White Paper

“Air Cargo - Digital Connectivity and Data Exchange Methodologies”

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01	Initial Draft	22-Feb-2016	S. Tahir Hasnain (IATA)
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06			
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1. Purpose

The purpose of this paper is to serve as a guide for the air cargo industry towards efficiently connecting and exchanging digital information with business partners across the supply chain. This paper reviews the various digital connectivity methodologies and outlines challenges associated with each method.

This paper specifies basic component digital framework and identifies gaps by analyzing its deployment in air cargo. Finally, this paper reemphasizes the need for standardized business processes for air cargo digital framework. It also establishes the guidelines that are instrumental in addressing existing challenges as well as facilitating the adoption of modern technology.

2. Target Audience

This document is intended for air cargo stakeholders who are directly or indirectly involved in digital connectivity and data exchange. These include carriers, freight forwarders, ground handlers, shippers, custom authorities, IT/messaging service providers and international organizations including IATA.

3. Background

Electronic data interchange has played a significant role in allowing the air cargo industry to operate more efficiently. Traditionally, the airline industry has relied on proprietary networks for digital data transmission such as Type B network. Different systems (both internal and external) are interconnected using these networks and exchanging information using IATA standard messages such as C-IMP and Cargo-XML. The proprietary networks provided a secure, reliable and real-time information exchange. For operational purposes, these networks support the instant messaging requirements in all business areas such as passenger, cargo, and baggage etc.

While these proprietary networks supported the airline industry business processes very well, recent modernization of the internet and new technologies have challenged the proprietary networks and exposes their many shortcomings and weaknesses. For example, Cargo-XML standards are not supported over Type B network. As the airline industry begins to gradually embrace modern technology it is inevitable that they will ultimately diverge from these proprietary networks. We see evidence of this today as airlines use latest cloud based technology and portable devices iPad, handheld scanners etc., in their internal systems and applications however; digital data

exchanges with partners are leveraged using proprietary networks and require internet based communication channels and tools.

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Air cargo stakeholders who have embraced new technologies and solutions often face challenges when trying to exchange digital information with their partner across the supply chain. In the air cargo industry, digital data transmission capabilities of an individual company are highly contingent by the technical capabilities of its partners.

The recurring questions being asked are:

“What do I need to do in order to connect with the partner airline/freight forwarder?”

“How can I find out that who is using which communication channel?”

“Where can I find out which messaging standards are supported by my partner?”

These questions were never raised in the past because the proprietary networks were solely managing the entire communication and were the only custodian of this information. New technologies have demonstrated that the air cargo industry must establish clear guidelines and standards around connectivity in order to begin seamlessly adopting new technologies and making them more competitive.

In the air cargo industry, digital data transmission strategy of an individual company is highly influenced by the technical capabilities of its partners

Next section takes a deeper look at the different digital connectivity methodologies that are presently used in air cargo.

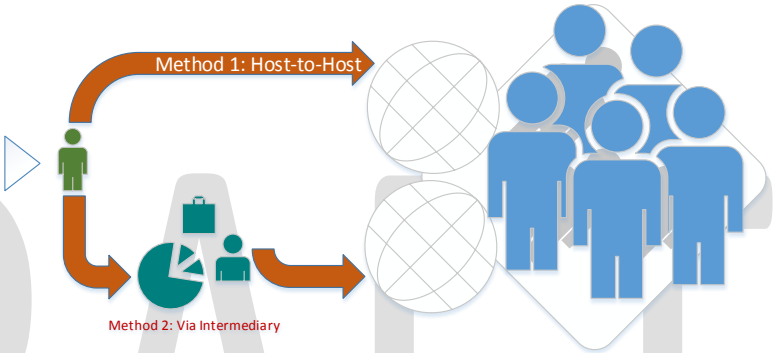
4. Message Transmission Approaches

Air cargo business processes are heavily reliant on digital information exchange between multiple parties. Essentially, there are two methods to connect digitally and based on a party's specific business requirements one can adopted either or both. The two methods are:

