CLOUD INTEGRATION ARCHITECTURE DOCUMENT

Polar Dynamics Robotics, Inc.

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Classification: Confidential

1. DOCUMENT PURPOSE AND SCOPE

1. This Cloud Integration Architecture Document ("Architecture Document") defines the authorized cloud infrastructure, integration patterns, and security protocols for Polar Dynamics Robotics, Inc.'s ("Company") IceNav(TM) Platform and associated autonomous mobile robot ("AMR") systems.

2. This document shall govern all cloud-based operations, data processing, and system integrations related to the Company's temperature-hardened AMR solutions and supporting technologies.

2. DEFINITIONS

1. "IceNav Platform" means the Company's proprietary cloud-based navigation and control system for cold-environment AMR operations.

2. "Production Environment" means the live operational environment serving customer deployments.

3. "Mission-Critical Systems" means those systems directly controlling AMR navigation, thermal management, and safety functions.

4. "Cold Chain Data" means operational data collected from AMRs operating in temperature-controlled environments.

3. CLOUD ARCHITECTURE SPECIFICATIONS

1. Primary Cloud Infrastructure

- Primary Provider: Amazon Web Services (AWS)
- Region: US-East-1 (Primary), US-West-2 (Disaster Recovery)
- Service Level Agreement: 99.99% uptime for Mission-Critical Systems

2. Core Services Configuration

- Compute: AWS ECS with Fargate for containerized workloads

- Storage: S3 (cold storage data), EBS (operational data)
- Database: Amazon Aurora PostgreSQL (primary), DynamoDB (real-time operations)
- Networking: AWS Transit Gateway, Site-to-Site VPN

4. INTEGRATION PATTERNS

1. AMR Communication Protocol

- Primary: MQTT over TLS 1.3
- Secondary: gRPC for high-throughput telemetry
- Fallback: REST API over HTTPS

2. Data Processing Pipeline

- Real-time processing via Amazon Kinesis
- Batch processing through AWS Batch
- ETL workflows managed by AWS Glue

5. SECURITY ARCHITECTURE

1. Authentication and Authorization

- AWS IAM for service-level access control
- OAuth 2.0 with PKCE for client applications
- Multi-factor authentication required for administrative access

2. Data Protection

- At-rest encryption using AWS KMS with customer-managed keys
- In-transit encryption using TLS 1.3
- Regular key rotation schedule: 90 days

6. COMPLIANCE AND REGULATORY REQUIREMENTS

1. The cloud architecture shall maintain compliance with:

- ISO 27001:2013
- SOC 2 Type II
- GDPR (where applicable)
- Industry-specific cold chain regulations

2. Audit Requirements

- Quarterly security assessments
- Annual penetration testing
- Continuous compliance monitoring

7. DISASTER RECOVERY AND BUSINESS CONTINUITY

1. Recovery Time Objective (RTO): 4 hours

2. Recovery Point Objective (RPO): 15 minutes

3. Geographic Distribution: Multi-region active-passive configuration

8. PROPRIETARY RIGHTS AND CONFIDENTIALITY

1. This Architecture Document contains confidential and proprietary information of Polar Dynamics Robotics, Inc. and is protected under applicable intellectual property laws.

2. No part of this document may be reproduced, transmitted, or distributed without the express written consent of the Company.

9. MAINTENANCE AND UPDATES

1. This Architecture Document shall be reviewed and updated quarterly by the Company's Cloud Infrastructure Team.

2. All changes must be approved by:

- Chief Technology Officer
- Chief Information Security Officer
- Cloud Architecture Review Board

10. EXECUTION AND APPROVAL

IN WITNESS WHEREOF, this Cloud Integration Architecture Document has been reviewed and approved by the undersigned authorized representatives of the Company.

APPROVED BY:

Marcus Chen

Chief Technology Officer

Date: January 11, 2024

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Chief Financial Officer

Date: January 11, 2024

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Chief Robotics Officer

Date: January 11, 2024