subatomic

LangGraph Workflow Definition: Account Opening Agentic Orchestration

1) Main Graph Structure

Graph Name: Account Opening Agentic Workflow Graph

Purpose:

To orchestrate, track, and ensure compliant, auditable, agent-driven execution of the entire account opening workflow, encompassing intake, validation, assembly, human-in-the-loop decisions, digital signature, submission, and system synchronization.

Entry Point:

Workflow Orchestrator Agent (Start Node – receives workflow trigger)

Exit Points:

- Success Terminal (Write-back Complete, Audit Finalized)
- Failure Terminal (Hard Exception, Unrecoverable Error, Audit Finalized)
- Escalation Terminal (Manual Remediation / Human Oversight, Audit Finalized)

State Schema:

Composed conceptually of:

- **Workflow Context:** Unique workflow/run identifiers, trigger metadata, execution history, attempt counts, current stage
- **Intake Data State:** Raw and normalized intake packet, classification, household/client association, intake artifacts
- **Validation State:** Validation results, flags/exceptions, anomaly/ambiguity findings
- **Packet State:** Assembled forms/packets, mapped fields, template references
- **Human Review State:** Review assignment/status, annotations, approve/reject/correct actions, timestamps
- **Signature State:** DocuSign envelope status, tracking info, signature results/history
- **Submission State:** Submission results, confirmation codes, receipts, status logs
- **Write-back State:** Salesforce/Edge update status, queue state
- **Audit State:** Step trace logs, event/decision lineage, explicit error records
- **Retry and Escalation State:** Retry counters, escalation flags/reasons, error details, manual interventions
- **Global State:** Overall workflow status, terminal reason

Graph Type:

Mixed – primarily sequential with multiple conditional branches, retry loops, and fallback/error pathways; audit occurs continuously

Complexity Level:

Complex (multiple branches, sub-graphs, nested conditions, agent and human-in-the-loop)

Sub-Graphs Included:

Yes

- Human Review Sub-Graph
- Retry Handler Sub-Graph
- Audit Trace Sub-Graph

2) Node Inventory

Node Name	Node Type	Purpose	Inputs	Outputs	State Modifications
Workflow Orchestrator Agent	Orchestrator Node	Directs execution, sequencing, and state transitions throughout workflow	Workflow trigger, workflow state	Next step activation, workflow state	Updates stage, logs transitions
Intake Agent	Tool/LLM Node	Ingests and normalizes intake, associates client/household	Raw forms/files, docs, mapping info	Normalized records, classification	Updates intake data, artifacts
Intake Exception Conditional	Conditional Node	Checks intake success, routes on error/oos	Intake results, error flags	Next: Validation or Exception Sub-Path	Flags exception, sets error state
Validation Agent	Validator Node	Validates completeness, consistency, rule compliance	Normalized intake, rule artifacts	Validation log/results, exception flags	Updates validation state
Validation Branch Conditional	Conditional Node	Decides next step based on validation result	Validation output	Next: Packet Assembly / Human Review	Updates status, logs path
Packet Assembly Agent	Tool/LLM Node	Assembles complete/pre-populated digital account packets/forms	Validated data, form templates	Prepared packets/forms	Updates packet state
Assembly Exception Conditional	Conditional Node	Routes flow on assembly exceptions	Assembly output, error detection	Next: Human Review / Exception Path	Sets error status, triggers fallback
Human Review Sub-Graph Node	Sub-Graph Node	Encapsulates human review, approval, correction, or escalate/abandon logic	Review packet, exceptions/ ambiguous items	Human action result, corrections	Updates review status and context
DocuSign Branch Conditional	Conditional Node	Decides if DocuSign envelope/signature is required	Workflow status, packet/meta info	Next: DocuSign Agent or Submission Agent	Sets signature requirement flag
DocuSign Envelope Agent	Tool Node	Prepares, sends, and tracks DocuSign envelopes for digital signatures	Prepared packets, recipient, template	Signature status, envelope info	Updates signature state
DocuSign Exception Conditional	Conditional Node	Checks DocuSign outcome, routes to retry or escalate on failure	Envelope status, timeout/error info	Retry Handler, Escalation	Updates retry/ escalation count
Submission Agent	Tool Node				

