Dynamic Pricing & Personalized Ancillaries – ML engine

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Agenda

01 Ancillary Market Trends and Challenges

02 Business Needs & Requirements

03 Ancillary Dynamic Pricing Engine Process Flow

04 ML module

05 Value & Conclusions

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ANCILLARY MARKET TRENDS & CHALLENGES

Excess Baggage

Seat Selection

Cabin Upgrades

Cab and Hotel Stay

Wi-Fi

Food and Beverages

Co Branded Credit Card

Key Challenges for airlines and the business

Airlines are not fully optimizing ancillary revenue, an $83B revenue stream in 2020

Complexity of static pricing requires manual intervention and is time intensive

A customer-centric business requires personalization of pricing

$83B Ancillary revenue globally in 2020

Sources: Ideaworks yearbooks (2017, 2018, 2019), plus “Airline Ancillary Services - Global Market Trajectory & Analytics” (Global Industry Analysts, April 2021)

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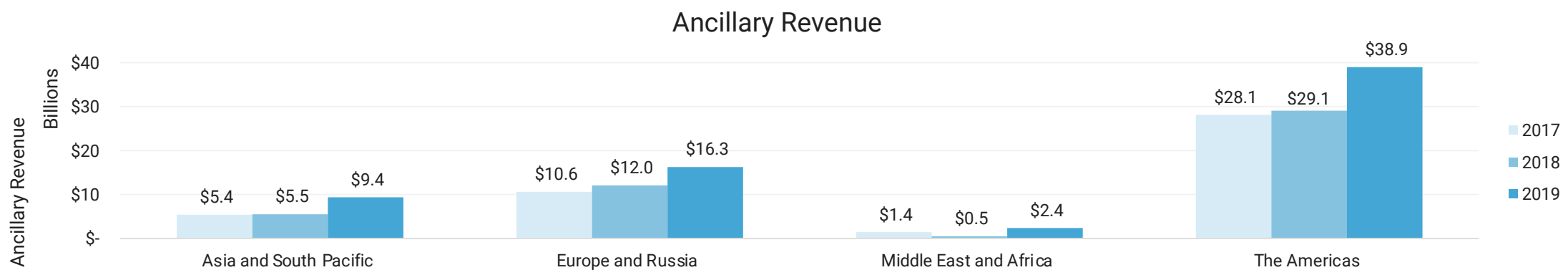
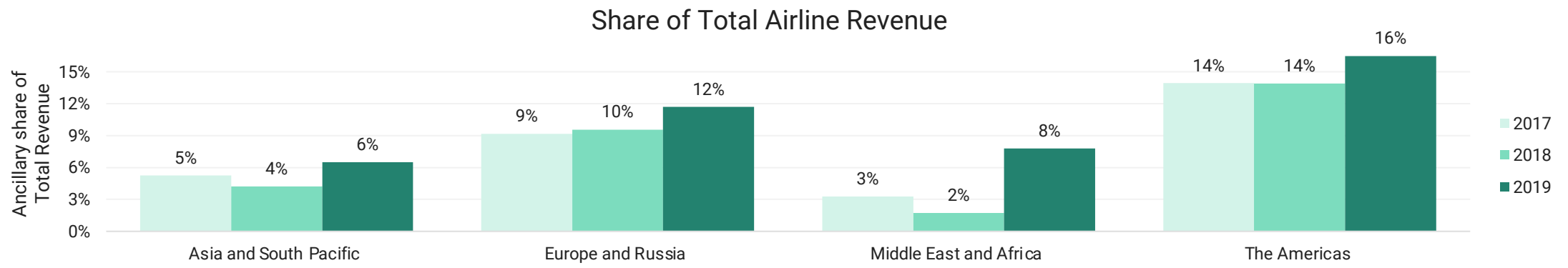
Ancillary Revenue projected to grow at 13% CAGR with frequent flyer programs driving revenue for US airlines





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Ancillary: Types

à la carte services

Services sold to passengers flying with the Airline
Dependent on Pax volume, not guaranteed

