GET STARTED

BRIDGING CLASSICAL & QUANTUM

PREPARING ENTERPRISE ARCHITECTURE FOR THE QUANTUM ERA

Bridging Classical & Quantum:

Event:

Conf42 Quantum Computing 2025

Role:

Executive Director at JP Morgan Chase Bank

Presenter:

Laxmikanth Mukund Sethu Kumar

QUANTUM WON'T REPLACE CLASSICAL IT WILL TRANSFORM HOW WE USE IT

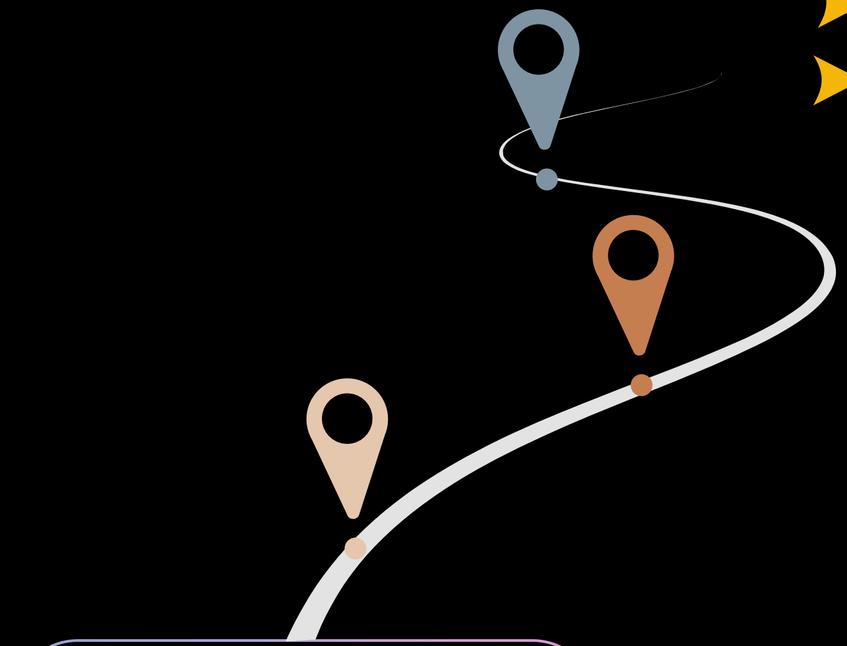
Enterprise innovation in the next decade depends on hybrid models.

Goal:

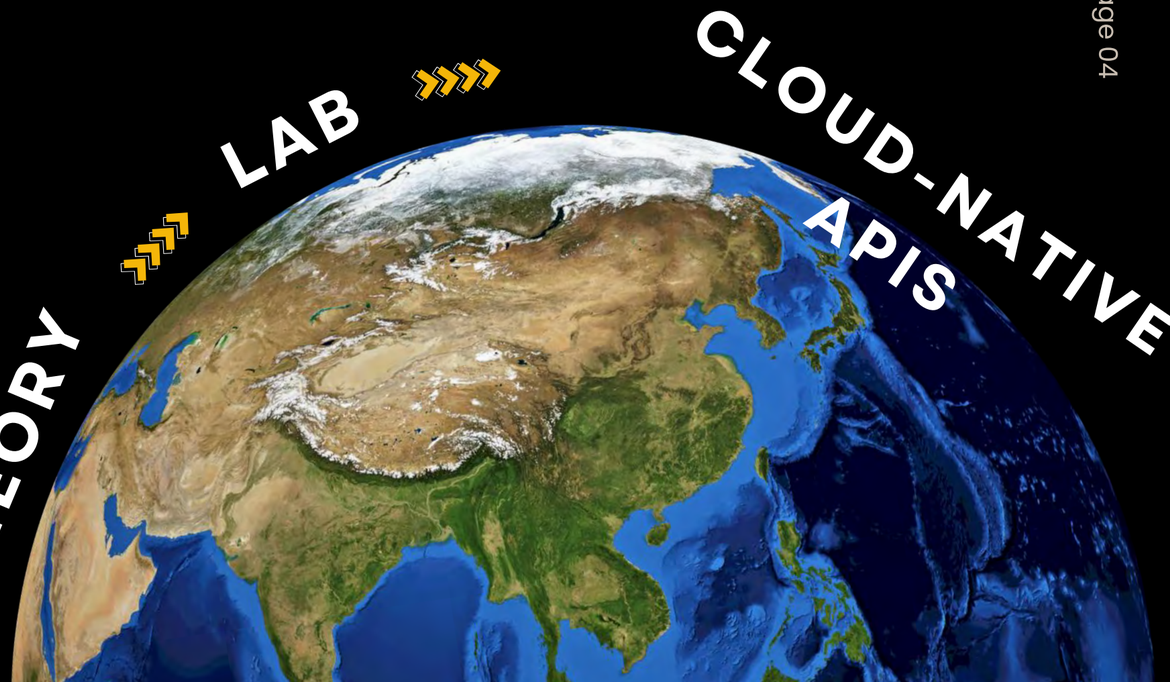
Shift mindset from competition to coexistence between classical and quantum.

