) Ineffective (M) Moderate (A) Adequate	CURRENT RISK LEVEL			Acceptable/ Unacceptable
Ref	Description	The Risk *What is the effect on the objective?*	Risk Sources *How can this happen?*	Risk Consequences *What damage or loss could occur?*		Likelihood	Measure of Consequence	Risk Level	
1.	Development of Global Hub within the stipulated time period	Lack of sufficient budget	Lack of STDF funds as anticipated	Significant delay of Hub development	Moderate	Very High	Progress associated with the Hub development	High	Unacceptable
2.	Technical issues	Lack of technical experts	Not being able to appoint technical experts having sufficient know ledge on phytosanitary and IT issues	Delay of Hub development due to technical incompatibilities	Adequate	Less likely	Operational capability of Hub during development	Low	Acceptable
3.	Lack of support from stakeholders (e.g. IPPC, participating countries etc.)	Delay or termination of Hub development	Lack of interest caused by problems associated with sufficient funding	Delay of Hub development	Adequate	Less likely	Progress associated with the Hub development	Low	Acceptable
4.	Misuse of funds allocated for Hub development	Delay of Hub development	Lack of knowledge and guidance provided by ESG	Delay of Hub development	Adequate	Less likely	Progress associated with the Hub development	Low	Acceptable
5.	Lack of cooperation from ESG members	Delay of Hub development	Differences in opinion	Delay of Hub development	Adequate	Less likely	Progress associated with the Hub development	Low	Acceptable
6.	Lack of guidance from IPPC	Delay of Hub development	Due to administrative changes associated with the IPPC Secretariat	Delay of Hub development	Ineffective	Possible	Progress associated with the Hub development	Moderate	Acceptable

Roles and responsibilities

Role	Assignee	Responsibilities
Business Owner	IPPC Bureau (on behalf of the CPM)	The group who initiated the project. The Bureau will take ownership of the deliverables and is responsible for implementing outputs and realising the benefits.
Project Sponsor	ePhyto Steering Group	The group who has ultimate accountability and responsibility of the project. Approves the project moving through the lifecycle. Oversees the business management and project management issues and provides support to senior levels.
Service Provider	United Nations International Computing Centre (UNICC)	This is the organisation chosen by the Project Sponsor to deliver the project outputs. Responsible for organising the project into tasks and managing the day-to-day aspects of the project.
Project Manager	IPPC Secretariat	To provide regular interaction with the Project Manager – pending STDF funding approval.
Business Change Owner	IPPC Secretariat	The budget holder of the STDF funding. Group who will own the project post implementation.

Clients/stakeholders

1. National Plant Protection Organisations (NPPO) of participating countries.
2. Commission on Phytosanitary Measures (CPM)
3. International Plant Protection Convention (IPPC)
4. CPM Bureau
5. ePhyto Steering Group (ESG)
6. Asia & Pacific Plant Protection Commission (APPPC)
7. APPPC ePhyto Working Group
8. Industry partners of participating countries
9. World Trade Organisation (WTO)
10. Standards and Trade Development Facility (STDF)
11. Regional Plant Protection Organisations (RPPO)
12. Food & Agriculture Organisation (FAO)
13. Association of South East Asian Nations (ASEAN)
14. North American Plant Protection Organisation (NAPPO)
15. European and Mediterranean Plant Protection Organization (EPPO)
16. Comité de Sanidad Vegetal del Cono Sur (COSAVE)
17. Inter-African Phytosanitary Council (IAPSC)
18. Near East Plant Protection Organization (NEPPO)
19. Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA)
20. Pacific Plant Protection Organisation (PPPO)
21. Communidad Andina (CA)

DELIVERABLES

Pilot approach

The ESG proposes a pilot approach for testing of the Hub and Generic System, to manage the large number of countries that may be ultimately directly involved. The ESG proposes 8-10 countries participating in the pilot.

The pilot will be conducted in the test environment, as a proof of concept, prior to 'going live' in the production environment.

For the pilot to be considered a success, it will require an assessment to determine if modifications are required prior to implementation.

Phases and milestones (subject to finalisation)

Phase/Milestone	Responsibility	Timeframe
Endorsement to develop Hub and Generic System	CPM 10	March 2015
Proposal to fund development of Hub and generic system	STDF	April 2015
Specifications development - final	ESG	September 2015
Determination of STDF funding	IPPC/ESG	October 2015
Request for tender – pilot Hub and generic system	UNICC/TBA	November 2015
Global ePhyto Symposium in Korea	Korea/ESG	November 2015
Select vendor for pilot	UNICC	January 2016
Commence pilot build	UNICC/TBA	February 2016
Complete pilot Hub and generic system build	UNICC/TBA	May 2016
Commence piloting of Hub and generic system	UNICC/TBA	July 2016
Pilot review	UNICC/ESG	December 2016
Hub and generic system – go live	UNICC/TBA	January 2017

Related projects and dependencies

- Funding approved from various bodies – the project should have operating funds for infra structure development (Hub) and capacity building. The lack of funding is a key factor that could impact the timely completion of this project.
- Harmonisation of terms and codes – the successful implementation of Appendix 1 to ISPM 12 requires further work on development of harmonised terms and codes. This work includes developing relevant phytosanitary subsets of larger code sets and the governance arrangements for maintaining lists (e.g. species lists) in a harmonised manner
- Several other Government-to-Government (G2G) certification bodies (e.g. CODEX, CITES, etc.) are also in early stages of developing eCertification solutions. There may be opportunities to work collaboratively and share development or hosting costs.
- World Customs Organisation (WCO) data model. The WCO Data Model is a set of data requirements that are mutually supportive and updated on a regular basis to meet the procedural and legal needs of cross-border regulatory agencies such as Customs, controlling export, import and transit transactions.

Constraints

- Lack of funds to develop the Global Hub if the funding approved by STDF will not be available
- Unforeseen technical barriers that need to be overcome by Hub developers
- Lack of developers who understand both the IT and phytosanitary elements
- Lack of adequate pilot participants
- Inability of pilot participants to follow the prescribed timeline

Assumptions

- The Hub will be piloted and tested in mid-2016
- Hub will have strong on-going support from all the stakeholders to ensure on-going sustainability
- ESG will be able to obtain funding from other sources for Hub development in lieu of STDF funding

GENERIC NATIONAL SYSTEM –SUMMARY OF SPECIFICATIONS

Overview

The ePhyto system consists of two main elements, production and receipt of ePhytos and an exchange mechanism. Exchange may be done through a Hub (as proposed under this project) or directly between NPPOs (point-to-point exchange).

The production and receipt of ePhytos can be done in many ways and will often be part of a national system for export certification and import. Countries that do not have an electronic national system for export certification and import will need one to participate in ePhyto. It would be most beneficial to develop such a system especially for developing countries so that they can also participate without major costs for development. Therefore the availability of a generic system is also part of the project.

A generic system will be made available to developing countries for use as their national system. The system could reside on a server used by the NPPO or could be web based and available on-line through secure access. Further details are available in Attachment A.

