

ENTERPRISE CALL ACCOUNTING SYSTEM

ARCHITECTURE OVERVIEW

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1. OVERVIEW

The Enterprise Call Accounting System (ECAS) is a four-tier application designed around a clean separation of concerns:

- Tier 1 — PBX Systems (external data sources)
- Tier 2 — Collection (data ingestion and parsing)
- Tier 3 — Database (shared persistence layer)
- Tier 4 — Presentation (REST API + Blazor web UI)

The key architectural principle is that the Collection Service and the Web Application communicate **ONLY** through the database.

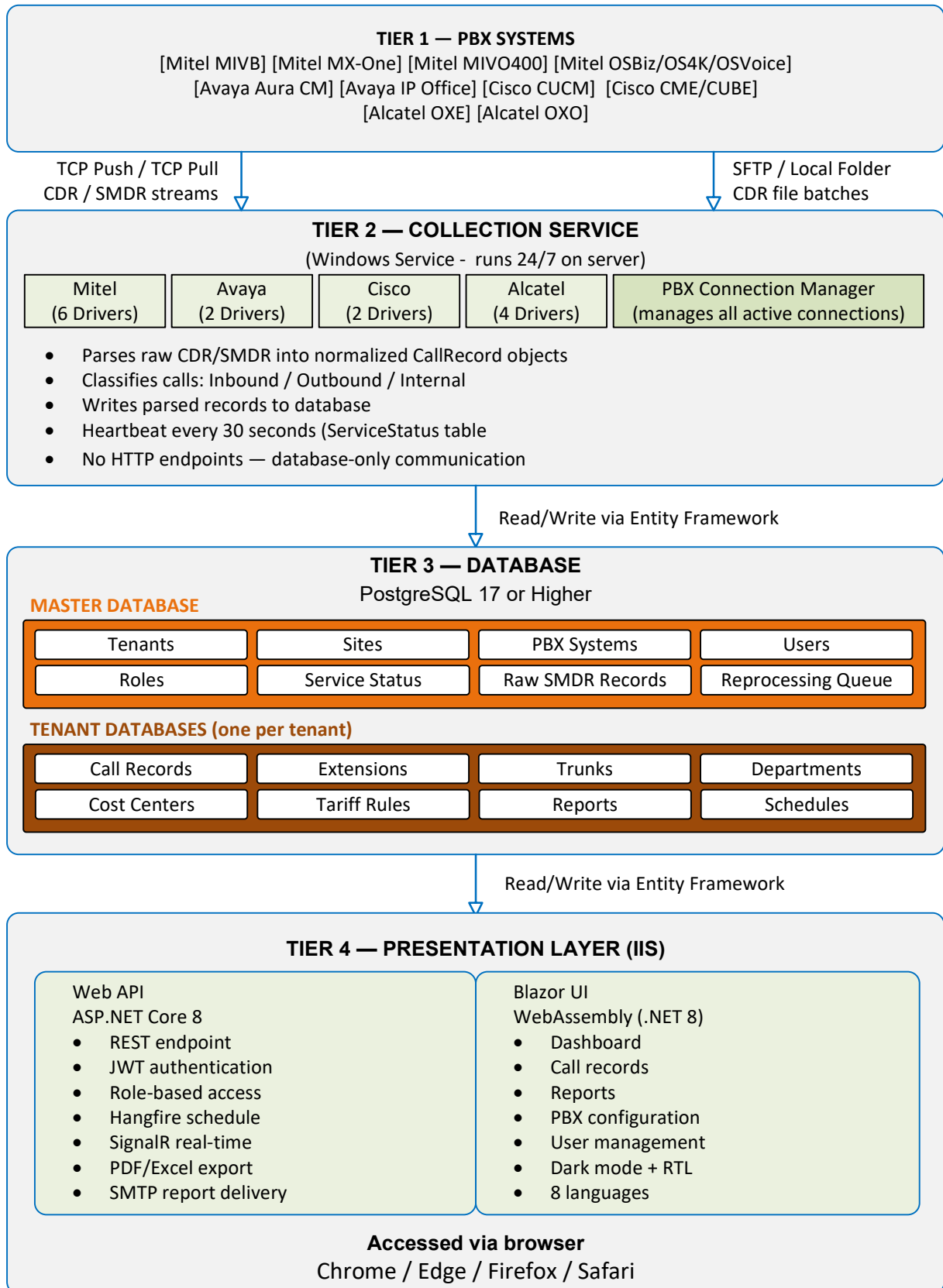
There is no direct network connection between them. This means each component can be restarted, updated, or scaled independently without affecting the other.