Preferred Seats

Extra Luggage

WiFi

Meals

Cabin Upgrades

Duty Free Products

strategic tie-ups

Upfront revenue, independent of pax flown

Car Rental

Insurance

Online Gaming

Advertising

Tickets to Events

Hotels

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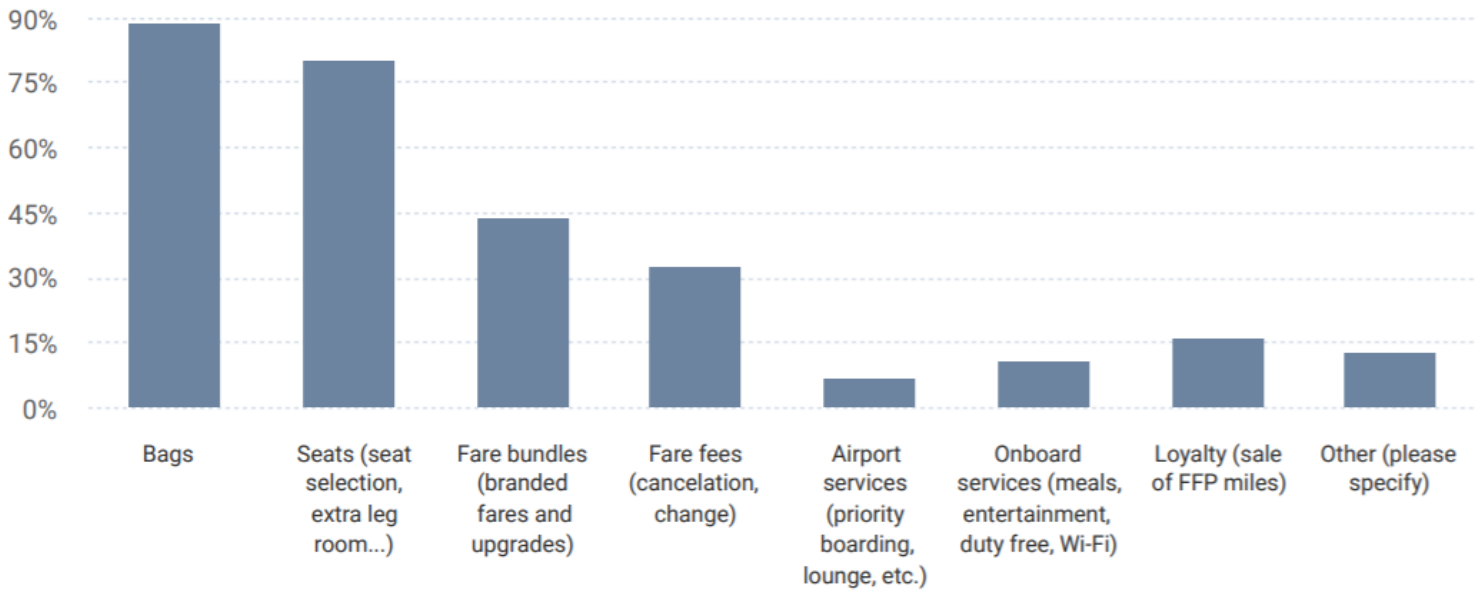
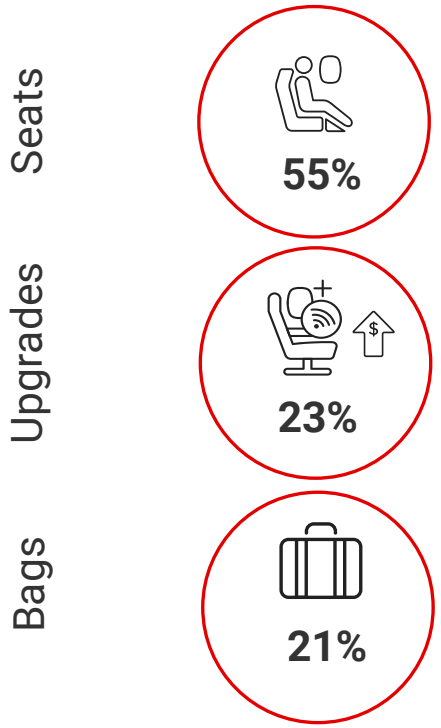
Bags remains the core revenue product for LCCs while Sabre data reveals Seats as the key ancillary revenue driver

What are your top 3 air ancillary products?



Source: 2019 Airline Digital Retailing Survey (Whitepaper) Diggintravel; 45 different airlines participated in the survey

Actual Ancillary Revenue Share



Source: Sabre data

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Recalibrate:
Product v/s Customer

Complete Retailer

Key to success in a post pandemic world will be unshackling themselves from their purely operational mindset

