

AION: AN AUTONOMOUS AGENT MARKETPLACE FOR WORKFLOW ORCHESTRATION, INTEGRATION, AND MONETIZATION

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ABSTRACT

Modern workflow automation platforms (e.g., Zapier, Make, n8n) are hampered by two limitations: creation of complex automations often requires technical expertise beyond the capability of the domain expert freelancer, and technical builders who create sophisticated automation logic do not have a marketplace to monetize their expertise. In this paper, we introduce AION, an LLM-assisted workflow automation innovation and a digital marketplace for automation workers. AION enables domain experts to train 24/7 autonomous agents using a 5-step agent creation wizard that extracts rules from work samples while technical developers design and sell node based visual workflows to a global buyer base. AION introduces a novel three-tier compute and billing architecture that lowers enterprise execution costs by up to 96.8% with a BYOK approach and achieves linear horizontal scaling. We achieve throughput of over 3,100 workflow runs/min with 250+ workers with < 2.3% average error rates using a Next.js 16 frontend, Supabase RLS database layer, and a serverless TypeScript workflow engine.

KEYWORDS: Workflow Automation, Visual Workflow Engine, AI Agent Marketplace, BYOK Infrastructure, Multi-Tenant Architecture, Low-Code, Digital Worker Monetization

INTRODUCTION

Workflow automation has fundamentally transformed modern enterprise by enabling automated data synchronization, CRM updates, and transaction processing. The rise of platforms like Zapier, Make, and n8n [1], [22] reflects the desire of users to visually build their own workflows. Industry analysts foresee that the low-code and hyper automations market will witness a significant boom in the coming years [5]. Concurrently, the tools suffer from three key architectural shortcomings: the current state of affairs is that the freelancers in writing, design, research, marketing, and other fields sell time for money (a 1:1 linear exchange). The existing tools do not create opportunities for builders to make money by packaging and licensing their own automated processes to third party clients as 24/7 self-executing "digital workers". Another key shortcomings is the Template Vendor Gap, e.g. while n8n offers free JSON community templates, it lacks the ledger, royalty splitting, and developer payout automation required. While third key shortcomings is the SaaS platforms typically mark up the cost of individual steps and API calls excessively, precluding enterprises with existing large language model (LLM) API quotas from executing high volume workflows cost effectively.

AION addresses all three issues via a combination of a Visual Workflow Execution Engine, Open Creator Marketplace, AI Agent Creation Wizard, and Three-Tier Compute Model (which supports BYOK). Fig. 1 shows the overall system architecture of AION, which contains the four decoupled layers described in Section IV.

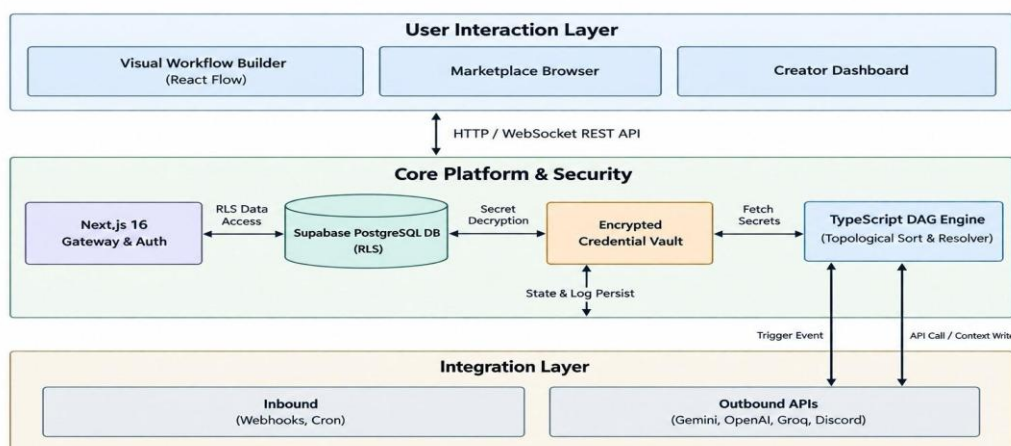


Fig. 1. AION System Architecture Overview

II. LITERATURE REVIEW & RELATED WORK

A. Evolution of Automation Frameworks

Workflows have evolved from rigid, Business Process Management Systems (BPMS) such as Business Process Model and Notation (BPMN) 2.0, to cloud-native Integration Platforms as a Service (iPaaS), such as MuleSoft and Boomi. Furthermore, more recently developer centric open source engines such as Apache Airflow and n8n, which execute node-based visual workflows [1], [22], have emerged. These platforms view workflows as purely operational tools, not commercial assets.