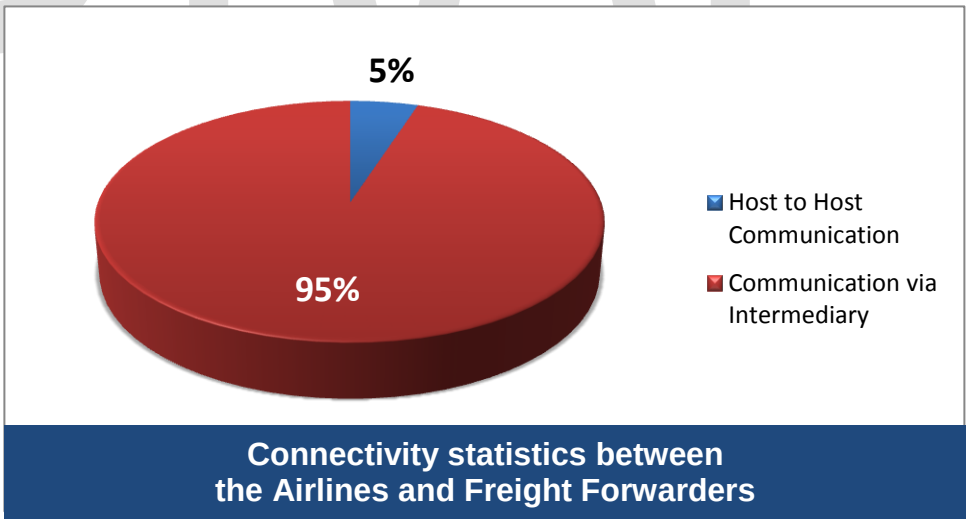
Method 1: Host-to-Host Connectivity

Method 2: Connectivity via an intermediary

The figure # depicts the Message Transmission approaches being adopted in the air cargo industry.



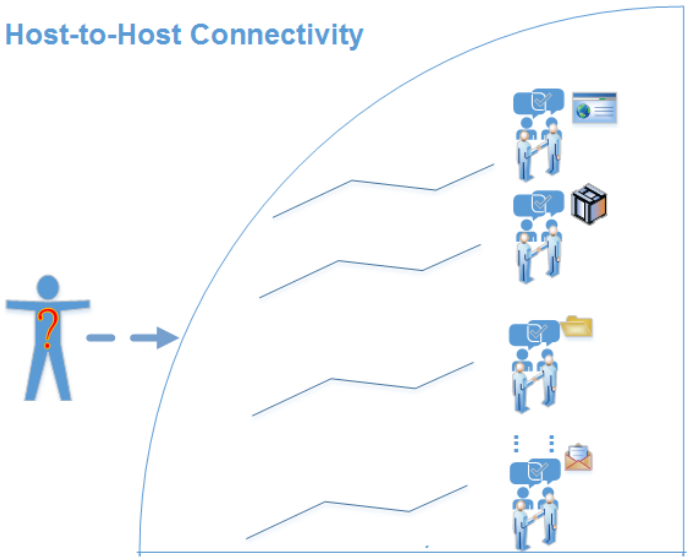
As of Q1 2016, Industry digital communication is dominated by Method 2 i.e. Connectivity via an intermediary. Figure # depicts the latest statistics of connectivity methodologies between airline and freight forwarders.



4.1 Host-to-Host Connectivity

In this method, two stakeholders communicate directly (host-to-host) with each using identical communication protocols. The figure # depicts the Host-to-Host connectivity scenarios.

In todays' world, while electronic communication is essential by every stakeholder, the requirements may vary from one stakeholder to another. For example security, reliability, authentication etc. Stakeholders, therefore adopt the communication channel based on their requirement. The air cargo industry therefore has adopted heterogeneous communication protocols fulfilling individual stakeholder requirements including the proprietary networks.



