System Base Labs

A Carbon-Neutral Company

SBL

Today's AI Startup. Engineering the Intelligence of Tomorrow

Infrastructure and Carbon-Neutral Strategy Whitepaper

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1. Overview

System Base Labs has engineered a next-generation infrastructure blueprint that marries raw compute capability with sustainable design. With 21 acres of carbon-neutral land, a hybrid energy stack, and a globally distributed orchestration framework, our AI operations achieve enterprise-grade performance without compromising environmental integrity.

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2. Storage & Data-Flow Architecture

- **Local Storage:** NVMe SSDs attached directly to compute nodes are used for scratch and checkpoint data (formatted as ext4).
- **Shared Storage:** CephFS operates across Xeon servers and rack-mount systems, delivering ~20 GB/s aggregate throughput for shared datasets and corpora.
- **Backup & Disaster Recovery:**
  - Hourly snapshots via ZFS-based NAS.
  - Daily off-site archival to Wasabi and AWS Glacier.
- **RDMA Interconnects:**
  - Enables GPU-direct memory access (DMA) across NVIDIA H100 clusters.
  - Achieves memory transfer speeds up to 180 GB/s.

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3. Software Stack & AI Orchestration

Layer	Technology Stack
OS	Ubuntu 22.04 (workstations), Rocky Linux 9 (servers)
Virtualization	Proxmox VE with SR-IOV support
Containers	Kubernetes 1.30, NVIDIA GPU Operator
Monitoring	Prometheus, Grafana, Alertmanager
AI Frameworks	PyTorch 2, TensorFlow 2.16, ONNX Runtime, Ollama
In-house AI	Shankar AI Core (LLM/NLP), Humsum Quantum, Brahma, Kinkara, Yama
CI/CD	GitLab Runner + ArgoCD
Billing	CloudKitty + Stripe Connector (Open Source)

- **GPU Virtualization:**
  - vGPU used for RTX 4090/4080.
  - MIG slicing used for NVIDIA A100 and H100 cards.

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4. Carbon Neutrality Strategy

4.1 Renewable Energy Mix

- 100 kW Solar farm = 140 MWh/year
- 95% energy needs covered
- Battery storage + demand-response buffering

4.2 PUE Optimization

- Liquid cooling brings baseline PUE to 1.18
- Workload scheduling aligned with solar peaks (12:00–16:00)
- Effective PUE optimized to ~1.15

4.3 Carbon Offset Strategy

- 50 tons of CO2e residuals addressed through:
  - Gold Standard Forestry programs in Western Ghats
  - Public blockchain ledger: Humsum-Chain

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5. Security, Compliance & Governance

- **Data Security:** AES-256 encryption at rest; TLS 1.3 in transit
- **Key Management:** FIPS-approved Hardware Security Modules (HSMs)
- **Audit Trails:** Compliant with 21 CFR Part 11 via GitLab and ArgoCD integration
- **Privacy:** GDPR and DPDP compliant
  - Kubernetes admission controllers enforce data-residency policies
- **Physical Security:**
  - 24/7 CCTV and biometric access

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6. GPU Rental & Capacity Utilization

Tier	GPU Slice	Price (INR/hr)	Audience
Nano	H100 (10 GB)	₹45	Students, hobbyists
Micro	4090 (24 GB)	₹120	Indie developers
Pro	A100 (80 GB)	₹400	Startups, research labs
Ultra	Dual H100 (160 GB)	₹1,300	Enterprises

- **Brahma Predictive Scheduler:**

- Maintains 70%+ cluster utilization
- Auto-discounts idle cycles

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7. Operations & Maintenance

- **Monitoring:** Prometheus sensors for temperature, load, and energy use
- **Preventive Maintenance:**
  - Coolant flush every 3 months
  - Inverter servicing annually
- **Redundancy:**
  - N+1 PSU & coolant pump redundancy
  - Hot-swappable fans
- **Disaster Protocols:**
  - Ansible-run failover triggered by YAML SOPs

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8. ESG Monitoring & Transparency

- **CO_2e Dashboards:** Real-time emission displays (Scope 1 & 2)
- **Monthly Reporting:** Auto-generated PDF reports, blockchain-hashed
- **Annual Audits:** Conducted by Bureau Veritas