Node Name	Node Type	Purpose	Inputs	Outputs	State Modifications
		Submits final packet to custodian, verifies receipt	Finalized/signed packets, submission info	Submission confirmation/ status	Updates submission state
Submission Exception Conditional	Conditional Node	Checks submission result, routes to retry/manual fallback on failure	Submission output	Retry Handler, Escalation	Updates error, retries, fallback status
Write-back Agent	Tool Node	Writes status, artifacts, lifecycle to Salesforce/Edge	Submission result, packet artifacts	Update confirmation/ status	Updates write-back state
Write-back Exception Conditional	Conditional Node	Routes flow on write-back error	Write-back result	Retry Handler, Escalation	Updates error, retries, fallback status
Retry Handler Sub-Graph Node	Sub-Graph Node	Handles retry logic for transient failures	Failed node context, retry state	Success/Failure/Escalation	Increments retries, updates error state
Audit Trace Agent	Validator Node	Logs and persists audit/trace/ action/decision events continuously	Transition/event data	Updated audit log	Updates audit state
Continuous Improvement Entry (future use)	LLM/Advisor Node	Triggers periodic evaluation of workflow/process improvements	Audit log/context	Recommendations	Updates process metadata

Node Types:
- **LLM Node:** Intake Agent, Packet Assembly Agent (generation/classification)
- **Tool Node:** Intake Agent, DocuSign Envelope Agent, Submission Agent, Write-back Agent, Packet Assembly Agent
- **Conditional Node:** All branches/decision points, exception checks
- **Validator Node:** Validation Agent, Audit Trace Agent
- **State Node:** Workflow Orchestrator (all orchestrative transitions)
- **Sub-Graph Node:** Human Review, Retry Handler, Audit Trace

3) Control Flow Definition

From Node	To Node(s)	Flow Type	Condition (if applicable)	Description
Workflow Orchestrator Agent	Intake Agent	Sequential	On workflow trigger	Initiates workflow
Intake Agent	Intake Exception Conditional	Sequential	On completion	Assess if intake normalized or errored
Intake Exception Conditional	Validation Agent	Conditional	Intake normalized OK	Proceed to validation
Intake Exception Conditional	Retry Handler Sub-Graph	Fallback	Intake error detected	Trigger retry or escalate
Validation Agent	Validation Branch Conditional	Sequential	On completion	Assess validation result
Validation Branch Conditional	Packet Assembly Agent	Conditional	All validations passed	Proceed to packet assembly
Validation Branch Conditional	Human Review Sub-Graph Node	Conditional	Fail, ambiguous, or flagged exception	Route to human review
Packet Assembly Agent	Assembly Exception Conditional	Sequential	On completion	Assess assembly result
Assembly Exception Conditional	Human Review Sub-Graph Node	Conditional	Assembly error or required review	Escalate for human review
Assembly Exception Conditional	DocuSign Branch Conditional	Conditional	Assembly complete, no review needed	Proceed
Human Review Sub-Graph Node	Assembly Exception Conditional	Sequential	Correction required	Return for re-assembly
Human Review Sub-Graph Node	DocuSign Branch Conditional	Sequential	Approval	Continue to next step
Human Review Sub-Graph Node	Workflow Orchestrator Agent	Sequential	Rejection/Abandon	Finalize as escalation/failure
DocuSign Branch Conditional	DocuSign Envelope Agent	Conditional	Signature required	Proceed to signature stage
DocuSign Branch Conditional	Submission Agent	Conditional	No signature required	Skip to submission
DocuSign Envelope Agent	DocuSign Exception Conditional	Sequential	On completion	Check signature status
DocuSign Exception Conditional	Submission Agent	Conditional	Envelope signed	Proceed
DocuSign Exception Conditional	Retry Handler Sub-Graph	Loop/ Fallback	Signature not completed/error	Retry or escalate
Submission Agent	Submission Exception Conditional	Sequential	On completion	Check submission result
	Write-back Agent	Conditional	Submission successful	Continue

