UNITED STATES PATENT AND TRADEMARK OFFICE

Patent No. US10555666

Distributed Computing Framework for Enterprise IoT Systems

Filing Date: March 15, 2018

Issue Date: September 23, 2020

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ABSTRACT

A system and method for distributed computing across enterprise IoT networks comprising a hierarchical node architecture for processing sensor data through edge computing devices. The invention includes adaptive load balancing protocols, fault-tolerant data synchronization mechanisms, and machine learning optimization algorithms for real-time operational analytics.

BACKGROUND OF THE INVENTION

[0001] Enterprise IoT systems generate massive quantities of sensor data requiring immediate processing for operational decision-making. Traditional centralized computing architectures face limitations in processing speed, network bandwidth, and system reliability when handling distributed IoT deployments at scale.

[0002] Existing solutions fail to adequately address the challenges of real-time processing across geographically dispersed sensor networks while maintaining data consistency and system fault tolerance.

SUMMARY OF THE INVENTION

[0003] The present invention provides a distributed computing framework specifically designed for enterprise IoT implementations. The system comprises:

a) A hierarchical node architecture with intelligent edge processing capabilities

b) Adaptive load balancing protocols for optimal resource utilization

c) Fault-tolerant data synchronization mechanisms

d) Machine learning algorithms for predictive maintenance and system optimization

DETAILED DESCRIPTION

Network Architecture

[0004] The distributed computing framework implements a three-tier architecture:

Edge Layer: Comprising IoT sensors and edge computing devices for initial data processing

Aggregation Layer: Regional nodes for data consolidation and intermediate analytics

Core Layer: Central processing hub for complex analytics and system-wide optimization

Load Balancing Protocol

[0005] The system implements a proprietary load balancing algorithm that:

- Continuously monitors processing capacity across all nodes
- Dynamically routes computational tasks based on current system load
- Maintains processing efficiency through predictive resource allocation
- Automatically scales processing capacity based on demand

Data Synchronization

[0006] The framework ensures data consistency through:

- Distributed ledger technology for transaction logging
- Atomic commit protocols for multi-node operations
- Real-time conflict resolution mechanisms
- Automated data recovery procedures

Machine Learning Integration

[0007] The system incorporates machine learning capabilities for:

- Predictive maintenance of network nodes
- Optimization of resource allocation
- Pattern recognition in sensor data
- Anomaly detection and alert generation

CLAIMS

A distributed computing system comprising:

a) A hierarchical network of processing nodes

b) Adaptive load balancing protocols

c) Fault-tolerant data synchronization mechanisms

d) Machine learning optimization algorithms

The system of claim 1, wherein the hierarchical network comprises edge devices, aggregation nodes, and a central processing hub.

The system of claim 1, wherein the load balancing protocols dynamically allocate processing tasks based on real-time system metrics.

[Claims 4-20 omitted for brevity]

DRAWINGS

[Figure references omitted for brevity]

TECHNICAL SPECIFICATIONS

Processing Capabilities:

- Edge Node Processing: Up to 10,000 events/second
- Aggregation Node Capacity: 100,000 events/second
- Core System Throughout: 1,000,000 events/second

Network Requirements:

- Minimum Bandwidth: 100 Mbps
- Recommended Latency: <50ms
- High Availability: 99.99% uptime

LEGAL NOTICES

EXECUTION

IN WITNESS WHEREOF, this patent application has been executed by the below-named inventors and assigned to Summit Digital Solutions, Inc.

/s/ Michael Chang

Michael Chang, Chief Technology Officer

Date: March 15, 2018

/s/ Dr. Robert Martinez

Dr. Robert Martinez, Chief Innovation Officer

Date: March 15, 2018

/s/ James Henderson

James Henderson, Chief Digital Officer

Date: March 15, 2018