Here's a detailed breakdown of **server specifications** (RAM, CPU, disk) and **recommended hard disk types** for each component in your **on-premises ISO 8583 monitoring and alerting system**, optimized for **100k–200k transactions per minute** with **High Availability (HA)**:

**1. Apache Kafka Brokers**

* **Role**: High-throughput message ingestion.
* **Specifications per Server**:
  + **CPU**: 16 vCPU (Intel/AMD, high clock speed).
  + **RAM**: 64 GB DDR4 (focus on low latency).
  + **Disk**: 2 TB NVMe SSD (RAID 10 for redundancy).
* **Why NVMe SSD?**
  + Kafka is I/O-bound; NVMe SSDs provide low-latency writes (critical for 200k+ TPM).
  + RAID 10 ensures redundancy and speed.

**2. Apache Flink Task Managers**

* **Role**: Real-time stream processing (fraud detection, aggregations).
* **Specifications per Server**:
  + **CPU**: 32 vCPU (multi-core for parallel processing).
  + **RAM**: 128 GB DDR4 (for stateful operations and JVM heap).
  + **Disk**: 1 TB NVMe SSD (local RocksDB state backend).
* **Why NVMe SSD?**
  + Fast read/write for checkpointing and stateful processing.

**3. Elasticsearch (Hot Tier)**

* **Role**: Transaction log storage and querying.
* **Specifications per Server**:
  + **CPU**: 64 vCPU (split between indexing and search threads).
  + **RAM**: 256 GB DDR4 (50% allocated to JVM heap, 50% for OS caching).
  + **Disk**: 4 TB NVMe SSD (RAID 0 for max IOPS).
* **Why NVMe SSD?**
  + Elasticsearch requires high IOPS for indexing and search operations.
  + RAID 0 maximizes throughput (redundancy handled via Elasticsearch replicas).

**4. VictoriaMetrics (TSDB)**

* **Role**: Time-series metrics storage (TPS, latency, error rates).
* **Specifications per Server**:
  + **CPU**: 32 vCPU (for compression and query processing).
  + **RAM**: 128 GB DDR4 (to cache frequent queries).
  + **Disk**: 10 TB SATA SSD (RAID 5 for capacity + redundancy).
* **Why SATA SSD?**
  + VictoriaMetrics is optimized for storage efficiency; SATA SSDs balance cost and performance.

**5. PostgreSQL (Primary + Replica)**

* **Role**: Reference data (BIN tables, merchant info) and reconciliation.
* **Specifications per Server**:
  + **CPU**: 16 vCPU (for OLTP workloads).
  + **RAM**: 64 GB DDR4 (shared buffers and query caching).
  + **Disk**: 2 TB NVMe SSD (RAID 10 for transactional workloads).
* **Why NVMe SSD?**
  + Low-latency I/O for write-ahead logs (WAL) and frequent updates.

**6. MinIO (Cold Storage)**

* **Role**: Long-term archival of logs and metrics.
* **Specifications per Server**:
  + **CPU**: 16 vCPU (erasure coding computations).
  + **RAM**: 64 GB DDR4 (buffering for large object storage).
  + **Disk**: 50 TB HDD (12 Gbps SAS HDDs in JBOD).
* **Why HDD?**
  + MinIO uses erasure coding for redundancy; HDDs provide cost-effective bulk storage.
  + Use ZFS compression to reduce disk usage by ~30–50%.

**7. Support Services (Grafana, Kibana, HAProxy, Prometheus)**

* **Role**: Visualization, alerting, and load balancing.
* **Specifications per Server**:
  + **CPU**: 8 vCPU (lightweight for web services).
  + **RAM**: 32 GB DDR4 (for dashboard rendering and in-memory caching).
  + **Disk**: 1 TB SATA SSD (RAID 1 for OS and application binaries).
* **Why SATA SSD?**
  + Sufficient for OS and application binaries; no heavy I/O requirements.

**8. Infrastructure (HAProxy, ZooKeeper, Patroni)**

* **Role**: Orchestration, load balancing, and HA coordination.
* **Specifications per Server**:
  + **CPU**: 8 vCPU.
  + **RAM**: 32 GB DDR4.
  + **Disk**: 500 GB SATA SSD (RAID 1 for reliability).

**Hard Disk Type Recommendations**

| **Component** | **Disk Type** | **Why?** |
| --- | --- | --- |
| **Kafka** | NVMe SSD | Low-latency writes for high-throughput message ingestion. |
| **Flink** | NVMe SSD | Fast local state backend for checkpointing. |
| **Elasticsearch** | NVMe SSD | High IOPS for indexing/searching logs. |
| **VictoriaMetrics** | SATA SSD | Cost-effective for time-series data with high compression. |
| **PostgreSQL** | NVMe SSD | Low-latency I/O for transactional workloads. |
| **MinIO** | SAS HDD | High-capacity, cost-effective for cold storage with erasure coding. |
| **Support Services** | SATA SSD | Balance of speed and cost for lightweight services. |

**Example Total Storage Requirements**

1. **Hot Storage (Elasticsearch)**:
   * 200k TPM × 1 KB/msg = 200 GB/day × 30 days = 6 TB (hot tier).
2. **Cold Storage (MinIO)**:
   * Retain raw logs for 1 year: 6 TB × 12 = 72 TB (use erasure coding for ~50% overhead → 144 TB raw).
3. **Time-Series Data (VictoriaMetrics)**:
   * 1M metrics/sec × 30 days = ~10 TB (compressed).

**Cost vs. Performance Optimization**

* **NVMe SSD**: Use for Kafka, Flink, Elasticsearch, and PostgreSQL (high I/O).
* **SATA SSD**: Use for VictoriaMetrics and support services (moderate I/O).
* **HDD**: Use for MinIO (cold storage).

This setup ensures **optimal performance**, **scalability**, and **cost efficiency** for your ISO 8583 monitoring system. Adjust based on actual workload patterns (e.g., larger HDDs for MinIO if retention periods increase).