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2. ARCHITECTURE DIAGRAM



3. COMPONENT DESCRIPTIONS

COLLECTION SERVICE

A Windows Service that runs continuously in the background, managing all connections to PBX systems.

Key responsibilities:

- Maintain persistent TCP connections to PBX systems (push mode)
- Initiate TCP connections to PBX systems (pull mode)
- Poll SFTP servers or local folders for CDR files
- Parse raw CDR/SMDR data using vendor-specific drivers
- Normalize parsed data into a unified call record format
- Classify calls as inbound, outbound, or internal
- Persist processed call records to the tenant database
- Report health status via Service Status table (heartbeat)
- Automatically reconnect on PBX failure

The Collection Service has NO HTTP server. It does not expose any web service endpoints. All Communication with the Web API occurs through the shared database only.

PBX DRIVERS

Each PBX system is supported by a dedicated driver that encapsulates all vendor-specific parsing logic. Drivers are isolated and can be updated independently.

Driver Category	Systems
Mitel Drivers (6)	MiVoice Business, MX-ONE, OpenScape 4000, OpenScape Voice, OpenScape Business and MiVoice Office 400
Avaya Drivers (2)	Aura CM, IP Office
Cisco Drivers (2)	CUCM, CME/CUBE
Alcatel Drivers (4)	OXE, OXO, OpenTouch, 4400

BLAZOR UI

A Blazor WebAssembly single-page application that runs entirely in the browser. Communicates with the Web API over HTTPS using JWT authentication.

Key features:

- Interactive dashboard with real-time charts (ApexCharts)
- Call records grid with filtering, sorting, and export
- Report builder with parameter selection
- PBX connection status monitoring
- Extension and department management
- Full dark mode support
- RTL (right-to-left) layout for Arabic language
- 8 language localizations with dynamic switching

WEB API

An ASP.NET Core 8 REST API hosted under IIS. Serves all data to the Blazor UI and handles all business logic including:

- User authentication (JWT Bearer tokens)
- Role-based access control (5 roles, 50+ permissions)
- Call record queries and filtering
- Report generation (PDF via QuestPDF, Excel via EPPlus)
- Scheduled report jobs (Hangfire background jobs)
- PBX system configuration management
- Multi-tenant data routing
- System administration (backup, restore, branding)

DATABASE

PostgreSQL (primary) or SQL Server (enterprise option). Organized into a master database and per-tenant databases.

Master DB:	Shared system-level data — tenants, users, PBX configurations, roles, service status
Tenant DBs:	Isolated call data per tenant — call records, extensions, departments, cost centres, reports

This separation ensures that tenant data is completely isolated. Tenants cannot access each other's call records.



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4. DATA FLOW

CDR INGESTION (REAL-TIME)

- PBX sends raw CDR/SMDR data over TCP to Collection Service (or Collection Service connects to PBX in pull mode)
- The appropriate vendor driver receives and parses the raw data into a normalized SMDR Parse Result object
- The Collection Service classifies the call (inbound, outbound, internal) and enriches it with site and PBX system metadata.
- The parsed Call Record is written to the tenant's Call Records table in PostgreSQL
- If raw SMDR storage is enabled, the raw text is also written to Raw SMDR Records (retained for 365 days)

CDR ACCESS (WEB INTERFACE)