The Shift is Real

- AWS Braket, IBM Quantum, Azure Quantum available
- Over 100+ quantum patents filed in 2023 alone
- Startups and enterprise R&D teams prototyping hybrid workflows



PROOF POINTS



What’s at Stake for Enterprises?

CLASSICAL SYSTEMS

PERFORMANCE-OPTIMIZED, SECURE, RELIABLE

EMERGING NEEDS:

QUANTUM FOR COMBINATORIAL OPTIMIZATION, ML ACCELERATION, MOLECULAR SIMULATION.

NEED TO INTERFACE QUANTUM WITH CLASSICAL EVENT-DRIVEN PIPELINES

Quantum 101 for Classical Architects

CORE PRINCIPLES

QUBITS, SUPERPOSITION, ENTANGLEMENT, INTERFERENCE

TAKE THINK IN TERMS OF PROBABILITY AWAYAMPLITUDES, NOT BINARY CERTAINTY

DIFFERENCE

CLASSICAL = BINARY LOGIC (0 OR 1)
QUANTUM = PROBABILISTIC STATE (0 AND 1 SIMULTANEOUSLY)

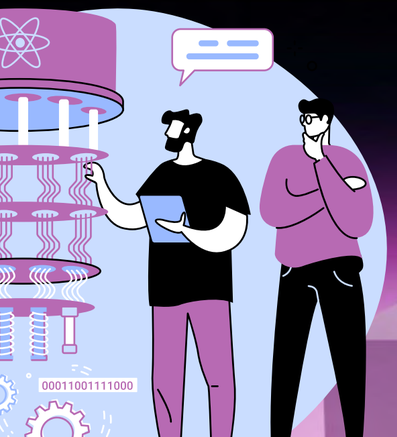
ARCHITECTURAL CHALLENGE

PROBLEM

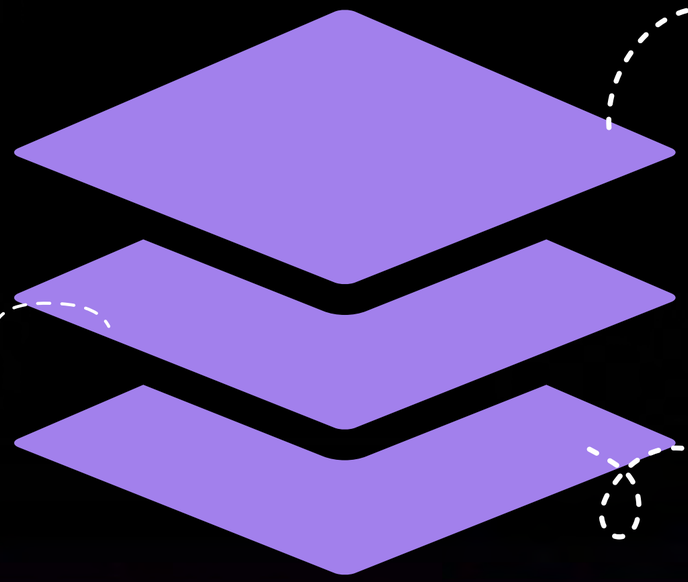
QUANTUM DOESN’T FIT DIRECTLY INTO EXISTING DEVOPS STACKS

MISSING PIECES

- Job orchestration
- State isolation for quantum workloads
- Latency tolerance



Hybrid Architecture Blueprint



APPLICATION TIER (MICROSERVICES, APIS)