The Project Manager will assess existing systems (e.g. ASYCER developed by UNCTAD as a phytosanitary module) for use as a generic system but will also assess the need to develop a new purpose built option.

General business rules

The generic system will have the following functionalities

- Data entry for export certification
- Production of an ePhyto with data in the UN/CEFACT format and the contents according to ISPM 12, Appendix 1
- Issuance/authorization of the ePhyto
- Sending and cancelling of the ePhyto
- Printing of the phytosanitary certificate
- Receipt of ePhytos
- Validating the authenticity of the ePhyto received
- Extraction of data from the ePhyto
- Printing of the received certificate data on paper
- Store the ePhytos for later reference
- External validation of phytosanitary certificate issued by generic system (i.e. comparison of the paper certificate with the ePhyto)
- Defined user roles (e.g. Inspector) with in-country administration of those roles
- Connected to the Hub/other users of the generic system
- Provision of adhoc reports

Options for future modules

There are a number of other functions that could be built into the generic system. These modules will greatly increase the efficiency of the export process and can be developed once the initial system has been successfully piloted, deployed and reviewed for efficacy. These future options include:

- Industry to enter export details (including request for inspection)
- Export inspection records
- Cost recovery (charging) function
- Training modules
- Industry and/or inspectors to attach supporting documents (e.g. Treatment certificates)
- Compilation of historical volume and cost data of ePhytos for statistical assessments.

GLOBAL HUB - SUMMARY OF SPECIFICATIONS

Overview

These specifications will assist with developing detailed costings for Hub development and operations. Additionally, these specifications will assist countries with existing systems to assess required changes if they are interested in participating in the Hub.

The initial version of the Hub will provide basic exchange functionality. Improvements may be made overtime as processes improve and national systems develop greater harmonisation with Appendix 1 to ISPM 12.

Technical details of the Hub can be found in Attachment B - The Hub service.

Hosting services

The UNICC will be engaged to assist with the contract management of developing the Hub and the generic national system. The UNICC will also be engaged in hosting the Hub and the design and potentially hosting a web-based generic national system. The UNICC will also be responsible for the running of the pilot (e.g. development of the test plan) and draft the pilot review document for consideration by the ESG.

Pilot parameters

The pilot approach is an integral component of successful projects. It allows testing of the system, with a select number of participants, prior to going live in the production environment.

The objective of the pilot is to test the approach of a single point exchange system – harmonised exchange mechanism.   The harmonisation of message content (e.g. codes and message structure) is not part of the pilot.

The pilot will

- utilise a standardised exchange protocol through a single point exchange
- be conducted in the test environment
- involve 8 -10 countries, as available
- involve countries with a mix of existing national systems and the generic system
- test both Push and Pull from the Hub into the importing national system
- run over an initial period of six months
- be assessed upon completion prior to moving countries into production
- only be operational for set hours per day (i.e. not 24/7)
- ensure a balance of countries that can only send, only receive and those that do both
- maintain a transaction log
- provide ePhytos for the receiving NPPOs in a ´bag of envelopes'

Countries participating in the pilot will

- use their existing national systems with modifications, as required
- use the generic system, as required to create and/or receive ePhytos
- either have the Hub Push ePhytos into the national system or Pull ePhytos from the Hub
- use existing content of ePhyto messages
- provide national system support
- complete a pre-determined test plan (including documenting exchange issues)
- pay for their own participation costs, when using their existing national system
- complete a documented review of the pilot

The technical details of the standardised exchange protocol are summarised as

- UN/CEFACT schema v12B
- a single WSDL to support the operations of the Hub (send and cancel)
- exchange protocol of SOAP over HTTPS
- ePhytos Pushed into the Hub and either Pushed or Pulled from the Hub
- authentication of the service consumer (i.e. initiator of the transaction)will occur through SSL client certificates and the service provider (i.e. receiver) through HTTPS

General Hub business rules

- Use of the Hub is voluntary
- The Hub is a single point, multilateral system
- The Hub will be available 24/7, once fully operational
- No information (messages, transactions) should be lost
- There is a single exchange protocol
- The IPPC determines the version of UN/CEFACT schema in use, at a given time
- To exchange ePhytos through the Hub, participating countries will require a national system or must use the generic system
- An envelope is used to allow the Hub to send the message to the correct destination
- The reception of the message by the Hub, and the delivery of the message by the Hub to the destination are not synchronous
- The messages are kept in the Hub temporarily, until they are confirmed as received by the final destination
- The Hub will conduct verification on the transmitted ePhytos (envelopes only)
- The Hub doesn't validate the ePhyto (message) content. The privacy of the message content is maintained as only the destination NPPO has access to reading the message
- The Hub facilitates secure transfer of ePhyto data between countries
- Authentication will be used to ensure the identity of both sending and receiving NPPOs
- A scheduled change management process that is clearly defined which includes prioritisation of proposed scheduling windows will be used when giving effect to changes in schema or exchange protocols.

ePhyto standards

The use of the Hub will require a greater standard of harmonisation in the ePhyto message. The ePhyto should be based on agreed terms and codes, minimizing free text. To that end,

- Information about replacement should be in the ePhyto, and is not part of the transmission protocol
- The ePhyto will allow, where possible, code compatibility with Customs systems (i.e. tariff code)

Version of UN/CEFACT schema

UN/CEFACT schema v12B.

WSDL

The ESG supports the development of a single WSDL.

Exchange protocol

The ESG supports an exchange protocol of SOAP over HTTPS.

Exchange mechanism

The Hub will accommodate the Pushing of an ePhyto from the NPPO of the exporting country to the Hub.

Retrieving messages from the Hub can be done in two ways; 1) Pushed by the Hub to the receiving NPPO or 2) Pulled by the NPPO from the Hub.

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The service consumer (sender/transaction initiator) identity is guaranteed through SSL Client Certificates. The service provider (receiver) identity is guaranteed through HTTPS protocol.

Message signature

The ESG recommends that the use of a message signature is unnecessary at this time. This is an additional requirement which may be considered for future inclusion.

Testing

A testing environment will be required to allow countries which have not been participating to join the Hub.

The UNICC will provide a standard test plan for countries to join the Hub.

Some countries already utilising the Hub will be involved in the testing process from a send and receive perspective.

GLOBAL HUB - ANALYSIS OF OPTIONS

In determining the specifications, the ESG considered:

- Input from the Technical Working Group
- A Global ePhyto Feasibility Study

A key, underlying principle is to first develop a simple version of the Hub, to allow uptake and participation, which can have additional features and complexity built-in over time. The ESG has sought to propose a design for the Hub that will support the objectives intended in implementing Appendix 1 of ISPM 12 and also to avoid additional obligations above what is currently required with paper phytosanitary certificates.

The work to achieve harmonisation of ePhyto content (e.g. code sets) is also a critical dependency in realising the intended benefits and outcomes of the harmonised implementation of ePhyto.

