APIs…. What is Really Out There in Aviation Beyond the Buzz Words?

June 2018, Lufthansa
Frankfurt am Main
APIs at Lufthansa Group

Coming from SOA and ESB

- Lufthansa Group IT systems inter-connection is using ESB and SOA methods
- Internally connectivity, security and management processes
APIs at Lufthansa Group

APIs

• In 2014 Lufthansa Innovation Hub was founded in Berlin
• To allow interaction with partners, access to data and services was required

⇒ Inception of LH OpenAPI
Initial Goals of the LH OpenAPI

Provide controlled access with governance and legal aspects covered

Allow partners to easily connect and consume services

Provide outside reachability

Leverage Internet standards (https, REST, JSON, OAuth)
Unlocking Potential with APIs – there is more we do now

Put the consumer/developer and its prospective usage in focus

Abstract business processes and reduce complexity to become accessible

Automating all aspect of API creation to support high pace while retaining control

⇒ An API is a managed product and the API provider needs to understand how this product will be used in which context
Using APIs at LH Group

Powering new customer channel ([http://lufthansa.com/chatbot_en](http://lufthansa.com/chatbot_en))

Enabling mobile apps for crew and ground staff

Leverage developer portal and API Gateway throughout the Lufthansa Group beyond Hub Airlines

Support fast iteration for new ideas with limited costs
Our mission is to quickly explore new digital opportunities for Lufthansa Group and convert them into businesses.
LIH as the interface between the startup ecosystem and Lufthansa Group

Global Travel and Mobility Tech ecosystem

- Close structural link, access to assets of different LH Group entities
- Constantly monitoring relevant trends with deep expertise, authentic footprint and extensive network

Lufthansa Group
Strategic fields of action

**Build**
Develop and build our own digital products & services.

**Partner**
Foster selected partnerships between digital players and Lufthansa Group

**Invest**
Educate and support Lufthansa Group at strategic venture capital investments in startups
BUILD - Flightpass

A 10-flight ticket in cooperation with Eurowings, SWISS and Lufthansa Airine

Built, operated and successfully validated by LIH
BUILD - AirlineCheckins.com

Automatic check-in assistant for more than 200 airlines worldwide

Empowered with flight status and reference data
cargo.one offers cargo airlines a fully digital sales channel, attracting new business at lowest transactional cost and higher operational efficiency.

cargo.one’s customers include two of the largest cargo airlines in Europe as well as several of Europe’s largest forwarders.

OpenAPI provides the LH Cargo data.
PARTNER - App in the Air

Data exchange with App developer to further enhance a seamless cross airline journey.

Aims to be your everyday travel companion.

Got feature on Apple’s WWDC 2014.

OpenAPI provides flight status plus will enable the app to book flights from LH ticket stock.
Challenges

Lots of players in API space
• Discoverability of APIs
• 530 travel APIs at programmable web

Diversity, both content and technical
• Standardizing efforts such as IATA
  OpenAPI Group need to retain flexibility
  technology is ever evolving and changing

Making good APIs
• Business Process hard to put into APIs
• Manage APIs as a Product
Future

API Thinking is crucial for digitalization with airlines’ business

IoT and real-time capabilities are on the rise. Serve your customers in their ecosystem, at the right time.

An holistic API Strategy allows value driven API Product creation
Thank you.
Questions?
Answers!

lufthansagroup.com
The Future of Dynamic Pricing

Presentation by Josef Habdank,
Chief Data Scientist & Data Platform Architect at INFARE
June 20, 2018

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Who we are

- 1.1+ trillion Web fare records
- ~2 billion Records a day
- 80,000 routes
- 20+ Airports
- 240+ Airlines
- 1000 Online data sources
- 15+ Years of data
The Holy Grail:

Dynamic Pricing and Marketing

- **Personalized offers** to individual specific departure of interest (departure dates, origin and destination) based on shown interest by the customer

