Quantum Artificial Intelligence - Architecture

Presented by The Reddix Group, LLC

Mission Statement:

DoD Quantum Artificial Intelligence (Q-AI)

IN NEAR REAL - TIME "FUTURE STATE"

Creates an Enterprise Common Operational Picture, that produces Enhanced Situational Awareness!

Potential National Security Threats - Part 1

CRIME

Example : product piracy, cyber attacks

AMENDMENTS TO THE LAW

Example : GDPR (2018)

INFRASTRUCTURE ISSUES

Example : power outages or network crashes

NATURAL DISASTERS

Example : earthquakes, floods

RESOURCE CONSTRAINTS

Example : loss of suppliers

LOSSES DUE TO ACCIDENTS

Examples : fire, machinery issues

HEALTH-RELATED ISSUES

Example : Flu season or any pandemics

SOCIAL & POLITICAL UNREST

Example : strikes, political upheavals, attacks

Potential National Security Threats - Part 2

Texas Power Outages

Storm Damage

Theft or Robbery

Power Outages

Viral Outbreak

Technical Failure

Space Weaponization

Natural Disaster

Cyber Attack

Human Error

Fire Accident

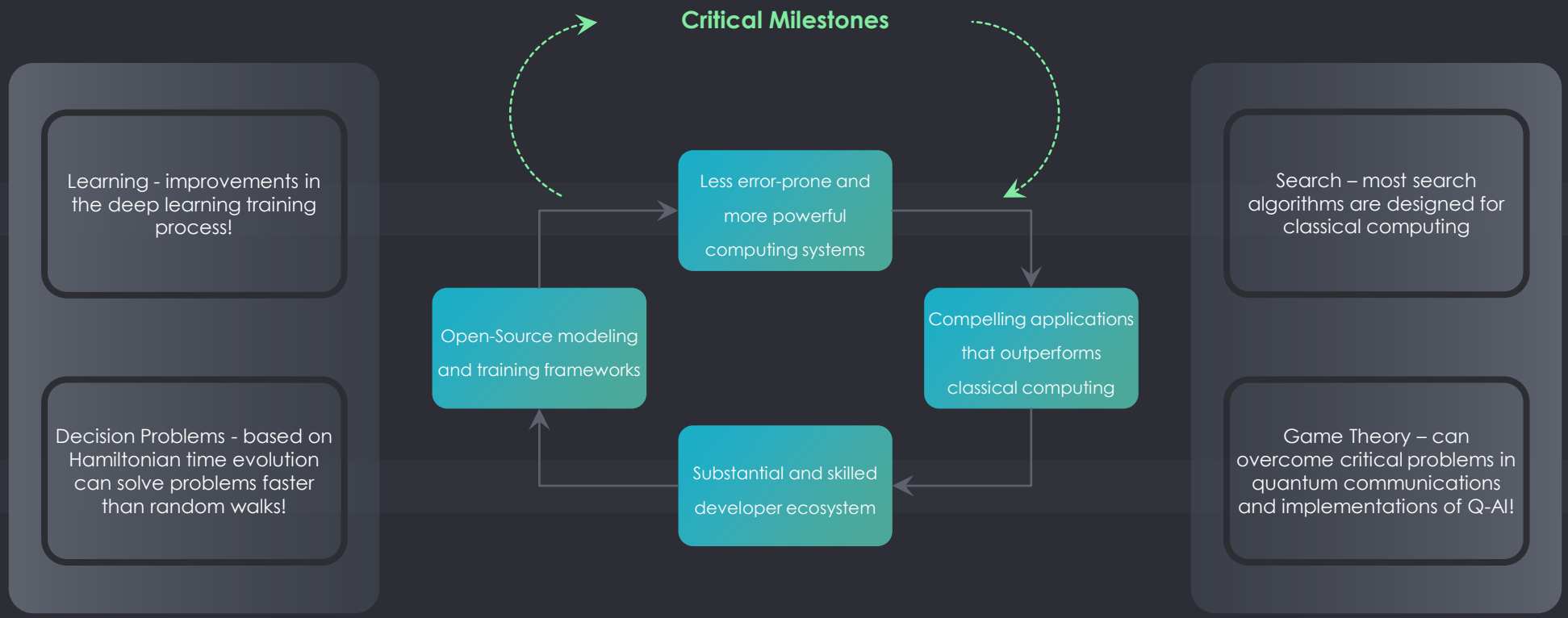
Water Shortage

Colonial Pipeline Ransomware Attack

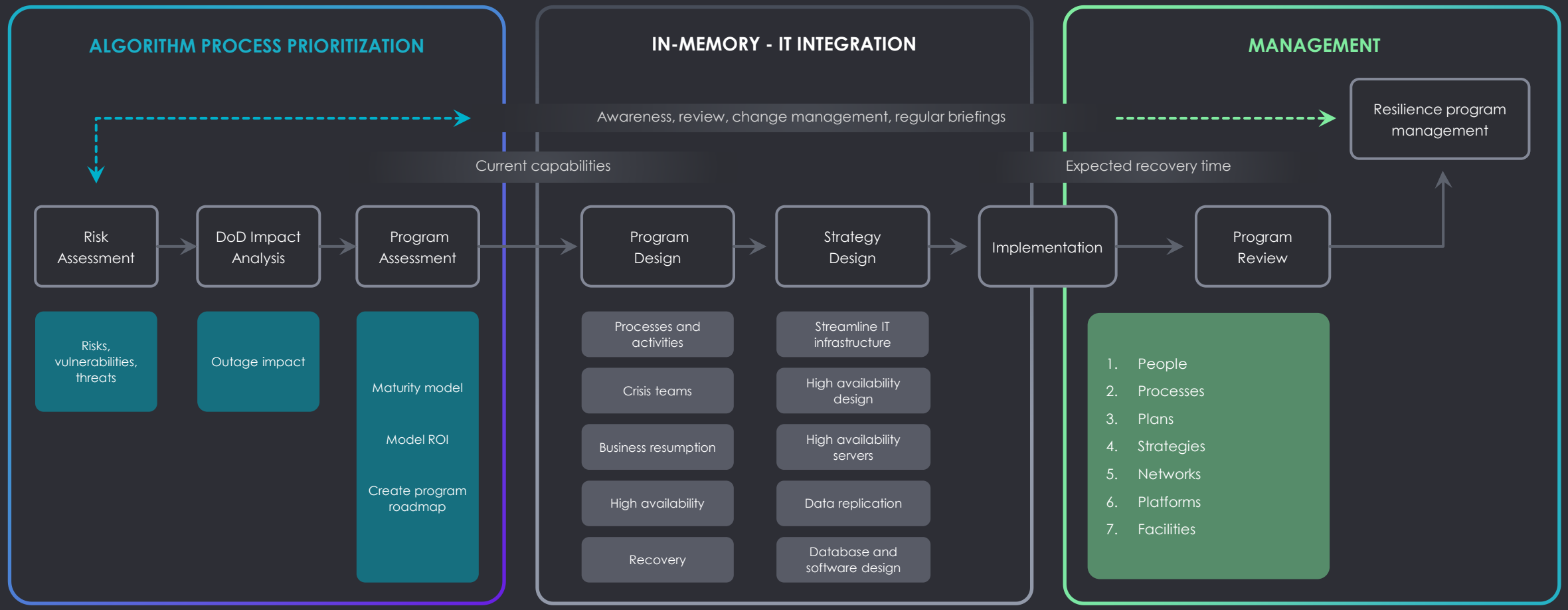
Jackson, MS Water Shortage

The Aim of Q-AI

Enhanced Situational Awareness (ESA)