Service provider

The UN International Computing Centre (UNICC) is the leading provider of Information Technology and Communications (ICT) services within the United Nations System. ICC Services are available to any Organization of the UN System including Programmes and Funds, Specialised Agencies and other UN entities. Currently, there are more than 35 partner organisations located in more than 12 different locations.

The UNICC will be able to provide the following services to the IPPC for ePhyto:

- System design
- Data centres for hosting services
- Enterprise backup
- System performance monitoring
- Physical platforms (storage option for countries)
- Support services (help desk)
- Training services

It is also worth noting that the UNICC makes no commercial profit and has no expenditure in marketing or publicity. As a cooperative, UNICC operates on a cost-recovery basis. One UNICC competitive advantage rests with its ability to drive down service costs through generating economies of scale.

Recommendation: Engagement of the UNICC (through a MOU with the IPPC/FAO) to fulfil the role of project manager, to provide infrastructure services (e.g. hosting service of the Hub) and to manage the development of the generic national system. The UNICC offers the level of security that IPPC contracting parties expect in the development of the Hub.

Version of UN/CEFACT schema

Extensible Mark-up Language (XML) is an internationally recognised language used to produce documents in a format that is both human-readable and machine-readable. XML is a textual data format that is standardized to allow communication between different computer systems and usability over the Internet. XML is widely used.

UN/CEFACT provides consistent XML schema to ensure standardization of exchange in certificate data. The ePhyto format (as per Appendix 1 to ISPM 12) is based on the UN/CEFACT XML schema with guidance on placing all elements of a phytosanitary certificate in a harmonized way in the schema.

Recommendation: The Hub will be built based upon UN/CEFACT schema v12B which includes considerations for re-export phytosanitary certificates.

Single WSDL

The Web Services Description Language (WSDL) is an XML-based interface definition language that is used for describing the functionality offered by a web service. In the simplest sense, the WSDL is the message language used for systems to communicate through a web service.

A point-to-point exchange system requires a separate WSDL to be developed and agreed upon as part of the bilateral agreement between NPPOs.

Recommendation: The Hub should be built based upon a single WSDL which may also be of benefit countries with existing bilateral agreements for exchange.

Exchange mechanism - secure SOAP and/or secure SMTP (into the Hub)

There are currently a number of potential exchange mechanisms in use for electronic certification exchange. The Hub could be designed to support SOAP over HTTPS (Web services) as well as Secure SMTP (Secure Mail).

Recommendation: To allow easier adoption of the Hub, the ESG concluded that a single method should be used for getting the ePhyto to the Hub from the national system. The ESG proposes using only SOAP over HTTPS as developing and maintaining both options will be too expensive. Furthermore, countries with existing exchange agreements use SOAP over HTTPS. Using a SOAP exchange protocol results in certificates being Pushed to the Hub. To Pull the message (certificate) into the Hub would be more expensive and does not align well with a post office box analogy.

Exchange mechanism - Push and/or Pull (out of the Hub)

The Hub could potentially support either Push or Pull as a method to retrieve messages. The retrieval method therefore could be selected by the NPPO.

The ESG considered whether to allow both methods or use only one. A Technical Working Group member noted that the Pull method is easier to implement and demands less resources. On the other hand, the members of the TWG also noted that the Push method operates better in some scenarios (e.g. land borders).

Recommendation: To facilitate more country participation, the ESG concluded that both Push and Pull should be options to get ePhytos from the Hub to the national system of the NPPO of the importing country.

Exchange mechanism - SOAP-Push requirements

Push and Pull exchange mechanisms have different requirements for implementation. SOAP-Push combination requires the following elements.

From the Hub:

- Implementing receiveMessage service
- Provide a HTTPS URL where the receiveMessage operation is conducted
- Giving an HTTPS URL requires an SSL certificate in the server
- Having an exceptional procedure in case the service is not available
- Implementing a receiveMessage client to consume the receiveMessage operation provided by the national system
- An SSL client certificate is required to consume the receiveMessage provided by the national system in a manner that assures identity of the Hub.

From a national system:

- Implementing a receiveMessage client to consume the receiveMessage operation provided by the Hub
- An SSL client certificate is required to consume the receiveMessage provided by the Hub in a manner that assures the identity of the national system
- Provide an HTTPS URL where the receiveMessage operation is conducted
- Providing an HTTPS URL requires an SSL certificate in the national system server.

The exporting country's national system acts as service consumer when it puts the message into the Hub and the Hub acts as service provider. When the message is sent to the importing country's national system, the Hub is the service consumer and the national system is the service provider. This defines a system where the NPPO of the exporting country Pushes the message to the Hub and the Hub Pushes the message to the NPPO of the importing country (i.e. the "Push-Push" mechanism).

Exchange mechanism - SOAP-Pull requirements

SOAP-Pull combination requires the following elements

From the Hub

- Implementing receiveMessage service
- Gives an HTTPS URL where the receiveMessage operation is provided
- Providing an HTTPS URL requires an SSL certificate in the server
- Having a "dataRequirement" message available with its pertinent schema
- Having an "acknowledgement" message available with its pertinent schema. This is an ACK (signal from the receiving NPPO to the Hub) necessary for deleting the transferred message from the Hub

From a national system

- Implementing a receiveMessage CLIENT to consume the receiveMessage provided by the Hub
- An SSL client certificate is required to consume the receiveMessage provided by the Hub such that the identity of national system is assured.

In this case, the exporting country's national system acts as service consumer when it puts the message into the Hub and the Hub acts as service provider. When the message is sent to the importing country's national system, the national system also acts as service consumer and the Hub as service provider. This defines a system where the NPPO of the exporting country Pushes the message to the Hub and the NPPO of the importing country Pulls the message from the Hub (i.e. the "Push-Pull" mechanism).

Definition of operations

Considering the functions of the Hub, basic operations will be:
- Sending ePhytos
- Cancelling ePhytos

In the future, other functionality, like notifications of rejections, requesting replacement certificates, etc., could be added to the ePhyto system functionality. No changes to the Hub would be required.

The use of these two functions, and the potential impact on current national systems, will be assessed as part of the evaluation of the pilot phase.

Definition of the envelope

The ePhyto itself (XML message) is contained in an 'envelope' to ensure it arrives at the correct destination country. The information on the electronic envelope needs to be consistent to ensure delivery, just as it is on a traditional paper envelope. The Hub will 'bundle' numerous envelopes for an NPPO into a 'bag', such that the NPPO will receive all available envelopes at one time.

Recommendation: The ePhyto envelope will require
- Certificate number
- Message type
- Message version (e.g., ePhyto schema version)
- Sender Id, Receiver Id (ISO codes – code only)
- and the message itself.

Authentication mechanisms

Authentication is the mechanism by which systems are validated to ensure that they are able to have access to send and/or to receive electronic certificates. Authentication commonly occurs through digital certificates or users/passwords that are allocated to the system (as you do with an individual user).

Currently, the Hub definition supports authentication through SSL client certificates. If user/password authentication is required, this mechanism could be added in near future.

