



Whitepaper

All bags aboard

Delivering a baggage service for the digital age



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1. Foreword

Digital technologies and cloud services are rapidly transforming every industry sector. Change is coming so quickly that it can be hard to understand where the best opportunities are, how new technologies can be used for commercial benefit. For the airline industry, however, there is a clear and present business opportunity: using digital technology to revolutionise the way passenger baggage is handled as it travels around the globe.

The last major innovation in baggage handling was the introduction of bar coded labels and readers 25 years ago. Now, new digital technologies such as Radio Frequency Identification (RFID) allow much more detailed tracking of bags in transit. They have the potential to further reduce the number of lost bags; to help airlines meet the demands of today's connected passengers; and to develop the robust infrastructure and processes airlines will need to manage the growth in global passenger numbers.

We believe that momentum is building around RFID as the technology of choice for baggage handling and tracking. The benefits of RFID have been proven in practice in air travel and many other industries. It can deliver measurable financial and operational benefits. As the air travel industry prepares to respond to IATA resolution 753, this paper sets out why and how RFID should be central to that response.

Neha Agarwal,
Proposition Director, IoT CoE
BT

Michael Vistisen,
BusinessUnit Director, Airports and Airlines
Lyngsoe Systems

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2. Baggage tracking: it's time to do it differently

Arriving without your bags is something every traveller dreads. The air travel industry has worked hard to address the problem of lost luggage, reducing the number of mishandled bags by half since 2007¹ (and saving an estimated \$22 billion as result). In spite of more people than ever flying (and checking in three billion bags every year²), the baggage mishandling rate is at an all time low (6.5 bags per 1,000 passengers). Even so, lost luggage remains a frustration for passengers and airlines. It's time to do it differently now.

Demand for air travel is booming. The Airports Council International reported robust passenger traffic gains for 2016³, despite economic and political uncertainty. Over half of the world's tourists who travel across international borders each year were transported by air⁴. By 2034, passenger numbers are expected to double to seven billion⁵. Handling this uplift in passenger numbers will be a challenge for airports, especially those with a restricted site. They will be looking for solutions that can increase passenger throughput without having to physically expand. Improving fundamental process such as baggage handling will be essential for managing future passenger growth. Low margins and unpredictable fuel costs further contribute to pressures to be operationally clever and efficient.

Airlines must also differentiate themselves. There is only so much that can be done to improve the in flight experience, and the focus is increasingly going to be customer interactions on the ground, before and after the flight. Today's flyers - like customers everywhere - have higher expectations of service. They're used to tracking delivery of all sorts of purchases online and don't understand why airlines can't do the same with luggage. IATA says 61 per cent of passengers would like to track their bag throughout the journey⁶.

They want to be confident their bags are on the same plane as they are, and to know when those bags will arrive at the reclaim - especially if they have paid a supplement for checked baggage.

IATA's 2016 Global Passenger Survey found that most travellers are keen to see the baggage process shaken up, and are open to the application of new technology in the process. The introduction of IATA resolution 753 in 2018 is a trigger for change. Airlines will be required to keep track of every checked luggage item from the start to finish of its journey. To comply, airlines will need to verify that they have the bag at four tracking points: passenger handover, aircraft loading, arrival and transfer/change of custody between carriers.

However, current baggage tracking technology (bar codes and manual scanning) just can't offer the level of granular data needed for compliance and to deliver the kind of service passengers want, at a price airlines can afford. Airlines that can't track bags across the four points may find themselves fined for lost bags (even if they weren't responsible for the loss, but have no proof of custody or handover). Poor tracking also creates opportunities for passenger fraud. Lots of airlines don't track the final handover to the passenger, and have no way of verifying a claim that 'my bag did not arrive'.

Airline/airport business models are changing fast (like the introduction of fees for checked bags and self-service check in). Better baggage handling could provide the basis for additional paid for services.

3. Baggage tracking in the digital age: a win-win

Using Internet of Things digital technologies such as RFID (Radio Frequency Identification) to label and track bags as they travel around the world has the potential to transform baggage handling, and bring real benefits to airlines and passengers alike.