Q-AI Plan of Attack



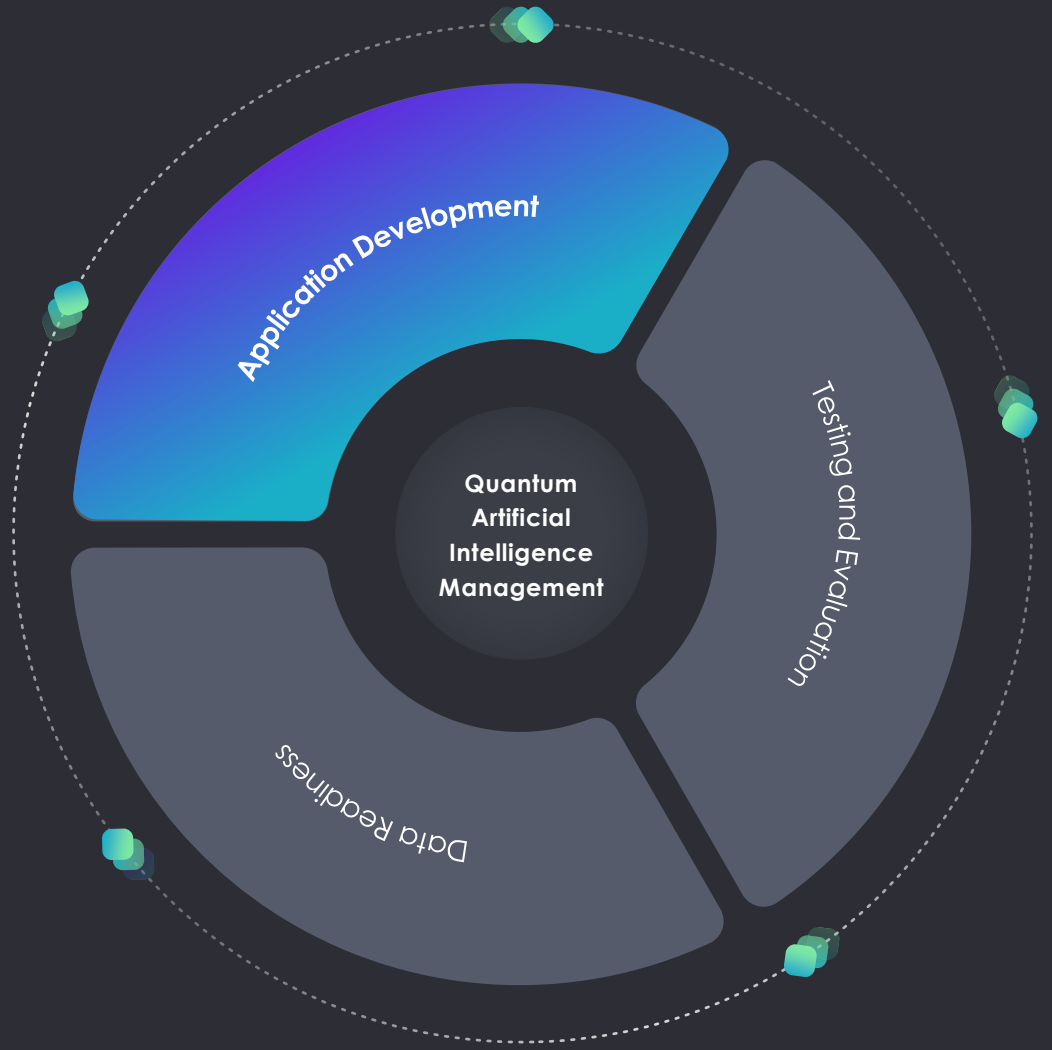
Q-AI Data Readiness

Labeling data is a significant expense and bottleneck for Machine Learning and Natural Language Processing (NLP) development. Current approaches, such as manually labeling data through crowdsourcing and internal labeling efforts, carry significant drawbacks including high cost, extensive time and resource consumption, and low consistency and accuracy. Jaxon is a semi-supervised training platform that amplifies a small number of human-provided labels into full-scale training datasets and high-quality models for text-oriented machine learning applications.

Jaxon brings together several open and proprietary techniques for effective sparse-data training. These techniques incorporate knowledge from large unlabeled corpora, human domain experts, and previously-trained models and machine learning assets in order to drastically reduce the demand for human labeling and annotation while improving model quality.

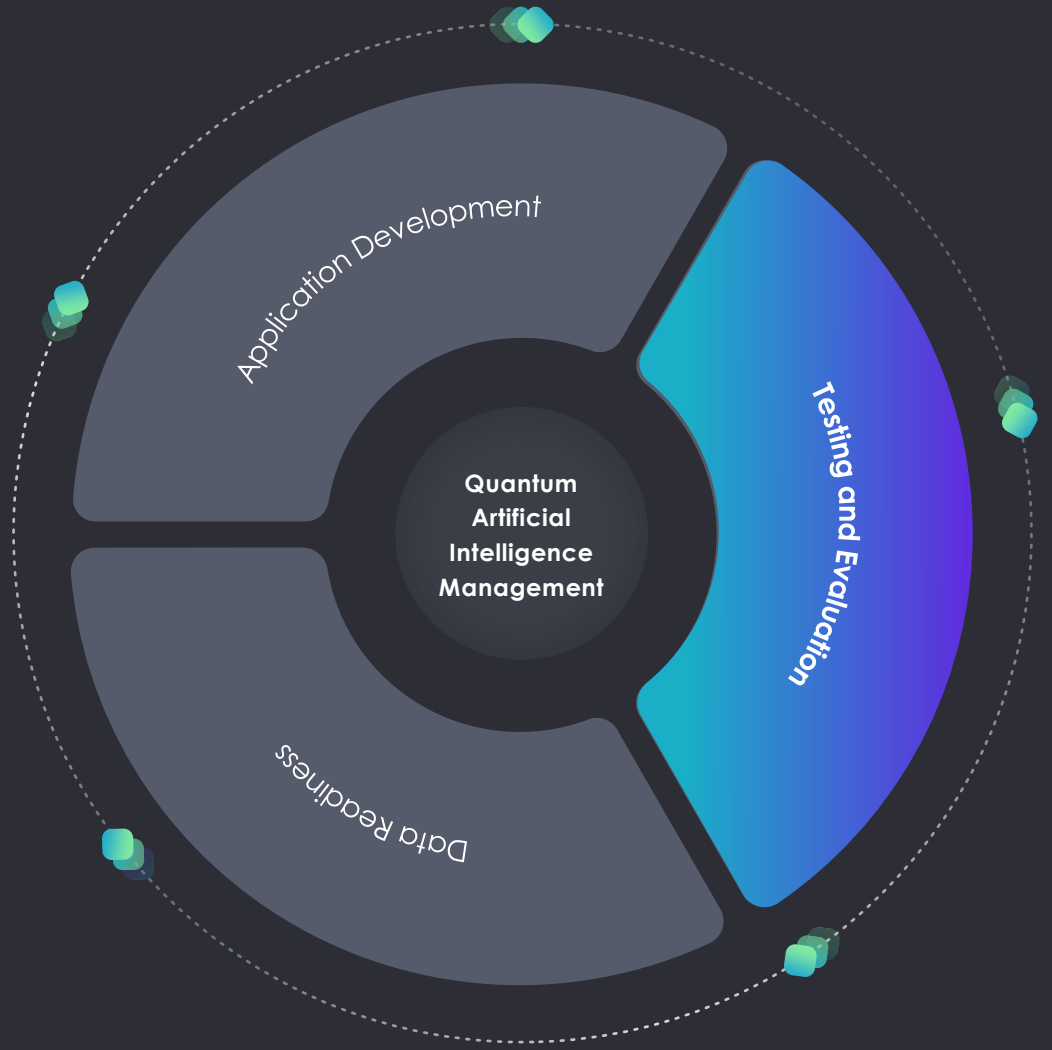
Q-AI Application Development

With the growth of cloud computing, more ingenious cyberthreats, and the need for fast and easily changeable applications, agencies are realizing that the traditional method of application development does not serve their needs. For more agencies, the answer is microservices. This application development approach breaks applications into smaller components for development.



