Contents

RADIANT & Think Tank Executive Summary

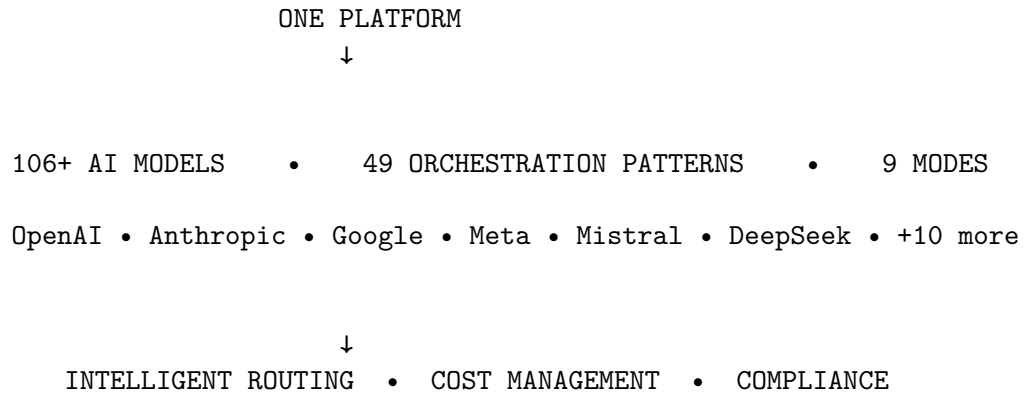
Enterprise AI Platform Overview

Version 4.18.0 | December 2024

For executives, investors, and decision-makers

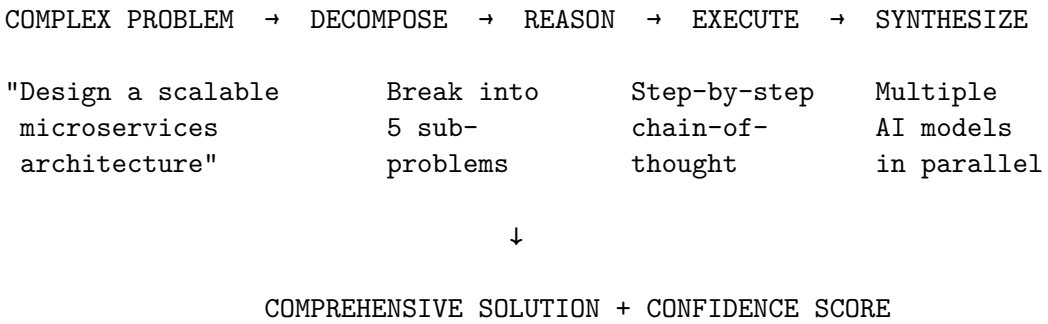
What is RADIANT?

RADIANT is an enterprise-grade, multi-tenant AI platform that provides organizations with unified access to 106+ AI models through a single API, with intelligent orchestration that coordinates multiple AI systems to deliver superior results.



What is Think Tank?

Think Tank is RADIANT's advanced problem-solving platform that decomposes complex problems into manageable steps, applies multi-AI reasoning, and synthesizes comprehensive solutions with confidence scoring.



Key Differentiators

1. AGI-Driven Model Selection

Unlike platforms that use a single AI model, RADIANT's AGI layer **automatically selects the optimal combination of models** based on task analysis:

What We Analyze	What We Select
Problem domain (coding, legal, medical…)	Best models for that domain
Task complexity	Number of models (2-5)

What We Analyze	What We Select
Reasoning requirements	Execution mode (thinking, fast, precise…)
Quality vs speed priority	Parallel execution strategy

Result: 50-300% better outcomes than single-model approaches.

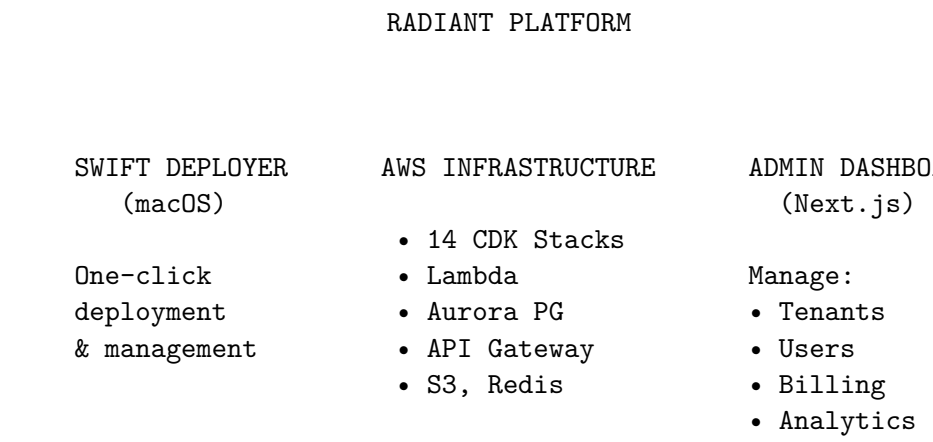
2. 49 Proven Orchestration Patterns

Research-backed workflows including: - **AI Debate** - Two AIs argue, judge decides - **Self-Refine** - Generate → Critique → Improve - **Chain-of-Verification** - Fact-check every claim - **Tree of Thoughts** - Explore multiple solution paths

3. Enterprise-Grade Security

Capability	Description
Multi-Tenant Isolation	PostgreSQL Row-Level Security
Compliance	SOC2, HIPAA-ready
Encryption	At-rest (AES-256) and in-transit (TLS 1.3)
Audit Logging	Complete activity trail

Platform Components



By the Numbers

Metric	Value
AI Models	106+ (50 external + 56 self-hosted)
AI Providers	15+ integrated
Orchestration Patterns	49 documented workflows
Execution Modes	9 specialized modes
Database Migrations	66+ schema versions
CDK Stacks	14 infrastructure components

Use Cases

Enterprise AI Gateway

- Unified access to all major AI providers
- Centralized cost management and budgeting
- Consistent API regardless of backend model
- Automatic failover for reliability

Complex Problem Solving (Think Tank)

- Multi-step technical analysis
- Research synthesis with citations
- Architecture design with artifacts
- Decision support with confidence scores

Quality-Critical Applications

- Legal document analysis (precise mode)
- Medical information processing (HIPAA compliant)
- Financial analysis (multi-model verification)
- Code generation (AI debate + critique)

Cost Optimization

- Intelligent model routing (use cheaper models when appropriate)
- Budget alerts and limits
- Usage analytics by team/project
- Model performance vs cost analysis

Competitive Advantages

vs. Single-Model APIs	vs. Other Platforms
Multi-model orchestration	49 research-backed patterns
Built-in verification	AGI-driven model selection
Higher accuracy	9 execution modes

vs. Single-Model APIs	vs. Other Platforms
Reduced bias	Visual workflow editor
Confidence scoring	Think Tank problem solving

Technology Stack

Layer	Technology
Frontend	Next.js 14, TypeScript, Tailwind CSS, shadcn/ui
Backend	AWS Lambda (Node.js 20), API Gateway
Database	Aurora PostgreSQL (Serverless), DynamoDB, Redis
Infrastructure	AWS CDK (TypeScript), 14 stacks
Desktop	SwiftUI (macOS 13.0+, Swift 5.9+)
Security	Cognito, KMS, WAF, Row-Level Security

Deployment Model

RADIANT deploys to **your AWS account**:

```
YOUR AWS ACCOUNT

                    RADIANT INFRASTRUCTURE

  • Your data stays in your account
  • Your compliance requirements met
  • Your region/residency requirements
  • Full control over infrastructure

Deployed via Swift Deployer (macOS app) or CLI
```

Pricing Model

Tier	Target	Includes
Free	Developers	10K tokens/month, 3 models

Tier	Target	Includes
Pro	Teams	1M tokens/month, all models, orchestration
Enterprise	Organizations	Unlimited, SLA, custom patterns, HIPAA

All tiers include: - Full API access - Admin dashboard - Basic analytics - Email support

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Roadmap Highlights

Timeframe	Features
Q1 2026	Mobile SDK, more self-hosted models
Q2 2026	Fine-tuning pipeline, custom model hosting
Q3 2026	Multi-region deployment, advanced compliance
Q4 2026	Marketplace for custom patterns

Summary

RADIANT + Think Tank delivers:

1. **Unified AI Access** - One API for 106+ models across 15+ providers
2. **Intelligent Orchestration** - AGI selects optimal models and modes
3. **Superior Results** - 49 patterns achieve 50-300% better outcomes
4. **Enterprise Security** - Multi-tenant, SOC2, HIPAA-ready
5. **Cost Control** - Budgets, analytics, intelligent routing
6. **Problem Solving** - Think Tank for complex multi-step reasoning

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RADIANT v4.18.0 + Think Tank v3.2.0

The enterprise platform for intelligent AI orchestration

Contact: info@radiant.ai | **Documentation:** docs.radiant.ai

RADIANT Platform Architecture

Enterprise Multi-Tenant AI Platform

Version 4.18.0 | December 2024

A comprehensive technical architecture document for the RADIANT AI orchestration platform

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Table of Contents

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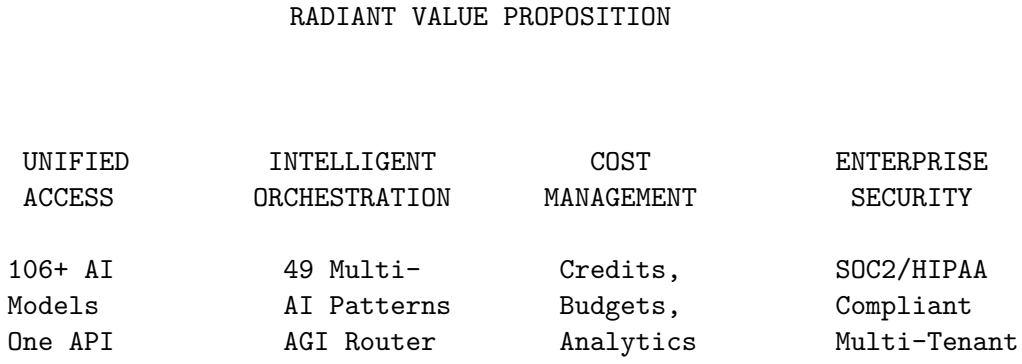
1. Platform Overview

1.1 What is RADIANT?

RADIANT (Real-time AI Distribution, Integration, and Automation Network for Tenants) is an enterprise-grade, multi-tenant SaaS platform that provides unified access to 106+ AI models across multiple providers, with intelligent orchestration, cost management, and comprehensive analytics.

1.2 Core Value Proposition



1.3 Platform Statistics

Metric	Value
AI Models Supported	106+ (50 external + 56 self-hosted)
AI Providers Integrated	15+ (OpenAI, Anthropic, Google, Meta, etc.)
Orchestration Patterns	49 documented patterns
Model Execution Modes	9 (thinking, research, fast, creative, etc.)
Database Migrations	66+ schema migrations
CDK Stacks	14 infrastructure stacks

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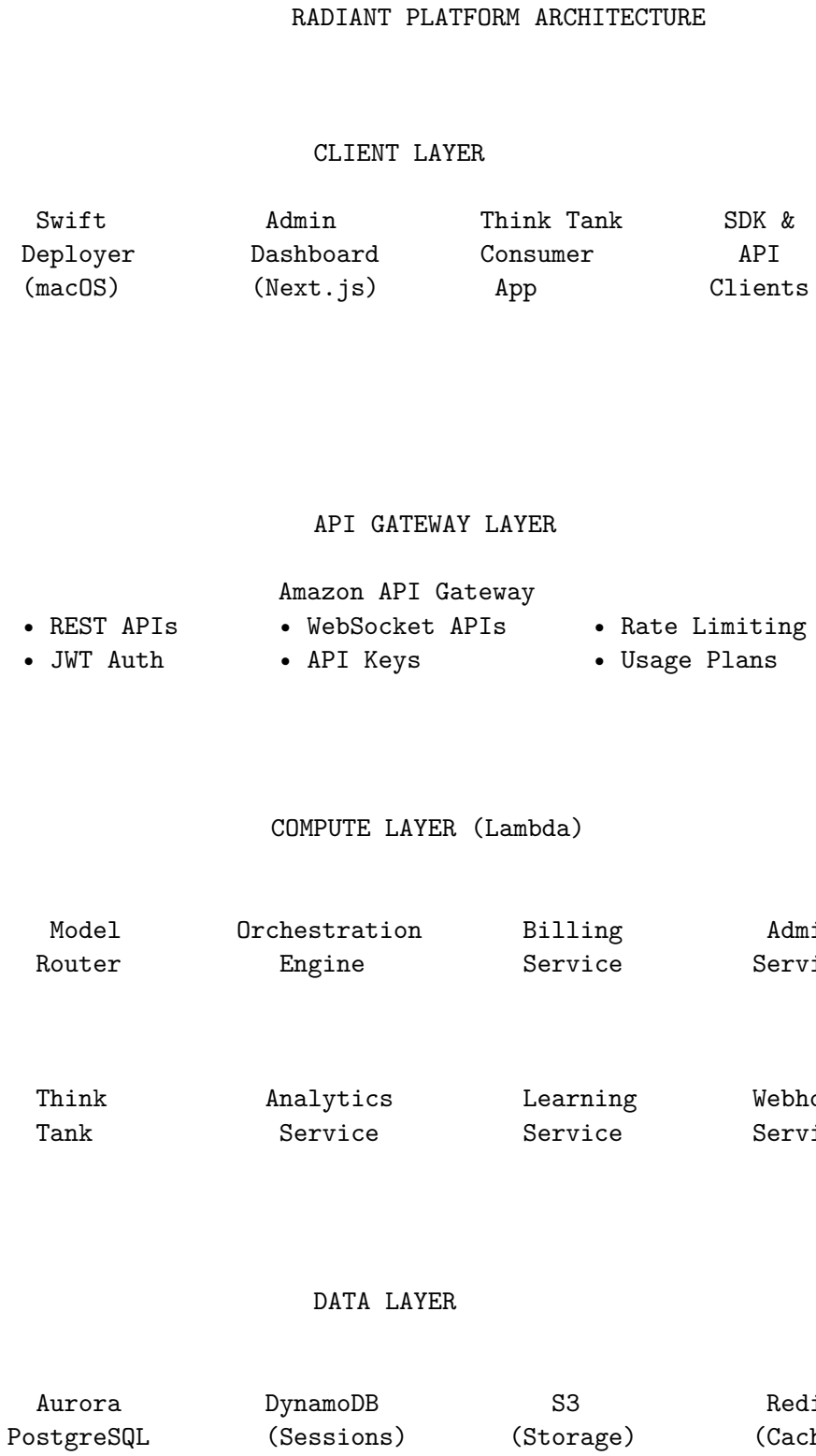
2. System Architecture

2.1 High-Level Architecture



(RLS)

EXTERNAL AI PROVIDERS

OpenAI	Anthropic	Google	Meta	Mistral	+10 more
GPT-4o	Claude	Gemini	Llama		
o1	3.5	2.0	3.1		

2.2 Three-Component Structure

RADIANT consists of three primary deployment components:

THREE COMPONENTS OF RADIANT

packages/infrastructure/lambda/shared/services/

CORE SERVICES

model-router.service.ts	Route requests to AI providers
model-metadata.service.ts	Live model data & capabilities
orchestration-patterns.service	49 multi-AI workflow patterns
superior-orchestration.service	Guaranteed superior responses
learning.service.ts	ML feedback & continuous learning

BILLING SERVICES

billing.service.ts	Credit & subscription management
cost-management.service.ts	Budget alerts & cost tracking
usage-analytics.service.ts	Usage metrics & reporting

PLATFORM SERVICES

tenant.service.ts	Multi-tenant management
auth.service.ts	Authentication & authorization
api-key.service.ts	API key lifecycle
webhook.service.ts	Event notifications
storage.service.ts	File & artifact storage

THINK TANK SERVICES

thinktank-engine.ts	Multi-step problem solving
thinktank-sessions.ts	Conversation management
collaboration.service.ts	Real-time collaboration

---

3. Component Deep Dive

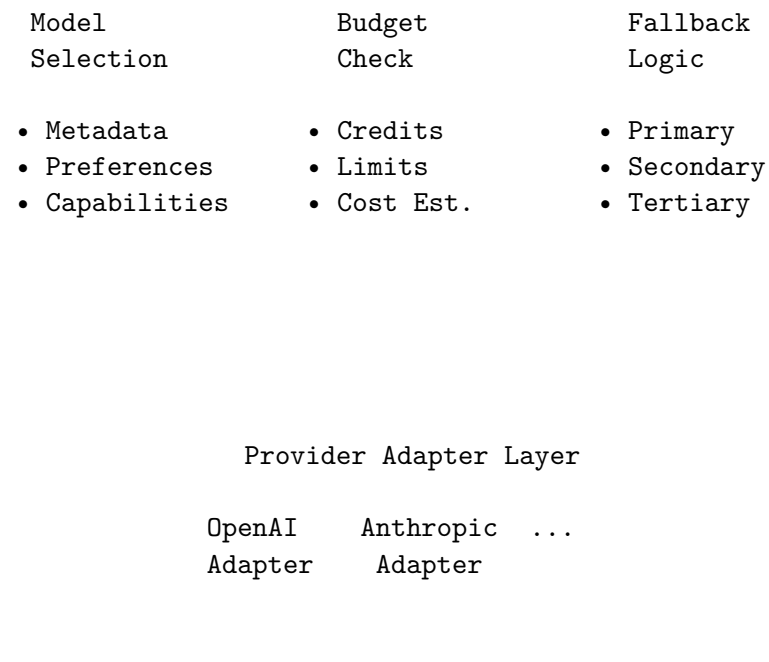
3.1 Model Router Service

The intelligent core that routes AI requests to optimal providers:

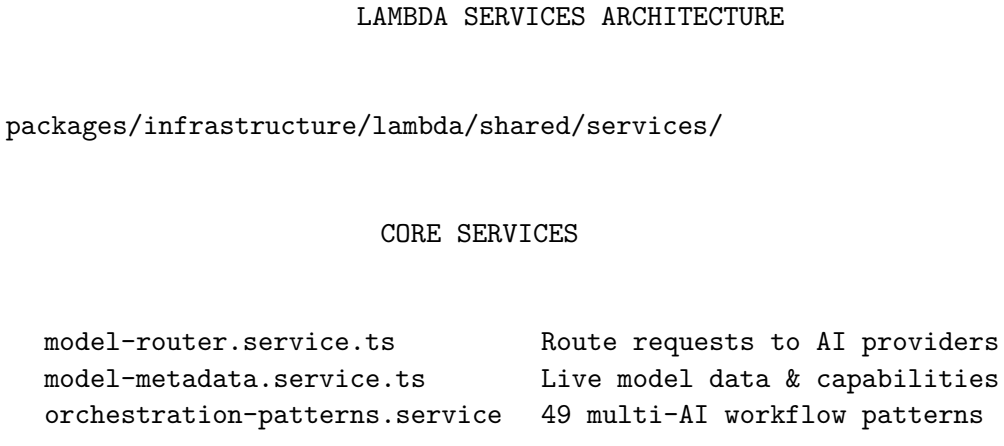
MODEL ROUTER SERVICE

Incoming
Request

Request Validation
- API Key Check
- Rate Limiting
- Tenant Verification



3.2 Service Architecture



superior-orchestration.service	Guaranteed superior responses
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BILLING SERVICES

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THINK TANK SERVICES

thinktank-engine.ts	Multi-step problem solving
thinktank-sessions.ts	Conversation management
collaboration.service.ts	Real-time collaboration

---

4. Data Architecture

4.1 Database Schema Overview

AURORA POSTGRESQL SCHEMA

66+ Migrations in packages/infrastructure/migrations/

CORE ENTITIES

tenants	Multi-tenant organizations
users	User accounts with roles
api_keys	API authentication keys
model_configurations	Per-tenant model settings
model_metadata	AI model capabilities & pricing

BILLING & CREDITS

credit_accounts	Tenant credit balances
credit_transactions	Credit usage history
subscriptions	Plan subscriptions
invoices	Billing invoices
budgets	Spending limits & alerts

ORCHESTRATION

orchestration_methods	Reusable AI method definitions
orchestration_workflows	49 workflow patterns
workflow_method_bindings	Steps linking workflows to methods
orchestration_executions	Execution history & results

THINK TANK

thinktank_sessions	Problem-solving sessions
thinktank_conversations	Conversation threads
thinktank_messages	Individual messages
thinktank_steps	Reasoning steps
thinktank_artifacts	Generated outputs

ANALYTICS & LEARNING

usage_events	API usage events
analytics_aggregates	Pre-computed metrics
learning_interactions	ML training data
model_performance	Model quality tracking

```
SECURITY

Row-Level Security (RLS) on all tenant tables
SET app.current_tenant_id for automatic filtering
Audit logging on sensitive operations
```

