

# 03 Design Phase

SECURAA Security Documentation

## SECURAA Secure SDLC - Design Phase

### Secure Architecture Design and Security Review

### Document Control

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### Phase Overview

The Design Phase translates security requirements into a secure technical architecture. This phase ensures security controls are built into the system design from the beginning, following the "Security by Design" principle.

### Phase Objectives

- Design Secure Architecture** - Create architecture that implements security controls
- Define Security Controls** - Specify technical security mechanisms

- 3. Review Data Flows** - Ensure secure data handling throughout the system
- 4. Plan Security Testing** - Define how security will be tested
- 5. Document Security Design** - Create comprehensive security design documentation

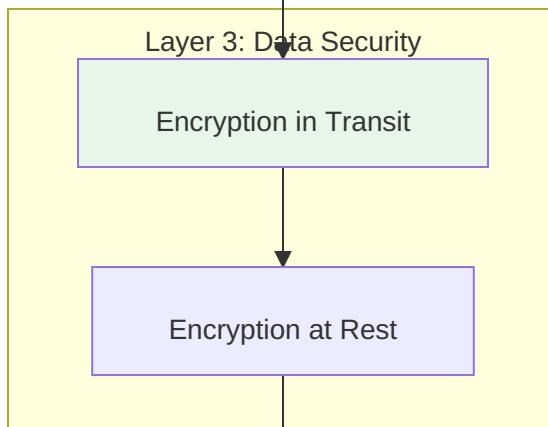
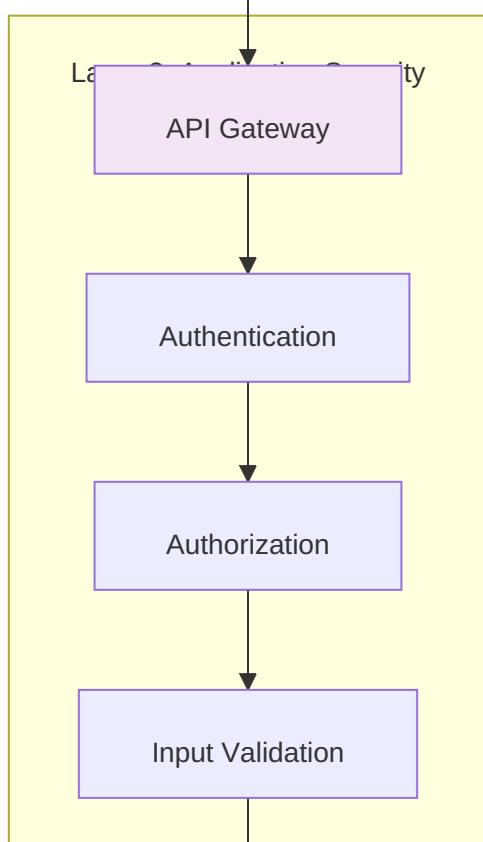
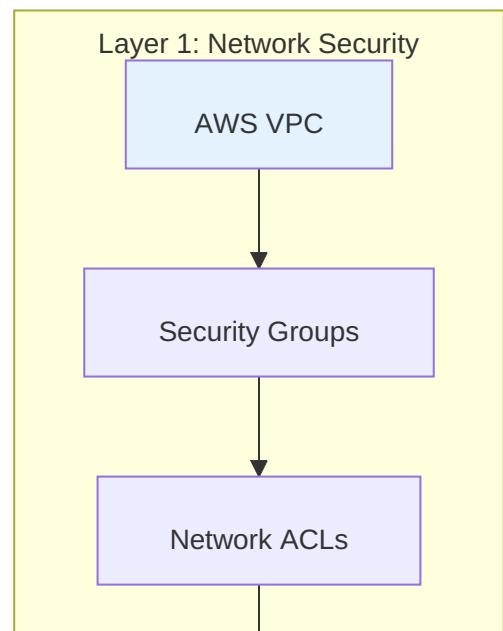
## Phase Duration

- **Simple Feature:** 2-3 days
  - **Medium Feature:** 1 week
  - **Major Feature/Project:** 2-3 weeks
- 