Due to this, in Host-to-Host communication, one must support all communication protocols implemented by the partners - a complicated and laborious exercise. Due to these challenges Host-to-Host connectivity is not a popular approach in air cargo industry.

Only a limited number of stakeholders allow for the Host-to-Host connectivity approach and even for the stakeholders who do it is not their preferred method of connectivity. As of Q1 2016, Host-to-Host communication constitutes less than 5% of the total air cargo communications between airlines and freight forwarders.

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Partners engaged in Host-to-Host connectivity prefer TCP/IP (Transmission Control Protocol/Internet Protocol) or web-based communication protocols such as FTP, SMTP, and Web-services etc. over proprietary networks to reduce cost of infrastructure

requirement. Some companies are offering connectivity solutions via cloud based on software as a service model (SaaS) model. Cloud based solutions allow global accessibility, easier collaboration and administration.

In Host-to-Host communication, one must support all communication protocols implemented by the partners; therefore it is not a popular approach in air cargo industry.

4.1.1 Challenges in Host-to-Host Connectivity

For a small number of connections, it is relatively convenient to connect directly however; management and maintenance gets complicated as the numbers of connections grows. Some of the challenges associated with Host-to-Host connectivity approach are listed in the table #

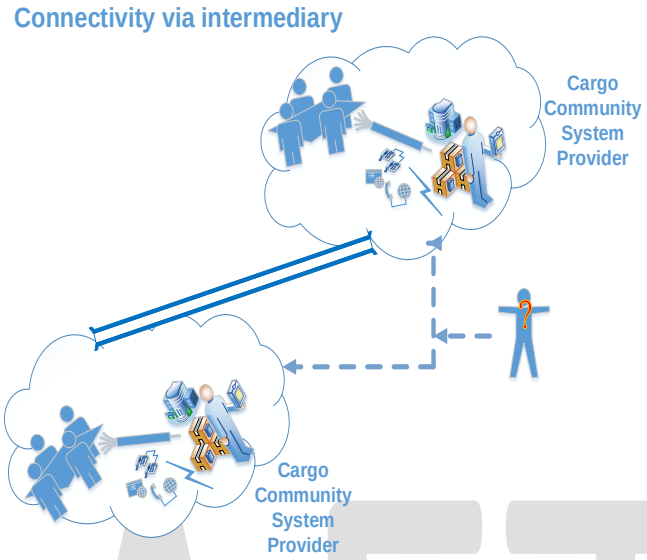
Challenges

- *Require bilateral agreements between the partners*
- *Additional maintenance and support for multiple communication channel*
- *Required multiple software licenses*
- *Limited adoption*
- *Lack of central repository for who is using which communication protocol*

4.2 Connectivity via an intermediary

Connecting via an intermediary involves exchanging data through a third party that specializes in the electronic data interchange services. This method is commonly used in the air cargo industry and these intermediaries are known as messaging services providers or as cargo community systems (CCS). The figure # depicts connectivity via intermediary scenario.

The CCS providers offer integrated platforms to air cargo stakeholders for data sharing and re-use. These CCS generally adhere to IATA messaging standards and provide solutions for regulatory compliance. The CCS support heterogeneous protocols ranging from the proprietary to modern web-based communication protocols.



At present, air cargo data is mostly exchanged using the CCS and connecting through intermediaries is a very popular and preferred approach of air cargo communications. As of Q1 2016, Connectivity via Intermediary constitutes more than 95% of the total air cargo communications between airlines and freight forwarders.

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Stakeholders connected with any particular CCS comprised community of that CCS. In order to transmit data via a CCS, one needs to establish a single communication channel with that specific CCS. Once that communication channel is established one can then exchange messages with all other entities connecting to that specific CCS. Furthermore, different CCS(s) collaborate and interconnect with each other, making it possible for stakeholders, connected to one CCS, exchange information with stakeholders connected to a different CCS.