MIDDLEWARE/ORCHESTRATION (QUANTUM JOB ROUTERS, QUEUES)

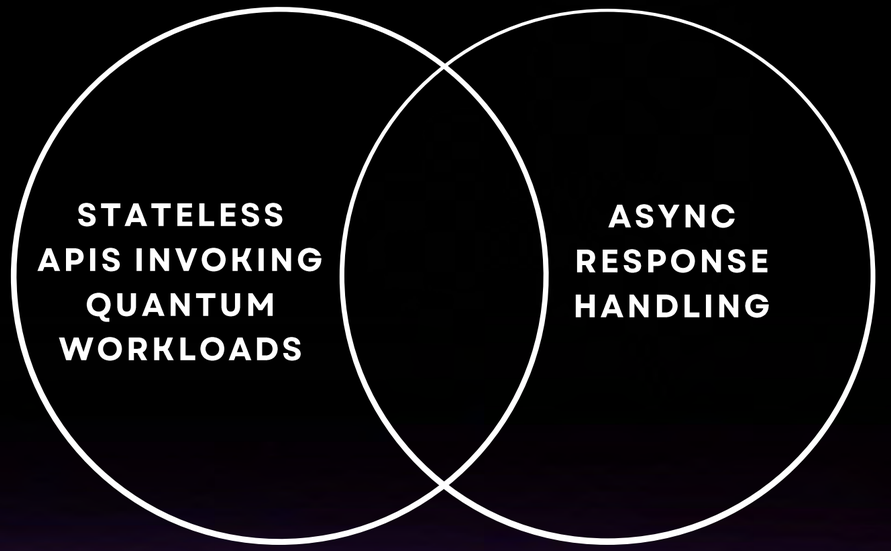
BACKEND SERVICES (CLASSICAL + QUANTUM EXECUTION)

PROBLEM

QUANTUM DOESN’T FIT DIRECTLY INTO EXISTING DEVOPS STACKS

Design Patterns for Hybrid Systems

- QUANTUM-AS-A-SERVICE (QAAS)
- QUANTUM TRIGGERS FROM CLASSICAL EVENT QUEUES (KAFKA, PUB/SUB)
- SERVERLESS QUANTUM MICROSERVICES



Middleware

& Integration Strategies

RESPONSIBILITIES

- Session management
- Job queuing and error retries
- Result normalization

STRATEGY: DECOUPLE QUANTUM LOGIC FROM ORCHESTRATION LOGIC

TOOLS : AWS BRAKET SDK, QISKIT RUNTIME, CIRQ + GRPC BRIDGES

Cloud-Native Abstractions

- Containers running quantum SDKs for local simulation
- Orchestrated via Kubernetes (e.g., K8s job runners)
- Serverless options (e.g., AWS Lambda + Braket trigger)
- DevOps: Quantum job linting, CI/CD for quantum kernels