## Secure Architecture Principles

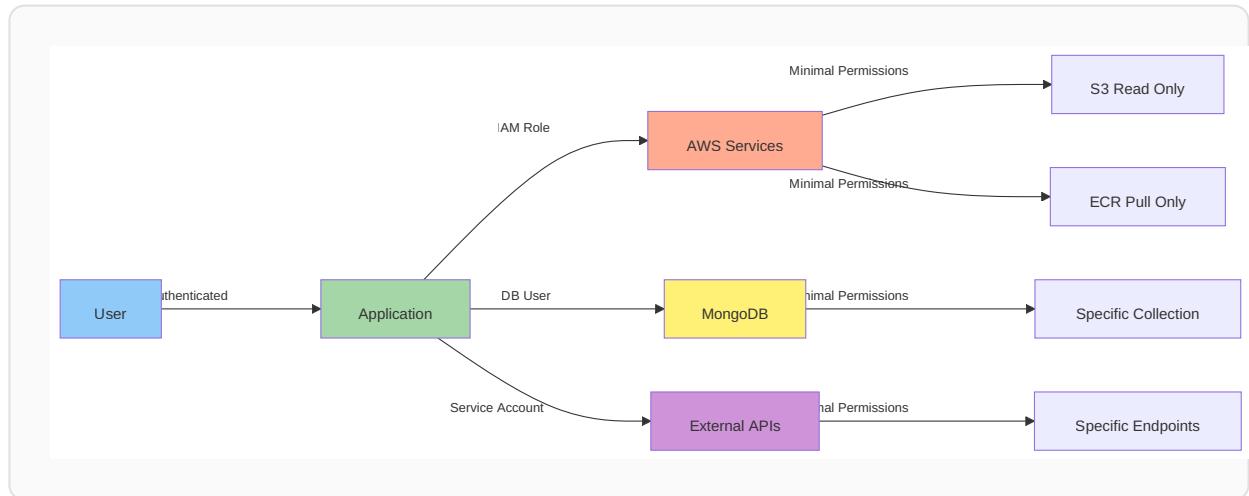
### Defense in Depth

Implement multiple layers of security controls:



## Least Privilege

Every component operates with minimum necessary permissions:



## Fail Secure

System fails in a secure state:

```
// Example: Fail secure pattern
func AuthorizeRequest(ctx context.Context, userID string, resource string) (bool, error) {
    // If authorization service is unavailable, deny access (fail secure)
    permissions, err := authService.GetPermissions(ctx, userID)
    if err != nil {
        logger.Error("Authorization service error", "error", err)
        return false, err // Deny access on error
    }

    // Check permissions
    return permissions.HasAccess(resource), nil
}
```

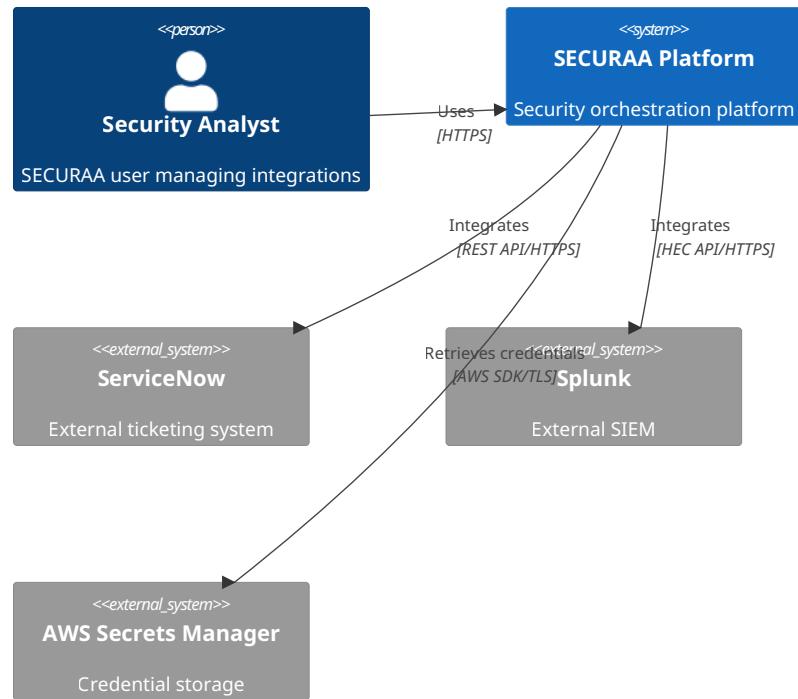
## Architecture Design Process

### Step 1: Component Diagram

Define all system components and their interactions:

