



**BHADALE GROUP OF COMPANIES
- IT AND REAL ESTATE**



Jul 11 2022

Quantum Software Engineering Services Catalogue

Bhadale IT Pvt. Ltd. (<https://www.bhadaleit.com/>)

Bhadale Group of Companies

Bhadale Group of Companies consists of:

1. **Bhadale IT Pvt. Ltd** is an IT and Computer Engineering subsidiary company

This division provides consultation in areas of cutting edge technologies, research outsourcing, and software consultation related to data center and related engineering practices

2. **Bhadale Engineering Pvt. Ltd** is a multi-engineering subsidiary company

Various divisions under this group provide design, & development of various IT and Engineering programs.

Bhadale Group has aggressive programs in place to serve the niche market. Below is related to cloud ecosystems

Bhadale Group IT Division, Quantum Services department

Below are few of our service offerings:

1. Quantum software engineering adoption ecosystems planning
2. Business Use case based quantum software engineering design
3. Open and proprietary quantum and classical ecosystems & integration
4. Partner ecosystems based solutions
5. Quantum cloud ecosystems based software engineering implementation
6. Industrial domain specific quantum services
7. Project specific services
8. Custom ecosystems services



Image courtesy (The Web), no intention for copyright infringement

We have a large set of subcategories; few are mentioned below with details tabulated

Service No	Service Name	Key Service features
1	Quantum software engineering adoption ecosystems planning	<p>We offer a wide range of quantum ecosystems based services for the convenience of our clients based on their business needs, and startup mission :</p> <ul style="list-style-type: none"> • Classical IT assets reuse based custom quantum ecosystem • Quantum Industrial taxonomy based ecosystems • Ecosystems covering multi-disciplines like Science, IT and Engineering • Ecosystems from IBM/Red Hat, Google, AWS, Intel and partners • Popular market platforms like GCP, Azure, Apache and Open Shift <p>Few of the software engineering services</p> <ul style="list-style-type: none"> • Horseshoe Modernization Model [1] [2] • Quantum reengineering process [2] • Quantum UML Profile, OMG UAP and KDM based models[2] • OMG based Meta – meta models, Meta Object Framework[3] • MBSE Grid- A SysML-Based Approach for Modeling Complex Systems[4] • End-to-End Quantum lifecycle management for the classical and quantum stack based on Enterprise Arch, Industry 4.0, TOGAF, Federal , Zachman frameworks <p>Based on our vast experience and expertise in serving the engineering and IT industry, we offer accelerated speedup in adapting to the ecosystem and use IEEE, NIST, ISO standards. We leverage on our tie-ups and partnerships with various institutes, universities and network</p>

2	Business Use case based quantum software engineering design	<p>Client business specific system design, with a general focus on domain and special focus on client enterprise needs. Few of our services:</p> <ul style="list-style-type: none"> • Requirements analysis to draft the systems landscape with various types of software elements, across full quantum stack • Business models design based on use cases as a platform independent model and software engineering using common technology-independent cQASM [5] code, OpenQL, & hardware specific executable QASM (eQASM) • Design abstraction layers on OOD for reusable items , use BPEL, existing modeler tools plug-in etc • KDM, UML based forward, reverse engineering with other IR languages and ATS transformation • Technology based platform specific models for target quantum servers, computing backend simulators and other ecosystems • A business ecosystem modeling based on industry frameworks and existing business priorities • Systems platform design based on the needs of the interrelated systems, System of Systems (SoS) and Cyber Physical Systems (CPS) • Business use case modeling using Model Based Systems Engineering (MBSE), and SysML • Design of various quantum computer software assets, enterprise libraries, inventory and the related processes that help in the scoping and development of the architecture, engineering design, and project planning
3	Open and proprietary quantum and classical software ecosystems planning & integration	<p>We offer planning for open source tools, products, frameworks, and integration services for existing and new ecosystems. Few of our services are:</p> <ul style="list-style-type: none"> • <i>Quantum Internet alliance</i> based software integration for end nodes (trapped ion qubits, diamond NV qubits, neutral atom qubits) and quantum repeaters (rare-earth-based memories, atomic gases, quantum dots) and integration of both subsystems • Quantum Cloud software development engineering using various industrial taxonomies, Classical platforms integration leading to unified quantum ecosystems with the right set of functions, processes and software models • Software Engineering related to Open Stack, Open Nebula, Apache stacks, Linux, JRE, Eclipse, Papyrus [6], OMG, SEI, TOGAF based ecosystems • Software Engineering for virtualized and related assets like Open Networking, Open Virtualization , Open Orchestrator etc • Full stack software integration, interoperability across various stack layers, quantum interfaces, protocols, quantum chips, control and data planes etc
4	Partner Ecosystems based quantum software engineering solutions	<p>We offer partner ecosystems based software engineering solutions. Few are mentioned below:</p> <ul style="list-style-type: none"> • Google • IBM • Intel • Microsoft