Authentication through user/password has also been taken into account, but the ESG concluded that authentication of the sender through SSL client certificates is securer and easier. There is a lack of standards to distribute and to store passwords in a secure form but, there are widely known mechanisms to distribute and securely store SSL client certificates.

A separate authentication service to maintain the authentication mechanism was also discussed but discounted. The delegation of authentication to another authority was seen to be controversial.

Recommendation: The Hub should be developed using SSL client certificates as a single authentication method for simplicity and cost minimisation. This is also a service that the UNICC can provide.

Authentication mechanism summary

Authentication of the service consumer (i.e. initiator of the transaction) will occur through SSL client certificates and the receiver (i.e. receiver of the transaction) through HTTPS.

Service	SSL client certificate - Consumer	HTTPS - Provider
Push into Hub	Exporting NPPO	Hub
Push from Hub	Hub	Importing NPPO
Pull from Hub	Importing NPPO	Hub

Transactional information to be stored by the Hub

There will be a need for the Hub 'server' to store a minimal amount of transactional information for traceability and potential charging purposes.

Recommendation: The Hub should store the following, minimal transactional information

- Sender Identification
- Receiver Identification
- transaction date and time
- Transaction Id
- List of Single Messages Information

There may be other information that the service provider considers necessary, which the ESG will consider.

Signed acknowledgment (non-repudiation of the receiver)

A 'signed acknowledgment' is an option that could protect the sender against the false assertion that the receiver did not receive the message. However, it does represent an obligation beyond what is prescribed for paper certificates and requires the extra step of a SSL certificate to implement it and is not entirely necessary for the Hub to function

Recommendation: The ESG concluded that the signed acknowledgement is therefore not necessary as it implies a new obligation for the NPPOs and makes the process more difficult.

Message signature

The options of a 'message signature' ensures that the message content cannot be altered, the certificate maintains its 'original' status. The authenticity of the message is ensured only through a secure transmission of the message. A digital certificate is required to implement it.

Message signature could be a critical issue for having a fully paperless exchange, especially when considering how to store an ePhyto for re-export in an electronic manner. NPPOs could send the messages to a private party, other organisations or other NPPOs (re-exports) without losing the authenticity of the message.

Recommendation: The use of a message signature is not considered necessary at this time; but will be reviewed following the pilot phase.

Message encryption

The ESG acknowledges the intention of the CPM to have messages encrypted during their temporary storage in the Hub for reasons of privacy, such that the information of the message is not being publicly available to other parties. The privacy of the message could be achieved through encryption.

However, under this proposal, the privacy of the message (ensuring that only the receiver is able to read the message) is ensured through an agreement with the Hub provider. Once the message is delivered to the NPPO of the importing country, it is the functionality of the Hub to delete the message and thereby maintain the privacy of the message. Encryption during temporary storage is technically difficult to achieve and does not add to the privacy of the message.

During the pilot phase of the Hub the messages will not be encrypted during temporary storage but the privacy is assured as described above. This will be evaluated after the pilot. Countries that would like to have nevertheless the messages encrypted in the Hub could send encrypted messages if the receiver is able and willing to decrypt the message.

Encryption is potentially only needed for the period of time when the message is at the Hub as the exchange of the message between the NPPO and the Hub is protected. Access to the message by a third parties when the message is at the Hub should be guaranteed by the Hub provider. Access to the message by third parties when the message is in the national system should be guaranteed by the national system.

Recommendation: It is therefore not necessary to encrypt the message itself. Encryption is done to avoid hackers reading the message. However, since HTTPS is used as the transmission protocol, it should avoid "man in the middle" attacks.

ATTACHMENT A - GENERIC NATIONAL PHYTOSANITARY SYSTEM

A generic national system allows countries without existing systems to participate in the electronic exchange of phytosanitary certificates. The system would be role-based and its basic features have been identified below. Furthermore, the system should only allow accessing the information that was produced or destined to an individual participating in the system. For example, a NPPO should be permitted to only obtain reports or view certificates that were issued by the NPPO or delivered to the NPPO. Similarly an exporter should only be able to obtain information regarding certificates produced for the exporter. Once functional, additional features could be added which are detailed below.

Basic requirements
    A. Must be compatible with IPPC – ISPM12 electronic certification (including Appendix 1)
    B. Must be able to exchange phytosanitary certificates with other participating countries
    C. Must be able to prepare certificates in both electronic and paper format
    D. Must be able to dynamically create users. The authorization of the user should be decentralized in different roles (not only the Administrator)
    E. Must be able to guarantee the identity of the sender of an ePhyto (via the Hub)
    F. Must be able to send, receive and store ePhytos(files) through the official exchange/s mechanism/s. (i.e. via the Hub)
    G. Must be able to store phytosanitary information of the received certificates. (They could be translated ePhytos or certificates created in the generic system)
    H. Must include as certificate validation function (e.g. security features – CAPTCHA) for receiving parties

Roles
Industry – companies should be able to access the generic system and apply for phytos in their country of export. Each company should register with the system and should be approved by the NPPO in the country of export. Company staff should be able to view information pertaining to their company only. Once the company is approved, they should be able to add and remove users without further NPPO approval. Industry should have at least two roles:

    A. **Company administrator**
        a. Registers the company with the NPPO
        b. Add additional users to the company
        c. Delete users from the company
        d. All features described in "B. Company user" below
    B. **Company user**
        a. Enters data to apply for phytosanitary certificates
        b. Views copies of completed phytosanitary certificates
        c. Deletes applications for phytosanitary certificates (in "pending" status)
        d. Views and edits the relationships with other companies providing commodities for certification
        e. Adding, changing or deleting an importer in a list of approved sources
        f. Adding, changing or deleting information about (e.g. a commercial address) an importer
        g. Reviewing only the ePhytos requested by the company

Generic system administrator –involved in the maintenance of "Master Data" lists of the generic system. The generic system administrator should be responsible for the initial set up of any participating countries.

The system should also include **IPPC administrators** (plant administrator, pest administrator, etc.) responsible for updating specific information in the generic system as harmonisation is improved or new terms added. The IPPC administrator should possess specialized knowledge and area expertise.

NPPO – each NPPO needs to work with the generic system administrator for initial set up of the system within their country.

A. **NPPO administrator**
   a. Sets up the NPPO account on the generic system
   b. Creates additional users or amends the status of users on the system
      i. Has the flexibility to add additional users as administrators, inspectors, basic NPPO users, or company administrators
   c. Deletes users from the system
   d. Amends information entered by the inspector
   e. And possesses all functions of the inspector
B. **Inspector**
   a. Completes certificates based upon applications by exporters which may include inputting some inspection details, additional declarations, and treatment information
   b. Rejects an application for an ePhyto
   c. Creates an application
   d. Lists and searches for previously issued certificates
   e. Lists and searches for certificates for imported consignments
   f. Cancels an ePhyto issued by the NPPO
   g. Prints paper versions of ePhytos issued and sends ePhytos (automatically when the certificate has been authorised)
   h. Runs printable reports on certificates issued and received
   i. Runs other reports (1-2 static reports - survey participants in the generic system to determine what is most important)
C. **Basic NPPO user**
   a. View information
   b. Input data, but not actually complete certificates

Possibilities for future enhancements. Depending on cost, the industry components mentioned above could also be added as a future enhancements. The inclusion of industry components could add cost recovery options which may be a cost effective model at implementation. Some countries however have estimated that the small volume of certificates issued under a generic system by some countries may not offset the costs of including industry components.