~$100 Billion

5-fold increase from 2010
Half of the aviation fuel cost

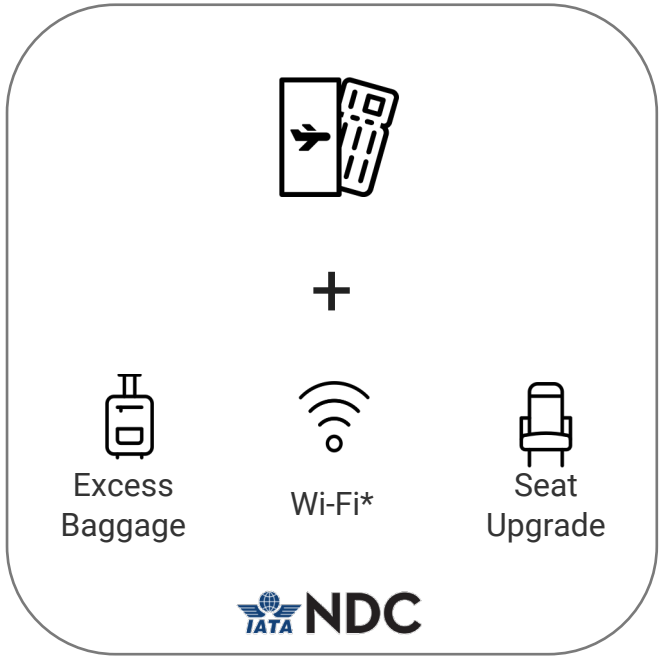
12%

Of the total revenue
$24 per pax flown

BUSINESS NEEDS & REQUIREMENT

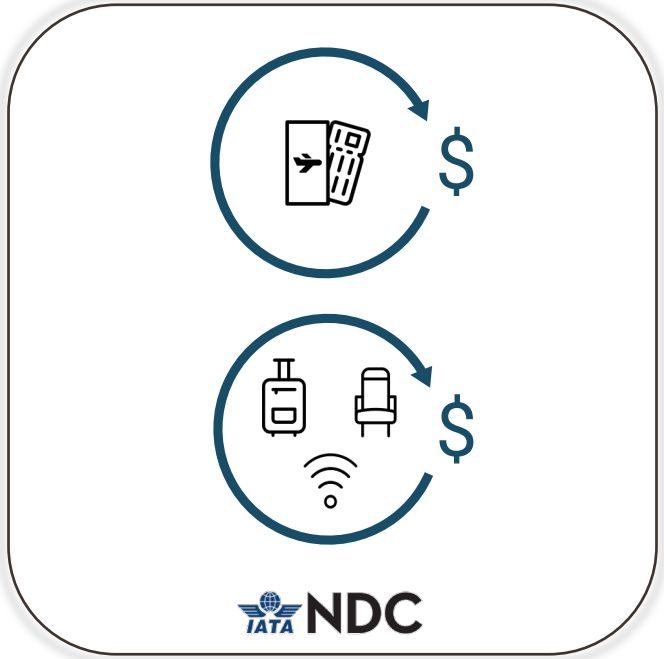
ML/AI to play a key role with pricing, bundling and 360-degree personalization

STATIC OFFER



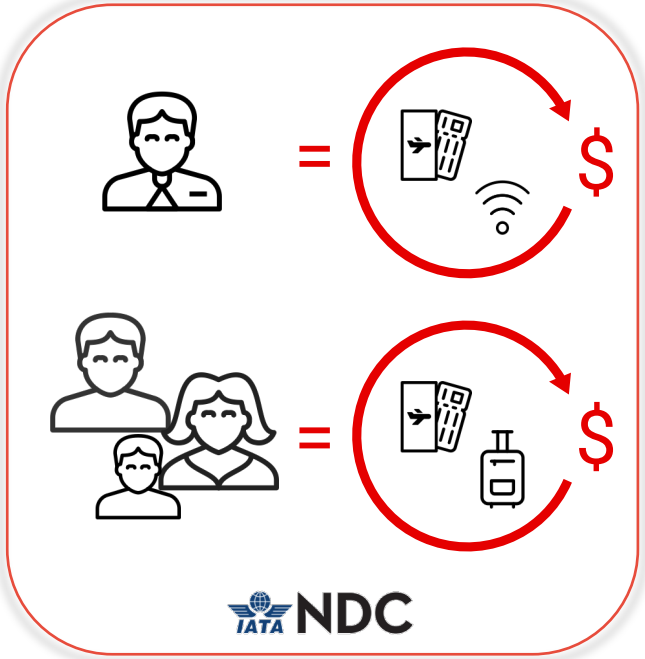
Ticket fares and ancillary product prices are time invariant.

DYNAMIC OFFER



Prices of tickets and ancillaries are dynamic based on segment context.

CUSTOM OFFER



Personalized pricing and offers are generated based on passenger attributes.

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Customer Centric Ancillary Pricing Evolution

Current Airline Methodology

Static Pricing

- ✗ Manual process
- ✗ Time intensive
- ✓ Analyst driven fares/offers
- ✗ Low refresh frequency
- ✗ Less price variation by execution channel
- ✗ Price variation by less dimensions

Ancillary Dynamic Pricing Engine

Dynamic Pricing

- ✓ Automated process with minimal manual intervention
- ✓ ML driven fares/offers
- ✓ High refresh frequency
- ✓ High flexibility for price variation by execution channel
- ✓ Price variation by many dimensions

Personalized Pricing

- ☆ Automated process without any manual intervention
- ✓ ML driven fares/offers
- ☆ Real time
- ✓ High flexibility for price variation by execution channel
- ☆ Passenger level price variation

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Ancillary Dynamic Pricing Engine - Requirements

ADPE dynamically generates best offers for passengers based on their propensity to purchase an ancillary

Personalized Offer
ADPE provides customized price/offer based on passenger preferences and market conditions

Ancillary Product Level Optimization
ADPE understands and customizes price/offer for booking flow, post booking flow and airport purchase differently

Machine Learning Driven
ADPE uses state of the art ML algorithms to generate incremental ancillary revenue

Unique Decision Support
Advanced visualizations for users to track various KPIs, rules and configurations

System Agnostic
ADPE is not dependent on GDS and can be configured to use with any retailing channel

No Manual Intervention
Pricing for each ancillary is automatically generated and sent to different retailing channels without user intervention

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Willingness to pay insights can be mined from rich historical airline PNR and Flight data using ML

- Cabin Load Factor
- Leg Origin Destination
- Departure Date
- Flight Distance/Duration
- Equipment Type

- Number in Party
- Travel Date
- Ticket Issue Date
- Ancillary Issue Date
- Ancillary Type and Value
- Booked Fare Class
- Booked Cabin
- Point of Sale
- Length of Stay
- Trip Origin Destination
- Trip Type (One Way or Round Trip)
- Travel Direction (Out, Return)
- Frequent Flyer Level

Seat choice

- Seat Row
- Seat Column (Window, Middle, Aisle)
- Seat Characteristics (Standard, Preferred, Extra Leg Room)

Excess Baggage

- Type of Bag Market (piece, weight, handbag only)
- Type of Bag Product (1KG, 5KG, 25KG, 32KG)