Q-AI Testing and Evaluation

Testing & Evaluation (T&E) – There are so many things that can go wrong during data transportation: Data can be corrupted, hit bottlenecks causing latency, or data sources may conflict generating duplicate or incorrect data, eliminating duplicates and incompatible data types, to obfuscate sensitive information while not missing critical data.



Preparing Quantum Datasets for Q-AI

01

Convert Q-AI data to the quantum dataset

Q-AI data can be represented as a multi-dimensional array of numbers which is called as quantum tensors. TensorFlow processes these tensors in order to represent, create a dataset for further use.

02

Choose Q-AI neural network models

Based on the Q-AI data structure, Q-AI neural network models are selected. The aim is to perform Q-AI processing in order to extract information hidden in an entangled state.

03

Sample or Average

Measurement of Q-AI states extract classical information in the form of samples from the classical distribution. The values are obtained from the Q-AI state itself.

04

Evaluate a classical neural networks model

Since Q-AI data is now converted into classical data, deep learning techniques are used to learn the correlation between data.

05

Exercising & Testing

Its main purpose is to validate the Q-AI continuity strategy, activities, assumptions regarding usefulness and security levels.

06

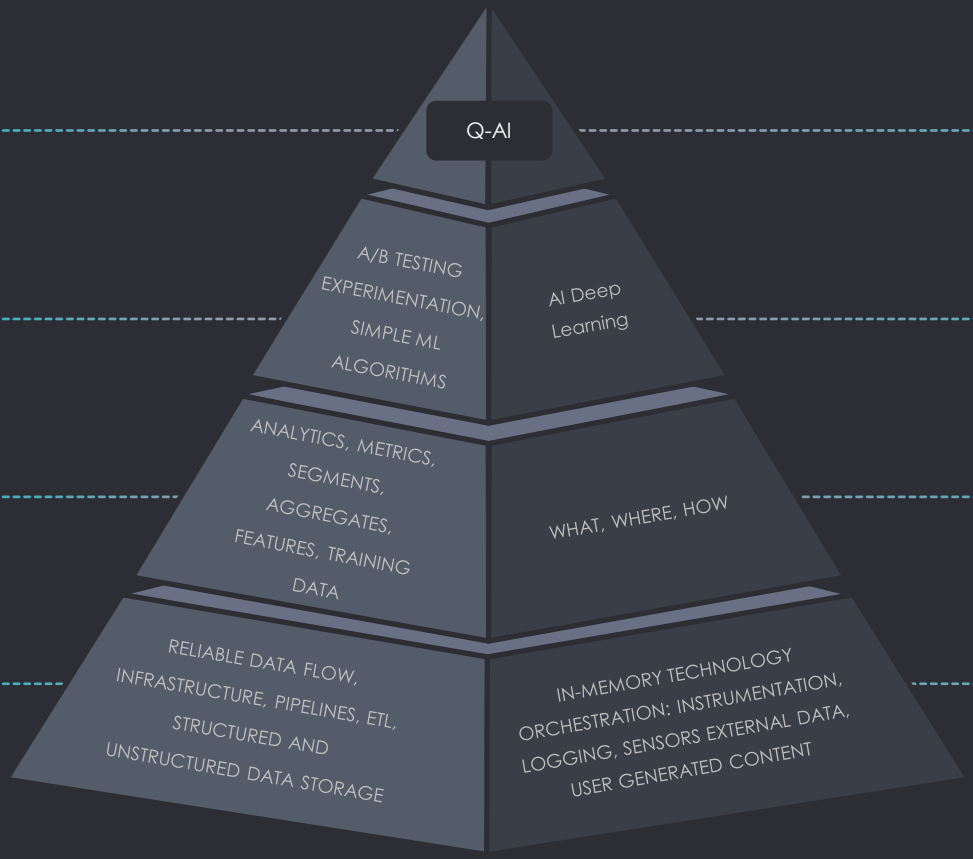
Continued Q-AI Maintenance Plan

This phase maintain the Q-AI algorithms in a constant ready-state. The maintenance process of a Q-AI ecosystem is constant and dynamic.

Q-AI Application Development Framework

Hierarchy of Needs

- LEARN / OPTIMIZE
- AGGREGATE / LABEL / OPTIMIZATION
- EXPLORE / TRANSFORM / REALTIME
- MOVE / STORE / COLLECT



KEY TO SUCCESS

UPDATE
Q-AI before & after an events

UTILIZE
Train the Q-AI in a crisis or exercise

STRUCTURE
Decide on how to structure the Q-AI

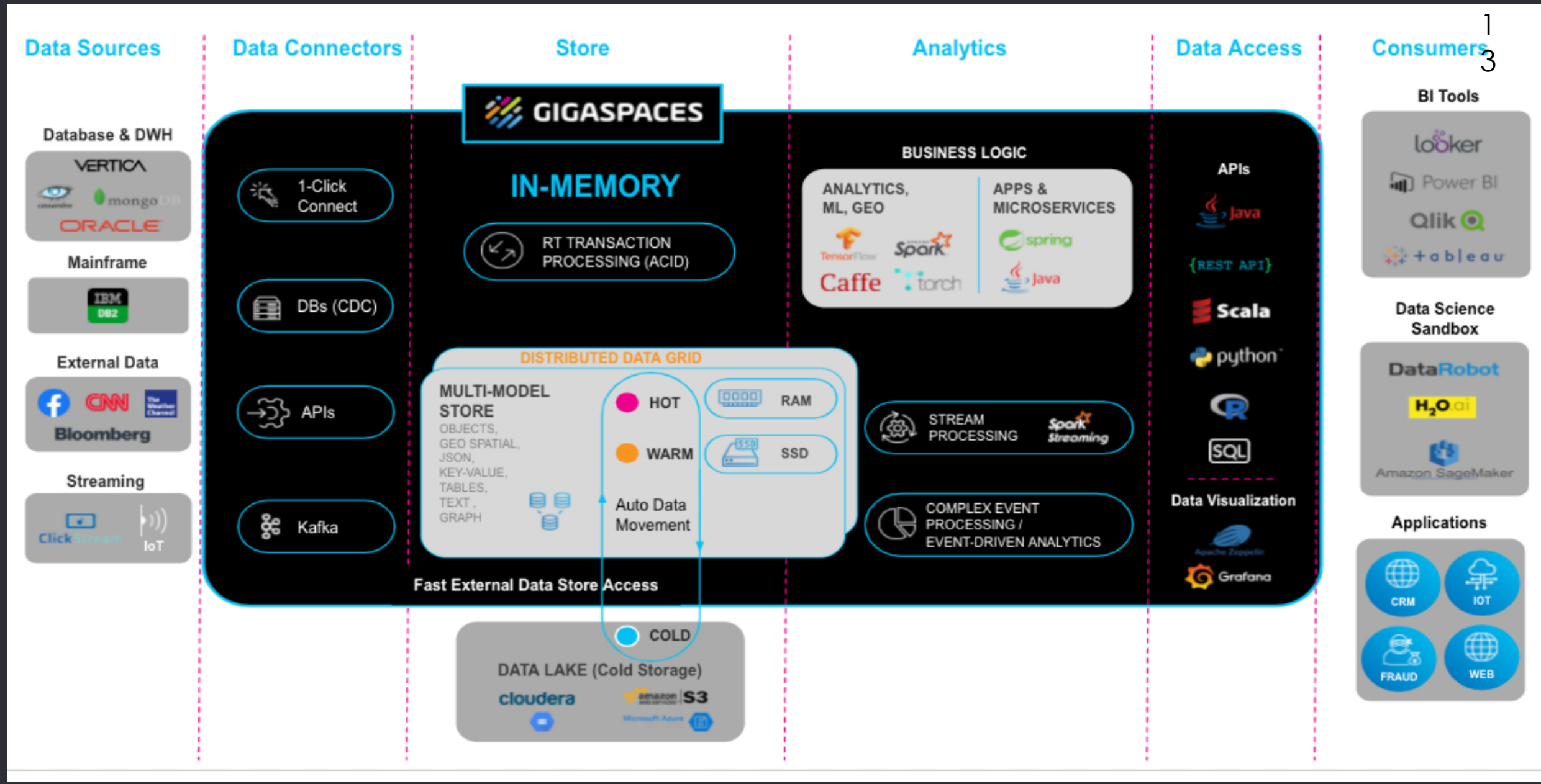
Q-AI PLAN
Build ML template & get started