Future improvements could include:
A. Report enhancements
B. Fee collection
C. Repository for foreign requirements
D. Training modules
E. Pre-issuance activities (e.g. importing country requirements, inspection of consignment module, request for inspection, addition of supporting documents)
F. Other post certificate issuance activities (e.g. combining or splitting certificates)

ATTACHMENT B- THE HUB SERVICE

Overview

The Hub should only provide one service, a **receiveMessage(envelope)** service. This service should:

1. Ensure the identity of the service consumer (initiator of the transaction)through SSL client certificates

2. Ensure the identity of the service provider (receiver) identity through HTTPS

3. Use an envelope to achieve the exchange

4. Be configurable to allow both Push and Pull methods to retrieve messages

5. Be highly extensible to expand functionality without the Hub provider having to make changes to the service

Different funtionalities can be achieved with different kinds of messages. Only **ePhyto Delivery, ePhyto Cancellation, dataRequirement, heartbeat, acknowledgment, response are required in initial setup**. These different messages must be accompanied by different XML containing different information. Such a structure allows for a highly extensible service.If it is necessary to develop new functionality, NPPOs can agree to the new kinds of messages and XMLs without the need for the Hub provider to make adjustments to the system

In almost all messages the Hub only receives the message from the sender and sends it to the receiver. But with "**dataRequirement**", "**heartBeat**" and"**acknowledgement**" message, the Hub not only receives and sends messages but also reacts as a consequence.

ReceiveMessage service
The service can be used for all communications (delivery of an ePhyto, cancellation of an ePhyto, datarequirement, acknowledgements, heartBeats, or any others required in future). Examples of all the scenarios are provided below.

The service provides a way to send an envelope, and within the envelope a message which includes: the sender identification, the receiver identification, etc. This service must be published by the Hub and by national systems configured as Push.

General definitions

- The exchange is conducted through SOAP
- The authentication of the service consumer (initiator of the transaction) of the exchange is done through SSL client certificates.
- An envelope is used to achieve the communication. The message is wrapped in another XML containing only the basic information to achieve the exchange (the envelope)
- Push and Pull are allowed to achieve the exchange. A NPPO must choose Push or Pull to retrieve messages when the NPPO joins the Hub. Push is achieved by having a special message called a "dataRequirement" transferred from the NPPO of the importing country to the Hub.
- Highly extensible. Only one service is required: receiveMessage. If it is necessary to have additional functionality, the NPPOs can agree on new kinds of messages and new XMLs, without requiring changes to the Hub

- The messages only need to be held in the Hub until they are sent to the final destination (or the final destination takes the messages), and the reception is confirmed
- The Hub must maintain a log of transactions including: transactionID, senderId, receiverId, currentDateTime, messageID, listOfSingleMessagesInformation, and any other information that the provider may deem necessary

All communications are by way of exchanging an envelope (or multiple envelopes in a single transaction = 'bag' of envelopes).

Information components
For each message to be exchanged, an XML schema with the information to be exchanged needs to be defined.

Envelope
Envelope = XML message that contains the **MessageType, MessageVersion,** the **CertificateNumber** if it is possible (it depends on the message type), the **SenderID**, the **ReceiverID,** the **Message** itself.

MessageType = A String to distinguish between different kinds of messages.

SenderID = The ID for sending given by the Hub when the NPPO joins

MessageVersion = the version of the XML schema used in the message (depends of the message type, this is not only the version of the SPSCertificate schema)

ReceiverID = Id for receiving given by the Hub when the NPPO joins

CertificateNumber = Number of the Phytosanitary Certificate to be issued or cancelled.

Message = an XML message for an ePhyto (compliant with the Appendix 1), or cancelation data (e.g. an ePhyto with the "Canceled" in the message).

Response
The content of the response by the Hub depends on the type of request. In general, the response will be a bag of envelopes for the requestor or an exception.

Bag of envelopes
The structure of the bag should contain a list of the envelopes in the message. The structure of the bag should be the same as the structure of the envelopes within the bag. It has a transaction id instead of a certificate number.

Acknowledgement
The acknowledgement which indicates receipt of the message should contain the transaction ID which has been received. The acknowledgement could be an XML schema, but if the only information needed is the transaction ID, it could be inserted directly into the envelope (that contains the acknowledgement).

DataRequirement
A dataRequirement schema is not needed, the messageType = dataRequirementType in the envelope.

HeartBeat
A heartBeat schema is not needed, the messageType = heartBeatType in the envelope.

Basic service operations

1. Hub functionality
2. Send a message to the Hub
3. Receive/retrieve a message from the Hub
      a. Push a message from the Hub
      b. Pull a message from the Hub

1. Hub functionality

The Hub needs to

- Implement the receiveMessage service. The service must be implemented with SOAP over **HTTPS.**
- Implement client to consume the receiveMessage service provided by the national system (only for retrieving through Push option).
- An SSL client certificate is required for the Hub to consume the receiveMessage provided by the national system such that the Hub identity will be ensured.

The National System needs to

- Implement client to consume the receiveMessage service.
- An SSL client certificate which ensures the client identity is required for the national system to consume the receiveMessage provided by the Hub
- Implement the receiveMessage service (only for retrieving through Push option). The service must be implemented with SOAP over HTTPS.
- Provide the HUB provider with an HTTPS URL where the receiveMessage operation is incorporated (only for retrieving through Push option).

Only one operation is required from the Hub service: **receiveMessage** (Envelope envelope)

Exception handling - HeartBeat message

1. The Hub receives a **receiveMessage (envelope)** request.
2. The Hub validates the **envelope** format. If the **envelope** format is not valid, it throws an exception (InvalidEnvelopeException). If it is valid, it continues to the next step.
3. The Hub looks at the **envelope. messageType**.
   When the Hub receives a an envelope it holds or sends the envelope to the receiver NPPO.
   When the Hub receives a "**dataRequirement**" or "**heartBeat**" it has higher responsibility to react in response.
   In this case, the Hub receives a "**heartBeat**" messageType
4. The Hub checks if the NPPO has chosen **Push** as retrieving method. If the NPPO has not chosen **Push**, an Exception is returned (InvalidMessageIdException). Otherwise it continues to the next step
5. The Hub looks for messages (the original envelopes) directed to the requestor NPPO marked as "sending failed".
6. The Hub creates a **bag of envelopes** with all the retrieved messages
7. The Hub creates **a XML response with the bag of envelopes** inside

8. The Hub sends a SOAP response containing the response
9. The Hub saves transaction information
10. Once the Hub receives an "acknowledgement" message, from the NPPO (See "Send a message to the Hub"), the Hub saves transaction information (of the acknowledgment) and deletes the envelopes that have been sent.

