Ai-SHA CRM
System Administrator Guide

Complete Infrastructure, Configuration, and Maintenance Guide

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CONFIDENTIAL - For System Administrators Only

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1. System Architecture Overview

1.1 Technology Stack

Ai-SHA CRM is built on a modern, scalable architecture:

Frontend:

- React 18 - Component-based UI framework
- Vite - Fast build tool and dev server
- TailwindCSS - Utility-first CSS framework
- Shadcn/UI - High-quality React component library
- TanStack Query - Data fetching and caching
- React Router - Client-side routing

Backend:

- Base44 Platform - Serverless backend infrastructure
- Deno Deploy - Edge runtime for backend functions
- PostgreSQL - Primary database (via Base44)
- Cloudflare R2 - Object storage for files/documents

AI & Integrations:

- OpenAI GPT-4 - Primary LLM for AI features
- ElevenLabs - Voice synthesis and conversational AI
- Twilio/SignalWire - Phone/SMS capabilities
- Thoughtly/CallFluent - AI calling platforms
- Stripe - Payment processing (if enabled)

1.2 System Components

The CRM consists of several interconnected components:

Core Modules:

- Dashboard - Overview and KPIs
- Contacts - Individual people management
- Accounts - Company/organization management
- Leads - Sales lead tracking and qualification
- Opportunities - Deal pipeline management
- Activities - Task, call, email, meeting tracking
- Calendar - Activity scheduling and visualization

Advanced Modules:

- Reports - Analytics and business intelligence
- BizDev Sources - Business development data imports

- Cash Flow - Financial transaction tracking
- Employees - Workforce management
- Document Processing - AI-powered document extraction
- AI Campaigns - Automated calling/email campaigns
- Integrations - Third-party system connections

Administrative Tools:

- User Management - Create, edit, invite users
- Tenant Management - Multi-organization support
- Permissions - Granular access control
- System Logs - Activity and error logging
- Performance Monitor - System health tracking
- Data Diagnostics - Data integrity and quality checks
- Webhooks - Event-driven integrations

1.3 Data Flow Architecture

Understanding how data flows through the system:

1. User Action: User performs action in UI (create contact, update opportunity, etc.)
2. Frontend Validation: React form validates input client-side
3. API Call: Frontend sends request to Base44 SDK
4. Authentication: Base44 verifies user session and permissions
5. Row-Level Security (RLS): Database checks entity-level permissions
6. Business Logic: Backend functions execute (denormalization, webhooks, etc.)
7. Database Update: Data is persisted to PostgreSQL
8. Async Tasks: Background jobs triggered (AI scoring, sync, notifications)
9. Response: Result returned to frontend
10. UI Update: React re-renders with new data

TIP: Understanding this flow is critical for debugging issues. Most problems occur at steps 4 (auth), 5 (RLS), or 6 (business logic).

2. Understanding Roles and Permissions

2.1 Two-Tier Permission System

Ai-SHA CRM uses a dual-layer permissions system:

Layer 1: Base44 Platform Roles

These are system-level roles that control platform access:

- superadmin: You - the app owner. Full access to everything including backend code, all tenants, all users. Cannot be restricted.
- admin: Tenant owners. Full access to their tenant data, users, and settings. Can create/manage users within their tenant.
- power-user: Advanced users with extended permissions (deprecated, use employee_role instead).
- user: Standard users. Default role for all non-admin users. Access controlled by employee_role.

> **WARNING:** NEVER change a superadmin to admin or user - you will lose access to the system!

Layer 2: CRM Employee Roles

These control data visibility within a tenant:

- manager: Can see ALL records within their tenant regardless of who created or is assigned to them. Use for sales managers, executives.
- employee: Can ONLY see records they created OR records assigned to them. Use for individual sales reps, support agents.
- null (no employee_role): Treated same as manager for backward compatibility.