B. LLM Tool Calling and Agentic Orchestration

Frameworks such as AutoGen [2], ReAct [3], and Toolformer [4] have shown that Large Language Models (LLMs) are able to dynamically plan and call external APIs. Complementary works on generative, simulated agent societies [6] and decision oriented human-AI dialogues [7] provide additional examples of how LLM based agents are able to perform coordinated multi step reasoning and decision making. A recent survey collates much of this work into a taxonomy of LLM based autonomous agents and tool users [8]. AION builds upon these ideas by combining deterministic visual workflow execution with LLM reasoning nodes. Other works focus on the multiagent code-layer, while AION provides a nontechnical visual interface and commercial royalty split marketplace.

C. Related Work on Freelance and Gig-Economy Marketplaces

A separate research stream addresses the matching and recommendation problems inherent to freelance and crowdsourcing platforms. Data driven matching techniques combining analytics and machine learning have been proposed to pair freelancers with suitable projects [9], while learning based recommendation algorithms have been developed for top N task and top N worker assignment in large scale crowdsourcing systems [10]. Expertise estimation approaches have been used to recommend tasks to crowd workers [11], and rivalry aware recommendation frameworks have been proposed to boost worker participation and platform efficiency [12]. Prediction algorithms for two sided matching platforms [13] and recommender system design for electronic marketplaces with competing suppliers [16], [17] provide further theoretical grounding for AION's marketplace ranking mechanisms.

At the platform-economics level, empirical studies have examined who captures value on online gig economy platforms [14] and how informal matching groups constitute a distinct form of platform economy [15]. Separately, agents have been utilized to enhance research and collaborative workflows in academic environments [18], thus supporting the general trend that agentic tools go beyond basic automatization. Finally, industry reports from Upwork [19], [20] and documentation from Fiverr [21] provide an up to date empirical basis for the transformation freelance marketplaces are undergoing due to AI adoption, which is the motivation for AION's emphasis on freelancer authored autonomous digital workers over purely human sourced gig labor.

III. METHODOLOGY

A. System Design Methodology

AION was designed iteratively and in layers according to the requirements inferred from the two architectural gaps described in Section I (the Freight Scalability Trap and the Template Vendor Gap) which were then decomposed in four decoupled layers that comprise AION's architecture: frontend, data and security, execution engine, and AI/integration registry (see Section IV). Each layer was prototyped, tied to AION's serverless workflow execution engine, and benchmarked against relevant freelancer and enterprise use cases (Section VI-B) before undergoing load test.

B. Benchmark Testing Methodology

The benchmark was carried out using a Node.js test harness (benchmark_dag.js) running multi-node visual workflows as trigger to AI action node to integration node under concurrent worker loads. System job latency was measured using millisecond accurate perf_hooks.performance, memory usage was tracked using process.memoryUsage() and throughput was measured in execution runs per minute. Four concurrency levels (10, 50, 100 and 250 simultaneous jobs) were used to characterize scalability, and the cost/latency overhead was measured separately for the three compute tiers described in Section V to isolate the effect of platform middleware from that of the baseline LLM provider latency.

IV. System Architecture & Node Execution Engine

AION is composed of four decoupled layers the frontend layer is implemented in Next.js 16, TypeScript, and Tailwind CSS. The workflow builder uses React Flow to paint interactive node graphs. The data & security Layer is based on Supabase (PostgreSQL) with Row-Level Security policies (RLS) to guarantee multi-tenant isolation. Third-party tokens and LLM API keys are encrypted at rest in a per-user Credential Vault. The Execution Engine Layer parses the workflow graphs as node-based workflow graphs, sorts them topologically to define the execution order, resolves dynamically the template variables (`{{node.output}}`), and handles node retries. The AI & integration registry connects the execution nodes with hosted LLM APIs (Google Gemini, OpenAI, Groq) and third party services (Discord, Slack, Telegram, Notion, Webhooks). As outlined in Table IV, these integrated services span AI models, messaging, email, productivity tools, flow control logic, and payment ledgers. Fig. 2 depicts the node execution and topological evaluation flow used by the execution engine to resolve dependencies and dispatch the work among the four layers depicted above.