Diagram1. Services published by the Hub(and by NPPOs National systems configured as Push)
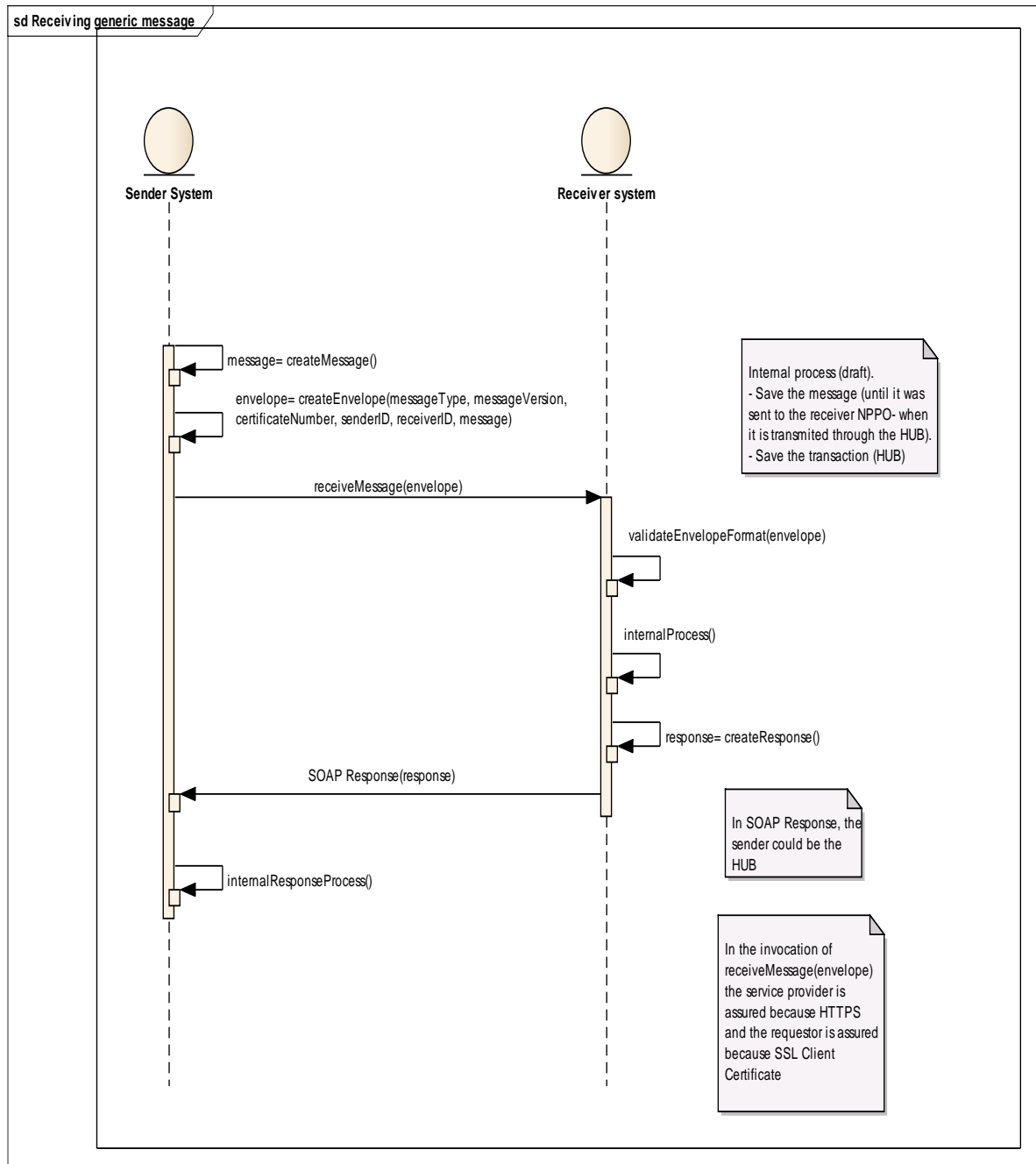
2. Send a message to the Hub

1. The NPPO of the exporting country "generates" the **message**
2. The NPPO then puts the **message** into an **envelope** to send it. This envelope is also an XML document that contains: the **message type** (in this case the type is "**ePhytoDeliveryType"**), the **message version** (in this case the SPSCertificate schema version), the **certificate number**, the **NPPO of the exporting country Identification**, the **NPPO of the importing country identification** and the **ePhyto** itself.
3. The service **receiveMessage (envelope)**, published (in this case) by the Hub is invocated through HTTPS to ensure the identity of the receiver. That is, ensures that the Hub will receive the message (it ensures the service provider ID).
4. The service consumer identity (initiator – NPPO of the exporting country) is ensured through the SSL client certificate. If the **service consumer is not valid,** the communication is not established.
5. Internally, the Hub implements the **receiveMessage** method by:
   I.   **Validating the envelope** format. If the **envelope** format is not valid, it throws an exception (InvalidEnvelopeException). If it is valid it continues to the next step
   II. Looking at the envelope.messageType. If it is not "dataRequirement" or "heartBeat", it continues to the next step or follows the steps in "dataRequirement (Pull- Retrieving messages to the Hub through SOAP (HTTPS) or heartBeat section".
   III. Holding the **envelope** until it is delivered to the NPPO of the importing country.
   IV. Saving the Transaction data.
   V.   Preparing a XML response with a successful or unsuccessful response.
   VI. Putting the XML Response into a **SOAP response**.
6. The NPPO of the exporting country receives the SOAP response.
7. The NPPO of the exporting country conducts internal processing and will mark the message as sent.

At this point the message is in the Hub - the next step would be to send the message to the NPPO of the importing country. It could be done by a different method (it could be asynchronous) or through a Push method or a Pull method.

