

## MODIHOST: Next Generation HMS

TECHNICAL WHITEPAPER

Ver. 1.0 | October 2019

- > Al powered
- > Blockchain enabled
- End customer experience centered
- > Big data & analytics leveraged
- > Service provider focused

MODIHOST TECHNICAL WHITEPAPER

# The Next Generation Hotel Management System







- > Motivation, Vision, Theme, High-level outline of the use cases, and grouping of use cases by the customer life cycle
- > High level architecture for group of use cases, and categorization by technology (AI, IoT, Microservices)
- > Architecture for HMS
- > Technology selection and rational for use case realization
- > Analytics categorization by personalization and generalization
- > High-level architecture for recommendation engine and NBA/NBO
- > AI, Analytics, IoT, Big Data interactions
- > Architecture Realization Roadmap for the HMS platform based on Microservices approach



## **Motivation**

Stability is no more for granted – it was a luxury of the past. Advances in technology led by ubiquitous connectivity, concern for the climate change, increasing awareness, access to information, and integration of culture have fundamentally shifted the market dynamics. These shifts are causing disruptions and globalization at an unprecedented pace. In today's environment, only a cognitive enterprise can thrive. The one that is agile enough to learn from its mistakes and self-corrects itself. The one that intelligently interacts with its clients, customers, and their environment in a manner that it adapts to exactly what they need and delivers it to their delight, paying

particular attention to specific requirements of each one of them individually. The next generation platform to support a cognitive enterprise must have the customer at its center and be focused on meeting their needs. As these needs change, the platform must enable the cognitive enterprise to reinvent itself. This reinvention must ripple through the entire organization across people, culture, technology, skills and processes, to quickly renew and readjust. Innovative adaptation must be engineered into very foundation of the enterprise itself as well as into enabling platform, with mechanisms of flexibility to auto-scale across a multitude of dimensions.

Aggarwal A, Jindal D

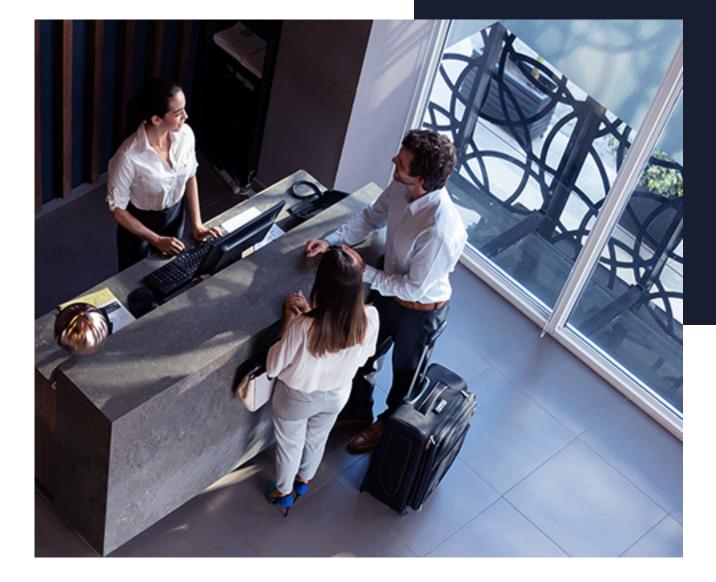
Excerpts from 'Data driven Al'





## FUTURISTIC CUSTOMER EXPERIENCE PLATFORM

for interactive communication to provide outstanding service in real-time, setting the new standard in hospitality





## Mission

To create an innovative
Microservices based core HMS
System with value added services
leveraging cloud, AI/ML, NLP,
Blockchain, IoT, and state of the
art in technology to bring a
differentiated customer
experience and generate new
revenue streams for our clients







#### **EXPERIENCE**

Creating a differentiated experience for the customer and real net new value for the service provider

#### **MICROSERVICES**

Based HMS, AI powered and blockchain enabled services – all offered on a pay by usage 'XaaS' model

Delighting the customer while creating new revenue streams and additional cross-sell / up-sell opportunities for interested customers in a non-intrusive and non-annoying manner



# HMS and Customer Experience Use Cases



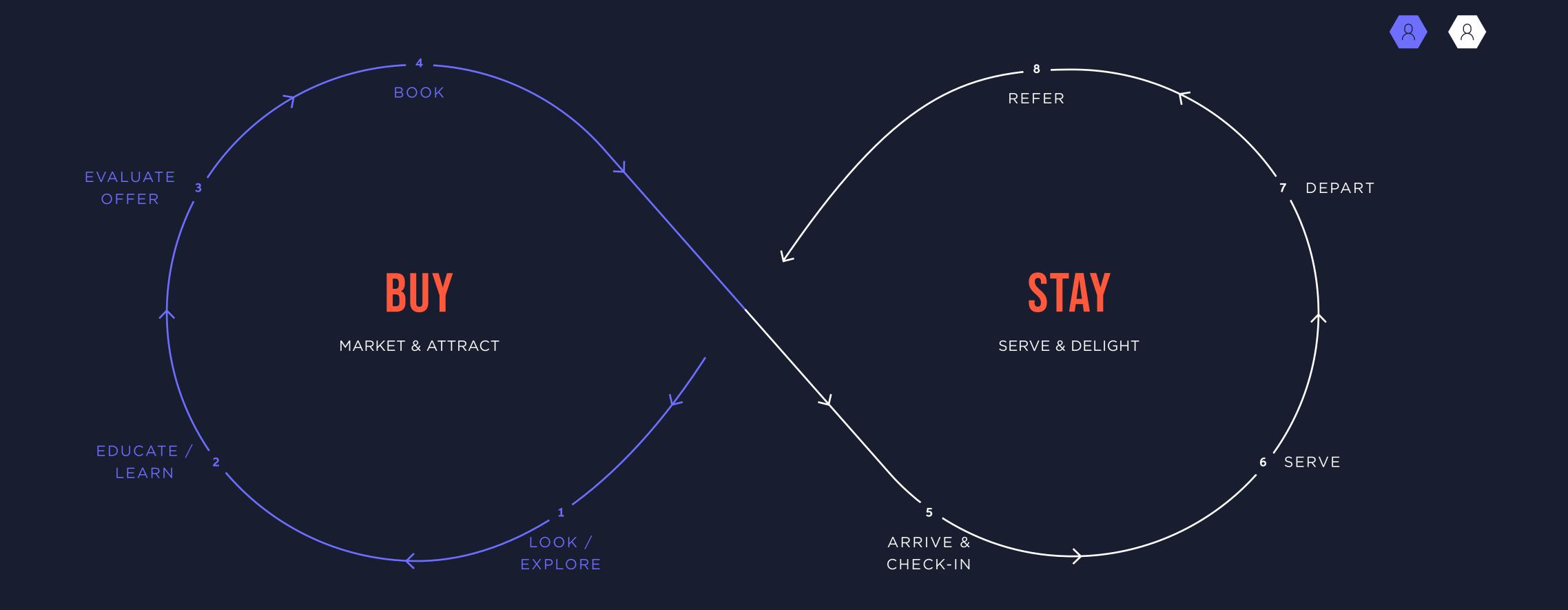
# Defining the new threshold for end to end customer interaction and experience

Core HMS enables looking, dynamic pricing, selection, inventory hold, booking, confirmation, and related services Value added HMS provides AI powered and blockchain enabled services, big data & analytics, recommendations for next best offer / next best action

BOTH CORE AND VALUE-ADDED HMS ARE OFFERED ON A PAY BY USAGE 'XAAS' MODEL



## **Customer Experience Lifecycle**





## **HMS Experience — Value Proposition for providers / Customers**





STAY

## **Customer Experience Lifecycle phases at a glance**

	Number	Phase	Channel	Activity	Criterion	HMS Play
	1	Look / Explore	Web, Mobile, Call, Chatbot/NLP, Social	Browse, gather inputs	Price, Preferences, Location proximity	Ads for provider XaaS, context driven query, 360° customer data - personalized offers, loyalty cross-linkage, dynamic pricing engine, recommendation engine
	2	Educate / Learn	Web, Mobile, Call, Chatbot/NLP, Social	Find out more	Facilities, Attractions	Provide more details per context, more granular personalization, best offers
	3	Evaluate Offers	Web, Mobile, Call, Chatbot/NLP, Social	Compare	Suitability to needs	Comparison engine, ratings, at a glance fair and honest view
	4	Book	Web, Mobile, Call, Email, Chatbot/NLP	Commit	The best option	CPQ, Order Management System, Inventory Interaction XaaS, CCTx,
	5	Arrive & Check-in	Mobile, GPS, In-person, Chatbot, NLP	Welcome, Transport	Guest Status, Type of Booking	Extra Services, Add-ons, Preferences, 360 data, Loyalty programs
	6	Serve	Text, Email, Chatbot/NLP, In-person, Call	In-room service, upkeep	Facilities, Info, Concierge, Environment	Mobile app chatbot – reschedule, weather, event cancellations, interactions, preferences, menu, orders, IoT
	7	Depart	Mobile Chatbot/NLP, In-person, Call	Goodbye, Transport	Ease of checkout, Bill delivery	Billing, Charges verification & dispute settlement, IoT sensor data
,	8	Refer	Text, Call, Email, Social	Refer others	Wowed	XaaS: Survey, Referral Incentives, Pain point / CX capture, feedback