Q-AI: IN-MEMORY SOLUTION

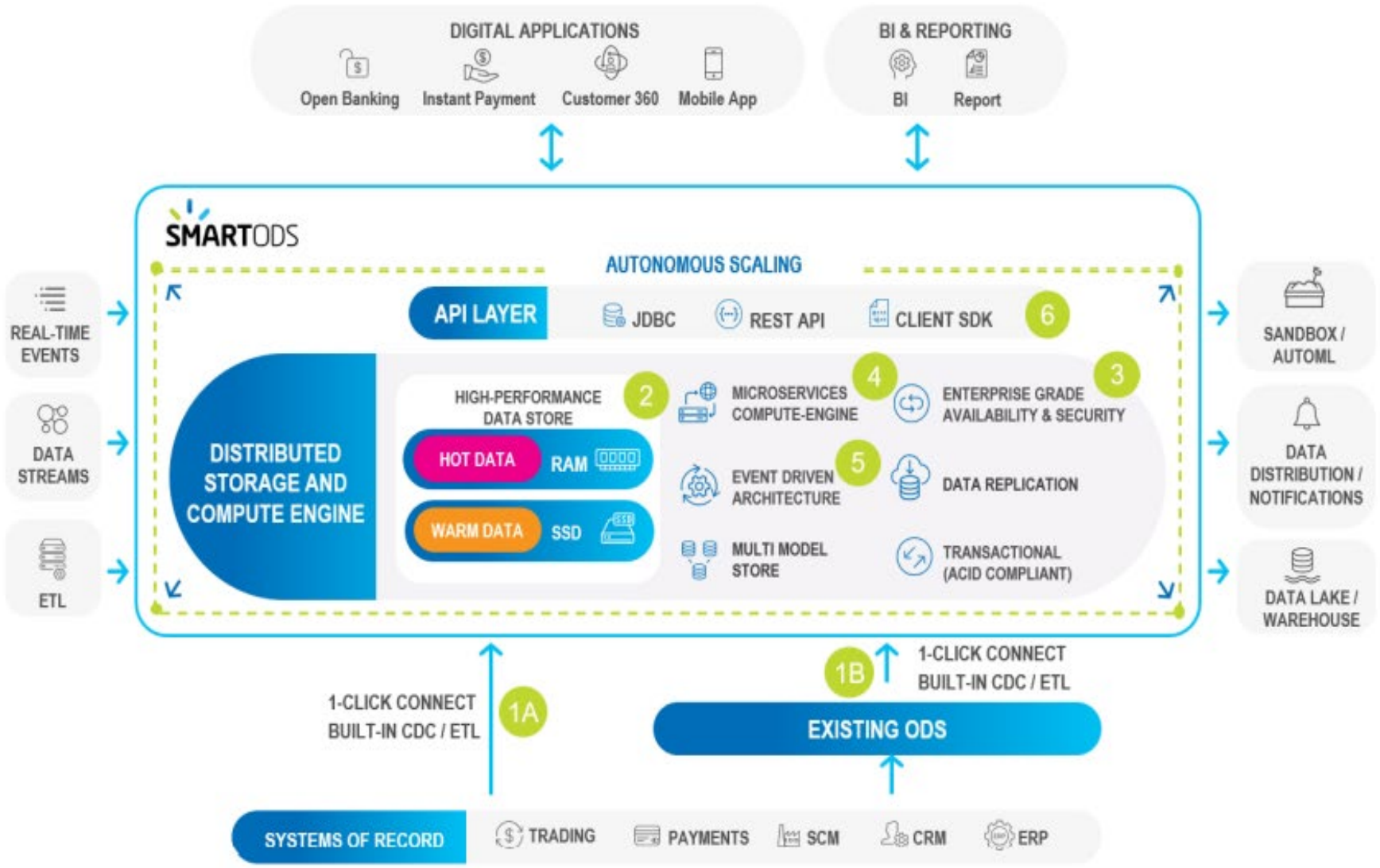
GigaSpaces's InsightEdge was designed to help enterprises seamlessly accelerate and scale their mission critical, time-sensitive applications and services. This distributed in-memory software platform can ingest, process and store large volumes of any data type, and ensures low latency performance dynamic scale across all environments. Customers leverage InsightEdge to power open banking initiatives, real time fraud and risk analysis, customer 360, analytics and BI on fresh data and more.

The InsightEdge platform integrates to siloed operational data stores and to the enterprise's systems of record with a single click (no-code connect), aggregating data in a low-latency data fabric. The dynamically scaling Data Integration Hub offloads API access from the enterprise's data stores (on-premise and cloud) and delivers rapid application response times to internal and external customers no matter the load while ensuring always-on services. The ability to collocate business logic with data in memory and perform dynamic server-side aggregations, reduces the movement of data to the client and delivers extreme performance.

Q-AI GigaSpaces: Orchestration



Q-AI GigaSpaces: Data Flows



1A 1-click connect to multiple systems of record with real-time and batch integrations

1B Connect to Existing ODS, using CDC or standard connectors/ETL

2 Business policy-driven data & index tiering - hot, warm, and cold storage.

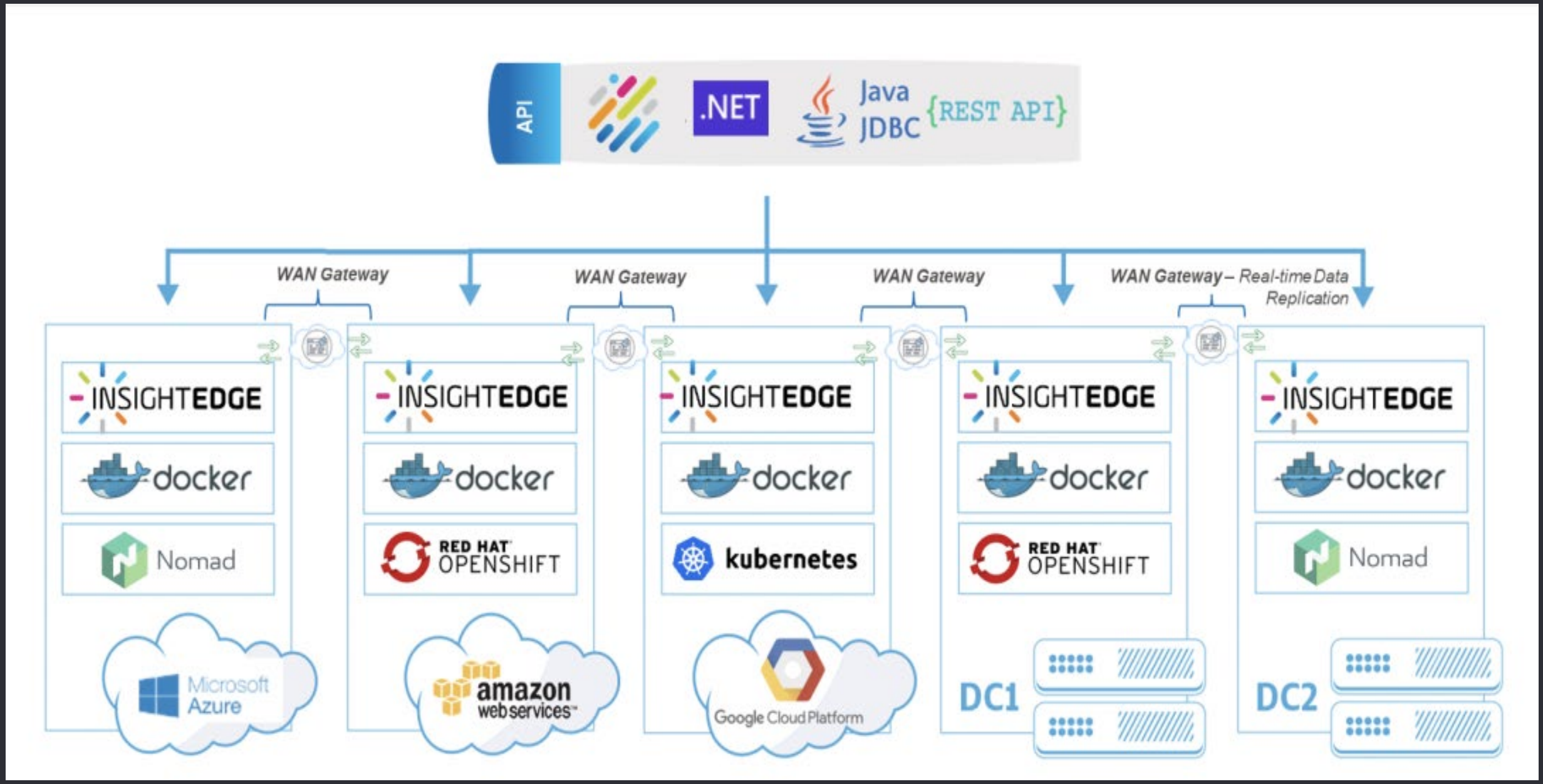
3 Enterprise ready designed for 99.999% availability & DR, and enterprise security