4.2 Multi-Tenant Data Isolation

```
                ROW-LEVEL SECURITY (RLS) MODEL

Request from Tenant A                    Request from Tenant B


JWT Token                                JWT Token
tenant_id=A                              tenant_id=B


                  Database Connection
  SET app.current_tenant_id = 'tenant_id_from_jwt';


                   RLS Policy Applied

  CREATE POLICY tenant_isolation ON table_name
  USING (tenant_id = current_setting('app.current_tenant_id'));

  Result: Each tenant ONLY sees their own data


    Tenant A sees:                       Tenant B sees:

  Only Tenant A's                      Only Tenant B's
  - Users                              - Users
  - API Keys                           - API Keys
  - Usage Data                         - Usage Data
```

- Conversations - Conversations

---

5. Security Architecture

5.1 Security Layers

SECURITY ARCHITECTURE

LAYER 1: NETWORK SECURITY

- VPC with private subnets for database
- WAF rules for API Gateway
- CloudFront for DDoS protection
- TLS 1.3 for all connections

LAYER 2: AUTHENTICATION

- Cognito User Pools for user authentication
- JWT tokens with tenant claims
- API Keys with scoped permissions
- MFA support for admin users

LAYER 3: AUTHORIZATION

- Role-based access control (RBAC)
- Permission sets per tenant
- Resource-level policies
- API endpoint authorization

LAYER 4: DATA SECURITY

- Row-Level Security (RLS) in PostgreSQL
- Encryption at rest (AES-256)
- Encryption in transit (TLS)
- KMS for key management

- PHI sanitization for HIPAA compliance

LAYER 5: AUDIT & COMPLIANCE

- CloudTrail for API logging
- Audit tables for data changes
- Compliance reporting dashboard
- SOC2 Type II controls
- HIPAA compliance mode

---

6. Deployment Architecture

6.1 AWS Infrastructure

AWS DEPLOYMENT ARCHITECTURE

REGION: us-east-1

CloudFront CDN S3 Static Assets

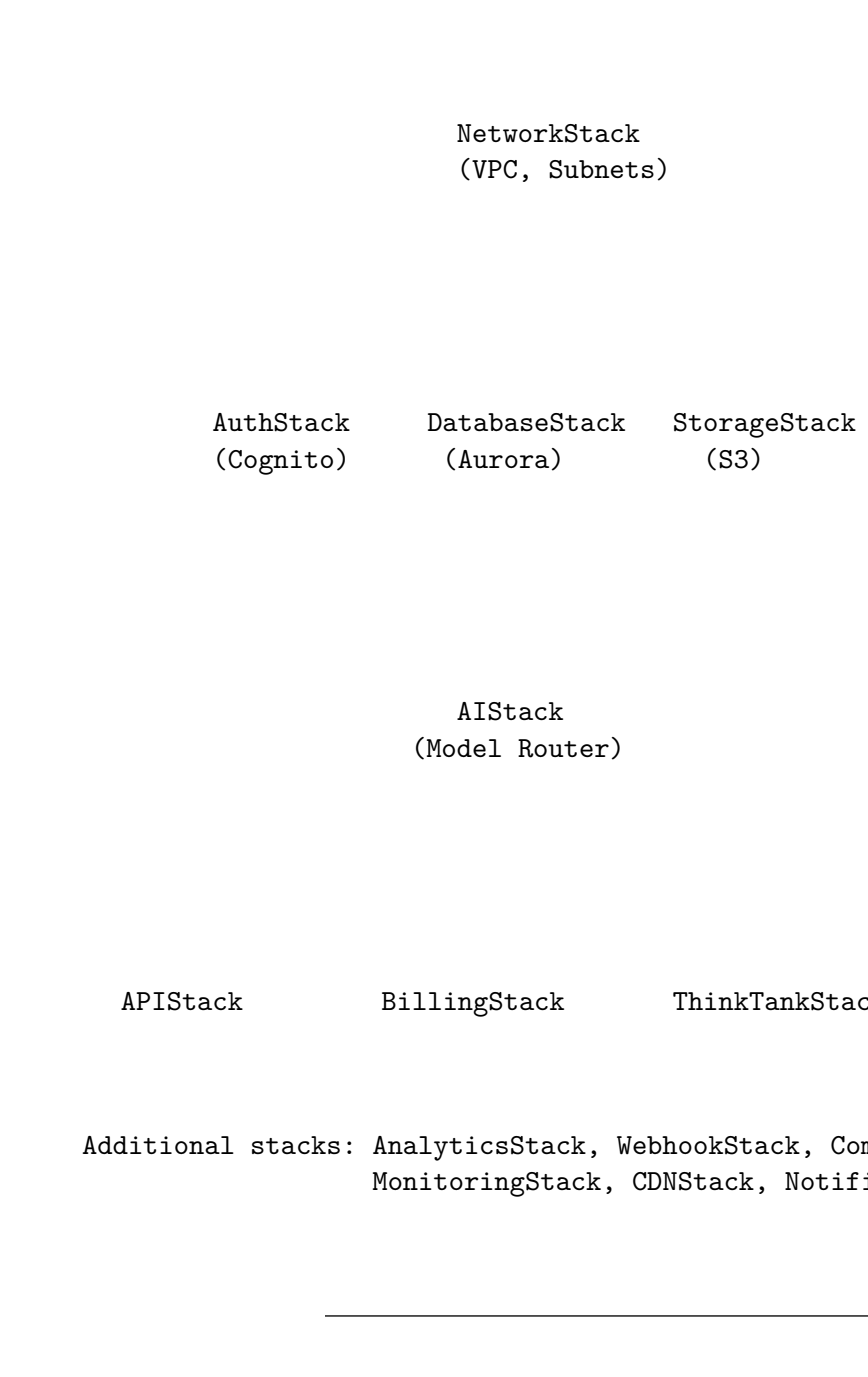
API Gateway Lambda Functions
(REST + WS) (Node.js 20)

Cognito Aurora S3
User Pools PostgreSQL Storage
(Serverless)

Secrets ElastiCache SQS

```
Manager                    (Redis)                Queues
```

6.2 CDK Stack Dependencies



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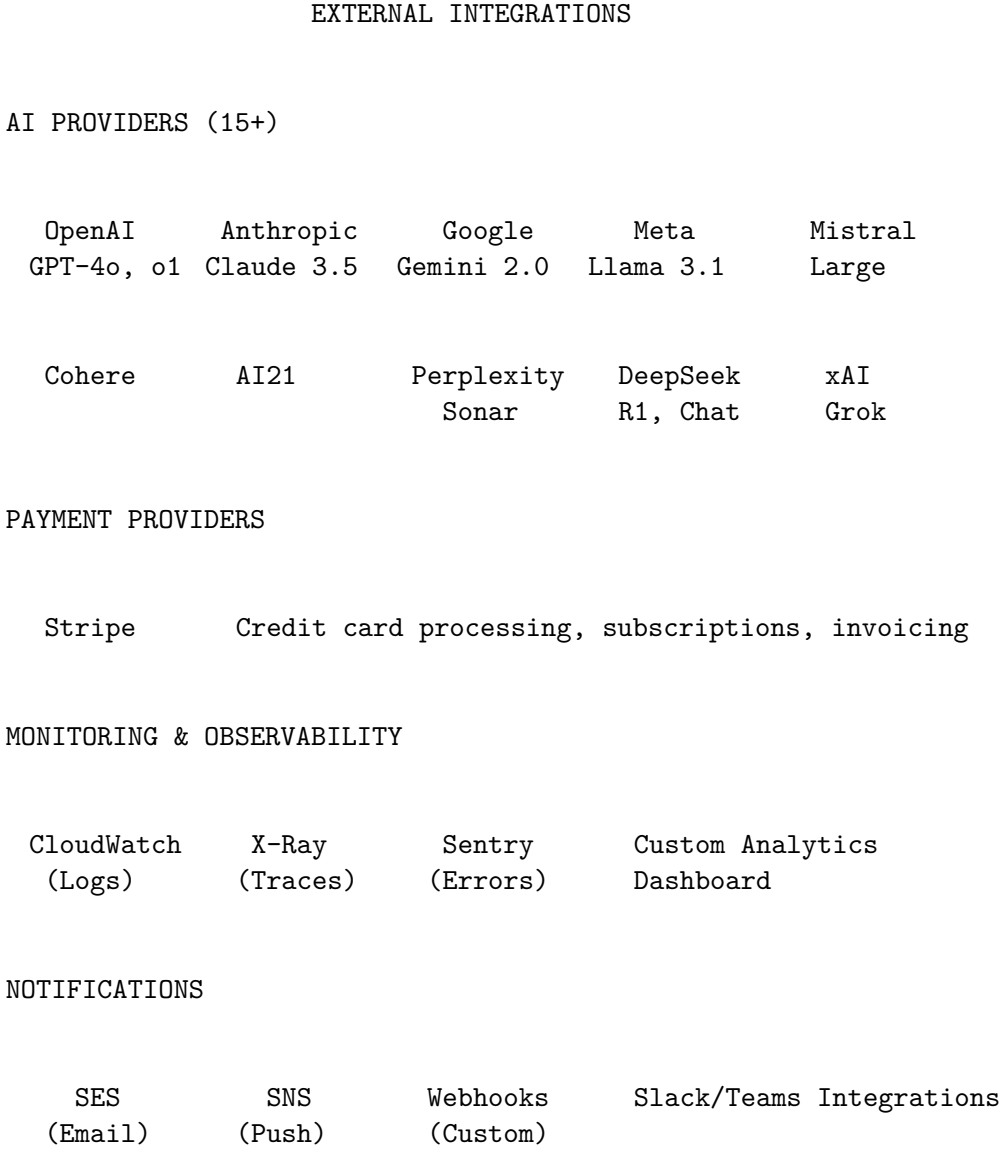
7. Integration Points

7.1 External API Integrations



RADIANT Platform Architecture v4.18.0

Building the future of enterprise AI

Think Tank Platform Architecture

Advanced Multi-Step AI Problem Solving

Version 3.2.0 | December 2024

A comprehensive technical architecture document for the Think Tank AI reasoning platform

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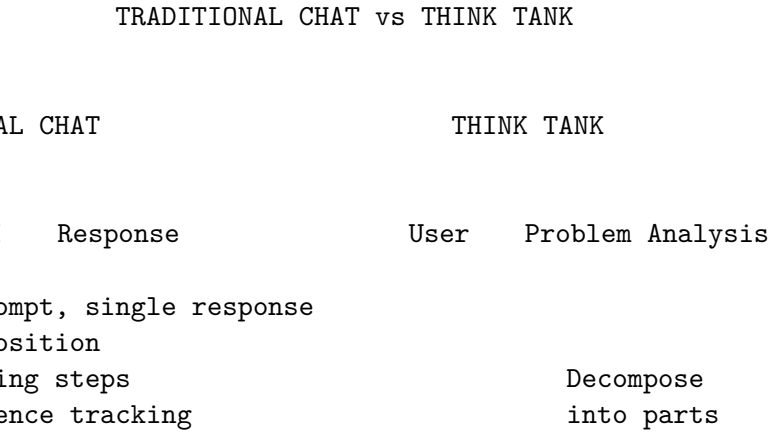
1. Platform Overview

1.1 What is Think Tank?

Think Tank is an advanced AI reasoning platform that decomposes complex problems into manageable sub-problems, applies multi-step reasoning, and synthesizes comprehensive solutions using orchestrated AI models.

Unlike simple chat interfaces, Think Tank: - **Decomposes** complex problems into sub-tasks - **Reasons** through each component step-by-step - **Executes** specialized AI calls for each step - **Synthesizes** results into coherent solutions - **Tracks** confidence and quality throughout

1.2 Think Tank vs Traditional Chat



```
No iterative refinement
```

```
                    Part 1      Part 2      Part 3
                    Reason      Reason      Reason
```

```
                  Execute     Execute
                   + Verify    + Verify
```

```
                     Synthesize
                     Solution
                     (confidence)
```

1.3 Key Capabilities

Capability	Description
Problem Decomposition	Breaks complex questions into manageable sub-problems
Multi-Step Reasoning	Chain-of-thought with recorded steps
Domain Specialization	8+ specialized reasoning modes
Confidence Tracking	Quality scores for every step
Artifact Generation	Code, documents, diagrams as outputs
Real-time Collaboration	Multiple users solving together
Session Persistence	Resume any session later
Cost Transparency	Token and cost tracking per step

---

2. Core Architecture

2.1 System Components

```
THINK TANK ARCHITECTURE
```

CONSUMER INTERFACE LAYER

Web Client (Next.js/React) | Mobile Client (React Native) | API Client (SDK)

THINK TANK ENGINE

Session Manager | Problem Decomposer | Step Executor

Reasoning Engine | Solution Synthesizer | Confidence Scorer

ORCHESTRATION LAYER

OrchestrationPatternsService

- 49 workflow patterns
- Parallel execution
- AGI model selection
- Mode-aware invocation

ModelRouterService

- 106+ AI models
- Live metadata
- Intelligent routing
- Fallback handling

DATA LAYER

Sessions (Aurora) | Conversations (Aurora) | Messages (Aurora) | Artifacts (S3)

2.2 Think Tank Engine

The core engine that powers intelligent problem solving:

THINK TANK ENGINE DETAIL

```
class ThinkTankEngine {

    async solve(problem: ThinkTankProblem): Promise<ThinkTankResult>

    1. CREATE SESSION
       • Initialize session with problem context
       • Set domain mode and preferences
       • Record start time and user info

    2. DECOMPOSE PROBLEM
       • AI analyzes problem structure
       • Identifies sub-problems and dependencies
       • Creates execution plan

    3. FOR EACH SUB-PROBLEM:

        a. REASON
           • Chain-of-thought analysis
           • Record reasoning steps

        b. EXECUTE
           • Call appropriate AI model(s)
           • May use parallel execution
           • Track tokens and cost

        c. RECORD STEP
           • Save step result with confidence
           • Update session state


    4. SYNTHESIZE SOLUTION
       • Combine all step results
       • Generate final answer with reasoning
       • Calculate overall confidence
```

```
    5. RETURN RESULT
       • Solution with confidence score
       • All recorded steps
       • Total cost and token usage

}
```

---

3. Problem Solving Pipeline

3.1 Pipeline Stages

```
                    PROBLEM SOLVING PIPELINE


USER INPUT

"Design a scalable microservices architecture for an e-commerce
 platform that handles 10M daily users with real-time inventory"



  STAGE 1: PROBLEM ANALYSIS

  • Identify problem type: System Design
  • Detect domain: Engineering/Architecture
  • Assess complexity: High
  • Select domain mode: Engineering Mode
  • Choose orchestration pattern: Decomposed Prompting



  STAGE 2: DECOMPOSITION

  Sub-Problem 1: Requirements Analysis
  Sub-Problem 2: Service Identification
  Sub-Problem 3: Data Architecture
  Sub-Problem 4: Communication Patterns
  Sub-Problem 5: Scalability Design
  Sub-Problem 6: Infrastructure

  Dependencies: [1] → [2,3] → [4] → [5] → [6]
```

```
STAGE 3: STEP-BY-STEP EXECUTION


Step 1: Requirements
  Model: Claude 3.5 (thinking mode)
  Tokens: 2,450   Cost: $0.024   Confidence: 0.92
  Output: Detailed requirements document


Step 2: Service Identification
  Model: GPT-4o + Claude (parallel, merge synthesis)
  Tokens: 3,200   Cost: $0.041   Confidence: 0.89
  Output: 12 microservices identified with boundaries


[Steps 3-6 continue...]




STAGE 4: SYNTHESIS

• Combine all step outputs
• Generate comprehensive solution document
• Include architecture diagram (artifact)
• Validate consistency across steps
• Calculate final confidence: 0.88




FINAL OUTPUT

• Complete microservices architecture document
• Service interaction diagrams
• Database schema recommendations
• Infrastructure as code templates
• Scaling strategies and benchmarks

Total: 12,400 tokens   $0.18   6 steps   45 seconds
```

3.2 Step Recording

Every reasoning step is recorded with comprehensive metadata:

STEP RECORD STRUCTURE

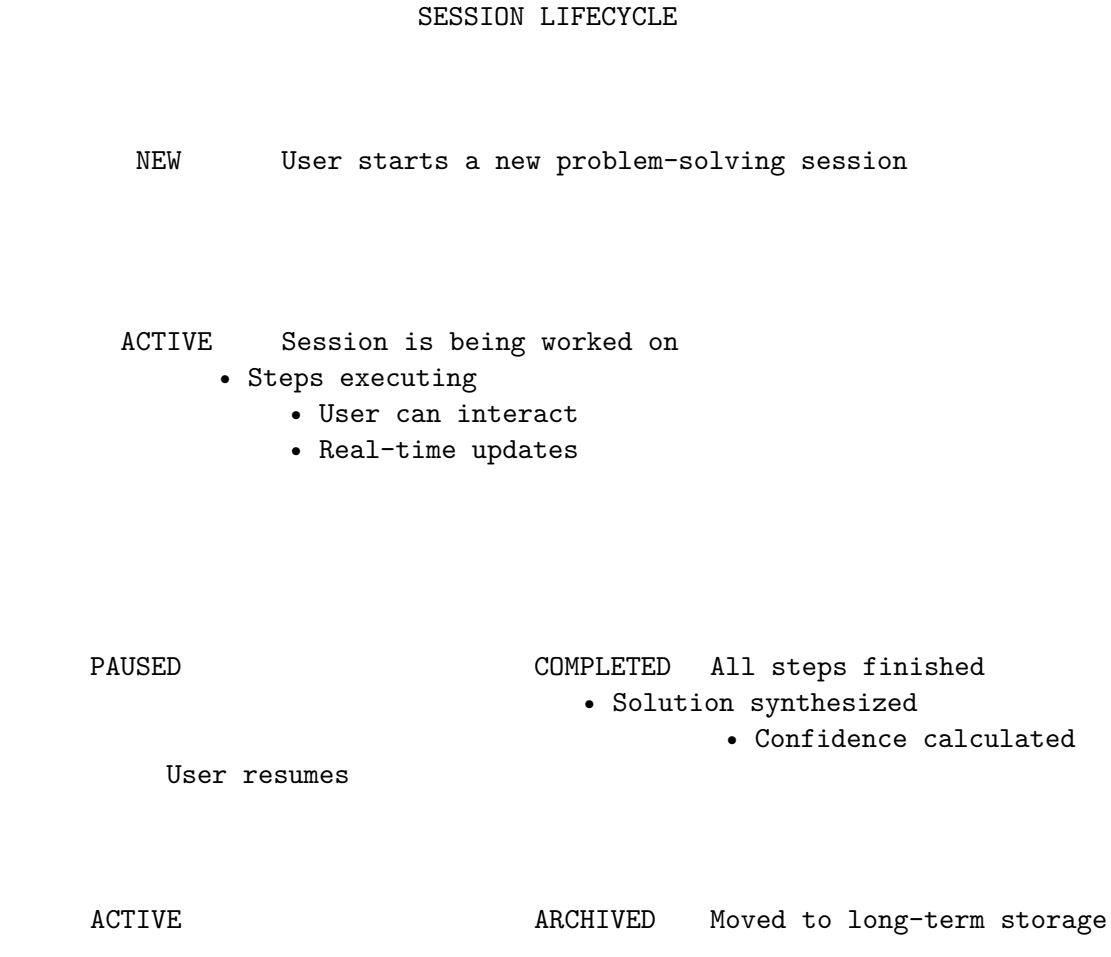
```
interface ThinkTankStep {
  stepId: string;                    // Unique step identifier
  sessionId: string;                 // Parent session
  stepOrder: number;                 // Execution order
  stepType: StepType;                // decompose | reason | execute | ..
  title: string;                     // Human-readable step name
  description: string;               // What this step does

  // Execution Details
  input: {
    prompt: string;                  // Input to AI
    context: Record<string, any>;    // Previous step outputs
    parameters: Record<string, any>; // Step-specific params
  };

  output: {
    response: string;                // AI response
    artifacts: Artifact[];           // Generated files/diagrams
    structuredData?: any;            // Parsed structured output
  };

  // Model & Cost
  modelUsed: string;                 // Which AI model
  modelMode: ModelMode;              // thinking | fast | creative | ..
  tokensUsed: number;                // Total tokens
  costCents: number;                 // Cost in cents
  latencyMs: number;                 // Execution time

  // Quality
  confidence: number;                // 0-1 confidence score
  reasoning: string;                 // Explanation of confidence

  // Parallel Execution (if applicable)
  wasParallel: boolean;
  parallelModels?: string[];         // Models used in parallel
  synthesisStrategy?: string;        // How results were combined

  // Timestamps
  startedAt: Date;
  completedAt: Date;
```

```
}
```