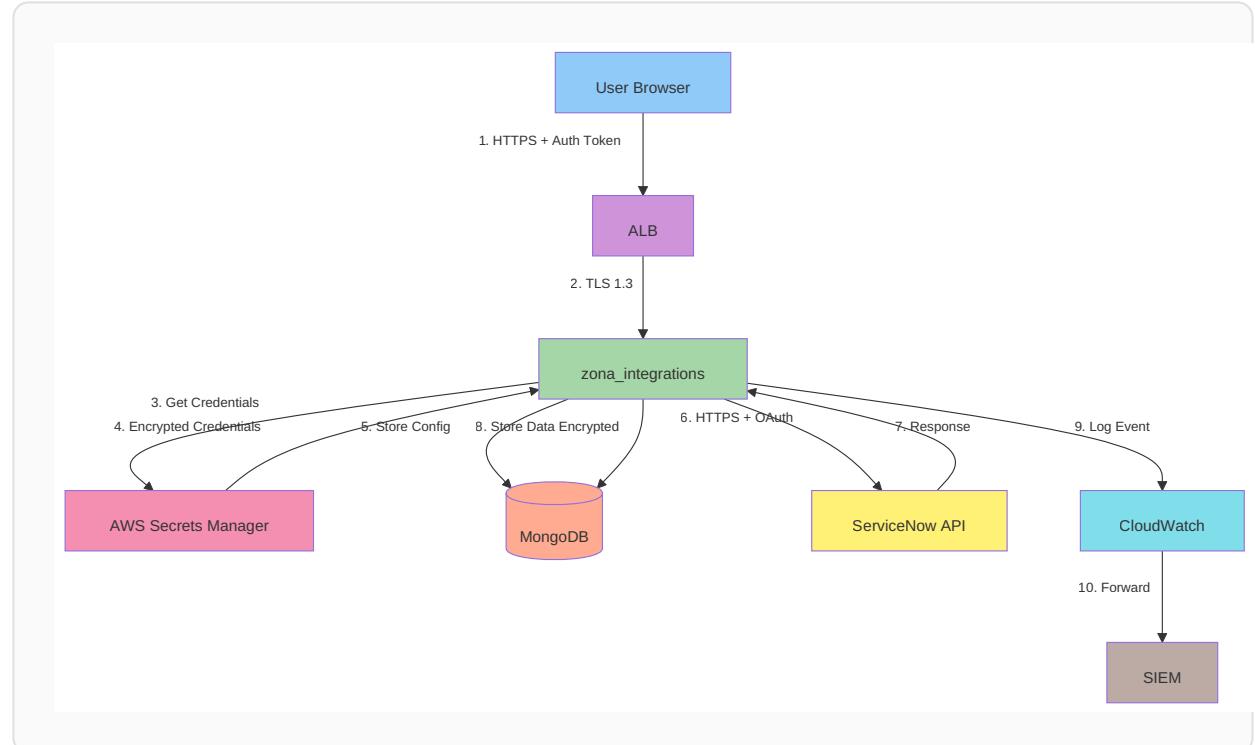
#### Example: Integration Service Architecture

### System Context - Integration Service



## Step 2: Data Flow Diagram

Map data flows with security controls:



## Step 3: Security Control Design

For each component, design security controls:

### Authentication Design

```

component: API Authentication

authentication_methods:
  primary:
    type: JWT (JSON Web Token)
    algorithm: HS256
    token_expiry: 1 hour
    refresh_token_expiry: 7 days
    secret_storage: AWS Secrets Manager
    rotation_policy: 90 days

  secondary:
    type: API Key
    format: "securaa_api_[random_32_chars]"
    storage: Hashed with bcrypt (cost factor 12)
    rate_limiting: 1000 requests/hour

administrative:
  type: MFA (Multi-Factor Authentication)
  methods: [TOTP, SMS, Email]
  enforcement: Required for admin operations
  session_timeout: 15 minutes

```

```
implementation:
  library: github.com/golang-jwt/jwt/v5
  middleware: AuthenticationMiddleware()
  error_handling: Generic error messages (no details)
  logging: Authentication success/failure events

security_features:
  - Token signature verification
  - Token expiration validation
  - Token revocation support (blacklist)
  - Brute force protection (5 attempts, 15-minute lockout)
  - Concurrent session detection
```

## Authorization Design

```
component: Authorization & Access Control

model: Role-Based Access Control (RBAC)

roles:
  - name: admin
    permissions:
      - integration:create
      - integration:read
      - integration:update
      - integration:delete
      - integration:execute
      - user:manage

  - name: analyst
    permissions:
      - integration:read
      - integration:execute
      - case:create
      - case:update

  - name: viewer
    permissions:
      - integration:read
      - case:read

permission_format: "resource:action"

enforcement:
  - Middleware: AuthorizationMiddleware()
  - Decorator: @RequirePermission("integration:create")
  - Function: HasPermission(user, "integration", "create")
```

```
storage:
  type: MongoDB collection
  schema:
    user_id: string
    roles: array[string]
    permissions: array[string]
    granted_at: timestamp
    granted_by: string

caching:
  enabled: true
  ttl: 300 seconds
  invalidation: On permission change

audit:
  log_event: authorization_check
  fields: [user_id, resource, action, result, timestamp]
```