## **HMS Core through Buy cycle**

Number	Phase	Channel	Activity	Criterion	HMS Play
1	Look / Explore	Web, Mobile, Call, Chatbot/NLP, Social	Browse, gather inputs	Price, Personal Preferences, Location proximity	Ads for provider XaaS, context driven query, 360° customer data – personalized offers, loyalty cross-linkage, dynamic pricing engine, recommendation engine
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4	Book	Web, Mobile, Call, Email, Chatbot/NLP	Commit	The best option	CPQ, Order Management System, Inventory Interaction XaaS, CCTx,

#### **Swag List of XaaS:**

- 1. Drives
- 2. Ads for provider/s, subscribed-in options, comparison of discounts from other providers, direct sales incentive, context driven query, device IP correlation, 360 customer data capture, preferences capture, retrieval personalized offers (dynamic recommendation engine ingests big data from social channels in real time, loyalty cross-linkage, dynamic pricing engine, NBO/NBA (this is the most important phase where a provider had a first chance to attract attention of the explorer buyer so match what one needs wisely to what you offer: internally score options before recommending)
- 3. Comparison Engine (within facility / brand), Cross-brand, Cross-type comparisons by context, ratings from review / multiple / averaged scores (this phase is comparing and evaluating selections before final decision)
- 4. CPQ, Order Management System, Inventory Interaction, CCTx, Commit Tx, Confirmation through preferred channels email, chat, sms text, with GPS directions / coordinate details, location and weather warnings



## Value Added HMS through Buy cycle

Number	Phase	Channel	Activity	Criterion	HMS Play
1	Look / Explore	Web, Mobile, Call, Chatbot/NLP, Social	Browse, gather inputs	Price, Preferences, location proximity	Ads for provider XaaS, context driven query, 360 customer data – personalized offers, loyalty cross-linkage, dynamic pricing engine, recommendation engine
2	Educate / Learn	Web, Mobile, Call, Chatbot/NLP, Social	Find out more	Facilities, Attractions	Provide more details per context, more granular personalization, best offers
3	Evaluate Offers	Web, Mobile, Call, Chatbot/NLP, Social	Compare	Suitability to needs	Comparison engine, ratings, at a glance fair and honest view
4	Book	Web, Mobile, Call, Email, Chatbot/NLP	Commit	The best option	CPQ, Order Management System, Inventory Interaction XaaS, CCTx,

#### Swag List of VAaaS:

- 1 & 2. Reinforcement learning (AI) driven Ads for provider/s (ads that evaluate effectiveness of previous ad actions that converted to buys), Reinforcement learning driven comparison of other providers (comparisons that have effectively been considered previously by same buyer or buyers of similar interest profile), AI layer assisted context driven query mapping to multiple data sources, AI assisted personalized recommendations (reinforcement learning to value add), AI driven pricing (reinforcement learning)
- 3. Context driven, AI assisted (reinforcement learning) comparison engine enablement (within facility / brand), Cross-brand,
- 4. Chatbot assistance to enable booking and provide conformation Chatbots also enable 1,2 & 3



## **Analytics HMS through Buy cycle**

Number	Phase	Channel	Activity	Criterion	HMS Play
1	Look / Explore	Web, Mobile, Call, Chatbot/NLP, Social	Browse, gather inputs	Price, Preferences, location proximity	Ads for provider XaaS, context driven query, 360 customer data – personalized offers, loyalty cross-linkage, dynamic pricing engine, recommendation engine
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#### Swag List of AaaS:

#### Generalization:

Corelate from device ID the browsing history, looks and books and map to just gathered data on customer demographics and generic preferences to aggregate the most likely offers to be accepted (Step 1)

#### Personalization:

Further refine output from Step 1 above to laser beam the focus on this particular individual, in view of personal tastes and preferences, and immediate correlation with any additional inputs from social media and other applicable data sources / rules (if any, viz. specific corporate restrictions for rate cap in case of business travelers)





Number	Phase	Channel	Activity	Criterion	HMS Play
5	Arrive & Check-in	Mobile, GPS, In-person, Chatbot, NLP	Welcome, Transport	Guest Status, Type of Booking	Extra Services, Add-ons, Preferences, 360 data, Loyalty programs
6	Serve	Text, Email, Chatbot/NLP, In-person, Call	In-room service, upkeep	Facilities, Info, Concierge, Environment	Mobile app chatbot – reschedule, weather, event cancellations, interactions, preferences, menu, orders, IoT
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8	Refer	Text, Call, Email, Social	Refer others	Wowed	XaaS: Survey, Referral Bonus / Incentives, Paint point / CX capture, feedback, verify

#### **Swag List of XaaS:**

5. Welcome aaS – book car, driver meets and greets at airport with name display; send GPS directions via email or mobile app, Room assignment by status, preferences (view, floor level, road noise sensitivity); check-in check-list by guest (personalized)

**HMS Core through Stay cycle** 

- 6. Check with guest that everything is fine, and ask them to let you know if anything can be made better by email, mobile app; Monitor and alert if traffic jams, event cancellations or area blockage owing to political unrest, protests, safety / severe weather
- 7. Thank you note by email / mobile app, bill delivery by email / preferred channel, airport transport vehicle driver meet and greet, GPS directions to airport if self-driving a rental vehicle and warning to adjust departure if traffic / weather delays, flight status notification, readjust airport pickup if flight delayed, coordinate flights departure time and vehicle pickup, assist in flight rescheduling / rebooking if significantly delayed or cancelled
- 8. Send survey, ask to refer if satisfied, ask for pain points and inform property / brand what they can improve, share feedback with brand, reassure, capture CX and enrich data

STAY

Number	Phase	Channel	Activity	Criterion	HMS Play
5	Arrive & Check-in	Mobile, GPS, In-person, Chatbot, NLP	Welcome, Transport	Guest Status, Type of Booking	Extra Services, Add-ons, Preferences, 360° data, Loyalty programs
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#### Swag List of VAaaS:

5. Mobile app / Robot welcomes by location tracking on arrival, auto check-in, step by step guidance to navigate to room location, auto-offer luggage assistance with drop instructions, auto-offer valet parking / self-parking with guided instructions, GPS integration for required VAaaSs.

Value Added HMS through Stay cycle

- 6. IoT sensors detect what is missing and housekeeping replenishes (except when DND); Chatbot / NLP to check everything is OK, turn lights on/off, adjust temperature heat/cool; order in-room service. Auto-laundry pickup; offer spa / other services per preference and persona type without being annoying,
- set or disable or readjust alarms, pick up vehicle timing adjustment, in-room breakfast delivery, set preferred music notes (if required), provide info about facilities on the house and extra services available, when asked, like trips to attractions and adventures etc., any special local event or occasion (viz. President House lit up on Jan 26th in New Delhi, India)
- 7, 8. Personally thank (chatbot / NLP / app) for the stay and business, with request / incentive to come back

STAY



## **Analytics HMS through Stay Cycle**

Number	Phase	Channel	Activity	Criterion	HMS Play
5	Arrive & Check-in	Mobile, GPS, In-person, Chatbot, NLP	Welcome, Transport	Guest Status, Type of Booking	Extra Services, Add-ons, Preferences, 360° data, Loyalty programs
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8	Refer	Text, Call, Email, Social	Refer others	Wowed	XaaS: Survey, Referral Bonus / Incentives, Paint point / CX capture, feedback, verify

#### **Swag List of AaaS:**

Generalization (CX):

Capture data related to the customer to analyze buying patterns for services, preferences, activities engaged (viz. adventure, tours etc.) at an aggregate level by demographics, income level, type pf traveler (leisure, adventure, business, family) – and play back from this aggregation as needed (Step 1)

Personalization (CX): Further capture data related to the individual customer to make it 360° view, over and above Step 1 above and play back from it as needed (Step 2)

Generalization (BX):

Capture data related to the brand to analyze customer buying patterns for services, preferences, activities engaged (viz. adventure, tours etc.) at an aggregate level by brand type

Personalization (PX):

Further capture data related to the specific property to make it 360 degree view, over and above brand aggregate level and play back from it as needed to customers when required

