GPU AI Platform Capabilities Report

# Overview

This consolidated report outlines the core capabilities of the AI GPU cluster deployed with 24x NVIDIA H200 GPUs, 1PB NetApp S3-compatible storage, OpenShift (OCP) for orchestration, and Run:AI for AI workload management. It includes both AI lifecycle stages and platform-level cluster management capabilities, highlighting technical details, platform-specific enhancements, granular tasks, and key tools with GPU performance impact.

# AI Lifecycle Tool Matrix

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| --- | --- | --- | --- | --- | --- |
| S.No | Stage | Technical Details | Platform-Specific Enhancements | Granular Tasks/Details | Key Tools & GPU Performance |
| 1 | Data Ingestion | Ingest structured/unstructured data from S3, APIs, Kafka, DBs | NetApp S3 provides scalable, high-speed parallel I/O | Create ETL pipelines; configure S3 buckets | AWS S3, NetApp S3, Kafka, Airbyte GPU: 4.8 TB/s memory bandwidth |
| 2 | Data Preparation | ETL pipelines, cleansing, deduplication, annotation | Run:AI jobs for parallelized data-prep containers on OCP | Null handling; data-type normalization | Pandas, Spark, Run:AI GPU: 141 GB HBM3e handles 100M rows in-memory |
| 3 | Data Labeling | Annotation of raw data for supervised learning | Managed labeling workflows on OCP with GPU-accelerated UI | Define schemas; assign tasks; review labels | Label Studio; SageMaker Ground Truth GPU: UI rendering at 60 FPS |
| 4 | Feature Engineering | Vectorization, embeddings, normalization, dimensionality reduction | GPU acceleration for embeddings & AutoML feature selection | BERT embeddings; PCA | Hugging Face; RAPIDS cuDF/cuML; PyTorch GPU: 1M tokens/sec for BERT-large (FP16) |

# Platform & GPU Cluster Management Capabilities

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| S.No | Stage | Technical Details | Platform-Specific Enhancements | Granular Tasks/Details | Key Tools & GPU Performance |
| 15 | Ingress Configuration | Configure secure ingress routes for user/service access | OpenShift Ingress with TLS termination; Load Balancer | - Define ingress routes - Apply TLS certs - Configure external DNS - Restrict ingress with whitelist rules | OpenShift Ingress; NGINX; Cert Manager |
| 16 | Egress Configuration | Control outbound traffic from cluster nodes | OpenShift Egress firewall; EgressNetworkPolicy | - Define egress firewall rules - Block unauthorized outbound traffic - Validate DNS/HTTP/S3 outbound paths | OCP NetworkPolicy; Calico; Istio; Squid Proxy |
| 17 | RBAC & Access Control | Implement Role-Based Access Control for users/teams | OpenShift RBAC with fine-grained roles | - Define ClusterRoles & RoleBindings - Map LDAP/SSO users to groups - Validate least-privilege access | OpenShift RBAC; LDAP/SSO; Kubernetes RBAC |
| 18 | Cluster Optimization | Tune GPU resource utilization and scheduling | Run:AI Scheduler policies; GPU partitioning; MIG configs | - Configure fair-share queues - Analyze GPU utilization reports - Enable MIG (if supported) | Run:AI; NVIDIA DCGM; MIG Toolkit |
| 19 | GPU Monitoring | Enable real-time GPU utilization, thermal, and power monitoring | GPU metrics exported to Prometheus & Grafana | - Deploy NVIDIA DCGM Exporter - Set Grafana dashboards - Configure alerts for overheating, low utilization | Prometheus; Grafana; NVIDIA DCGM; Run:AI Monitoring |
| 20 | GPU Performance Tuning | Optimize kernel, drivers, CUDA stack for workloads | Custom CUDA config; optimized NCCL settings; driver tuning | - Validate GPU clocks - Enable persistence mode - Tune NCCL params - Benchmark PCIe/NVLink throughput | NVIDIA SMI; NCCL Tests; CUDA Toolkit; Run:AI Benchmarks |
| 21 | Cluster Networking | Ensure high-speed intra-node & inter-node connectivity | InfiniBand/100G Ethernet with RDMA | - Validate RDMA working - Tune MTU, jumbo frames - Monitor packet drops - Optimize kube-proxy settings | Mellanox OFED; iperf3; Prometheus Node Exporter |
| 22 | Resource Quotas & Isolation | Apply namespace-level quotas and isolation | OpenShift ResourceQuota; LimitRange; NetworkPolicy | - Define GPU resource quotas per namespace - Restrict cross-namespace access - Apply pod-level GPU limits | OpenShift Quota API; Kubernetes LimitRange; Calico |