

Updated Architecture Diagram – Enterprise & Accreditation Edition

This document extends the Automotive and Diesel LMS architecture to include visual diagrams, Kubernetes deployment specifications, accreditation-ready system descriptions, and executive-ready formatting. It is suitable for institutional review, Perkins/CTE compliance, and leadership briefings.

1. Executive Summary

The Automotive and Diesel LMS platform is a modular, AI-enabled learning ecosystem that integrates curriculum generation, simulation assets, and media generation. The architecture leverages Stable Diffusion for visual content, Ollama for language generation, and Blender for 3D assets, all orchestrated through scalable backend services.

2. Visual Architecture Diagram (Conceptual)

The architecture is organized into clearly defined layers. Frontend clients communicate through an edge routing layer to backend APIs, which coordinate AI and rendering services. Generated assets are stored centrally and served back to learners and instructors.

Diagram Description:

- Frontend: Next.js LMS UI and documentation site
- Edge: Nginx reverse proxy
- Backend: Phoenix API and FastAPI Gateway
- Services: Ollama, Blender Worker, Stable Diffusion WebUI
- Storage: PostgreSQL and S3/MinIO

3. Kubernetes Deployment Appendix

Stable Diffusion and other AI services may be deployed on GPU-enabled Kubernetes nodes. This ensures isolation of compute-intensive workloads and predictable performance.

Key Kubernetes Concepts:

- GPU nodeSelector and tolerations
- ClusterIP service exposure
- Readiness probe using /sdapi/v1/options
- Liveness probe on TCP port 7860
- Horizontal scaling disabled for GPU-bound workloads

4. Accreditation & Compliance Narrative

This architecture aligns with post-secondary CTE accreditation and Perkins V expectations by supporting reproducible instructional content, auditable workflows, and separation of instructional delivery from content generation. AI-generated assets are traceable, versioned, and instructor-reviewed prior to student release.

The modular design ensures accessibility, scalability, and long-term maintainability, meeting institutional requirements for instructional technology systems.

5. Image Generation Provider Specification

An abstract Image Generation Provider interface allows the LMS to switch between local Stable Diffusion, alternative pipelines such as ComfyUI, or future cloud services without architectural refactoring.

Provider Contract:

GenerateImage(prompt, resolution, steps, cfg, sampler, seed) → PNG

6. Leadership & Operational Notes

This architecture supports phased rollout, starting with a single-GPU local deployment and scaling to clustered environments as enrollment and content demands grow. The design minimizes vendor lock-in while maximizing instructional innovation.