Different CCSs collaborate and interconnect with each other, allowing their community members to exchange information with the communities of other CCSs

Subsequently, for commercial and operational reasons, it is also possible for one stakeholder to join multiple communities directly.

4.2.1 Challenges in connectivity via intermediary

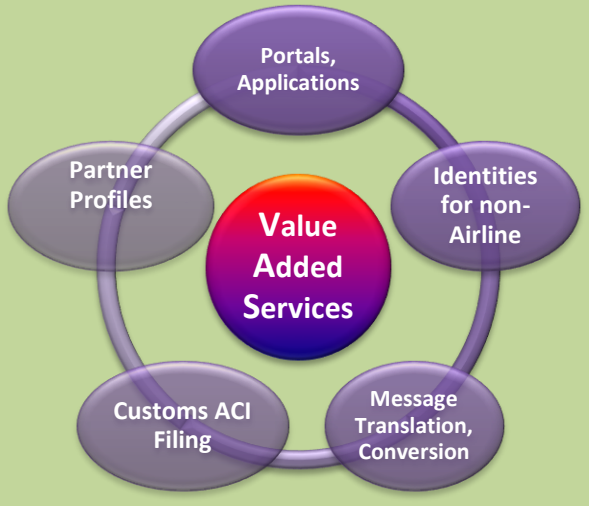
While the different CCS seamlessly connect their members with each other and form a global community, there are challenges associated with this approach. Some of these challenges are encountered by the CCS themselves while others are encountered by the users including the airlines, freight forwarder etc. Some challenges are so severe that they prevent technology advancements in the air cargo industry and require immediate resolution. The common challenges are listed in the table #.

Challenges

- *Lack of standardized registration process*
- *No prerequisites defined for the customers*
- *Lack of standard business processes between airlines, freight forwarders and CCS*
- *Complex problem solving when multiple CCS are involved*
- *Switching from on CCS to another is complicated*
- *Lack of visibility(track and trace) on the customer end*
- *Lack of transparency on the customer end*
- *The technical details i.e. comm. protocol etc. of an individual remain within its CCS partner.*
- *Lack of central repository for who is using which communication protocol*

4.2.2 Value Added Services by CCS

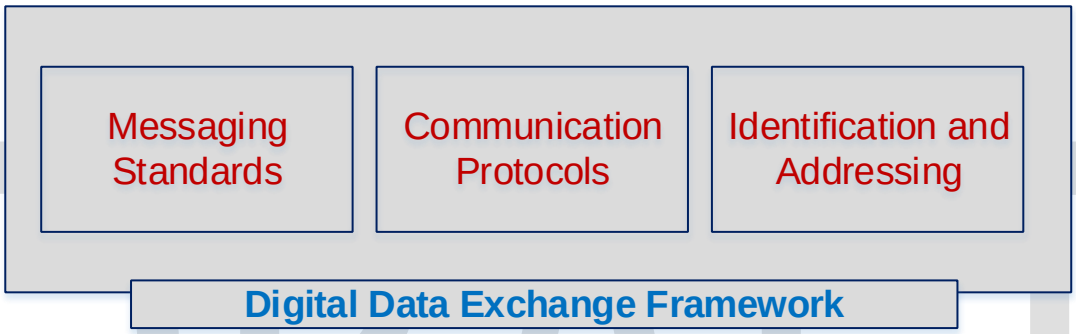
Over the years, CCS have expanded the scope of their services to non-traditional players in the air cargo supply chain communication such as custom authorities and regulators etc. While connectivity remains the basic service for the CCS, CCS are now offering a number of value added services, products (portals and applications). The Table # provides a high level overview of Basic and Value Added Services by CCS.