Security

- Auth across classical/quantum boundary
- Zero-trust models

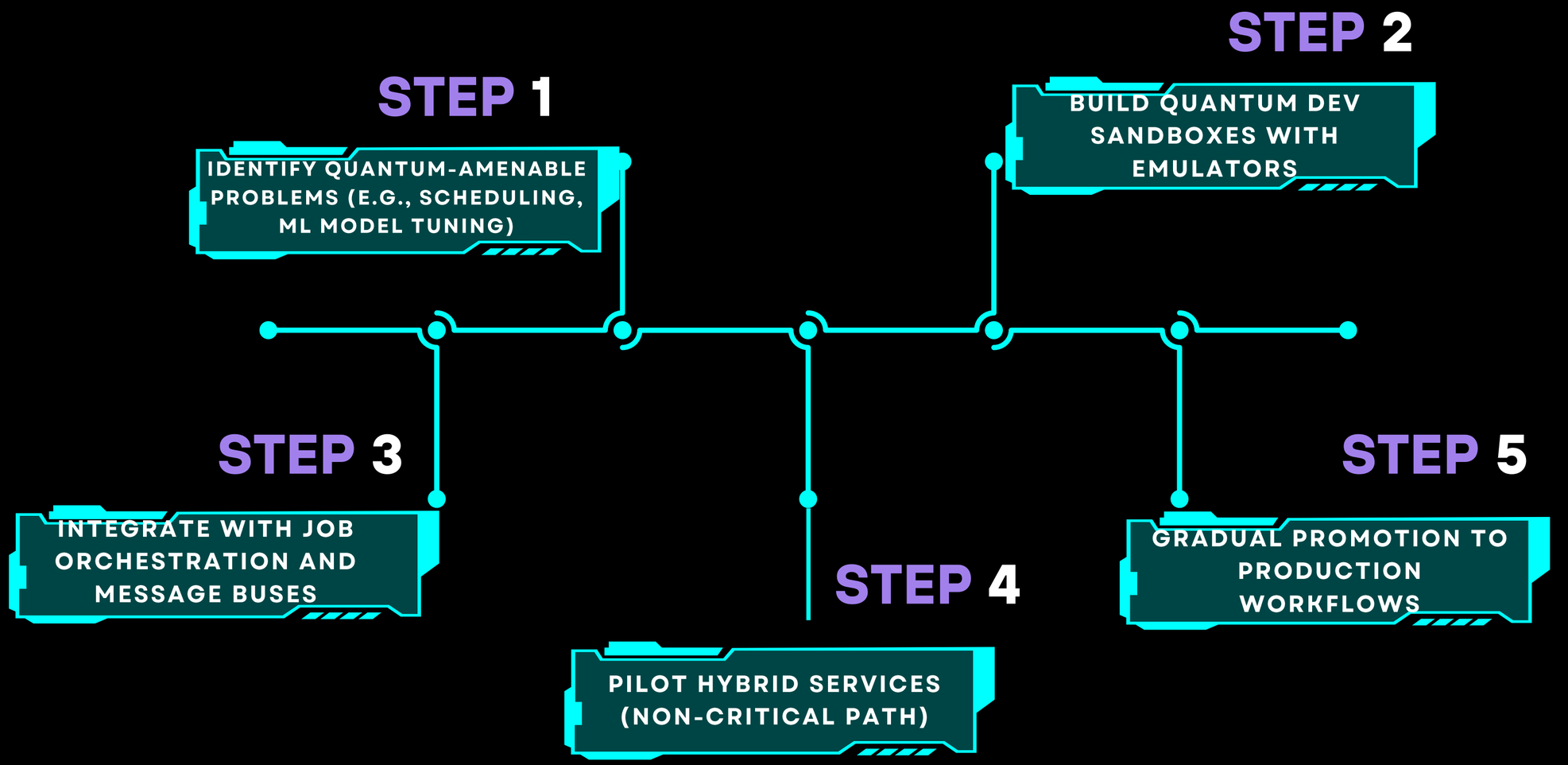
Interoperability

- Protocol standards: QIR, OpenQASM
- Vendor-neutral interfaces

Observability

- Telemetry for quantum jobs
- Integration with Prometheus, OpenTelemetry

Practical Roadmap for Enterprises



Future-Proofing