Diagram 2 - Sending an ePhyto from the NPPO of the Exporting Country to the Hub
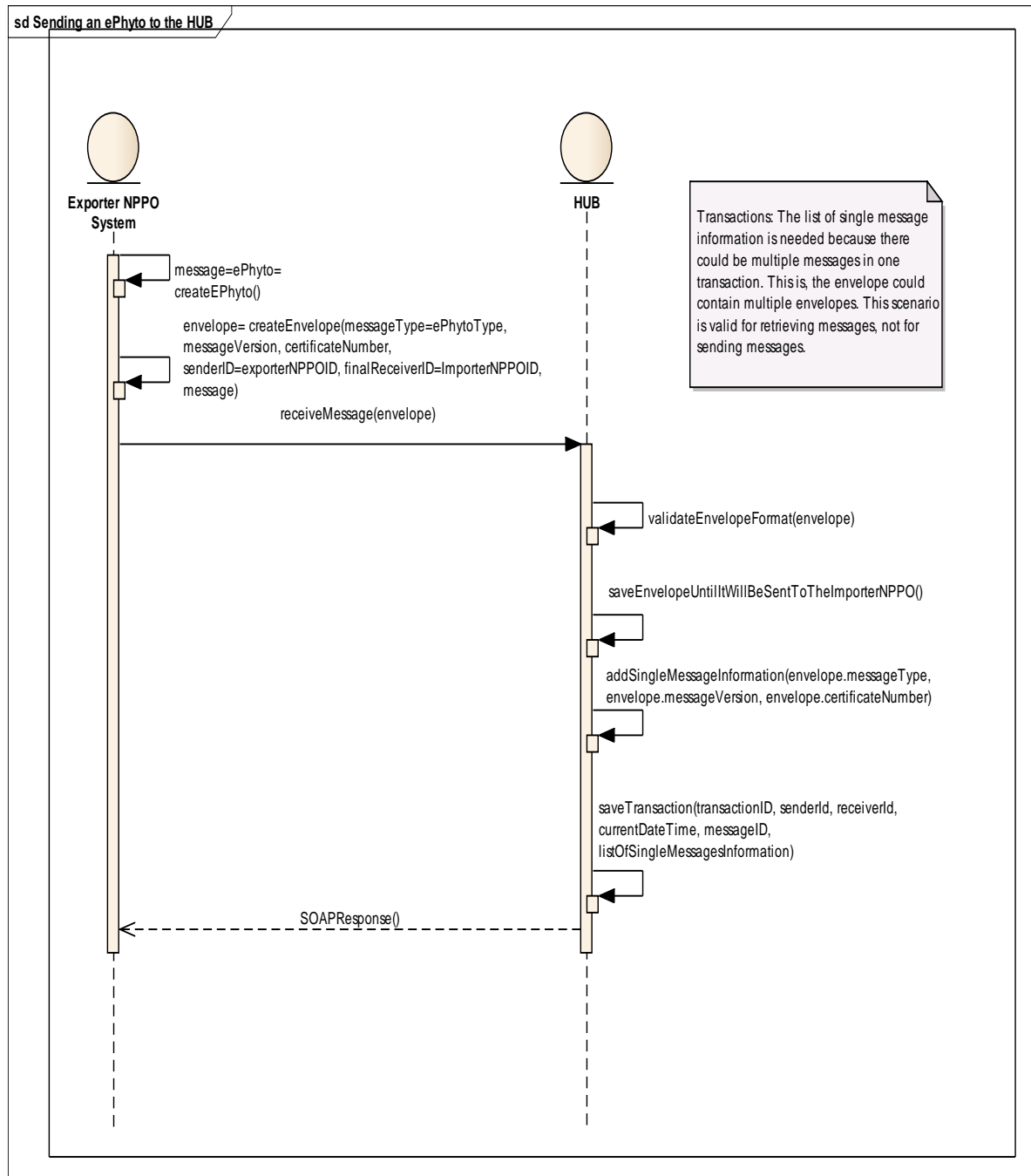
3. Receive/retrieve messages from the Hub

There are two options to receive or retrieve messages (bag of envelopes) from/to the Hub:

a) If the NPPO is configured as Push for receiving messages from the Hub, the Hub sends the Bag of Envelopes to the receiver NPPO immediately or when the Hub believes that it is appropriate. See **"3A.Receiving messages from the Hub - Push a message from the Hub".**

b) If the NPPO is configured as Pull for retrieving messages from the Hub, the Hub waits for a "dataRequirement". See **"3B. Retrieving messages from the Hub- Pull a message from the Hub"**

3A. Receiving messages from the Hub - Push a message from the Hub

The Hub sends the messages to the NPPO as receiver immediately or when the Hub believes that it is appropriate.

1. The Hub looks for the messages to be sent to the importing NPPO; these messages will be **envelopes** (the original ones). It could be done immediately after receiving the message or as configured.
2. Once the **envelopes** are found, a new **bagofenvelopes** containing all the information necessary for the communication (including the single messages to be sent).
3. The Hub looks for the URL of the Service – which will be given by the NPPO when it joined the Hub.
4. The service **receiveMessage (bagofenvelopes)** provided (in this case) by the **NPPO of the importing country** is invocated through HTTPS. This ensures the identity of the server, that is, it ensures that the NPPO of the importing country will receive the message (it ensures the service provider ID). Where the service is not available when the Hub sends the message to the receiver NPPO, the **exceptional procedure** described below is followed.
5. The service consumer identity (initiator – Hub) is ensured through the SSL client certificate. If the **service consumer is not valid,** the communication is not established.
6. Internally, the Importer country implements the **receiveMessage** method follows:
   I. **Validates the envelope** format.
   II. Obtains the **listOfSingleEnvelopes** from the received **bagOfEnvelopes**.
   III. The NPPO of the importing country makes other internal processing, for example, it marks ePhytos as received.
7. The Hub receives the **SOAP response**.
8. The Hub saves transaction data and deletes the envelopes which have been sent.

The **exceptional handling procedure** follows after the Hub tries to send the message X times (X is configurable) over a specified period of time (also configurable). If the message cannot be sent after these efforts, the message must be marked as "sending failed". Once the service is available, the receiver NPPO should send a "heart beat" message to the Hub. When this message is received by the Hub, the Hub will retry sending all messages marked as "sending failed" to the NPPO.

Regardless of whether the Push/Pull method is used, if one message is held by the Hub for longer than a specified period (configurable), the System Adminstrator should be notified, so that the NPPO can be contacted to obtain information as to the reasonwhy the service is unavailable and what interim actions are to be taken.

