



intellect**soft**
ENGINEERING YOUR VISION

Digital Transformation in Hospitality & Entertainment

Technical Guide

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Table of Contents

Introduction	03
Digital Transformation Roadmap	04
Internet of Things	06
Smart Room System: Technical Overview	09
Hotel Smart Room: User Journey	10
1. Self-managed Check-in & Keyless Entry	10
2. In the Smart Room	12
3. Self-managed Check-Out & Keyless Exit	14
Artificial Intelligence / Machine Learning	16
4. Smart Moods	17
5. Voice Assistant	18
6. Single Data Warehouse	19
Augmented & Virtual Reality	20
Virtual Hotel Tour	22
Blockchain	23
Blockchain-based Loyalty System	24
Main Features of the System	25
Implementation: Technical Overview	26
Reference Architecture	27
About Intellectsoft	28
Intellectsoft Innovation Labs	29

Introduction



Today, the hospitality and entertainment industry faces a wide array of challenges. Modern customers have sky-high expectations for customer experiences and expect companies across industries to innovate¹. There is a pressing need to gather, accumulate, and leverage big data to deliver highly personalised guest experiences as well as improve operations across the board. Facing competition from disruptors, hotels also need to find new ways to innovate with the help of emerging technologies. Finally, hotel chains need to become leaner in the quickly changing world and leave disintegrated legacy systems behind in favor of a single platform for all operations.

The scale of these challenges is staggering, but fitting solutions already exist. From Internet of Things (IoT) to a single data warehouse for all operations to orchestrating cross-location loyalty programs on blockchain, hotel chains are already integrating new technologies into the legacy layer to extract maximum business value and deliver a hyper-personalized customer experiences. The digital transformation (DT) of the hospitality industry is in full motion.

Based on the experience of Intellectsoft's leading tech minds, this white paper will explore our company's case studies of building and integrating complex solutions for clients in the hospitality and entertainment industry as part of their digital transformation efforts. Along the way, the paper will also touch upon the challenges of DT and technology trends in the industry.

Let's start.

¹ Salesforce Research: Customer Expectations Hit All-Time Highs — <https://www.salesforce.com/research/customer-expectations/#>

Digital Transformation Roadmap



Digital transformation requires very careful planning and is a step-by-step process that takes several years to perform with an experienced team. Below you can see an estimated DT roadmap that stretches for over two years. In reality, everything is customizable and the set of use cases and technologies will depend on the business needs of a particular hotel chain. This also means that DT can take more time.

Essentials

STAGE 1

Property MS

- API development to enable integration with new systems
- Mobile and web development



IoT

STAGE 2

Check-in

- Mobile check-in
- Keyless entrance through RFID/mobile app/facial rec.
- Automatic DND

1 YEAR

Smart Room

- Room control with tablet app
- Smart home experience
- Gathers data about guest preferences

Voice Control

- Enabled by Alexa or Google Home
- Natural Language Processing



1,5 YEAR



AI/ML

STAGE 3

AI/ML

- Room availability prediction, discounts management
- Smart facility operations
- Smart Moods
- Chatbots

2 YEAR



Blockchain, AR/VR

STAGE 4

Blockchain

- Loyalty program
- Secure supply chain

AR/ VR

- Virtual hotel tour
- Next-gen marketing campaigns



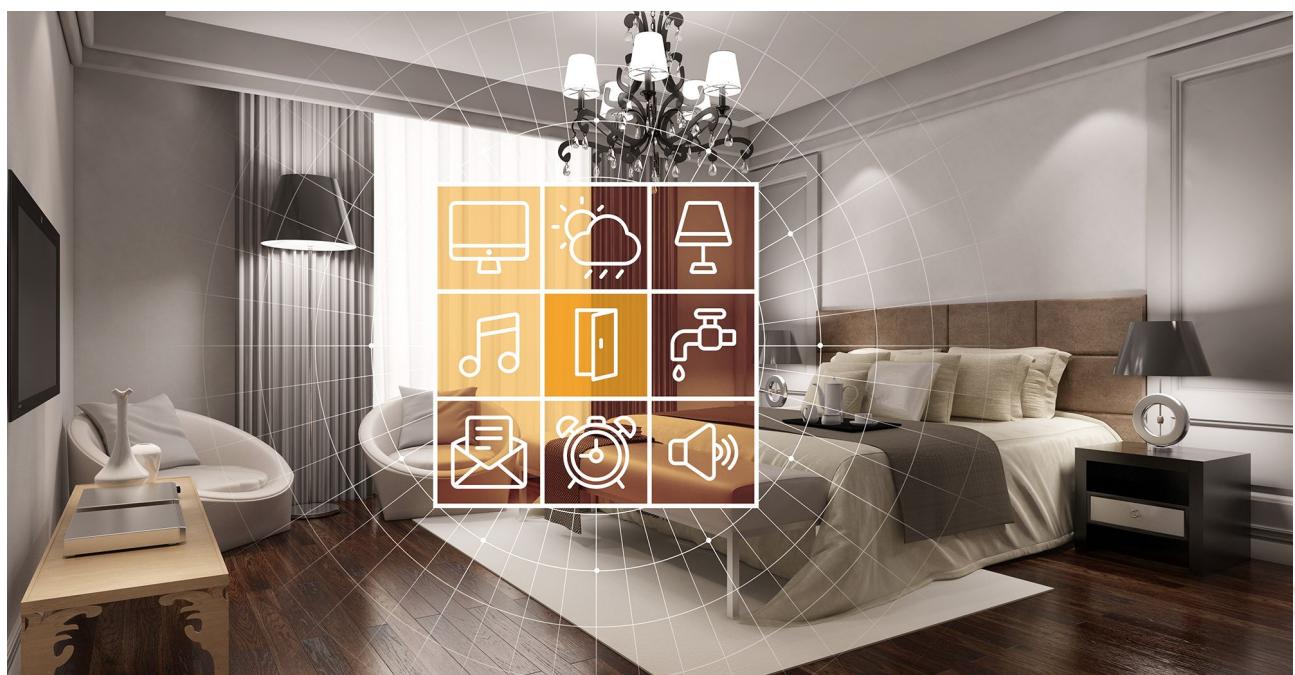
Internet of Things



Familiar to modern households, the smart room (SR) concept is now emerging in the hospitality industry. The core difference between a private home SR and a hotel SR lies in the number of application areas and users they cover.