More automation will help airlines to reduce operational costs. Automated scanning can reduce the number of people it takes to check and load bags on and off the aircraft. It can also help to reduce the number of mishandled bags, and the costs associated with restoring them to their rightful journey and owner.

According to IATA, real time tracking of bags could save the air transport industry \$3 billion⁷. Because RFID increases the read rates at transfer, the airline can process more bags on the same conveyor/sorter system. When bags are scanned accurately the first time, there are fewer errors. And replacing manual handling with automation saves time and reduces the potential for delays.

The airline will be able to give passengers much better information, to reassure them that their bags are actually in the hold, to alert them when they are unloaded and when they will be delivered to the baggage reclaim hall. No longer stressing about bags makes for a much more relaxing journey for the passenger. Luggage tracking will be an additional feature in the airline's app. Better knowledge about the location and status of bags will allow airlines to develop new passenger services such as offering off airport bag drop locations, or home pickup and delivery.

When it comes to airlines, Delta is the pathfinder. Described by the airline as "a historic shift for Delta and the 120 million bags it handles annually"¹¹, a \$50 million investment in automated RFID tracking has replaced manual scanning of bar codes at 84 US airports. Initial deployments showed bags tracked at a 99 per cent success rate, ensuring proper routing and loading. US flyers can get a map view of their bag's last scanned location on Delta's mobile app, and the airline plans to provide push notifications to passengers with updates on checked baggage¹². RFID will help Delta to maintain its position as the leading U.S.-based global airline for baggage performance¹³.

In short, RFID is both an established, tried and tested technology and part of the new Internet of Things.

There is already real life evidence to support the business case:

In 2008, Hong Kong International was the first airport in the world to introduce RFID baggage tracking, where it has helped to improve sortation, increase capacity and reduce the number of mishandled bags⁸.

Milan Malpensa, the second largest airport in Italy, was the first in Europe to deploy a comprehensive RFID-enabled baggage handling system in response to rising passenger numbers. Malpensa handles close to 20 million passengers a year and serves more than 110 airlines. A rise from 93 to 100 per cent in the read rate of its baggage handling system has reduced costs, speeded up processing time and increased transparency⁹. Lisbon airport has a similar system.

RFID technology is widely used in Scandinavia, with 33 pier and claim readers use in 11 airports¹⁰.



4. Technology choices for baggage management and the case for RFID

Current baggage tracking technology – **the bar code-based label** – has been around a long time. It has several upsides: global standards, ubiquity and ease of read. The downside is that bar codes require manual scanning, which is slow, and open to human error. Bar codes cannot be automatically scanned without direct sight so it takes two employees to load the aircraft – one to lift the bags and one to scan each one. While bar codes are not going away, it is time to consider what newer digital technologies have to offer.

The Internet of Things has progressed rapidly from hypothetical scenarios to practical solutions. Low cost, low power networks and more affordable sensors make global deployment easier and more cost effective than ever before. There are several emerging technologies to consider.

Bluetooth Low Energy (BLE) is one of the newer technologies on the block. Bluetooth is a wireless technology standard for exchanging data over short distances and a Bluetooth device uses radio waves to connect. With the advent of ‘Bluetooth low energy’ functionality (BLE), small sensors can operate with tiny batteries for months, even years.

BLE has its merits but its relatively high price (around \$30, although this will probably come down further) and complexity are likely to deter mainstream acceptance. However, BLE remains an exciting technology. Samsonite has chosen BLE for its self-tracking luggage. Another potential application might be cargo tracking for high value items – such as monitoring a pallet of smartphones as it moves through the global supply chain.

Electronic baggage tags combine the benefits of Bluetooth and RFID. The passenger can have their own re-usable tag, which is compatible with airline RFID systems, and track the progress of the bag via Bluetooth. Both luggage manufacturers and airlines are developing electronic baggage tags, but the cost will probably restrict them to the high value, frequent flyer segment, who will be able to drop off their checked bags in seconds and be rapidly reunited with it at the end of their journey.