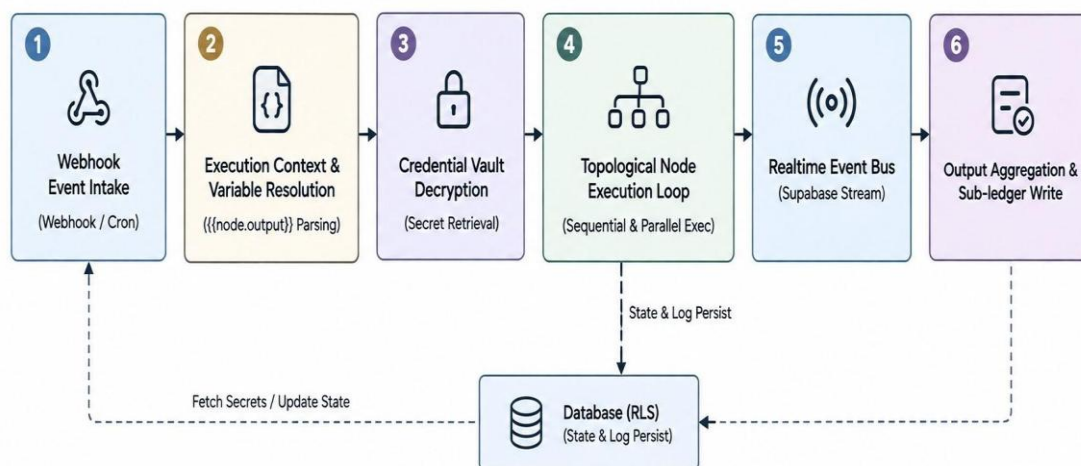


Fig. 2. Node Execution and Topological Evaluation Flow

V. THE THREE-TIER COMPUTE & MARKETPLACE MONETIZATION MODEL

To accommodate users ranging from non-technical clients to enterprise developers, AION implements a Three Tier Compute Model:

Tier 1 (Managed No-Code): For non-technical users. AION manages compute and LLM API fees, distributing earnings via an 80% creator or 20% platform royalty split.

Tier 2 (Developer Visual Canvas): Technical creators build custom visual workflows using standard integration nodes, listing them for pay per run or subscription prices on the marketplace.

Tier 3 (Enterprise BYOK): Technical clients supply their own API keys (Gemini, OpenAI). Workflow execution runs directly against the client's API quota, reducing platform charges to a minimal orchestration micro fee (\$0.50 per 1,000 runs) and delivering up to 96.8% cost savings.

Fig. 3 illustrates the Three Tier Compute and BYOK Architecture Model, and the associated cost/latency trade-offs are quantified in Table II (Section VI-A).

