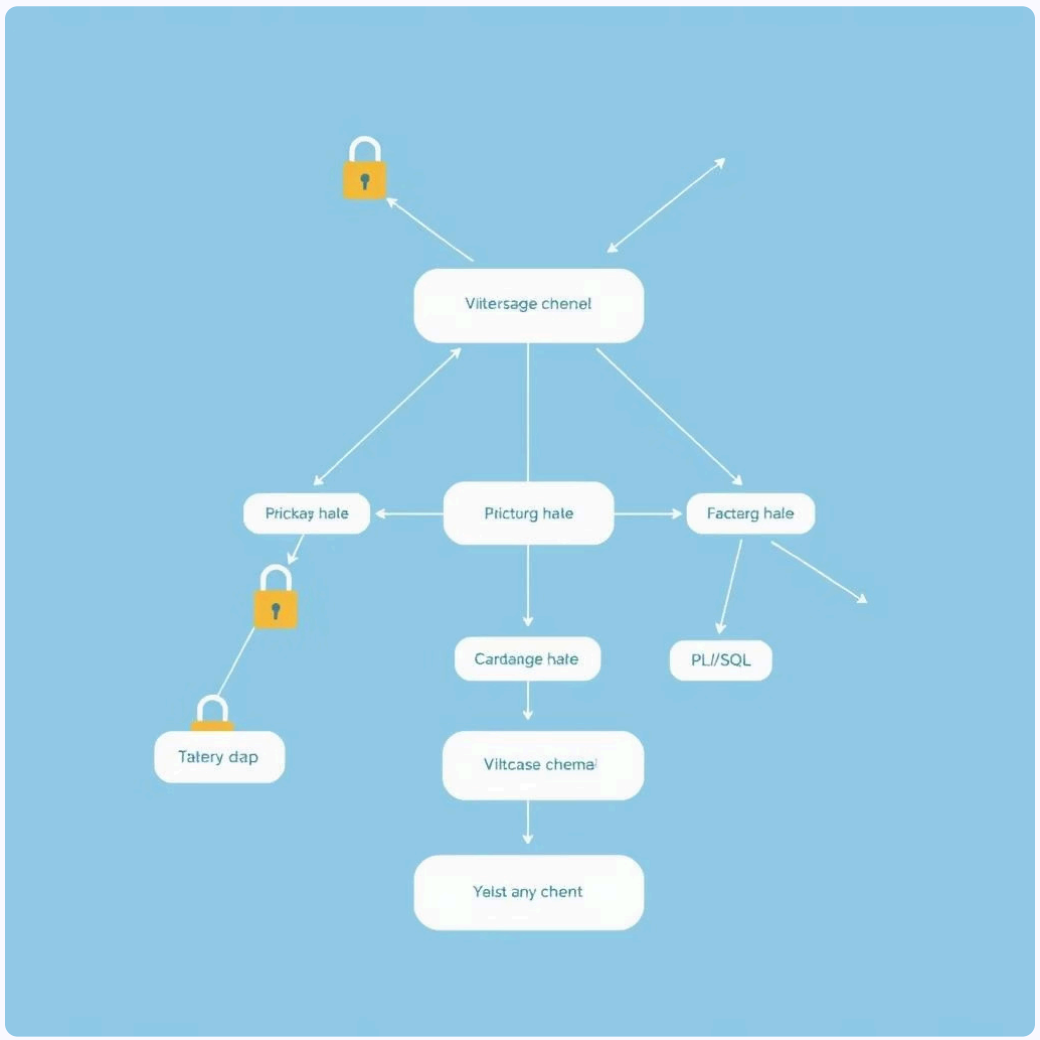
CRM Database System – PL/SQL Practicum

Welcome to the Vision Technologies Company presentation on our enhanced CRM Database System. This practicum highlights our robust PL/SQL implementation, developed using Oracle SQL Developer 24.3 within the `lu_plsqlauca_25815` PDB. Our focus was on a comprehensive database-side solution, ensuring optimal performance and reliability.