Without Disruption

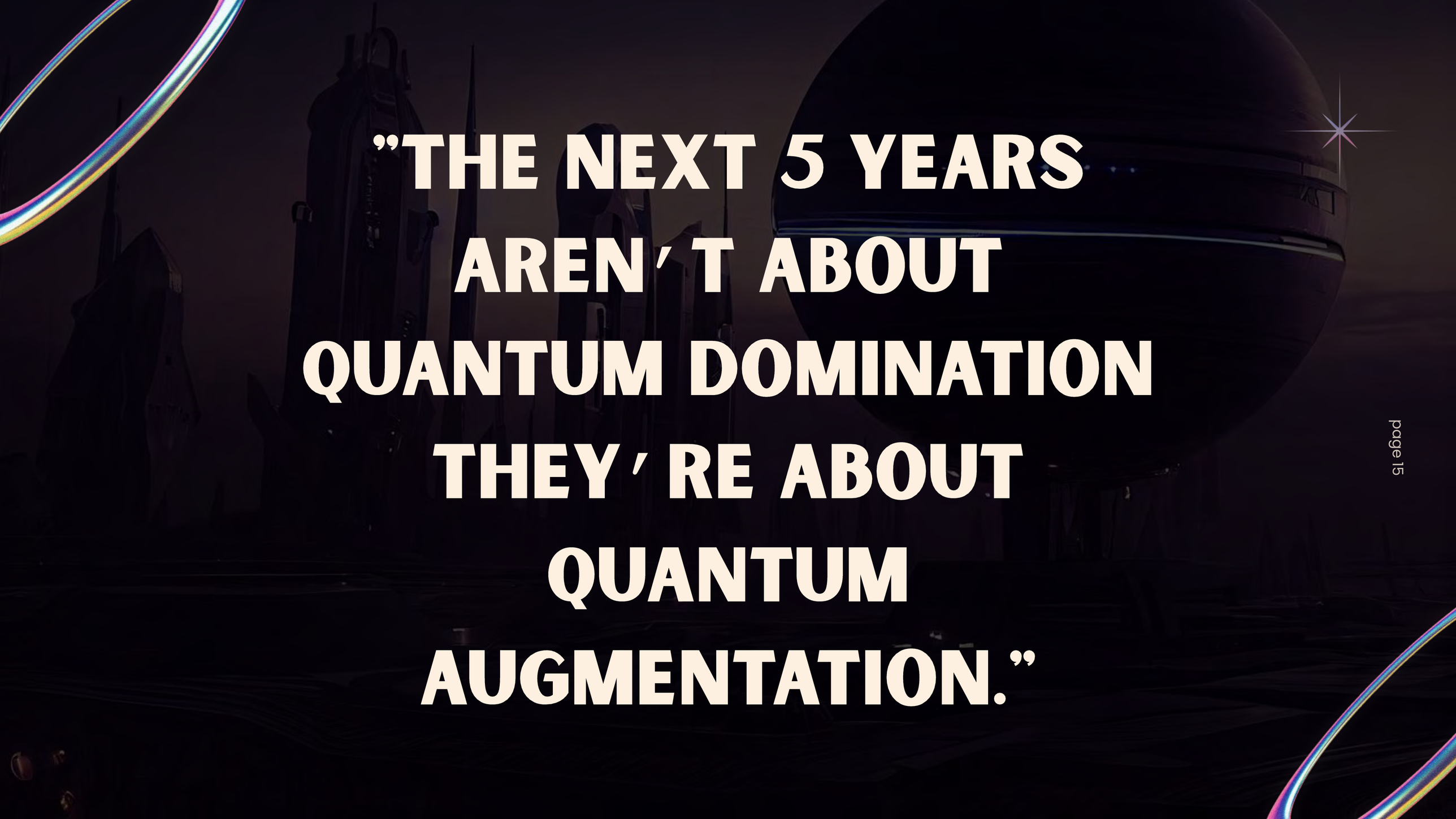
Strategy

- Modular integration
- Adapter layers to existing systems

Minimize risk

- Use polyglot SDKs and simulator
- Hybrid CI/CD pipelines

GOAL: EXPERIMENT WITHOUT REWRITING THE STACK


"THE NEXT 5 YEARS
AREN'T ABOUT
QUANTUM DOMINATION
THEY'RE ABOUT
QUANTUM
AUGMENTATION."


Thank You