LoRa technology¹⁴ is another new communication standard, designed for wireless, battery operated devices across a regional, national or global network. Combined with Internet of Things sensors it could provide the basis for a baggage tracking solution. The main downside of LoRa is that it is unlicensed and anyone can put a network in place. Consequently, LoRa’s service quality and reliability are not as good as a ‘carrier grade’ mobile network.

Similarly, **NarrowBand IoT (NB-IoT)** is another radio technology standard that uses mobile telephone networks,

and provides low cost, long battery life, and enabling a large number of connected devices.

However, compared with RFID, low power and mesh deployments are still relatively costly and untried. Both technologies also ask the same question about the safety implications of having hundreds of devices transmitting radio signals in the hold of the aircraft, although sending the device ‘to sleep’ when on board would resolve this.

All the signs point to **RFID** as the technology of choice for baggage tracking. RFID is an Internet of Things technology which has been around long enough to move beyond bleeding edge to stable deployments in commercial environments. In their joint paper, the International Air Transport Association (IATA) and SITA have strongly supported the business case for RFID.

RFID uses radiofrequency electromagnetic fields to transfer data that identifies and tracks tags attached to baggage. An RFID baggage tracking system consists of passive RFID tags on the baggage (which can store substantially more data than barcodes), automatic fixed RFID readers to scan the baggage tag as it moves around through its journey, software to process this information and forward tracking information in real time to the baggage handling system. The system will automatically detect a bag’s destination and route it accordingly, or alert/stop if it is heading to the wrong flight.

The RFID chip is incorporated in the familiar bar coded paper tag, which is encoded and printed as usual at the airport. The tag is disposed after each journey. An RFID tag can be scanned at a distance of five to eight metres. It does not require line of sight to scan, it has a high read speed and is cost-effective. And it has no battery, making it safe for air travel.



The pros and cons of competing technologies

	Passive RFID	1D barcode	2D barcode	Bluetooth Low Energy	NFC	LoRA
Cost of a baggage tag	Low	Very low	Very low	Medium	Low	Medium
Air safe?	Yes	Yes	Yes	Possible by design	Yes	Possible by design
Range	<10m	<1m	<1m	<100m	<10cm	<10km
Read speed	High	Low	Low	High	Low	Medium
Automated read?	Yes	Partial	Partial	Yes	Yes	Yes
Line of sight?	No	Yes	Yes	No	No	No
Maturity level	High	Very High	Very High	Medium	Medium	Low



In addition to airports and airlines, RFID has been proven operationally sound in other sectors such as logistics, manufacturing and retailing:

- In 2016, Spanish retail group Inditex completed the deployment of RFID technology for stock management across its entire Zara store base, more than 2,000 shops around the world, and is now rolling it out to other Group brands¹⁵.
- Pack and Sea A/S uses RFID to track the whereabouts of fish crates used by the Danish fishing industry, giving it not only real time visibility of those assets but enabling complete traceability of the fish in each crate¹⁶.
- Swiss Post uses RFID to speed the flow of letters and parcels in its postal and logistics centres¹⁷.



The operational and financial benefits of RFID include:

Affordability.

RFID tags are today produced in billions and the costs have come right down. SITA/IATA's business case shows that RFID can be deployed for as little US\$0.1 per passenger on average, while generating expected savings of more than US\$0.2 per passenger¹⁸.

More accurate tracking.

Accuracy rates with RFID have gone up substantially. Delta has reported a 99.9 per cent success rate for its RFID tracking, ensuring most bags make it onto the right flight. More efficient tracking could reduce the number of mishandled bags by up to 25 per cent by 2022¹⁸, according to IATA/SITA.

Faster loading.

To scan a bar code requires a human being and line of sight but RFID labels are scanned automatically by readers located throughout the process, from the bag drop off to loading onto the aircraft. It typically takes two people to load bags for a flight, one to handle and one to scan. Using hands free RFID can remove one person from that process, or use two to load bags twice as fast, for greater productivity,

Global standards and performance.