2.2 How Permissions Combine

The system evaluates permissions in this order:

Permission Hierarchy:

1. If user.role = "superadmin" -> FULL ACCESS to everything
2. If user.role = "admin" -> Full access to their tenant_id data
3. If user.role = "user" AND employee_role = "manager" -> See all tenant data
4. If user.role = "user" AND employee_role = "employee" -> See only own/assigned records

Practical Examples:

- Sarah (admin, no employee_role): Sees everything in her tenant, can manage users
- Mike (user, employee_role=manager): Sees all contacts/leads/opps in his tenant, cannot manage users
- Jane (user, employee_role=employee): Only sees contacts/leads assigned to jane@company.com

2.3 Navigation Permissions

Control which menu items users see via navigation_permissions object:

```
{
  "Dashboard": true,
  "Contacts": true,
  "Accounts": true,
  "Leads": true,
  "Opportunities": true,
  "Activities": true,
  "Calendar": true,
  "BizDevSources": false,  // Hide from this user
  "CashFlow": false,
  "Employees": false,       // Admin only
  "Reports": true,
  "Settings": false,        // Admin only
  "Integrations": false,
  "AICampaigns": false,
  "Agent": true,
  "Documentation": true
}
```

TIP: Set navigation permissions when inviting users or editing their profiles in User Management.

3. User Management

3.1 Inviting New Users

To add a new user to the system:

1. Navigate to Settings -> User Management
2. Click "Invite User" button
3. Fill in the invitation form:

Required Fields:

- Email: User email address (must be unique)
- Full Name: User full name for display
- Tenant: Which client/organization they belong to
- Role: admin or user (almost always "user")
- Employee Role: manager or employee (controls visibility)

Optional Fields:

- Access Level: read or read_write (default: read_write)
- Can Use Softphone: Enable phone calling from CRM
- Navigation Permissions: Which modules they can access

4. Click "Send Invitation"
5. User receives email with signup link
6. User creates password and completes registration

> **TIP:** The invitation link expires in 7 days. Users who do not complete signup in time need a new invitation.

3.2 Editing User Permissions

To modify an existing user:

1. Go to Settings -> User Management
2. Find the user in the list
3. Click the Edit (pencil) icon
4. Modify any of:

    * Employee Role: Change between manager/employee
    * Access Level: Change read vs read_write
    * Navigation Permissions: Show/hide menu items
    * Softphone Access: Enable/disable calling
    * Active Status: Deactivate user (they cannot log in)

5. Click "Save Changes"
6. Changes take effect immediately (user may need to refresh)

> **WARNING:** DO NOT change a user role from admin to user or vice versa unless you understand the implications. This is a platform-level change.

3.3 Deactivating Users

To temporarily or permanently remove access:

1. Edit the user (as above)
2. Toggle "Active" to OFF
3. Save changes

Deactivated users:
- Cannot log in
- Do not consume a license seat
- Their data remains in the system
- Can be reactivated later by toggling Active back to ON

> **TIP:** Prefer deactivation over deletion. Deleting users can break audit logs and record ownership.

4. Tenant (Client) Management

4.1 Understanding Tenants

Tenants (also called "Clients") are separate organizations using your CRM. Each tenant has:

- Isolated data: Contacts, leads, accounts, opportunities are per-tenant
- Separate users: Users belong to one tenant (except you as superadmin)
- Custom branding: Logo, colors, domain (optional)
- Industry settings: Configure AI context for the tenant business type

4.2 Creating a New Tenant

To onboard a new client/organization:

1. Navigate to Settings -> Tenant Management
2. Click "Add Client"
3. Fill in tenant information:

Required:

- Name: Company/organization name

Recommended:

- Industry: Select from dropdown (affects AI recommendations)
- Business Model: B2B, B2C, or Hybrid
- Geographic Focus: Primary region (North America, Europe, etc.)
- Country: Specific country
- Major City: Primary location

Branding (Optional):

- Logo URL: Link to tenant logo image
- Primary Color: Hex color code (e.g., #3b82f6)
- Accent Color: Secondary hex color

4. Click "Create Tenant"
5. Tenant is created with a unique tenant_id

> **TIP:** Always set Industry and Business Model - the AI uses these for contextual recommendations and market research.