## Data Protection Design

```
component: Data Encryption

encryption_at_rest:
  algorithm: AES-256-GCM
  key_management:
    service: AWS KMS
    key_rotation: Automatic (365 days)
    key_alias: "alias/securaa-data-encryption"

encrypted_fields:
  - integration_credentials
  - api_tokens
  - customer_pii
  - sensitive_case_data

implementation:
  library: securaa_lib/encrypt_decrypt
  function: CredentialsEncrypt(data, key)

encryption_in_transit:
  protocol: TLS 1.3
  minimum_version: TLS 1.2
  cipher_suites:
    - TLS_AES_256_GCM_SHA384
    - TLS_AES_128_GCM_SHA256
    - TLS_CHACHA20_POLY1305_SHA256
```

```
certificate_management:
  provider: AWS Certificate Manager
  renewal: Automatic
  validation: DNS validation

implementation:
  load_balancer: ALB with TLS termination
  backend: TLS for service-to-service communication
  external: HTTPS only for external APIs

data_masking:
  pii_fields:
    - email: "us***@example.com"
    - phone: "***-***-1234"
    - ssn: "***-**-1234"

implementation:
  logging: Mask before logging
  display: Mask in UI (unmask with permission)
  export: Mask in reports (unless authorized)

key_rotation:
  encryption_keys: 365 days
  api_keys: 90 days
  jwt_secrets: 90 days
  integration_credentials: On-demand + 180 days
```

## Microservices Security Design

### Service-to-Service Communication

```
communication_pattern: Service Mesh

security_controls:
  authentication:
    method: mTLS (Mutual TLS)
    certificates: Service-specific certificates
    validation: Certificate pinning

  authorization:
    method: JWT tokens
    scope: Service-specific scopes
    validation: Token signature + claims

  encryption:
```

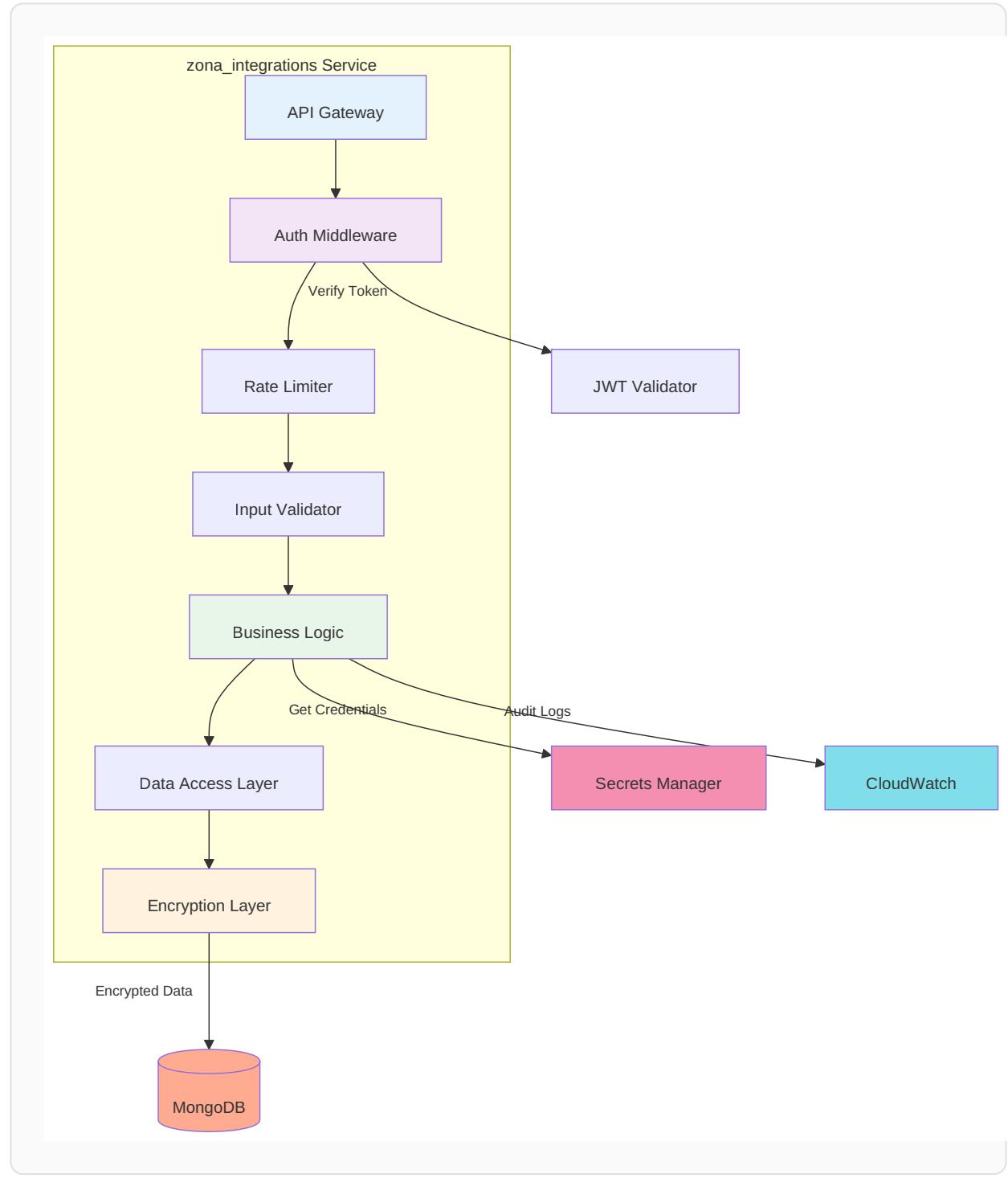
```
protocol: TLS 1.3
mandatory: true
fallback: Not allowed

service_registry:
  location: MongoDB collection "service_registry"
  schema:
    service_name: string
    endpoints: array[string]
    public_key: string
    allowed_callers: array[string]

network_policies:
  default: Deny all
  allow_rules:
    - from: zona_integrations
      to: zona_apis_manager
      ports: [8080]
    - from: zona_user
      to: MongoDB
      ports: [27017]
```