		<ul style="list-style-type: none"> • IEEE / ISO • Quantum Alliances <p>Software algorithms engineering using Google Cirq, Tensorflow quantum, Colab, Google Quantum, and Google industrial solutions based offerings for various domains.</p> <p>IBM Qiskit, IBM Quantum labs, IBM Circuit Composer based solutions for various quantum phases of delivery using UML, SysML, based on IBM recommended software development processes and methodologies</p> <p>Intel quantum computing software chips like Tangle Lake [7], interconnects, control software for various qubits like superconducting qubits, quantum dots, silicon chips (CMOS, MOSFET , FPGA) , Cryoelectronics, Horse Ridge II [8] cryogenic quantum control chip etc</p> <p>We offer extended services for full stack integration, cross-compilers, cross-programming, transformations from classical to quantum states, quantum memory based operations, and design of ansatz , templates for various quantum circuit configurations</p>
5	Quantum cloud software planning and implementation	<p>We offer services from various partner offerings. Few of our services:</p> <ul style="list-style-type: none"> • Cross-partner software ecosystems design, development • Offering our unique expertise in quantum data center engineering , RAN, distributed quantum computing master / slave node configurations • Migration of classical software data / lakes , tiers to multi-partner software ecosystem using tools and wizards • Cross cloud software security systems • Micro services/ API / REST / SOA based framework design • Multi cloud managed services framework design, automated release management software • Custom ecosystem software component, interfaces, language packages like Python, C++, Q# design
6	Industrial domain specific quantum software services	<p>We offer unique tailored ecosystems for 50+ domains based on the leading partner solutions.</p> <p>One sample domain offerings :</p> <ul style="list-style-type: none"> • Quantum military software for improvised missile systems, ambient sensors, precise clocking and real time quantum computing (able to solve years of supercomputer's effort) • Quantum military software for improvised anti-missile systems using a sleuth photon fabric with detectors able to detect many airborne, water based and land missile dispatches from various earth's/ sea layers • Quantum foreign object ecosystem software shield for better protection and safeguard of protected and other assets offering 100+ more safety points than classical protection • Quantum biosphere and ecology protection software system for safety of the

		<p>earth resources from hostile attacks like missiles, air, water or land based bio-chemical warfare deliveries includes real time signature matching of various viruses, flies, birds, or vector based attacks</p> <ul style="list-style-type: none"> Quantum software aided military supplies for various types of operational and capability needs to handle, counter or defeat the enemy cause
7	Project specific services	<p>We offer services for projects related to migration, quantum project framework design, quantum technology stack design or as per our capability. We cater to specific needs like work load specific to Big data, Data science, AI/ML, Micro services, real time streaming, mobile etc.</p> <p>Few of our services are:</p> <ul style="list-style-type: none"> Quantum software Project Requirements analysis Drafting of project specific quantum ecosystems design Designing the development tools, apps, services Integrating and testing the software components at client environments Offer value added services c Integration of software libraries from Intel, IBM, PennyLane, AWS Braket, Azure Quantum, OMG, Eclipse plug-ins, etc
8	Custom ecosystems services	<p>As per client needs based on our offers, mixture of these along with client specified systems</p> <p>We are flexible to offer our consultants on a project or a time basis, as an internal or external hire based on your business needs. We place our consultant based on your specified merit and work needs. We have a team of licensed engineers and developers who can be of help in your project and quantum solutions</p>

References:

- 1: <https://insights.sei.cmu.edu/blog/information-technology-systems-modernization/>
- 2: <http://ceur-ws.org/Vol-2705/short4.pdf>
- 3: <https://epub.jku.at/obvulioa/download/pdf/5894932>
- 4: <https://epubl.ktu.edu/object/elaba:31768092/31768092.pdf>
- 5: http://ce-publications.et.tudelft.nl/publications/1706_cqasm_v10_towards_a_common_quantum_assembly_language.pdf
- 6: <https://www.eclipse.org/papyrus/>
- 7: <https://newsroom.intel.com/news/future-quantum-computing-counted-qubits/>
- 8: <https://www.intel.com/content/www/us/en/newsroom/news/2nd-gen-horse-ridge-cryogenic-quantum-control-chip.html>

Disclaimer: All rights are owned by respective owners. We have no intention to infringe copyrights or brand names. All details, references are for educational purposes only

For more details, contact below:

Contact

Bhadale IT Pvt. Ltd

Program Manager: Vijayananda Mohire, Email: vijaymohire@gmail.com