4.3 Configuring Tenant Settings

After creating a tenant, configure additional settings:

AI Calling Setup (Optional):

- CallFluent: Set webhook URL and API key in tenant settings
- Thoughtly: Configure agent ID and API key
- ElevenLabs: Set conversational AI agent ID for this tenant

Module Permissions:

Control which modules this tenant can access by setting ModuleSettings records:

- Enable/disable BizDev Sources
- Enable/disable Cash Flow tracking
- Enable/disable Employee Management
- Enable/disable AI Campaigns
- Enable/disable Document Processing

4.4 Tenant Data Isolation

How data separation works:

- Every Contact, Lead, Account, Opportunity, Activity has a tenant_id field
- Row-Level Security (RLS) filters data by user tenant_id automatically
- Users can ONLY see data where record.tenant_id = user.tenant_id (except superadmin)
- There is NO cross-tenant data leakage

> **WARNING:** NEVER manually change a record tenant_id unless you are migrating data. This can break referential integrity.

5. Data Management & Maintenance

5.1 Data Consistency Manager

Located at Settings -> Diagnostics -> Data Consistency Manager

This tool identifies and fixes common data issues:

What It Checks:

- Orphaned Records: Contacts linked to non-existent accounts
- Missing Assignments: Records with null assigned_to that should have values
- Invalid Tenant References: Records pointing to deleted tenants
- Broken Relationships: Opportunities linked to deleted contacts
- Denormalization Drift: Cached fields out of sync with source data

How to Use:

1. Click "Run Consistency Check"
2. Review the report showing issues found
3. Click "Fix Issues" to auto-correct problems
4. Review the fix log to see what was changed

> **TIP:** Run this monthly or after major data imports/bulk operations.

5.2 Denormalization Sync

What is denormalization? Cached copies of related data for faster queries.

Examples:

- Contact.account_name cached from Account.name
- Lead.assigned_to_name cached from User.full_name
- Opportunity.contact_email cached from Contact.email

Over time, cached data can become stale. To fix:

1. Go to Settings -> Denormalization Sync
2. Click "Run Full Sync"
3. Wait for completion (can take 30-60 seconds for large databases)
4. Review the sync report

Or use incremental sync (faster):

1. Click "Run Incremental Sync"
2. Only syncs records updated in last 7 days

TIP: A cron job runs incremental sync automatically every 6 hours. Manual full sync needed only for data fixes.

5.3 Test Data Management

Manage test/demo data without affecting production metrics:

1. Go to Settings -> Test Data Manager
2. Mark records as test data (sets is_test_data = true)
3. Toggle "Show Test Data" switch in any module to hide/show
4. Use "Bulk Cleanup" to delete all test data at once

WARNING: Test data cleanup is permanent and cannot be undone!

6. Monitoring & System Health

6.1 System Health Dashboard

Located at Settings -> System Health Dashboard

This shows overall system status:
- API Response Times: Average latency for key operations
- Error Rate: Percentage of failed requests
- Active Users: Currently logged in users
- Database Size: Total storage used
- Function Execution: Backend function health

6.2 Performance Monitor

Located at Settings -> Performance

Track specific operations:

Metrics Tracked:

- Entity List: Time to load Contacts, Leads, Accounts, etc.
- Entity Filter: Time to filter with complex queries
- Entity Create: Time to insert new records
- Entity Update: Time to modify records
- Function Invocation: Time for backend functions

If you see slow performance:
1. Check Performance Monitor for bottlenecks
2. Look for operations taking > 2 seconds
3. Check Integration Usage Monitor for rate limits
4. Review recent code changes that may have added inefficiency

6.3 Integration Usage Monitor

Located at Settings -> Integration Usage

Track API calls to external services:
- OpenAI: Token usage and costs
- ElevenLabs: Character count and voice generation
- Twilio/SignalWire: SMS and call volumes
- Cloudflare R2: Storage and bandwidth

TIP: Set up alerts when approaching API limits to avoid service disruptions.

6.4 System Logs

Located at Settings -> System Logs

View application logs:
- INFO: Normal operations (user login, record created, etc.)
- WARNING: Non-critical issues (validation failures, missing data)
- ERROR: Problems requiring attention (API failures, data issues)
- DEBUG: Detailed diagnostic information

Filtering Logs:

1. Select log level to view
2. Filter by source component
3. Search by keyword or user email
4. Export logs for external analysis

6.5 Sync Health Monitor

Located at Settings -> Sync Health Monitor

Track background sync jobs:
- Denormalization Sync: When last run, records updated
- Orphan Cleanup: Deleted orphaned records count
- Data Integrity: Referential integrity checks

Each sync shows:
- Start/End Time
- Duration
- Records Processed
- Errors Encountered
- Status (Completed, Failed, Partial)