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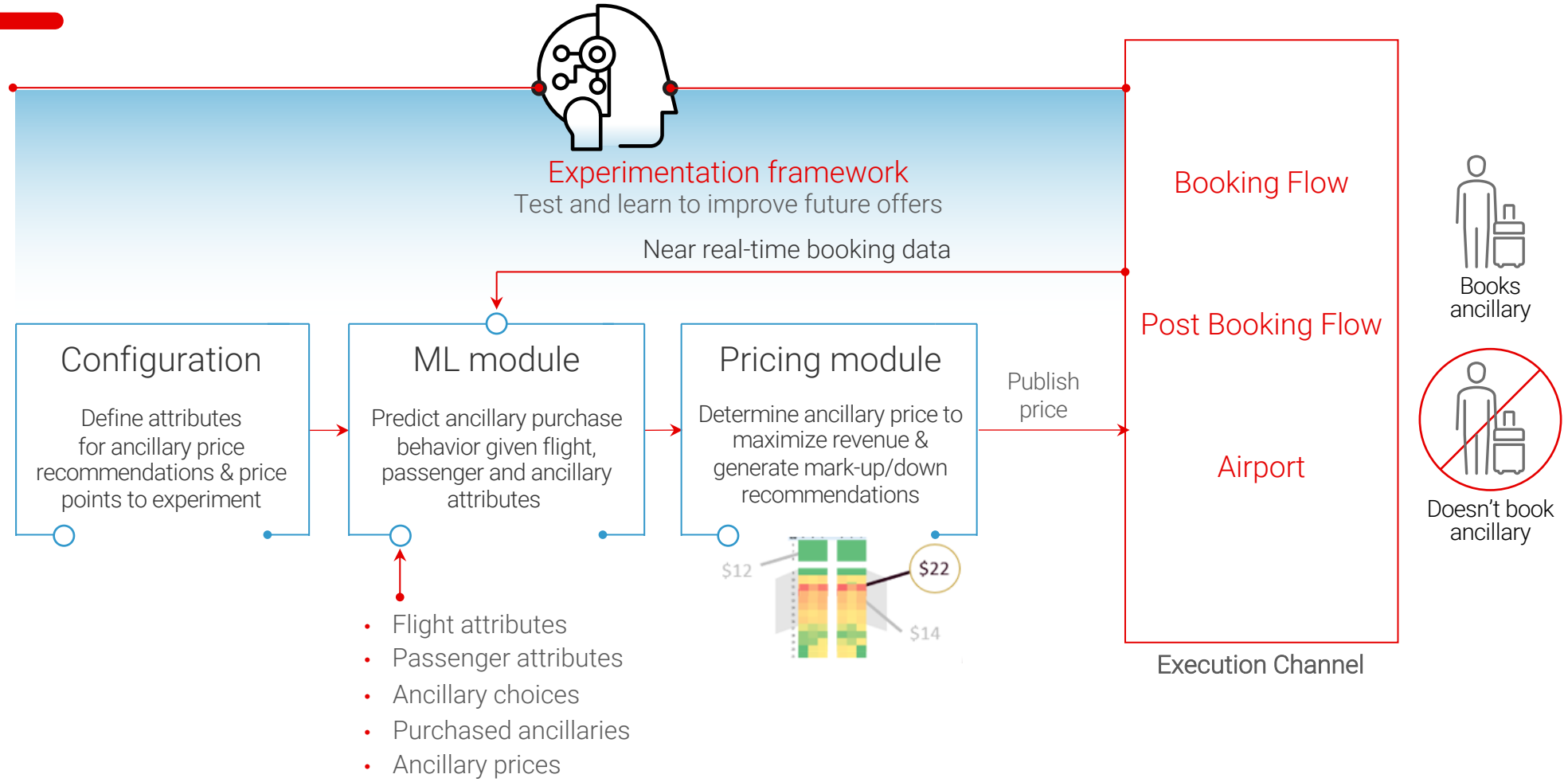
ANCILLARY DYNAMIC PRICING ENGINE PROCESS FLOW

ADPE consumes a trained ML model to determine the right price by request and channel