Project Overview: Scope & Objectives

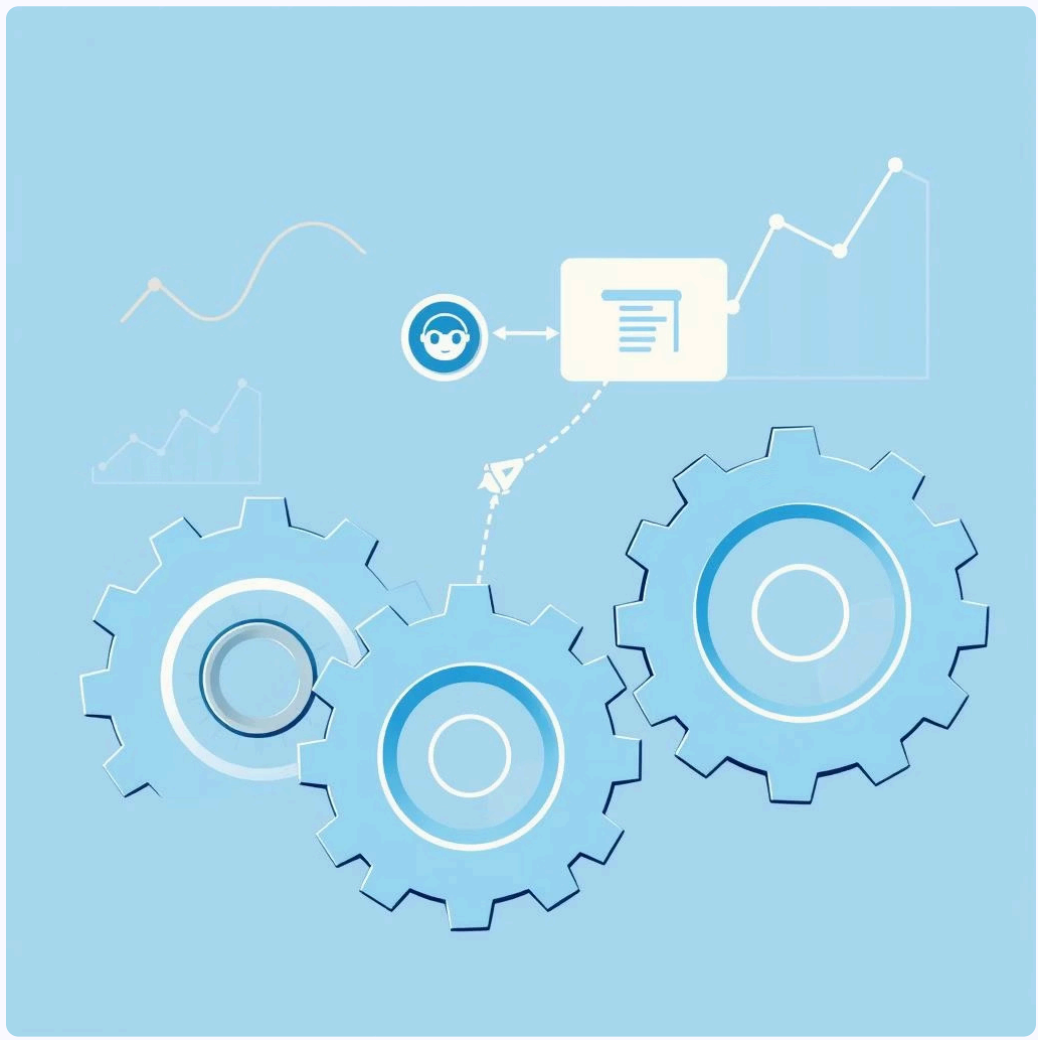
Project Scope: Database-Side Implementation

- Schema design & relationships
- PL/SQL automation logic
- Security & access control mechanisms
- Database-side implementation for core functionalities



Key Objectives: Driving Operational Excellence

- Streamline CRM operations for efficiency
- Enforce critical SLA compliance
- Automate technician assignment processes
- Enable advanced reporting & analytics capabilities



Database Schema: The Foundation of Our CRM

Our CRM system is built upon a meticulously designed entity-relationship diagram, ensuring data integrity and efficient information flow.

