

# AI-Powered Solution Apartments: Revolutionizing Device Connectivity with Cost-Optimized Cloud Solutions

Industry	Solutions	Partner
Real Estate Technology, Smart Home, IoT	IoT Cloud Architecture Design, IoT Platform Development, Cost Optimization, Security & Compliance	Amazon Web Services (AWS)



## The Client

iApartments is a technology-forward property management company that provides fully managed, smart residential spaces across major metropolitan areas. It specializes in integrating cutting-edge IoT technology with traditional property management to create seamless living experiences for modern urban residents. With a portfolio spanning multiple cities, iApartments manages thousands of residential units equipped with smart home features including automated lighting, climate control, security systems, and energy management. Its platform combines digital tools with professional property management services to streamline daily operations, enhance resident convenience, and optimize property performance. By leveraging technology, iApartments ensures reliable 24/7 support, proactive maintenance, and data-driven decision-making. That way, the innovator is actively making urban living simpler, more efficient, and more sustainable.

## Business Requirements & Challenges

As iApartments expanded its operations and IoT infrastructure, the company partnered with DPL to address critical scalability and cost challenges in their cloud architecture. The existing infrastructure was experiencing bottlenecks that hindered growth and resulted in escalating cloud costs. Key business requirements included:

### 1. Scalability and Performance Bottlenecks:

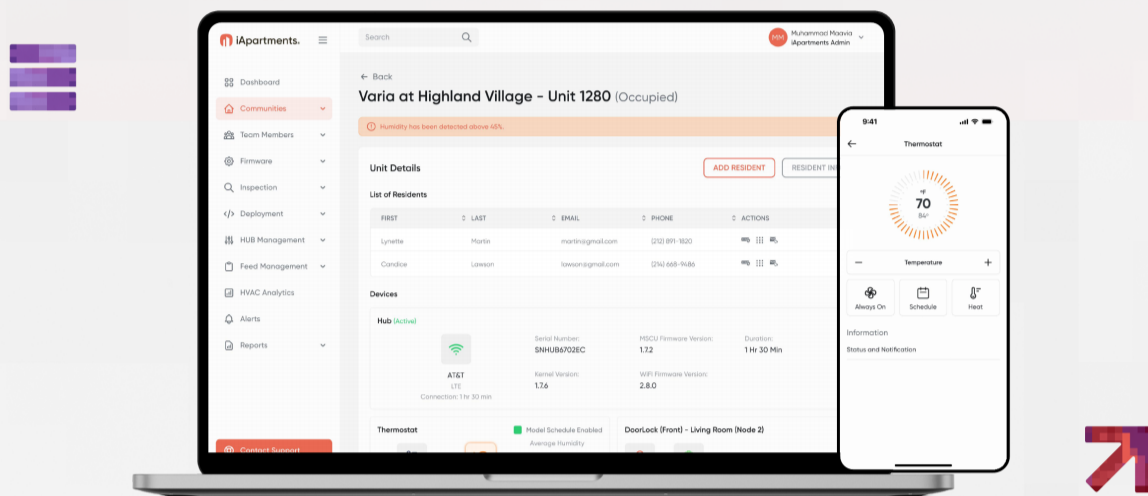
The platform needed to support rapid business growth while maintaining consistent performance. Infrastructure bottlenecks could impact device connectivity and user experience, particularly during peak usage periods. Therefore, the system had to be able to handle sudden traffic spikes without degradation in service quality.

### 2. Enhanced Security and Device Connectivity:

Managing 200,000+ connected devices required robust security measures and reliable connectivity protocols. The platform needed stronger authentication mechanisms, end-to-end encrypted communication channels, and comprehensive monitoring capabilities to ensure secure and reliable device operations across all properties.

### 3. Operational Simplicity:

The infrastructure needed simplified monitoring, logging, and maintenance processes to reduce operational overhead. The property management team further required real-time data related to system health, device status, and performance metrics, without requiring deep technical expertise to process it.