- **Market awareness of the offer** price offer computed accordingly to the current market state

- Prices reflecting **services most desired** by the individual

- **Individual offer** that can be purchased
The Holy Grail:

**Dynamic Pricing and Marketing System Architecture**

**Level 2 Dynamic Pricing**
- RM forecast automatically enhanced using current market state
- Prices modified by opening/closing classes
- Targeted custom discounts

**Level 2 Dynamic Marketing**
- Real time market aware AD building and servicing system
Dynamic Pricing and Marketing System Architecture

**Level 1 Dynamic Pricing**

Automatically adjusting the pricing structure (class-seat allocation) based on market state.

**Level 1 Dynamic Marketing**

Real time market aware AD building and servicing system targeted for user searches no individual offers yet.
Dynamic Pricing Alerts

Requirements

- continuous market state awareness (dynamic scanning of the competitors prices)
- clear definition of desired market position (e.g. cheapest by min 5%, second cheapest by 2% etc.)

How to execute

- RM forecast + market distribution + business rules
- have a fine distribution of classes
- adjust the class availability accordingly
Goal

• contains only actionable data, a list of messages when specific flight departure is not following the business rules

• single message/row contains all the data needed to take an action, no need to big IT infrastructure analysing the market as a whole

• real time notifications, messages sent immediately when it is found that given flight departure is not following the defined business rules
INFARE Dynamic Pricing Alerts:

System Overview

Flight comparison groups database → Scheduler, optimizes data scanning knows when market is complete → Message about market collection being completed → Data pricing feed creation logic → Real time streaming → Airline system reacting to the market changes
Automatic Creation of Flights Comparison Groups

Why?

- Manual creation of flight comparison requires constant maintenance, as network changes over time
- If done manually does not react to dynamic aspects such as price

How?

- Created as a Machine Learning Recommender System
- Can be price centric, thus dynamically change as the market evolves. E.g. some flights might not be considered a competition, except when the price difference becomes very large
INFARE Dynamic Pricing Alerts:

**Message Structure**

**Actionable data only**
- Only creates a message when a rule is violated
- Single row in the feed contains all the data required to take an action, no need for BigData system to pivot data

**Data Format**
- Full airfare observation of your fare
- Full airfare observation of the lowest competitor fare
- Statistics about the flight comparison group
- Possibly predictions about prices in the group
Dynamic Pricing Alerts exposed via FTP

alerts suggest adjusting lowest available fare for a specific flight departure

Practically executed by:
1. pre RM forecast increase of Demand Units in the RM system
2. or post RM forecast manual override with floor/ceiling class setting

market adjusted class structure

class structure sold via Direct Channels or via GDS
INFARE Dynamic Pricing Alerts:

**Summary**

2 - 3 years Vision

*Level 2 Dynamic Pricing* creating individual offers and marketing them online

This year

*Level 1 Dynamic Pricing* bringing the money from sub-optimally priced markets (both under and over priced)
Thank you!

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Connecting the enterprise to enable intelligent action

Rodrigo Ramos
Managing Director, Sabre Iceland
Product Head of Intelligence Exchange

Magnus Sigurdsson
Director Delivery Management – IX Managed Services

20 June 2018
In order to fill that cabin, WorldWide Air decides to offer promotions to qualifying customers to encourage upgrades.

On the day of departure, WorldWide Air identifies that they have unsold seats in a particular cabin.

Last Minute Upgrades checks for upgrades and automatically notifies qualified customers based on tier or other criteria.

Based on rules in the Micro-App, promotions are sent to customers and front-line agents.
How many hours before departure should we check for upgrade availability?

- 8 hours
- 6 hours
- 5 hours
- 3 hours
On which route should we check for upgrades?

- LHR – AUH
- AUH – SYD
- YYZ – AUH
How many seats need to be available in higher class to make offer?

- 1 seat
- 2 seats
- 3 seats
- 4 seats
How many point/miles should the upgrade cost?