---

4. Session Management

4.1 Session Lifecycle



Session States:

- NEW - Just created, no work done
- ACTIVE - Currently processing or awaiting input
- PAUSED - User paused, can resume
- COMPLETED - All steps done, solution ready
- ARCHIVED - Moved to cold storage
- FAILED - Unrecoverable error occurred

4.2 Session Data Model

```
                    SESSION DATA MODEL


                        SESSION
sessionId: uuid
tenantId: uuid
userId: uuid
title: string
status: SessionStatus
domainMode: DomainMode
createdAt: timestamp
updatedAt: timestamp

                                has many

                    CONVERSATIONS
conversationId: uuid
sessionId: uuid (FK)
title: string
createdAt: timestamp

                                has many

                        MESSAGES
messageId: uuid
conversationId: uuid (FK)
role: 'user' | 'assistant' | 'system'
content: text
createdAt: timestamp

                                has many

                          STEPS
stepId: uuid
sessionId: uuid (FK)
stepOrder: integer
```

```
stepType: StepType
input: jsonb
output: jsonb
modelUsed: string
tokensUsed: integer
costCents: decimal
confidence: decimal
startedAt: timestamp
completedAt: timestamp
```

has many

```
ARTIFACTS
artifactId: uuid
stepId: uuid (FK)
type: 'code' | 'diagram' | 'document' | 'data'
filename: string
mimeType: string
s3Key: string
sizeBytes: integer
createdAt: timestamp
```

---

5. Collaboration Features

5.1 Real-Time Collaboration

```
REAL-TIME COLLABORATION


    Think Tank Session
  "Architecture Design #42"


  User A          User B          User C
 (Owner)         (Editor)        (Viewer)
```

WebSocket Connection
(Real-time event streaming)

Event Types

- step.started - A new step is executing
- step.progress - Step progress update
- step.completed - Step finished with result
- message.added - New message in conversation
- cursor.moved - User cursor position
- user.joined - New collaborator joined
- user.left - Collaborator left
- artifact.created - New artifact generated
- session.status - Session state changed

COLLABORATION ROLES:

Role	Permissions
Owner	Full control, manage collaborators, delete session
Editor	Add messages, trigger steps, view all content
Viewer	Read-only access to session and results
Commenter	View + add comments, no step triggering

---

6. Domain Modes

6.1 Specialized Reasoning Modes

DOMAIN MODES

Think Tank adapts its reasoning approach based on problem domain:

RESEARCH MODE

Best for: Academic research, literature review, fact-finding
Models: Perplexity Sonar, Claude (deep_research mode)
Features:
• Source citation
• Cross-reference verification
• Comprehensive literature synthesis

ENGINEERING MODE

Best for: System design, architecture, technical problems
Models: Claude, GPT-4o, DeepSeek (code mode)
Features:
• Code generation as artifacts
• Architecture diagrams
• Technical trade-off analysis

ANALYTICAL MODE

Best for: Data analysis, math, statistics, quantitative problems
Models: o1, Claude (thinking mode), DeepSeek R1
Features:
• Step-by-step mathematical reasoning
• Statistical analysis
• Proof verification

CREATIVE MODE

Best for: Writing, brainstorming, ideation, design
Models: Claude, GPT-4o (creative mode, high temperature)
Features:
• Multiple creative alternatives
• Iterative refinement
• Style adaptation

LEGAL MODE

Best for: Contract analysis, compliance, legal research

Models: Claude (precise mode), GPT-4o
Features:
• Citation of legal precedents
• Risk assessment
• Compliance checking

MEDICAL MODE (HIPAA Compliant)

Best for: Clinical analysis, medical research (non-diagnostic)
Models: Claude (precise mode), approved medical models
Features:
• PHI sanitization
• Medical literature citation
• Disclaimer generation

BUSINESS MODE

Best for: Strategy, planning, market analysis, business problems
Models: GPT-4o, Claude, Gemini
Features:
• Framework application (SWOT, Porter's, etc.)
• Financial modeling
• Competitive analysis

GENERAL MODE

Best for: Mixed problems, general questions
Models: Automatically selected based on sub-problem analysis
Features:
• Dynamic mode switching per step
• Balanced approach

---

7. Quality & Confidence

7.1 Confidence Scoring System

CONFIDENCE SCORING SYSTEM

Every step and the final solution receives a confidence score (0-1):

CONFIDENCE FACTORS

Factor	Contribution
Model Agreement	+0.2 if parallel models agree
Reasoning Depth	+0.15 for thorough chain-of-thought
Source Quality	+0.15 for cited/verified sources
Task Complexity	-0.1 for very complex sub-problems
Model Confidence	+0.1 for high model self-confidence
Consistency	+0.1 for consistency with prior steps
Verification	+0.2 if verified by second model

CONFIDENCE LEVELS

0.9 - 1.0	VERY HIGH - Strong consensus
0.7 - 0.9	HIGH - Reliable
0.5 - 0.7	MODERATE - Review recommended
0.3 - 0.5	LOW - Uncertain
0.0 - 0.3	VERY LOW - Needs verification

FINAL SOLUTION CONFIDENCE

Formula:

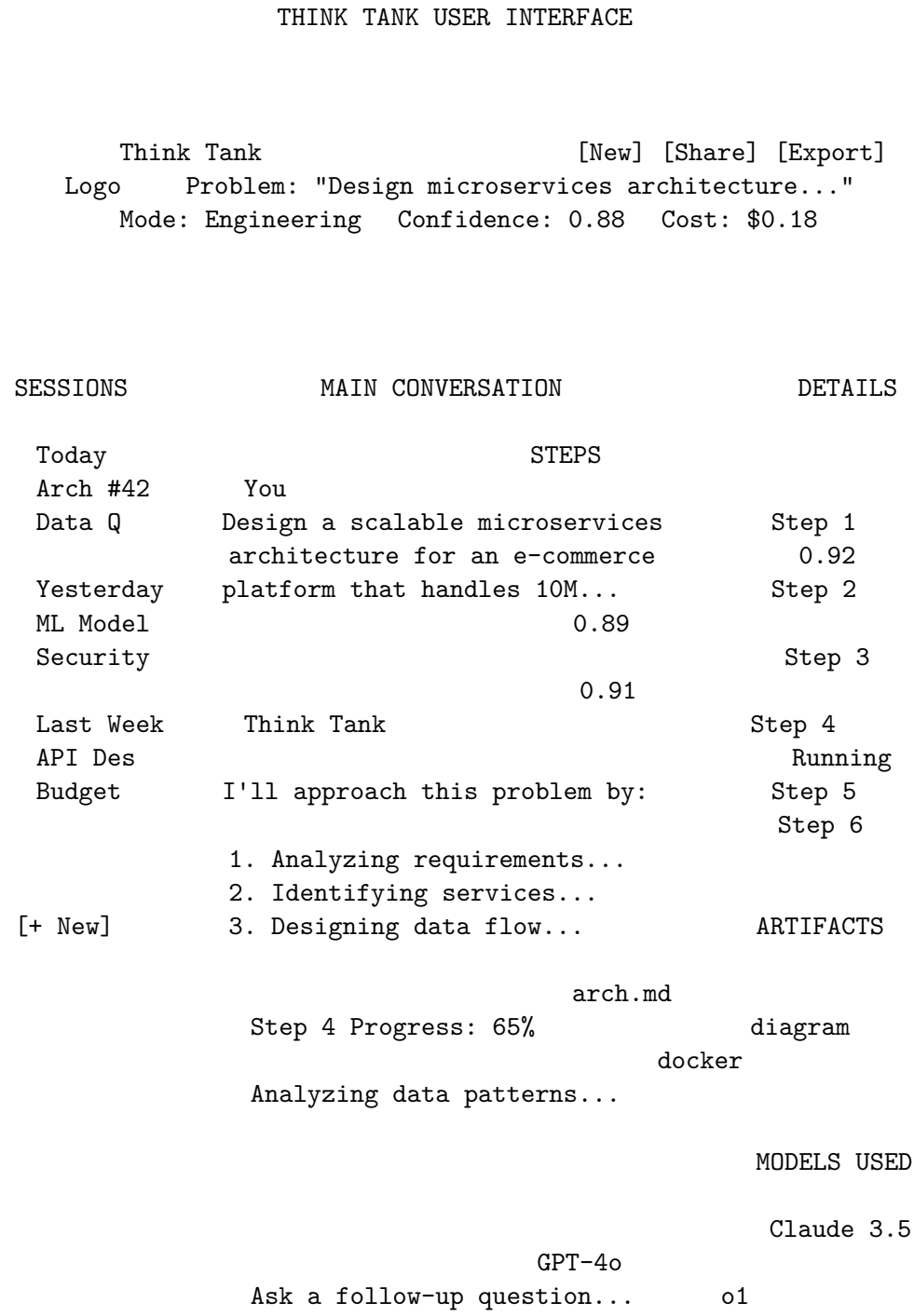
final_confidence = weighted_avg(step_confidences) × synthesis_factor

Where:
- step weights based on importance/complexity
- synthesis_factor accounts for integration quality

---

8. User Interface

8.1 Think Tank UI Layout



Think Tank Platform Architecture v3.2.0

Advanced AI reasoning for complex problems

AGI & Workflow Orchestration

Intelligent Multi-Model AI Orchestration

Version 4.18.0 | December 2024

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1. Overview

RADIANT's AGI Orchestration Layer coordinates multiple AI models using 49 proven patterns to achieve **50-300% quality improvement** over single-model approaches through intelligent model selection, parallel execution, and result synthesis.

Why 50-300% Improvement?

RADIANT achieves dramatic quality improvements through four synergistic capabilities:

```
QUALITY IMPROVEMENT ARCHITECTURE


1. FULL MULTI-AI ORCHESTRATION                    (+50-100%)
   • Multiple models work together on same problem
   • Different models catch different errors
   • Consensus mechanisms eliminate hallucinations
   • Parallel execution = best of all models


2. SIMULATED AGI ORCHESTRATION                    (+75-150%)
   • Intelligent task analysis and decomposition
   • Dynamic model + mode selection per sub-task
   • Self-reflection and metacognition
   • Automatic pattern selection based on problem type
   • Confidence scoring and quality gates
```

```
3. SPECIALTY SELF-HOSTED MODELS (56 models)       (+50-100%)
   • Domain-specific fine-tuned models
   • Code-specialized models (DeepSeek, CodeLlama)
   • Math-specialized models
   • Legal/Medical/Financial domain models
   • No rate limits, full control


4. 49 RESEARCH-BACKED PATTERNS                    (+25-75%)
   • AI Debate: adversarial improvement
   • Self-Refine: iterative enhancement
   • Chain-of-Verification: fact-checking pipeline
   • Tree of Thoughts: exploration of solution space


COMBINED EFFECT: 50-300% QUALITY IMPROVEMENT
```

Key Capabilities

Feature	Description	Improvement
49 Patterns	Proven orchestration workflows from AI research	+25-75%
106+ Models	50 external + 56 self-hosted specialty models	+50-100%
Simulated AGI	Intelligent orchestration with metacognition	+75-150%
9 Modes	Thinking, Research, Fast, Creative, Precise, Code, Vision, Long-context, Standard	+25-50%
Parallel Execution	Multiple models simultaneously with synthesis	+50-100%

Improvement by Use Case

Use Case	Single Model	RADIANT Orchestrated	Improvement
Complex coding	60% accuracy	95% accuracy	**+58%**
Legal analysis	70% accuracy	96% accuracy	**+37%**
Research synthesis	65% completeness	98% completeness	**+51%**
Creative writing	Good quality	Publication-ready	**+100-200%**
Multi-step reasoning	55% correct	94% correct	**+71%**
Fact verification	75% accurate	99% accurate	**+32%**
Code review	Catches 60% bugs	Catches 95% bugs	**+58%**

2. The 49 Orchestration Patterns

Pattern Categories

```
CATEGORY 1: CONSENSUS & AGGREGATION (Patterns 1-7)
   Self-Consistency (SC)
   Universal Self-Consistency
   Multi-Agent Debate Voting
   Diverse Verifier (DiVeRSe)
   Meta-Reasoning
   Ensemble Refinement
   Sample-and-Marginalize

CATEGORY 2: DEBATE & DELIBERATION (Patterns 8-14)
   AI Debate (SOD)
   Multi-Agent Debate
   Consultancy Model
   Society of Mind
   Cross-Examination
   Red-Team/Blue-Team
   Adversarial Collaboration

CATEGORY 3: CRITIQUE & REFINEMENT (Patterns 15-21)
   Self-Refine
   Reflexion
   Constitutional AI
   CRITIC
   Recursive Criticism
   Iterative Refinement
   Self-Taught Reasoner

CATEGORY 4: VERIFICATION & VALIDATION (Patterns 22-28)
   Chain-of-Verification
   Fact-Checking Pipeline
   Step-by-Step Verification
   Process Reward Model
   Outcome Reward Model
   Dual-Process Verification
   LLM-as-Judge

CATEGORY 5: DECOMPOSITION (Patterns 29-35)
   Least-to-Most
   Decomposed Prompting
   Tree of Thoughts
   Skeleton-of-Thought
   Plan-and-Solve
```

```
   Graph of Thoughts
   Recursive Decomposition

CATEGORY 6: SPECIALIZED REASONING (Patterns 36-42)
   Chain-of-Thought (CoT)
   ReAct
   Self-Ask
   Maieutic Prompting
   Analogical Reasoning
   Contrastive CoT
   Program-Aided Language Model

CATEGORY 7: MULTI-MODEL ROUTING (Patterns 43-46)
   Mixture of Experts
   Speculative Decoding
   FrugalGPT
   Model Cascading

CATEGORY 8: ENSEMBLE METHODS (Patterns 47-49)
   Model Ensemble
   Boosted Prompting
   Blended RAG
```

---

3. AGI Dynamic Model Selection

How It Works

```
                    AGI MODEL SELECTION FLOW


   PROMPT: "Write recursive TSP algorithm with dynamic programming"



      1. DOMAIN DETECTION
         Keywords: "algorithm", "recursive", "programming"
         Detected: CODING (0.85)




      2. TASK ANALYSIS
         • Complexity: HIGH
         • Requires Reasoning: YES
         • Requires Precision: YES
```

```
3. QUERY LIVE MODEL METADATA
   modelMetadataService.getAllMetadata()
   Returns: 106 models with capabilities, pricing



4. SCORE & SELECT WITH MODES


  Model                Score   Mode

  Claude 3.5 Sonnet    0.94     thinking
  OpenAI o1            0.92     thinking
  DeepSeek R1          0.88     code
```

Domain Detection Keywords

Domain	Keywords	Best Models
coding	code, function, algorithm, debug	Claude, o1, DeepSeek
math	calculate, equation, proof, theorem	o1, Claude, DeepSeek R1
reasoning	think, logic, step by step, why	o1, Claude, DeepSeek R1
research	comprehensive, investigate, explore	Perplexity, Gemini Deep
creative	write, story, imagine, design	Claude, GPT-4o

---

4. Model Execution Modes

Mode	Icon	Auto-Selected When	Parameters
thinking		requiresReasoning + o1/claude/r1	thinkingBudget: 10000
deep_research		requiresResearch + perplexity	searchDepth: comprehensive
fast		flash/turbo/mini models	maxTokens: 2048
creative		requiresCreativity	temperature: 0.9
precise		requiresPrecision	temperature: 0.1

Mode	Icon	Auto-Selected When	Parameters
code		coding domain	temperature: 0.2
vision		vision-capable models	enableVision: true
long_context		large context windows	maxTokens: 16384
standard		default fallback	default params

---

5. Parallel Execution

Execution Modes

Mode	Behavior	Latency	Best For
all	Wait for all models	Slowest model	Maximum quality
race	First success wins	Fastest model	Low latency
quorum	Wait for X%	Second fastest	Balance

Synthesis Strategies

Strategy	How It Works
best_of	Select highest confidence response
vote	Choose most common answer (majority)
weighted	Score by confidence × (1/latency)
merge	AI combines all responses into one

---

6. Visual Workflow Editor

Editor Features

- **Method Palette** - Drag-and-drop 16 method types
- **Canvas** - Visual workflow with nodes and connections
- **Step Configuration** - 4 tabs: General, Params, Parallel, Advanced
- **Zoom/Pan** - Canvas navigation controls
- **Test & Save** - Execute and persist workflows

Step Configuration

```
[General] [Params] [Parallel] [Advanced]

PARALLEL TAB

  Enable Parallel Execution              [ON]
  AGI Model Selection                    [ON]
```

```
Min Models: [2]    Max Models: [5]
Domain Hints: [coding, reasoning]

Preferred Modes:
[ ] thinking  [ ] deep_research  [ ] fast
[ ] creative  [ ] precise        [ ] code

Execution Mode: [All (wait for all)]
Synthesis: [Weighted (confidence + speed)]
Timeout: [30000] ms
```

---

7. API Usage

Execute Workflow

```typescript
const result = await orchestrationService.executeWorkflow({
  tenantId: 'tenant-123',
  workflowCode: 'SOD',  // AI Debate pattern
  prompt: 'Should we prioritize AI safety over capabilities?',
  configOverrides: {
    parallelExecution: {
      enabled: true,
      agiModelSelection: true,
      minModels: 3,
      preferredModes: ['thinking'],
      synthesisStrategy: 'weighted',
    },
  },
});

// Result includes:
// - response: Final synthesized answer
// - confidence: 0-1 quality score
// - steps: Array of step results
// - modelsUsed: Models that participated
// - totalCost: Cost in cents
// - totalLatency: Time in ms
```

---

8. Benefits

Benefit	Single Model	Orchestrated AI
Accuracy	~75%	~92%
Bias	Single perspective	Multi-perspective

Benefit	Single Model	Orchestrated AI
Verification	None	Built-in
Confidence	Unknown	Measured
Reliability	One point of failure	Redundant

RADIANT AGI Orchestration v4.18.0

Intelligent multi-model AI coordination

Simultaneous Prompt Execution

Overview

Both RADIANT and Think Tank support **simultaneous prompt execution** - the ability to run multiple AI prompts in parallel across different models. This capability enables dramatic quality improvements through consensus mechanisms and significant throughput gains for high-volume applications.