## Service Security Architecture

### Example: zona\_integrations Service



## Database Security Design

### MongoDB Security Configuration

```
mongodb_security:  
  authentication:  
    enabled: true  
    mechanism: SCRAM-SHA-256
```

```
users:
  - username: securaa_app
    database: admin
    roles: [readWrite on mssp_core]
    password: Stored in AWS Secrets Manager

  - username: securaa_READONLY
    database: admin
    roles: [read on mssp_core]
    password: Stored in AWS Secrets Manager

authorization:
  enabled: true
  role_based_access: true

encryption:
  at_rest:
    enabled: true
    method: AES-256
    key_management: AWS KMS

  in_transit:
    tls_mode: requireTLS
    certificate_key_file: /etc/ssl/mongodb.pem
    ca_file: /etc/ssl/ca.pem

network_security:
  bind_ip: 127.0.0.1,10.0.1.0/24
  port: 27017
  firewall_rules:
    - allow from zona_services subnet
    - deny all others

auditing:
  enabled: true
  log_level: "auditLog"
  events:
    - authentication
    - authorization
    - DDL operations
    - DML operations on sensitive collections
  destination: CloudWatch Logs

backup:
  frequency: Daily
  retention: 30 days
  encryption: Enabled
  location: S3 with encryption
```

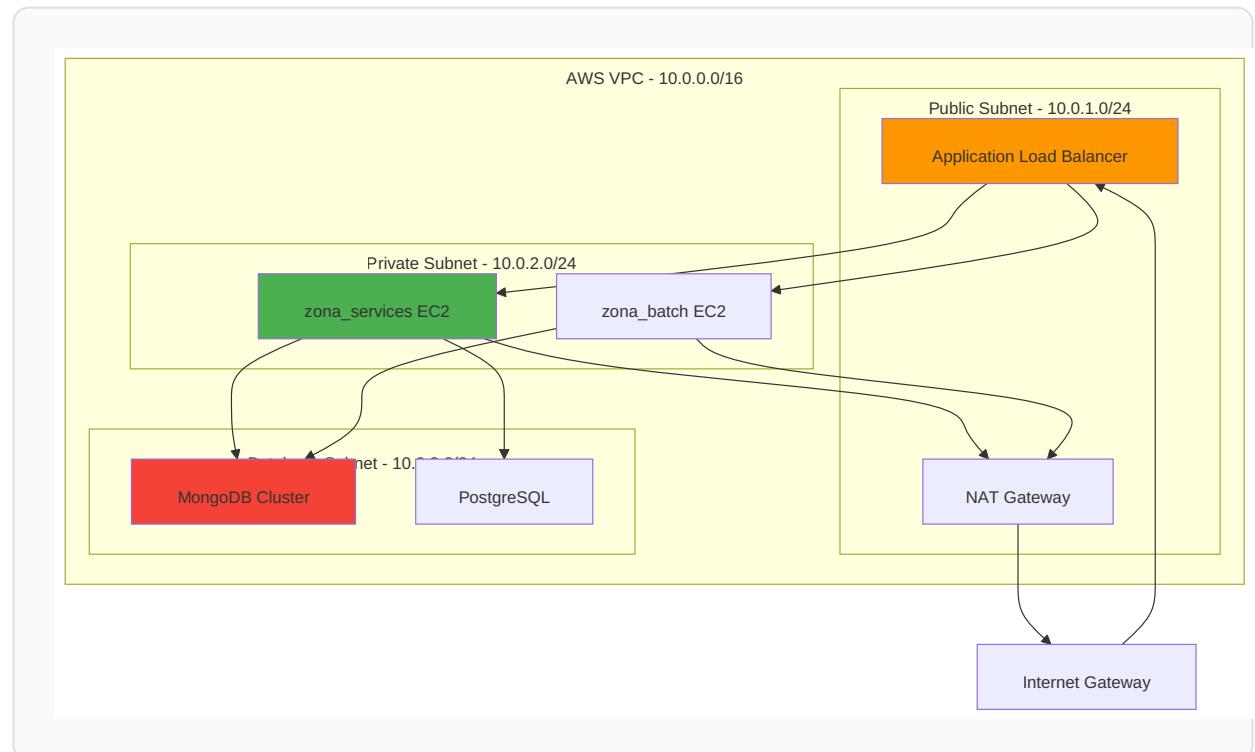
## Data Schema Security

```
// MongoDB schema with built-in security
{
  collection: "integrations",
  validator: {
    $jsonSchema: {
      bsonType: "object",
      required: ["tenant_id", "integration_type", "created_by"],
      properties: {
        tenant_id: {
          bsonType: "string",
          description: "Tenant ID for multi-tenancy isolation"
        },
        integration_type: {
          bsonType: "string",
          enum: ["servicenow", "splunk", "qradar", ...],
          description: "Must be a valid integration type"
        },
        credentials: {
          bsonType: "string",
          description: "Encrypted credentials (AES-256)"
        },
        api_endpoint: {
          bsonType: "string",
          pattern: "^https://",
