

# Database server selection

## 1. Understanding the Database Server Role in SMS

The database server is the backbone of the SMS, responsible for:

- Storing statistical data (baggage flow, error counts, etc.).
  - Processing large volumes of data for real-time monitoring and historical analysis.
  - Generating reports for operational insights.
  - Ensuring data security and fault tolerance.
- 

## 2. Key Considerations for Choosing a Database Server

### a. Performance Requirements

- **Read/Write Speed:** The system must handle continuous data input (baggage counts, sensor data) and provide fast query responses for reports.
- **Transaction Processing:** Support multiple simultaneous transactions from BHS systems and SCTs without latency.

### b. Storage Capacity

- Analyze data volume requirements:
  - Number of baggage records per day, including attributes like flight number, timestamp, and baggage type.
  - Error logs and metadata storage.
  - Daily, weekly, monthly, and yearly data storage and backups.
- Include a buffer for data growth (e.g., 5–10 years of data).

### c. Scalability

- Choose a system that supports vertical (adding resources to the server) and horizontal (adding more servers) scaling to accommodate future growth.

### d. Availability and Redundancy

- High availability (HA) and redundancy are crucial to avoid data loss or system downtime.

### e. Budget Constraints

- Balance between performance and cost, choosing hardware that meets the requirements without excessive overhead.
- 

### 3. Types of Database Servers

#### a. On-Premises Database Servers

- **Benefits:**
  - Complete control over hardware and data security.
  - Ideal for systems requiring strict data privacy and real-time processing.
- **Components:**
  - **Processor (CPU):** Multi-core processors for handling parallel queries (e.g., Intel Xeon or AMD EPYC).
  - **Memory (RAM):** 32–128 GB or more, depending on query load.
  - **Storage:** SSDs for high-speed data access; HDDs for archival storage.
  - **RAID Configuration:** Redundant Array of Independent Disks for fault tolerance (RAID 10 or RAID 5 recommended).
  - **Network Interface:** Gigabit Ethernet or higher for fast data exchange with the BHS system.

### 4. Hardware Recommendations

#### Minimum Specifications for On-Premises Server:

- **Processor:** Dual Intel Xeon E5-2600 v4 or equivalent (16 cores or more).
- **Memory:** 64 GB DDR4 RAM.
- **Storage:**
  - 2–4 TB SSD for operational data.
  - 4–10 TB HDD for archival and backups.
  - RAID 10 for redundancy and performance.
- **Network Interface:** Dual 10 Gigabit Ethernet ports.
- **Power Supply:** Redundant power supplies.
- **Cooling:** Adequate cooling for continuous operation.

#### High-Performance Configuration for Large-Scale Systems:

- **Processor:** Dual AMD EPYC 7002 series with 32 cores each.
- **Memory:** 128–256 GB DDR4 ECC RAM.
- **Storage:**
  - 4 TB NVMe SSD for database operations.
  - 10–20 TB HDD for backups and historical data.
- **Other:**

- Hot-swappable drives for maintenance.
  - Hardware RAID controller.
- 

## 5. Selection Criteria

### a. Evaluate Based on Usage:

- High transaction volume → Opt for high CPU and SSDs.
- Large-scale analytics → Invest in more RAM and storage.

### b. Future Proofing:

- Choose servers with modular upgradability for RAM, storage, and processors.

### c. Vendor Options:

- Dell PowerEdge, HPE ProLiant, Lenovo ThinkSystem, and Supermicro.

### d. Database System Compatibility:

- Ensure hardware supports your chosen database (e.g., MySQL, PostgreSQL, Oracle, or MongoDB).
- 

## 6. Example Configuration

### Small System:

- **Purpose:** Handle up to 1 million records per day with basic analytics.
- **Configuration:**
  - CPU: Intel Xeon E-2236 (6 cores, 3.4 GHz).
  - RAM: 32 GB DDR4.
  - Storage: 1 TB SSD + 2 TB HDD.
  - Cost: ~\$3,000.

### Medium System:

- **Purpose:** Manage up to 10 million records per day with detailed analytics.
- **Configuration:**
  - CPU: Dual Intel Xeon Gold 5218 (16 cores each).
  - RAM: 128 GB DDR4 ECC.
  - Storage: 4 TB NVMe SSD + 10 TB HDD.
  - Cost: ~\$10,000.

## Large System:

- **Purpose:** Enterprise-grade, >50 million records per day, advanced analytics.
  - **Configuration:**
    - CPU: Dual AMD EPYC 7742 (64 cores each).
    - RAM: 256 GB DDR4 ECC.
    - Storage: 10 TB NVMe SSD + 20 TB HDD in RAID 10.
    - Cost: ~\$30,000.
- 

## 7. Integration with SMS

- The database server interfaces with:
  - **BHS Sensors and Terminals:** To ingest raw data.
  - **Supervisory Computer Terminal (SCT):** For querying and reporting.
  - **Networking Infrastructure:** To ensure seamless data flow.