AlirOS Data Sheet

AlirOS is a control plane and software platform that combines quantum networking hardware components into capable nodes running BBM92 key distribution today, and the Quantum Internet tomorrow.

Overview

The scalable control plane for quantum networks.

- Provides sophisticated logical devices by combining components into composite devices.
- Allows selection of individual quantum devices to meet desired criteria. For example: best of breed, ROI, service levels, etc.
- Provides real-time control, synchronization, and timing
- Speaks the management languages that enterprise networks already understand

Network Stack Architecture

Interoperability Layer for Applications and Operations

- **Applications**: APIs provided by the AlirOS RPC layer to control and consume quantum-derived data from AlirOS
    - Cisco SKIP integration provides quantum-generated symmetric keys to existing infrastructure
- **Industry Best Practice Config**, **Management**, and **Control** via **NETCONF/YANG**: seamless integration with SDN platforms like Aliro Orchestrator and Cisco NSO
- **Engineered for Automation**: Metric Layer collects telemetry from services and logical devices and publishes it to Prometheus enabling real-time visibility, alerting, diagnostics, and closed-loop control.

Service Layer for Meeting Needs

- **Modular Services** implement functional capabilities, transforming device level interactions into coordinated behaviors, structured data, and valuable outputs.
    - Keystore
    - Polarization Compensation

Resource Layers for Abstraction and Access

- **Resource Access Layer** (RAL) brings up, activates, manages, and provides stateful access to devices.
- **Logical Devices** abstract vendor-specific hardware implementations by providing common APIs for distinct classes of logical devices, allowing vendors and device builders complete implementation freedom while presenting a consistent interface to the system.

Lower Layers for Real-time Control (RTC)

- Architected for **Extensibility**
    - Module Access Layer

    - Session Management
    - Kernel and Driver APIs
- **Independent Timing**
    - Timing Calibration
    - Time Tagging
- **BBM92 Protocol Implementation**
    - Basis Sifting
    - Authentication
    - Information Reconciliation
    - Privacy Amplification
    - Coincidence Peak Finding
    - Link Viability
    - Two tier polarization control feedback loop
    - Key Generation

Physical Layer Integrations

- **Fast, direct connection** to photon detectors via Transistor-Transistor Logic (TTL) interface
- **Easy integration** with all USB, Ethernet, Web, and PCIe accessible devices
- Example devices: entangled photon sources, photon detectors, bespoke measurement modules, motorized polarization controllers, etc.

Functionality

Physics-based security (BBM92).
Key material is generated through quantum entanglement, not mathematical computation. Any eavesdropping attempt disturbs the entanglement and is immediately detectable.

Native integration with Cisco SKIP.
Cisco switches and encryptors use the SKIP protocol to request quantum-generated keys directly from AlirOS nodes, protecting traffic across Cisco switches while existing infrastructure remains unchanged.

Continuous optical stability.
Automated polarization compensation monitors and optimizes the quantum link, preserving key rates and service continuity at long distances.

FPGA-based compute and I/O offload.
Basis sifting, authentication, error correction, and other protocol steps can be handled on chip lowering CPU and enabling wider platform adoption.

Built in time tagging.
FPGA logic provides real-time sampling and timestamping of photon detector output signals. This eliminates external hardware, saves rack space, and reduces BOM cost.

Native clock alignment.
FPGA logic uses Ethernet clock recovery to line up the clocks of distant nodes. This reduces BOM cost and improves ROI by replacing costly White Rabbit (WR) systems. WR is also supported to accommodate circumstances where it is preferred.

Software-based synchronization.
Statistical arrival patterns of the entangled photons themselves are used to normalize offsets due to unequal propagation delay and correctly identify pairs.

Scalable architecture for emerging quantum-enabled workflows.
Hardware can be onboarded through configuration and new interfaces are always abstracted by logical devices with common APIs. As your quantum network grows, the same platform flexibly and conveniently scales with it.

Future Oriented
AlirOS is designed to serve as the control plane providing coordination, observability, and hardware abstraction that enterprise quantum infrastructure will demand. Organizations deploying AlirOS today are not buying a point solution; they are establishing the operational foundation their quantum network will run on for years to come.