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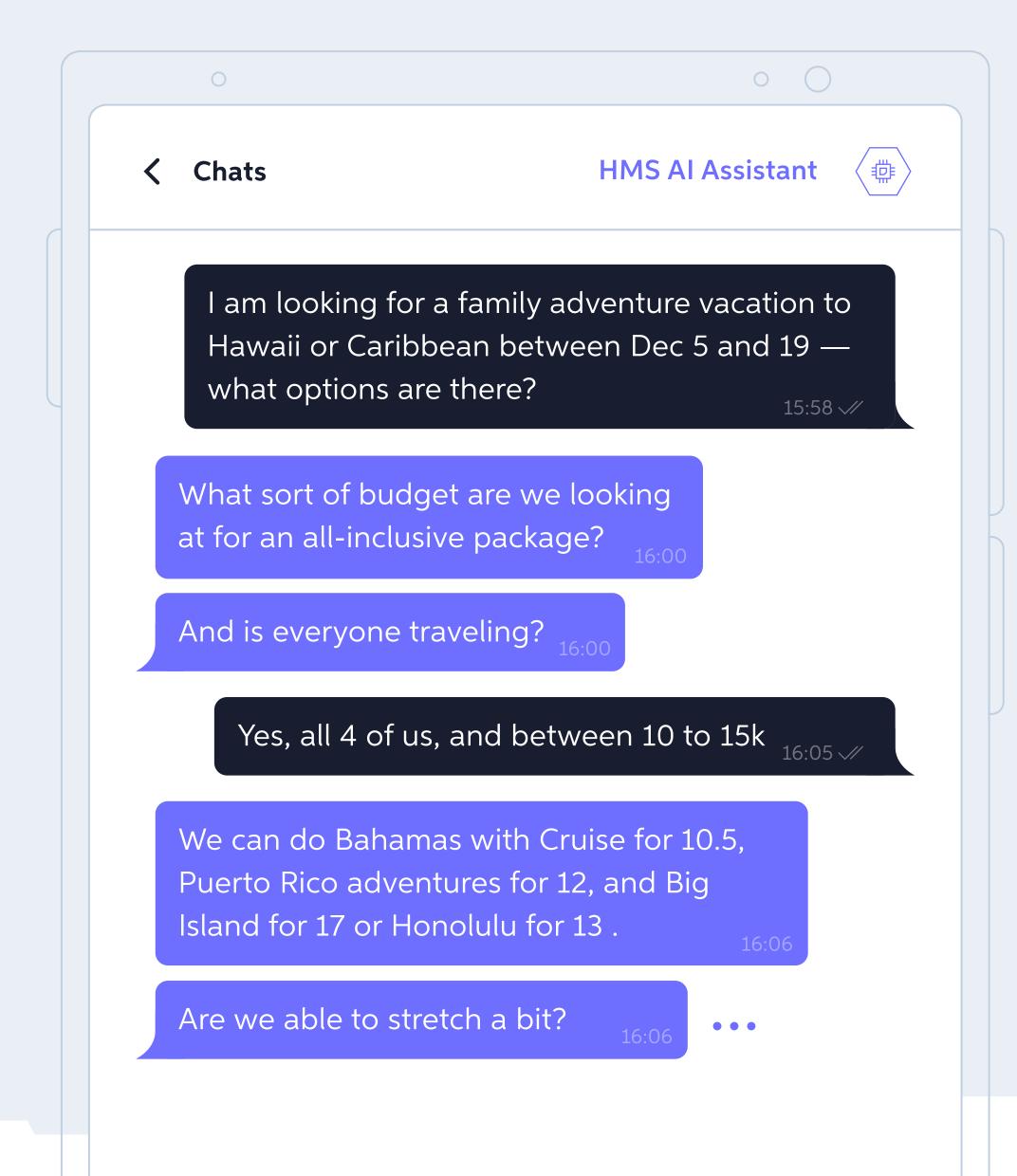
## Use Cases to Al Dialog Mapping at a glance

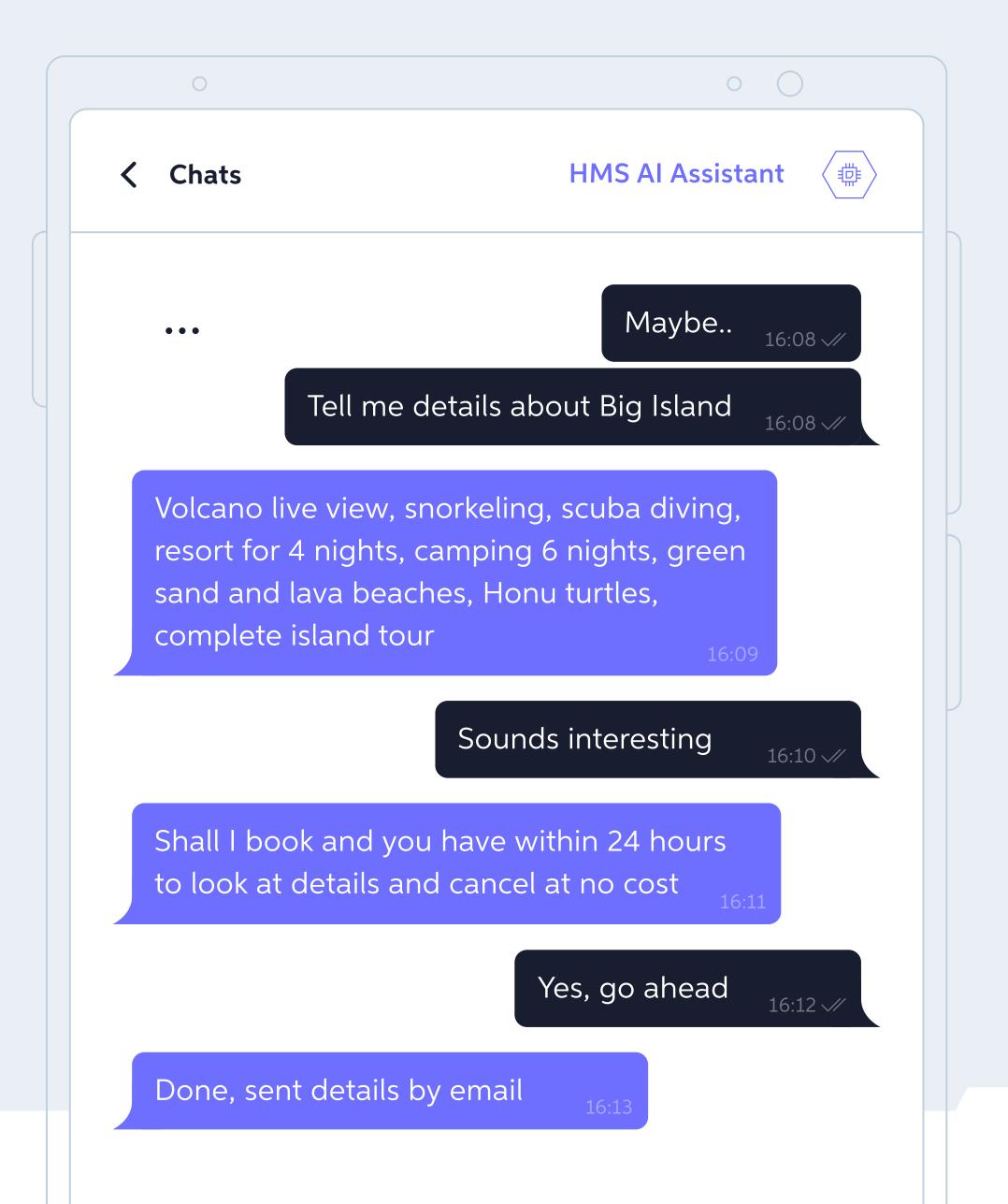


I am looking for a family adventure vacation What sort of budget are we looking at for an all-inclusive package?



### **Buy: HMS AI Assist Dialog / NLP**







1-2 LOOK/EXPLORE

## **HMS AI Assist Dialog / NLP** (Behind the scenes)



#### **CUSTOMER**

User downloads HMS AI app, creates family profile, enters credit card details, and enables NLP feature



### **HMS AI MOBILE APP VIRTUAL AGENT**

Intelligent interpreter quickly identifies missing details and asks to fill the gaps – once data is completed, match general data to search, and then further personalize options

Profile data includes departure airport, preferred airline / hotel chains / brands

I am looking for a family adventure vacation to Hawaii or Caribbean between Dec 5 and 19 what options are there?

What sort of budget are we looking at for an all-inclusive package?

And is everyone traveling?

Yes, all 4 of us, and between 10 to 15k 16:05 //

We can do Bahamas with Cruise for 10.5, Puerto Rico adventures for 12, and Big Island for 17 or Honolulu for 13.

Are we able to stretch a bit?