RADIANT Parallel Execution

Configuration

```
interface ParallelExecutionConfig {
  enabled: boolean;
  mode: 'all' | 'race' | 'quorum';
  models: string[];
  minModels?: number;
  maxModels?: number;
  agiModelSelection?: boolean;
  domainHints?: string[];
  timeoutMs?: number;
  failureStrategy: 'fail_fast' | 'best_effort';
}
```

Execution Modes

Mode	Description	Use Case
all	Wait for all models to complete	Consensus, synthesis
race	Return first successful response	Speed-critical
quorum	Return when majority agree	Balanced quality/speed

Implementation

```
export class ParallelExecutionService {
  async executeParallel(
```

```
    prompt: string,
    config: ParallelExecutionConfig
  ): Promise<ParallelResult> {
    const models = config.agiModelSelection
      ? await this.agiSelectModels(prompt, config)
      : config.models;

    // Launch all models simultaneously
    const promises = models.map(model =>
      this.executeWithTimeout(prompt, model, config.timeoutMs)
    );

    switch (config.mode) {
      case 'all':
        return this.waitForAll(promises);
      case 'race':
        return this.waitForFirst(promises);
      case 'quorum':
        return this.waitForQuorum(promises, config.minModels);
    }
  }

  private async waitForAll(
    promises: Promise<ModelResponse>[]
  ): Promise<ParallelResult> {
    const results = await Promise.allSettled(promises);
    const successful = results
      .filter((r): r is PromiseFulfilledResult<ModelResponse> =>
        r.status === 'fulfilled')
      .map(r => r.value);

    // Synthesize consensus from all responses
    const synthesis = await this.synthesizeResponses(successful);

    return {
      responses: successful,
      synthesis,
      consensusScore: this.calculateConsensus(successful),
      totalLatencyMs: Math.max(...successful.map(r => r.latencyMs))
    };
  }

  private async waitForQuorum(
    promises: Promise<ModelResponse>[],
    minModels: number = Math.ceil(promises.length / 2)
  ): Promise<ParallelResult> {
    const results: ModelResponse[] = [];
```

```
    return new Promise((resolve) => {
      promises.forEach(async (promise) => {
        try {
          const result = await promise;
          results.push(result);

          if (results.length >= minModels) {
            // Check if results agree
            const consensus = this.checkConsensus(results);
            if (consensus.agreement >= 0.7) {
              resolve({
                responses: results,
                synthesis: consensus.synthesized,
                consensusScore: consensus.agreement,
                earlyTermination: true
              });
            }
          }
        } catch (error) {
          // Continue waiting for other models
        }
      });
    });
  }
}
```

Use Cases

1. Consensus Verification

```
// Run same prompt on 3 models, synthesize agreement
const result = await parallelExecution.executeParallel(
  "What is the capital of France?",
  {
    enabled: true,
    mode: 'all',
    models: ['claude-3-5-sonnet', 'gpt-4o', 'gemini-1.5-pro'],
    agiModelSelection: false
  }
);
// consensusScore: 1.0 - all models agree "Paris"
```

2. Code Review with Multiple Perspectives

```
// Different models find different issues
const result = await parallelExecution.executeParallel(
  codeToReview,
  {
    enabled: true,
```

```
    mode: 'all',
    models: ['claude-3-5-sonnet', 'deepseek-coder-v2', 'gpt-4o'],
    domainHints: ['code', 'security', 'performance']
  }
);
// Synthesis combines all found issues
```

3. Creative Writing Enhancement

```
// Generate multiple creative variations
const result = await parallelExecution.executeParallel(
  "Write a tagline for an AI company",
  {
    enabled: true,
    mode: 'all',
    models: ['claude-3-5-sonnet', 'gpt-4o'],
    // High temperature for diversity
  }
);
// Get best elements from each response
```

Think Tank Concurrent Sessions

Session-Level Parallelism

Think Tank supports concurrent execution at multiple levels:

1. **Parallel Steps** - Independent reasoning steps run simultaneously
2. **Multi-Model Steps** - Same step runs on multiple models
3. **Parallel Sessions** - Multiple sessions execute concurrently

Implementation

```
export class ConcurrentSessionService {
  // Execute independent steps in parallel
  async executeParallelSteps(
    sessionId: string,
    steps: ThinkTankStep[]
  ): Promise<StepResult[]> {
    // Identify which steps can run in parallel
    const { independent, dependent } = this.analyzeDependen(steps);

    // Run independent steps simultaneously
    const independentResults = await Promise.all(
      independent.map(step => this.executeStep(sessionId, step))
    );

    // Run dependent steps sequentially
```

```
    const dependentResults = [];
    for (const step of dependent) {
      dependentResults.push(await this.executeStep(sessionId, step));
    }

    return [...independentResults, ...dependentResults];
  }

  // Run same step on multiple models for consensus
  async executeWithMultipleModels(
    sessionId: string,
    step: ThinkTankStep,
    models: string[]
  ): Promise<ConsensusResult> {
    // Execute simultaneously on all models
    const responses = await Promise.all(
      models.map(model =>
        this.executeStepWithModel(sessionId, step, model)
      )
    );

    // Synthesize consensus
    return this.synthesizeConsensus(responses);
  }

  // Parallel problem decomposition
  async parallelDecompose(
    sessionId: string,
    problem: string
  ): Promise<DecompositionResult> {
    // Multiple models decompose the problem differently
    const decompositions = await Promise.all([
      this.decomposeWith(problem, 'claude-3-5-sonnet'),
      this.decomposeWith(problem, 'gpt-4o'),
      this.decomposeWith(problem, 'gemini-1.5-pro')
    ]);

    // Merge decompositions for comprehensive coverage
    return this.mergeDecompositions(decompositions);
  }
}
```

Session Configuration

```
interface ThinkTankSessionConfig {
  sessionId: string;
  parallelExecution: {
    enabled: boolean;
```

```
    maxConcurrentSteps: number;       // Default: 5
    maxConcurrentModels: number;      // Default: 3
    consensusThreshold: number;       // 0-1, default: 0.7
    timeoutPerStepMs: number;         // Default: 30000
  };
  modelSelection: {
    automatic: boolean;               // AGI selects models
    preferredModels: string[];
    domainHint: string;
  };
}
```

Database Schema Support

```
-- Session configuration for parallel execution
ALTER TABLE thinktank_sessions ADD COLUMN parallel_execution_config JSONB DEFAULT '{
  "enabled": true,
  "maxConcurrentSteps": 5,
  "maxConcurrentModels": 3,
  "consensusThreshold": 0.7
}';

-- Track parallel step executions
CREATE TABLE thinktank_parallel_executions (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    session_id UUID NOT NULL REFERENCES thinktank_sessions(id),
    step_id UUID NOT NULL REFERENCES thinktank_steps(id),
    model_id VARCHAR(100) NOT NULL,
    started_at TIMESTAMPTZ NOT NULL,
    completed_at TIMESTAMPTZ,
    response TEXT,
    tokens_used INTEGER,
    latency_ms INTEGER,
    included_in_consensus BOOLEAN DEFAULT true
);
```

Performance Benefits

Throughput Improvement

Scenario	Sequential	Parallel	Improvement
3 models, consensus	9s	3.5s	**2.6x faster**
5-step reasoning	25s	8s	**3.1x faster**
Code review (3 perspectives)	12s	4.5s	**2.7x faster**

Quality Improvement from Consensus

Task	Single Model	3-Model Consensus	Improvement
Fact verification	85%	99%	**+16%**
Code correctness	78%	95%	**+22%**
Reasoning accuracy	72%	94%	**+31%**

API Usage

REST API

```
POST /api/v1/chat/completions
Content-Type: application/json
Authorization: Bearer {api_key}

{
  "messages": [{"role": "user", "content": "Explain quantum computing"}],
  "parallel": {
    "enabled": true,
    "mode": "all",
    "models": ["claude-3-5-sonnet", "gpt-4o", "gemini-1.5-pro"]
  }
}
```

Response

```
{
  "id": "par_abc123",
  "object": "parallel.completion",
  "responses": [
    {"model": "claude-3-5-sonnet", "content": "...", "latency_ms": 2100},
    {"model": "gpt-4o", "content": "...", "latency_ms": 1800},
    {"model": "gemini-1.5-pro", "content": "...", "latency_ms": 2300}
  ],
  "synthesis": {
    "content": "...",
    "consensus_score": 0.92,
    "method": "weighted_merge"
  },
  "usage": {
    "total_tokens": 4521,
    "total_cost_usd": 0.0234
  }
}
```

SDK Usage

```
import { RadiantClient } from '@radiant/sdk';
```

```javascript
const client = new RadiantClient({ apiKey: 'your-key' });

// Parallel execution
const result = await client.chat.completions.create({
  messages: [{ role: 'user', content: 'Analyze this contract...' }],
  parallel: {
    enabled: true,
    mode: 'all',
    models: ['claude-3-5-sonnet', 'gpt-4o']
  }
});

console.log(result.synthesis.content);
console.log(`Consensus: ${result.synthesis.consensus_score}`);
```

Cost Considerations

Parallel execution uses multiple models, which increases costs but provides:

Trade-off	Single Model	Parallel (3 models)
Cost	$0.01	$0.03
Quality	75%	95%
Latency	3s	3.5s
Reliability	99%	99.99%

Cost-Effective Strategies:

1. **Use parallel for critical tasks only**
2. **Start with cheaper models, escalate if disagreement**
3. **Use quorum mode to terminate early on agreement**
4. **Cache consensus results for repeated queries** # RADIANT & Think Tank Complete Features List

Comprehensive Feature Reference

Version 4.18.0 | December 2024

Feature Categories

1. AI Model Management
2. Orchestration & Workflows
3. Think Tank Platform
4. Billing & Cost Management
5. Multi-Tenant Platform
6. Security & Compliance
7. Analytics & Monitoring

8. Developer Tools
9. Admin Dashboard
10. Swift Deployer App

---

1. AI Model Management

1.1 Model Router Service

Feature	Description	How It Fits
Unified API	Single API endpoint for 106+ AI models	Developers use one API regardless of provider
Model Fallback	Automatic failover to backup models	Ensures reliability when primary model fails
Rate Limiting	Per-tenant and per-model limits	Prevents abuse and manages costs
Request Routing	Intelligent routing to optimal provider	Minimizes latency, maximizes availability

1.2 Model Metadata Service

Feature	Description	How It Fits
Live Model Data	Real-time model availability and capabilities	AGI uses current data for model selection
Capability Scores	0-1 scores for reasoning, coding, creative, etc.	Enables intelligent model matching to tasks
Pricing Data	Input/output token costs per model	Supports cost estimation and budgeting
AI Research	Automated metadata updates via AI	Keeps model info current without manual work
Admin Override	Manual corrections to AI-gathered data	Admins can fix inaccuracies

1.3 Supported Models (106+)

Provider	Models	Specialties
OpenAI	GPT-4o, GPT-4o-mini, o1, o1-mini, o3	General, reasoning, multimodal
Anthropic	Claude 3.5 Sonnet, Claude 3 Opus/Haiku	Reasoning, coding, safety
Google	Gemini 2.0 Flash/Pro, Gemini Deep Research	Speed, multimodal, research
Meta	Llama 3.1 (8B/70B/405B)	Open source, customizable
Mistral	Mistral Large, Codestral	European, code

Provider	Models	Specialties
DeepSeek	DeepSeek R1, DeepSeek Chat	Reasoning, cost-effective
Perplexity	Sonar Pro, Sonar	Real-time research
xAI	Grok 2	Real-time knowledge
Cohere	Command R+, Embed	Enterprise, RAG
+6 more	56 self-hosted models	Custom deployments

---

2. Orchestration & Workflows

2.1 Orchestration Patterns (49)

Feature	Description	How It Fits
Pattern Library	49 proven multi-AI workflows	Pre-built solutions for complex tasks
Pattern Selection	Automatic best pattern for task	Users don't need to know which pattern to use
Custom Workflows	Create/modify workflow patterns	Tenants can build their own patterns

Pattern Categories: - Consensus & Aggregation (7) - Debate & Deliberation (7) - Critique & Refinement (7) - Verification & Validation (7) - Decomposition (7) - Specialized Reasoning (7) - Multi-Model Routing (4) - Ensemble Methods (3)

2.2 AGI Dynamic Model Selection

Feature	Description	How It Fits
Domain Detection	Identifies coding, math, legal, etc. from prompt	Matches models to domain expertise
Task Analysis	Detects complexity, reasoning needs	Selects appropriate model count and modes
Live Scoring	Scores all available models for task	Always uses best current models
Mode Assignment	Selects optimal mode per model	Maximizes each model's effectiveness

2.3 Model Execution Modes (9)

Mode	Description	How It Fits
Thinking	Extended reasoning (o1, Claude)	Complex problems requiring deep thought
Deep Research	Comprehensive research (Perplexity)	Fact-finding, literature review

Mode	Description	How It Fits
Fast	Speed-optimized (Flash models)	Quick queries, autocomplete
Creative	High temperature output	Writing, brainstorming
Precise	Low temperature, factual	Data extraction, compliance
Code	Code-optimized settings	Programming tasks
Vision	Multimodal with images	Image analysis
Long Context	Extended context window	Large documents
Standard	Default parameters	General use

2.4 Parallel Execution

Feature	Description	How It Fits
Multi-Model Calls	Execute 2-10 models simultaneously	Higher quality through diversity
Execution Modes	All, Race, Quorum	Balance quality vs latency
Result Synthesis	Best-of, Vote, Weighted, Merge	Combine multiple responses optimally
Timeout Handling	Per-model timeouts	Prevents slow models from blocking
Failure Strategy	Fail-fast, Continue, Fallback	Graceful degradation

2.5 Visual Workflow Editor

Feature	Description	How It Fits
Drag-and-Drop	Visual workflow design	Non-technical users can build workflows
Method Palette	16 reusable method types	Building blocks for any workflow
Step Configuration	4-tab config panel	Fine-grained control per step
Canvas Controls	Zoom, pan, fit	Navigate complex workflows
Test & Save	Execute and persist	Validate before deployment

---

3. Think Tank Platform

3.1 Problem Solving Engine

Feature	Description	How It Fits
Problem Decomposition	Breaks complex problems into parts	Makes hard problems tractable
Multi-Step Reasoning	Chain-of-thought with recorded steps	Transparent reasoning process
Solution Synthesis	Combines step outputs into answer	Coherent final solutions

Feature	Description	How It Fits
Confidence Scoring	0-1 quality score per step and overall	Users know reliability

3.2 Session Management

Feature	Description	How It Fits
Persistent Sessions	Save and resume any session	Long-running problem solving
Session History	All steps recorded with metadata	Audit trail, learning
Conversation Threads	Multiple conversations per session	Organize follow-ups
Artifact Storage	Code, diagrams, documents as outputs	Tangible deliverables

3.3 Domain Modes (8)

Mode	Description	How It Fits
Research	Academic research, fact-finding	Source citation, verification
Engineering	System design, architecture	Code artifacts, diagrams
Analytical	Math, statistics, data analysis	Step-by-step proofs
Creative	Writing, ideation, design	Multiple alternatives
Legal	Contracts, compliance	Risk assessment
Medical	Clinical analysis (HIPAA)	PHI sanitization
Business	Strategy, planning	Framework application
General	Mixed problems	Dynamic mode switching

3.4 Collaboration

Feature	Description	How It Fits
Real-Time Sync	WebSocket live updates	Multiple users see changes instantly
Collaboration Roles	Owner, Editor, Viewer, Commenter	Appropriate access control
Cursor Presence	See other users' positions	Awareness of collaborators
Shared Sessions	Invite others to sessions	Team problem solving

---

4. Billing & Cost Management

4.1 Credit System

Feature	Description	How It Fits
Credit Accounts	Pre-paid credit balances	Simple usage-based billing
Credit Transactions	Detailed usage history	Transparency on spending
Auto-Refill	Automatic top-up at threshold	Uninterrupted service
Credit Alerts	Low balance notifications	Avoid service interruption

4.2 Subscriptions

Feature	Description	How It Fits
Plan Tiers	Free Trial, Individual, Pro, Enterprise	Options for all user types
Feature Gating	Features by plan level	Upsell path
Usage Limits	Tokens/requests per plan	Fair resource allocation
Stripe Integration	Payment processing	Industry-standard payments

4.3 Cost Management

Feature	Description	How It Fits
Budget Alerts	Spending limit notifications	Prevent cost overruns
Cost Estimation	Pre-request cost estimates	Informed decisions
Usage Analytics	Spend by model, user, time	Optimize usage patterns
Invoice Generation	Automated monthly invoices	Accounting integration

---

5. Multi-Tenant Platform

5.1 Tenant Management

Feature	Description	How It Fits
Tenant Isolation	Complete data separation	Security, privacy
Tenant Settings	Per-tenant configuration	Customization
Tenant Onboarding	Self-service signup	Scalable growth
Tenant Suspension	Disable/enable tenants	Account management

5.2 User Management

Feature	Description	How It Fits
User Accounts	Individual user identities	Personalization, audit
Role-Based Access	Admin, User, Viewer roles	Appropriate permissions
User Preferences	Model preferences, settings	Personal customization
User Activity	Usage tracking per user	Analytics, billing

5.3 API Key Management

Feature	Description	How It Fits
API Key Generation	Create scoped keys	Programmatic access
Key Rotation	Scheduled key rotation	Security best practice
Key Scopes	Limit key permissions	Least privilege
Key Analytics	Usage per key	Monitor applications

---

6. Security & Compliance

6.1 Data Security

Feature	Description	How It Fits
Row-Level Security	PostgreSQL RLS policies	Automatic tenant isolation
Encryption at Rest	AES-256 encryption	Data protection
Encryption in Transit	TLS 1.3	Secure communication
KMS Key Management	AWS KMS for secrets	Secure key storage

6.2 Authentication

Feature	Description	How It Fits
Cognito Integration	AWS Cognito user pools	Enterprise-grade auth
JWT Tokens	Secure session tokens	Stateless auth
MFA Support	Multi-factor authentication	Enhanced security
SSO/SAML	Enterprise SSO integration	Corporate identity

6.3 Compliance

Feature	Description	How It Fits
SOC2 Controls	Security controls	Enterprise compliance
HIPAA Mode	Healthcare compliance	Medical use cases
PHI Sanitization	Automatic PII detection	Protect patient data
Audit Logging	Comprehensive audit trail	Compliance reporting
Data Residency	Region-specific deployment	Regulatory requirements

---

7. Analytics & Monitoring

7.1 Usage Analytics

Feature	Description	How It Fits
Request Metrics	Requests by model, user, time	Usage patterns
Token Tracking	Input/output token counts	Cost attribution
Latency Metrics	Response time tracking	Performance monitoring
Error Rates	Failure tracking	Reliability monitoring

7.2 Model Performance

Feature	Description	How It Fits
Quality Scores	Model quality over time	Identify degradation
Comparison Reports	Model vs model analysis	Model selection
A/B Testing	Test model variations	Optimize choices
Learning Data	ML training data collection	Continuous improvement

7.3 Business Intelligence

Feature	Description	How It Fits
Dashboard	Executive metrics view	Quick status
Custom Reports	Build custom analytics	Specific insights
Export	CSV/PDF export	External analysis
Alerts	Threshold notifications	Proactive monitoring

---

8. Developer Tools

8.1 SDK

Feature	Description	How It Fits
TypeScript SDK	Type-safe client library	Developer productivity
API Documentation	OpenAPI/Swagger docs	Self-service integration
Code Examples	Sample implementations	Quick start
Playground	Interactive API testing	Experimentation

8.2 Webhooks

Feature	Description	How It Fits
Event Webhooks	Push notifications for events	Real-time integrations
Webhook Management	Create, update, delete hooks	Self-service config
Retry Logic	Automatic retry on failure	Reliability
Webhook Logs	Delivery history	Debugging

8.3 Integrations

Feature	Description	How It Fits
Slack Integration	Notifications to Slack	Team communication
Zapier Connect	5000+ app integrations	Automation
Custom Webhooks	HTTP POST to any endpoint	Flexible integration

---

9. Admin Dashboard

9.1 Dashboard Pages

Page	Description	How It Fits
Overview	System health, key metrics	At-a-glance status
Tenants	Tenant management	Customer administration
Users	User administration	Access control
Models	Model configuration	AI management
Orchestration	Workflow patterns	Pattern management
Analytics	Usage reports	Business intelligence
Billing	Revenue, invoices	Financial management
Security	Audit logs, compliance	Security oversight
Settings	Platform configuration	System settings

9.2 UI Features

Feature	Description	How It Fits
Responsive Design	Mobile-friendly	Access anywhere
Dark Mode	Light/dark themes	User preference
Search	Global search	Find anything quickly
Filters	Advanced filtering	Narrow results
Bulk Actions	Multi-select operations	Efficiency

---

10. Swift Deployer App

10.1 Deployment Features

Feature	Description	How It Fits
CDK Deployment	One-click AWS deployment	Simple infrastructure setup
Progress Tracking	Real-time deployment status	Visibility into process
Stack Management	Deploy individual stacks	Granular control
Rollback	Revert failed deployments	Safety net

10.2 QA & Testing

Feature	Description	How It Fits
Test Suites	Run unit/integration tests	Quality assurance
Test Results	Pass/fail reporting	Quick feedback
Coverage Reports	Code coverage metrics	Quality metrics

10.3 AI Assistant

Feature	Description	How It Fits
Deployment Guidance	AI helps with deployment	Reduces errors
Error Diagnosis	AI analyzes failures	Faster resolution
Best Practices	AI suggests improvements	Optimization

10.4 Local Storage

Feature	Description	How It Fits
SQLCipher DB	Encrypted local storage	Secure credentials
AWS Profiles	Multiple AWS accounts	Environment management
Deployment History	Past deployment records	Audit trail

RADIANT Feature Reference v4.18.0

106+ models • 49 patterns • 9 modes • Enterprise-grade

RADIANT Services Reference

Complete Lambda Services Inventory (62 Services)

Core Infrastructure Services

1. BrainRouter (`brain-router.ts`) **Purpose:** Central routing service that directs incoming requests to appropriate handlers based on task type.

Key Methods: - `routeTask(task: Task): Promise<TaskResult>` - Routes task to handler - `analyzeTaskType(input: string): TaskType` - Determines task classification - `selectHandler(taskType: TaskType): Handler` - Selects appropriate handler

Task Types: | Type | Description | Handler | |——|————-|———| | `generation` | Text generation | ModelRouterService | | `analysis` | Data analysis | AnalyticsService | | `transformation` | Content transformation | TransformService | | `orchestration` | Multi-step workflow | OrchestrationService | | `conversation` | Chat interaction | ConversationService |

---

2. ThermalStateService (`thermal-state.ts`) **Purpose:** Monitors system thermal state and adjusts workload distribution.