## Business Impact and Considerations

Addressing these challenges was critical for iApartments' business continuity and growth strategy. The implications of not modernizing their cloud infrastructure included:

- Escalating operational costs threatening business profitability and competitive positioning
- Limited ability to onboard new properties and scale device deployments
- Potential service disruptions during peak usage affecting resident satisfaction
- Security vulnerabilities in IoT device communications exposing properties to cyber risks
- Increased complexity in system monitoring and troubleshooting impacting operational efficiency
- Growing technical debt requiring specialized skills for infrastructure management

## AWS Services Utilized

The solution leveraged a comprehensive suite of AWS services to deliver a robust, scalable, and cost-effective platform:

### 1. Resilient, High-Availability Cloud Architecture

The solution deployed a multi-region, fault-tolerant architecture designed specifically for large-scale IoT workloads. Key components included:

- Multi-AZ deployment across US East and US West regions for geographic redundancy
- Auto-scaling groups configured to handle traffic fluctuations and ensure consistent performance
- Application Load Balancers distributing device connections across multiple availability zones
- Disaster recovery protocols with automated failover capabilities and data replication

### 2. Large-Scale IoT Device Management Platform

A secure, scalable platform capable of simultaneously managing 200,000+ connected devices was established using AWS IoT Core as the foundation. The following technologies were used:

- AWS IoT Core configured with device registry, message broker, and rules engine
- MQTT and HTTPS protocols for efficient, low-latency device communications
- Device shadows for tracking and maintaining device state even when offline
- AWS IoT Device Defender for continuous security auditing and anomaly detection
- Fleet indexing for fast device queries and bulk operations across the device population

### 3. Cost-Optimized Infrastructure Design

The infrastructure was re-engineered from the ground up to achieve the target of sub-\$1 per device monthly operating cost. This process entailed the use of:

- Right-sized EC2 instances using a mix of Reserved, Spot, and On-Demand instances
- S3 lifecycle policies with Intelligent-Tiering for automated data archival
- Amazon ElastiCache for reducing database load and improving response times
- CloudFront CDN for efficient content delivery and reduced data transfer costs
- AWS Lambda for event-driven processing, eliminating idle compute costs
- DynamoDB with on-demand billing for variable workload patterns

### 4. Enhanced Security Architecture

Security was embedded into every layer of the architecture with multiple defense mechanisms:

- X.509 certificate-based device authentication with automatic rotation
- TLS 1.3 encryption for all device-to-cloud communications
- AWS IAM with least-privilege access policies and role-based permissions
- AWS WAF protecting APIs from common web exploits and bot attacks
- AWS Secrets Manager for secure storage of credentials and API keys
- VPC isolation with private subnets and security groups controlling network access
- AWS GuardDuty for continuous threat detection and AWS Security Hub for centralized findings

### 5. Comprehensive Monitoring and Observability

End-to-end visibility was implemented to simplify operations and enable proactive issue resolution:

- Amazon CloudWatch with custom dashboards for real-time infrastructure and application monitoring
- Centralized logging using CloudWatch Logs with log insights for pattern analysis
- AWS X-Ray for distributed tracing and application performance analysis
- SNS-based alerting with PagerDuty integration for critical issues
- Automated health checks and self-healing mechanisms for common failure scenarios



## AWS Services Utilized

The solution leveraged a comprehensive suite of AWS services to deliver a robust, scalable, and cost-effective platform:

### Core IoT & Compute Services

- AWS IoT Core – Device connectivity, message routing, and rules engine
- AWS IoT Defender – Security auditing and anomaly detection
- Amazon EC2 – Application servers with Auto Scaling groups
- AWS Lambda – Serverless event processing and automation
- Elastic Load Balancing (ALB/NLB) – Traffic distribution and health monitoring

### Data Storage & Database Services

- Amazon DynamoDB – NoSQL database for device state and telemetry
- Amazon RDS (PostgreSQL) – Relational data for user accounts and properties
- Amazon S3 – Object storage with Intelligent-Tiering for logs and archives
- Amazon ElastiCache (Redis) – In-memory caching for performance optimization
- Amazon Timestream – Time-series database for IoT metrics