4 High performance compute engine with millisecond response time for your digital applications

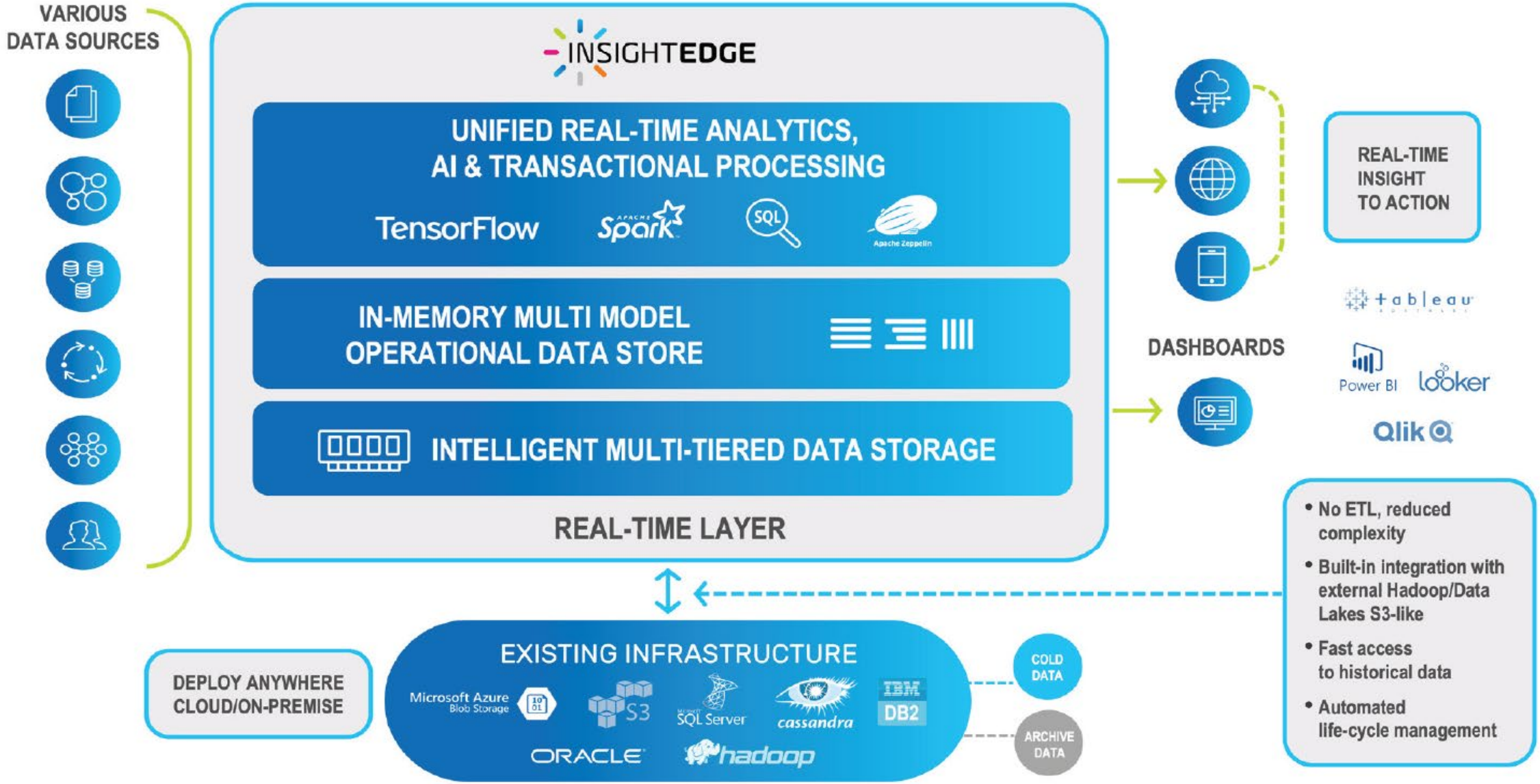
5 Event driven architecture allows applications to subscribe to different event templates