From Node	To Node(s)	Flow Type	Condition (if applicable)	Description
Submission Exception Conditional				
Submission Exception Conditional	Retry Handler Sub-Graph	Fallback	Submission error	Retry or escalate
Write-back Agent	Write-back Exception Conditional	Sequential	On completion	Check write-back result
Write-back Exception Conditional	Audit Trace Agent	Conditional	Write-back successful	Proceed to terminal audit and success
Write-back Exception Conditional	Retry Handler Sub-Graph	Fallback	Write-back error	Retry or escalate
Retry Handler Sub-Graph Node	Originating Node	Loop	Retry succeeds and max retries not reached	Return to failed node
Retry Handler Sub-Graph Node	Human Review Sub-Graph Node	Fallback	Retries exhausted	Escalate to manual/human
Audit Trace Agent	Terminal Node (Success/ Escalation)	Sequential	All required steps/audits complete	End workflow

4) Sub-Graph Definitions

Sub-Graph: Human Review

Property	Definition
Purpose	Enables human reviewer(s) to assess, correct, or resolve flagged exceptions, ambiguities, or required approvals; records all actions for audit
Scope	Manual review/approval/rejection/correction, escalate to secondary reviewer as needed
Entry Conditions	Invoked whenever validation, assembly, or policy triggers exception/human review required
Exit Conditions	Human action taken: Approve, Reject, or Request Correction
State Input	Packet to review, relevant exception/validation data, state snapshot
State Output	Review decision, corrections/amendments, annotations, audit log update
Contains Sub-Graphs	No (single-layer)

Sub-Graph Node Structure:

Node Name	Node Type	Purpose	Flow Position
Assign Reviewer	Tool Node	Assigns human reviewer, sends notification	Entry
Wait for Human Action	State Node	Suspends until reviewer acts (approval/correction/reject)	Mid
Decision Branch	Conditional Node	Determines next route: approve/correct/reject/escalate	After human action
Escalate/Timeout Handler	Conditional Node	Handles SLA breach, escalation if reviewer idle	On timeout/exception

Sub-Graph Control Flow:

From Node	To Node(s)	Flow Type	Condition
Assign Reviewer	Wait for Human Action	Sequential	Reviewer assigned/alert sent
Wait for Human Action	Decision Branch	Sequential	Human response received
Decision Branch	Approve Path	Conditional	Approved
Decision Branch	Correction Path	Conditional	Correction/Amend requested
Decision Branch	Reject Path	Conditional	Rejected or Abandoned
Escalate/Timeout Handler	Decision Branch	Fallback	SLA/Timeout occurred

Sub-Graph: Retry Handler

Property	Definition
Purpose	Handles retry logic for transient, recoverable failures in tool interactions
Scope	Node-level retries, tracks attempts, triggers escalation after limit
Entry Conditions	Invoked when Intake, DocuSign, Submission, or Write-back node fails
Exit Conditions	Retry succeeds, retries exhausted, or escalation needed
State Input	Failed node context, current retry count, error detail
State Output	Updated retry count, success indicator, error/escalation state

Property	Definition
Contains Sub-Graphs	No (single layer)

Sub-Graph Node Structure:

Node Name	Node Type	Purpose	Flow Position
Retry Decision	Conditional Node	Checks if retry is possible	Entry
Retry Attempt	Sub-Graph Node	Calls failed node/function again	Within loop
Retry Count Update	State Node	Increments and persists retry counter	Each retry
Escalation Node	Conditional Node	Triggers fallback/escalate if limit hit	Termination