7. Security Best Practices

7.1 User Access Principles

- Least Privilege: Give users minimum permissions needed for their job
- Regular Reviews: Quarterly audit of user permissions
- Immediate Revocation: Deactivate users when they leave organization
- Strong Passwords: Enforce complexity via Base44 platform settings
- 2FA Enabled: Encourage (or require) two-factor authentication

7.2 Data Protection

- Tenant Isolation: NEVER assign a user to multiple tenants
- RLS Validation: Trust Row-Level Security, do not bypass it
- API Key Rotation: Change integration API keys quarterly
- Secure Secrets: Store all keys in Base44 environment variables, never in code
- Audit Logging: Review Settings -> Audit Log monthly

7.3 Audit Log

Located at Settings -> Diagnostics -> Audit Log

Every significant action is logged:
- User login/logout
- Record creation, updates, deletion
- Permission changes
- Role modifications
- Settings changes
- Integration configuration

Each log entry contains:
- Timestamp
- User email and role
- Action type
- Entity affected
- Old and new values (for updates)
- IP address

7.4 Incident Response

If you suspect unauthorized access or data breach:

1. Immediately change superadmin password
2. Review Audit Log for suspicious activity

3. Deactivate compromised user accounts
4. Rotate all API keys and integration credentials
5. Review RLS policies to ensure they are enforcing correctly
6. Notify affected tenants if data exposure confirmed
7. Document incident and root cause analysis

> **WARNING:** Take security incidents seriously. A data breach can destroy customer trust and result in legal liability.

8. Backend Functions

8.1 What Are Backend Functions?

Backend functions are serverless JavaScript/TypeScript functions that run on Deno Deploy. They handle:

- Complex business logic that cannot run in the browser
- Integration with external APIs (OpenAI, Twilio, Stripe, etc.)
- Scheduled tasks (cron jobs)
- Webhooks (receiving data from external systems)
- Data processing and transformations

8.2 Key Functions You Should Know

Data Management:

- syncDenormalizedFields: Updates cached fields across entities
- cleanupOrphanedData: Removes records with broken relationships
- validateEntityReferences: Checks referential integrity
- backfillUniqueIds: Generates unique IDs for records missing them
- consolidateDuplicateContacts: Merges duplicate contact records

User Management:

- inviteUser: Sends user invitation emails
- updateUserRole: Changes user permissions (admin use only)
- syncEmployeeUserPermissions: Syncs Employee <-> User permissions
- diagnoseUserAccess: Troubleshoots permission issues

AI Operations:

- invokeSystemOpenAI: Calls OpenAI API for AI features
- generateAIEmailDraft: Creates AI email drafts
- generateEntitySummary: Summarizes contact/lead/account data
- processScheduledAICalls: Executes scheduled AI calls
- universalAICall: Handles CallFluent/Thoughtly integrations

Document Processing:

- r2DocumentManager: Manages file uploads/downloads to R2 storage
- processReceiptForCashFlow: Extracts data from receipt images
- agentWebSearch: Performs web searches for AI context

Cron Jobs:

- cronJobRunner: Master function that executes scheduled tasks
- cronDenormalizationSync: Runs every 6 hours to sync cached data

- cronOrphanCleanup: Runs daily to clean up orphaned records
- processScheduledAICalls: Runs every 5 minutes to check for pending AI calls

8.3 Function Debugging

If a function is failing:

1. Check Settings -> Performance Monitor for error messages
2. Review Settings -> System Logs filtered by function name
3. Test the function directly from base44 dashboard -> code -> functions
4. Check that required environment variables (API keys) are set
5. Verify external API status (OpenAI, Twilio, etc.)

