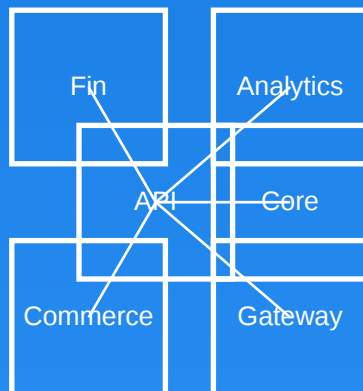


VCS One Commerce

Technical Architecture Guide

Architecture, APIs, and Implementation Details



Launch Anywhere. Sell Everywhere.

Architecture Overview

Microservices Architecture

VCS One Commerce is built on a modern microservices architecture that enables horizontal scaling, independent deployment, and technology diversity across services.

Core Service Components

API Gateway (Nginx): Single entry point for all client requests, handles load balancing, SSL termination, rate limiting, and routing to backend services

Core Service (Python/FastAPI): Authentication, user management, tenant management, and system-wide configuration

Commerce Service (Node.js/NestJS): Product catalog, cart, order management, checkout workflow, and commerce-specific business logic

FinCloud Service (Python/FastAPI): Financial operations including forex processing, tax calculations, and payment reconciliation

Analytics Service (Python/FastAPI): Data aggregation, reporting, and AI/ML operations for personalization and analytics

Secure Service (Python/FastAPI): Security operations, audit logging, compliance tracking, and threat detection

API-First Design

All services expose RESTful and GraphQL APIs with comprehensive OpenAPI/Swagger documentation. The platform follows the twelve-factor app methodology for cloud-native deployment.

API Design Principles

- RESTful resource-based URLs with standard HTTP methods (GET, POST, PUT, PATCH, DELETE)

- GraphQL for flexible, client-driven queries and efficient data fetching

- Stateless authentication using JWT tokens with OAuth 2.0 / OpenID Connect

- Consistent error handling with structured error responses

- Versioning strategy: URL-based (v1, v2) and header-based semantic versioning

- Rate limiting per API key and per user with configurable quotas

- Request/response logging with correlation IDs for distributed tracing

Headless Architecture

The platform is fully headless, separating backend commerce logic from frontend presentation. This enables deployment of multiple storefronts (web, mobile, kiosk, voice assistants) all consuming the same backend APIs.

Headless Components

- Backend API layer with business logic, data persistence, and integrations

- Content Delivery Network (CDN) for static assets and performance optimization

- Frontend Application SDKs for React, Next.js, Vue, and mobile frameworks

- Webhook system for real-time event notifications and data synchronization

- Pre-built frontend components and templates for rapid storefront development

Database Schema Overview

Each microservice maintains its own database following the Database-Per-Service pattern. PostgreSQL is used as the primary relational database with Redis for caching and Celery for asynchronous task processing.

Data Architecture

Core Service DB: Users, tenants, roles, permissions, system configuration

Commerce Service DB: Products, variants, catalogs, carts, orders, payments

FinCloud Service DB: Forex rates, tax rules, duties, financial transactions

Analytics Service DB: Events, metrics, reports, ML model configurations

Redis Cache: Session storage, rate limiting, real-time inventory updates

Message Queue (Celery/RabbitMQ): Async task processing, event streaming

Infrastructure: Multi-Cloud Deployment

VCS One Commerce is cloud-agnostic and can be deployed on AWS, Azure, GCP, or hybrid environments. Infrastructure is defined as code using Terraform and managed via Kubernetes.

Infrastructure Components

Containerization: Docker containers orchestrated via Kubernetes for high availability and auto-scaling

Service Mesh: Istio for service-to-service communication, load balancing, and security policies

Monitoring: Prometheus for metrics, Grafana for visualization, ELK stack for logging

CI/CD: GitLab CI or GitHub Actions for automated testing, building, and deployment pipelines

Storage: Object storage (S3/Blob/GCS) for media, managed PostgreSQL instances for databases

CDN: CloudFront/CloudFlare for global content delivery and DDoS protection

Core Modules Deep Dive

Forex & Tax-Smart Checkout

Real-time foreign exchange processing and comprehensive tax calculation engine for international commerce compliance.