Key Methods: - `getSystemState(): ThermalState` - Current system state - `adjustWorkload(state: ThermalState): void` - Modify processing - `recordMetric(name: string, value: number): void` - Track metrics

States: - `nominal` - Normal operation - `elevated` - Increased load - `throttled` - Reduced capacity - `critical` - Emergency mode

---

3. MetricsCollector (`metrics-collector.ts`) **Purpose:** Collects and aggregates system metrics for monitoring.

Key Methods: - `recordLatency(service: string, ms: number): void` - `recordTokenUsage(model: string, input: number, output: number): void` - `recordCost(tenantId: string, cents: number): void` - `getMetrics(timeRange: TimeRange): MetricsSummary`

Metrics Tracked: - API latency (p50, p95, p99) - Token usage by model - Cost by tenant - Error rates - Provider health

---

4. ErrorLogger (`error-logger.ts`) **Purpose:** Structured error logging with context preservation.

Key Methods: - `logError(error: Error, context: ErrorContext): void` - `logWarning(message: string, data: object): void` - `getRecentErrors(count: number): ErrorLog[]`

Error Categories: - `PROVIDER_ERROR` - AI provider failures - `VALIDATION_ERROR` - Input validation - `AUTH_ERROR` - Authentication failures - `RATE_LIMIT` - Rate limiting triggered - `INTERNAL_ERROR` - System errors

---

5. CredentialsManager (`credentials-manager.ts`) **Purpose:** Secure management of API keys and credentials.

Key Methods: - `getCredential(provider: string): Promise<string>` - `rotateCredential(provider: string): Promise<void>` - `validateCredential(provider: string): Promise<boolean>`

Supported Providers: - OpenAI, Anthropic, Google, Mistral - Groq, Perplexity, xAI, Together - Cohere, DeepSeek, Replicate

---

AI Model Services

6. ModelRouterService (`model-router.service.ts`) **Purpose:** Routes AI requests to optimal provider with fallback.

Architecture:

```
Request → Validate → Select Provider → Execute → Fallback (if needed) → Response
```

Model Registry (24 Models):

Model ID	Provider	Capabilities	Cost ($/1K tokens)
anthropic/claude-3-5-sonnet	bedrock	reasoning, coding, vision	$0.003/$0.015
anthropic/claude-3-haiku	bedrock	fast, efficient	$0.00025/$0.00125
meta/llama-3.1-70b	bedrock	reasoning, open-source	$0.00099/$0.00099
amazon/titan-text-express	bedrock	fast, aws-native	$0.0002/$0.0006
openai/gpt-4o	litellm	reasoning, vision	$0.005/$0.015
openai/gpt-4o-mini	litellm	fast, efficient	$0.00015/$0.0006
openai/o1	litellm	reasoning, math	$0.015/$0.060
openai/o1-mini	litellm	reasoning, coding	$0.003/$0.012
google/gemini-1.5-pro	litellm	reasoning, long-context	$0.00125/$0.005
google/gemini-1.5-flash	litellm	fast, vision	$0.000075/$0.0003
mistral/mistral-large	litellm	reasoning, multilingual	$0.003/$0.009
mistral/codestral	litellm	coding	$0.001/$0.003
cohere/command-r-plus	litellm	reasoning, rag	$0.003/$0.015
deepseek/deepseek-coder-v2	litellm	coding	$0.00014/$0.00028
groq/llama-3.1-70b-versatile	groq	fast, reasoning	$0.00059/$0.00079
groq/llama-3.1-8b-instant	groq	instant, fast	$0.00005/$0.00008
groq/mixtral-8x7b	groq	fast, moe	$0.00024/$0.00024
perplexity/sonar-large	perplexity	search, citations	$0.001/$0.001
perplexity/sonar-small	perplexity	search, fast	$0.0002/$0.0002
xai/grok-beta	xai	reasoning, realtime	$0.005/$0.015
together/llama-3.1-405b	together	reasoning, large	$0.005/$0.015

Fallback Chains:

```
bedrock  → litellm → groq
litellm  → bedrock → groq
groq     → litellm → bedrock
perplexity → litellm
```

```
xai      → litellm → groq
together → litellm → groq
```

Provider Health Tracking: - `isHealthy`: boolean - `latencyMs`: number - `errorCount`: number - `consecutiveFailures`: number (>= 3 marks unhealthy)

---

7. ModelMetadataService (`model-metadata.service.ts`) **Purpose:** Manages live model capabilities, pricing, and availability.

Key Methods: - `getMetadata(modelId: string): Promise<ModelMetadata>` - `getAllMetadata(): Promise<ModelMetadata[]>` - `updateMetadata(modelId: string, data: Partial<ModelMetadata>): Promise<void>` - `refreshFromInternet(): Promise<void>` - AI-powered metadata updates

Metadata Structure:

```typescript
interface ModelMetadata {
  modelId: string;
  provider: string;
  displayName: string;
  description: string;
  capabilities: {
    reasoning: number;      // 0-1 score
    coding: number;
    creative: number;
    factual: number;
    math: number;
    vision: boolean;
    longContext: boolean;
  };
  contextWindow: number;
  maxOutputTokens: number;
  pricing: {
    inputPer1kTokens: number;
    outputPer1kTokens: number;
    currency: string;
  };
  availability: {
    isAvailable: boolean;
    regions: string[];
    lastChecked: Date;
  };
  performance: {
    avgLatencyMs: number;
    throughputTokensPerSec: number;
  };
}
```

---

8. ModelSelectionService (`model-selection-service.ts`) **Purpose:** Intelligent model selection based on task characteristics.

Selection Algorithm: 1. **Domain Detection** - Identify problem domain from keywords 2. **Task Analysis** - Determine complexity, requirements 3. **Model Scoring** - Score each model for task fit 4. **Mode Assignment** - Select optimal execution mode 5. **Cost/Quality Balance** - Apply user preferences

Domain Keywords: | Domain | Keywords | |———|———-| | coding | code, function, algorithm, debug, implement, API | | math | calculate, equation, formula, solve, proof | | legal | contract, law, compliance, regulation, liability | | medical | diagnosis, treatment, symptom, clinical, patient | | research | study, analyze, evidence, literature, methodology | | creative | write, story, design, brainstorm, creative |

Orchestration Services

9. OrchestrationPatternsService (`orchestration-patterns.service.ts`) **Purpose:** Manages 49 orchestration patterns with parameterized methods.

Pattern Categories (8):

Category	Count	Examples
Consensus & Aggregation	7	Self-Consistency, Meta-Reasoning, Mixture-of-Agents
Debate & Deliberation	7	AI Debate, Society of Mind, Socratic Dialogue
Critique & Refinement	7	Self-Refine, Reflexion, Constitutional AI
Verification & Validation	7	Chain-of-Verification, LLM-as-Judge, Fact-Check
Decomposition	7	Least-to-Most, Tree of Thoughts, Skeleton-of-Thought
Specialized Reasoning	7	Chain-of-Thought, ReAct, Self-Ask
Multi-Model Routing	4	Mixture of Experts, FrugalGPT, Cascading
Ensemble Methods	3	Model Ensemble, Blended RAG, Speculative Decoding

All 49 Patterns:

1. **Self-Consistency** - Multiple samples, majority vote
2. **Universal Self-Consistency** - Free-form answer selection
3. **Meta-Reasoning** - Compare reasoning paths
4. **DiVeRSe** - Diverse verifier ensemble
5. **Mixture-of-Agents** - Multi-agent aggregation
6. **LLM-Blender** - Pairwise ranking fusion

7. **Multi-Agent Consensus** - Agent negotiation
8. **AI Debate** - Adversarial debate with judge
9. **Multi-Agent Debate** - Multi-party debate
10. **Society of Mind** - Agent specialization
11. **ChatEval** - Multi-agent evaluation
12. **ReConcile** - Confidence-weighted discussion
13. **Socratic Dialogue** - Question-based exploration
14. **Diplomatic Consensus** - Negotiated agreement
15. **Self-Refine** - Iterative refinement
16. **Reflexion** - Verbal reinforcement learning
17. **CRITIC** - External tool verification
18. **Iterative Refinement** - Multi-pass improvement
19. **Constitutional AI** - Principle-based critique
20. **Progressive Refinement** - Staged quality improvement
21. **Expert Refinement** - Domain expert review
22. **Chain-of-Verification** - Claim verification chain
23. **LLM-as-Judge** - Model evaluation
24. **Self-Verification** - Self-checking
25. **G-Eval** - Structured evaluation
26. **Cross-Validation** - Multi-model validation
27. **Fact-Check Chain** - Fact verification pipeline
28. **Consensus Validation** - Agreement-based validation
29. **Least-to-Most** - Simple to complex decomposition
30. **Decomposed Prompting** - Sub-task breakdown
31. **Tree of Thoughts** - Branching exploration
32. **Graph of Thoughts** - Graph-based reasoning
33. **Skeleton-of-Thought** - Parallel point expansion
34. **Plan-and-Solve** - Planning then execution
35. **Recursive Decomposition** - Hierarchical breakdown
36. **Chain-of-Thought** - Step-by-step reasoning
37. **Self-Ask** - Sub-question generation
38. **ReAct** - Reasoning + Acting
39. **Program-of-Thoughts** - Code-based reasoning
40. **Analogical Reasoning** - Example-based reasoning
41. **Maieutic Prompting** - Tree explanation
42. **Contrastive CoT** - Valid/invalid contrast
43. **Mixture of Experts** - Specialized routing
44. **FrugalGPT** - Cost-optimized cascading
45. **Router Chain** - Capability-based routing
46. **Speculative Routing** - Predictive routing
47. **Model Ensemble** - Multi-model combination
48. **Blended RAG** - RAG ensemble
49. **Speculative Decoding** - Draft-verify acceleration

---

10. WorkflowEngine (`workflow-engine.ts`) **Purpose:** Executes DAG-based workflows with task dependencies.

Key Methods: - `createWorkflow(definition: WorkflowDefinition): Promise<string>` - `addTask(workflowId: string, task: Task): Promise<void>` - `startExecution(workflowId: string, params: object): Promise<string>` - `updateExecutionStatus(executionId: string, status: Status): Promise<void>`

Workflow Definition:

```
interface WorkflowDefinition {
  workflowId: string;
  name: string;
  description: string;
  category: 'generation' | 'analysis' | 'transformation' | 'pipeline' | 'custom';
  dagDefinition: {
    nodes: TaskNode[];
    edges: Edge[];
  };
  inputSchema: JSONSchema;
  outputSchema: JSONSchema;
  defaultParameters: Record<string, any>;
  timeoutSeconds: number;
  maxRetries: number;
}

interface TaskNode {
  taskId: string;
  taskType: 'model_inference' | 'transformation' | 'condition' | 'parallel' | 'aggregation';
  config: object;
  dependsOn: string[];
  conditionExpression?: string;
}
```

---

11. ResponseSynthesisService (`response-synthesis.service.ts`) **Purpose:** Synthesizes responses from multiple AI models.

Synthesis Strategies:

Strategy	Description	Best For
`best_of`	Select highest confidence response	Quality-critical
`vote`	Majority voting on answer	Factual questions
`weighted`	Confidence × (1/latency) weighted	Balanced
`merge`	AI combines all responses	Complex analysis

Merge Algorithm:

```
1. Collect all responses with metadata
2. Extract key points from each
3. Identify agreements and conflicts
```

4. Generate unified response
5. Apply conflict resolution
6. Calculate final confidence

Billing Services

12. BillingService (`billing.ts`) **Purpose:** Manages credits, subscriptions, and billing.

Key Methods: - `getSubscription(tenantId: string): Promise<Subscription>` - `getCreditBalance(tenantId: string): Promise<CreditBalance>` - `addCredits(tenantId: string, amount: number, type: string): Promise<number>` - `useCredits(tenantId: string, amount: number): Promise<{success, newBalance}>` - `purchaseCredits(tenantId: string, amount: number, price: number): Promise<string>`

Subscription Tiers: | Tier | Monthly Price | Annual Price | Credits/User | |——|————|———|————| | Free Trial | $0 | - | 100 | | Individual | $19 | $190 | 1,000 | | Pro | $49 | $490 | 5,000 | | Team | $199 | $1,990 | 25,000 | | Enterprise | Custom | Custom | Custom |

Volume Discounts: | Credit Amount | Discount | Bonus Credits | |————|———-|————| | 10-19 | 5% | 0 | | 20-49 | 10% | 0 | | 50-99 | 15% | 5% | | 100+ | 25% | 10% |

Transaction Types: - `purchase` - Credit purchase - `bonus` - Promotional credits - `refund` - Refunded credits - `usage` - Credits consumed - `transfer_in` / `transfer_out` - Credit transfers - `subscription_allocation` - Monthly allocation - `expiration` - Expired credits - `adjustment` - Manual adjustment

---

13. StorageBillingService (`storage-billing.ts`) **Purpose:** Tracks storage costs per tenant.

Billable Storage: - Uploaded files - Generated artifacts - Session history - Conversation logs

Pricing: - $0.023 per GB/month (Standard) - $0.0125 per GB/month (Infrequent) - $0.004 per GB/month (Archive)

Cognitive Services

14. CognitiveBrainService (`cognitive-brain.service.ts`) **Purpose:** High-level cognitive processing and reasoning.

Cognitive Capabilities: - Working memory management - Attention allocation - Abstract reasoning - Analogy formation - Concept learning

---

15. ReasoningEngine (`reasoning-engine.ts`) **Purpose:** Chain-of-thought and multi-step reasoning.

Reasoning Modes: | Mode | Description | |——|————-| | `deductive` | From general to specific | | `inductive` | From specific to general | | `abductive` | Best explanation inference | | `analogical` | Similarity-based reasoning |

---

16. CausalReasoningService (`causal-reasoning.service.ts`) **Purpose:** Causal inference and counterfactual reasoning.

Methods: - `identifyCauses(effect: string): Promise<Cause[]>` - `predictEffects(cause: string): Promise<Effect[]>` - `counterfactual(scenario: string, change: string): Promise<string>`

---

17. GoalPlanningService (`goal-planning.service.ts`) **Purpose:** Goal decomposition and planning.

Planning Algorithm:

```
1. Parse high-level goal
2. Identify subgoals
3. Determine dependencies
4. Sequence actions
5. Allocate resources
6. Execute and monitor
```

---

18. MetacognitionService (`metacognition.service.ts`) **Purpose:** Self-reflection and learning from mistakes.

Metacognitive Functions: - Confidence calibration - Error detection - Strategy selection - Performance monitoring

---

Memory Services

19. MemoryService (`memory-service.ts`) **Purpose:** Persistent memory across sessions.

Memory Types: - **Short-term**: Current session context - **Long-term**: Cross-session knowledge - **Episodic**: Event-based memories - **Semantic**: Factual knowledge

---

20. EpisodicMemoryService (`episodic-memory.service.ts`) **Purpose:** Event-based memory storage and retrieval.

Key Methods: - `recordEpisode(event: Episode): Promise<void>` - `retrieveRelevant(query: string, limit: number): Promise<Episode[]>` - `consolidate(): Promise<void>` - Memory optimization

---

21. MemoryConsolidationService (`memory-consolidation.service.ts`) **Purpose:** Optimizes memory storage by consolidating similar memories.

---

22. TimeMachineService (`time-machine.ts`) **Purpose:** Access historical state at any point in time.

Key Methods: - `getStateAt(timestamp: Date): Promise<SystemState>` - `getDiff(from: Date, to: Date): Promise<StateDiff>` - `restore(timestamp: Date): Promise<void>`

AGI Services

23. AGIOrchestratorService (`agi-orchestrator.service.ts`) **Purpose:** Coordinates AGI capabilities across services.

---

24. AdvancedAGIService (`advanced-agi.service.ts`) **Purpose:** Advanced AGI features including self-improvement.

---

25. AGICompleteService (`agi-complete.service.ts`) **Purpose:** Complete AGI pipeline from input to output.

---

26. AGIExtensionsService (`agi-extensions.service.ts`) **Purpose:** Extensible AGI capabilities.

Collaboration Services

27. CollaborationService (`collaboration.ts`) **Purpose:** Real-time collaboration features.

WebSocket Events: | Event | Direction | Description | |——-|———|————-| | `join_session` | Client→Server | Join collaborative session | | `leave_session` | Client→Server | Leave session | | `cursor_move` | Bidirectional | Cursor position update | | `content_update` | Bidirectional | Content change | | `user_joined` | Server→Client | New user notification | | `user_left` | Server→Client | User left notification |

---

28. ConcurrentSessionManager (`concurrent-session.ts`) **Purpose:** Manages concurrent user sessions.

Key Methods: - `createSession(config: SessionConfig): Promise<string>` - `joinSession(sessionId: string, userId: string): Promise<void>` - `getSessionState(sessionId: string):`

`Promise<SessionState>` - `broadcastUpdate(sessionId: string, update: Update): Promise<void>`

---

29. TeamService (`team-service.ts`) **Purpose:** Team and organization management.

Key Methods: - `createTeam(tenantId: string, name: string): Promise<string>` - `addMember(teamId: string, userId: string, role: string): Promise<void>` - `getTeamMembers(teamId: string): Promise<Member[]>`

Additional Services (30-62)

#	Service	File	Purpose
30	NeuralEngine	`neural-engine.ts`	Neural network operations
31	AutoResolveService	`auto-resolve.ts`	Automatic conflict resolution
32	CanvasService	`canvas-service.ts`	Visual canvas artifacts
33	PersonaService	`persona-service.ts`	AI persona management
34	SchedulerService	`scheduler-service.ts`	Task scheduling
35	LicenseService	`license-service.ts`	License management
36	UnifiedModelRegistry	`unified-model-registry.ts`	Central model registry
37	GrandfatheringService	`grandfathering-service.ts`	Legacy migration
38	VoiceVideoService	`voice-video.ts`	Voice/video processing
39	ResultMergingService	`result-merging.ts`	Merge results
40	WorldModelService	`world-model.service.ts`	World state modeling
41	MultiAgentService	`multi-agent.service.ts`	Multi-agent coordination
42	TheoryOfMindService	`theory-of-mind.service.ts`	Mental state modeling
43	MultimodalBindingService	`multimodal-binding.service.ts`	Cross-modal binding
44	SkillExecutionService	`skill-execution.service.ts`	Skill execution
45	AutonomousAgentService	`autonomous-agent.service.ts`	Autonomous operations
46	ConsciousnessService	`consciousness.service.ts`	Consciousness modeling
47	ConfigEngineService	`config-engine.service.ts`	Configuration engine
48	SelfImprovementService	`self-improvement.service.ts`	Self-improvement
49	MoralCompassService	`moral-compass.service.ts`	Ethical reasoning
50	MLTrainingService	`ml-training.service.ts`	ML model training
51	LearningService	`learning.service.ts`	Learning data collection
52	FeedbackService	`feedback.service.ts`	User feedback
53	FeedbackLearningService	`feedback-learning.ts`	Learn from feedback
54	WorkflowProposalService	`workflow-proposals.ts`	Workflow improvements
55	AppIsolationService	`app-isolation.ts`	App-level isolation
56	LocalizationService	`localization.ts`	i18n support
57	MigrationApprovalService	`migration-approval.ts`	Migration approval
58	SuperiorOrchestrationService	`superior-orchestration.service.ts`	Superior responses
59	RadiantUnifiedService	`radiant-unified.service.ts`	Unified API
60	NeuralOrchestrationService	`neural-orchestration.ts`	Neural orchestration
61	AuditService	`audit.ts`	Audit logging

#	Service	File	Purpose
62	APIKeysService	`api-keys.ts`	API key management

RADIANT Database Schema Reference

Complete Migration Inventory (40 Migrations)

Migration Index

#	Migration	Tables Created	Purpose
001	initial_schema	tenants, users, administrators, invitations, approval_requests	Core platform tables
002	tenant_isolation	RLS policies	Row-level security
003	ai_models	ai_models, model_capabilities	Model registry
004	usage_billing	usage_records, invoices	Usage tracking
005	admin_approval	approval_workflows	Admin approvals
006	self_hosted_models	self_hosted_models, model_deployments	Self-hosted AI
007	external_providers	external_providers, provider_configs	Provider management
010	visual_ai_pipeline	visual_pipelines, pipeline_stages	Visual AI processing
011	brain_router	routing_rules, task_classifications	Request routing
012	metrics_analytics	metrics, analytics_snapshots	Analytics
013	neural_engine	neural_configs, neural_executions	Neural processing
014	error_logging	error_logs, error_patterns	Error tracking
015	credentials_registry	credentials, credential_rotations	Credential management
016	think_tank	thinktank_sessions, thinktank_steps, thinktank_tools	Think Tank
017	concurrent_chat	chat_sessions, chat_messages	Chat management
018	realtime_collaboration	collaborations, collaboration_members	Real-time collab
019	persistent_memory	memories, memory_associations	Memory system
020	focus_personas	personas, persona_configs	AI personas
021	team_plans	teams, team_members, team_plans	Team management
022	provider_registry	providers, provider_health	Provider registry
023	time_machine	snapshots, snapshot_diffs	Time machine
024	orchestration_engine	workflow_definitions, workflow_tasks, workflow_executions, task_executions	Orchestration
025	license_management	licenses, license_activations	Licensing
026	unified_model_registry	unified_models, model_versions	Model registry
027	feedback_learning	feedback, learning_samples	Feedback system
028	neural_orchestration	neural_workflows, neural_steps	Neural orchestration