• • •



3-4 EVALUATE/BOOK

## HMS Al Assist Dialog (Behind the scenes)



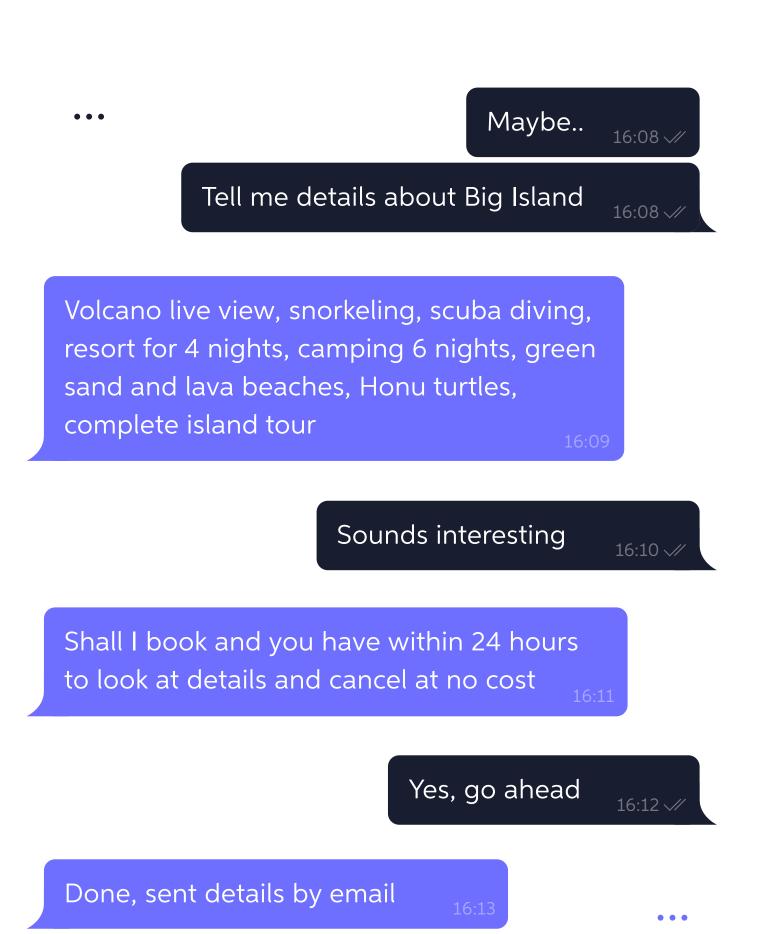
#### **CUSTOMER**

Is guided through options and interest to make desired selection



#### **HMS AI VIRTUAL AGENT**

Calls out the details gathered, and once user commits, makes selections and makes booking – will be auto confirmed and committed if user doesn't change / cancel within 24 hours window





5-8 SERVE

## HMS Al Assist Dialog / NLP (Behind the scenes)



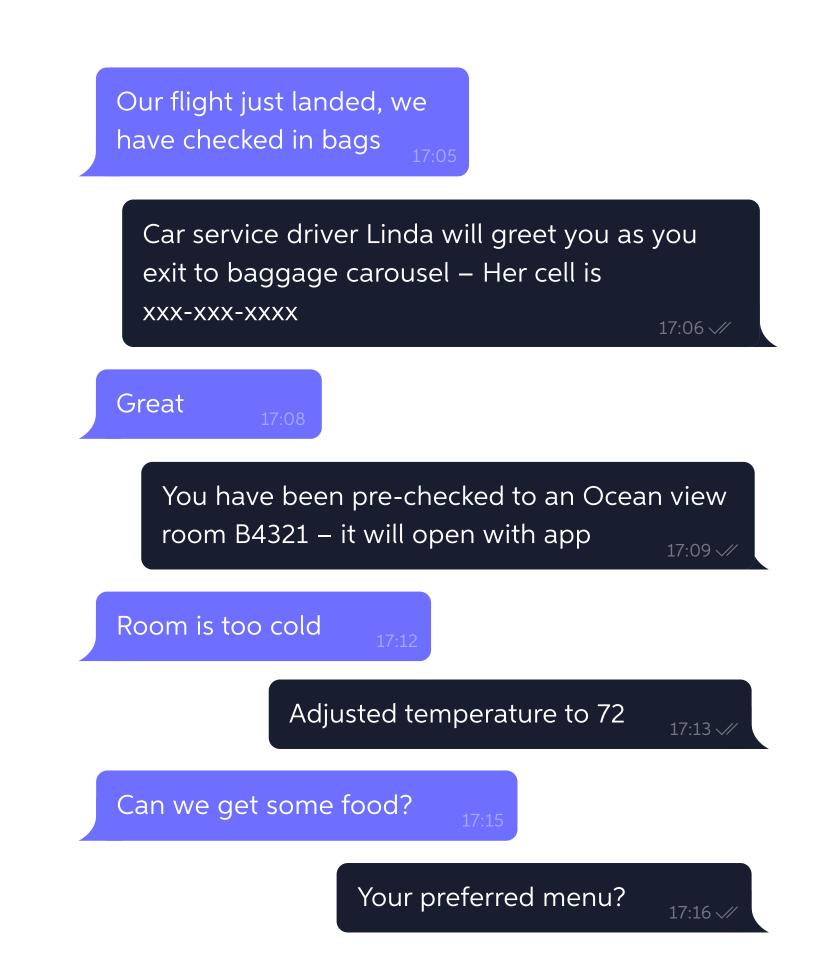
#### **CUSTOMER**

User interacts with HMS app with voice messages or dialog box to provide inputs, get information, and make changes



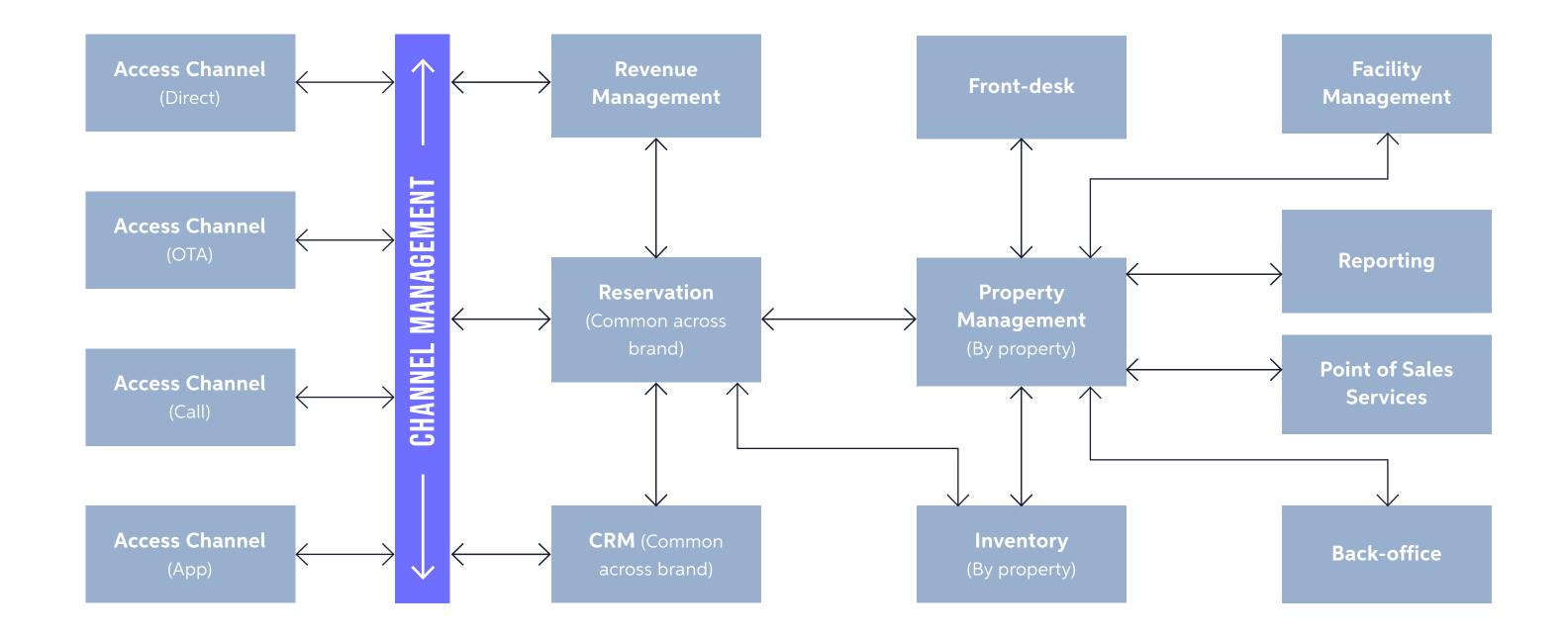
#### **HMS AI VIRTUAL AGENT**

Tracks flight arrival to coordinate car service, hotel auto check-in; takes inputs from dialog and preferred menu from profile/s to order dining; connects to specific resort's IoT API to adjust room temp