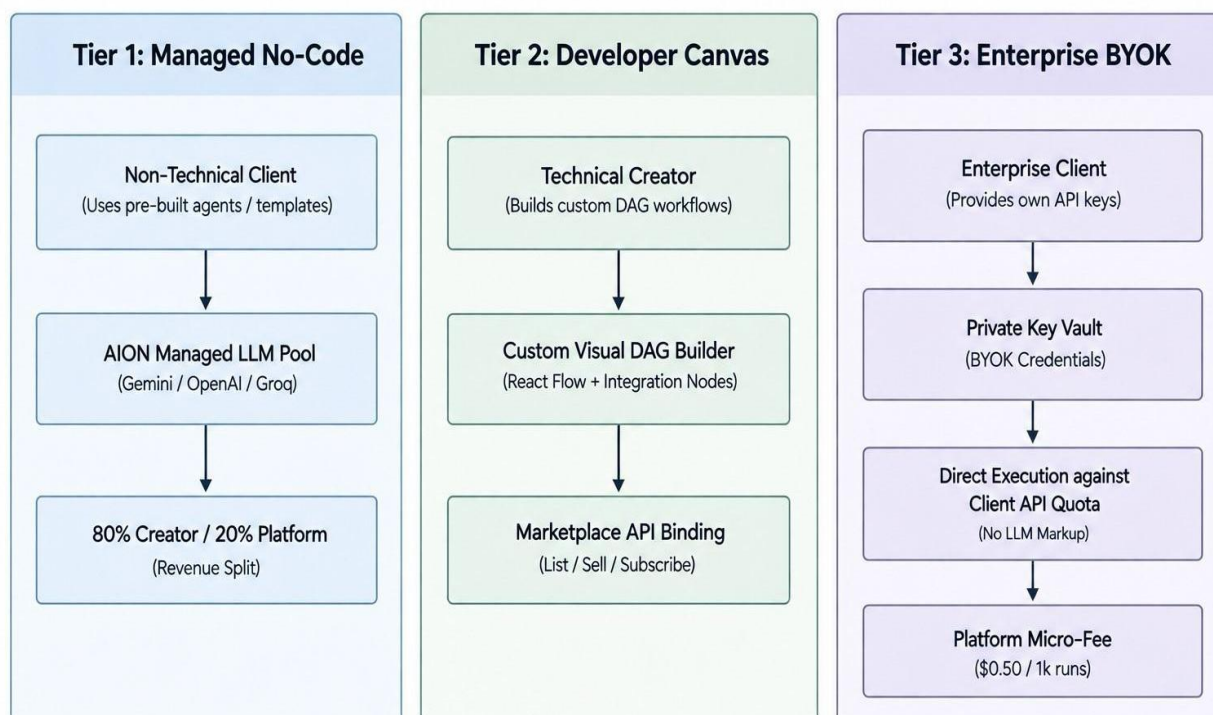


Fig. 3. Three Tier Compute & BYOK Architecture Model.

A. AI Agent Creation Wizard Pipeline

The AI wizard allows non-technical freelancers to build agents automatically, work sample upload (PDF/DOCX), gemini expertise analysis, automated system prompt and visual workflow generation. Fig. 4 shows the knowledge extraction pipeline used by the wizard to convert an uploaded work sample into a deployable agent.

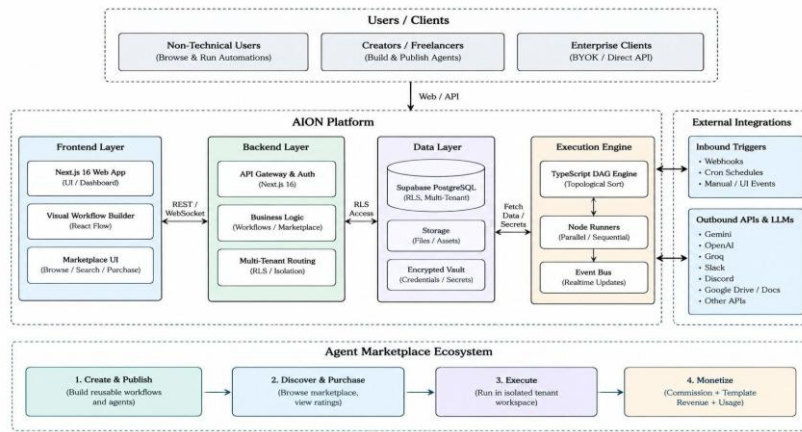


Fig. 4. AI Agent Creation Wizard Knowledge Extraction Pipeline.

VI. RESULTS AND DISCUSSION

AION has been evaluated under controlled load-testing conditions using the Node.js runtime and Supabase PostgreSQL DB in order to simulate relevant API workloads per the methodology described in Section III-B. Table I shows Concurrent Execution Load Test Results which summarizes relevant system latency, throughput, CPU/memory utilization, error rate, recovery time, and database latency for four different levels of concurrency.