          description: "Must be HTTPS URL"
        },
        created_by: {
          bsonType: "string",
          description: "User who created the integration"
        },
        created_at: {
          bsonType: "date"
        },
        last_modified_at: {
          bsonType: "date"
        },
        last_modified_by: {
          bsonType: "string"
        }
      }
    }
  },
  indexes: [
    { tenant_id: 1, integration_type: 1 },
    { created_at: 1 }
```

```
]  
}
```

## AWS Infrastructure Security Design

### VPC Architecture



### Security Groups Design

```
security_groups:  
alb_sg:  
  name: "securaa-alb-sg"  
  description: "Application Load Balancer security group"  
  inbound_rules:  
    - port: 443  
      protocol: TCP  
      source: 0.0.0.0/0  
      description: "HTTPS from internet"  
    - port: 80  
      protocol: TCP  
      source: 0.0.0.0/0  
      description: "HTTP (redirect to HTTPS)"  
  outbound_rules:  
    - port: 8080
```

```
protocol: TCP
destination: app_sg
description: "To application servers"

app_sg:
  name: "securaa-app-sg"
  description: "Application servers security group"
  inbound_rules:
    - port: 8080
      protocol: TCP
      source: alb_sg
      description: "From load balancer"
    - port: 22
      protocol: TCP
      source: bastion_sg
      description: "SSH from bastion only"
  outbound_rules:
    - port: 27017
      protocol: TCP
      destination: db_sg
      description: "To MongoDB"
    - port: 5432
      protocol: TCP
      destination: db_sg
      description: "To PostgreSQL"
    - port: 443
      protocol: TCP
      destination: 0.0.0.0/0
      description: "HTTPS to external APIs"

db_sg:
  name: "securaa-db-sg"
  description: "Database servers security group"
  inbound_rules:
    - port: 27017
      protocol: TCP
      source: app_sg
      description: "MongoDB from app servers"
    - port: 5432
      protocol: TCP
      source: app_sg
      description: "PostgreSQL from app servers"
  outbound_rules: []
```