Sub-Graph Control Flow:

From Node	To Node(s)	Flow Type	Condition
Retry Decision	Retry Attempt	Loop	Retries remaining
Retry Attempt	Retry Decision	Loop	Retry did not succeed
Retry Decision	Escalation Node	Fallback	Retries exhausted
Retry Attempt	Success Exit	Conditional	Retry succeeds

Sub-Graph: Audit Trace

Property	Definition
Purpose	Captures, persists, and structures all workflow events, decisions, errors
Scope	Runs after each key state change; also terminal event flush
Entry Conditions	Invoked at every workflow step transition and on terminal states
Exit Conditions	Audit log updated, error/lineage trace persisted
State Input	Event context, state differential, error/decision data
State Output	Updated audit log/traces, immutable event record
Contains Sub-Graphs	No

Sub-Graph Node Structure & Flow:
Single pass: Receives event → structures log entry → persists via Audit Adapter → propagates error if write fails.

5) Conditional Branching Logic

Decision Point	Condition	If True →	If False →	Default →
Intake Exception Conditional	Intake normalization successful	Validation Agent	Retry Handler	Escalate on hard fail
Validation Branch Conditional	All validations pass	Packet Assembly	Human Review	Human Review
Assembly Exception Conditional	Assembly/Mapping error OR review required	Human Review	DocuSign Branch Cond	Human Review
Human Review Decision Branch	Human approves	DocuSign Branch	Correction Path	Reject/Escalate
DocuSign Branch Conditional	Signature required	DocuSign Envelope	Submission Agent	Submission Agent
DocuSign Exception Conditional	Envelope signed and completed	Submission Agent	Retry Handler	Retry Handler/ Escalate
Submission Exception Conditional	Submission to custodian successful	Write-back Agent	Retry Handler	Retry Handler/ Escalate
Write-back Exception Conditional	Salesforce/Edge write-back successful	Audit Trace Agent	Retry Handler	Retry Handler/ Escalate
Retry Decision Node (in Retry Handler)	Retry count < max_retries AND error is retryable	Retry Attempt	Escalation Node	Escalation Node
Escalation/Timeout Handler	Timeout, inaction, or unrecoverable error	Escalate	Continue Wait	Escalate

6) Loop Patterns

Loop Name	Loop Type	Iteration Condition	Loop Body Nodes	Exit Condition
Intake/Tool Retry Loop	Retry	retrycount < maxretries AND error is retryable	Retry Handler Sub-Graph, Target Node	Retry succeeds, or limit hit
Human Review SLA Wait	While	Human not responded, within allowed time	Wait for Human Action	SLA breach or human action

Loop Name	Loop Type	Iteration Condition	Loop Body Nodes	Exit Condition
DocuSign Polling Loop	Retry	Signature status not complete & retry remaining	DocuSign Envelope Agent, Retry Handler	Signature obtained or retries exhausted

7) Parallel Execution Patterns

Parallel Group Name	Nodes in Parallel	Synchronization Point	Merge Strategy
Continuous Audit Logging	Audit Trace Agent (runs in parallel with all)	After each agent execution	Combine Outputs (append all traces to a single workflow log)