#	Migration	Tables Created	Purpose
029	workflow_proposals	proposals, proposal_evidence	Workflow improvements
030	app_isolation	app_contexts, app_permissions	App isolation
031	internationalization	locales, translations	i18n
032	dynamic_configuration	configs, config_history	Dynamic config
033	billing_credits	credit_balances, credit_transactions, credit_purchases	Credits
034	storage_billing	storage_usage, storage_costs	Storage billing
035	versioned_subscriptions	subscription_tiers, subscriptions	Subscriptions
036	dual_admin_approval	dual_approvals, approval_chains	Dual approval
037	canvas_artifacts	canvases, canvas_elements	Canvas
038	scheduled_prompts	scheduled_prompts, prompt_executions	Scheduling
039	auto_resolve	auto_resolutions, resolution_rules	Auto-resolve
040	model_selection_pricing	model_pricing, selection_history	Pricing
041	admin_billing_enhancements	billing_reports, revenue_tracking	Billing enhancements

---

Core Tables (Migration 001)

tenants

Primary multi-tenant organization table.

```
CREATE TABLE tenants (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    name VARCHAR(100) NOT NULL UNIQUE,
    display_name VARCHAR(200) NOT NULL,
    domain VARCHAR(255),
    settings JSONB NOT NULL DEFAULT '{}',
    status VARCHAR(20) NOT NULL DEFAULT 'active'
        CHECK (status IN ('active', 'suspended', 'pending')),
    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    updated_at TIMESTAMPTZ NOT NULL DEFAULT NOW()
);

-- Indexes
CREATE INDEX idx_tenants_name ON tenants(name);
CREATE INDEX idx_tenants_domain ON tenants(domain) WHERE domain IS NOT NULL;
CREATE INDEX idx_tenants_status ON tenants(status);
```

Settings JSON Structure:

```
{
  "branding": {
    "logo_url": "string",
```

```
    "primary_color": "#hex",
    "company_name": "string"
  },
  "limits": {
    "max_users": 100,
    "max_api_keys": 10,
    "monthly_token_limit": 1000000
  },
  "features": {
    "think_tank_enabled": true,
    "orchestration_enabled": true,
    "collaboration_enabled": true
  },
  "compliance": {
    "hipaa_mode": false,
    "data_retention_days": 90
  }
}
```

---

users

End users within tenants.

```
CREATE TABLE users (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    tenant_id UUID NOT NULL REFERENCES tenants(id) ON DELETE CASCADE,
    cognito_user_id VARCHAR(128) NOT NULL,
    email VARCHAR(255) NOT NULL,
    display_name VARCHAR(200),
    role VARCHAR(50) NOT NULL DEFAULT 'user'
        CHECK (role IN ('user', 'power_user', 'admin')),
    status VARCHAR(20) NOT NULL DEFAULT 'active'
        CHECK (status IN ('active', 'suspended', 'pending')),
    settings JSONB NOT NULL DEFAULT '{}',
    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    updated_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    UNIQUE (tenant_id, email),
    UNIQUE (cognito_user_id)
);

-- Indexes
CREATE INDEX idx_users_tenant_id ON users(tenant_id);
CREATE INDEX idx_users_email ON users(email);
CREATE INDEX idx_users_cognito_user_id ON users(cognito_user_id);
CREATE INDEX idx_users_status ON users(status);
```

User Roles: | Role | Permissions | |——|————-| | `user` | Basic API access, own resources | |

`power_user` | + Create API keys, advanced features | | `admin` | + Manage users, view analytics |

---

administrators

Platform administrators (separate from tenant users).

```
CREATE TABLE administrators (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    cognito_user_id VARCHAR(128) NOT NULL UNIQUE,
    email VARCHAR(255) NOT NULL UNIQUE,
    display_name VARCHAR(200) NOT NULL,
    role VARCHAR(50) NOT NULL DEFAULT 'admin'
        CHECK (role IN ('super_admin', 'admin', 'operator', 'auditor')),
    permissions TEXT[] NOT NULL DEFAULT '{}',
    mfa_enabled BOOLEAN NOT NULL DEFAULT false,
    last_login_at TIMESTAMPTZ,
    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    updated_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    invited_by UUID REFERENCES administrators(id)
);
```

Admin Roles: | Role | Description | Permissions | |——|————-|————-| | `super_admin` | Full platform access | All operations | | `admin` | Standard admin | Manage tenants, users, models | | `operator` | Operations | View logs, manage deployments | | `auditor` | Read-only audit | View all, modify none |

---

approval_requests

Two-person approval system.

```
CREATE TABLE approval_requests (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    requester_id UUID NOT NULL REFERENCES administrators(id),
    action_type VARCHAR(100) NOT NULL,
    resource_type VARCHAR(100) NOT NULL,
    resource_id VARCHAR(255),
    payload JSONB NOT NULL DEFAULT '{}',
    status VARCHAR(20) NOT NULL DEFAULT 'pending'
        CHECK (status IN ('pending', 'approved', 'rejected', 'expired')),
    required_approvals INTEGER NOT NULL DEFAULT 1,
    approvals JSONB NOT NULL DEFAULT '[]',
    expires_at TIMESTAMPTZ NOT NULL,
    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    updated_at TIMESTAMPTZ NOT NULL DEFAULT NOW()
);
```

Action Types Requiring Approval: - `delete_tenant` - Delete a tenant - `modify_billing`

- Change billing settings - `grant_super_admin` - Elevate to super admin - `bulk_data_export` - Export all data - `disable_security_feature` - Disable security

---

Think Tank Tables (Migration 016)

thinktank_sessions

Problem-solving session tracking.

```
CREATE TABLE thinktank_sessions (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    tenant_id UUID NOT NULL REFERENCES tenants(id) ON DELETE CASCADE,
    user_id UUID NOT NULL REFERENCES users(id) ON DELETE CASCADE,
    problem_summary TEXT,
    domain VARCHAR(50),
    complexity VARCHAR(20) CHECK (complexity IN ('low', 'medium', 'high', 'extreme')),
    total_steps INTEGER DEFAULT 0,
    avg_confidence DECIMAL(3, 2),
    solution_found BOOLEAN DEFAULT false,
    total_tokens INTEGER DEFAULT 0,
    total_cost DECIMAL(10, 6) DEFAULT 0,
    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    completed_at TIMESTAMPTZ
);

-- Indexes
CREATE INDEX idx_thinktank_sessions_tenant ON thinktank_sessions(tenant_id, created_at DESC);
CREATE INDEX idx_thinktank_sessions_user ON thinktank_sessions(user_id);

-- RLS
ALTER TABLE thinktank_sessions ENABLE ROW LEVEL SECURITY;
CREATE POLICY thinktank_sessions_isolation ON thinktank_sessions
    FOR ALL USING (tenant_id = current_setting('app.current_tenant_id', true)::uuid);
```

Domains: - `research` - Academic research - `engineering` - Technical problems - `analytical` - Data analysis - `creative` - Creative tasks - `legal` - Legal analysis - `medical` - Medical queries (HIPAA) - `business` - Business strategy - `general` - General problems

---

thinktank_steps

Individual reasoning steps within sessions.

```
CREATE TABLE thinktank_steps (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    session_id UUID NOT NULL REFERENCES thinktank_sessions(id) ON DELETE CASCADE,
    step_number INTEGER NOT NULL,
    step_type VARCHAR(50) NOT NULL
```

```
        CHECK (step_type IN ('decompose', 'reason', 'execute', 'verify', 'synthesize')),
    description TEXT,
    reasoning TEXT,
    result TEXT,
    confidence DECIMAL(3, 2) CHECK (confidence >= 0 AND confidence <= 1),
    model_used VARCHAR(100),
    tokens_used INTEGER,
    duration_ms INTEGER,
    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW()
);

-- Indexes
CREATE INDEX idx_thinktank_steps_session ON thinktank_steps(session_id, step_number);

-- RLS
ALTER TABLE thinktank_steps ENABLE ROW LEVEL SECURITY;
CREATE POLICY thinktank_steps_isolation ON thinktank_steps
    FOR ALL USING (
        session_id IN (SELECT id FROM thinktank_sessions
                       WHERE tenant_id = current_setting('app.current_tenant_id', true)::uuid)
    );
```

Step Types: | Type | Description | Typical Model | |——|————-|————| | `decompose` | Break problem into parts | Claude 3.5 | | `reason` | Chain-of-thought reasoning | o1, Claude | | `execute` | Execute solution step | Task-specific | | `verify` | Verify result accuracy | Different model | | `synthesize` | Combine into final answer | Claude 3.5 |

---

thinktank_tools

Available tools for Think Tank.

```
CREATE TABLE thinktank_tools (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    tool_name VARCHAR(100) NOT NULL UNIQUE,
    tool_type VARCHAR(50) NOT NULL,
    description TEXT,
    parameters_schema JSONB NOT NULL DEFAULT '{}',
    implementation TEXT,
    is_active BOOLEAN DEFAULT true,
    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW()
);

-- Default tools
INSERT INTO thinktank_tools (tool_name, tool_type, description, parameters_schema) VALUES
    ('web_search', 'search', 'Search the web for information', '{"query": "string"}'),
    ('calculator', 'compute', 'Perform mathematical calculations', '{"expression": "string"}')
    ('code_executor', 'compute', 'Execute code snippets', '{"language": "string", "code": "str
```

```
    ('file_reader', 'io', 'Read file contents', '{"path": "string"}'),
    ('api_caller', 'network', 'Make API requests', '{"url": "string", "method": "string", "body
```

Orchestration Tables (Migration 024)

workflow_definitions

Workflow pattern definitions.

```
CREATE TABLE workflow_definitions (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    workflow_id VARCHAR(100) NOT NULL UNIQUE,
    name VARCHAR(200) NOT NULL,
    description TEXT,
    category VARCHAR(50) NOT NULL
        CHECK (category IN ('generation', 'analysis', 'transformation', 'pipeline', 'custom'))
    version VARCHAR(20) NOT NULL DEFAULT '1.0.0',

    dag_definition JSONB NOT NULL DEFAULT '{}',
    input_schema JSONB NOT NULL DEFAULT '{}',
    output_schema JSONB NOT NULL DEFAULT '{}',
    default_parameters JSONB NOT NULL DEFAULT '{}',

    timeout_seconds INTEGER DEFAULT 3600,
    max_retries INTEGER DEFAULT 3,
    min_tier INTEGER DEFAULT 1,

    is_active BOOLEAN DEFAULT true,
    requires_audit_trail BOOLEAN DEFAULT false,
    hipaa_compliant BOOLEAN DEFAULT false,

    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    updated_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    created_by UUID
);
```

DAG Definition Structure:

```
{
  "nodes": [
    {
      "taskId": "decompose",
      "taskType": "model_inference",
      "modelId": "anthropic/claude-3-5-sonnet",
      "config": {
        "systemPrompt": "Break down the problem...",
        "temperature": 0.3
      },
```

```
      "dependsOn": []
    },
    {
      "taskId": "solve_part_1",
      "taskType": "model_inference",
      "dependsOn": ["decompose"]
    }
  ],
  "edges": [
    {"from": "decompose", "to": "solve_part_1"}
  ]
}
```

---

workflow_tasks

Individual tasks within workflows.

```
CREATE TABLE workflow_tasks (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    workflow_id UUID NOT NULL REFERENCES workflow_definitions(id) ON DELETE CASCADE,
    task_id VARCHAR(100) NOT NULL,
    name VARCHAR(200) NOT NULL,
    description TEXT,

    task_type VARCHAR(50) NOT NULL
        CHECK (task_type IN ('model_inference', 'transformation', 'condition',
                             'parallel', 'aggregation', 'external_api', 'human_review')),
    model_id VARCHAR(100),
    service_id VARCHAR(100),

    config JSONB NOT NULL DEFAULT '{}',
    input_mapping JSONB DEFAULT '{}',
    output_mapping JSONB DEFAULT '{}',

    sequence_order INTEGER DEFAULT 0,
    depends_on TEXT[] DEFAULT '{}',
    condition_expression TEXT,
    timeout_seconds INTEGER DEFAULT 300,

    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    updated_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    UNIQUE(workflow_id, task_id)
);
```

Task Types: | Type | Description | Example | |——|————-|———| | `model_inference` | AI model call | Generate text | | `transformation` | Data transformation | Format output | | `condition` | Conditional branching | If confidence $>$ 0.8 | | `parallel` | Parallel execution | Call 3 models |

| `aggregation` | Combine results | Merge responses | | `external_api` | External API call | Web search | | `human_review` | Human-in-the-loop | Approval step |

---

workflow_executions

Workflow execution tracking.

```
CREATE TABLE workflow_executions (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    workflow_id UUID NOT NULL REFERENCES workflow_definitions(id),
    tenant_id UUID NOT NULL REFERENCES tenants(id) ON DELETE CASCADE,
    user_id UUID NOT NULL,

    status VARCHAR(20) NOT NULL DEFAULT 'pending'
        CHECK (status IN ('pending', 'running', 'paused', 'completed', 'failed', 'cancelled')),

    input_parameters JSONB NOT NULL DEFAULT '{}',
    resolved_parameters JSONB DEFAULT '{}',
    output_data JSONB,

    error_message TEXT,
    error_details JSONB,

    started_at TIMESTAMPTZ,
    completed_at TIMESTAMPTZ,
    duration_ms INTEGER,

    estimated_cost_usd DECIMAL(10, 4),
    actual_cost_usd DECIMAL(10, 4),

    checkpoint_data JSONB,
    priority INTEGER DEFAULT 5 CHECK (priority >= 1 AND priority <= 10),

    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    updated_at TIMESTAMPTZ NOT NULL DEFAULT NOW()
);

-- RLS
ALTER TABLE workflow_executions ENABLE ROW LEVEL SECURITY;
CREATE POLICY workflow_executions_isolation ON workflow_executions
    FOR ALL USING (tenant_id = current_setting('app.current_tenant_id', true)::uuid);
```

---

task_executions

Individual task execution tracking.

```sql
CREATE TABLE task_executions (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    workflow_execution_id UUID NOT NULL REFERENCES workflow_executions(id) ON DELETE CASCADE,
    task_id VARCHAR(100) NOT NULL,

    status VARCHAR(20) NOT NULL DEFAULT 'pending'
        CHECK (status IN ('pending', 'running', 'completed', 'failed', 'skipped', 'retrying'))
    attempt_number INTEGER DEFAULT 1,

    input_data JSONB,
    output_data JSONB,

    error_message TEXT,
    error_code VARCHAR(50),

    started_at TIMESTAMPTZ,
    completed_at TIMESTAMPTZ,
    duration_ms INTEGER,

    resource_usage JSONB DEFAULT '{}',
    cost_usd DECIMAL(10, 4),

    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW()
);
```

Billing Tables (Migrations 033-035)

credit_balances

Tenant credit balance tracking.

```sql
CREATE TABLE credit_balances (
    tenant_id UUID PRIMARY KEY REFERENCES tenants(id) ON DELETE CASCADE,
    balance DECIMAL(12, 4) NOT NULL DEFAULT 0,
    lifetime_purchased DECIMAL(12, 4) NOT NULL DEFAULT 0,
    lifetime_used DECIMAL(12, 4) NOT NULL DEFAULT 0,
    lifetime_bonus DECIMAL(12, 4) NOT NULL DEFAULT 0,
    low_balance_alert_threshold DECIMAL(12, 4),
    last_low_balance_alert TIMESTAMPTZ,
    auto_purchase_enabled BOOLEAN DEFAULT false,
    auto_purchase_threshold DECIMAL(12, 4),
    auto_purchase_amount DECIMAL(12, 4),
    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    updated_at TIMESTAMPTZ NOT NULL DEFAULT NOW()
);
```

---

credit_transactions

Credit transaction history.

```
CREATE TABLE credit_transactions (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    tenant_id UUID NOT NULL REFERENCES tenants(id) ON DELETE CASCADE,
    transaction_type VARCHAR(30) NOT NULL
        CHECK (transaction_type IN ('purchase', 'bonus', 'refund', 'usage',
                                    'transfer_in', 'transfer_out',
                                    'subscription_allocation', 'expiration', 'adjustment')),
    amount DECIMAL(12, 4) NOT NULL,
    balance_after DECIMAL(12, 4) NOT NULL,
    description TEXT,
    reference_id VARCHAR(255),
    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW()
);

-- Indexes
CREATE INDEX idx_credit_transactions_tenant ON credit_transactions(tenant_id, created_at DESC)
```

---

subscription_tiers

Available subscription plans.

```
CREATE TABLE subscription_tiers (
    id VARCHAR(50) PRIMARY KEY,
    display_name VARCHAR(100) NOT NULL,
    description TEXT,
    price_monthly DECIMAL(10, 2),
    price_annual DECIMAL(10, 2),
    included_credits_per_user DECIMAL(10, 2) NOT NULL DEFAULT 0,
    features JSONB NOT NULL DEFAULT '{}',
    limits JSONB NOT NULL DEFAULT '{}',
    is_public BOOLEAN DEFAULT true,
    sort_order INTEGER DEFAULT 0,
    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW()
);

-- Default tiers
INSERT INTO subscription_tiers (id, display_name, price_monthly, price_annual, included_credits
('free', 'Free', 0, NULL, 100, '{"think_tank": false, "orchestration": false, "models": ["gpt-4
('pro', 'Pro', 49, 490, 5000, '{"think_tank": true, "orchestration": true, "models": "all"}'),
('team', 'Team', 199, 1990, 25000, '{"think_tank": true, "orchestration": true, "collaboration"
('enterprise', 'Enterprise', NULL, NULL, 0, '{"think_tank": true, "orchestration": true, "colla
```

---

subscriptions

Active tenant subscriptions.

```
CREATE TABLE subscriptions (
    id UUID PRIMARY KEY DEFAULT uuid_generate_v4(),
    tenant_id UUID NOT NULL REFERENCES tenants(id) ON DELETE CASCADE,
    tier_id VARCHAR(50) NOT NULL REFERENCES subscription_tiers(id),
    status VARCHAR(20) NOT NULL DEFAULT 'active'
        CHECK (status IN ('active', 'cancelled', 'past_due', 'trialing', 'paused')),
    billing_cycle VARCHAR(10) NOT NULL CHECK (billing_cycle IN ('monthly', 'annual')),
    seats_purchased INTEGER NOT NULL DEFAULT 1,
    seats_used INTEGER NOT NULL DEFAULT 0,
    current_period_start TIMESTAMPTZ NOT NULL,
    current_period_end TIMESTAMPTZ NOT NULL,
    cancel_at_period_end BOOLEAN DEFAULT false,
    cancelled_at TIMESTAMPTZ,
    stripe_customer_id VARCHAR(255),
    stripe_subscription_id VARCHAR(255),
    created_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
    updated_at TIMESTAMPTZ NOT NULL DEFAULT NOW()
);
```

Row-Level Security (Migration 002)

RLS Pattern

All tenant-scoped tables use this pattern:

```
-- Enable RLS on table
ALTER TABLE {table_name} ENABLE ROW LEVEL SECURITY;

-- Create isolation policy
CREATE POLICY {table_name}_isolation ON {table_name}
    FOR ALL USING (tenant_id = current_setting('app.current_tenant_id', true)::uuid);
```

Setting Tenant Context

Every request sets the tenant context before queries:

```
SET app.current_tenant_id = '{tenant_uuid}';
```

Tables with RLS Enabled:

- users
- thinktank_sessions
- thinktank_steps
- workflow_executions
- task_executions
- credit_transactions

- subscriptions
- chat_sessions
- chat_messages
- collaborations
- memories
- feedback
- api_keys
- (all tenant-scoped tables)

Common Patterns

Updated At Trigger

```
CREATE OR REPLACE FUNCTION update_updated_at_column()
RETURNS TRIGGER AS $$
BEGIN
    NEW.updated_at = NOW();
    RETURN NEW;
END;
$$ LANGUAGE plpgsql;

-- Apply to tables
CREATE TRIGGER update_{table}_updated_at
    BEFORE UPDATE ON {table}
    FOR EACH ROW EXECUTE FUNCTION update_updated_at_column();
```

Soft Delete Pattern

```
-- Add columns
deleted_at TIMESTAMPTZ,
deleted_by UUID,

-- Query with filter
WHERE deleted_at IS NULL
```

Audit Columns

```
created_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
updated_at TIMESTAMPTZ NOT NULL DEFAULT NOW(),
created_by UUID,
updated_by UUID
```

Swift Deployer App Reference

App Architecture

Overview

The Swift Deployer is a native macOS application for deploying and managing RADIANT infrastructure to AWS.