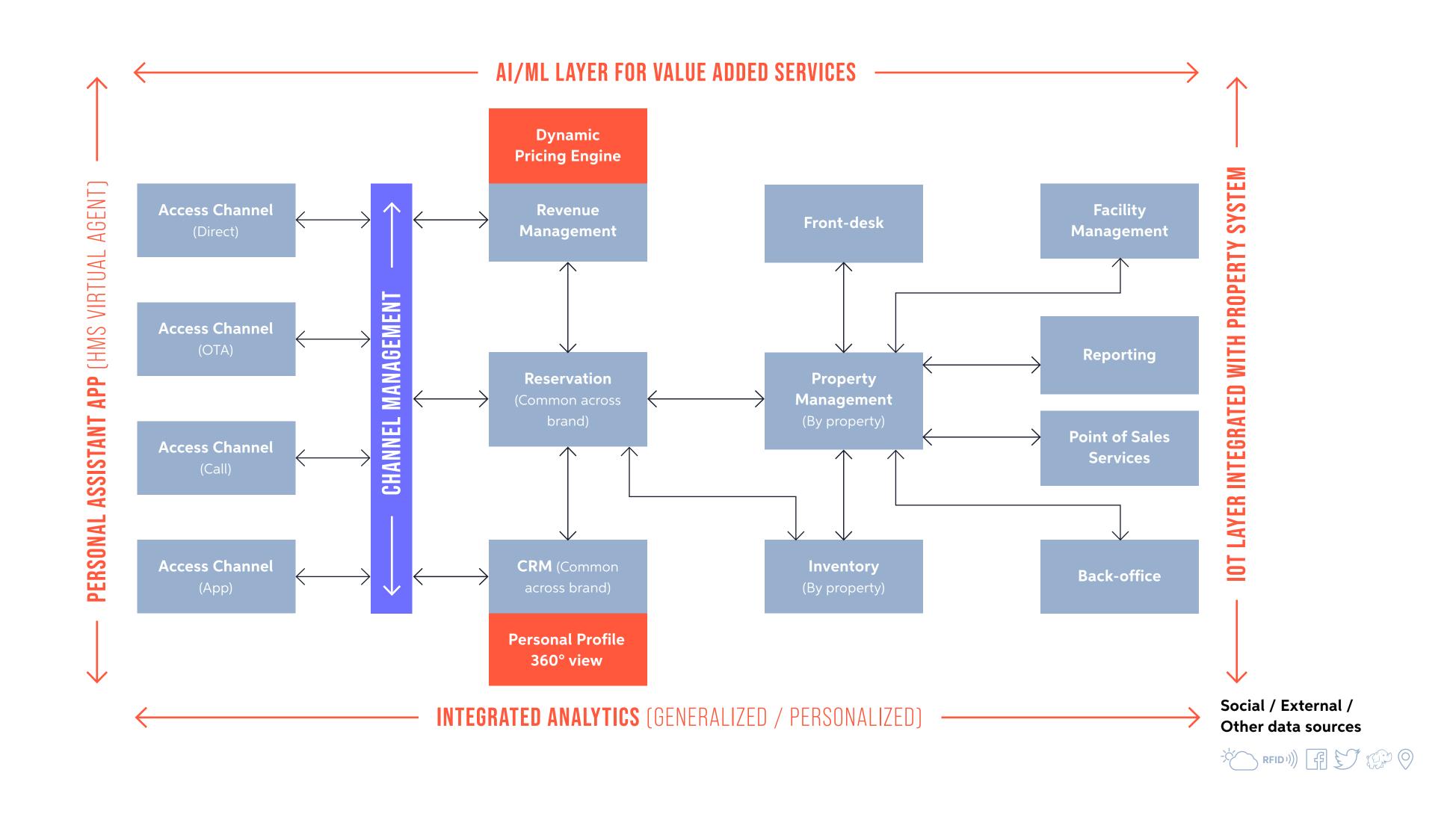


## **Conventional Core HMS Architecture at a glance**





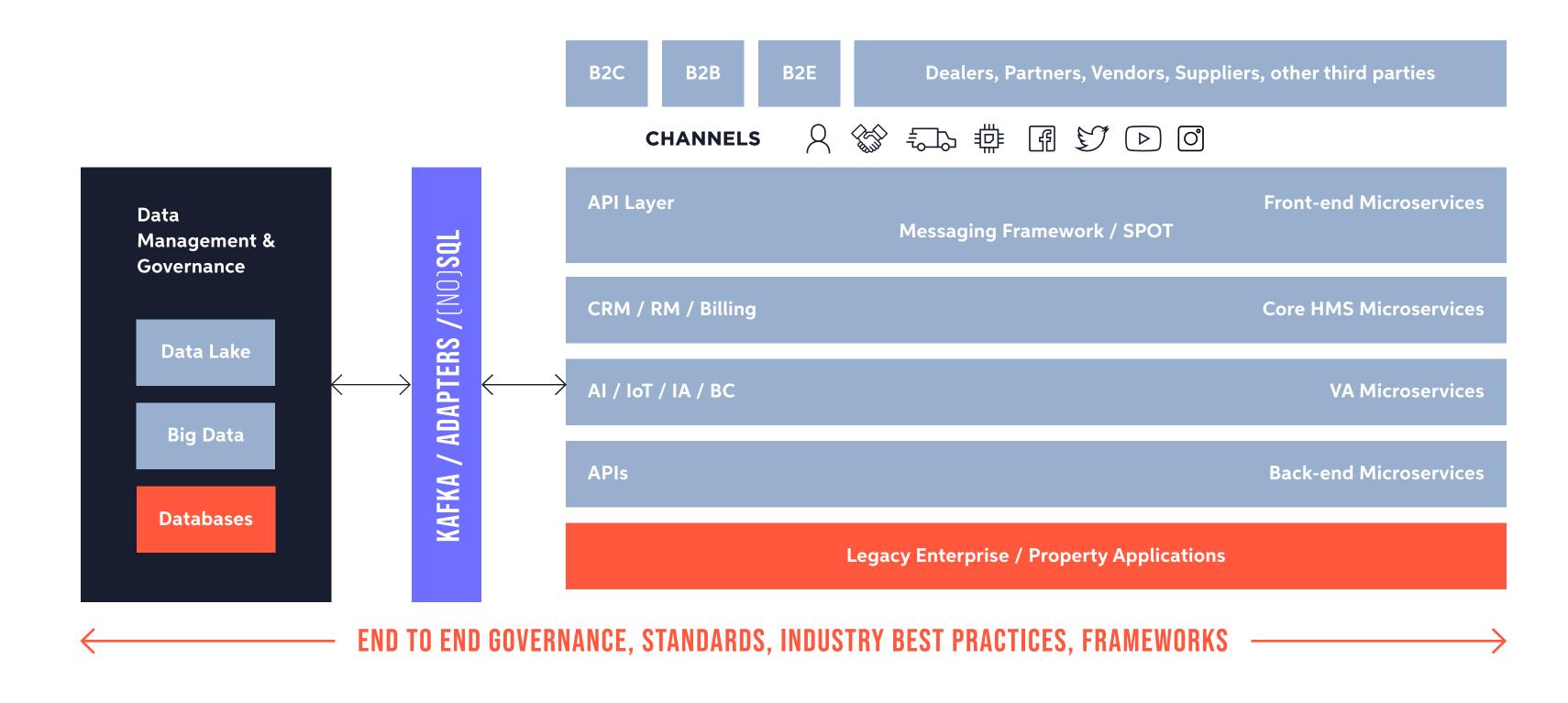
## **Conventional Core HMS Architecture at a glance**