8) State Management Definition

State Field	Type	Scope	Modified By Nodes	Read By Nodes	Persistence
workflow_context	Dict/meta	Graph-Level	Orchestrator, all nodes (update stage, IDs)	All	Session
intake_data	Structured/objects	Graph-Level	Intake Agent, Human Review	Validation, Assembly, Orchestrator	Session
validation_state	Structured	Graph-Level	Validation Agent, Human Review	Packet Assembly, Orchestrator	Session
packet_state	Structured	Graph-Level	Packet Assembly, Human Review	DocuSign, Submission	Session
review_state	Structured	Sub-Graph Level	Human Review Sub-Graph	Human Review Sub-Graph, Orchestrator	Session
signature_state	Structured	Graph-Level	DocuSign Agent, Retry Handler	Submission Agent, Orchestrator	Session
submission_state	Structured	Graph-Level	Submission Agent, Retry Handler	Write-back Agent, Orchestrator	Session
writeback_state	Structured	Graph-Level	Write-back Agent, Retry Handler	Audit Trace	Session
audit_state	Structured/log	Graph-Level	Audit Trace Agent, Orchestrator	All	Long-Term
retry_state	Counters/flags	Sub-Graph Level	Retry Handler, Orchestrator	Retry Handler, Orchestrator	Session
escalation_state	Flags/meta	Graph-Level	Orchestrator, Human Review, Retry Handler	Audit, Orchestrator	Session

9) Error Handling Definition

Error Type	Detection Point	Recovery Strategy	Fallback Path	Escalation
Intake error	Intake Agent	Retry (Retry Handler)	Human Review Exception	Operations/manual review
Validation exception/ambiguity	Validation Agent	Route for human review	Human Review	Supervisor/compliance review
Assembly error	Packet Assembly Agent	Retry, else human review	Human Review	Operations/manual correction
DocuSign failure/timeout	DocuSign Envelope Agent	Retry Handler	Human Review/Escalate	Operations/manual fallback
Submission failure	Submission Agent	Retry Handler	Human Review/Escalate	Manual submission
Write-back failure	Write-back Agent	Retry Handler	Human Review/Escalate	Manual reconciliation
Audit log write failure	Audit Trace Agent	Redundant write/alert	Stop/replay	Compliance alert; stop workflow
Unrecoverable workflow error	Orchestrator	Escalate and halt	Terminal Failure	Compliance/ops
Human review SLA breach/inaction	Human Review Sub-Graph	Escalate secondary reviewer	Supervisor/compliance	Manual override
Config/memory/persistence fail	Continuous Improvement Agent	Retry, notify stakeholders	Admin intervention	Ops/admin manual action

Error Propagation:
- On retry limit or unrecoverable state, errors escalate to human or supervisor and mark workflow for manual/compliance handling.
- All error events are logged to the audit state and surfaced both at node and workflow level.

10) Sub-Graph Composition Map

Parent Graph	Sub-Graph Node	Sub-Graph Name	Invocation Condition	State Mapping
Account Opening Agentic Workflow Graph	Human Review Sub-Graph	Human Review	On validation/assembly fail, exception, ambiguity	Inherits full context, review_state outputs mapped back to parent graph
Account Opening Agentic Workflow Graph	Retry Handler Sub-Graph	Retry Handler	On any tool/external node error	Receives node context+retry_state, outputs retry/escalation result to parent
		Audit Trace		

Parent Graph	Sub-Graph Node	Sub-Graph Name	Invocation Condition	State Mapping
Account Opening Agentic Workflow Graph	Audit Trace Sub-Graph		After every node transition, and on terminal exit	Receives full transition/event data, logs outcome – parent audit_state joined