# IAM Security Design

## Service Roles

```
iam_roles:
  codebuild_role:
    name: "SecuraaCodeBuildRole"
    description: "Role for AWS CodeBuild to build and push images"
    assume_role_policy:
      service: codebuild.amazonaws.com

    policies:
      - name: "SecuraaCodeBuildPolicy"
        permissions:
          ECR:
            - ecr:GetAuthorizationToken
            - ecr:BatchCheckLayerAvailability
            - ecr:PutImage
            - ecr:InitiateLayerUpload
            - ecr:UploadLayerPart
            - ecr:CompleteLayerUpload
          S3:
            - s3:GetObject
            - s3:PutObject
        resources:
          - "arn:aws:s3:::secura-build-artifacts/*"

    CloudWatch:
      - logs>CreateLogGroup
      - logs>CreateLogStream
      - logs:PutLogEvents

  SecretsManager:
    - secretsmanager:GetSecretValue
  resources:
    - "arn:aws:secretsmanager:*:secret:secura/*"

ec2_app_role:
  name: "SecuraaEC2AppRole"
  description: "Role for EC2 application instances"
  assume_role_policy:
    service: ec2.amazonaws.com

  policies:
    - name: "SecuraaAppPolicy"
      permissions:
        ECR:
          - ecr:GetAuthorizationToken
          - ecr:BatchGetImage
          - ecr:GetDownloadUrlForLayer
        SecretsManager:
```

```

    - secretsmanager:GetSecretValue
resources:
    - "arn:aws:secretsmanager:*:*:secret:securaa/prod/*"
CloudWatch:
    - logs>CreateLogGroup
    - logs>CreateLogStream
    - logs:PutLogEvents
    - cloudwatch:PutMetricData
S3:
    - s3:GetObject
resources:
    - "arn:aws:s3:::securaa-config/*"

```

## IAM Policies - Least Privilege

```

{
  "Version": "2012-10-17",
  "Statement": [
    {
      "Sid": "AllowECRPushForCodeBuild",
      "Effect": "Allow",
      "Action": [
        "ecr:GetAuthorizationToken",
        "ecr:BatchCheckLayerAvailability",
        "ecr:PutImage",
        "ecr:InitiateLayerUpload",
        "ecr:UploadLayerPart",
        "ecr:CompleteLayerUpload"
      ],
      "Resource": "arn:aws:ecr:us-east-2:665853670667:repository/securaa/*",
      "Condition": {
        "StringEquals": {
          "aws:RequestedRegion": "us-east-2"
        }
      }
    },
    {
      "Sid": "DenyUnencryptedS3Uploads",
      "Effect": "Deny",
      "Action": "s3:PutObject",
      "Resource": "arn:aws:s3:::securaa-*/*",
      "Condition": {
        "StringNotEquals": {
          "s3:x-amz-server-side-encryption": "AES256"
        }
      }
    }
  ]
}

```

```
]  
}
```

## API Security Design

### API Security Controls

```
api_security:  
  endpoint: "/api/v1/integrations"  
  
  authentication:  
    required: true  
    methods: [JWT, API_KEY]  
    location: Header "Authorization"  
  
  authorization:  
    required: true  
    permissions: ["integration:read", "integration:create"]  
  
  input_validation:  
    content_type: application/json  
    max_body_size: 10MB  
    schema_validation: OpenAPI 3.0 spec  
    sanitization: HTML entity encoding  
  
  rate_limiting:  
    authenticated: 1000 requests/hour  
    unauthenticated: 100 requests/hour  
    burst: 50 requests/minute  
  
  output_encoding:  
    response_type: application/json  
    encoding: UTF-8  
    sanitization: Remove sensitive fields  
  
  security_headers:  
    Content-Security-Policy: "default-src 'self'"  
    X-Content-Type-Options: "nosniff"  
    X-Frame-Options: "DENY"  
    X-XSS-Protection: "1; mode=block"  
    Strict-Transport-Security: "max-age=31536000; includeSubDomains"  
  
  error_handling:  
    mode: Generic messages  
    status_codes:
```

```
authentication_failure: 401
authorization_failure: 403
validation_failure: 400
server_error: 500
error_response:
  format: '{"error": "message", "code": "ERROR_CODE"}'
  no_stack_traces: true
  no_sensitive_info: true

logging:
  log_requests: true
  log_responses: false
  log_errors: true
  sanitize_logs: true
  fields: [timestamp, user_id, endpoint, method, status_code]
```

## API Versioning Strategy

```
versioning:
  strategy: URI versioning
  format: "/api/v{major}/resource"
  examples:
    - "/api/v1/integrations"
    - "/api/v2/integrations"

  deprecation_policy:
    notification_period: 6 months
    support_period: 12 months after deprecation
    sunset_date: Announced in headers
    header: "Sunset: Sat, 01 Jan 2026 00:00:00 GMT"

  breaking_changes:
    major_version_bump: true
    backwards_compatibility: Not required

  non_breaking_changes:
    minor_version: Not reflected in URI
  examples:
    - Adding optional fields
    - Adding new endpoints
    - Adding new response fields
```