## $\Rightarrow$

### **Future HMS Solution Architecture:**

## Target Digital HMS enabled by Microservices & APIs

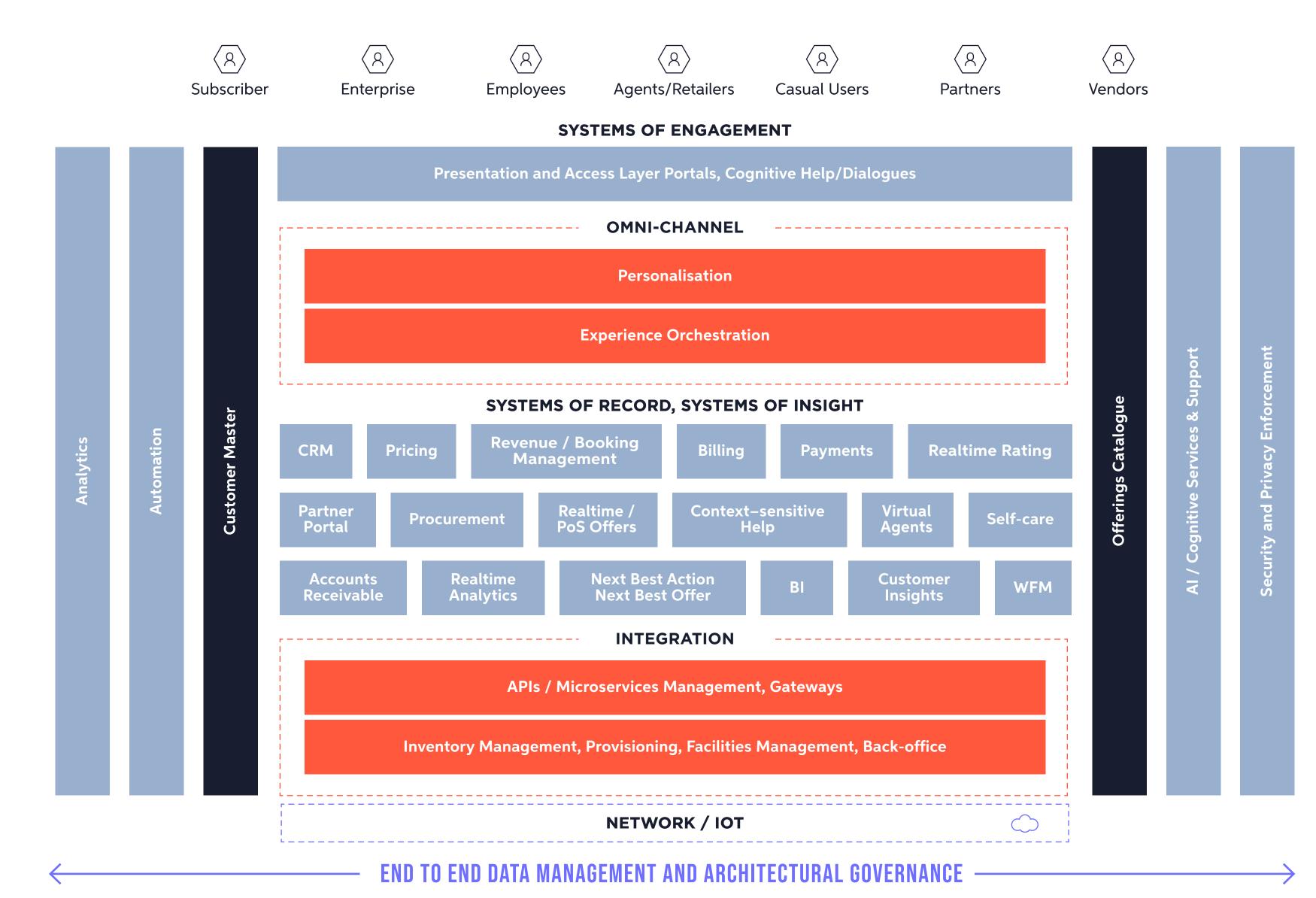


- Each HMS System functional module will be divided into small components based on Microservices
- Each Microservice will interface with API layer. The communication layer will be implemented using a simple "messaging framework" instead of a more complex enterprise service bus and business process management, as applicable.
- Data is consolidated centrally, and Information will be accessed by using standard API Layer.

- Based on this architecture, data and application layers are separated, and information will be shared across the entire enterprise.
- Big data & analytics capabilities will be consolidated into centralized systems and enriched with prescriptive and cognitive functionalities.

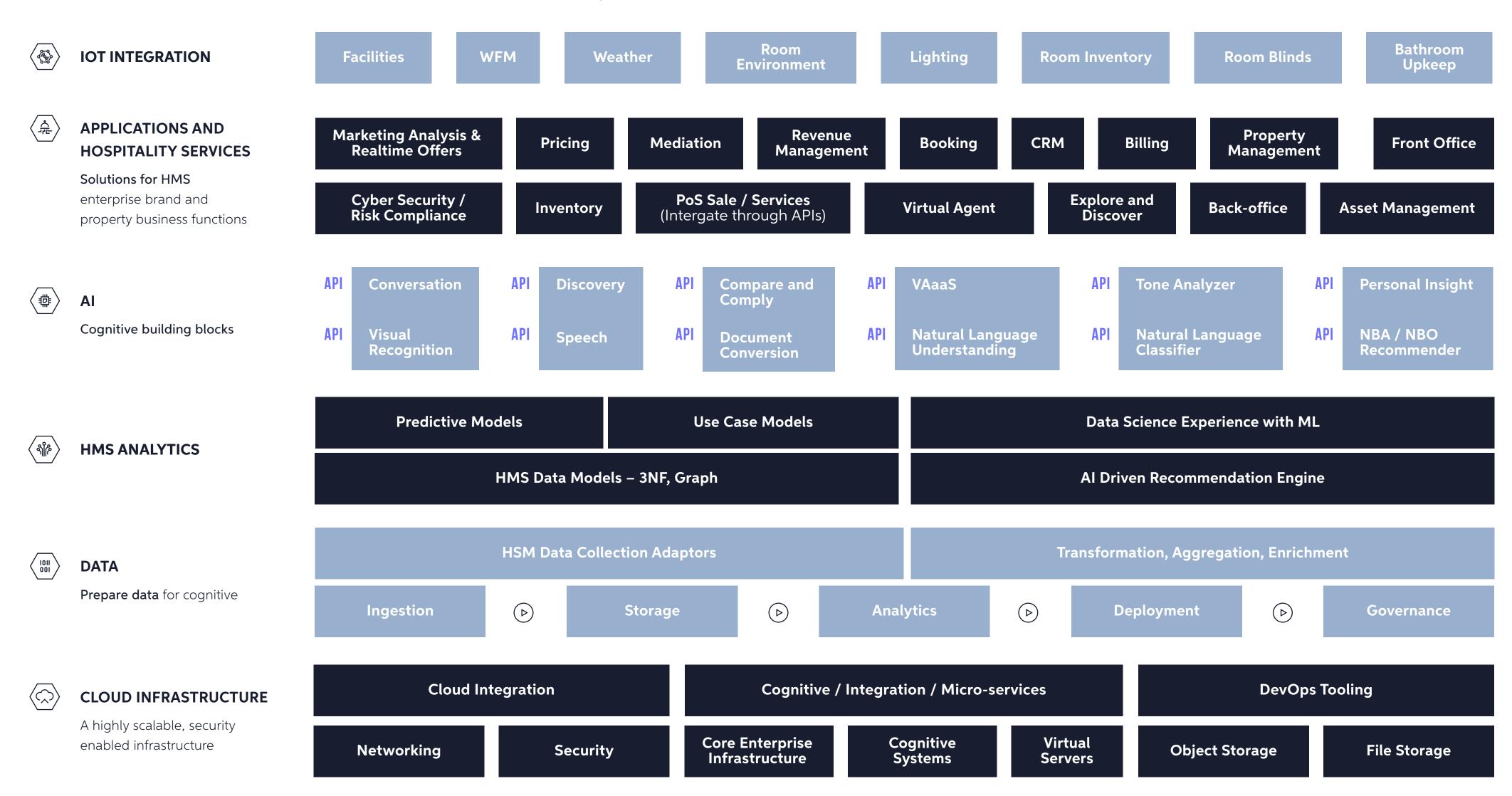
## $\Rightarrow$

### **End-State HMS Reference Architecture**





**HMS solution component blocks** mapped across technology layers – target state architecture deeply leverages AI / IoT for actionable insights to deliver contextual services that resonate with customer experience





## **Technology Selection and Rationale**

Scope	Criterion	Technology	Rationale
Core HMS Module functions	Move away from COTS	Microservices	Modular approach, scalable, open, no vendor lock-in
Virtual Agent	Conversational, Intelligent	Watson Assistant	NLP, proven on multiple deployments
Value-added services	Reinforced learning	AI / ML platform	Context driven development
IoT integration	Seamless integration	API exposition	Ease of deployment
Dynamic Pricing Engine	Reinforced learning with outliers	AI / ML platform	Extended search and price adjustment within limit checks
Customer Profile – XRM (extended)	Dynamic profile updated with big data	No SQL Cloud database	Fast access, quick updates
Big data integration	Unstructured data ingestion	Hadoop / Kafka	Social, IoT, weather, other data integration
Deployment	Cloud based continuous deployment	Docker Container / Cloud	Agile CD/CI/CT
Data ingestion from multiple sources / formats / emails	Consistent results, irrespective of data format	Annotation / Extraction (Supervised Learning)	Labeling data for training sets using Open Source tools



## Analytics enrichment by personalization and generalization of data

GENERALIZATION: Remove all identifiers, anonymous – white-label to sell as trends

PERSONALIZATION: Address specific user needs (vegan, organic, 72°, golf, hiking,..)