State Mapping:
- Input: Parent state and node context passed in entirety or by reference for consistency/audit
- Output: Sub-graph modifies only applicable sub-state fields (e.g., review results, retry counts, audit logs)
- Bidirectional as required, with parent integrating sub-graph results on return
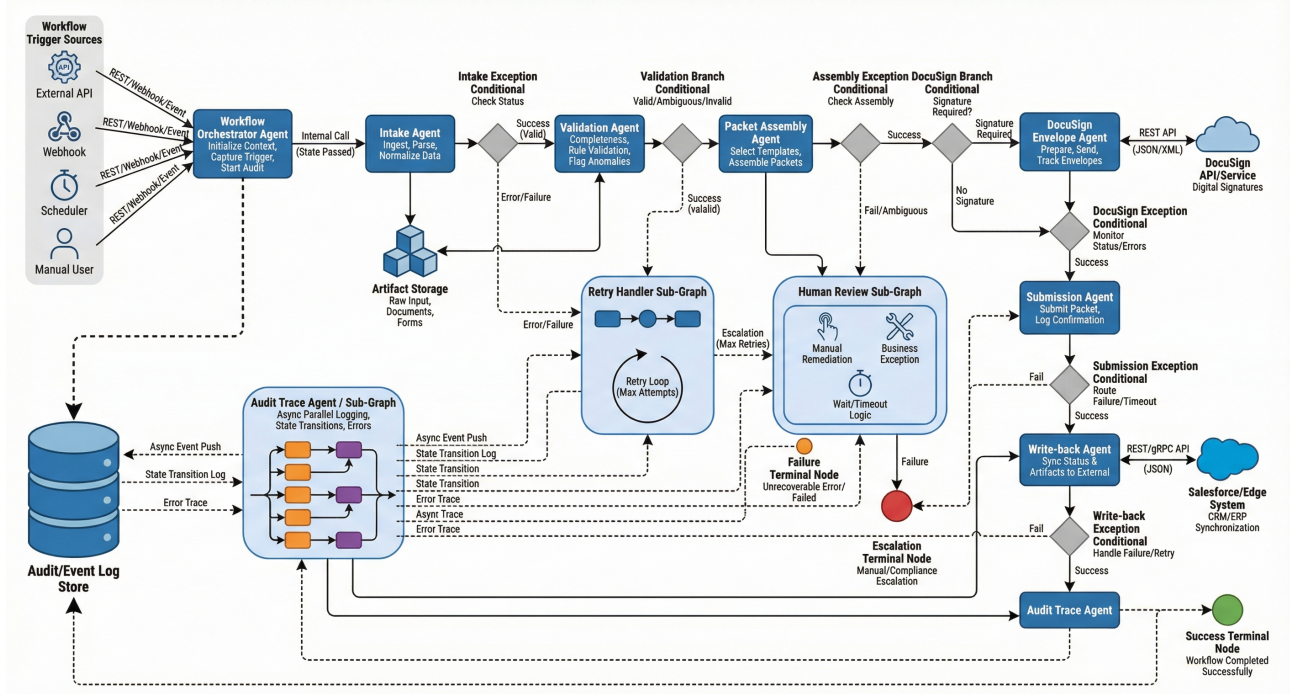
11) Graph Execution Flow (Conceptual)

Figure: Visual representation of the LangGraph execution flow

Entry Point:
- The workflow begins with the **Workflow Orchestrator Agent** node, which ingests a workflow trigger event (API, webhook, schedule, or manual). The orchestrator initializes the workflow context, assigns identifiers, captures the triggering metadata, and records the initial audit entry. The initial state includes all intake metadata and the counters for attempts/retries are set to zero.