- User opens the browser and authenticates via the Blazor UI (JWT token issued by Web API)
- User navigates to Call Records, applies filters (date range, extension, direction, PBX, etc.)
- Blazor UI sends an authenticated REST request to the Web API
- Web API queries the tenant's CallRecords table with the applied filters
- Results are returned as JSON and rendered in the browser grid
- User can export to Excel or PDF on demand, or schedule automated report delivery via email

REAL-TIME MONITORING

- The dashboard polls the Web API every 30–60 seconds for live call statistics
- Collection Service status (connected/disconnected) is visible in real time via the ServiceStatus heartbeat
- New call records appear on the dashboard without requiring a full page refresh

5. COLLECTION METHODS

TCP PUSH (PBX INITIATES CONNECTION)

The PBX is configured to send CDR/SMDR records to the ECAS server. The Collection Service listens on a configured TCP port and accepts connections from the PBX.

PBX —TCP—► Collection Service (listener)

Supported by: Mitel MX-ONE, OpenScope 4000/Voice/Business, MiVoice Office 400, Avaya Aura CM, Cisco CME/CUBE, Alcatel OXE/OXO/OpenTouch/4400

Advantages: Real-time delivery, minimal configuration on the ECAS side

TCP PULL (ECAS INITIATES CONNECTION)

The Collection Service connects to the PBX and retrieves CDR records. The PBX acts as a server.

Collection Service —TCP—► PBX (listener)

Supported by: Mitel MiVoice Business, Avaya IP Office

Advantages: Works when PBX cannot initiate outbound connections (behind NAT/firewall)

SFTP / LOCAL FOLDER

The Collection Service periodically polls an SFTP server or local/network folder for CDR files. Files are read, parsed, and then moved to a processed folder.

Collection Service —SFTP—► SFTP Server

Collection Service —reads—► Local/Network Folder

Supported by: Cisco CUCM, Mitel OpenScope Voice

Advantages: Works for batch-oriented systems that generate CDR files rather than streams. No persistent TCP connection required.



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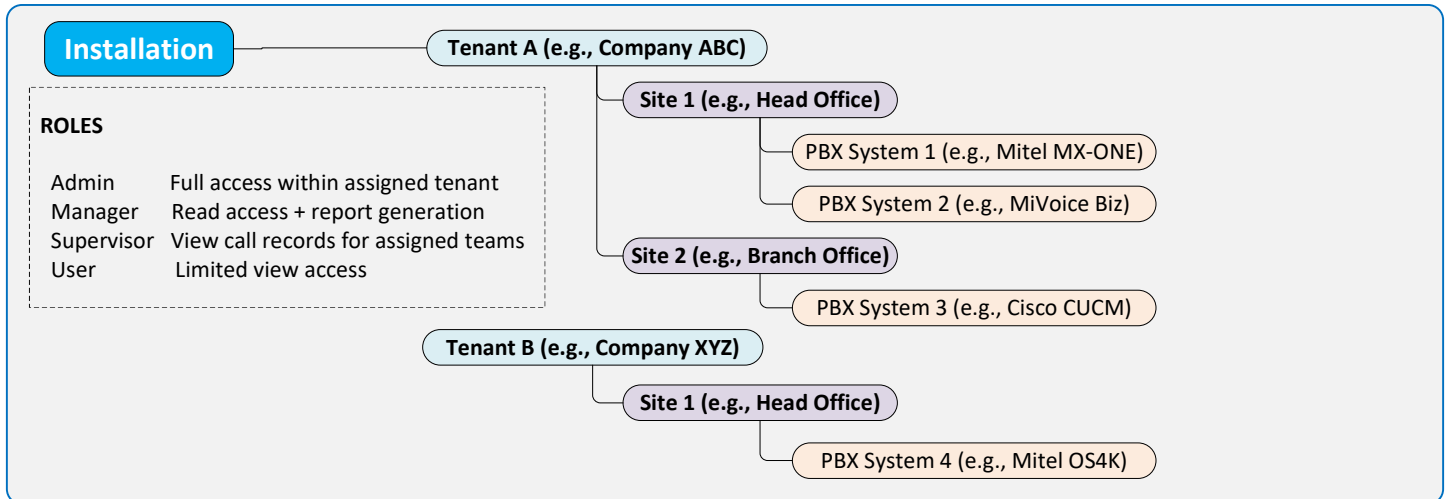
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6. MULTI-TENANT ARCHITECTURE