## CONTEXT EXAMPLE:

Predict Churn
by demographics/
Location

(Generalization);

Customer Sentiment/
Tone Analysis /
Browsing behavior
(Personalization)



#### **UNDERSTAND**

- Multiple data sources
- Non-digital inputs
- > The context

#### **REASON**

- > Find connections
- Recognize ambiguity
- > Considers rules

#### **LEARN**

- > Mistakes are not repeated
- Apply patterns
   of challenges to
   each situation

## TARGET NBA/NBO for CUSTOMER RETENTION:

Incentives by demographics/
Location

(Generalization);

Specific incentives per XRM profile, personalized Issue resolution

**Referral Bonus** 

(Personalization);

AI / ML LAYER: Context driven integration and enrichment

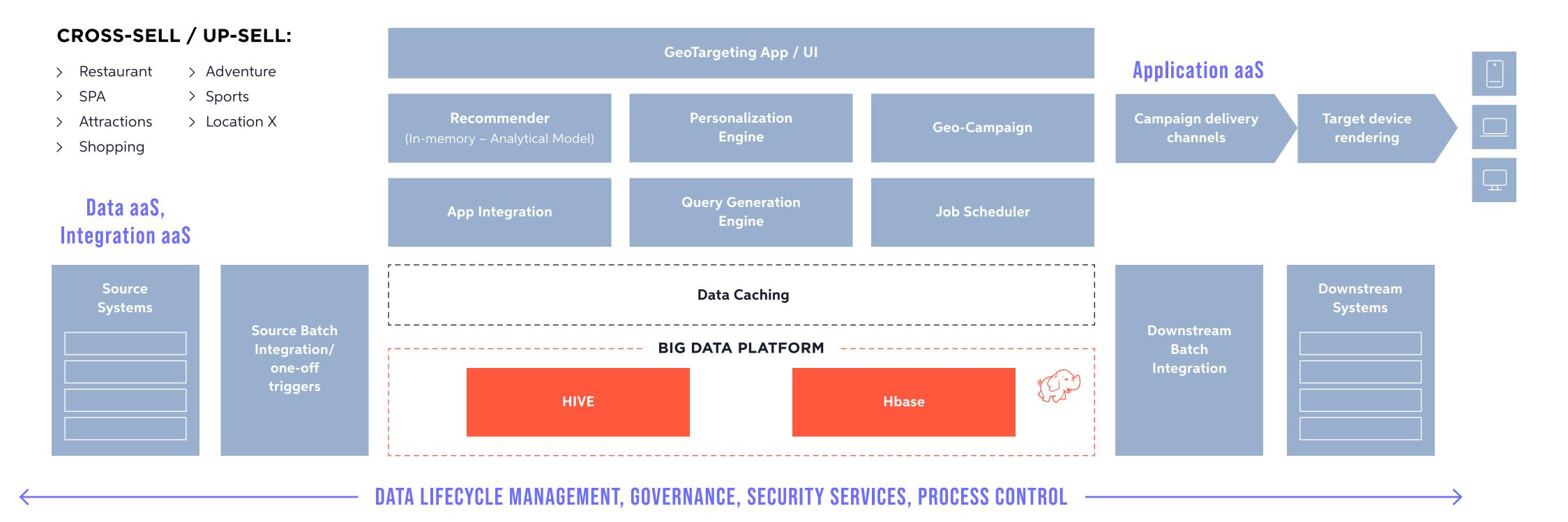
Real time update with social, VA, IoT, browsing inputs

Customer Profile Data (basic / extended – includes sub users)



### **Recommendation Engine:**

## Partner/PoS Geo-Targeting Architecture - Cloud enabled



OGC WPS\*

(Consumer GeoSpacial Data),

IP Spidering, Spend/ Preference Profile

\*OpenGIS Web Processing Service

Consumer movement tracking

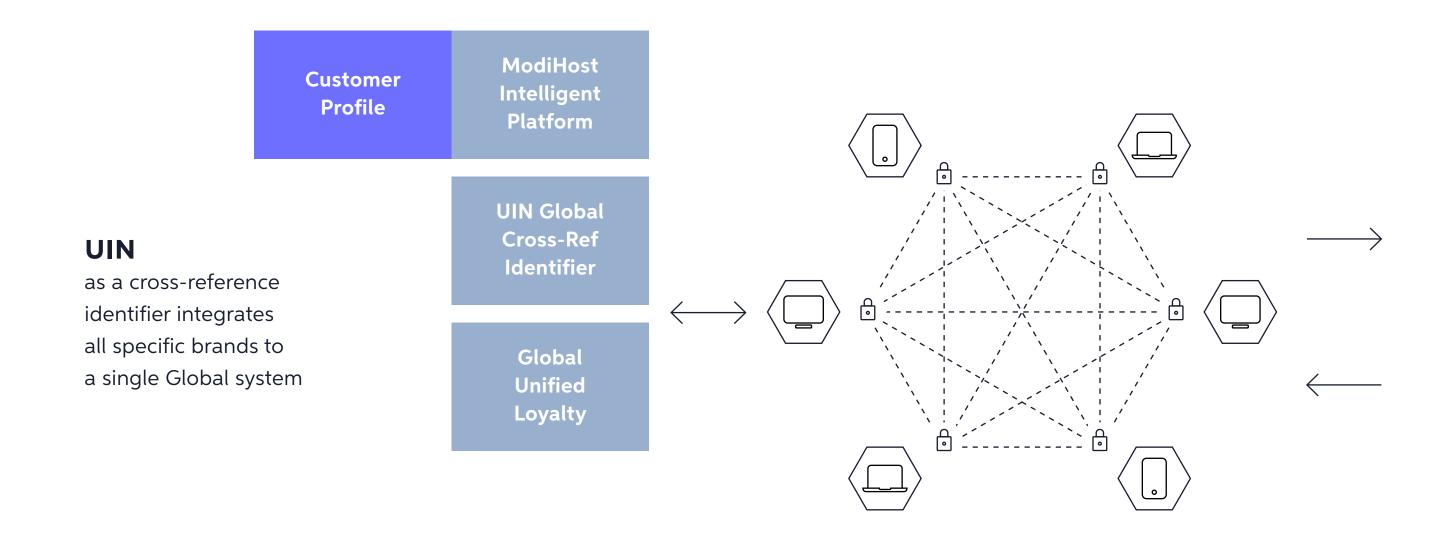
(local, inter-city, intra-region, inter-national initiates data collation request