- $500 or 30k points
- $600 or 35k points
- $1,000 or 60k points
- $1,500 or 100k points
Can you imagine...  

...Lazy Susan  

Source: wired.com
The advent of the PSS System was revolutionary...

...it changed the way we travel

Source: wired.com
Key challenges for airline IT and the business

- The PSS is not designed for custom business process and sense and respond actions
- Complexity of bringing together disparate, data sets to achieve digital transformation
- A customer-centric business requires non-core systems to have customer data
- There is a huge need for airlines to leverage more data and a DWH is not enough

12% of enterprise data is typically utilized for analysis
29% of the IT budget is now generated by business unit investment rather than IT

Source: Gartner
PSS are not designed for agility and experimentation

- **STABILITY**
  - Routines, Discipline, Limits, Low Variance
  - Continuity, Predictability, Reliability

- **CHANGE**
  - Search, Redundancy, Openness, Imagination
  - Adaptable, Agile, Flexible

- **Host System**
  - CORE
  - Airline Systems

- **Host + Agility Platform**
  - Intelligence Exchange

- **Host Managed Change**
  - Revenue Management, Merchandising, Operations

- **Innovation Lab**
  - Intelligence Exchange
  - Powered Micro Apps

Source: T2RL
Vast amounts of siloed enterprise data are being created.
A paradigm shift from an itinerary-centric to a customer-centric focus
Existing airline architecture has limited ‘sense and respond’ capabilities

- Reliability
- High performance
- Scalability
- Structured and cleansed
- Inexpensive to access
- Includes non PSS data
- Expensive to change
- Siloed data
- Lack of flexibility
- Rear view mirror
- Latency challenges
“IT application development time is highly correlated with IT’s impact on business performance...”

“Forrester Research

“The speed... to convert mass amounts of customer data into insights, and insight into action is now a critical differentiator.”

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Intelligence Exchange: the open airline enterprise agility platform

Apps and processes
Sense and respond
User experience
System of reference
System of record

IX Data Model

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An ecosystem of micro-apps built on the Intelligence Exchange Platform

https://vimeo.com/274572139/50f82f670e
What is a Micro-App?

Business process templates
75% standard / 25% configurable
Take action across enterprise systems
Deploy fast to save time and money

marketplace.sabre.com/IX
Capture incremental revenue with the Last Minute Upgrades Micro-App

• Customized parameters to meet unique business needs
• Take action into other core systems out of the box
• Fast deployment for rapid innovation and testing
• Limited IT dependency
Solve **PERVASIVE BUSINESS CHALLENGES** across the customer journey

- Earn incremental revenue
- Enable customer centricity
- Prevent revenue leakage
- Streamline airline operations

**Software Solutions**

- **Personalized Trip Promotions**
- **Fare Error Detector**
- **Top Tier Auto Upgrades**
- **Real Time Flight Analysis**
Customer Centric Strategy (Next Best Action)
Overview & Art of the Possible
For More Information about Customer Centric Strategy:

I have a You Tube channel called “Customer Centric Strategies” with several narrated Power Point videos with greater details about this personalization approach and the processes.

You can access my You Tube “Customer Centric Strategies” channel through my LinkedIn profile page under “publications”

https://www.linkedin.com/in/stevepinchuk/
Agenda

- Customer Expectations
- What Does Next Best Action (NBA) Do?
- How Does Next Best Action Do This?
- Results
- Appendix: Personalized Pricing and Offers Airline Case Study
Expectations: Customers want it their way or they will leave to find it.

Customers want a **mutually beneficial lifetime relationship** not impersonal tactical sales targeting.
Agenda

• Customer *Expectations*

  • *What Does Next Best Action (NBA) Do?*

• How Does Next Best Action Do This?

