PROVISIONAL PATENT APPLICATION

Title: Dynamic Quantum Resource Allocation System with Adaptive Performance Optimization

Inventor(s): Brian James Rutherford

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Inventors: [TO BE COMPLETED WITH ACTUAL INVENTOR NAMES]

Assignee: MWRASP Quantum Defense Systems, Inc.

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TECHNICAL FIELD

The present invention relates to quantum computing systems for cybersecurity applications, and more particularly to dynamic quantum resource allocation systems and methods.

BACKGROUND OF THE INVENTION

Current cybersecurity systems lack the advanced capabilities provided by dynamic quantum resource allocation. Existing solutions suffer from performance limitations, scalability issues, and inability to handle quantum-era threats effectively.

SUMMARY OF THE INVENTION

The present invention provides dynamic quantum resource allocation specifically designed for quantum-enhanced cybersecurity applications. The system addresses limitations of prior art through innovative algorithms, real-time processing capabilities, and quantum-classical integration.

Key Innovations

1. Advanced Algorithms: Proprietary algorithms optimized for cybersecurity applications

2. Real-Time Processing: Microsecond-level response times for critical security analysis

3. Quantum Integration: Seamless integration with quantum computing resources

4. Scalable Architecture: Support for enterprise-scale deployment

DETAILED DESCRIPTION

System Architecture

The dynamic quantum resource allocation system comprises multiple interconnected components:

1. Core Processing Engine: Central system for primary operations

2. Integration Layer: Interfaces with existing cybersecurity infrastructure

3. Optimization Module: Performance and efficiency optimization

4. Management System: Configuration and monitoring capabilities

Technical Implementation

The system implements advanced algorithms specifically designed for quantum-enhanced cybersecurity applications, providing significant performance advantages over existing solutions.

CLAIMS

Claim 1: A dynamic quantum resource allocation system comprising: a) a processing engine configured to coordinate quantum and classical computational resources for diverse computational workloads; b) an integration layer for seamless operation with existing computing infrastructure; c) optimization algorithms that dynamically allocate resources based on computational requirements and system performance; d) management capabilities for enterprise-scale quantum computing deployment across multiple application domains.

Claim 2: The dynamic quantum resource allocation system of Claim 1, wherein the processing engine comprises:

a) a quantum resource monitor configured to continuously assess quantum computing resource availability and performance metrics;

b) a classical resource monitor configured to track traditional computing resource utilization and capacity; and

c) a load balancing algorithm configured to optimally distribute cybersecurity analysis tasks between quantum and classical processing units.

Claim 3: The dynamic quantum resource allocation system of Claim 1, wherein the integration layer comprises:

a) a cybersecurity API interface configured to communicate with existing security infrastructure including SIEM and SOAR platforms;

b) a data normalization module configured to standardize threat data formats across different security tools; and

c) a real-time synchronization system configured to maintain consistent state across all integrated security components.

Claim 4: The dynamic quantum resource allocation system of Claim 1, wherein the optimization algorithms implement:

a) machine learning models that predict optimal resource allocation based on historical performance data;

b) adaptive thresholding mechanisms that adjust resource allocation decisions based on current system performance; and

c) predictive scaling algorithms that anticipate resource needs based on threat pattern analysis.

Claim 5: The dynamic quantum resource allocation system of Claim 2, wherein the quantum resource monitor implements:

a) quantum coherence time tracking to optimize quantum algorithm execution timing;

b) quantum error rate monitoring to ensure analysis accuracy and reliability; and

c) quantum gate fidelity assessment to maintain optimal quantum processing performance.

Claim 6: The dynamic quantum resource allocation system of Claim 1, wherein the system implements priority-based resource allocation that:

a) assigns high priority to computationally intensive tasks requiring immediate quantum processing;

b) allocates classical resources for high-volume, low-complexity computational workloads; and

c) implements emergency resource reservation for time-critical computational scenarios across diverse application domains.

Claim 7: A method for dynamic quantum resource allocation in computational systems comprising:

a) receiving computational workloads and determining processing complexity requirements;

b) evaluating current quantum and classical resource availability and performance metrics;

c) applying machine learning algorithms to predict optimal resource allocation strategies;

d) dynamically routing computational tasks to quantum or classical processing units based on optimization criteria;

e) monitoring computational performance and adjusting resource allocation algorithms based on results;

f) maintaining real-time integration with existing computing infrastructure throughout the resource allocation process.

Claim 8: The method of Claim 7, wherein the step of applying machine learning algorithms comprises:

a) analyzing historical performance data to identify optimal resource allocation patterns;

b) implementing reinforcement learning algorithms that improve allocation decisions over time; and

c) utilizing predictive analytics to anticipate future resource needs based on threat intelligence.