Worldwide standards are in place for RFID radio standards, hardware and infrastructure, built upon the barcode standards originally developed by GS1. Today's RFID readers are production grade, high performing devices.

Detailed information in real time.

The RFID chip can also generate detailed information that can be used for business process improvement or service innovation, such as notifications to passengers so they know exactly where their bags are.

Backward compatibility.

RFID chips can be combined with existing bar code label technology. Consumers won't notice the difference: the label will still have a bar code and flight details, plus the integral RFID tag.

Compliance with IATA Resolution 753.

From June 2018, airlines will need to be able to demonstrate (1) delivery of baggage when custody changes (2) acquisition of baggage when custody changes, (3) provide an inventory of bags upon departure of a flight and (4) be capable of exchanging these events with other airlines as needed. Unless they adopt RFID tracking technologies, it is hard to see how airlines will be able to comply with 753 in a cost effective way.

The question is not if, but when, airlines will adopt RFID as the basis for transforming baggage handling for the digital age.

5. Steps to successful implementation

Introducing RFID technology into the baggage handling process is a major project, and a huge task for the CIO. However, there's plenty to learn from the successful commercial deployments that are already in operation.

These lessons include:

1. Start with a spreadsheet. The first step is to make the business case. What's driving this move to RFID? What benefits do you want/anticipate? Where's the payoff?
2. Engage with all stakeholders. It is really important that everyone is on board. There are a lot of stakeholders to consult, to involve, to train, including senior managers, marketing, operational teams, ground handlers - they all have to take in the new system, understand what it can do for the business and how it impacts their work. Success requires outstanding project management capabilities.
3. Understand the technology. RFID is the right technology for digital transformation of baggage handling. But it is still important that you understand what it can and cannot do. For example, at the right scale, the RFID chip supplier will be able to customise tags for your airline.
4. Work with experience technology partners. When it comes to IT, airlines have always been highly sophisticated operators, with excellent in house expertise. However, when it comes to RFID, wholesale DIY may not be the right approach; working with specialist vendors who understand the nature (and limitations) of RFID, as well as the integration challenges will help to avoid pitfalls and keep deployment on track.
5. Choose the right path for implementation. Delta went for a scaled deployment at once. But other airlines may prefer to advance in steps, perhaps introducing RFID to major hubs first, or rolling out reusable tags for loyalty customers. Be guided by the business case and where the gains are.
6. Understand what processes need to be introduced.
7. Test everything before it goes live. That means testing not only the technology but all the others processes that relate and interact with your baggage handling system.



6. Last word

Digital transformation must always be for sound business objectives. By introducing digital technology in the form of RFID to baggage handling, airlines can achieve several positive outcomes - a better customer experience, lower operating costs and greater employee productivity. Those who choose not to go down this route will potentially find themselves at a disadvantage.

For airlines (and airports) who are ready to embrace the digital age, the good news is that there is a bank of experience and wealth of knowledge about how to deploy RFID in baggage handling. No one needs to do it alone.

BT and Lyngsoe Systems - global technology partners for airlines

BT has worked with the airline industry for decades and we understand its business challenges: we also operate in a rapidly changing, globally competitive, internationally regulated industry. In addition, we're helping customers across many industry sectors - banks, logistics, hospitality, retailers and energy - to navigate the new digital landscape and make the most of its possibilities.

Our partner Lyngsoe Systems is a world leader in electronic logistics control and RFID technology. Lyngsoe has helped major airlines and airports around the globe to deploy RFID to automate baggage handling, reduce mishandled items and improve operational efficiency.

We've worked together since 2004. One of our largest RFID implementations, with 4,000 readers on 426 sites, delivers quality of service tracking for a leading postal company.

http://www.globalservices.bt.com/uk/en/industries/airlines_and_travel

<http://www.lyngsoesystems.com/en/solutions/airports-airlines/>

If you would like to talk more about the ideas raised in this paper please contact us.

marketing.support@bt.com



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