8.4 Creating Custom Functions

If you need custom business logic:

1. Go to base44 dashboard -> code -> functions
2. Create new function
3. Use Deno.serve() pattern:

```
import { createClientFromRequest } from 'npm:@base44/sdk@0.7.1';

Deno.serve(async (req) => {
  try {
    const base44 = createClientFromRequest(req);
    const user = await base44.auth.me();
    if (!user) {
      return Response.json({ error: 'Unauthorized' }, { status: 401 });
    }

    // Your logic here

    return Response.json({ success: true });
  } catch (error) {
    return Response.json({ error: error.message }, { status: 500 });
  }
});
```

4. Deploy the function
5. Call from frontend using base44.functions.invoke("functionName", params)

9. AI Features & Integrations

9.1 OpenAI Integration

The CRM uses OpenAI GPT-4 for various AI features. Setup:

1. Set OPENAI_API_KEY in base44 environment variables
2. Configure in Settings -> Admin OpenAI Settings (your account only)
3. Set model (gpt-4o-mini recommended for cost, gpt-4 for quality)
4. Set token limits and temperature

What Uses OpenAI:

- AI Agent (Avatar): Conversational assistant
- Email Composer: Draft emails based on prompts
- Entity Summaries: Generate summaries of contacts, leads, accounts
- Lead Scoring: Automatic scoring and qualification
- Document Extraction: Extract structured data from images/PDFs
- Market Research: AI-powered industry insights

> **TIP:** Monitor token usage in Settings -> LLM Usage Monitor to control costs.

9.2 ElevenLabs Conversational AI

ElevenLabs provides voice-based AI interactions:

1. Set ELEVENLABS_API_KEY in environment variables
2. Create a conversational agent in ElevenLabs dashboard
3. Copy agent ID and paste in Tenant settings (elevenlabs_agent_id field)
4. The AI avatar widget automatically connects to this agent

Users can now:
- Click the floating avatar to talk to AI
- Use voice commands to navigate the CRM
- Ask questions about their data verbally
- Get verbal responses with natural voice synthesis

9.3 AI Calling (CallFluent/Thoughtly)

Automate outbound calling campaigns with AI:

CallFluent Setup:

1. Get API webhook URL from CallFluent

2. In Tenant settings, set ai_calling_providers.callfluent.webhook_url
3. Set API key if required
4. Mark callfluent.is_active = true

Thoughtly Setup:

1. Set THOUGHTLY_API_KEY in environment variables
2. Get agent ID from Thoughtly dashboard
3. In Tenant settings, set ai_calling_providers.thoughtly.agent_id
4. Mark thoughtly.is_active = true

Now you can schedule AI calls in Activities or AI Campaigns modules.

9.4 Document Processing

AI extracts structured data from images and PDFs:

Business Cards:

- Upload image of business card
- AI extracts name, email, phone, company, title
- Creates Contact and Account records automatically
- Sets processed_by_ai_doc = true for tracking

Receipts/Invoices:

- Upload receipt image or PDF
- AI extracts vendor, amount, date, items, payment method
- Creates CashFlow transaction record
- Suggests tax category and tags

9.5 AI Agent (Conversational)

The crm_assistant agent is configured in agents/crm_assistant:

It has access to:
- All CRM entities (Contact, Lead, Account, Opportunity, Activity)
- Web search via agentWebSearch function
- Tenant context (industry, business model, geography)
- DocumentationFile entity for answering "how-to" questions

Users interact via:
- Agent page (dedicated chat interface)
- FloatingAIWidget (avatar in corner of every page)
- Voice commands (if ElevenLabs configured)
- WhatsApp (if configured)

10. Webhooks & Automations

10.1 Understanding Webhooks

Webhooks allow the CRM to send data to external systems when events occur. Examples:

- New contact created -> Send to marketing automation
- Opportunity won -> Trigger invoicing system
- Lead assigned -> Notify in Slack
- Activity completed -> Update project management tool

10.2 Configuring Webhooks

Located at Settings -> Integrations -> Webhooks

1. Click "Add Webhook"
2. Choose the trigger event (e.g., contact.created)
3. Enter the target URL (usually an n8n webhook URL)
4. Optionally add description
5. Mark as active
6. Save

Available Events:

- contact.created, contact.updated, contact.deleted
- account.created, account.updated, account.deleted
- lead.created, lead.updated, lead.deleted
- opportunity.created, opportunity.updated, opportunity.deleted
- activity.created, activity.updated, activity.deleted

10.3 Webhook Payload

When an event fires, the CRM sends a POST request with JSON payload:

```
{
  "event": "contact.created",
  "timestamp": "2025-01-15T10:30:00Z",
  "tenant_id": "abc123",
  "data": {
    "id": "contact_xyz",
    "first_name": "John",
    "last_name": "Doe",
    "email": "john@example.com",
    "created_by": "user@company.com",
    "created_date": "2025-01-15T10:30:00Z"
    // ... all contact fields
  }
```

```
}
```