While a private SR is primarily aimed at homeowners, a hotel SR covers more users and areas:

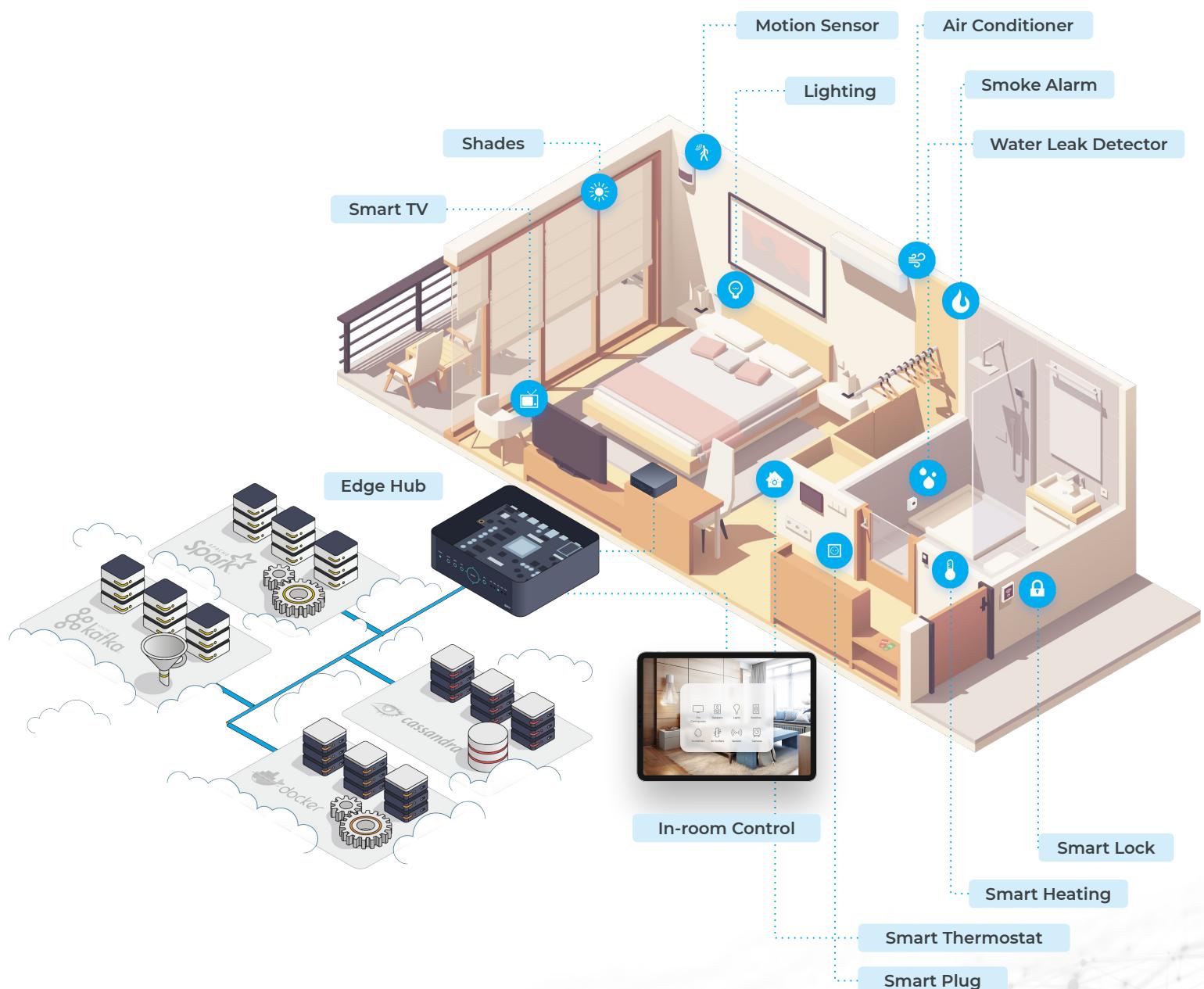
1. **Hotel Guest** — primary user who expects a comfortable stay powered by new technologies.
2. **Housekeeping** — employees, tools, and infrastructure responsible for efficient room maintenance and housekeeping workflow.
3. **Property management** — a bird's-eye view of the property, energy consumption, environment condition monitoring, alarm triggers.
4. **Front desk and guest services** — fast, responsive request management in the hotel experience.
5. **Technical Maintenance** — the ability to detect and resolve issues before the guest notices them.