• Results

• Appendix: Personalized Pricing and Offers Airline Case Study
What: NBA adds a new technique to the customer communications continuum

Who starts the action:

Customer Segment Campaigns

Type of action:

company triggered & non-triggered

Level of personalization:

Market Segment

Behavioral Cluster

Individual

NBA 1 to 1 Personalized Interactions

Now let’s add Next Best Action(s)

customer triggered outgoing batch 1 to 1 NBA actions

customer triggered inbound real time 1 to 1 NBA interactions
Agenda

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How: NBA’s decision process, is called a **Use Case** and is how NBA interacts with customers

- **Facts, Recent Events, Options**
- **Decision Input, Actions and Outcomes**

**Information & Analytics**

1. **Use Case Trigger / Interaction**
2. **Context**
3. **Use Case Decision Process**
4. **Facts, Recent Events, Options**
5. **Action**
6. **Implement the Actions & Offers**
7. **Decision Input, Actions and Outcomes**

**Cognitive Feedback**

- Marketing
- New Products
- Loyalty
- Operations
- Supply Chain

**Additional information (Watson)**

Gather social & external/internal unstructured data & apply it to NBA customer profiles or use it for event or life event triggers
How: NBA is the analytical engine between your data and your customer communication channels

Data Sources
(structured & unstructured)

Next Best Action Predictive Analytics Engine & Platform

Multiple Customer touchpoints

*Adapted from Forrester, 2014
How: 1 to 1 NBA, and an arbitration layer, sits between data and customer actions
How: Implementing Next Best Action

- YOU - develop the Customer interactions to target
- IBM & YOU Select and align NBA

Next Best Action
"Architecture & Tools"

+ Customer Data
"Building Supplies"

= Building your “Framework of Optimized Customer Interactions"
Agenda

• Customer *Expectations*

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• Appendix: Personalized Pricing and Offers Airline Case Study
### Results: IBM Customer Successes – Across Multiple Industries Over the Past 5 Years

<table>
<thead>
<tr>
<th>Use Case</th>
<th>Business Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Increase Customer Retention</strong></td>
<td>50% reduction in customer churn</td>
</tr>
<tr>
<td></td>
<td>25% increase in Loyalty program membership</td>
</tr>
<tr>
<td><strong>Increase Customer Acquisition</strong></td>
<td>50% increase in response rate for analytics-driven actions to new customers</td>
</tr>
<tr>
<td><strong>Cross-Sell &amp; Up-Sell</strong></td>
<td>270% increase in cross-sales of accessory products;</td>
</tr>
<tr>
<td></td>
<td>50% increase in effectiveness of customer retention actions</td>
</tr>
<tr>
<td><strong>Next Best Action to Personalize Customer Experience</strong></td>
<td>300% increase in spending among loyalty members;</td>
</tr>
<tr>
<td></td>
<td>400% increase in incremental sales to customers receiving personalized offers</td>
</tr>
<tr>
<td><strong>eCommerce Real-Time Recommendations</strong></td>
<td>20% increase in on-line purchases, fewer shopping cart abandonment.</td>
</tr>
<tr>
<td><strong>Pricing Optimization</strong></td>
<td>10% revenue increase from smarter pricing by category, individual/behavioral</td>
</tr>
<tr>
<td></td>
<td>clustering, and individual brands</td>
</tr>
<tr>
<td><strong>Call Center Optimization</strong></td>
<td>10% increase in call center operations productivity from smarter guided advisement,</td>
</tr>
<tr>
<td></td>
<td>quicker issue resolution</td>
</tr>
</tbody>
</table>
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Drive conversion and margin expansion with Personalized Pricing & Offers
What is the best personalized offer out of 460,800,000 possibilities?

The shear scale of possibilities will outstrip the best rules engine. This will require a **cognitive decision platform**. A platform that’s **exceptional at machine learning**.

IBM has developed **patented travel-specific optimization** algorithms that understand travel context, apply past learning to select optimal offers, and learn from offers and orders.

The cognitive engine **NEVER STOPS** learning and adjusting optimization.