FX Rate Processing

Integration with multiple FX data providers (XE, OANDA, Fixer.io) with automatic failover and weighted averaging

Real-time rate updates every 15 seconds with historical rate storage for reconciliation

Configurable margin/markup policies with dynamic pricing rules based on transaction volume and currency pairs

Rate locking mechanism: 10-minute quote validity for cart-to-checkout flow

Tax Calculation Engine

Rule-based tax engine supporting VAT, GST, sales tax, and consumption tax across 200+ jurisdictions

Product tax classification using HS (Harmonized System) codes with automatic taxability determination

Customer location detection via IP geolocation, billing address, and explicit selection

Real-time duty calculation for cross-border shipments based on origin, destination, and incoterms

Invoice generation with tax breakdown, compliance documentation, and digital signatures

AI-Driven Localization

Machine learning-powered content adaptation, cultural optimization, and personalized user experiences.

ML Models & Processing

Neural machine translation (NMT) using transformer models fine-tuned on domain-specific commerce terminology

Sentiment analysis and cultural adaptation of product descriptions and marketing copy

Recommendation engine using collaborative filtering and content-based algorithms with real-time A/B testing

Price elasticity modeling using historical sales data, competitor intelligence, and demand forecasting

Image recognition for automatic product categorization and visual search capabilities

Content Translation Pipeline

Multi-stage translation workflow: initial draft, human review, cultural validation, and quality assurance

Translation memory system to maintain consistency and reduce costs for repeated content

Leverage community translations with crowd-sourced validation and voting mechanisms

SEO optimization for translated content including meta tags, alt text, and structured data markup

Marketplace Vendor Hub

Comprehensive multi-tenant vendor management with automated onboarding, performance tracking, and financial operations.

Multi-Tenant Architecture

Row-level security with tenant isolation using shared database with application-level filtering

Vendor-specific data partitioning with independent product catalogs and order workflows

Configurable commission structures with tiered pricing, promotional discounts, and volume-based incentives

Performance SLAs with automated penalty calculations and dispute resolution workflows

KYC/KYB Workflows

Automated identity verification using government ID scanning, liveness detection, and document OCR

Business registration validation with real-time checks against business registries and commercial databases

Bank account verification via micro-deposit validation and SWIFT/BIC code verification

Risk scoring algorithms using credit checks, transaction history, and behavioral analytics

Compliance monitoring with ongoing sanctions screening and adverse media checks

Sustainability Tracker

Comprehensive environmental impact calculation and reporting for products and logistics.

Carbon Calculation Algorithms

Life Cycle Assessment (LCA) methodology using IPCC emission factors and industry databases (Ecoinvent, DEFRA)

Manufacturing emissions based on material composition, energy consumption, and production methods

Transportation emissions calculated from shipment weight, distance, and mode (air/sea/road/rail) with carrier-specific fuel efficiency data

Packaging footprint analysis including material sourcing, production, and end-of-life disposal

Offset recommendations with integration to certified carbon offset marketplaces

Logistics API Integrations

Carrier integrations: DHL, FedEx, UPS, USPS, Shippo, EasyShip for real-time shipping calculations

Route optimization algorithms to minimize carbon impact while meeting delivery SLA requirements

Alternate delivery options: consolidation, slower shipping modes, local fulfillment centers

Real-time tracking and carbon impact updates throughout the delivery lifecycle

API Reference

Authentication

All API requests require OAuth 2.0 authentication. Client credentials are provided through environment variables or API key management dashboard.

OAuth 2.0 Endpoints

Endpoint	Description
POST /oauth/token	Obtain access token using client credentials or authorization code
POST /oauth/revoke	Revoke access token
GET /oauth/userinfo	Get authenticated user information
POST /oauth/refresh	Refresh access token using refresh token

Product Catalog APIs

Endpoint	Description
GET /api/v1/products	List products with filtering, sorting, pagination
GET /api/v1/products/{id}	Get product details by ID
POST /api/v1/products	Create new product
PUT /api/v1/products/{id}	Update product
DELETE /api/v1/products/{id}	Delete product
GET /api/v1/products/{id}/variants	List product variants
POST /api/v1/products/{id}/reviews	Submit product review

Order Management APIs

Payment & Tax APIs

Integration Webhooks

Webhooks provide real-time notifications for key events. Configure webhook URLs in the developer dashboard and verify payload signatures using HMAC-SHA256.

order.created, order.updated, order.shipped, order.delivered
payment.succeeded, payment.failed, payment.refunded
product.updated, inventory.low_stock
vendor.onboarded, vendor.suspended, vendor.removed

Integration Patterns

Headless Frontend Integration

Connect any frontend framework to the VCS One Commerce APIs. SDKs are available for popular frameworks with pre-built components and hooks.