Smart Room Overview



- Personalized hotel experience
- Digital control of room environment and sensors with in-room tablet
- Tablet operates in the Kiosk mode
- Cloud backend
- Offline and online operation
- Bird's-eye view of all smart rooms
- Preventive maintenance





Smart Room System: Technical Overview

1. **Advanced Android-based tablet** running in Kiosk mode in every suite. The suite may consist of multiple rooms and the guest can use several tablets interchangeably to control the rooms; tablet detection is enabled by beacon technology.
2. **Configurable set of sensors and devices**, like lights, air conditioners, thermostats, window shades, TV, and other.
3. **Fire and smoke detection** with integrated CO2 and CO sensors.
4. **Smart room controller/EdgeHub/Smart hub** that controls everything and connects to the backend.
5. **Hybrid cloud infrastructure** (scalable and highly available):
 - a) Telemetry, activity data collection, alarm notifications
 - b) Dashboard for hotel operations team
 - c) Monitoring and notifications system for IT, security, maintenance, and other departments
 - d) Mobile device management system for tablets
 - e) Custom smart hub fleet management

Digital transformation of the hotel starts with the smart room system. This means that these elements not only power up the smart room, they lay the foundation for other technologies in the DT roadmap, the ones we will explore further.



Hotel Smart Room: User Journey

1. Self-managed Check-in & Keyless Entry

The traditional check-in process may take up to 10-20 minutes for guests and is often frustrating due to queues, language barriers, time of arrival, and other factors. Automatic check-in and check-out solve the issues. The process is integrated with the smart room system, hotel management system, and the property's subsystems.

To ensure all-around security, the smart room hub executes a set of rules and conditions in close collaboration with the backend infrastructure. The process is common to the software development industry:

- **Authentication.** The system checks mobile app credentials, performs public password key (PPK) exchange, and uses face recognition to let the guest check-in/check out.
- **Authorization.** To allow for keyless entering, the smart room checks if the guest has the right to access the room based on a range of permissions. The permissions can be extended to housekeepers and technicians and are customisable, allowing the hotel to limit what they can access.



Check-in Process Overview

- Automatic check-in
- Cryptographically signed and verified
- Mobile keyless access to the room
- Integrated with the smart room hub
- Multiple composable verification sources (NFC, BLE, face recognition)





2. In the Smart Room

Enabling a shift to a personalized guest experience is an in-room tablet that allows the guest to access a wide range of features and services:

- Control over room amenities
- Access to guest services
- Integration of entertainment platforms like Netflix and Spotify
- Chat with staff
- Room information guide, and other features

As for the **backend** part, hotels can leverage the following features:

- A dashboard to observe the data on how guests use and request guest services in real-time
- Requests can trigger API calls or rule execution
- Infrastructure on uServices that is ready to support new properties
- Updates can be carried out with little-to-no downtime

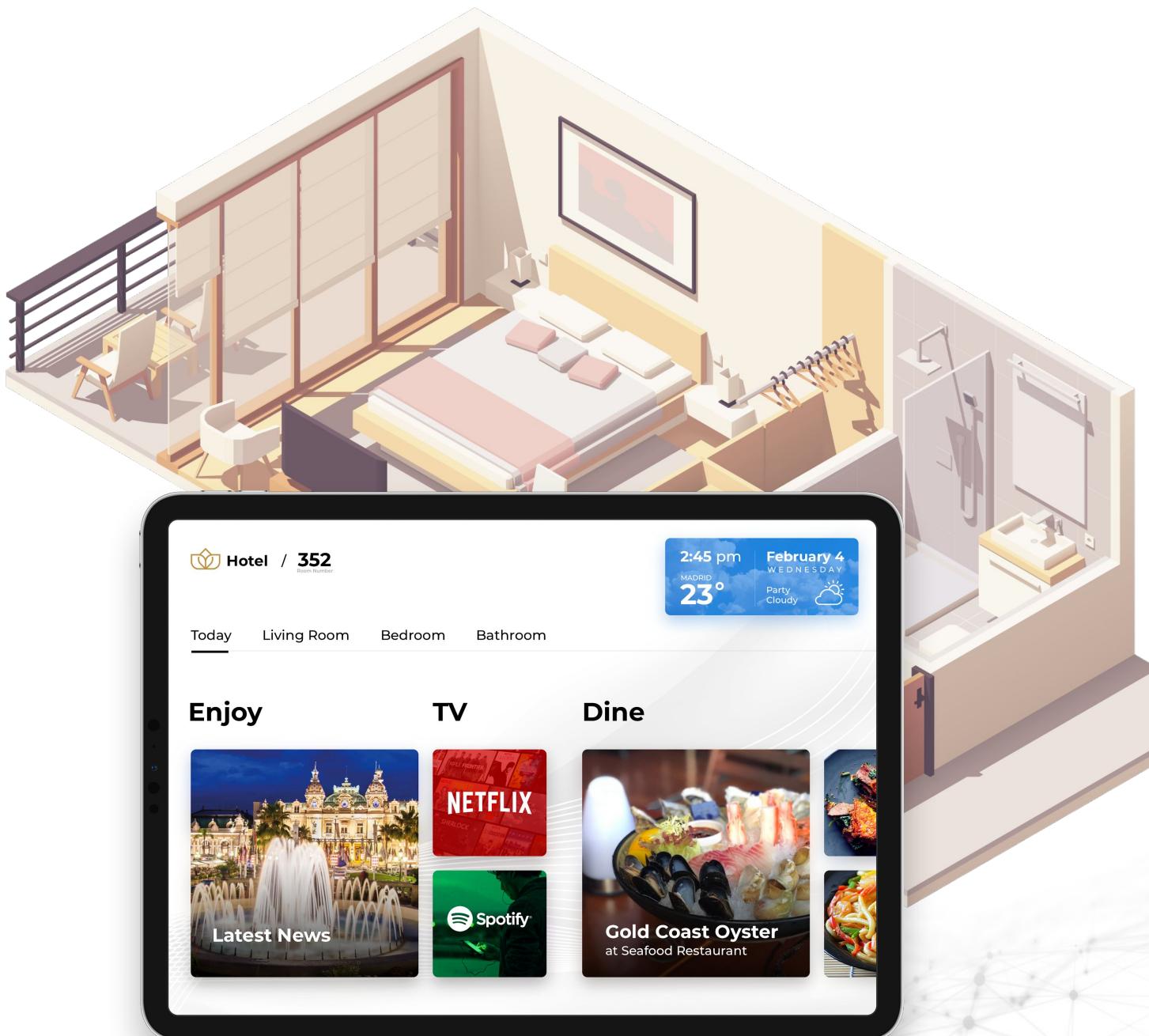
On the one hand, the smart room system will give a hotel first-hand data insights on each guest's behaviour. This will allow for delivering highly personalised services and guest experience overall. On the other hand, the system will automate a range of hotel processes, can be scaled to new properties effectively, as well as allow the hotel perform system updates fast and without interfering with the guest experience.