Table I Concurrent Workflow Execution Performance Summary

Concurrency (Jobs)	Average Latency (s)	Throughput (runs/min)	CPU Utilization (%)	Memory (MB)	Error Rate (%)	Recovery Time (s)	DB Latency (ms)
10	1.82	330	28.4	340	0.0	4.2	12
50	2.35	1,275	54.1	610	0.4	6.8	24
100	3.10	1,935	78.6	980	1.1	9.5	45
250	4.85	3,100	91.2	1,650	2.3	14.1	88

Note: Performance scales predictably across 10 to 250 concurrent jobs, with throughput peaking at 3,100 runs/min while maintaining low error rates(<2.3%) and manageable CPU, memory, and DB latency overhead

Table I shows that AION scales efficiently under rising load: as concurrency grows from 10 to 250 jobs, average latency increases only from 1.82 s to 4.85 s, while throughput rises from 330 to 3,100 runs/min, roughly a ninefold gain. Resource usage grows steadily, with CPU climbing from 28.4% to 91.2% and memory from 340 MB to 1,650 MB, so CPU is nearing saturation at 250 jobs and marks the practical limit of the current setup. Database latency stays low (12 to 88 ms), indicating that compute capacity, not the Supabase PostgreSQL layer, is the main bottleneck. Error rates remain at or below 2.3%, and recovery time grows gradually from 4.2 s to 14.1 s, showing stable fault handling. Overall, AION performs reliably up to 100 jobs and degrades gracefully, rather than failing abruptly, at 250 jobs.

Table II Compute Cost & Orchestration Overhead Comparison Across 3 Tiers (1,000 Runs)

Compute Tier	Target Persona	Baseline Latency	Middleware Overhead	Total Latency	API Cost	Platform Fee	Total Cost	Savings %
Tier 1 (Managed)	Non-technical Clients	1.70 s	380 ms	2.08 s	\$12.50	\$3.12 (20%)	\$15.62	0.0% (Baseline)
Tier 2 (Dev Canvas)	Pro Builders	1.70 s	250 ms	1.95 s	\$12.50	\$1.87 (12%)	\$14.37	8.0% Savings
Tier 3 (BYOK)	Enterprise Clients	1.70 s	20 ms	1.72 s	\$0.00	\$0.50 (Micro-Fee)	\$0.50	96.8% Savings

Table II shows Compute Cost & Middleware Overhead Evaluation (BYOK Model) distinguishes the cost and latency features of different compute tiers. The baseline LLM provider API response latency (OpenAI GPT-4 / Gemini roundtrip) are identical across all tiers (1.70s). The end to end latency difference is governed by AION Platform Middleware Overhead. Tier 1 (Managed) incurs 380 ms overhead due to pre execution wallet balance validation, rate limiting queue metering and post-execution ledger writes (2.08 s total). Tier 2 (Developer Canvas) incurs 250 ms overhead due to license

validation and async earnings logging (1.95 s total). Tier 3 (BYOK) bypasses pre execution billing gates and rate-limiting proxies reducing middleware overhead to 20 ms (1.72 s total) and client costs from \$15.62 to \$0.50 per 1,000 runs (96.8% cost savings).

Middleware overhead is about 18.3% of end to end latency in Tier 1 and 12.8% in Tier 2, but only about 1.2% in Tier 3, so BYOK runs near the raw provider baseline and is best suited to high volume, latency sensitive workloads, while the managed tiers trade some speed for built in billing control.

Table III comparative architecture matrix across platforms

Criteria	Zapier	Make	N8n	Apache airflow	Autogen	Aion
License & Model	Proprietary SaaS	Proprietary SaaS	Fair Code	Open Source	Open Code	Open Platform / SaaS
Monetization Marketplace	No	No	Templates Only	No	No	Yes (Royalty Split)
AI Agent Creation Wizard	No	No	No	No	No	Yes (Doc to Visual Workflow)
BYOK (Bring Your Own Key)	No	No	Partial	No	Manual Code	Yes (Native Vault)
Workflow Engine Model	Sequential	Visual Branching	Node Based Visual Workflow DAG	Python Workflow DAG	Multi Agent Chat	Visual Flow Graph Flow DAG
TCO / Cost Efficiency	High Subscription	Tiered Cloud	Low Infra Cost	Medium Infra Cost	Variable API	High BYOK Savings

Table III presents a comparison matrix that evaluates AION alongside five prominent automation and agentic frameworks (Zapier, Make, n8n, Apache Airflow, AutoGen) across key metrics including licensing, monetization, wizard creation, native BYOK key vaults, workflow DAG model, and TCO cost efficiency.