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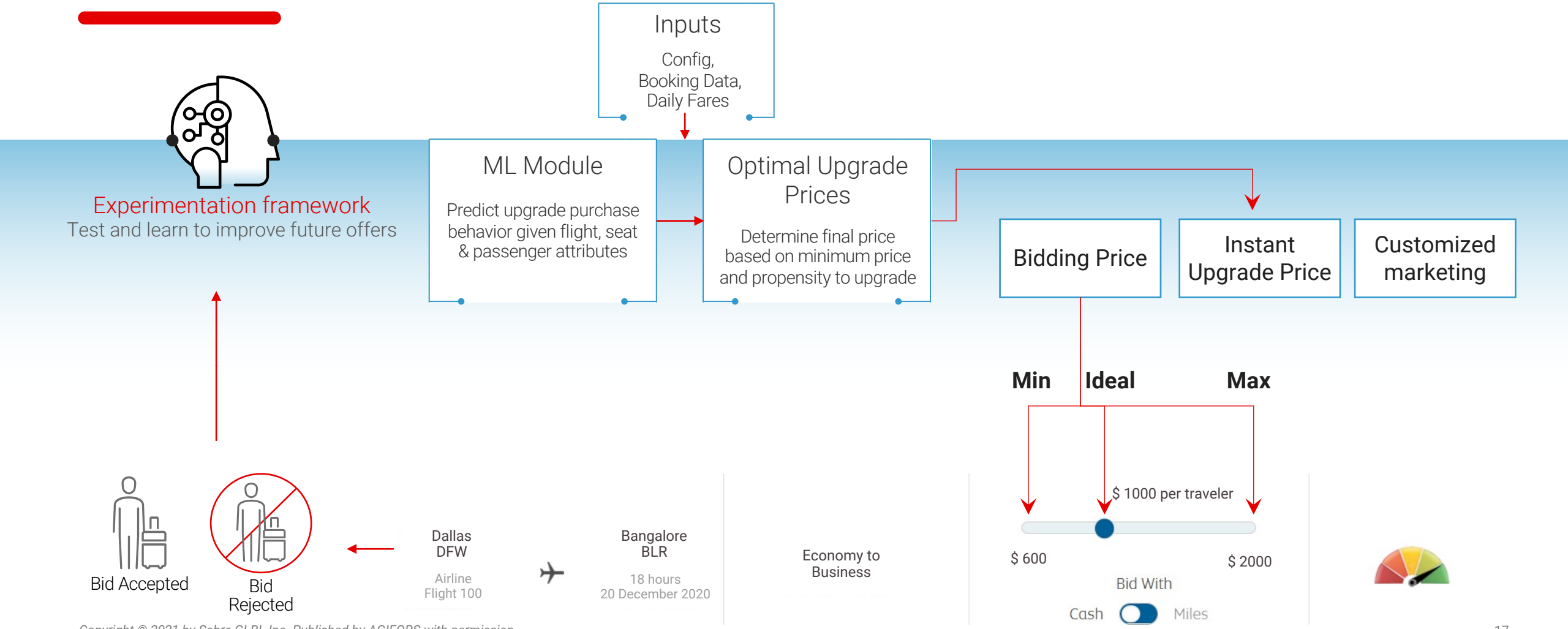
ADPE recommends multiple price points for upgrades based on execution channel and traveler profile



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Business Use case - flow

Input data

Passenger Booking

Party size
Channels
Advance Purchase
Frequent Flyer status
Booked Cabin
Additional attributes

Flight Attributes

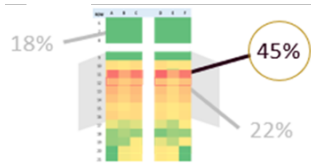
Cabin Load Factor
Leg Origin and Destination
Departure Date
Flight Distance / Duration
Equipment Type

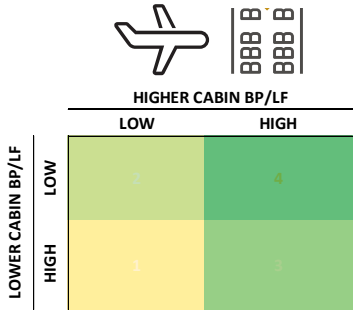
Ancillary Selection

ML Model

Model Recommendation

High Prob | Low Prob



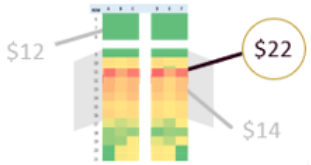


Final Price Output

$5 per kg | $45 | $25

25kg | 10kg

High Price | Low Price



PNR 1 **$250**

PNR 2 **$220**

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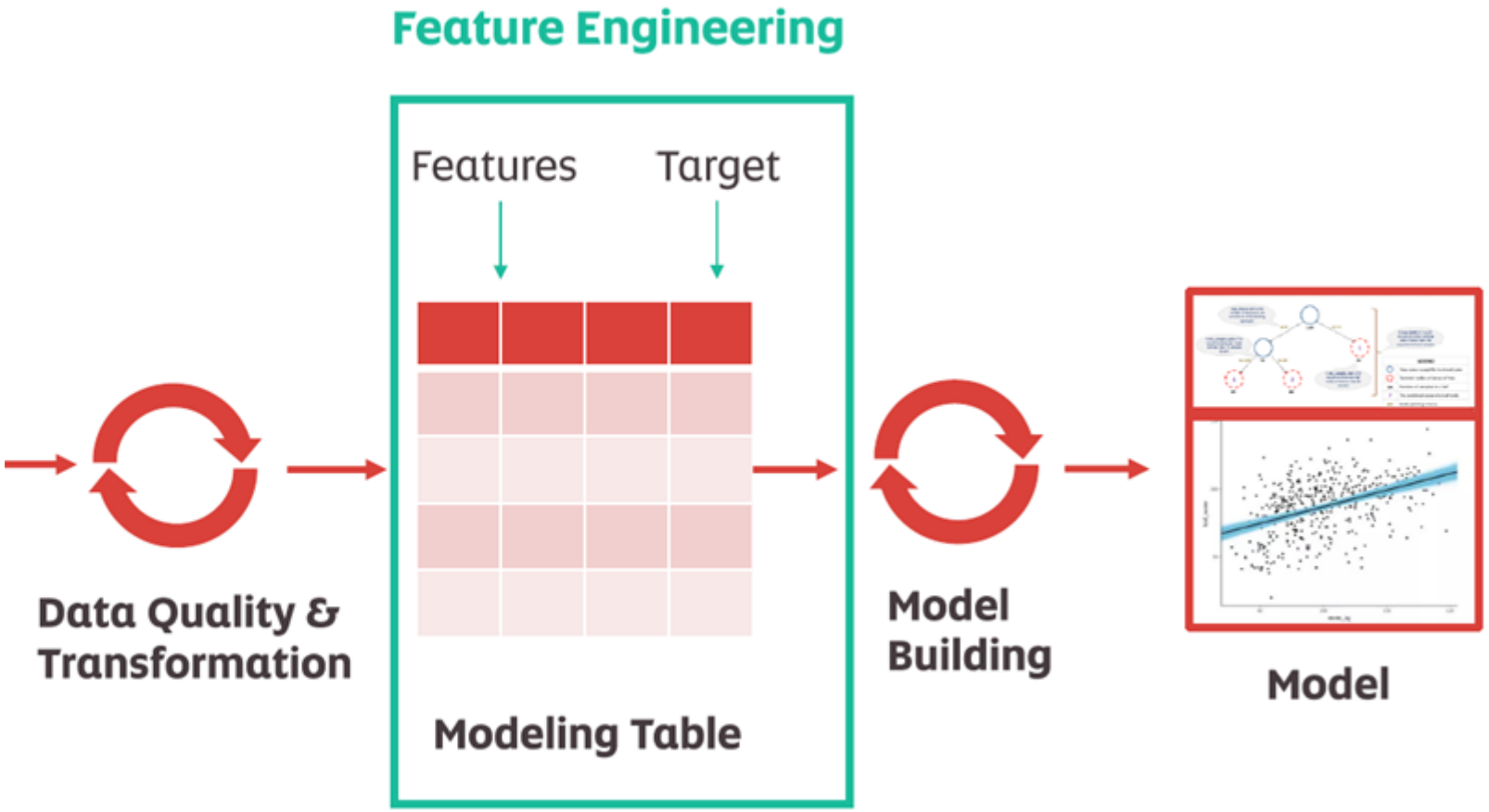
ML MODULE