Basic Services	Value Added Services
↗ *Connectivity between heterogeneous / homogenous protocols* ↗ *Route messages from one stakeholder to another* ↗ *Route messages to other CCS* ↗ *Delivery guaranteed* ↗ *Message Transformation* ↗ *Track and Trace* ↗ *Reporting* ↗ *Archiving*	

5.1 Digital Data Exchange Framework

Generally, there are three key components of digital connectivity. As a pre-requisite, each player involved in electronic interchange must conceive and adhere to these components:

- Messaging Standards
- Communications Protocol
- Trading Partners Identification and Addressing



5.1.1 Messaging Standards

Messaging standards allow exchanging data via electronic means. By adhering to the same standard, different entities, can electronically exchange documents such as air waybill, flight manifest etc.

Two messaging standards are available in the air cargo:

Cargo-XML (emerging)	Maintained by Cargo-XML Task Force (CXMLTF)	Published in Cargo-XML Manual and Toolkit
Cargo-IMP (traditional)	Formerly maintained by Cargo-Data Interchange Task Force (CDITF)	Published in Cargo-IMP Manual

As per industry demand, the IATA Cargo Services Conference (CSC) decided the freeze of Cargo-IMP Messages and discontinuation of the IATA Cargo-IMP Manual. Effective 1st January 2015, the Cargo-IMP Manual 34th Edition is the final edition and there will no longer be any changes to the Cargo-IMP Messages. The Cargo-IMP

standard can continue to be used; however, future developments of messaging standards will occur in the Cargo-XML standards only

The air cargo industry is in its early stage of implementing the Cargo-XML standards. IATA published a whitepaper aimed at facilitating industry adoption of the Cargo-XML standards by providing different implementation strategies, migration approaches and the necessary guidelines. This paper also discusses the role of different stakeholders in adopting the standards and contains information about different tools and resources provided by IATA for Cargo-XML adoption. Cargo-XML White Paper is available at: http://www.iata.org/whatwedo/cargo/e/Documents/cargo-xml-standards-white-paper.pdf

5.1.2 Communication Protocols

For the most part, the air cargo sector relies on the proprietary communication protocols. However, the industry also supports a number of modern internet based protocols as well. There are a number of communication protocols used in the air cargo industry either Host-to-Host connectivity or via a messaging intermediary. Some of these communication protocols are proprietary while others are open source. Some of the protocols are based on modern internet based technology.

- **SSH** Secure Shell
- **FTP** File Transfer Protocol
- **SMTP** Simple Mail Transfer Protocol
- **HTTP** Hyper Text Transfer Protocol
- **HTTPS** Secure Hyper Text Transfer Protocol
- **SFTP** Secure File Transfer Protocol
- **SSL** Secure Socket Layer*
- **TLS** Transport Layer Security*
- **POP** Post office protocol
- **Web Services** **&** **SOAP** HTTP based web services, Simple Object Access Protocol
- **MATIP** Mapping of Airline Traffic over Internet Protocol
- **AS1**/**AS2** Applicability Statement 1/2
- **Type B** SITA's Type B Messaging Service
- **Type X** SITA's Type X Distribution Service
- **MQ Series**
- **AS4** Applicability Statement 4

  * used with other protocols.

Note: In 2014, IATA e-Cargo TAG Electronic Technical Advisory Group (e-TAG) recommended AS4 as a standard communication protocol for the air cargo digital exchanges however, it is less likely that AS4 will be a common protocol for air cargo community due to *availability of low cost/free communication protocols i.e. s/ftp, SMTP etc.,CCS continuous support for existing communication protocols and Costly migration/adoption of AS4. It is important to note that AS4 is relatively new protocol and chances are it will further evolve as the advancement in the technology.*

5.1.3 Trading Partners Identification and Addressing

Identification and addressing are fundamental to digital connectivity. For the air cargo industry, irrespective of the connectivity method used, the sender and recipient identification and addressing remains the challenging part of digital communication. As a pre-requisite, each stakeholder involved in electronic interchange must have a unique identifier and a unique address in order to successfully communicate with other parties.

