photo by Daquella manera

Lowering mishandling

Despite existing technological solutions, the problem of mishandled baggage still plagues airlines, airports and most importantly passengers. We take a look at a solution that could provide much needed improvements

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Recent 2007 world statistics from IATA and SITA show a total estimated loss of $3.8 billion for around 42 million mishandled bags worldwide. No wonder that fighting the "misconnected bags" syndrome is one of the top targets of the transportation industry. The maths are all too simple: assuming a wide body jet capacity of 265 passengers, with an average load factor of 65%, at least 1 out of the 166 passengers will, statistically, not pick up his luggage at destination. Factors contributing to bag mishandling by air carriers have been regularly investigated, and multiple origins were invoked in SITA's survey, yet the picture is clear: transit is the biggest culprit. Looking into the frequency distribution on page 28, at least half of the mishaps were due to the lack of time for the bags to make their connection. This is a direct challenge to the published Mean Connect Time (MCT), a value often used by the hub management and the policy makers as a strong competitive argument to attract additional carriers, bolster connecting traffic and benefit from accrued revenues. There are a variety of reasons for such type of misconnection, such as a late inbound flight arrival, or excessive luggage transfer difficulties at the connecting hub, typically because of a choked baggage handling system. Several remedies have been explored over the years by in the industry, yet, the approach to the transfer

bag pandemics has been most of the time defensive, and largely failed to challenge the root reason for an increasing baggage congestion.

Tackling the challenge

Simply stated, the main reason for the continuous increase in bag congestion is the mandated rescanning of transfer bags at almost all international hubs. This implies unnecessary costly, complex and time-consuming multi-tier EDS detection level procedures, "forgetting" that all incoming bags were legitimately granted a "clear" status before reaching the transfer airport. Transfer ratios as high as 55% are common in many major international hubs. Therefore, proactively achieving a significant decrease in transfer bag re-examination with no security compromises would lead to better airport MCT performance, increased passenger satisfaction, improved cost-economics and enhanced security with less service disruptions.

What if we streamlined bag motion during transfer, and increased bag image transfers between airports? The way I suggest to look for a solution is to modify the overall process by tackling the root problem, namely the number of bags subject to transfer X-ray checks. By and large, simple tail-to-tail bag transfers are being performed in many airports for domestic (and flagship carrier) connections, as a simple and cost-effective way to speed up bag connections with no re-scans at all.

However, distances, apron congestion and safety regulations would prevent or severely limit tail-to-tail transfers at large transfer hubs.

Even if interoperability looks distant, proofs-of-concept of remote bag X-ray security checks are being evaluated

Therefore, our approach could consist of designing a check-through "fast track" for transfer bags, geared to bypass X-ray security at the transfer baggage sortation stage.

One could use the originating country's screening evaluation (i.e. the EDS "clearance") for this transfer bag, if such data was available at transfer, also including screener and machine identifications, operational conditions and other useful parameters. Of course, the origin country would have to set up and maintain a specific bilateral cross-certification with the transit airport control authorities. If the above two conditions were satisfied, the bag would take a fast path to the next flight.

When in doubt, one could always re-scan or request the images to be transferred and re-evaluated. It is worth noting that the above process of using the airport of origin early threat level assessment for transfer cargo bags is currently under review by the European Union.

On the brighter side, the remote bag management process described earlier could use infrastructure, technology and resources already in place at both the origin and transfer airports. Thus, it could directly contribute to a strong CAPEX reduction at the transfer hub, as the total equipment workload would significantly decrease.

Missing standards

The crux of the problem would be to establish, cross-certify, control and maintain the performance and operational efficiency of remote bag inspection systems between airports. This is quite a daunting task, since vendor equipment output data and formats are proprietary, and many required standards concerning X-ray equipment threat detection performance are under current

photo by alex s.

rewriting.
EDS tomographic X-ray machines are modified medical CT scanners, capable today, like their hospital counterparts, to perform within seconds the continuous data acquisition of a bag picked up from a conveyor belt and to produce 3D slices from which automated or screener-assisted threat image evaluation is routinely performed in airports.

Not only are medical CT and baggage EDS machines alike in physics, they also share common manufacturers

One of the most important achievements of the medical imaging community is the well-established Digital Imaging and Communications in Medicine standard (DICOM). This standard has a strong focus: it enables remote diagnostics, remote handling, distant exchange and bi-directional transmission of clinical data from all imaging modalities, irrespective of the equipment brand used. Dicom proved essential in allowing the medical imaging industry to align itself on a set of standards while preserving the integrity and confidentiality of important and sensitive patient data. In 15 years, the Dicom architecture has become a world standard, now endorsed in Europe by CEN and worldwide by ISO, with steady growth in many new medical and emerging health disciplines.