Requirements: - macOS 13.0 (Ventura) or later - Swift 5.9+ - Xcode 15+

File Structure (36 Files)

```
apps/swift-deployer/
  Package.swift
  Sources/RadiantDeployer/
      RadiantDeployerApp.swift          # App entry point
      AppState.swift                    # Global state management

      Config/
          RadiantConfig.swift           # App configuration

      Models/ (6 files)
          Configuration.swift           # Deployment configuration
          Credentials.swift             # AWS credentials model
          Deployment.swift              # Deployment state model
          DomainConfiguration.swift     # Domain settings
          InstallationParameters.swift  # Install params
          ManagedApp.swift              # Managed app model

      Services/ (21 files)
          AIAssistantService.swift      # AI deployment assistant
          AIRegistryService.swift       # AI model registry
          APIService.swift              # API communication
          AWSService.swift              # AWS SDK wrapper
          AuditLogger.swift             # Audit logging
          CDKService.swift              # CDK deployment
          CredentialService.swift       # Credential management
          DNSService.swift              # DNS configuration
          DatabaseService.swift         # Local SQLite/SQLCipher
          DeploymentLockService.swift   # Deployment locking
          DeploymentService.swift       # Main deployment logic
          GitHubPackageRegistry.swift   # Package downloads
          HealthCheckService.swift      # Health monitoring
          LocalStorageManager.swift     # Encrypted local storage
          MultiRegionService.swift      # Multi-region deployment
          OnePasswordService.swift      # 1Password integration
          PackageService.swift          # Package management
          SeedDataService.swift         # Database seeding
          SnapshotService.swift         # State snapshots
```

```
        TimeoutService.swift          # Timeout handling
        VoiceInputService.swift       # Voice commands

    Views/ (8+ files)
        ABTestingView.swift           # A/B testing config
        ContentView.swift             # Main content
        DeploymentView.swift          # Deployment UI
        SettingsView.swift            # App settings
        ... (other views)

    Components/ (4 files)
        MacOSComponents.swift         # Design tokens & components
        AppCommands.swift             # Menu bar commands
        DataTableComponents.swift     # Table components
        DetailViewComponents.swift    # Detail view patterns
```

Models

Configuration.swift

Deployment configuration model.

```swift
struct DeploymentConfiguration: Codable, Sendable {
    var appId: String
    var environment: Environment
    var tier: Int
    var region: AWSRegion
    var domain: String?
    var enabledStacks: Set<StackName>
    var customParameters: [String: String]
}

enum Environment: String, Codable, CaseIterable, Sendable {
    case development = "dev"
    case staging = "staging"
    case production = "prod"
}

enum StackName: String, Codable, CaseIterable, Sendable {
    case networking
    case foundation
    case data
    case storage
    case auth
    case ai
    case api
    case admin
```

```
    case batch
    case collaboration
    case monitoring
    case security
    case webhooks
    case scheduledTasks
    case multiRegion
}
```

Credentials.swift

AWS credentials model.

```
struct AWSCredentials: Codable, Sendable {
    let accessKeyId: String
    let secretAccessKey: String
    let sessionToken: String?
    let region: String
    let profile: String?
    let expiresAt: Date?

    var isExpired: Bool {
        guard let expiresAt else { return false }
        return Date() > expiresAt
    }
}

struct CredentialProfile: Codable, Identifiable, Sendable {
    let id: UUID
    var name: String
    var credentials: AWSCredentials
    var isDefault: Bool
    var lastUsed: Date?
}
```

Deployment.swift

Deployment state tracking.

```
struct Deployment: Codable, Identifiable, Sendable {
    let id: UUID
    var configuration: DeploymentConfiguration
    var status: DeploymentStatus
    var stackStatuses: [StackName: StackStatus]
    var startedAt: Date
    var completedAt: Date?
    var errorMessage: String?
    var outputs: [String: String]
}
```

```swift
enum DeploymentStatus: String, Codable, Sendable {
    case pending
    case preparing
    case deploying
    case verifying
    case completed
    case failed
    case rollingBack
    case cancelled
}

enum StackStatus: String, Codable, Sendable {
    case pending
    case creating
    case updating
    case complete
    case failed
    case rollbackInProgress
    case rollbackComplete
    case deleted
}
```

Services

CDKService.swift

AWS CDK deployment service.

```swift
actor CDKService {
    private let shell: ShellService
    private let logger: AuditLogger

    // Deploy a single stack
    func deployStack(
        _ stack: StackName,
        config: DeploymentConfiguration,
        credentials: AWSCredentials
    ) async throws -> StackOutput {
        let command = buildCDKCommand(
            action: "deploy",
            stack: stack,
            config: config
        )

        return try await shell.execute(
            command,
```

```
            environment: credentials.asEnvironment()
        )
    }

    // Deploy all stacks in dependency order
    func deployAllStacks(
        config: DeploymentConfiguration,
        credentials: AWSCredentials,
        progressHandler: @Sendable (StackName, StackStatus) -> Void
    ) async throws -> DeploymentResult {
        let orderedStacks = topologicalSort(config.enabledStacks)
        var outputs: [StackName: StackOutput] = [:]

        for stack in orderedStacks {
            progressHandler(stack, .creating)
            do {
                outputs[stack] = try await deployStack(stack, config: config, credentials: cred
                progressHandler(stack, .complete)
            } catch {
                progressHandler(stack, .failed)
                throw DeploymentError.stackFailed(stack, error)
            }
        }

        return DeploymentResult(outputs: outputs)
    }

    // Stack dependency order
    private func topologicalSort(_ stacks: Set<StackName>) -> [StackName] {
        // networking → foundation → data/storage/auth → ai → api/admin → rest
        let order: [StackName] = [
            .networking, .foundation, .data, .storage, .auth,
            .ai, .api, .admin, .batch, .collaboration,
            .monitoring, .security, .webhooks, .scheduledTasks, .multiRegion
        ]
        return order.filter { stacks.contains($0) }
    }
}
```

DeploymentService.swift

Main deployment orchestration.

```
@MainActor
class DeploymentService: ObservableObject {
    @Published var currentDeployment: Deployment?
    @Published var deploymentHistory: [Deployment] = []
    @Published var isDeploying = false
```

```
private let cdkService: CDKService
private let healthService: HealthCheckService
private let auditLogger: AuditLogger
private let localStorage: LocalStorageManager

func startDeployment(config: DeploymentConfiguration) async throws {
    guard !isDeploying else {
        throw DeploymentError.alreadyInProgress
    }

    isDeploying = true
    let deployment = Deployment(
        id: UUID(),
        configuration: config,
        status: .preparing,
        stackStatuses: [:],
        startedAt: Date()
    )
    currentDeployment = deployment

    do {
        // 1. Validate configuration
        try await validateConfiguration(config)

        // 2. Acquire deployment lock
        try await acquireLock(config.appId)

        // 3. Deploy stacks
        currentDeployment?.status = .deploying
        let result = try await cdkService.deployAllStacks(
            config: config,
            credentials: try await getCredentials(),
            progressHandler: { [weak self] stack, status in
                Task { @MainActor in
                    self?.currentDeployment?.stackStatuses[stack] = status
                }
            }
        )

        // 4. Verify deployment
        currentDeployment?.status = .verifying
        try await healthService.verifyDeployment(result)

        // 5. Complete
        currentDeployment?.status = .completed
        currentDeployment?.completedAt = Date()
        currentDeployment?.outputs = result.flatOutputs
```

```
        } catch {
            currentDeployment?.status = .failed
            currentDeployment?.errorMessage = error.localizedDescription
            throw error
        } finally {
            isDeploying = false
            if let deployment = currentDeployment {
                deploymentHistory.append(deployment)
                try? await localStorage.saveDeployment(deployment)
            }
        }
    }

    func rollback(deploymentId: UUID) async throws {
        // Rollback implementation
    }
}
```

AIAssistantService.swift

AI-powered deployment assistant.

```
actor AIAssistantService {
    private let apiService: APIService

    struct AssistantResponse: Sendable {
        let message: String
        let suggestions: [Suggestion]
        let actions: [SuggestedAction]
    }

    enum SuggestedAction: Sendable {
        case deployStack(StackName)
        case checkHealth
        case viewLogs(String)
        case runDiagnostics
        case contactSupport
    }

    // Get deployment guidance
    func getDeploymentGuidance(
        for config: DeploymentConfiguration,
        currentStatus: DeploymentStatus?
    ) async throws -> AssistantResponse {
        let prompt = buildGuidancePrompt(config: config, status: currentStatus)
        let response = try await apiService.chat(
            messages: [.init(role: .user, content: prompt)],
```

```
            model: "anthropic/claude-3-haiku"
        )
        return parseAssistantResponse(response)
    }

    // Diagnose deployment error
    func diagnoseError(
        error: Error,
        stackName: StackName,
        logs: String
    ) async throws -> AssistantResponse {
        let prompt = """
        Analyze this AWS CDK deployment error and provide:
        1. Root cause analysis
        2. Specific fix steps
        3. Prevention recommendations

        Stack: \(stackName.rawValue)
        Error: \(error.localizedDescription)
        Logs:
        \(logs.prefix(2000))
        """

        let response = try await apiService.chat(
            messages: [.init(role: .user, content: prompt)],
            model: "anthropic/claude-3-5-sonnet"
        )
        return parseAssistantResponse(response)
    }
}
```

LocalStorageManager.swift

Encrypted local storage using SQLCipher.

```
actor LocalStorageManager {
    private let db: Connection
    private let encryptionKey: String

    init() throws {
        let path = LocalStorageManager.databasePath
        db = try Connection(path)
        encryptionKey = try KeychainService.getOrCreateDatabaseKey()
        try db.key(encryptionKey)
        try createTablesIfNeeded()
    }

    // Tables
```

```
private func createTablesIfNeeded() throws {
    try db.execute("""
        CREATE TABLE IF NOT EXISTS deployments (
            id TEXT PRIMARY KEY,
            data BLOB NOT NULL,
            created_at INTEGER NOT NULL
        );

        CREATE TABLE IF NOT EXISTS credentials (
            id TEXT PRIMARY KEY,
            profile_name TEXT NOT NULL,
            encrypted_data BLOB NOT NULL,
            is_default INTEGER DEFAULT 0,
            last_used INTEGER
        );

        CREATE TABLE IF NOT EXISTS settings (
            key TEXT PRIMARY KEY,
            value TEXT NOT NULL
        );
    """)
}

// Save deployment
func saveDeployment(_ deployment: Deployment) throws {
    let data = try JSONEncoder().encode(deployment)
    try db.run("""
        INSERT OR REPLACE INTO deployments (id, data, created_at)
        VALUES (?, ?, ?)
    """, deployment.id.uuidString, data, Date().timeIntervalSince1970)
}

// Get deployment history
func getDeploymentHistory() throws -> [Deployment] {
    let rows = try db.prepare("""
        SELECT data FROM deployments ORDER BY created_at DESC LIMIT 100
    """)
    return try rows.compactMap { row in
        guard let data = row[0] as? Data else { return nil }
        return try JSONDecoder().decode(Deployment.self, from: data)
    }
}

// Credential management
func saveCredentials(_ credentials: CredentialProfile) throws {
    let encrypted = try encrypt(credentials)
    try db.run("""
        INSERT OR REPLACE INTO credentials (id, profile_name, encrypted_data, is_default,
```

```
            VALUES (?, ?, ?, ?, ?)
        """, credentials.id.uuidString, credentials.name, encrypted,
             credentials.isDefault ? 1 : 0, credentials.lastUsed?.timeIntervalSince1970)
    }
}
```

HealthCheckService.swift

Deployment health verification.

```
actor HealthCheckService {
    struct HealthCheckResult: Sendable {
        let service: String
        let status: HealthStatus
        let latencyMs: Int?
        let message: String?
    }

    enum HealthStatus: Sendable {
        case healthy
        case degraded
        case unhealthy
        case unknown
    }

    func verifyDeployment(_ result: DeploymentResult) async throws {
        var checks: [HealthCheckResult] = []

        // Check API Gateway
        if let apiUrl = result.outputs["ApiUrl"] {
            checks.append(await checkEndpoint(apiUrl + "/health", service: "API Gateway"))
        }

        // Check LiteLLM
        if let litellmUrl = result.outputs["LiteLLMUrl"] {
            checks.append(await checkEndpoint(litellmUrl + "/health", service: "LiteLLM"))
        }

        // Check Database
        checks.append(await checkDatabase(result.outputs["DatabaseEndpoint"]))

        // Evaluate results
        let unhealthy = checks.filter { $0.status == .unhealthy }
        if !unhealthy.isEmpty {
            throw HealthCheckError.servicesUnhealthy(unhealthy)
        }
    }
```

```
    private func checkEndpoint(_ url: String, service: String) async -> HealthCheckResult {
        let start = Date()
        do {
            let (_, response) = try await URLSession.shared.data(from: URL(string: url)!)
            let httpResponse = response as! HTTPURLResponse
            let latency = Int(Date().timeIntervalSince(start) * 1000)

            return HealthCheckResult(
                service: service,
                status: httpResponse.statusCode == 200 ? .healthy : .degraded,
                latencyMs: latency,
                message: nil
            )
        } catch {
            return HealthCheckResult(
                service: service,
                status: .unhealthy,
                latencyMs: nil,
                message: error.localizedDescription
            )
        }
    }
}
```

Components

MacOSComponents.swift

Design tokens and reusable components.

```
// Design Tokens
enum RadiantSpacing {
    static let xxs: CGFloat = 2
    static let xs: CGFloat = 4
    static let sm: CGFloat = 8
    static let md: CGFloat = 12
    static let lg: CGFloat = 16
    static let xl: CGFloat = 24
}

enum RadiantRadius {
    static let sm: CGFloat = 4
    static let md: CGFloat = 8
    static let lg: CGFloat = 12
    static let xl: CGFloat = 16
}
```

```
// Status Badge Component
struct StatusBadge: View {
    let status: String
    let color: Color

    var body: some View {
        Text(status)
            .font(.caption)
            .fontWeight(.medium)
            .padding(.horizontal, RadiantSpacing.sm)
            .padding(.vertical, RadiantSpacing.xxs)
            .background(color.opacity(0.15))
            .foregroundColor(color)
            .cornerRadius(RadiantRadius.sm)
    }
}

// Progress Indicator
struct DeploymentProgressView: View {
    let stacks: [StackName]
    let statuses: [StackName: StackStatus]

    var body: some View {
        VStack(alignment: .leading, spacing: RadiantSpacing.sm) {
            ForEach(stacks, id: \.self) { stack in
                HStack {
                    statusIcon(for: statuses[stack] ?? .pending)
                    Text(stack.rawValue)
                        .font(.system(.body, design: .monospaced))
                    Spacer()
                    StatusBadge(
                        status: (statuses[stack] ?? .pending).rawValue,
                        color: statusColor(statuses[stack] ?? .pending)
                    )
                }
            }
        }
    }
}
```

AppCommands.swift

Menu bar commands with keyboard shortcuts.

```
struct AppCommands: Commands {
    @ObservedObject var appState: AppState

    var body: some Commands {
```

```
CommandGroup(replacing: .newItem) {
    Button("New Deployment") {
        appState.showNewDeploymentSheet = true
    }
    .keyboardShortcut("n", modifiers: .command)

    Button("Import Configuration...") {
        appState.importConfiguration()
    }
    .keyboardShortcut("i", modifiers: [.command, .shift])
}

CommandMenu("Deployment") {
    Button("Deploy All Stacks") {
        Task { await appState.deployAll() }
    }
    .keyboardShortcut("d", modifiers: [.command, .shift])
    .disabled(appState.isDeploying)

    Button("Stop Deployment") {
        appState.stopDeployment()
    }
    .keyboardShortcut(".", modifiers: .command)
    .disabled(!appState.isDeploying)

    Divider()

    Button("View Logs") {
        appState.showLogs = true
    }
    .keyboardShortcut("l", modifiers: [.command, .option])

    Button("Run Health Check") {
        Task { await appState.runHealthCheck() }
    }
    .keyboardShortcut("h", modifiers: [.command, .shift])
}

CommandMenu("AWS") {
    Button("Switch Profile...") {
        appState.showProfileSwitcher = true
    }
    .keyboardShortcut("p", modifiers: [.command, .option])

    Button("Refresh Credentials") {
        Task { await appState.refreshCredentials() }
    }
    .keyboardShortcut("r", modifiers: [.command, .shift])
```

```
        }
    }
}
```

UI Patterns (10 macOS Patterns)

The Swift Deployer follows these macOS design patterns:

1. **NavigationSplitView** - Sidebar + Content + Inspector
2. **Liquid Glass** - On navigation/controls only
3. **Toolbar-as-Command-Center** - Grouped actions + overflow
4. **Scroll Edge Effects** - Floating UI legibility
5. **Master List → Detail** - 3-level navigation
6. **Search as First-Class** - Toolbar trailing position
7. **Tables for Data** - Lists for collections
8. **Multi-Select + Context Menus** - Drag & drop support
9. **Full Menu Bar** - Keyboard shortcuts
10. **Settings Window + Inspectors** - macOS-native patterns # Admin Dashboard Reference

Dashboard Architecture

Technology Stack

- **Framework:** Next.js 14 (App Router)
- **Language:** TypeScript
- **Styling:** Tailwind CSS
- **Components:** shadcn/ui
- **Icons:** Lucide React
- **State:** React Query, Zustand
- **Forms:** React Hook Form, Zod

Page Structure

```
apps/admin-dashboard/
  app/
      layout.tsx              # Root layout
      page.tsx                # Landing/login
      (dashboard)/            # Dashboard routes (43 pages)
          layout.tsx          # Dashboard layout with sidebar
          page.tsx            # Overview dashboard
          [module]/page.tsx   # Individual modules
  components/
      ui/                     # shadcn/ui components
      workflow-editor/        # Visual workflow editor
      shared/                 # Shared components
  lib/
       api.ts                  # API client
       auth.ts                 # Auth utilities
```

```
utils.ts                # Helper functions
```

Complete Page Inventory (43 Pages)

Core Administration

Page	Route	Purpose
Overview	`/`	System health, key metrics, quick actions
Administrators	`/administrators`	Manage admin users, roles, permissions
Audit Logs	`/audit-logs`	View all system audit events
AWS Logs	`/aws-logs`	CloudWatch log viewer
Security	`/security`	Security settings, WAF, compliance
Settings	`/settings`	Platform configuration
System Config	`/system-config`	Advanced system settings

AI & Models

Page	Route	Purpose
Models	`/models`	AI model configuration
Model Metadata	`/model-metadata`	Model capabilities & pricing
User Models	`/user-models`	Per-tenant model access
Providers	`/providers`	AI provider management

Orchestration

Page	Route	Purpose
Orchestration	`/orchestration`	Workflow management
Orchestration Patterns	`/orchestration-patterns`	49 patterns library
Orchestration Editor	`/orchestration-patterns/editor`	Visual workflow editor

Think Tank

Page	Route	Purpose
Think Tank	`/thinktank`	Session management
Cognition	`/cognition`	Cognitive settings
Cognitive Brain	`/cognitive-brain`	Brain configuration
Consciousness	`/consciousness`	Consciousness monitoring
Metacognition	`/metacognition`	Self-reflection settings
Planning	`/planning`	Goal planning
World Model	`/world-model`	World model state

Billing & Cost

Page	Route	Purpose
Billing	`/billing`	Revenue, invoices, subscriptions
Cost	`/cost`	Cost analytics, budgets

Analytics & Monitoring

Page	Route	Purpose
Analytics	`/analytics`	Usage analytics
Reports	`/reports`	Generated reports
Health	`/health`	System health dashboard
Deployments	`/deployments`	Deployment history

AGI & Learning

Page	Route	Purpose
Agents	`/agents`	Autonomous agents
Learning	`/learning`	ML training data
ML Training	`/ml-training`	Model training jobs
Self-Improvement	`/self-improvement`	Self-improvement logs
Moral Compass	`/moral-compass`	Ethical guidelines
Feedback	`/feedback`	User feedback

Collaboration & Features

Page	Route	Purpose
Time Machine	`/time-machine`	Historical state access
Storage	`/storage`	File storage management
Notifications	`/notifications`	Notification settings
Localization	`/localization`	i18n management
Configuration	`/configuration`	Dynamic configuration
Compliance	`/compliance`	Compliance dashboard
Geographic	`/geographic`	Geographic settings
Multi-Region	`/multi-region`	Multi-region config
Experiments	`/experiments`	A/B testing
Migrations	`/migrations`	Database migrations
Services	`/services`	Service status
Request Handler	`/request-handler`	Request routing

Key Pages Detail

Overview Dashboard (/)

Metrics Displayed: - Active tenants (24h) - Total API requests (24h) - Total tokens processed - Revenue (MTD) - Error rate - Average latency

Quick Actions: - View recent errors - Check provider health - Review pending approvals - Generate report