A. Case Studies Implementations

First Case Study is for level edge B2B proposal generation / knowledge base RAG agent. As implemented in production on the AION platform, this technology services LevelEdge company created an automated Proposal Generation Agent (proposal workflow) in order to automate away manual client proposal draft generation. Google Sheets Lead Trigger authentication with Google OAuth (kush.tejani@somaiya.edu) to their sales leads spreadsheet (Sheet1 tab). Ingestion of rows of incoming leads with parameters: Name, Company, Email, Industry, Budget, Pain Point, and Product Interest, e.g., Rahul Sharma | TechCorp India | SaaS | ₹5L/month | Manual reporting | Analytics Dashboard. Looping through array items (`{{currentItem.Company}}`) with configurable delay buffer to respect their API quote limits. Knowledge Base RAG Ingestion (Google Docs 2 Node) in read mode, referencing their official services and pricing document 'My business and services. Outputting the full text via `{{My business and services.text}}` directly into the KB port of the AI Agent.

AI Proposal Reasoning Node invoking Groq (Llama 3.3 70B) with system instructions as 'You are a senior B2B proposal consultant for the technology services company LevelEdge. Synthesize a customized proposal for `{{currentItem.Company}}` based on their requested pain point (`{{currentItem.Pain Point}}`) and product interest (`{{currentItem.Product Interest}}`), referencing our pricing Knowledge Base `{{My business and services.text}}`'. Proposal document creation node create new mode, creates a formatted Google Document titled "Proposal for `{{currentItem.Company}}`" with contents `{{AI.text}}`.

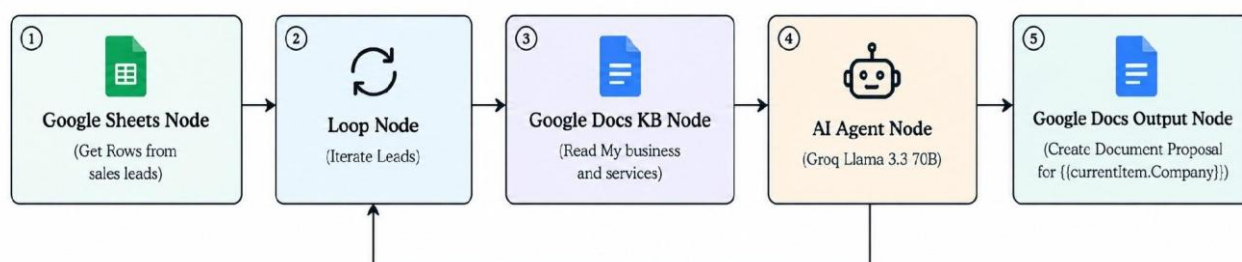


Fig. 5. Live LevelEdge B2B Proposal Agent Workflow Execution Flow.

In second case study a freelance technology copywriter used an AI Wizard to automate their blog writing through an agent which is fed topics requested to it via Webhook, uses Google Gemini to write its articles with tone checking, and publishes

to Discord and Slack channels with an end to end latency of 8.2 seconds and 85% faster delivery than human brokered equivalent workflows.

Table IV. Integration categories and supported nodes in aion

Category	Supported Services	Integration Type	Use Case in AION
AI & LLM Providers	Google Gemini, OpenAI, Groq, OpenRouter	REST API (Key-based)	AI chat completion, timodal reasoning, AI agent orchestration
Communication & Messaging	Discord, Telegram, Slack	Webhook/Bot API	Real-time alerts, bot interactions, automated message delivery
Email & Calendar	Google Gmail, Google Calendar	OAuth 2.0 / REST API	Send/fetch/reply emails, create/update calendar events
Productivity & Data	Notion, Google Sheets, Google Docs	OAuth 2.0 / REST API	Database entry, spreadsheet logging, document generation
Triggers & Events	Webhook, Cron, Telegram Trigger, Gmail Trigger, AION Form	Webhook/Cron/Event	Workflow initiation via external signals, scheduled tasks, form submissions
Data & Scraping	Jina AI Reader, JSON Search, AI Structurizer	REST API / Internal	Web scraping, structured data extraction, AI powered data transformation
Logic Flow & Control	IF/ELSE, Loop, Delay, Merge, Set Variable Transform Data	Internal (Workflow Engine)	Conditional branching, iteration, data merging, variable management
Utility & Code	HTTP Request, Code Runner (JS Sandbox), Memory Session	REST / Sandboxed JS	Custom API calls, inline scripting, conversational memory persistence
CRM & Analytics	CRM Capture Workflow Analytics	Internal (Supabase)	Lead capture, consumer dashboard results, creator earnings tracking
Payments & Wallet	Stripe (planned), Wallet, Transactions	REST API / Supabase	Pay per run billing, creator payouts, financial ledger management