### Networking & Content Delivery

- Amazon VPC – Isolated network environment with public and private subnets
- Amazon CloudFront – Global CDN for low-latency content delivery
- Amazon Route 53 – DNS management and health-based routing
- AWS PrivateLink – Secure connectivity for service endpoints

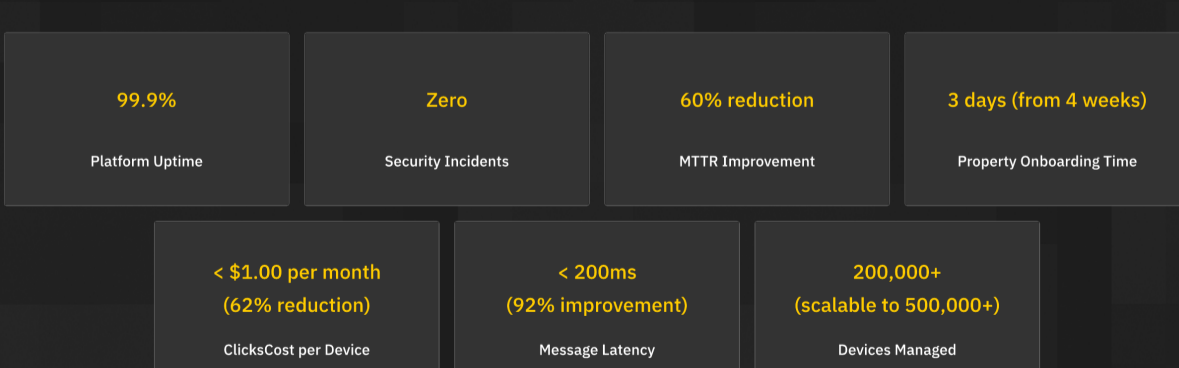
### Security & Compliance

- AWS IAM – Identity and access management with role-based policies
- AWS Certificate Manager – SSL/TLS certificate management
- AWS Secrets Manager – Secure credential storage and rotation
- AWS WAF – Web application firewall for API protection
- AWS GuardDuty – Intelligent threat detection
- AWS Security Hub – Centralized findings and compliance checks
- AWS KMS – Key management for encryption at rest

### Management & Monitoring

- Amazon CloudWatch – Comprehensive monitoring, metrics, and dashboards
- AWS CloudTrail – API activity logging and audit trail
- AWS X-Ray – Distributed tracing and performance insights
- AWS Systems Manager – Parameter Store and operational automation
- Amazon SNS – Alert notifications and event-driven messaging
- Amazon EventBridge – Event-driven architecture orchestration
- AWS CloudFormation – Infrastructure as Code for reproducible deployments

## Business Outcomes and Benefits



In addition to the above, the AWS cloud transformation delivered significant measurable benefits across operational, financial, and strategic dimensions:

### Cost Reduction Achievement

- Achieved annual cost savings of over 100K with projected 3-year savings of 300K
- Improved cost predictability through Reserved Instances and Savings Plans

### Enhanced Scalability & Performance

- Eliminated performance bottlenecks during peak traffic periods
- Delivered auto-scaling capability that can handle 5x traffic spikes without manual intervention

### Strengthened Security Posture

- Ensured 100% of device communications encrypted end-to-end with TLS 1.3
- Automated certificate rotation reducing security management overhead by 80%
- Enabled real-time threat detection with automated remediation for common attack patterns
- Delivered compliance readiness for SOC 2, ISO 27001 requirements

### Operational Efficiency Improvements

- Reduced the time spent on infrastructure management and troubleshooting by 75%
- Centralized dashboards providing real-time visibility across 200,000+ devices
- Reduced mean time to detection (MTTD) from hours to minutes
- Enabled self-healing capabilities to automatically resolve 40% of common issues
- Streamlined the deployment process, reducing release cycles from weeks to days

### Business Growth Enablement

- Enabled infrastructure to support 300% business growth without major re-architecture
- Established the foundation for AI/ML initiatives including predictive maintenance
- Improved resident satisfaction scores by 28% due to better system reliability
- Enhanced competitive positioning with proven enterprise-grade infrastructure



**Talha Saleem**  
Head of Growth  
info@dpl.it.com