As for the **guest's data privacy and security**, the smart room system uses technical models like anonymization, cryptography, and data expiration removal. The guest's session also automatically resets upon check-out.



In-room Experience Overview

- Personalized dashboard with access to amenities, guest services
- Kiosk-based tablet
- Integrated with the smart room hub
- Entertainment platform integration (Netflix, Spotify, etc.)
- Automatic guest session reset on check-out





3. Self-managed Check-Out & Keyless Exit

Making a great last impression is critical, so properly transforming the check-out experience is important. During this step, the hotel also has a chance to acquire the most valuable data by allowing the guest to rate the experience.

Here, the authentication and authorization steps are the same as in the automatic check-in process, but the check-out subsystem covers much more ground:

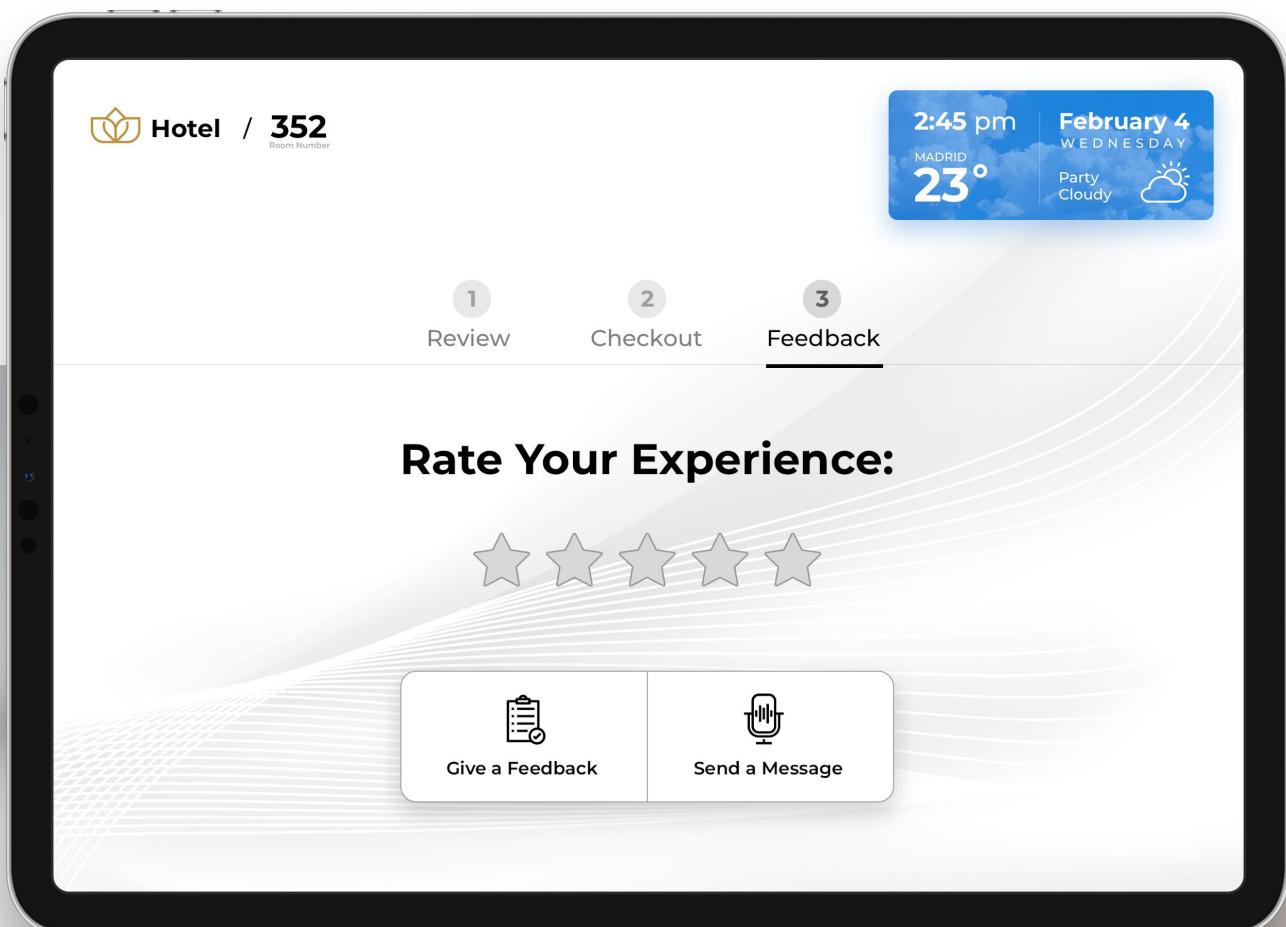
- Notifies the guest about the check-out in advance
- Monitors and notifies about upcoming events (like scheduled flights) and possible schedule changes
- Automatically orders transportation to airport or train station
- Presents the final bill for confirmation, charges the amount
- Deletes all sensitive data collected during the stay, anonymizes and encrypts data that can be retained for future stays
- Asks to rate the stay and provide feedback
- Locks the rooms, puts air conditioning into standby mode and power consuming devices into sleep mode
- Notifies housekeepers about the check-out, that the room needs to be cleaned for upcoming guests