As a pre-requisite, each stakeholder must have a unique identification and addressing to be successfully communicating with the partners

As it is currently established, that unique identification and a robust addressing scheme are two fundamental components of electronic connectivity and the time has come for the air cargo sector to ask itself two fundamental questions:

"Do all the stakeholders have a unique permanent identification in the air cargo industry?"

"Do all the stakeholders have a unique addressing mechanism in air cargo industry?"

The answer to the two questions above is No because neither a unique identification system exists nor is there a single organization in air cargo industry issuing identifiers. With regards to addressing mechanisms, these are highly complicated and differ from one stakeholder to another.

Lets first understand the different identification and addressing mechanisms exist in the air cargo industry.

In the air cargo industry, identification and addressing methods vary from one stakeholder to another. A number of identification and addressing methods being used in the industry are Teletype Address (TTY), Auxiliary Codes, Participation Identification and Message Addressing Scheme (PIMA) and Email Address. In the air cargo industry, it is common that one stakeholder retains or uses multiple identifications and different addressing methods.

In the air cargo industry, it is common that one stakeholder having multiple identifications and different addressing methods

Below is a summary and an analysis of the identification and addressing methods used by different stakeholders.

5.1.3.1 Airlines using Teletype Address

Method:	Teletype Address
Issued By:	IATA *Note: IATA issue Airline two letter code and scheme for composing the address*
Maintained By:	SITA, ARINC and AVFINITY
Published By:	Not Published
Size:	7 characters
Syntax:	Airport Code (Three letter) + Office Designator (Two letter)+ Airline two letter prefix
Example:	ZRHFMLX where ZRH is airport code, FM is the Freight/Cargo System LX is the two letter airline code of Swiss International Air Lines
Special Note:	*The same schema is applicable to other functional areas in airlines such as PAX & Baggage services, ULD, Ground Handling etc.*

5.1.3.2 Freight Forwarders using Teletype Address

Method:	Auxiliary Code
Issued By:	A4A through SITA,AIRINC,AVFINITY
Maintained By:	Airlines for America (A4A)
Published By:	*IATA (Airline Coding Directory)*
Size:	7 characters
Syntax:	Airport Code (Three letter) + Office Designator (Two letter)+ Auxiliary Code *Note Following Auxiliary Codes are applicable*: **CR** Car Rental Companies/Miscellaneous, **HL** Hotel/Motel Companies, **XA** ARINC, **XB** IATA, **XD** A4A, **XH** Special Ground Handling Service, **XI** AEI, **XS** SITA, **YA** Government Civil Aviation/Government, **YY** General Addressing, **ZZ** Computer Tests, **2X/6X7X/8X** Miscellaneous, **X2/X6** non-scheduled Air Transportation, **GN** General Aviation
Example:	LHRAE7X is the identification for DHL Global Forwarding. where LHR is airport code, AE is Air Express, 7X is Auxiliary Code

5.1.3.3 Freight Forwarders using PIMA

Method:	Participant identification and message addressing (PIMA) Scheme
Issued By:	Cargo Community System (CCS) Providers Note: IATA issue scheme for PIMA format
Maintained By:	Cargo Community System (CCS) Providers

Published By:	*Not published Publically*
Size:	33 characters
Syntax:	CCS System Identifier + CCS Group Code + CCS Code Type + CCS Participant Identifier + Separator + Airport/City Code + CCS Participant Office
Example:	TDVAGT03MERIDIAN/ATL1 where **TDV** is CCS Identification, **AGT** is Group Code, **03** is the code for Agent Name, **MERIDIAN** is the Agent Name, / is separator, **ATL** is the airport/city code of the participants, **1** is the Participant Office

5.1.3.4 Freight Forwarders using TPR

Method:	Third Party Reference (TPR)
Issued By:	Cargo Community System (CCS) Providers
Maintained By:	Cargo Community System (CCS) Providers
Published By:	*Not published Publically*
Size:	7 characters
Syntax:	Agent Name (4 char) + City Code(3 char) Note: The TPR can vary and can also contain a 3-char Agent Name and a 3-char City Code + 1-char number, e.g. KUEVIE1
Example:	**CEVAIAH** Where CEVA is agent name

	IAH is city code

5.1.3.5 Other Identifications Schemes

The above identifications are implied for digital connectivity however, there are other identification schemes available for different purposes.