Core Entities & Relationships

- **CUSTOMERS** → **SERVICE_REQUESTS** → **ASSIGNMENTS** → **TECHNICIANS**
- **PRODUCTS** → **SERVICE_REQUESTS**
- **SERVICE_REQUESTS** → **FEEDBACK**
- **SLA_RULES** → **SERVICE_REQUESTS** (priority mapping)

A total of **7 tables** comprise our schema: CUSTOMERS, PRODUCTS, TECHNICIANS, SLA_RULES, SERVICE_REQUESTS, ASSIGNMENTS, and FEEDBACK, interconnected for robust CRM functionality.

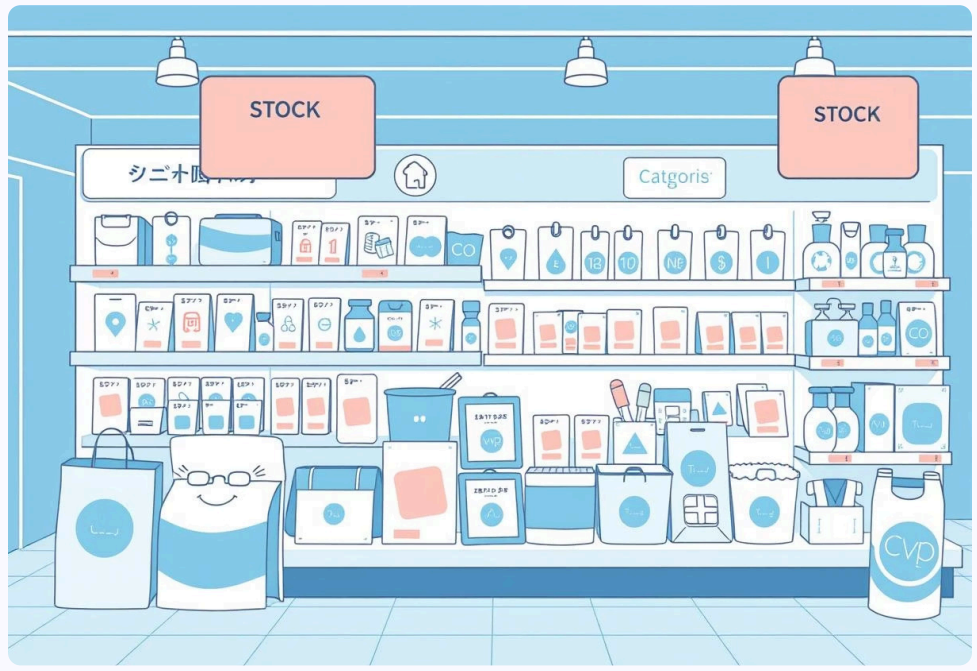
Core Tables: Primary Data Structures

CUSTOMERS

- Customer ID, Name, Contact, Company, Tier
- **Key Indexes:** `tier`, `company`

PRODUCTS

- Product ID, Name, Category, Price, Stock
- **Key Index:** `category`

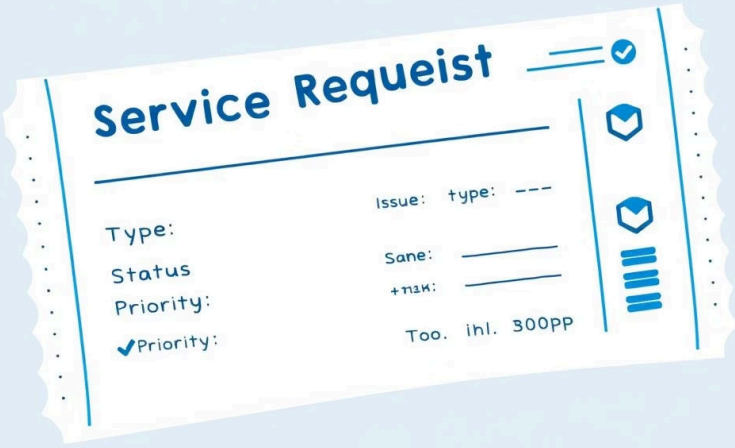


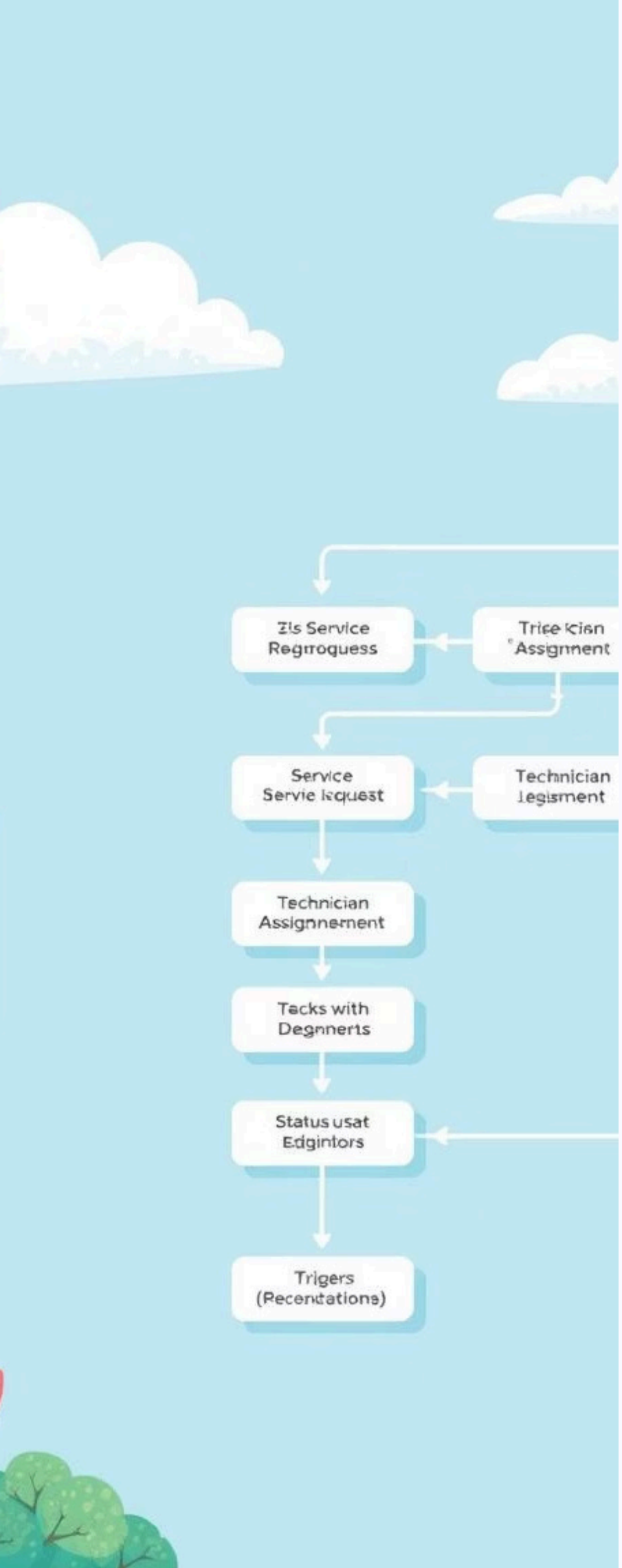
TECHNICIANS

- Technician ID, Name, Skill Level, Availability
- **Key Indexes:** `availability`, `skill_level`

SERVICE_REQUESTS

- Request ID, FKs, Issue Type, Status, Priority, Timestamps
- **Key Indexes:** `status`, `priority`, `created_at`, `customer_id`
- **Constraints:** Foreign keys, CHECK constraints for data integrity





PL/SQL Components: Automated Workflow Triggers

Our system leverages powerful PL/SQL triggers to automate critical CRM workflows, ensuring efficiency and responsiveness.

TRG_AUTO_ASSIGN_TECHNICIAN

Event: AFTER INSERT on SERVICE_REQUESTS

- Auto-assigns tech based on priority & skill
- Considers workload (max 5 assignments)
- Updates status to 'Assigned'
- Sets technician availability to 'Busy' when threshold reached

Technology: Compound trigger pattern (v2.0) prevents mutating table errors.