**BIG DATA PLATFORM aaS** 

PAY-BY-USAGE, GET PAID BY END-USER BUYING MODELS FOR CLOUD ENABLED ENVIRONMENTS

## $\Rightarrow$

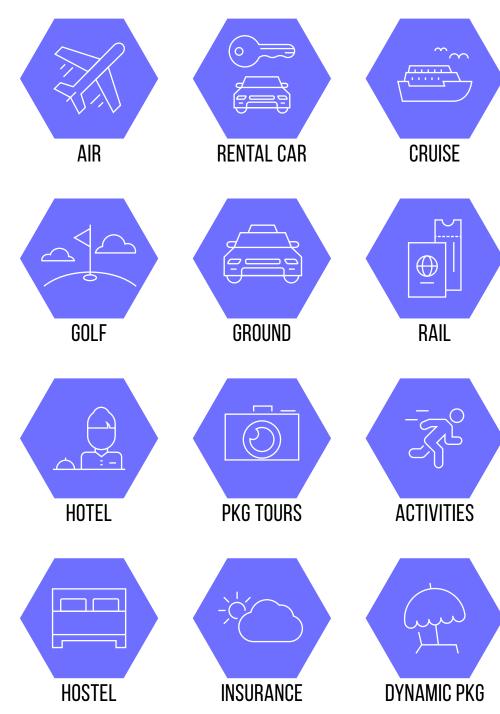
## **Cross-brand loyalty integration**



POTENTIAL TO OFFER AS A
VALUE ADDITION IN LOYALTY
SUPPLY CHAIN ONCE CRITICAL
MASS HAS BEEN GATHERED

## SMART CONTRACTS / PERMISSIONED BLOCK-CHAIN:

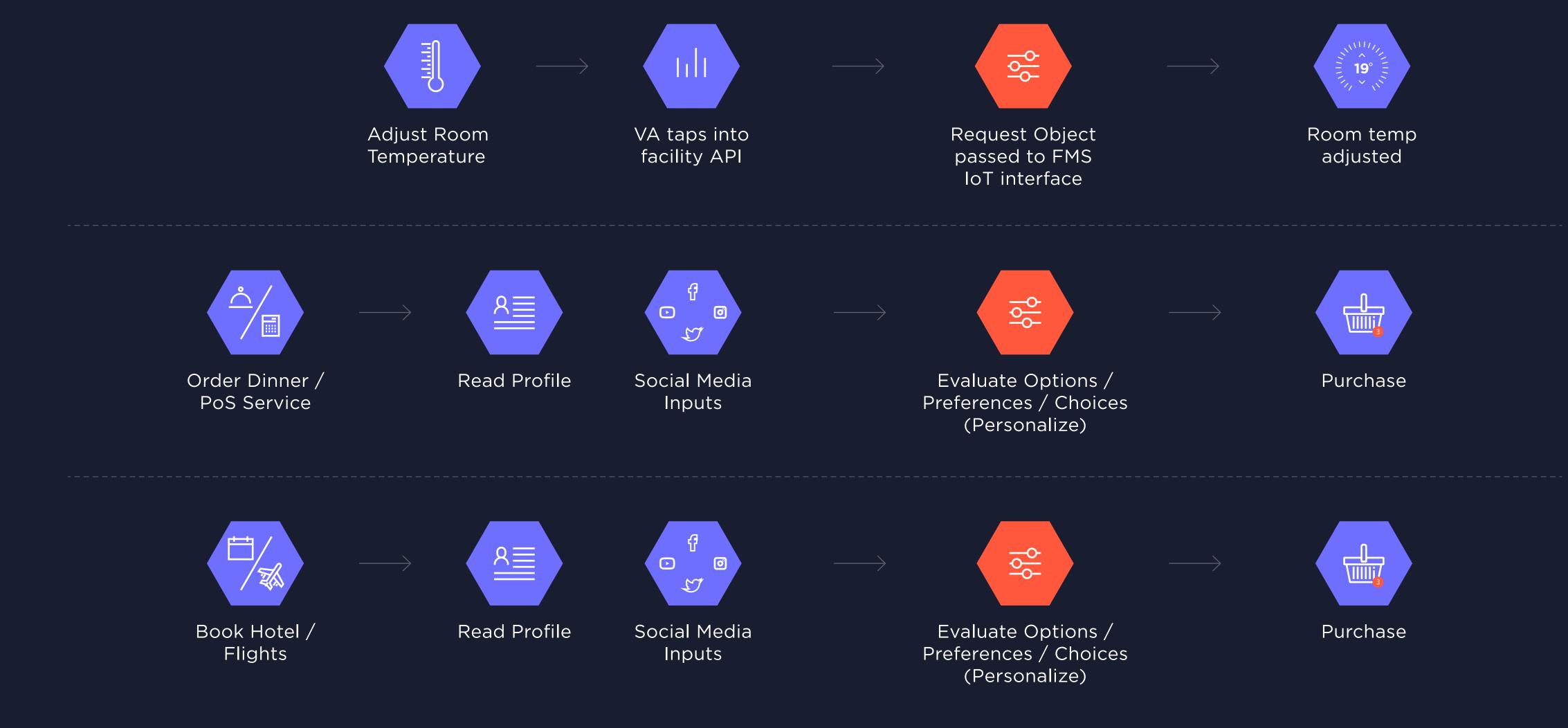
mapping to / from specific loyalty program to / from Global Unified Loyalty, with options to transfer / gift points





## Al, Analytics, IoT, Big Data interactions (Illustrative)

WYNDHAM
•DESTINATIONS

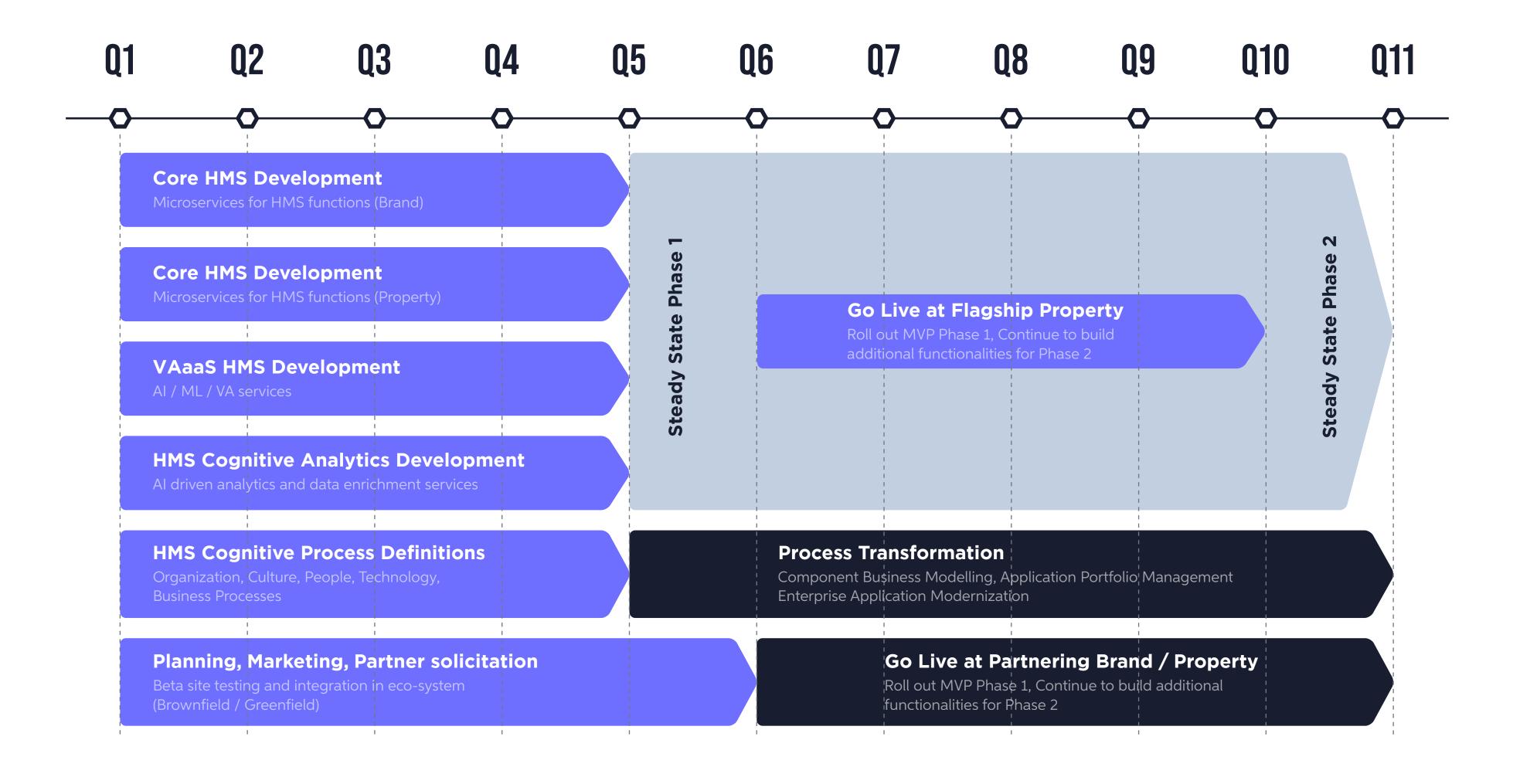


**Marriott** 

Hilton



## HMS Architecture Roadmap at a glance (Quarterly)





Flexibility in the
ModiHost HMS next
generation platform
must accommodate
a diversity of options,
tastes, and preferences

From eco-tourist to luxury seeker, any tech-savvy customer must be able to leverage inherent flexibility in the platform to customize offerings to their exacting needs

A multitude of options to pick across the spectrum of offering's portfolio in a non-binding manner

Not a one size fits all approach – you can go camping, hiking, on a yoga retreat, or seek an all inclusive luxury vacation, and still better, anything in-between that fits your requirements, wishes, and budget

Your tastes and preferences may vary over time, and the platform adjusts and adapts to a 'new' you



## VAaaS:

Additional optional services to be considered

Virtual tour of the room and views from the window (dovetails to directions once inside the property)

Virtual vicinity tour and aerial view of property

Place a plant in the room – which one? Bamboo, money-plant, others?

Specific dining options – vegan, vegetarian, organic only: we can be very specific and deep drilling down to any level of detailed decomposition





<b>3NF</b> (3rd Normal Form)	CT (Continuous Testing)	<b>PoS</b> (Point of Sales)
aaS (as a Service)	CX (Customer Experience)	PX (Property Experience)
AI (Artificial Intelligence)	<b>DND</b> (Do Not Disturb)	RM (Revenue Management)
API (Application Programming Interface)	FMS (Facility Management System)	Rol (Return on Investment))
<b>B2B</b> (Business to Business)	GPS (Global Positioning System)	<b>SQL</b> (Structured Query Language)
<b>B2C</b> (Business to Customer)	<b>HMS</b> (Hotel Management System)	<b>TBD</b> (To be decided)
<b>B2E</b> (Business to Enterprise)	IA (Integrated Analytics)	<b>UIN</b> (Universal Identification Number)
BC (Block-Chain)	IoT (Internet of Things)	UNY (Universal Virtual Currency)
<b>BI</b> (Business Intelligence)	IP (Internet Protocol)	<b>VA</b> (Value Addition)
<b>BX</b> (Brand Experience)	<b>k</b> (1000)	VAaaS (Value Addition as a Service)
CCTx (Credit Card Transaction)	<b>ML</b> (Machine Learning)	<b>WFM</b> (Workforce Management System)
CD (Continuous Development / Deployment)	MVP (Minimum Viable Product)	XaaS (Anything as a Service)
CI (Continuous Integration)	NBA (Next Best Action)	XRM (Extended Customer Relationship
COTS (Commercial Off The Shelf)	NBO (Next Best Offer)	Management)
CPQ (Configure Price Quote)	NLP (Natural Language Processing)	
CRM (Customer Relationship Management)	PMS (Property Management System)	



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