5.1.3.5.1 Cargo Account Settlement Systems (CASS)

For billing and settlement between airline and freight forwarders, Freight Forwarders, who are part of IATA Cargo Account Settlement Systems (CASS), use different identifications assigned by IATA. CASS operates through CASSlink, an advanced, global, web-enabled e-billing solution.

Method:	Cargo Accounting Settlement Systems (CASS)
Issued By:	IATA
Maintained By:	IATA
Published By:	IATA
Size:	11 characters
Syntax:	Geographical Designator (2 digit) + Area Designator (1 digit) + Location Designator (4 digit) + Slash + CASS Code (3 digit) + Check Digit (1 digit)
Example:	3847028/0203 is the CASS number for DHL Global Forwarding (Italy) Where ▪ Geographic Designator: 38 ▪ Area Designator: 4 ▪ Location Designator: 7028 ▪ Slash: / ▪ CASS Number: 020 ▪ Check Digit: 3 * Check digit is calculated from the first 10 digits using modulus 7 approach

5.1.4 Challenges in Identification and Addressing

Teletype identification and addressing has served the airline industry during the last five decades and so is the PIMA scheme for freight forwarders. The common challenges faced by the industry are:

- Getting an Identity is ambiguous and cumbersome process.
- Identity Management Procedure and Schemes differ from one stakeholder to another hence identities are not harmonized.
- Not all stakeholders have permanent identities.
- No centralized repository for Identities and addresses
- Maintenance of identities is challenging

6. Moving Forward

During the last decade, with the evolution of technology, air cargo has been trying to keep pace on its e-commerce and digitization capabilities. However, some fundamental components of digital exchange such as identification and addressing have been somewhat overlooked. It is quite evident that air cargo lacks the global standards, harmonized procedures and a central repository needed for identity management and addressing scheme.

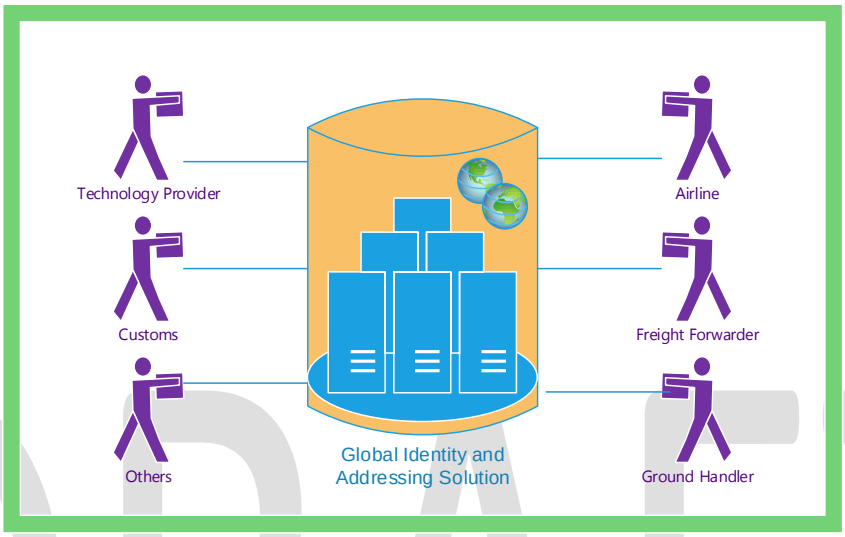
Identity Management and Addressing are building blocks of air cargo digital communication framework and unless, these are addressed properly, the air cargo industry will continue struggling to embrace the modern technology.