Asking the guest to rate the experience is crucial — it is the most fitting opportunity to receive guest feedback and understand what is working and what doesn't. Based on guests' ratings left from stay to stay and the nature of their emotional feedback, the hotel will be able to align the experience for each guest in the needed areas, making it continuously consistent and satisfying for everyone.

Check-out Process Overview



- Automated check-out
- Preset check-out alarm
- Preview and confirm the final bill
- Automated transportation ordering
- Crucial trip notifications and alarms
- Integration with smart room hub
- Comprehensive feedback collection





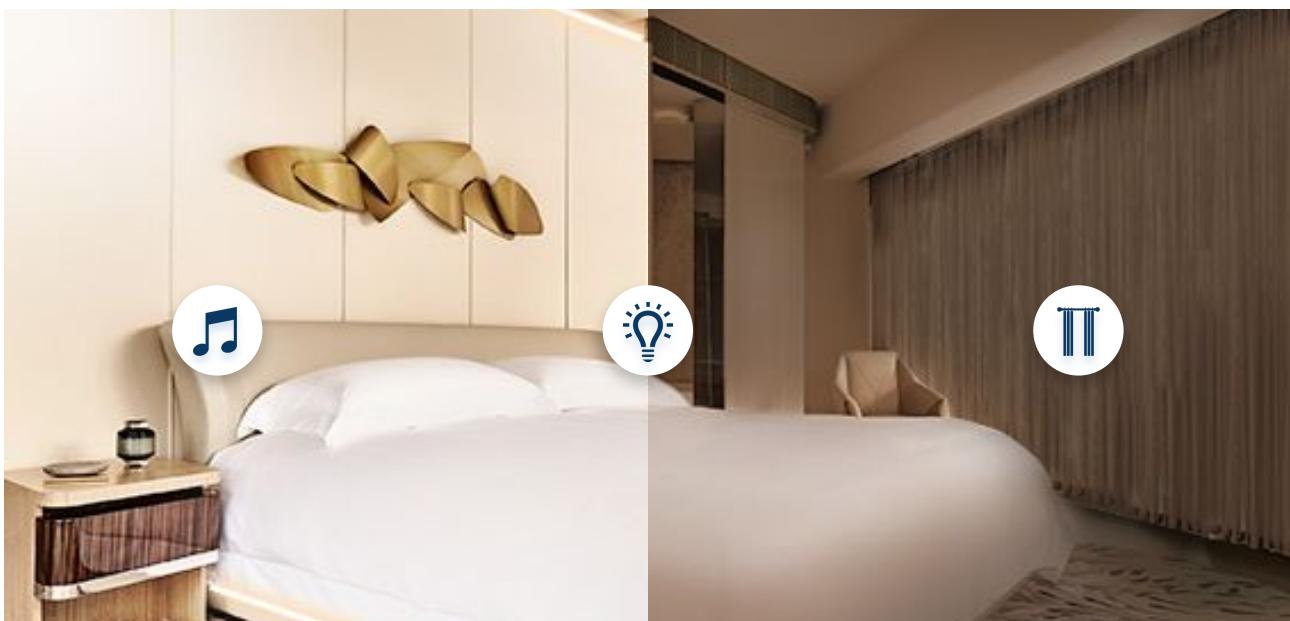
Artificial Intelligence / Machine Learning



4. Smart Moods

AI-driven algorithms allow the hotel to go above and beyond with the smart room, justifying its name and giving more value to the guest. For example, **smart moods** is a solution based on neural networks that adjusts the smart room environment to guest behaviour, communicating with IoT devices in it. Smart moods rely on backend data and processing infrastructure, and bring a new, immersive level of comfort to the guest with different presets:

- **Good Morning:** the neural network sets off the alarm clock, opens blinds, prepares tea/coffee, turns on a news channel on room TV at low volume.
- **Party Time:** unlocks the door, puts on a music playlist, turns up the lights, notifies the hotel staff about bringing drinks.
- **Dinner:** turns on the TV/plays music at low volume, dims the lights, and opens a restaurant menu on the in-room tablet.
- **Goodnight:** turns off the lights and TV, lowers room temperature, and closes the blinds.



Technology-wise, Smart Moods are built on top of two paradigms:

- **Rule-based behavior**, where rules are preconfigured in IFTTT (If-This-Then-That) fashion and triggered based on a set of conditions.
- **Probabilistic** inference based on Neural Network models that are taught on behavior of real guests



5. Voice Assistant

Further improving the smart room comfort is the voice assistant (VA). This AI-driven solution allows the guest to control room environment with simple voice commands, manage Smart Moods, and access the **concierge mode** to make voice inquiries.

VA works alongside the in-room tablet, covering the situations where using the latter is not too comfortable. Or, it simply provides an alternative to guests who prefer talking instead of using the tablet or messaging in the staff chat.