Next.js Integration Example

```
import { useProducts } from '@vcs-commerce/nextjs-sdk'; function ProductList() { const { products, loading } = useProducts({ filters: { isActive: true }, limit: 20 }); if (loading) return ; return ( {products.map(product => ( ))} ); }
```

React Integration Example

```
import { CartProvider } from '@vcs-commerce/react'; function App() { return ( ); }
```

Payment Gateway Integration

The platform integrates with major payment processors through a unified payments API. Payment methods are automatically configured based on merchant settings and customer location.

Supported Payment Providers

Stripe: Credit/debit cards, Apple Pay, Google Pay, ACH, SEPA, and 120+ payment methods globally

PayPal: PayPal Checkout, Venmo, Pay Later options, and localized payment flows

Regional Providers: GrabPay, Alipay, WeChat Pay, iDEAL, Klarna, Afterpay, Affirm, and many more

Bank Transfers: Automated reconciliation and invoice generation for B2B transactions

Shipping Provider Integration

Calculate shipping costs in real-time and generate labels through integrated carriers and aggregator services.

Direct Carriers: DHL, FedEx, UPS, USPS with full API integration for rates, tracking, and label generation

Aggregators: Shippo, EasyShip, ShipStation for multi-carrier rate comparison and label printing

Regional Carriers: Local postal services and fulfillment providers for southeast Asia, Europe, and Latin America

Custom Integration: Webhook-based integration for proprietary logistics systems

ERP/CRM Integration

Synchronize product catalogs, orders, customers, and inventory data with enterprise systems using pre-built connectors or API-based integration.

Salesforce: Bidirectional sync for customers, orders, and leads with Salesforce Commerce Cloud integration

SAP: Product master data, inventory, and order fulfillment via SAP BAPI and IDoc protocols

Oracle NetSuite: Financial data, inventory levels, and customer records with suitelet customization support

Generic Integration: REST API with webhook subscriptions for custom system integrations

Security & Compliance

PCI-DSS Compliance

VCS One Commerce is PCI-DSS Level 1 certified. Payment card data is never stored on our servers. We leverage tokenization and hosted payment fields from PCI-compliant payment processors.

End-to-end encryption for payment data transmission using TLS 1.3+

Tokenization for secure storage of payment method references

Segmentation of cardholder data environment with network isolation

Regular security testing including quarterly vulnerability scans and annual penetration testing

Access control with role-based permissions and multi-factor authentication for administrative users

Data Encryption

All data is encrypted both in transit and at rest using industry-standard algorithms and key management practices.

In Transit: TLS 1.3 with perfect forward secrecy for all API communications, WebSocket connections, and webhook deliveries

At Rest: AES-256 encryption for databases and object storage with separate encryption keys per tenant

Key Management: AWS KMS, Azure Key Vault, or Google Cloud KMS for centralized key management with automated rotation

Database Security: Transparent Data Encryption (TDE) for PostgreSQL with encrypted backups and replication

GDPR Compliance

Full compliance with GDPR and regional data protection regulations including privacy-by-design principles and comprehensive data subject rights management.

Explicit consent management with granular permissions and audit trails

Right to access: data export in machine-readable formats (JSON, CSV)

Right to deletion: secure data purging with retention policy compliance

Data minimization: automatic purging of unnecessary personal data

Privacy Impact Assessments (PIAs) for new features and data processing activities

Data breach notification: automated detection and 72-hour reporting workflows

Multi-Region Data Residency

Data residency controls ensure customer data remains within designated geographic boundaries to comply with local regulations (e.g., data sovereignty laws).

Configurable data residency policies with automatic routing to region-specific databases and storage. Cross-region data replication disabled by default with explicit consent required for cross-border data transfers.

Developer Resources

- **Developer Portal:**
<https://vcsmys.com/developers>
- **API Documentation:**
<https://vcsmys.com/api/docs>
- **SDK Downloads:**
<https://vcsmys.com/sdk>
- **Integration Guides:**
<https://vcsmys.com/integrations>
- **Code Examples:**
<https://vcsmys.com/examples>
- **Support & Forums:**
<https://vcsmys.com/support>

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