TRG_UPDATE_STATUS_ON_FEEDBACK

Event: AFTER INSERT on FEEDBACK

- Auto-closes request status
- Sets `resolved_at` timestamp
- Updates technician availability when no active assignments remain

Ensures timely closure and accurate resource tracking.

PL/SQL Components: Business Logic Packages

Our modular PL/SQL packages encapsulate core business logic, enhancing maintainability and reusability.

PKG_TICKET_MANAGEMENT

- `FUNC_CREATE_REQUEST`: New service requests
- `FUNC_UPDATE_STATUS`: Update request status
- `PROC_REASSIGN_TICKET`: Reassign tickets
- `PROC_CLOSE_REQUEST`: Close requests with notes

PKG_SLA_MONITORING

- `FUNC_CHECK_SLA_COMPLIANCE`: Returns status
- `FUNC_GET_REMAINING_TIME`: Hours until deadline
- `PROC_ESCALATE_OVERDUE_TICKETS`: Auto-escalate priority
- `PROC_MONITOR_ACTIVE_REQUESTS`: Real-time monitoring

PKG_REPORTING

- `FUNC_AVG_RESOLUTION_TIME`: Technician performance
- `FUNC_CUSTOMER_SATISFACTION_SCORE`: CSAT (1-5)
- `PROC_GENERATE_WEEKLY_REPORT`: Comprehensive statistics
- `PROC_TECHNICIAN_PERFORMANCE_REPORT`: Individual analytics

Security Model: Role-Based Access Control (RBAC)

Our robust security model employs Role-Based Access Control to ensure data integrity and restrict access based on user responsibilities.

CRM_ADMIN

Full access (SELECT, INSERT, UPDATE, DELETE) on all tables; Execute all PL/SQL objects.

CRM_MANAGER

Read/write on operational tables (CUSTOMERS, SERVICE_REQUESTS, ASSIGNMENTS, FEEDBACK); Read-only on reference tables; Execute management & reporting packages.

CRM_TECHNICIAN

Read requests, update assignments & status; Execute ticket management package.

CRM_CUSTOMER

Read own requests, submit feedback; Limited access for self-service.

CRM_ANALYST

Read-only access to all tables; Execute reporting procedures & functions.

Testing & Validation: Comprehensive Test Coverage

Rigorous testing ensures the reliability and accuracy of our CRM system's functionality.

Test Data Population

- **12 customers:** Various tiers (Bronze, Silver, Gold, Platinum)
- **9 products:** Multiple categories
- **6 technicians:** All skill levels (Junior, Mid, Senior, Expert)
- **15+ service requests:** Diverse statuses & priorities
- **Multiple assignments & feedback records**

Validated Scenarios

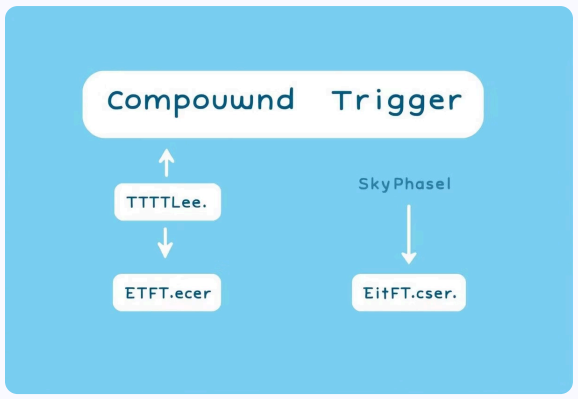
- ✅ SLA violation simulation & escalation
- ✅ Feedback integration (auto-close verification)
- ✅ End-to-end workflow (customer → request → assignment → resolution → feedback)
- ✅ Function validation (SLA compliance, resolution times, satisfaction scores)
- ✅ Auto-assignment trigger validation

Result: All triggers, procedures, and packages have been thoroughly tested and verified.

Recent Updates & Best Practices: Version 2.0 Improvements

→ Compound Trigger Implementation

- Resolved `ORA-04091` mutating table errors.
- Adhering to Oracle 11g+ best practices.
- Clean separation: `AFTER EACH ROW` + `AFTER STATEMENT`.