ML Workflow

Data Integration

- Collect data from different sources
- Get business understanding of the available data
- Determine relationship between different data sources
- Understand and validate the correlation with the target variable



8 - 10 weeks	3 weeks	2 weeks

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ML Model Training involves multiple iterations

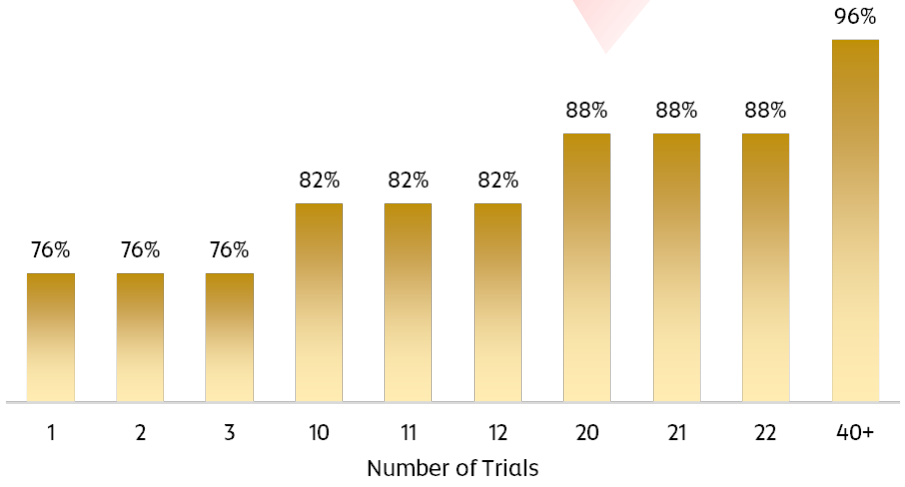
Model Features

Travel Attributes

Passenger Attributes

Aircraft Attributes

Model Accuracy



Model Prediction Accuracy

	NO	YES
NO	98%	2%
YES	18%	82%

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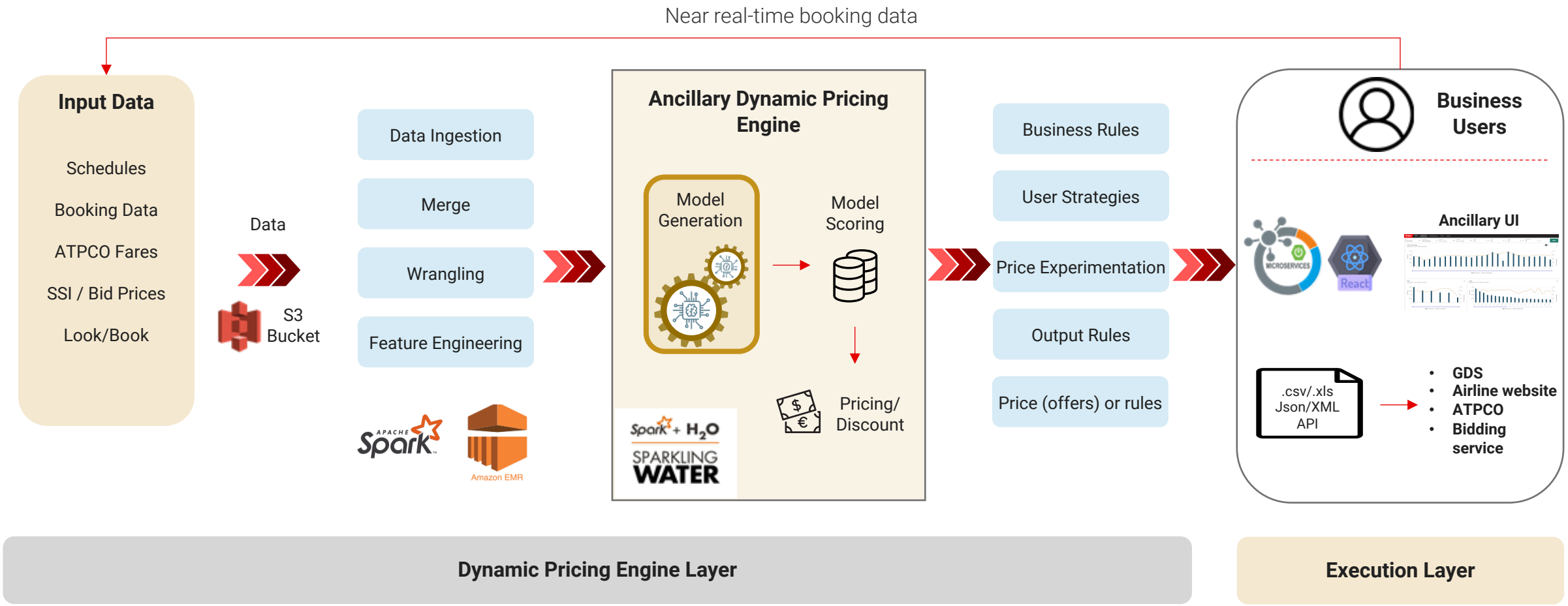
ADPE – Architecture / Data Flow