Identity management and addressing serve as the foundation of air cargo digital communication. Until, the challenges surrounding identity and addressing are addressed properly, the air cargo industry will struggle to embrace new technologies and continue its reliance of CCS.

Ideally, identities should be recognized and accessible by all stakeholders and there is an utmost need to setup the business process around issuing & managing these identities and that addressing the below requirements (Figure#) will sufficiently set a strong foundation for air cargo industry digital transformation.

There is a strong need to have a centralized Identity Management Solution that issue

and distribute unique identities for all parties in the air cargo digital exchange. The figure # depicts the global identity management solution.



7. Summary

The air cargo industry is progressively moving towards digital transformation even though technology penetration, digital connectivity and infrastructure vary across the supply chain, digital transformation remains inevitable. The industry is versatile and stakeholder expects autonomy however; digital collaboration with business partners is becoming an obligation throughout the supply chain process.

While industry leverages multiple techniques and methodologies for digital transmission, there is an ultimate need to harmonize the basic principles allowing individual stakeholders to adhere and take part, irrespective of their chosen technology (technology agnostic).

Global Identity standards will pave the foundation for the digital transmission and the airline industry is urging IATA to set the necessary standards for permanent and harmonized identity scheme, a clear guideline for issuing identities and a single centralized repository for maintaining the identities. Unlike traditional standard setting activities, it would be rather a difficult task as it requires new identity management

standards to be interoperable with the existing identities management practices Figure XX.

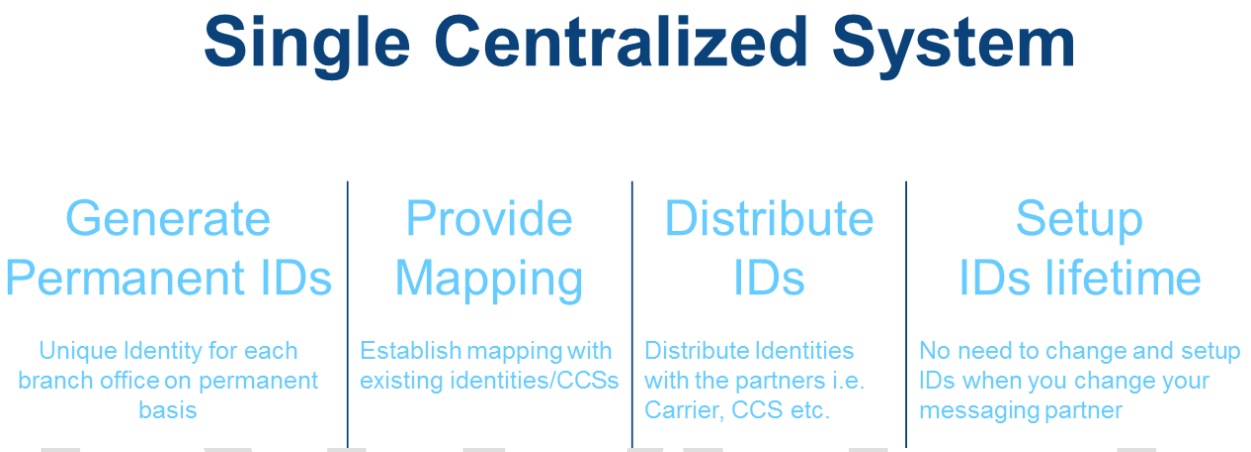


Figure XX

IATA is well recognized for leading the airline industry towards common global standards. IATA needs to define a strategy to take advantage of the potential offered by the rapid progress of digital technologies, in order to generate smart, sustainable, and inclusive growth in the airline industry.

Standardizing the identity management practices would level the road for digital revolution in the air cargo and lead the industry towards the digital transformation.

For any further information please visit www.iata.org/cargo-xml or contact us at Cargoxml@iata.org