10.4 Testing Webhooks

To test a webhook configuration:

1. Use a service like webhook.site to get a test URL
2. Create a webhook pointing to that URL
3. Trigger the event (e.g., create a contact)
4. Check webhook.site to see if payload was received
5. Debug any issues in Settings -> System Logs

10.5 n8n Integration

n8n is a workflow automation tool that works perfectly with webhooks:

1. Create an n8n workflow
2. Add a Webhook trigger node
3. Copy the webhook URL
4. Create webhook in CRM pointing to that URL
5. Build your workflow (send to Slack, create Trello card, etc.)

> **TIP:** See Settings -> Integrations -> Webhook Examples for common n8n workflow patterns.

11. Common Administrative Tasks

11.1 Bulk User Updates

Need to change permissions for multiple users?

1. Currently, edit users individually in User Management
2. For mass changes, export user list to CSV
3. Modify in spreadsheet
4. Use backend function or contact Base44 support for bulk import

11.2 Data Cleanup Workflows

Monthly data maintenance checklist:

- Run Data Consistency Manager -> Fix Issues
- Run Denormalization Sync -> Full Sync
- Review Duplicate Detection (Contacts, Accounts)
- Clean up test data (if used)
- Archive old completed activities (> 1 year)
- Review and merge duplicate BizDev Sources
- Check Data Quality Report for incomplete records

11.3 Performance Tuning

If the system feels slow:

1. Check Performance Monitor for bottlenecks
2. Review Integration Usage for rate limiting
3. Run Database Size check - consider archiving old data
4. Clear browser cache and hard reload (Ctrl+Shift+R)
5. Check System Logs for errors
6. Verify cron jobs are running (Settings -> Cron Job Manager)

11.4 Onboarding New Tenants

Standard onboarding checklist:

1. Create Tenant with industry and branding
2. Invite first admin user for that tenant
3. Admin user logs in and completes profile
4. Configure tenant-specific integrations (AI calling, etc.)
5. Import initial data (contacts, accounts) if needed
6. Set up navigation permissions for user roles

7. Create sample data or conduct training
8. Schedule follow-up check-in after 1 week

12. Troubleshooting Guide

12.1 User Cannot See Records

Most common support issue. Follow this diagnostic:

Step 1: Verify User Setup

- Go to Settings -> User Management
- Find the user, click Edit
- Check that tenant_id is set correctly
- Verify employee_role (manager sees all, employee sees own)
- Confirm is_active = true

Step 2: Check Record Ownership

- If employee_role = "employee", they only see records where:
    * * created_by = their email, OR
    * * assigned_to = their email
- Check the record in question - is it assigned to them?

Step 3: Run Diagnostic

- Settings -> Diagnostics -> User Record Diagnostic
- Enter user email
- Click "Run Diagnostic"
- Review the report showing what they can/cannot see and why

> **TIP:** If diagnostic shows RLS blocking access, either change their employee_role to manager or reassign records to them.

12.2 Lead Visibility Issues

Leads have special visibility rules:

- Leads MUST have tenant_id set
- Leads MUST have assigned_to set (or user is manager)
- Lead.assigned_to must match User.email exactly

To diagnose:

1. Settings -> Diagnostics -> Lead Visibility Diagnostic
2. Select a lead that user cannot see
3. Review the report
4. Click "Fix Lead Assignment" if offered

12.3 Integration Failures

If OpenAI, Twilio, or other integrations are not working:

1. Settings -> Integration Usage -> Check for errors
2. Verify API key is set in environment variables
3. Test the integration directly (click "Test" button if available)
4. Check external service status page (status.openai.com, etc.)
5. Review System Logs for error messages

12.4 Cron Jobs Not Running

If automated tasks are not executing:

1. Settings -> Cron Job Manager
2. Check "Last Executed" timestamp for each job
3. If stale (> 1 hour old), click "Run Now" to test
4. If still failing, check System Logs for cron errors
5. Verify cronJobRunner function is deployed and working

12.5 Data Corruption

If you suspect data corruption:

1. Run Settings -> Data Consistency Manager immediately
2. Review issues found, note which entities affected
3. Click "Fix Issues" to auto-correct
4. Run Settings -> Data Quality Report
5. If major issues persist, contact Base44 support for database restore

> **WARNING:** Always back up data before major fixes or imports. Use CSV export as a safety net.