6 Unified API layer for all digital applications and operational analytics

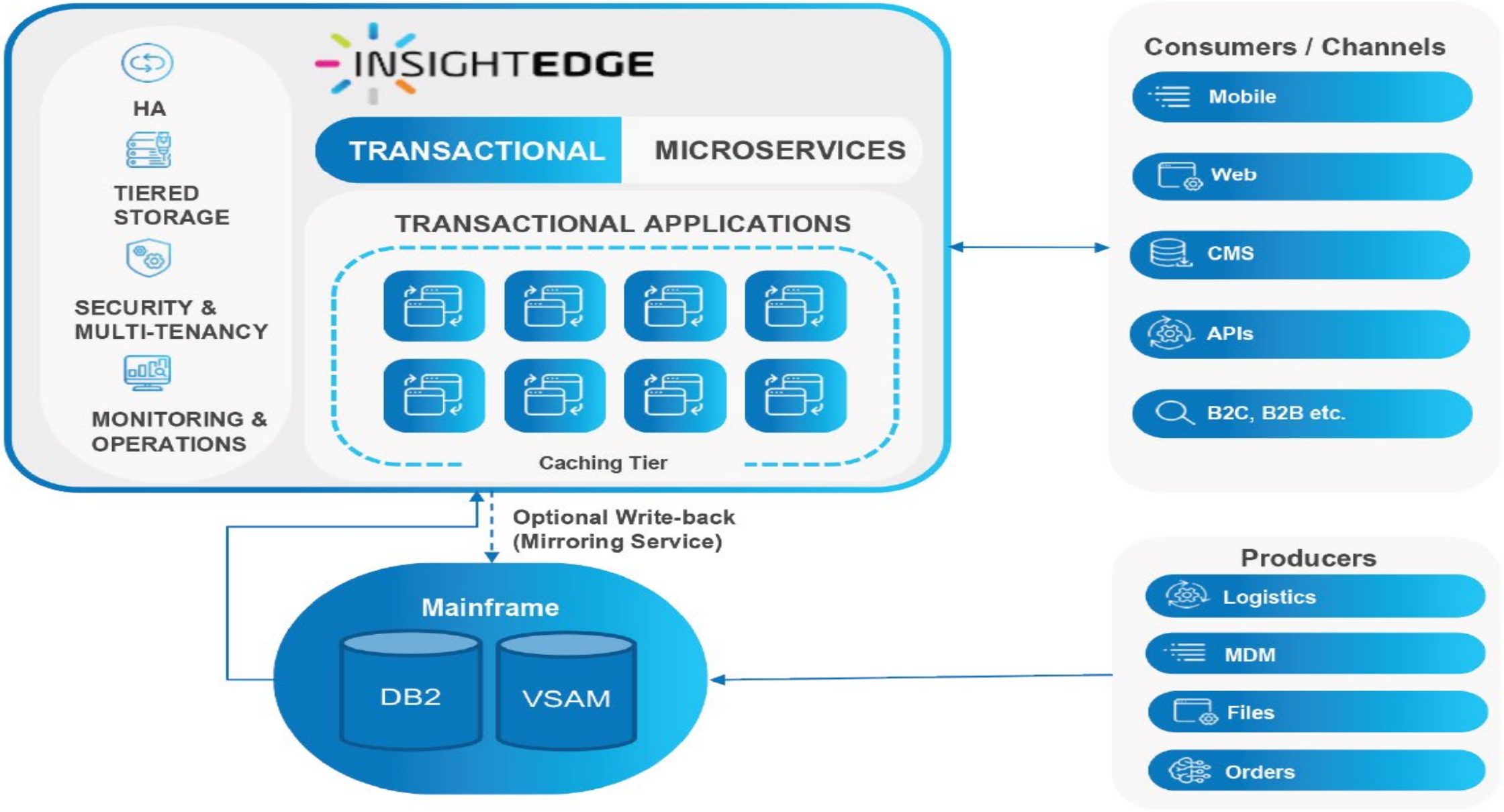
Q-AI GigaSpaces: Cloud & Datacenter Integration



Q-AI GigaSpaces: AI/ML



Q-AI GigaSpaces: How To Run Microservices



Q-AI GigaSpaces: Example

TRANSPORTATION/ IOT

CASE STUDY: Predictive Maintenance

BUSINESS CHALLENGE:

- Railway corporation runs predictive analytics on its fleet of trains in real-time

TECHNICAL CHALLENGE:

- Trains location heatmap
- Correlating fuel consumption, temperature, weather and road conditions
- Bad weather alerts filter
- Real-time enriched data with external data

RESULTS:

- Improve train performance and reduce downtime with real-time visibility of 10Ks trains
- Reduce maintenance costs by up to 75% per mile
- Faster time to market of new online services

Reduce maintenance costs by up to 75% per mile

QUANTUM COMPUTING MARKET MAP

Tractics

Quantum Encryption

Q→NU
EVERYWHERE IN YOUR LIFE
IDQ
Quintessence Labs
MagiQ.
TAQBit

Hardware

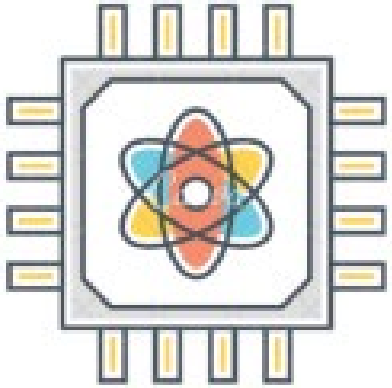
Optalysys
qutools
rigetti
AQT
TURING
IONQ
qci Quantum Circuits, Inc
D:Wave

Software

qb quantumbenchmark
STRANGE WORKS
1QBit
QBITLOGIC
Q*Branch
QuSoft
Q-CTRL
Artiste-qb.net

Building Quantum Computers

TURING
qci Quantum Circuits, Inc
Optalysys
IONQ
rigetti
D:Wave
KILIMANJARO



Quantum AI

QBITLOGIC
CQC
QINDOM
XANADU

Opticial Quantum Computers

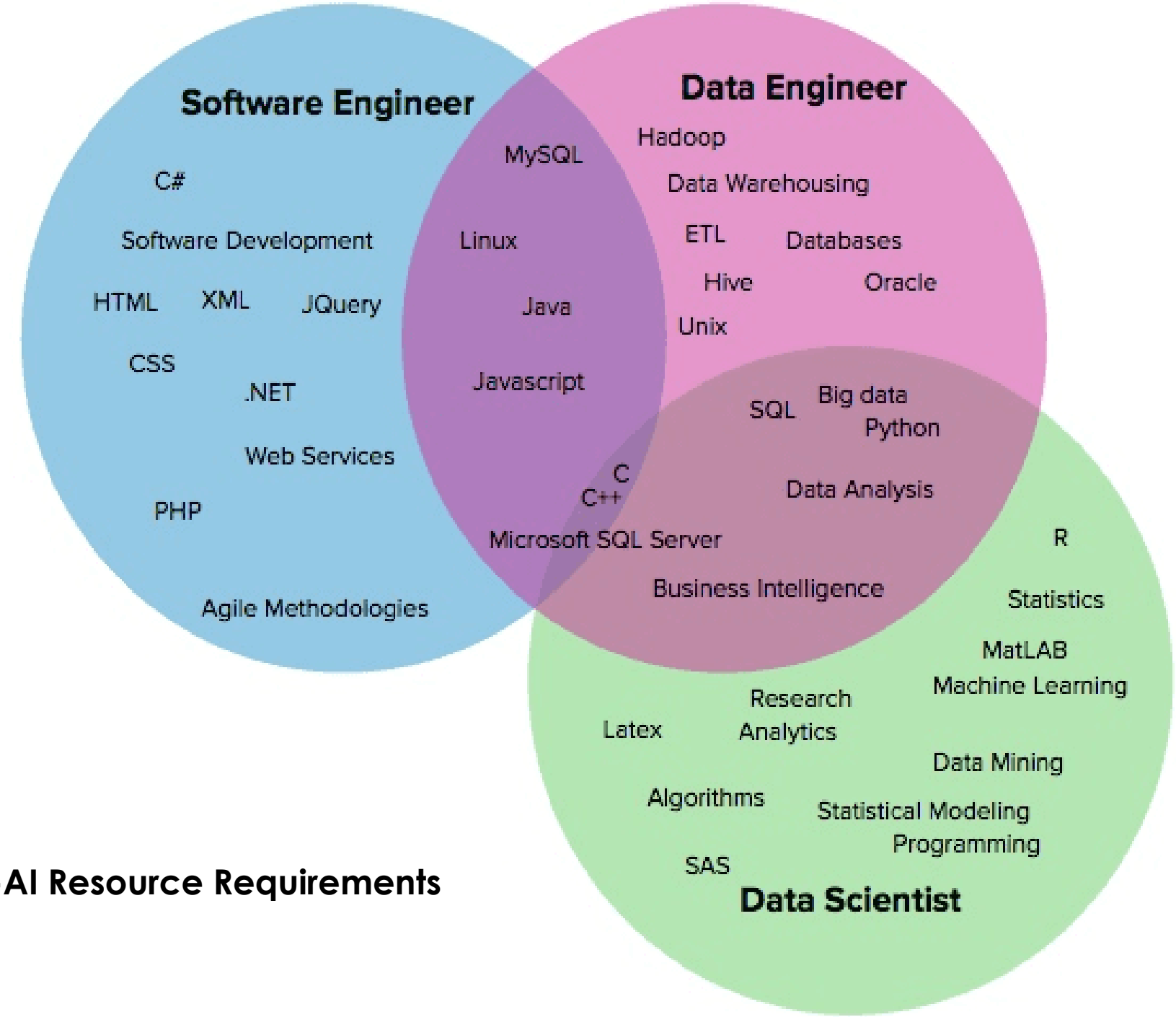
PSIQ
QD LASER
QUANDELA
SINGLE QUANTUM
Quantum Opus
SPARROW QUANTUM