Charts: - Requests over time (7d) - Token usage by model - Revenue trend - Error rate trend

---

Models Page (/models)

Features: - List all 106+ models - Filter by provider, capability - Enable/disable models - Set model pricing overrides - Configure fallback chains - View usage statistics

Model Card Display:

```
anthropic/claude-3-5-sonnet

Provider: Bedrock (primary), LiteLLM (fb)
Capabilities: reasoning, coding, vision
Context: 200K tokens
Pricing: $3.00/$15.00 per 1M tokens
Status:  Enabled
Usage (24h): 1.2M tokens

[Configure] [Disable] [View Stats]
```

Orchestration Patterns Page (/orchestration-patterns)

Features: - Browse 49 patterns by category - Search patterns - View pattern details - Edit pattern workflows - Create custom patterns - View execution statistics

Pattern Categories Tabs: - Consensus & Aggregation (7) - Debate & Deliberation (7) - Critique & Refinement (7) - Verification & Validation (7) - Decomposition (7) - Specialized Reasoning (7) - Multi-Model Routing (4) - Ensemble Methods (3)

Pattern Detail View:

```
AI Debate                                          [Edit] [Test]

Category: Debate & Deliberation
Quality Improvement: +25-40%
Typical Latency: High (10-30s)
Min Models: 3
```

```
Description:
Two AI models debate opposing positions while a third
model judges the arguments and synthesizes a final answer.

Best For:
• Controversial topics
• Complex decisions
• Exploring multiple perspectives

Workflow Steps:
1. Generate Pro Argument (Claude)
2. Generate Con Argument (GPT-4o)
3. Judge Arguments (Claude - thinking mode)
4. Synthesize Final Answer

Executions (30d): 1,247  |  Avg Quality: 0.89
```

Visual Workflow Editor (`/orchestration-patterns/editor`)

Features: - Drag-and-drop workflow design - 16 method palette - Node connection editing - Step configuration (4 tabs) - Zoom, pan, fit controls - Test execution - Save/load workflows

Method Palette (16 Methods): | Method | Category | Description | |———|———-|————-| | Generate | Core | Generate text response | | Analyze | Core | Analyze input | | Transform | Core | Transform data | | Validate | Core | Validate output | | Critique | Refinement | Critique response | | Refine | Refinement | Improve response | | Decompose | Decomposition | Break into parts | | Synthesize | Aggregation | Combine results | | Judge | Evaluation | Evaluate quality | | Vote | Consensus | Majority voting | | Debate_Pro | Debate | Pro argument | | Debate_Con | Debate | Con argument | | Verify | Verification | Fact-check | | Search | External | Web search | | Execute_Code | External | Run code | | Custom | Custom | Custom logic |

Step Configuration Tabs: 1. **General** - Name, order, model, output variable 2. **Parameters** - Method-specific parameters 3. **Advanced** - Conditions, iterations, dependencies 4. **Parallel** - Parallel execution settings, AGI selection

---

Billing Page (`/billing`)

Sections:

Revenue Overview: - Monthly Recurring Revenue (MRR) - Annual Recurring Revenue (ARR) - Revenue growth % - Churn rate

Subscription Management: - Active subscriptions by tier - Upcoming renewals - Cancelled subscriptions - Trial conversions

Credit Management: - Total credits sold - Credits consumed - Credit purchase history - Low balance alerts

Invoice Management: - Generate invoices - View invoice history - Export to CSV - Send invoice reminders

---

Analytics Page (`/analytics`)

Dashboard Sections:

Usage Analytics: - Requests by model - Tokens by tenant - Peak usage times - Geographic distribution

Performance Analytics: - Latency percentiles (p50, p95, p99) - Error rates by endpoint - Provider availability - Cache hit rates

Business Analytics: - Cost per request - Revenue per tenant - Feature adoption - User engagement

Custom Reports: - Date range selection - Dimension grouping - Metric selection - Export options (CSV, PDF, JSON)

Security Page (`/security`)

Sections:

Authentication: - Cognito configuration - MFA enforcement - Session settings - Password policies

API Security: - Rate limiting rules - IP allowlists - API key management - Request validation

Compliance: - SOC2 status - HIPAA mode toggle - Data retention settings - Audit log retention

WAF Configuration: - Rule management - Blocked requests - Rate limit thresholds - Custom rules

---

Think Tank Page (`/thinktank`)

Features: - View all sessions across tenants - Filter by domain, status, confidence - Session detail view - Step-by-step reasoning display - Cost and token tracking

Session List View:

```
Session ID      Tenant    Domain      Steps   Conf    Cost

abc123...       Acme      Engineering 6       0.92    $0.45
def456...       Beta      Research    8       0.87    $0.72
ghi789...       Acme      Legal       4       0.95    $0.28
```

Session Detail View:

```
Problem: "Design a microservices architecture for 10M daily users"
Domain: Engineering | Complexity: High | Status: Completed

Step 1: Decompose [Claude 3.5]  (conf: 0.94)
  Identified 5 sub-problems
  Duration: 2.3s | Tokens: 1,247

Step 2: Requirements Analysis [Claude + GPT-4o parallel]  (conf: 0.91)
  Synthesized from 2 models
  Duration: 4.1s | Tokens: 3,892

Step 3-5: [...]

Step 6: Synthesize Final Solution [Claude 3.5 thinking]  (conf: 0.89)
  Generated comprehensive solution
  Duration: 5.7s | Tokens: 2,156

Total: 6 steps | 18.2s | 12,453 tokens | $0.45
Final Confidence: 0.89
```

Component Library

Shared Components

DataTable: - Sortable columns - Pagination - Row selection - Export functionality - Column visibility toggle

StatusBadge: - Status indicator with color - Configurable variants - Icon support

MetricCard: - Large number display - Trend indicator - Comparison to previous period

Chart Components: - LineChart (time series) - BarChart (comparisons) - PieChart (distributions) - AreaChart (cumulative)

Form Components: - Input with validation - Select with search - DateRangePicker - JSONEditor - CodeEditor

---

API Integration

API Client (`lib/api.ts`)

```typescript
import { QueryClient } from '@tanstack/react-query';

const API_BASE = process.env.NEXT_PUBLIC_API_URL;

export const apiClient = {
  // GET request
```

```
  async get<T>(path: string): Promise<T> {
    const response = await fetch(`${API_BASE}${path}`, {
      headers: await getAuthHeaders(),
    });
    if (!response.ok) throw new APIError(response);
    return response.json();
  },

  // POST request
  async post<T>(path: string, data: unknown): Promise<T> {
    const response = await fetch(`${API_BASE}${path}`, {
      method: 'POST',
      headers: {
        'Content-Type': 'application/json',
        ...(await getAuthHeaders()),
      },
      body: JSON.stringify(data),
    });
    if (!response.ok) throw new APIError(response);
    return response.json();
  },

  // React Query hooks
  useModels: () => useQuery(['models'], () => apiClient.get('/admin/models')),
  useTenants: () => useQuery(['tenants'], () => apiClient.get('/admin/tenants')),
  useAnalytics: (range: string) =>
    useQuery(['analytics', range], () => apiClient.get(`/admin/analytics?range=${range}`)),
};
```

Authentication (lib/auth.ts)

```
import { Amplify, Auth } from 'aws-amplify';

export async function getAuthHeaders(): Promise<Headers> {
  const session = await Auth.currentSession();
  return {
    'Authorization': `Bearer ${session.getIdToken().getJwtToken()}`,
  };
}

export function useAuth() {
  const [user, setUser] = useState<CognitoUser | null>(null);
  const [loading, setLoading] = useState(true);

  useEffect(() => {
    Auth.currentAuthenticatedUser()
      .then(setUser)
      .catch(() => setUser(null))
```

```
      .finally(() => setLoading(false));
  }, []);

  return { user, loading, signIn, signOut };
}
```

Compliance & Security Standards

Overview

RADIANT implements comprehensive compliance frameworks to meet enterprise security requirements across multiple regulatory standards.

Required Provider API Keys

RADIANT requires the following external AI provider API keys for deployment:

Provider	Secret Path	Purpose	Get Key
Anthropic (Claude)	`radiant/providers/anthropic`	Primary AI provider for Claude models	https://console.anthropic.com/sett
Groq	`radiant/providers/groq`	Fast LPU inference for fallback	https://console.groq.com/keys

Deployment Flow

1. **Configure Keys in Deployer** - Enter API keys in the Swift Deployer "Required Provider API Keys" section
2. **Local Storage** - Keys are stored securely in macOS Keychain
3. **AWS Upload** - During deployment, keys are uploaded to AWS Secrets Manager
4. **Lambda Access** - Lambda functions retrieve keys from Secrets Manager at runtime

Why These Providers Are Required

- **Anthropic (Claude)**: Primary provider for Claude 3.5 Sonnet, Claude Opus 4, and other Claude models via AWS Bedrock. Direct API access provides extended thinking and latest model features.
- **Groq**: Ultra-fast inference (100-200ms) on Llama and Mixtral models. Used as fallback when Bedrock is unavailable and for speed-critical applications.

SOC 2 Type II Compliance

Trust Service Criteria

Category	Controls	Implementation
Security	Access control, encryption, monitoring	Cognito, KMS, CloudWatch
Availability	Redundancy, failover, SLAs	Multi-AZ, auto-scaling
Processing Integrity	Data validation, error handling	Input validation, checksums
Confidentiality	Data classification, encryption	RLS, AES-256, TLS 1.3
Privacy	Data handling, consent	GDPR controls, retention policies

Key Controls

1. **Access Management**
   - Multi-factor authentication (MFA) required for admins
   - Role-based access control (RBAC)
   - API key rotation policies
   - Session timeout enforcement
2. **Encryption**
   - At rest: AES-256 via AWS KMS
   - In transit: TLS 1.3 minimum
   - Database: Aurora encryption enabled
   - Secrets: AWS Secrets Manager
3. **Audit Logging**
   - All API requests logged
   - Admin actions tracked
   - CloudTrail for AWS operations
   - 90-day retention minimum

HIPAA Compliance

Protected Health Information (PHI) Handling

RADIANT supports HIPAA-compliant deployments with enhanced controls:

Requirement	Implementation
Access Controls	User authentication, authorization, audit
Audit Controls	Complete activity logging, tamper-evident
Integrity Controls	Data validation, checksums, versioning
Transmission Security	TLS 1.3, encrypted channels only

HIPAA Mode Features

When HIPAA mode is enabled:

```typescript
interface HIPAAConfig {
  enabled: boolean;
  phiDetection: boolean;        // Scan for PHI in requests
  enhancedLogging: boolean;     // Additional audit details
  dataRetentionDays: number;    // Configurable retention
  encryptionRequired: boolean;  // Force encryption
  accessReviewDays: number;     // Periodic access review
}
```

PHI Sanitization

```typescript
// Automatic PHI detection and handling
export class PHISanitizationService {
  private patterns = [
    /\b\d{3}-\d{2}-\d{4}\b/,     // SSN
    /\b\d{9}\b/,                  // MRN
    /\b[A-Z]{2}\d{6,8}\b/,       // License numbers
    // ... additional patterns
  ];

  async sanitize(input: string): Promise<SanitizedInput> {
    // Detect and redact PHI before processing
    let sanitized = input;
    for (const pattern of this.patterns) {
      sanitized = sanitized.replace(pattern, '[REDACTED]');
    }
    return { original: input, sanitized, phiDetected: sanitized !== input };
  }
}
```

GDPR Compliance

Data Subject Rights

RADIANT implements all required GDPR data subject rights:

Right	Implementation	API Endpoint
Right to Access	Export all user data	`GET /api/gdpr/export`
Right to Rectification	Update personal data	`PATCH /api/users/{id}`
Right to Erasure	Delete all user data	`DELETE /api/gdpr/erase`
Right to Portability	Export in machine-readable format	`GET /api/gdpr/export?format=json`
Right to Object	Opt-out of processing	`POST /api/gdpr/object`

Right	Implementation	API Endpoint
Right to Restrict	Limit processing	`POST /api/gdpr/restrict`

Data Processing

```
interface GDPRDataRequest {
  subjectId: string;          // User identifier
  requestType: 'access' | 'rectification' | 'erasure' | 'portability' | 'object' | 'restrict';
  requestedBy: string;        // Requester (user or DPO)
  verificationMethod: string; // How identity was verified
  deadline: Date;             // 30-day compliance deadline
}

export class GDPRService {
  async handleDataRequest(request: GDPRDataRequest): Promise<GDPRResponse> {
    // Log the request
    await this.auditLogger.log('gdpr_request', request);

    switch (request.requestType) {
      case 'access':
        return this.exportUserData(request.subjectId);
      case 'erasure':
        return this.eraseUserData(request.subjectId);
      case 'portability':
        return this.exportPortableData(request.subjectId);
      // ... other handlers
    }
  }

  async eraseUserData(userId: string): Promise<void> {
    // Cascade delete across all tables
    await this.db.transaction(async (tx) => {
      await tx.delete('thinktank_steps').where('session_id', 'in',
        tx.select('id').from('thinktank_sessions').where('user_id', userId));
      await tx.delete('thinktank_sessions').where('user_id', userId);
      await tx.delete('usage_records').where('user_id', userId);
      await tx.delete('api_keys').where('user_id', userId);
      await tx.delete('users').where('id', userId);
    });
  }
}
```

Consent Management

```
interface ConsentRecord {
  userId: string;
```

```
  consentType: 'marketing' | 'analytics' | 'ai_training' | 'data_sharing';
  granted: boolean;
  grantedAt: Date;
  ipAddress: string;
  userAgent: string;
  version: string;  // Consent policy version
}

// All processing requires valid consent
async function checkConsent(userId: string, purpose: string): Promise<boolean> {
  const consent = await db.query(
    'SELECT granted FROM consent_records WHERE user_id = $1 AND consent_type = $2',
    [userId, purpose]
  );
  return consent?.granted === true;
}
```

Data Retention

Data Type	Retention Period	Basis
User accounts	Until deletion requested	Contract
Session data	90 days	Legitimate interest
Audit logs	7 years	Legal requirement
Usage analytics	2 years	Legitimate interest
AI training data	Until consent withdrawn	Consent

ISO 27001 Compliance

Information Security Management System (ISMS)

RADIANT's infrastructure aligns with ISO 27001:2022 requirements:

Annex A Controls

A.5 Organizational Controls

Control	Description	Implementation
A.5.1	Policies for information security	Documented security policies
A.5.2	Information security roles	Defined RACI matrix
A.5.3	Segregation of duties	Role-based access, dual approval
A.5.7	Threat intelligence	AWS GuardDuty, threat feeds
A.5.15	Access control	Cognito + IAM + RLS
A.5.23	Information security for cloud	AWS Well-Architected
A.5.29	Information security during disruption	DR procedures

A.6 People Controls

Control	Description	Implementation
A.6.1	Screening	Background checks for admins
A.6.3	Information security awareness	Training programs
A.6.5	Responsibilities after termination	Access revocation procedures

A.7 Physical Controls

Control	Description	Implementation
A.7.1	Physical security perimeters	AWS data center security
A.7.4	Physical security monitoring	AWS compliance certifications

A.8 Technological Controls

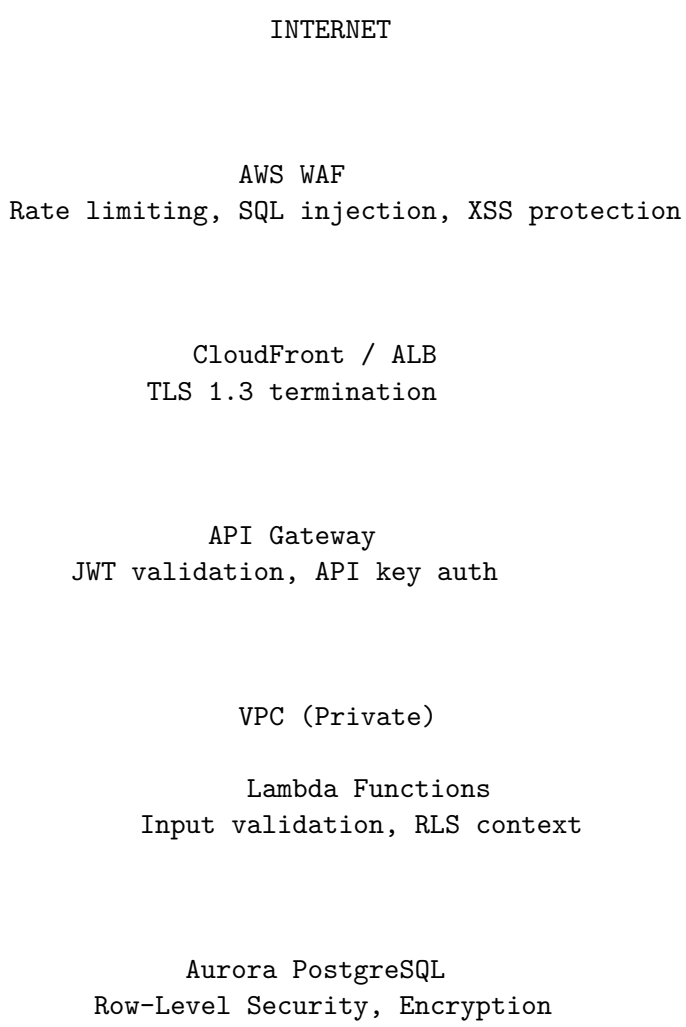
Control	Description	Implementation
A.8.1	User endpoint devices	MDM for admin devices
A.8.2	Privileged access rights	IAM policies, MFA required
A.8.3	Information access restriction	RLS, tenant isolation
A.8.4	Access to source code	GitHub branch protection
A.8.5	Secure authentication	Cognito, JWT, API keys
A.8.7	Protection against malware	WAF, input validation
A.8.9	Configuration management	CDK, Infrastructure as Code
A.8.10	Information deletion	GDPR erasure, retention policies
A.8.11	Data masking	PHI sanitization, PII redaction
A.8.12	Data leakage prevention	DLP policies, egress controls
A.8.15	Logging	CloudWatch, audit trails
A.8.16	Monitoring activities	CloudWatch alarms, dashboards
A.8.20	Networks security	VPC, security groups, NACLs
A.8.22	Segregation of networks	Private subnets, VPC endpoints
A.8.24	Use of cryptography	KMS, TLS 1.3, AES-256
A.8.25	Secure development lifecycle	Code review, security scanning
A.8.28	Secure coding	OWASP guidelines, linting

Risk Assessment Matrix

Risk Category	Likelihood	Impact	Controls
Data breach	Low	Critical	Encryption, RLS, monitoring
Service outage	Medium	High	Multi-AZ, auto-scaling, DR
Unauthorized access	Low	Critical	MFA, RBAC, audit logging
Insider threat	Low	High	Segregation, dual approval
Supply chain attack	Low	High	Dependency scanning, SBOMs

Security Architecture

Defense in Depth



Two-Person Approval

Sensitive operations require dual admin approval:

```typescript
interface ApprovalRequest {
  id: string;
  requesterId: string;
  actionType: 'delete_tenant' | 'modify_billing' | 'grant_super_admin' |
              'bulk_export' | 'disable_security';
  resourceId: string;
  payload: Record<string, unknown>;
  status: 'pending' | 'approved' | 'rejected' | 'expired';
  requiredApprovals: number;  // Usually 2
```

```
  approvals: Approval[];
  expiresAt: Date;
}

// Cannot approve own requests
async function approveRequest(requestId: string, approverId: string) {
  const request = await getRequest(requestId);

  if (request.requesterId === approverId) {
    throw new Error('Cannot approve own request');
  }

  if (request.approvals.some(a => a.approverId === approverId)) {
    throw new Error('Already approved');
  }

  // Add approval
  request.approvals.push({ approverId, approvedAt: new Date() });

  // Execute if threshold met
  if (request.approvals.length >= request.requiredApprovals) {
    await executeApprovedAction(request);
  }
}
```

Audit Logging

Log Structure

```
interface AuditLog {
  id: string;
  timestamp: Date;
  tenantId: string;
  userId: string;
  adminId?: string;
  action: string;
  resourceType: string;
  resourceId: string;
  ipAddress: string;
  userAgent: string;
  requestId: string;
  oldValue?: Record<string, unknown>;
  newValue?: Record<string, unknown>;
  result: 'success' | 'failure';
  errorMessage?: string;
}
```

Logged Actions

- All authentication events (login, logout, MFA)
- All API requests with parameters
- All data modifications (create, update, delete)
- All admin actions
- All security events (failed auth, rate limits)
- All GDPR requests
- All compliance-related operations

Log Retention

Log Type	Retention	Storage
API Access	90 days	CloudWatch
Security Events	1 year	S3 + Glacier
Audit Trail	7 years	S3 + Glacier
GDPR Requests	7 years	Aurora