Claim 9: The dynamic quantum resource allocation system of Claim 1, wherein the management capabilities comprise:

a) a centralized dashboard for monitoring resource utilization across quantum and classical systems;

b) automated alerting mechanisms for resource bottlenecks and performance degradation; and

c) configuration management tools for adjusting resource allocation parameters in real-time.

Claim 10: The dynamic quantum resource allocation system of Claim 1, wherein the system maintains:

a) microsecond-level response times for resource allocation decisions;

b) 99.9% uptime reliability for critical cybersecurity analysis operations; and

c) seamless failover capabilities between quantum and classical processing resources during system maintenance or failures.

INDUSTRIAL APPLICABILITY

The dynamic quantum resource allocation system described herein has significant industrial applicability across the quantum computing industry and enterprise cybersecurity sector, providing essential infrastructure for optimal utilization of quantum computing resources.

Primary Industrial Applications

Quantum Cloud Service Providers: Major quantum computing platforms like IBM Quantum Network, Google Quantum AI, AWS Braket, and Microsoft Azure Quantum can integrate this resource allocation system to optimize utilization across their customer base. The system maximizes revenue per quantum processing unit while ensuring optimal performance for cybersecurity workloads.

Enterprise Hybrid Computing Centers: Large corporations and government agencies deploying hybrid quantum-classical cybersecurity systems can implement this technology to optimize their computational resource investments. The system ensures maximum return on investment for expensive quantum computing infrastructure while maintaining superior cybersecurity capabilities.

High-Performance Computing Centers: National laboratories, research institutions, and supercomputing centers can utilize this system to efficiently allocate quantum resources for cybersecurity research and operational security applications, optimizing both research productivity and operational effectiveness.

Cybersecurity Service Providers: Managed Security Service Providers (MSSPs) and cybersecurity consulting firms can deploy this system to offer premium quantum-enhanced security services, providing superior threat detection capabilities while optimizing operational costs through intelligent resource management.

Manufacturing and Commercial Deployment

Software-as-a-Service Architecture: The resource allocation system is implemented as intelligent software middleware that integrates with existing quantum computing platforms and cybersecurity infrastructure, enabling immediate commercial deployment without requiring specialized hardware manufacturing.

Cross-Platform Integration: The system's design supports all major quantum computing architectures (superconducting, trapped ion, photonic, neutral atom) and classical high-performance computing systems, providing broad market applicability across diverse technology environments.

Enterprise Scalability: The system scales from small quantum computing deployments to large multi-tenant quantum cloud services, addressing market needs across different scales of quantum computing adoption and enterprise cybersecurity requirements.

Market Demand and Economic Impact

Quantum Computing Resource Optimization: As quantum computing time costs $1-50 per minute depending on the system, intelligent resource allocation becomes critical for commercial viability. This system addresses the fundamental challenge of quantum resource optimization that affects the entire quantum computing industry's economic sustainability.

Enterprise Cybersecurity ROI: Organizations investing in quantum-enhanced cybersecurity need to demonstrate clear return on investment. This resource allocation system provides measurable improvements in threat detection efficiency and computational cost optimization, addressing a critical requirement for enterprise quantum adoption.

Market Growth Facilitation: The system enables broader quantum computing adoption by making quantum resources more cost-effective and accessible for cybersecurity applications, potentially accelerating the quantum computing market growth from $1.3 billion to projected $15+ billion by 2030.

Technical Manufacturing Feasibility

Immediate Deployment: The system utilizes existing quantum computing APIs (Qiskit, Cirq, Amazon Braket), cloud infrastructure, and machine learning frameworks, ensuring immediate technical feasibility for commercial deployment across all major quantum computing platforms.

Standards Compliance: The system is designed to integrate with emerging quantum computing standards and cybersecurity regulations, ensuring long-term market viability and compliance across regulated industries.

Performance Optimization: The system's microsecond-level decision making and 99.9% uptime requirements are achievable using current technology infrastructure, providing immediate value for quantum computing service providers and enterprise customers.

This invention solves the critical challenge of quantum resource optimization that currently limits the commercial viability of quantum-enhanced cybersecurity applications, making it essential technology for the successful industrialization of quantum computing in cybersecurity markets.

ABSTRACT

A dynamic quantum resource allocation system for quantum-enhanced cybersecurity applications that provides advanced capabilities through innovative algorithms, real-time processing, and quantum-classical integration, addressing limitations of existing cybersecurity solutions.

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