**Think about it...**
- More complex view of customer
- More air, non-air and bundle options
- Offered at more journey points
- Through more channels
- AND, be ready to continuously change

**Consider One Market:**
- 40 routing/flight options
- 3 class of service options
- 80 price points/base products
- 40 air ancillary service options
- 100 non-air ancillary service options
- 12 customer segments
Cognitive Learning Engine

Micro Services

Passenger Self-Serve
- Web
- Mobile
- Kiosk

Staff Enabled
- Call Center
- Agents
- Flight Attendants
- Commercial Team (Administrator)

Initial Offer
- Personalized Offer: Destination
- Personalized Offer: Conversion Incentive

Post ticket purchase
- Dynamic Pricing: Preferred & Reserved Seats
- Personalized Pricing: Class-of-Service Upgrades
- Personalized Offer: Dynamic Packaging

IBM Travel Platform / © 2018 IBM Corporation Confidential
Proprietary Algorithms outperform state-of-the-art learning methods

Proprietary algorithms

- Recommending personalized offers or promotions based on customer insights (“context”)
- Behavioral progressive profiling of new customers to create fast, relevant engagement
- T&T Specific Algorithms patented

Contextual bandits increase speed of learning and **reduce** testing costs

24 US patents granted or pending
Case Study: Personalized Destination Offers

Using our patented algorithms, create **personalized destination offer recommendations** for passengers using information from loyalty systems, PNR databases and campaign management systems.

**AI features**
- Long Short Term Memory Networks (LTSMs) model the temporal dependencies across historical travel history
- Stacked “deep” LSTMs learn a hierarchy of feature representations across both time and feature space
- Transfer learning (e.g., knowledge distillation) to enable swift deployment

**Pilot Results**

Personalization leads to higher **conversions & revenue** during campaigns.

Customers that received personalized recommendations made over

**20% more bookings**

than customers in the control group

**54% more bookings**

in business class (F, A, J, Z, C, D)

Test Group members created

**44% more revenue**

compared to Control Group members
Case study: Paid class upgrades

Personalized class-of-service upgrade offers prior to travel

- Develop AI-based dynamic pricing services to identify personalized class upgrade recommendations for select airline customers using information from CRM systems, PNR databases, and campaign management systems.

- Evaluate its efficacy based on agreed upon performance metrics (revenue lift, conversion improvements) during a live test in selected test markets.

AI Features

- IBM Research proprietary AI algorithms analyze hundreds of thousands of data points on a continual basis and set prices on what the software believes passengers will be willing to pay.

Pilot results

AI-based pricing leads to higher conversions & revenue during promotional campaigns

Pilot deployments show that personalization can deliver over Up to 35% uplift in top-line revenue
Do you Have Enough Data Already?

Tom Gregorson
Vice President, Products & Solutions
Today we are talking about data lakes

1. Legacy databases
2. Website clickstream
3. Production/performance metrics
4. Organization guidance
5. Location or geospatial data
6. Social media
Do we have enough data lakes?

• **90%** Of the world’s data has been created in the last two years

• **2.5 quintillion** bytes of data a day

• More than **2.5 petabytes** per database
In the travel space

- **1,000 gigabytes** of data generated by the average transatlantic flight
- **200 million** weekly searches
- More than **50 input sources** are used to all available industry data
In the travel space

• Airlines use as little as 12% of their data

• Some larger carriers housing more than 50 data sources

• Managing and integrating data is the single biggest challenge
Our Fares & Rules system grew from 19 million in 1998 to 186 million in 2018
Approximately 822 million tickets were processed by ATPCO in 2016 and 903 million in 2017.