Voice assistants are enabled by natural language processing (also an AI field) and can be taught to understand and use the industry's vocabulary. However, building and integrating custom natural language processing models on language data sets is highly complex. Integrating with Amazon or Google cloud services is an easier option.

Voice Assistant Overview

- In-room tablet alternative/replacement
- Voice control of smart room devices
- Smart Moods activation
- Concierge mode
- Hospitality vocabulary
- Personalized



- Amazon Alexa
- Google Home



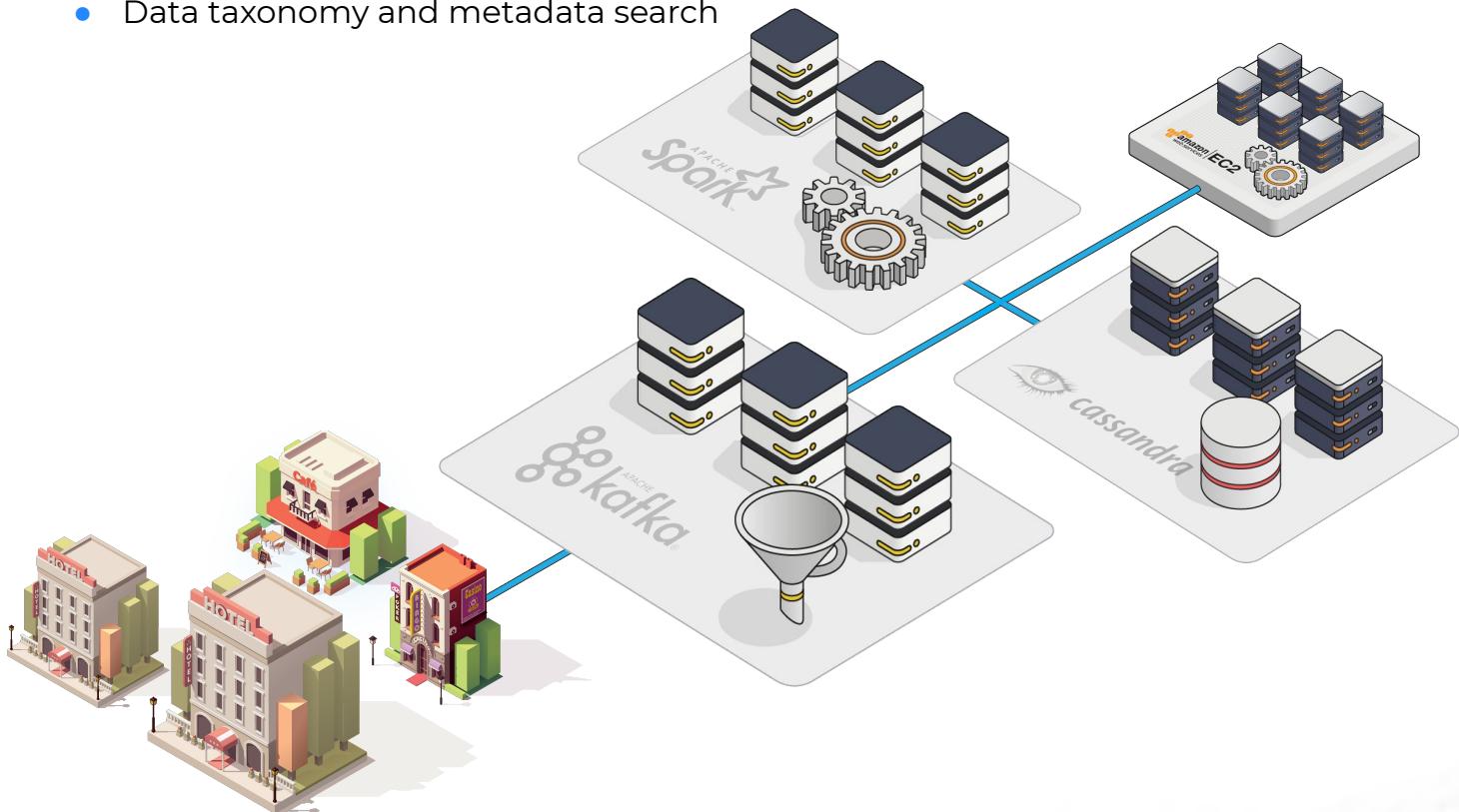


6. Single Data Warehouse

All the technology solutions explored above produce and consume a lot of data. A single data warehouse model gathers this and all other hotel's enterprise data under one cloud dome. With it, the hotel can access, govern, provision, and evolve everything connected to its data and data lifecycle.

Data Warehouse Overview

- Infrastructure for data collection is based on existing sources in a hotel's ecosystem
- Single true storage for all the hotel's data
- Backbone for business intelligence and AI/ML services
- Stream processing for real-time decision making, business triggers
- Cloud, on-premises, or hybrid solution
- Data taxonomy and metadata search



Today, many companies are moving away from silos, data duplication, and integration from multiple sources to a single data storage to enable faster scalability, integrate new technologies, big data-driven decision making, and other benefits.



Augmented & Virtual Reality

VR

For marketing needs



AR



For tips inside the hotel
and gamification



When it comes to both technology and uses cases, AR and VR are only emerging in the hospitality industry. Still, hotels are starting to see both can offer a lot of value in marketing, property navigation, and entertainment.

For example, a hotel can develop a **Pokémon Go-like app** for kids, or gamify the process of property navigation for guests, allowing them to navigate and discover information about the hotel and earn loyalty points in the process.