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ML Problem Formulation

- How likely is the sale of a given seat type?

Booking Data
Flight Data
Seat Maps
One Seat Type + Price

Binary Classification Model
(GBM Model in POC)
(DNN in Product)

Purchase Probability
for a
GIVEN Seat Type

Which seat type is most likely to sell?

Booking Data
Flight Data
Seat Maps
ALL Seat Type + Price

Multiclass Classification Model
(Experimental – Future Enhancement)

Purchase Probability
for a
ALL Seat Types

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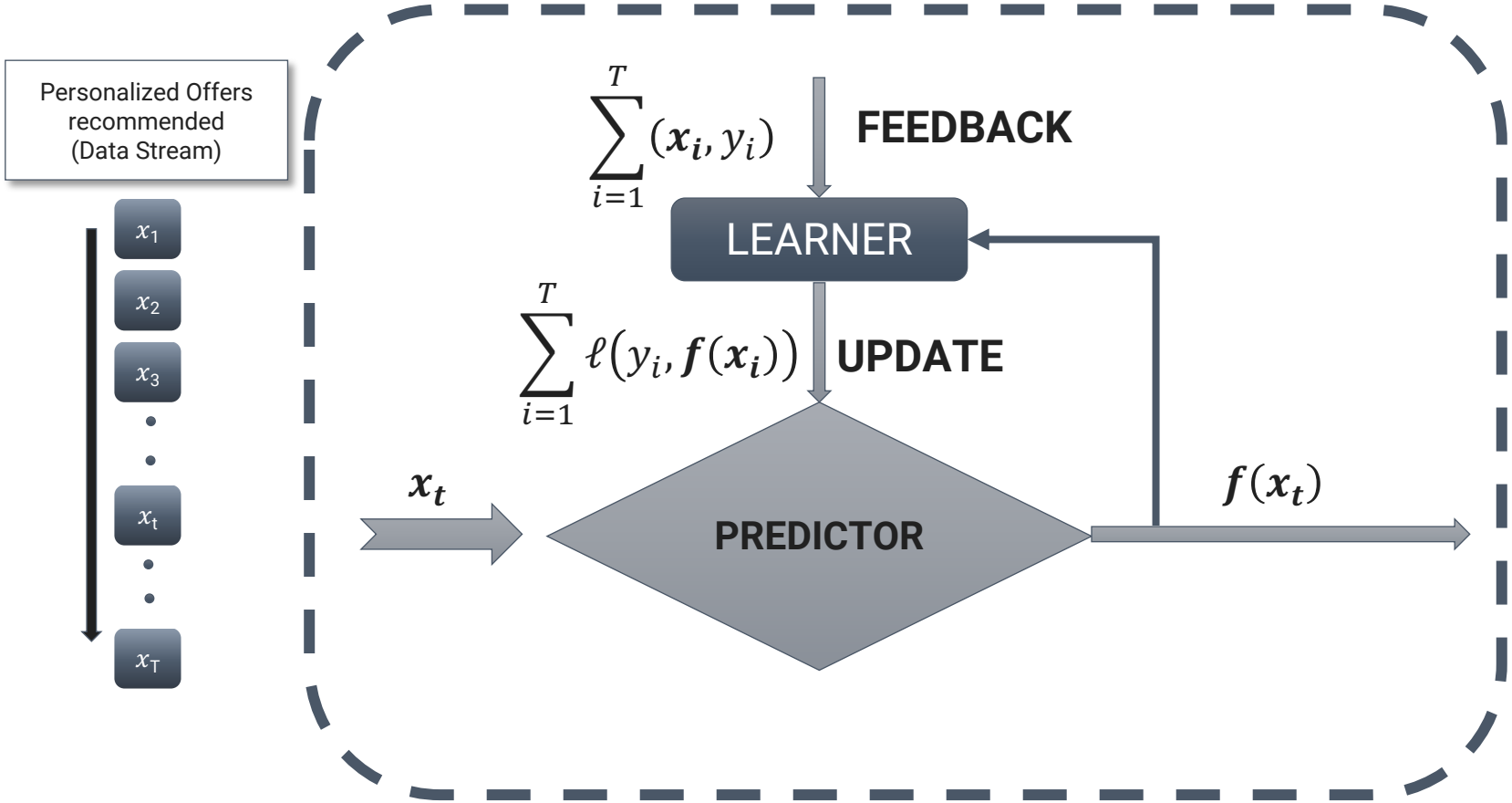
Why DNN? – Feedback + Incremental Learning