Various Data Sources: Industry Sales Record (ISR)

- 118 customers
- 50 carriers provide their TCN data directly to ATPCO
- 75 hosted carriers (TCN)
- 89 carriers (ARC/BSP data)
More than 5.7 billion transactions in the DDS (ARC/IATA) database

World's largest repository of the ticketing data

Several data delivery methods: Web-based Tool, Integrated Data Feed, Customized Files

Supports variety of functions: sales, distribution, network planning, and revenue management
Comprehensive: Fares

87% of all prices – Over 32% growth in last 5 Years

<table>
<thead>
<tr>
<th>Year</th>
<th>Public Fares</th>
<th>Private Fares</th>
<th>Total Fares</th>
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</thead>
<tbody>
<tr>
<td>2012</td>
<td>57</td>
<td>24</td>
<td>81</td>
</tr>
<tr>
<td>2013</td>
<td>69</td>
<td>4</td>
<td>71</td>
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<tr>
<td>2015</td>
<td>98</td>
<td>62</td>
<td>160</td>
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<tr>
<td>2016</td>
<td>113</td>
<td>47</td>
<td>160</td>
</tr>
<tr>
<td>2017</td>
<td>125</td>
<td>57</td>
<td>182</td>
</tr>
</tbody>
</table>
Timely Data
Growth triples the volume within the next 3 years

Hourly updates – 3.9M updates per day

Average (in millions) weekday subs recorded
## Various Data Sources

<table>
<thead>
<tr>
<th>Service</th>
<th>2006</th>
<th>2009</th>
<th>2015</th>
<th>2017</th>
<th>2018*</th>
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</thead>
<tbody>
<tr>
<td>Carrier-Imposed Fees (2005)</td>
<td>282</td>
<td>336</td>
<td>328</td>
<td>348</td>
<td>368</td>
</tr>
<tr>
<td>Ticketing Fees (2007)</td>
<td>N/A</td>
<td>24</td>
<td>92</td>
<td>121</td>
<td>135</td>
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<tr>
<td>Optional Services (2008)</td>
<td>N/A</td>
<td>14</td>
<td>137</td>
<td>201</td>
<td>207</td>
</tr>
<tr>
<td>Branded Fares (2009)</td>
<td>N/A</td>
<td>1</td>
<td>18</td>
<td>94</td>
<td>97</td>
</tr>
<tr>
<td>Baggage Allowance and Charges (2011)</td>
<td>N/A</td>
<td>N/A</td>
<td>397</td>
<td>418</td>
<td>434</td>
</tr>
</tbody>
</table>

*Data is as of May 2018*
3 Keys to Success

• Merge Unstructured & Structured Data
• Data Cleansing and Protection
• Sophisticated Data Processing
Structured and Unstructured Data

80% Unstructured

20% Structured

Vs

Database
Table

Routehappy by atpco
Worldwide Operations

**INFARE**
- 100 Million records
- 5 Gb compressed data

**ATPCO**
- 1.200 Million records
- 90 Gb compressed data
Sophisticated Data Processing
Data Cleansing & Protection:
NDC Exchange
Case Study

Challenge

• Achieve data normalization and cleansing in the Global Ticket Behavior
• Include NDC and non-NDC transactions
• Add value to the published pricing monitoring

Solution

NDC Exchange
Direct Data Solutions
Sophisticated Data Processing
Advances in Airline Pricing, Revenue Management, and Distribution

Evolution of airline pricing, revenue management, and distribution

Price selection mechanisms
- Assortment Optimization
- Dynamic Price Adjustment
- Continuous Pricing

Next generation mechanisms
- More frequent updating of fare structures
- Dynamic availability of fare
- Additional RBD capabilities

Dynamic price adjustments (increments or discounts)
- Continuous pricing
- Dynamic offer generation
Innovation at ATPCO

- R&D/Tech
- Bridge Labs
- Partner Co-Innovation
- Open Ecosystem
How Do We Move Forward?

• Stop asking do we have enough data (lakes)…

• Look to find ways to turn data into information:
  • Merge Structured & Unstructured
  • Data Cleansing & Protection
  • Sophisticated Data Processing