Meanwhile, creating a **virtual hotel** can facilitate the hotel's marketing efforts. Guests would take virtual tours with a VR headset or AR-enabled mobile application to get a better perspective on what they are paying for, instead of just browsing beautified photos and watching video ads, which can often come across as unrealistic. The main task is to recreate the hotel in great detail — with high rendering, realistic lighting, rich textures, and advance shadow mapping.

The hotel can also use VR to freshen up the existing on-premises entertainment options, for example create VR rooms where guests can play immersive games designed specifically for VR headsets.

Like any technology that facilitates the digital transformation of the hotel, AR and VR are platforms connected to other hotel systems and the data warehouse.



Virtual Hotel Tour

- Virtual tours with advanced visuals that recreate the hotel in great detail
- Free-roaming exploration during the virtual tour
- Dedicated gaming floor with various games and social features
- Built as a platform with community and monetization in mind





Blockchain



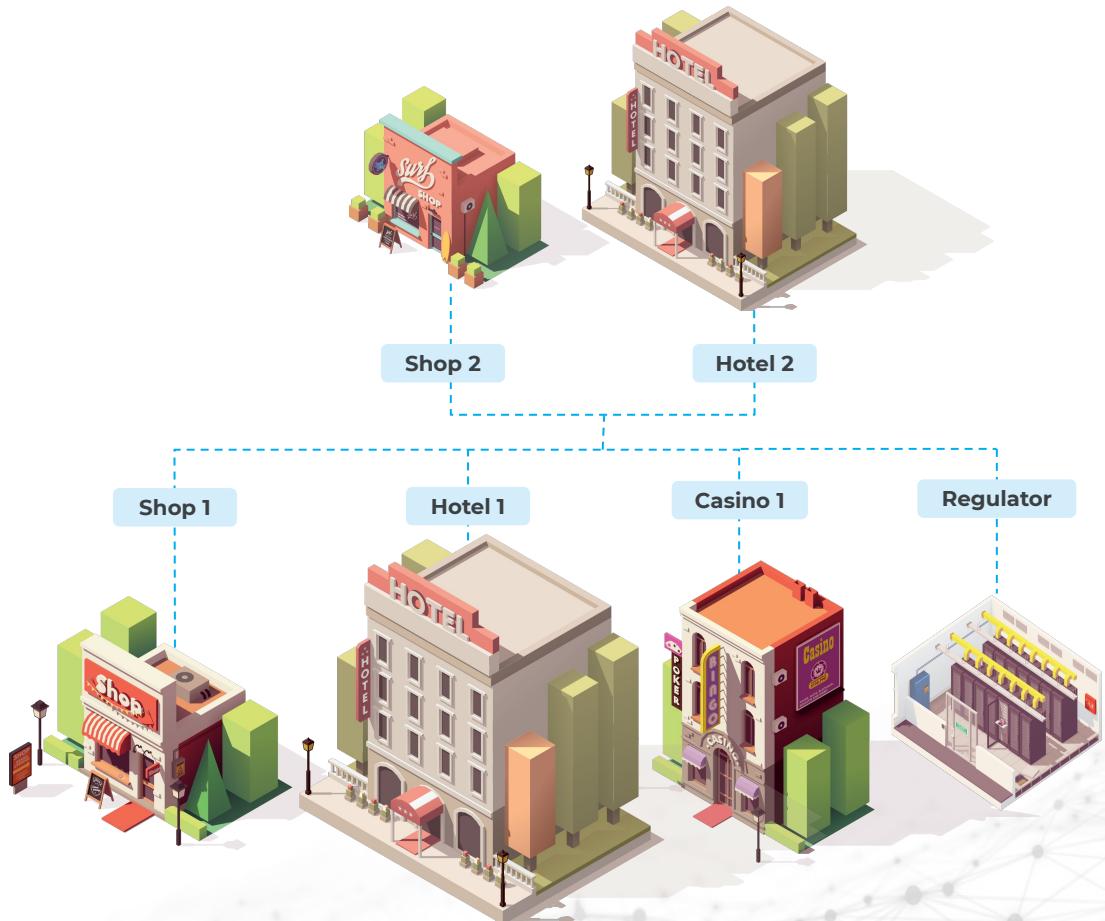
Blockchain-based Loyalty System

While blockchain technology has the potential to streamline the entire hotel system by removing the intermediaries, hotel chains will need time to become more tech-savvy and build the necessary infrastructure for it. To extract value from blockchain in a meaningful way today, the hotel can turn to building a blockchain-based loyalty ecosystem.

Let's explore a use case based on Intellectsoft's real-life projects.

Connecting all parts of hotel infrastructure and creating a consistent experience, a blockchain-based hotel loyalty system creates opportunities to convert new guests into recurring ones even if intermediaries are at play.

This cannot be achieved if parts of hotel infrastructure are disconnected. Using loyalty points in hotel casinos is a good example: connecting technical, accounting, and legal aspects of hotel gambling is hard to do.





On a higher level, a typical blockchain-based loyalty ecosystem connects all hotels, forming a single network. On a lower level, blockchain, together with PMS system components, gathers every infrastructure part of every hotel in one single environment:

- Shops
- Restaurants
- Casinos, entertainment facilities
- Spas, gyms, etc.
- Any other part of infrastructure

Main Features of the System

1. Common identity for entire ecosystem

- No private data
- Aggregates references of all identities

2. Shared loyalty account with a single balance

- Points accrual and redemption
- Complex cross-platform campaign execution
- Balance global visibility among participants
- Rule-based rating engine for point calculation

3. Secure transactions storage

- Cryptographic coin support for points ownership/digital currency ecosystem
- PoS points redemption for goods and services
- Automatic payment reconciliation among members



Implementation: Technical Overview

1. The blockchain-based loyalty systems we built for our clients are not fully decentralized. This was preconditioned by the nature of the projects to ensure practical feasibility and extract value.