Symbols	Description
$\boldsymbol{x}$	List of input variables/ Features [flight segment, booking, PNR]
$\boldsymbol{f}(\boldsymbol{x})$	For a given list of $\boldsymbol{x}$ features, outputs probability of seat purchase
y	Ground Truth/ Target Variable [Type of Seat purchased]
$(\boldsymbol{x_i}, y_i)$	i^{th} training sample
T	# of Training Samples for Feedback
$\ell(y, \boldsymbol{f}(\boldsymbol{x}))$	Cost function: minimize loss

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VALUE & CONCLUSIONS

What does this mean to Business?

BEFORE		*NOW*
ONLY 20% of ancillary seats in Network used to receive price changes – **Manually**		100% of ancillary seats in Network receive dynamic price changes – **Trip level personalized & Automated**
High level Seat upgrade prices are reviewed **less frequently**		**POS** purchase propensity, **load factor** and **flight forecast** changes captured in an **Automated fashion**
Manual price changes required for each digital touch point		**Trip level personalized** fares made available in all digital touch points in **Automated fashion**

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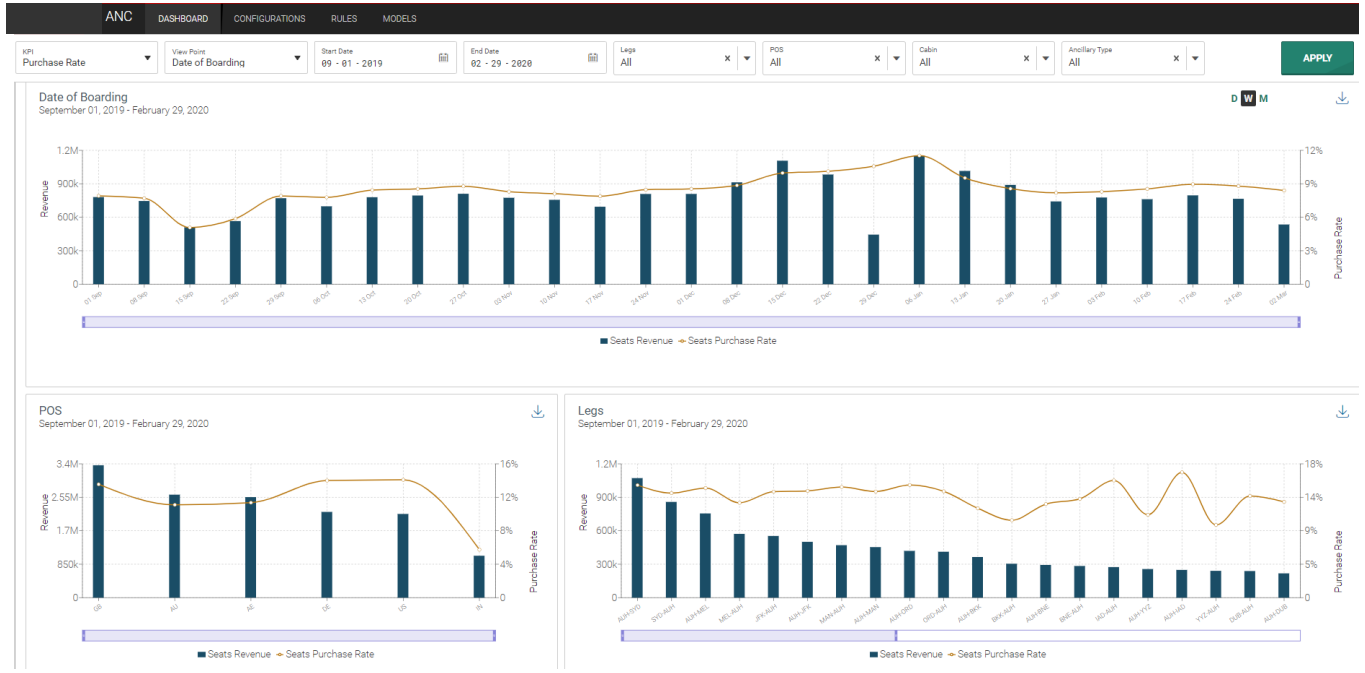
Value Tracking

Comparison Methodology

- ML routes vs Network
- Before and after measurement
- Switching ML on and off in different comparable periods
- Price Experimentation

KPIs

- ✓ Revenue
- ✓ Ancillary Purchase Count
- ✓ Revenue per Flown
- ✓ Purchase Rate
- ✓ Average Price
- ✓ Seat Selection Rate
- ✓ Cabin Load Factor
- ✓ Excess Weight Carried



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Extension and Add-on benefits of APDE

Customized Offer at PNR Level
ADPE can provide PNR level price variations

Targeted Marketing Campaigns
ADPE provides customized price/discount based on passenger and flight attributes

ML Based Price Experimentation
ADPE has additional module to perform automated price experimentation

Price Elasticity Analysis
After few months, ADPE generated price variation can be used for price elasticity study

Trip Purpose Segment Application
ADPE can use segments as features for ML models and price recommendations

Ancillary Bundling Offers
Next step is to get possible ancillary bundles and corresponding price recommendations

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