ECAS supports full multi-tenancy. A single installation can serve multiple organizations (tenants), each with their own:

- Isolated database (per-tenant schema/database)
- Independent PBX systems and sites
- Separate user accounts and role assignments
- Custom branding (logo, colors, report headers)
- Independent report schedules and tariff tables

HIERARCHY



7. SECURITY ARCHITECTURE

AUTHENTICATION

- JWT Bearer tokens with configurable expiry (default 60 min)
- Unique RSA-generated JWT secret per installation
- Secure login page with brute-force protection

AUTHORIZATION

- Role-Based Access Control (RBAC)
- 5 built-in roles with 50+ granular permissions
- Permissions enforced at both API and UI layers
- Tenant-scoped data access — users cannot see other tenants

DATA ISOLATION

- Per-tenant databases ensure complete call data isolation
- API enforces tenant context on every request

TRANSPORT SECURITY

- HTTPS (TLS 1.2+) for all web traffic (recommended)
- Certificates managed via IIS*
- SMTP communication supports TLS/SSL for report delivery

LICENSING

- RSA-SHA256 digital signature on license files
- Hardware binding (machine-specific license validation)
- License expiry enforcement at application start-up

* SSL Certificate provided by Customer



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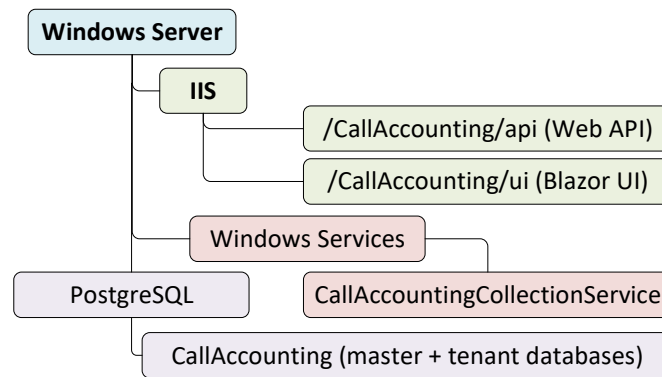
8. TECHNOLOGY STACK

Layer	Technology
Runtime	.NET 8.0
Web Framework	ASP.NET Core 8
Frontend	Blazor WebAssembly (.NET 8)
Database ORM	Entity Framework Core 8
Primary Database	PostgreSQL 17
Alt Database	Microsoft SQL Server 2019+
Web Server	IIS 10+ (Windows)
Background Jobs	Hangfire 1.8
Real-Time	SignalR
PDF Reports	QuestPDF
Excel Reports	EPPlus
Charts (UI)	ApexCharts (Blazor-ApexCharts)
SFTP Client	SSH.NET
Logging	Serilog (structured logging)
API Documentation	Swagger / OpenAPI

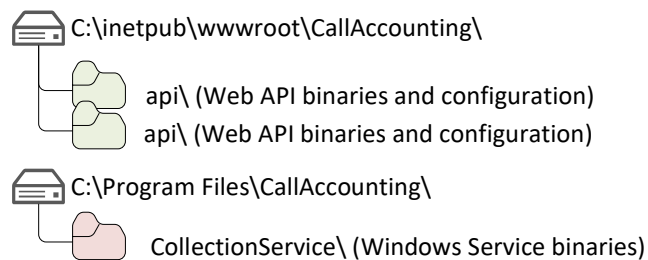
9. DEPLOYMENT ARCHITECTUR

SINGLE-SERVER DEPLOYMENT (STANDARD)

All components run on a single Windows Server. This is the recommended configuration for most deployments.



FOLDER STRUCTURE



AUTOMATED INSTALLER

The ECAS installer (CallAccountingSetup.exe) performs all deployment steps automatically. Manual deployment via the Deploy.ps1 PowerShell script is also available for system administrators who prefer scripted deployments.