2. The level of centralization is substantial. We still needed APIs and a number of integrations to ensure the loyalty experience works. They include:

- ePOS machines
- Membership system
- Mobile apps
- Administration tools

There is a service layer that uses blockchain functionality (like building and deploying smart contracts according to rules engine) and connects the parts of the loyalty system.

3. The Infrastructure is cloud-based, deployed to corresponding availability zones, and uses Kubernetes. This allows for high flexibility: installing on-premises servers or deploying to other cloud providers is easy to do.

As we can see, blockchain is only part of the solution, but its impact and benefits are substantial:

- Common identity
- Shared loyalty system
- Secure transactions storage

Still, blockchain is a relatively new technology, so the concept of a blockchain-based loyalty system will continue evolving. We are also working on new features aimed at both technological and legal aspects of the system.

Reference Architecture



Blockchain

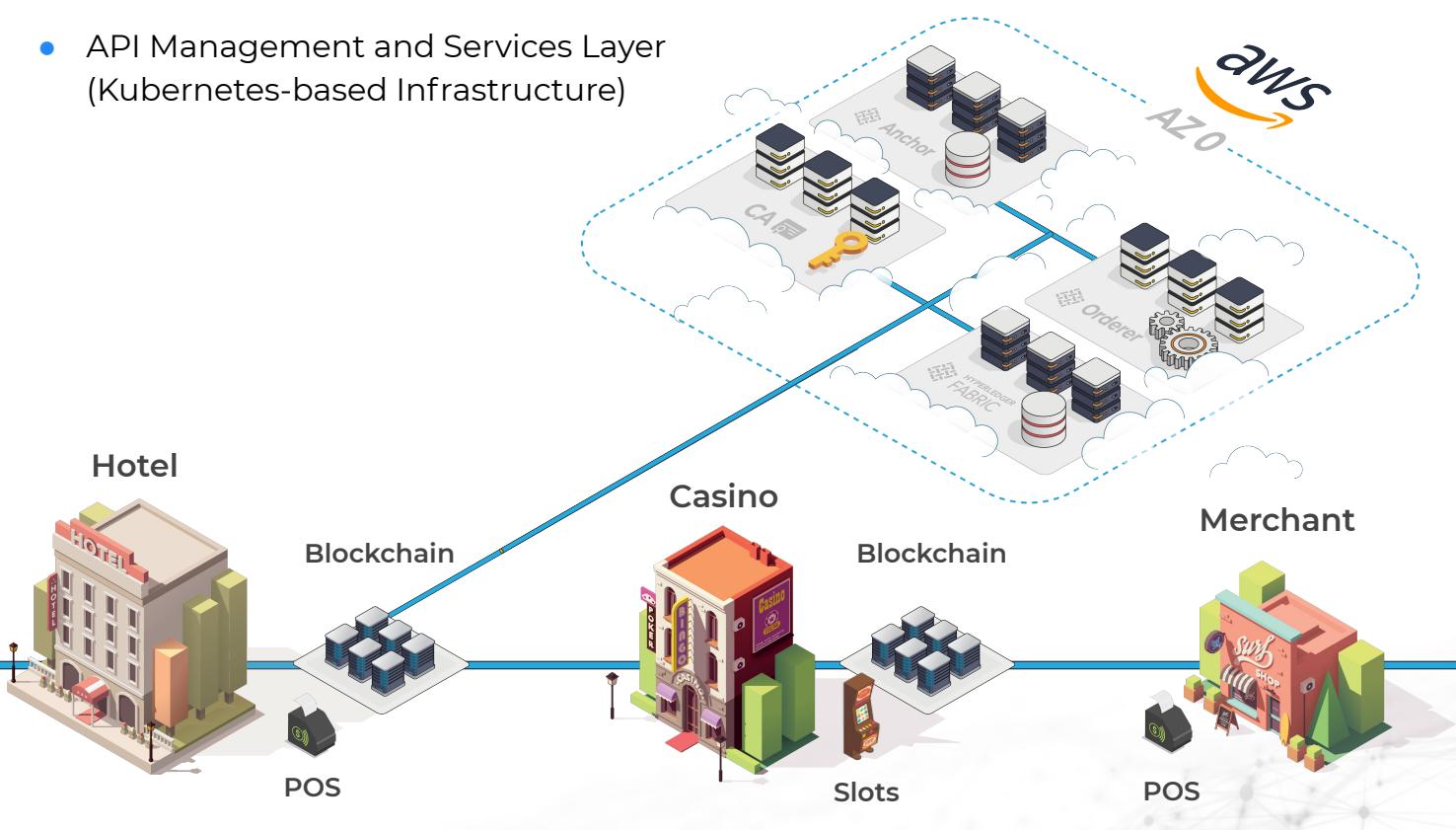
- Blockchain integration through Service Layer
- Common platform for all blockchain participants with pragmatic centralization

Centralization

- Synchronization with casino and HMS workflows
- Merchant and hotel ePOS systems integration
- Slots and tables integration with RFID membership cards

Infrastructure

- Automated provisioning
- Terraform (Cloud)
- Ansible (Platform + Fabric)
- Middleware on AWS PaaS
- API Management and Services Layer (Kubernetes-based Infrastructure)



Thank You For Reading

We hope this white paper provided a comprehensive overview of the current of digital transformation in the hospitality industry.



If you have any remaining questions, or if you need assistance in your digital transformation efforts, get in touch with us for a consultation.

[Get in Touch](#)