Quantum Cloud Computing

IONQ
Q-CTRL
rigetti
D:Wave
QCWARE

Quantum Circuits

BraneCell
QuTel, Inc
SILICON QUANTUM COMPUTING
qci Quantum Circuits, Inc

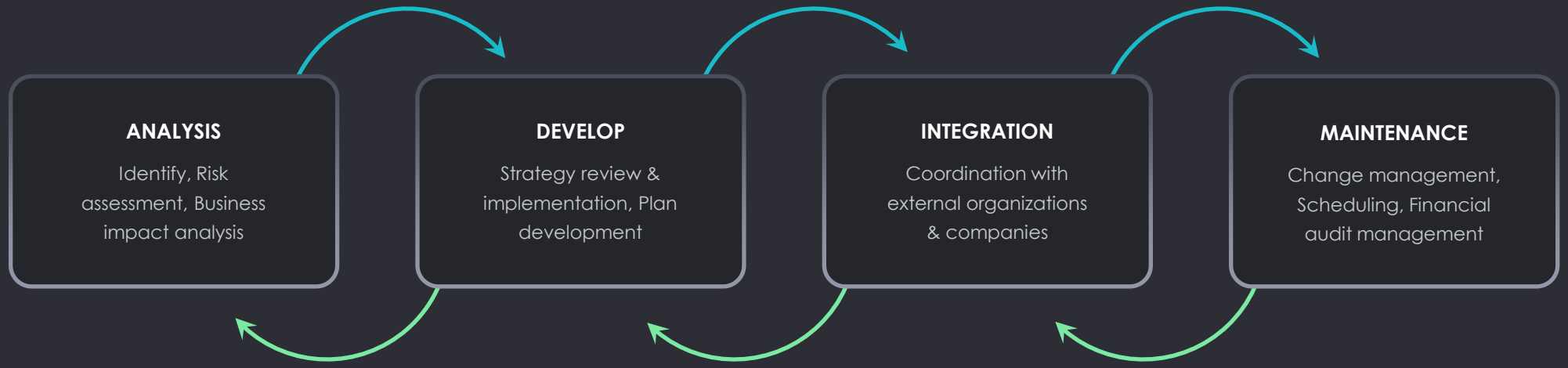


Q-AI Resource Requirements

Q-AI Build Cycle

PROJECT STARTS

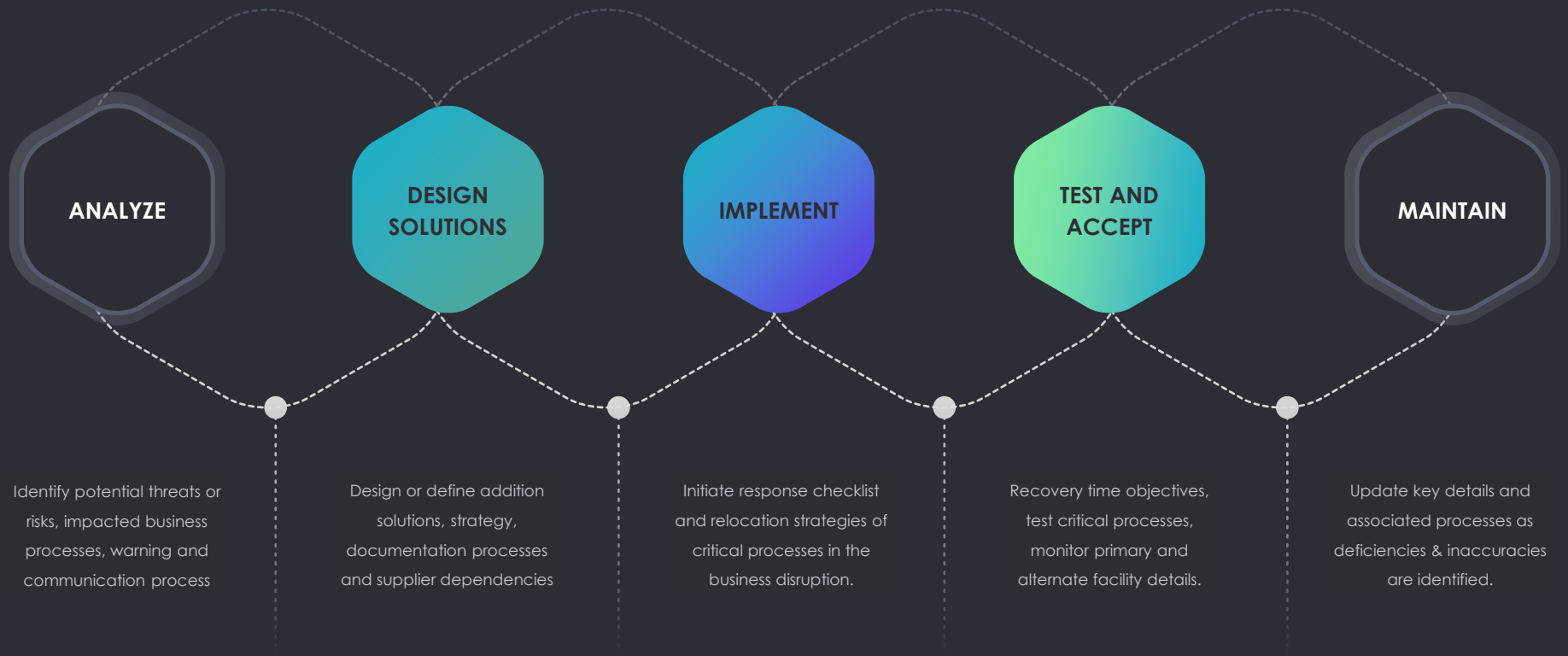
Project management & awareness, leadership, basic development



ASSESSMENTS

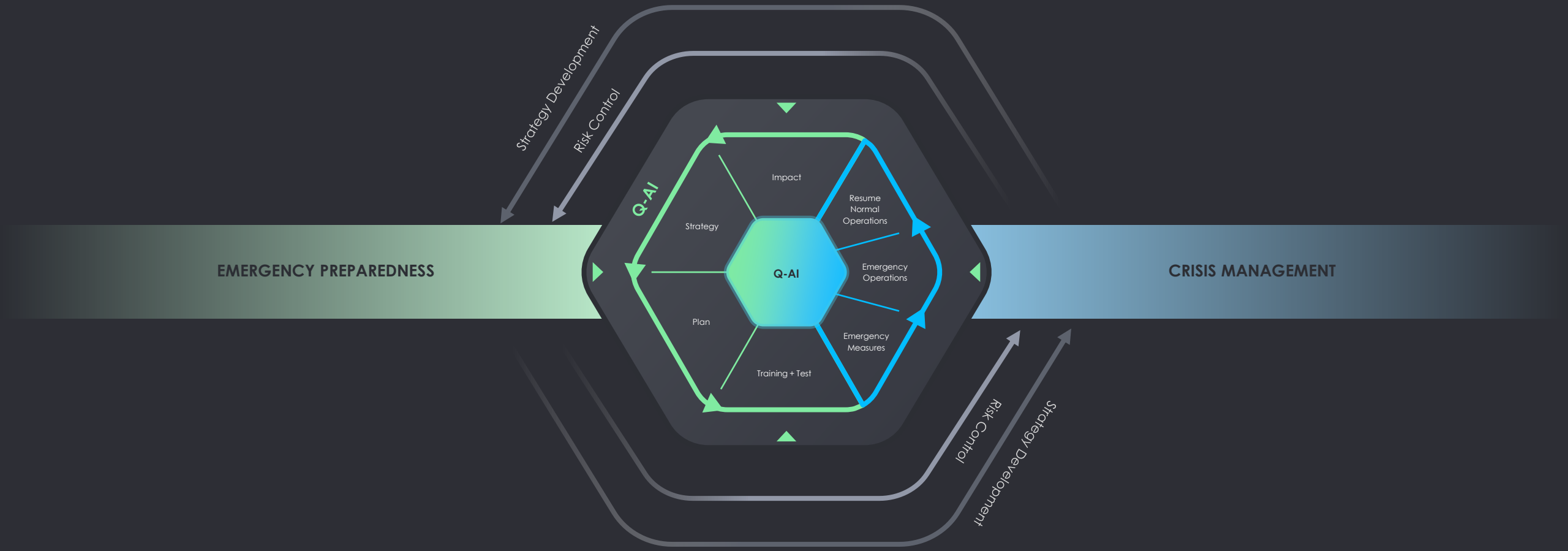
Development & implementation of test scenarios, staff training, Gap analysis