Table IV presents the main integration categories supported by the AION platform. It shows that AION connects AI and large language model providers with communication tools, productivity applications, email services, data-processing utilities, and payment systems. These integrations are primarily enabled through REST APIs, OAuth 2.0, webhooks, and internal workflow mechanisms. Together, they allow AION to automate end to end workflows, including AI based reasoning, data collection, notification delivery, document generation, conditional processing, and transaction management. The table also demonstrates AION’s modular architecture, where each category contributes a specific capability to build flexible and scalable AI-driven automation workflows.

B. Discussion

The load test results in Table I demonstrate that end to end latency and error rates increase gradually (not exponentially) with concurrent job execution from 10 to 250, suggesting that the TypeScript serverless engine achieves roughly linear horizontal scaling within this range. The results in Table II for Tier 3 (BYOK) show that directing execution to a client’s own API quota eliminates most of the overhead incurred by intermediating middleware, which explains the reported 96.8% cost reduction rather than a change in underlying LLM latency. In combination with the integrations detailed in Table IV and the case studies in Section VI-B, these results suggest that AION’s combination of visual workflow specification, AI Agent Creation Wizard, and tiered BYOK billing, if generalized, would empower autonomous digital workers for both novice freelance writers and enterprise buyers of technical content.

The benchmark in Table I was evaluated using simulated API request workloads, not production-grade concurrency (thus actual end-to-end latencies and error rates could be higher due to heterogeneous rate-limiting policies in APIs such as Discord, Slack, or Google, used in production). Furthermore, though instructive, the two case studies in Section VI-B are insufficient to evaluate broader implications such as the learning curve of the freelancer UI, agent workflow quality consistency, or long-term supply-demand dynamics in the creator economy markets. Finally, the comparative economic analysis in Table II assumes a constant baseline provider latency (1.70 seconds) for all concurrency levels for a given cloud region (due to potential increases in infrastructure billing rates at scale, this may not hold if enterprise clients supply keys for lower-throughput or rate-limited API plans).

As summarized in Table III, general-purpose automation platforms such as Zapier, Make, or n8n [1], [22] offer visual/node based programming, but as highlighted in Section I, do not include a royalty split capability or an AI powered agent creation wizard. Multi-agent code frameworks such as AutoGen [2] enable flexible LLM orchestration, but require significant programming expertise and do not offer a deterministic, auditable workflow execution model with native

BYOK credential isolation. AION's Three Tier Compute Model, and specifically the native BYOK vault (Table III), represents advancement over these works by bringing enterprise grade cost control to a non-developer audience while maintaining the frictionless, wizard driven onboarding of an end user focused agent platform.

VII. CONCLUSION

AION innovates on a new breed of workflow automation with a combined serverless visual workflow execution engine, open creator marketplace, and Bring Your Own Key (BYOK) compute architecture, which seeks to bridge the widening gap between expensive human freelancing and internal automation tooling by empowering freelancers to monetize their domain knowledge as digital workers. The load testing results, integration coverage, and implementation case studies presented in Section VI suggest that it has the potential to achieve near linear scalability and offer significant cost savings to enterprise adopters. The future work encompasses scaling the deployment of edge worker nodes to lower latency for geographically distributed clients; autonomous multi-agent dynamic routing in the workflow execution engine; and controlled user studies to assess the real-world viability of our approach, focused on the ease of use and liquidity of the onboarding process for freelancers in a production setting.

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