Diagram 3A – Receiving messages from the Hub– Push method
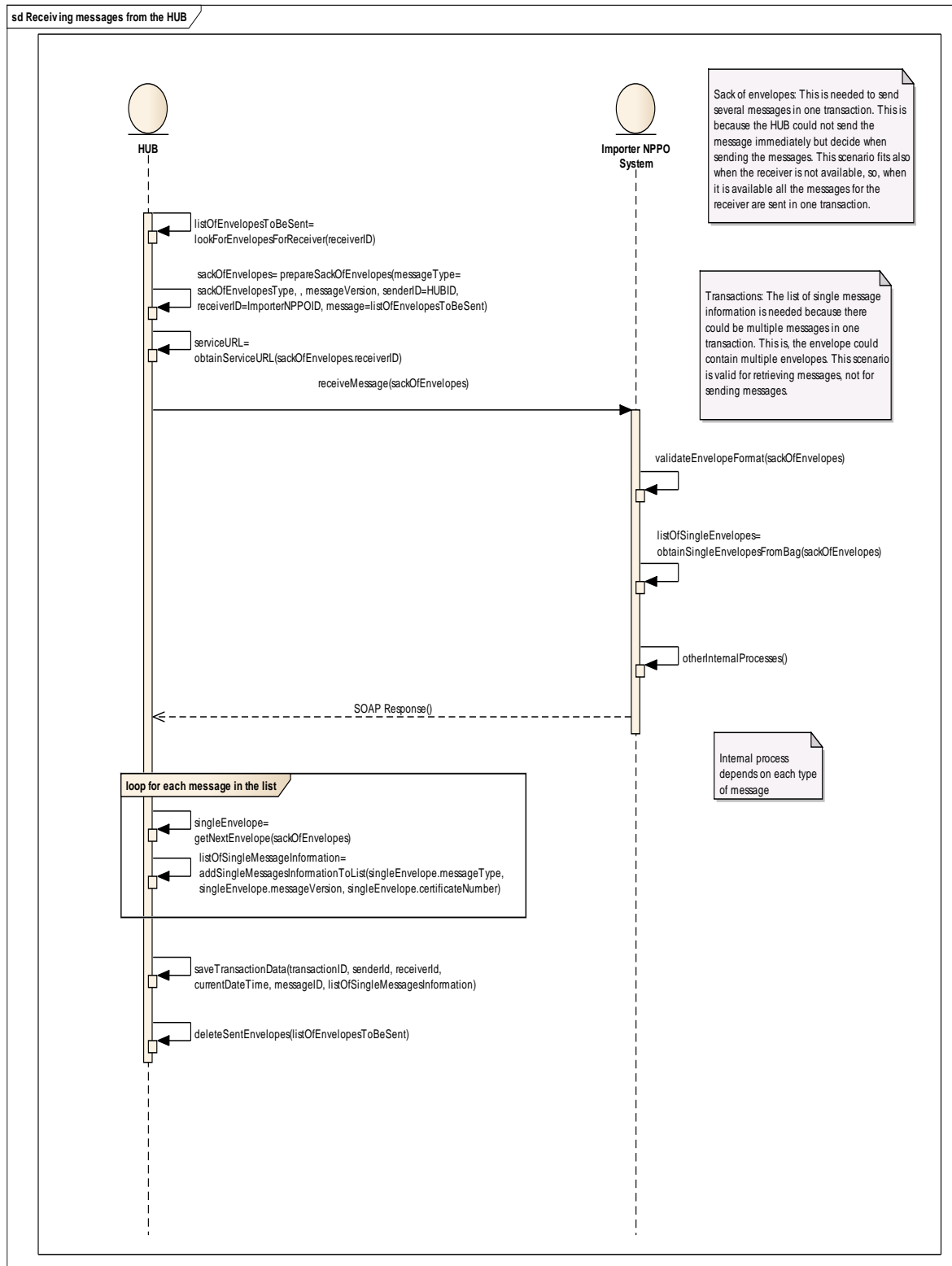
3B. Retrieving messages from the Hub - Pull a message from the Hub

This method is not only used to retrieve ePhytos, it is also used to retrieve cancelations, or any other information that could be exchanged in the future.

1. The NPPO, which needs to retrieve its messages from the Hub, "generates" the "XML of Requirement" document. In the diagram it is called **message** or **xmlRequirementData**.
2. Once the **xmlRequirementData** is generated, it is necessary putting the **message** in an **envelope** in order to send it. The envelope is also an XML document that contains: the **message type** (in this case the type is "**dataRequirementType**"), the **message version** (in this case the dataRequirement schema version), the **requestor NPPO Identification**, the **Hub identification** and the **request message** itself.
3. The service **receiveMessage (envelope)** is published, in this case, by the **Hub** and invocated through HTTPS. This ensures the identity of the service provider - that is it ensures that the Hub is who will receive the message. The service **consumer identity** (initiator – Importing NPPO) is ensured through the SS**L cl**ient certificate. If the **service consumer is not valid, t**he communication is not established.
4. Internally, **the Hub implements the receiveMessage** method in this way:
   I. Val**idat**es **the envelope** format. If the **envelope** format is not valid, it throws an exceptio**n (InvalidEnvelopeException).** If it is valid it continues to the next step
   II. The Hub look**s into the envelope (or the Hub looks at t**he **envelope.messageType**) to obtain the **messageType**; in this case should be "**dataRequirement**". The Hub checks if the NPPO has chosen a **Pull** method for retrieving ePhytos. If the NPPO hasn't chosen **a Pull** method an exception is returned (InvalidMessageIdException). Otherwise it continues with the next step
   III. Then, the Hub must look for the messages to be sent; these messages will be **envelopes** (the original single envelopes directed to the service consumer NPPO), and creates a **listOfEnvelopes** with these messages.
   IV. The Hub creates a **bag of envelopes** containing all the information necessary to achieve the communication (including the list of envelopes to be sent).
   V. The Hub creates a XML response with the bag of envelopes inside or with the exception.
   VI. This response created in the previous step will be the SOAP response.
5. The Hub saves the transaction information.
6. An "acknowledgement" message is sent from the NPPO to the Hub upon receipt of the Bag of envelopes (See **Send a message to the Hub)**. Upon receipt of the "acknowledgement" message, the Hub saves transaction information for the acknowledgement and then deletes the envelopes that have been sent

Diagram 3B - Retrieving messages from the Hub – Pull method

sd Retrieving messages from the HUB

NPPO System

HUB

message=xmlRequirementData= createRequirementMessage()

singleEnvelope=
createEnvelope(messageType=messageRequirementType,
messageVersion, requestorID, receiverID=HUBID, message,)

receiveMessage(singleEnvelope)

Sack of envelopes: This is needed to send several messages in one transaction. This is because the HUB will send all the available messages for the requestor.

It is not only for sending ePhytos, it doesn't matter what kind of message the envelope contains

Transactions: The list of single message information is needed because there could be multiple messages in one transaction. This is, the envelope could contain multiple envelopes. This scenario is valid for retrieving messages, not for sending messages.

validateEnvelopeFormat(envelope)

listOfSingleEnvelopes=
lookMessagesToBeSent(requestorID)

sackOfEnvelopes=
prepareSackOfSingleEnvelopes(messageType=
sackOfEnvelopesType, , messageVersion, senderID=HUBID,
receiverID=RequestorID, message=listOfSingleEnvelopes)

saveTransaction(transactionID, senderId, receiverId,
currentDateTime, messageID,
listOfSingleMessagesInformation)

xmlResponse= crearResponse(sackOfEnvelopes,
transactionID)

SOAPResponse(xmlResponse)

ACK= createAcknowledgement(transactionID)

singleEnvelope=
createEnvelope(messageType=acknowledgementType,
messageVersion, senderID, receiverID=HUBID, message=ACK,)

receiveMessage(singleEnvelope)

listOfRecognizedEnvelopes=
getListOfEnvelopesAsociatedToTransaction(transactionID)

loop for each message in the list

singleEnvelope=
getNextSingleEnvelope(listOfRecognizedEnvelopes)

listOfSingleMessagesInformation=
addSingleMessagesInformationToList(singleEnvelope.messageType +
"ACK", singleEnvelope.messageVersion,
singleEnvelope.certificateNumber)

saveTransaction(transactionID, senderId, receiverId,
currentDateTime, messageID,
listOfSingleMessagesInformation)

deleteSentEnvelopes(listOfRecognizedEnvelopes)

SOAPResponse()