Q-AI Model Development Flow



Test & Evaluation

Q-AI as a Component of Resilience Management



Q-AI Cyber Risk Analysis Steps

IDENTIFY RISKS

- Internal and external risks
- Direct and indirect risks
- Risks that can and cannot be managed

EVALUATE RISKS

- Assess risk probability
- Assess impact
- Assigning and prioritizing risk

DESIGN POSSIBLE RISK SCENARIO

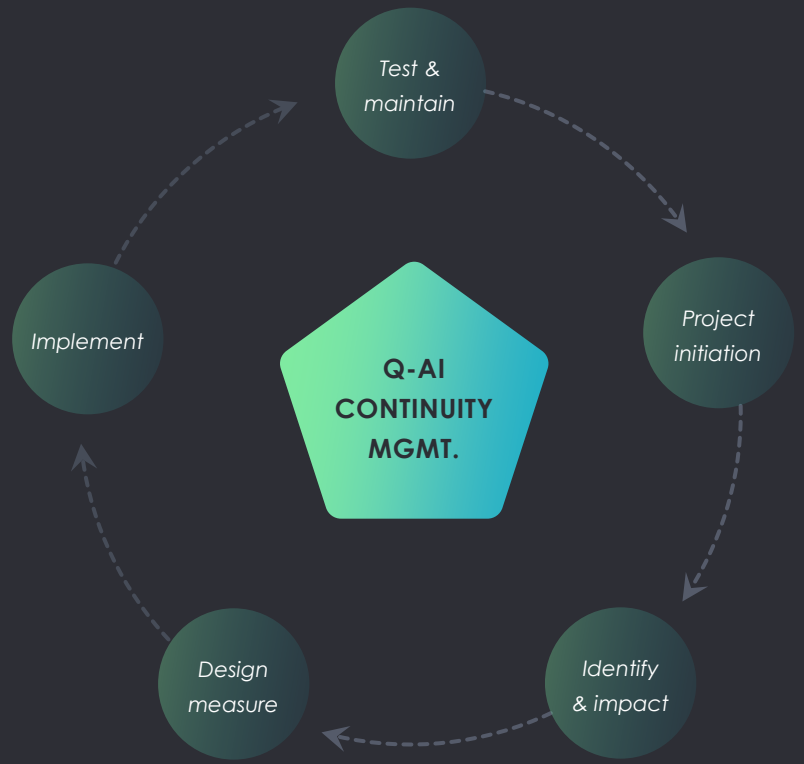
- IT failure and network collapse
- Building damage
- Delivery bottlenecks
- Loss of employees

SELECT RISK STRATEGIES

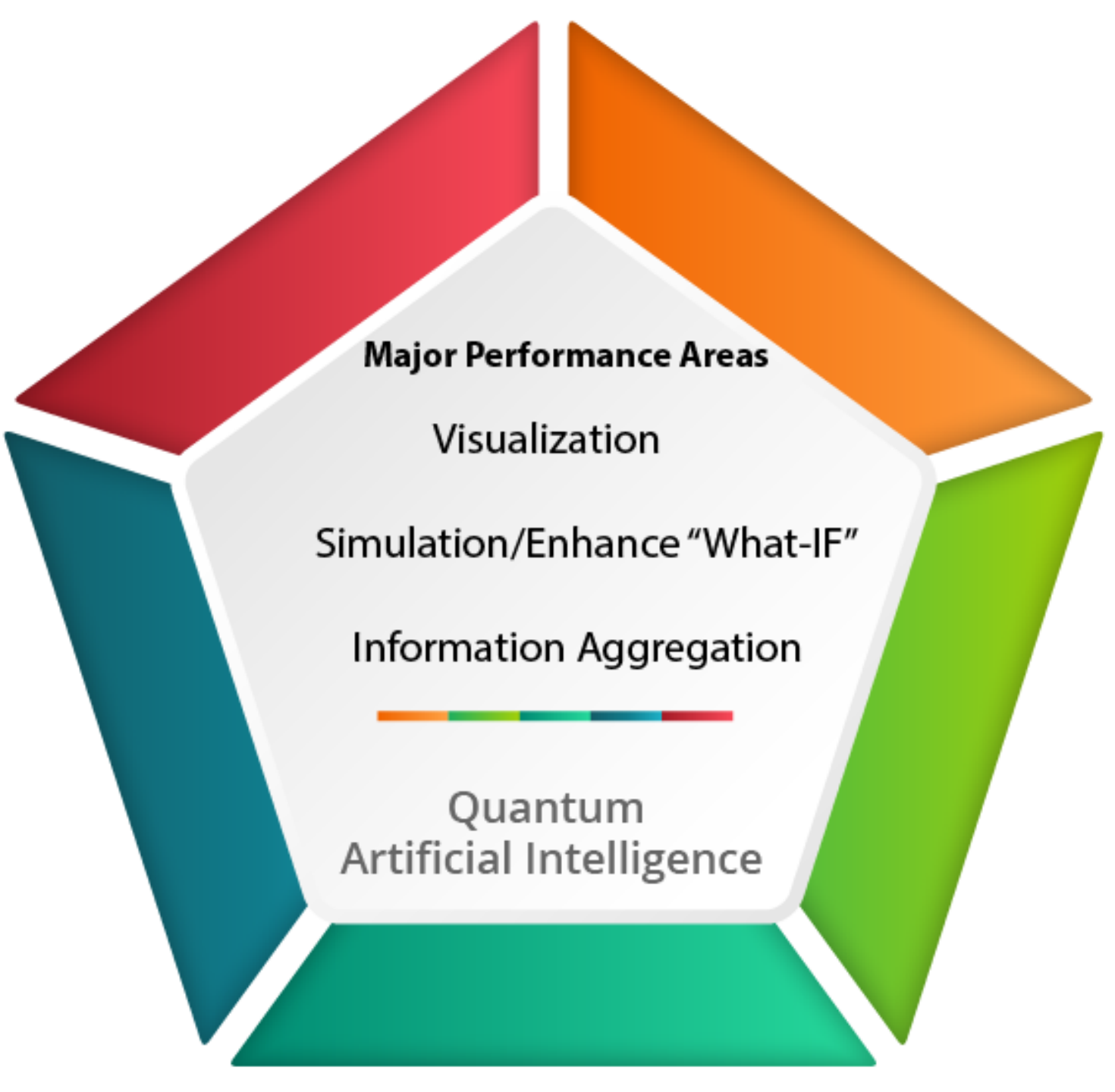
- Acceptance
- Transfer
- Avoidance
- Reduction

Strategic Q-AI Framework

MODIFIES & CREATE VALUE



SUSTAINS & PRESERVES VALUE


Major Performance Areas
Visualization
Simulation/Enhance "What-IF"
Information Aggregation
Quantum
Artificial Intelligence