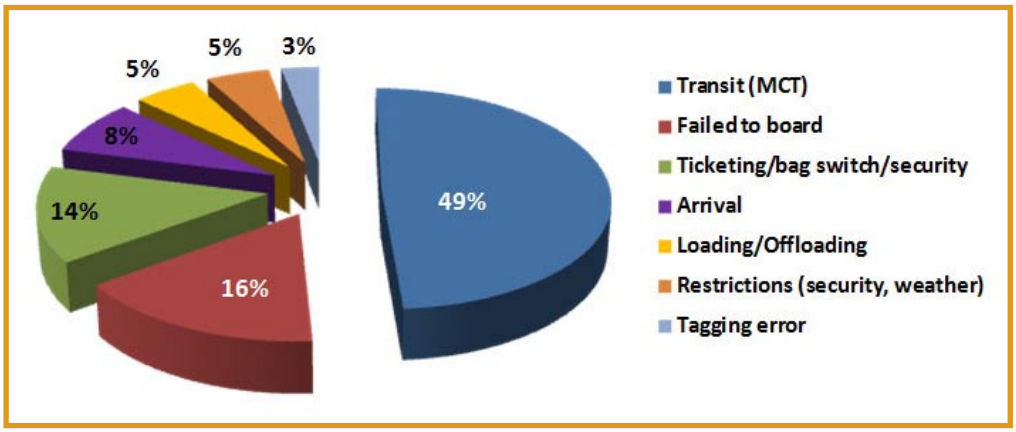
Dicom encompasses several key components, which are of interest, should one consider using some of its functionalities in remote bag image management in the future:

- an information model, including specific object pair classes, enabling for example to safely exchange CT image data, if they comply to the standard;
- a transport model, which goes beyond the ISO layer model, since it also checks the compatibility between the sending and receiving stations;
- a set of information management services, enabling for example to gain (or relinquish) ownership and control of the acquired data set between distant stations.

Not only are medical CT and baggage EDS machines alike in their physics, they also have many common manufacturers. And they both provide fairly large data sets that are usually more than one single planar image. Handling those multiple images is precisely what Dicom was designed for. Its contribution is to bundle together patient – or possibly "baggage" – data, clinical acquisition conditions – or possibly "type of source, single or multi-source energy conditions of the EDS" –, raw data sets and typical pre-set physician evaluation slices – or possibly "color coded, thresholded, threat images" produced –, not to mention reports and diagnostics – or possibly "bag clearance status".

Dicom has been key in the emergence of tele-medicine, tele-radiology, and quality diagnostics associated with secure access to data remotely stored. A qualified physician sitting at a Dicom-compliant console can look into any pre-set analysis performed elsewhere (possibly a transfer bag screener looking at the remote origin EDS-assisted functional image). A physician using Dicom can also perform, if and when needed, additional image reconstruction from raw data from a distant console to match a specific request – possibly the remote re-evaluation of an EDS-assisted "bag clear" decision by a transfer bag

Primary origin of mishandled bags
Source: adapted from 2007 SITA data



screener, using on-the-fly raw acquisition EDS data collected at the origin airport.

Some useful ingredients

Although Dicom could well handle EDS and all other X-ray types of baggage images, our industry may not need all its bells and whistles. Here are some short- to medium-range goals the transportation industry might target, if it were to adopt or mimic the use of some Dicom features:

• start with a full (sub-)set of established ISO standards constantly upgraded to integrate specific requests from many emerging medical and other specific imaging modalities;

• get a realistic chance from day one to link all stakeholders, since they all would benefit from globally interoperable standards and communication protocols;

• rapidly exchange and cross-analyze multi-slice high resolution remote bag images with an outstanding track record for data quality, data integrity and privacy respect;

• easily integrate with baggage sortation systems, by extending the use of standard Baggage Sortation Messages and other existing Edifact procedures to serve as active links, mailbox backups, batch or high priority data transfer requests via VPN's under Dicom compatibility.

A specific add-on of baggage security into Dicom would integrate Threat Image Projections (T.I.P) procedures and performances to remotely assess the expertise level of the origin bag screeners, enabling to establish, maintain, update and challenge the cross-certification remote bag management agreement which has been initiated between two airports (or countries).

How far down the road?

Even if interoperability still looks fairly distant, initial proofs-of-concept of remote bag X-ray security checks are already under evaluation. One area of interest is in the early assessment of bio-security monitoring, which, today, is routinely performed upon arrival, by mandating 100% 1-D X-ray inspection targeted, say, at hidden grains or fruits. The same check can also be performed "preventively", by applying the adequate X-ray sequence while the departing bag is being inspected at the bag sortation phase. Subsequent "no-check" clearance by the receiving airport, or later revisiting upon bag arival, are options given to the receiving airport officers. This is also perceived as a true opportunity to redeploy bio-security and customs officers to less routine tasks. Initial results showed a fair level of cooperation between equipment vendors.

The current industry consolidation, which already severely impacted single carriers, is now pushing major hubs to pool and cross-brand each other to better mimic their dominant carrier's own survival strategy. This will result in an increased requirement to further harmonize existing screening airport equipment. I would urge, therefore, the transportation industry to proactively require participation of bag screening equipment manufacturers, in order to lower the discrepancies between data acquisition, storage and transfer processes of their existing products and look for interoperable bridges. Many of them have strong expertise in advanced interoperable standards such as Dicom through their medical divisions. They should, therefore, be in an interesting position to embrace a gradual industry shift towards interoperable standards and technologies for remote bag management to ensure data integrity, process scalability and application convergence while favoring inter-airport agreements to further bolster the airports handling capacity.

The approach to the transfer bag pandemics has been most of the time defensive