# Container Security Design

## Docker Image Security

```
# Secure Dockerfile example
FROM golang:1.17-alpine AS builder

# Security: Run as non-root user
RUN addgroup -S appgroup && adduser -S appuser -G appgroup

# Security: Use specific versions
WORKDIR /app
COPY go.mod go.sum ./
RUN go mod download && go mod verify

# Build application
COPY . .
RUN CGO_ENABLED=0 GOOS=linux go build -a -installsuffix cgo -o main .

# Final stage - minimal image
FROM alpine:3.18

# Security: Install security updates
RUN apk --no-cache add ca-certificates && \
    apk --no-cache upgrade

# Security: Run as non-root user
RUN addgroup -S appgroup && adduser -S appuser -G appgroup
USER appuser

WORKDIR /home/appuser

# Copy binary from builder
COPY --from=builder --chown=appuser:appgroup /app/main .

# Security: Use specific port (non-privileged)
EXPOSE 8080

# Security: Define health check
HEALTHCHECK --interval=30s --timeout=3s --start-period=5s --retries=3 \
CMD wget --no-verbose --tries=1 --spider http://localhost:8080/health || exit 1

# Run application
CMD [ "./main" ]
```

## Container Runtime Security

```
container_security:
  image_scanning:
    tool: AWS ECR Image Scanning
    on_push: true
    severity_threshold: HIGH
    fail_on_critical: true

  image_signing:
    enabled: true
    tool: Docker Content Trust
    key_management: AWS KMS

  runtime_security:
    read_only_root_filesystem: true
    no_new_privileges: true
    drop_capabilities: [ALL]
    add_capabilities: [NET_BIND_SERVICE]

  resource_limits:
    memory: 2GB
    cpu: 1.0
    pids_limit: 100

  network_security:
    network_mode: bridge
    port_mapping: "8080:8080"
    expose_only_necessary_ports: true
```

---

## Security Design Review Checklist

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### Architecture Review

- **Authentication**
  - Authentication mechanism defined and secure
  - Token/session management designed
  - MFA requirements identified
  - Password policy defined (if applicable)
-



## **Authorization**

- Authorization model defined (RBAC/ABAC)
- Permissions and roles documented
- Least privilege principle applied
- Authorization enforcement points identified



## **Data Protection**

- Sensitive data identified and classified
- Encryption at rest designed (AES-256+)
- Encryption in transit designed (TLS 1.3)
- Key management strategy defined
- Data masking strategy defined



## **Input Validation**

- Input validation rules defined
- Sanitization approach documented
- File upload security designed (if applicable)
- Output encoding strategy defined



## **API Security**

- API authentication designed
- API authorization designed
- Rate limiting strategy defined
- API versioning strategy defined
- Security headers defined



## **Database Security**

-

- Database authentication designed
  - Database authorization designed
  - Database encryption designed
  - Backup strategy defined
  - SQL/NoSQL injection prevention
- 

### **Infrastructure Security**

- Network segmentation designed
  - Security groups/firewalls defined
  - IAM roles and policies designed
  - Secrets management designed
  - Container security designed
- 

### **Logging & Monitoring**

- Security events logging designed
- Log retention policy defined
- Monitoring and alerting designed
- SIEM integration designed

## **Threat Model Validation**

- All threats from Requirements Phase addressed
- Mitigations designed for high/critical threats
- Residual risks documented and accepted
- New threats identified during design addressed

## **Compliance Validation**

-

- SOC 2 controls addressed in design
  - ISO 27001 controls addressed in design
  - GDPR requirements addressed in design
  - Industry-specific compliance addressed
- 

## Design Phase Deliverables

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### Required Documentation

#### 1. Architecture Diagram

- Component diagram
- Data flow diagram
- Network diagram
- Deployment diagram

#### 2. Security Design Document

- Authentication design
- Authorization design
- Data protection design
- API security design
- Infrastructure security design

#### 3. Database Design

- Schema design with security
- Access control design
- Encryption design
- Backup and recovery design

#### 4. API Specification

- OpenAPI 3.0 specification
- Security requirements per endpoint
- Authentication/authorization requirements
- Rate limiting specifications

#### 5. Threat Model Update

- Updated threat model based on design
- New threats identified

- Mitigation strategies
- Residual risks

## 6. Security Test Plan

- SAST test cases
  - DAST test cases
  - Penetration testing scope
  - Security acceptance tests
- 

## Phase Exit Criteria

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The Design Phase is complete when:

1.  **Architecture diagrams are complete and approved**
  2.  **Security design document is complete**
  3.  **All security controls are defined and documented**
  4.  **Threat model is updated with design-level threats**
  5.  **Security review completed by security team**
  6.  **Database design includes security controls**
  7.  **API security specifications are documented**
  8.  **Infrastructure security design is complete**
  9.  **Security test plan is created**
  10.  **Security team has approved the design**
- 

## Next Phase

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Once all exit criteria are met, proceed to [04\\_Development\\_Phase.md](#) for secure coding and development.

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*This document is part of the SECURAA Secure SDLC documentation suite. For questions, contact [security@securaa.com](mailto:security@securaa.com)*