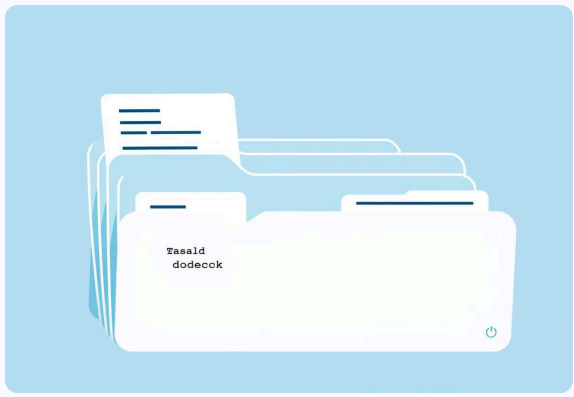


→ Error Handling & Robustness

- Comprehensive exception handling throughout the codebase.
- Graceful degradation when DBA privileges are unavailable.
- Idempotent scripts for safe reruns and recovery.

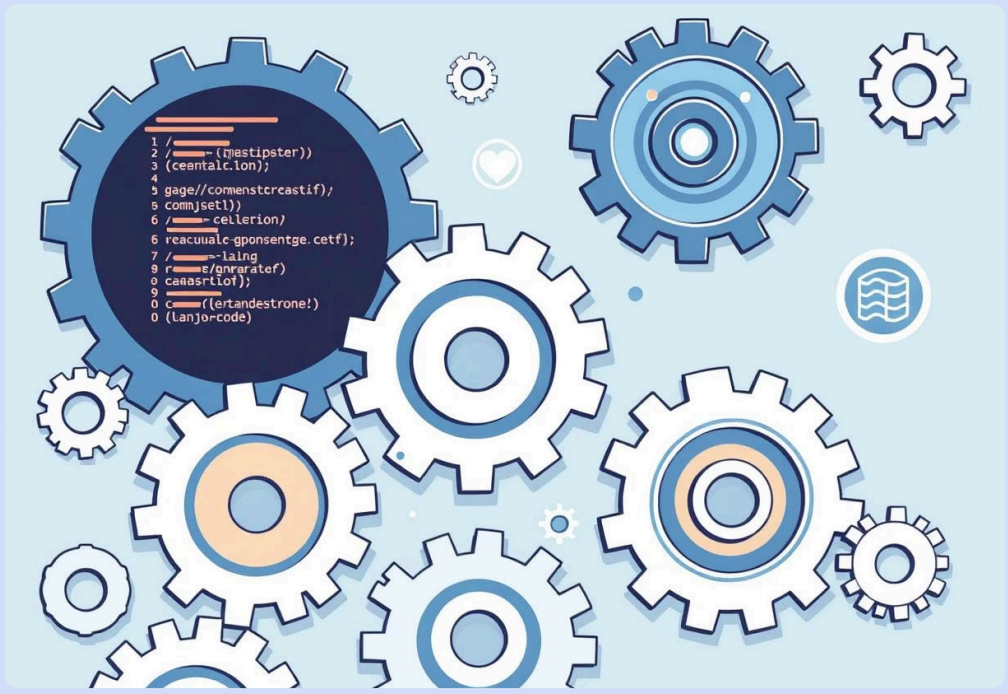
→ Clean Installation & Orchestration

- Automatic object cleanup for streamlined deployment.
- Robust rollback script (`99_rollback_all.sql`).
- Master script orchestration (`00_master_script.sql`) for seamless setup.



Best Practices

- Modular package design
- Consistent naming conventions
- Strategic indexing for performance
- CHECK constraints for data integrity



Future Enhancements: Roadmap & Potential Improvements

Our journey of continuous improvement includes exciting plans for advanced features and optimizations.

Security & Compliance

- Row-level security (RLS) for data privacy
- Audit tables for change tracking
- Enhanced access logging

Automation & Integration

- Email notifications on SLA violations
- SMS alerts for critical requests
- Integration with external ticketing systems

Analytics & Reporting

- Real-time dashboard views
- Advanced workload balancing
- Predictive analytics for SLA compliance

Performance & Scalability

- Materialized views for reporting
- Advanced partitioning strategies
- Performance tuning & optimization