Main Execution Path:
- The orchestrator passes execution to the **Intake Agent**, which ingests, parses, and normalizes all intake data (raw forms, uploads, client mapping). Normalization output and any error flags update the intake state and artifacts.
- Immediately after intake, the **Intake Exception Conditional** node evaluates whether ingestion succeeded. If yes, flow continues; if error, flow passes to the **Retry Handler Sub-Graph** (to perform retry logic) or, upon further failure, to **Human Review Sub-Graph/Escalation**.
- Upon successful intake, the flow proceeds through the **Validation Agent** that applies completeness, consistency, and rule validation (per custodian/account policies). The output is a structured validation log and, where needed, anomaly or ambiguity flags.
- The **Validation Branch Conditional** then inspects the validation outcome. Valid packets flow to **Packet Assembly Agent** for structuring and pre-population; invalid, ambiguous, or exception states are routed to the **Human Review Sub-Graph** for manual review and remediation.
- In assembly, the **Packet Assembly Agent** selects and populates custodian forms/templates, constructing all digital packets. The outcome feeds into the **Assembly Exception Conditional**, which routes failed/malformed or policy-flagged cases to **Human Review**, and successful assembly to the signature requirement decision.
- Next, the **DocuSign Branch Conditional** checks workflow configuration, packet meta, and policy to determine if digital signature (DocuSign) is necessary. If so, flow continues to **DocuSign Envelope Agent**; otherwise, directly to submission.
- At **DocuSign Envelope Agent**, envelopes are prepared, signed, and tracked for completion. The **DocuSign Exception Conditional** monitors whether signatures are complete in time and without error. Failures route to the **Retry Handler Sub-Graph** (with loop and limit), then escalate to human/manual if unresolved.
- Upon successful signature, flow proceeds to **Submission Agent**, which selects appropriate submission channel and logs confirmation. **Submission Exception Conditional** routes failures to **Retry Handler Sub-Graph**, and ultimately to escalation on repeated failure.
- On receipt acknowledgment, flow moves to the **Write-back Agent** for Salesforce/Edge system synchronization of all status, artifacts, and lifecycle data. **Write-back Exception Conditional** handles retries/fallback similarly.
- At each major transition or error branch, the **Audit Trace Agent** runs in parallel to update the immutable event, trace, and lineage logs.
- The succeeding terminal branch is the **Audit Trace Agent**, which ensures all success, escalation, and failure states are finalized and trace-flushed for compliance.

Branching Points:
- Exception, ambiguity, or specific policy triggers at Intake, Validation, Assembly, Signature, Submission, or Write-back nodes cause conditional branching to **Retry Handler** (for recoverable errors) or **Human Review Sub-Graph** (for business/exception cases).
- Conditional decisions are visually represented as diamond-shaped nodes linking either to the next workflow step, to a retry/error-handling loop, or to manual review paths.

Parallel Execution Sections:
- The **Audit Trace Agent** node is visually shown as parallel to all main graph flows, connected to every node. It receives a data push from each state transition, step execution, or exception/failure event.

Loop Sections:
- **Retry Handler Sub-Graph** is visualized as a self-loop around error-prone nodes (Intake, DocuSign, Submission, Write-back). The handler includes a counter and an exit to escalation after max retries.
- The **Human Review Wait** node within the human review sub-graph embodies a while-loop pattern for reviewer response/SLA handling; a timeout path leads to escalation.

Sub-Graph Invocations:
- Invocations to **Human Review Sub-Graph** and **Retry Handler Sub-Graph** are marked as nested "modules" branching off the main path at conditional nodes. Sub-graph entry and exit points are connected to the parent graph with explicit state mapping arrows (representing data handoff and return).
- The **Audit Trace Sub-Graph** can be visually grouped as a side-rail that logs every entry/exit from every node and sub-graph.

Exit Points:
- Upon completion, the workflow reaches a grouped terminal section comprising **Success**, **Failure**, and **Escalation** nodes. These are visually clustered, each finalizing through the **Audit Trace Agent**.
- The **Success Terminal** is reached when all steps, including write-back and final audit, complete with status "success".
- The **Failure Terminal** is entered via unrecoverable error or persistent failure after escalation/review.
- The **Escalation Terminal** is entered upon human/manual involvement, SLA breach, or compliance hand-off.
- In all cases, terminal audit logging confirms and seals the workflow trace.

Spatial/Visual Patterns:
- The architecture can be rendered as a left-to-right progression of main agent nodes (Orchestrator → Intake → Validation → Packet Assembly → DocuSign/Submission → Write-back → Audit).
- Conditional/branching nodes are depicted as diamonds between stages, with sub-graphs as modular offshoots.
- Audit logging runs as a vertical "rail" or background layer approving/annotating each transition.
- Parallel/loop flows are shown with arrows criss-crossing back into previous nodes, annotated with retry limits and escalation paths.
- Sub-graph boundaries are boxed/grouped, with explicit entry/exit points and state arrows connecting to the main execution path.

End of Definition