

IBM Quantum Hardware Generations: A Practical Overview

This document summarizes the different IBM quantum computer architectures visible on the IBM Quantum Platform, explaining what each generation means, why access differs, and how these machines compare.

Heron-Class Machines (Open Access Tier)

These are the machines available to users on the **Open Plan**, including your instance `test_00`. They represent the most modern publicly accessible technology.

Heron r1 (e.g., *ibm_torino*)

- ~133 qubits
- Superconducting transmon qubits
- Heavy-Hex topology
- Earlier revision of Heron architecture
- Good performance but slightly higher noise than r2

Heron r2 (e.g., *ibm_fez*, *ibm_marrakesh*)

- ~156 qubits
- Improved qubit fidelities and couplers
- More stable calibrations
- Better readout performance
- Ideal for GHZ, Bell, and error-mitigation experiments

Summary:

Heron machines are the best public-facing superconducting systems IBM offers today. They are well-calibrated, stable, and designed for general research access.

Eagle-Class Machines (Premium Tier)

These are often visible but padlocked.

Eagle

- 127 qubits
- Earlier large-scale superconducting generation
- Used primarily by research partners and institutions
- Known for deep circuit capability but higher noise than Heron

Eagle systems represent IBM's older high-performance fleet, mostly used for academic or enterprise-level projects requiring contractual access.

Osprey-Class Machines (High-End Premium)

Osprey

- ~433 qubits
- Much larger qubit lattice
- More routing challenges and higher noise
- Used for scaling research, compilation studies, and advanced algorithms
- Not available to Open Plan users

Osprey machines explore scaling laws and error accumulation in large qubit arrays.

Flamingo-Class Machines (Next Generation)

Flamingo

- ~1,121 qubits (announced)
- Intended as next leap in scale
- Future focus on modularity, error-mitigation research, and multi-node systems
- Expected to be available only for elite research programs

These represent IBM's roadmap toward utility-scale quantum computing.

Why Some Machines Are Locked

Padlocked machines indicate **restricted access tiers**.

Reasons include: - Enterprise or institutional contracts - Experimental hardware not suitable for public workloads - High operational cost - Reserved capacity for research partnerships

Your account belongs to the **Open Plan**, which provides: - High-quality Heron r1/r2 systems - Personal instance with short queues - Access to modern transmon hardware without the premium contract barrier

Summary Table

Machine Class	Qubits	Architecture	Access Tier	Notes
Heron r1	~133	Superconducting	Open	Stable, slightly older revision
Heron r2	~156	Superconducting	Open	Best public machines, improved fidelities
Eagle	127	Superconducting	Premium	Earlier large-scale generation
Osprey	433	Superconducting	Premium	For scaling research and enterprise users
Flamingo	1121	Superconducting	Premium	Future roadmap hardware

These distinctions help clarify why only certain machines are available to your instance and how each generation fits into IBM's broader strategy for scaling quantum computing.