13. Database Schema & Architecture

13.1 Core Entities

The CRM database consists of these primary entities:

Contact:

- Represents individual people
- Links to Account via account_id
- Has activities, opportunities, notes
- Key fields: tenant_id, assigned_to, email, phone, status

Account:

- Represents companies/organizations
- Parent to multiple Contacts
- Linked to Opportunities
- Key fields: tenant_id, name, industry, type

Lead:

- Potential customer not yet qualified
- Converts to Contact + Account + Opportunity
- Has scoring and qualification workflow
- Key fields: tenant_id, assigned_to, status, score

Opportunity:

- Sales deal tracking
- Links to Account and Contact
- Has stages, amount, close_date
- Key fields: tenant_id, assigned_to, stage, amount

Activity:

- Tasks, calls, meetings, emails
- Links to Contact, Lead, Account, or Opportunity
- Scheduled or completed
- Key fields: tenant_id, assigned_to, type, status, due_date

13.2 Denormalized Fields

For performance, some data is cached (denormalized):

- Contact.account_name <- Account.name
- Lead.assigned_to_name <- User.full_name
- Opportunity.contact_email <- Contact.email
- Activity.related_name <- (depends on related_type)

These are kept in sync by cronDenormalizationSync job every 6 hours.

13.3 Row-Level Security (RLS)

Every entity has RLS rules in the schema:

```
"rls": {
  "read": {
    "$or": [
      {"user_condition": {"role": "admin"}},
      {"$and": [
        {"tenant_id": "{{user.tenant_id}}"},
        {"$or": [
          {"user_condition": {"employee_role": "manager"}},
          {"assigned_to": "{{user.email}}"}
        ]}
      ]}
    ]
  },
  "write": { /* similar */ }
}
```

This enforces data isolation automatically at the database level.

14. Performance Optimization

14.1 Query Optimization

- Use filter() instead of list() when possible (narrows results)
- Limit results with the limit parameter (default 100)
- Use indexes on frequently filtered fields (tenant_id, assigned_to, status)
- Avoid N+1 queries by denormalizing related data

14.2 Caching Strategy

- TanStack Query caches API responses automatically
- Cache duration: 5 minutes for list data, 10 minutes for detail data
- Invalidate cache on mutations (create, update, delete)
- Use ApiManager for centralized cache control

14.3 Data Archival

Archive old data to improve performance:

- Activities > 1 year old and completed
- Opportunities closed (won/lost) > 1 year ago
- BizDev Sources that have been promoted or are inactive

Use Settings -> Data Management -> Archive Old Data

14.4 Monitoring Performance

- Set up alerts when API response times > 2 seconds
- Review Performance Monitor weekly
- Track database size growth monthly
- Monitor integration usage to avoid rate limits

15. Backup & Disaster Recovery

15.1 Base44 Automatic Backups

Base44 platform automatically backs up your database:

- Continuous backups (point-in-time recovery)
- Daily snapshots retained for 7 days
- Weekly snapshots retained for 4 weeks
- Monthly snapshots retained for 6 months

To request a restore, contact Base44 support with:
- Tenant ID
- Approximate date/time to restore to
- Justification for restore

15.2 Manual Export Backups

Create your own backups by exporting data:

1. Go to each module (Contacts, Leads, Accounts, Opportunities)
2. Click "Export CSV"
3. Save files with datestamp (e.g., contacts_2025-01-15.csv)
4. Store in secure location (encrypted cloud storage)

> **TIP:** Automate monthly exports and store for compliance/audit purposes.

15.3 Disaster Recovery Plan

In case of catastrophic failure:

1. Contact Base44 support immediately
2. Provide incident details and impact assessment
3. Request point-in-time database restore
4. If restore not possible, import from CSV backups
5. Notify affected users of service disruption
6. Document lessons learned and update DR plan

15.4 Testing Recovery

Test your DR plan quarterly:

1. Create a test tenant

2. Export data from production
3. Import into test tenant
4. Verify data integrity and completeness
5. Time the recovery process
6. Update DR documentation with findings