



Build Agents with the Agent Development Kit

Course description

Build Agents with the Agent Development Kit is an advanced-level, instructor-led course designed for software developers, engineers, platform and DevOps professionals, and technical or solutions architects who want to build enterprise-grade AI agent systems using Google's Agent Development Kit (ADK).

The course provides a practical progression from building a simple ADK agent to designing and deploying sophisticated multi-agent systems. Participants learn how ADK represents agents, tools, and runners, how tools are exposed to models through automatically generated schemas, and how session state enables coordination across agents.

Learners then explore multi-agent orchestration using deterministic workflow agents, graph-based workflows, conditional routing, parallel fan-out and joins, and task-based collaboration. The course also covers grounding agents in enterprise data through ADK grounding tools, multi-source retrieval, and external Model Context Protocol (MCP) integrations. Finally, participants learn how to deploy multi-agent systems to Agent Runtime and register and share agents through Gemini Enterprise, enabling organizational users to discover and access agent capabilities.

- Course level: Advanced
- Duration: 1 day

Activities

This course includes instructor-led presentations, technical demonstrations, guided agent development activities, hands-on ADK exercises, multi-agent workflow design, enterprise grounding scenarios, MCP integration demonstrations, deployment walkthroughs, architecture discussions, and knowledge checks.

Course objectives

In this course, you will learn to:

- Describe the ADK agent model, including Agent configuration, tools, and the runner.
- Configure and run a functional ADK agent, and apply optional parameters based on application requirements.
- Use the ADK CLI to scaffold, run, and test agents locally.
- Explain how ADK automatically generates tool schemas from Python functions.
- Build custom tools using descriptive function names, docstrings, and parameter types.
- Use ToolContext to securely manage authentication, session state, and artifacts.
- Explain session state scopes and implement safe state modifications.
- Design multi-agent workflows using shared invocation state and the `output_key` pattern.
- Build multi-agent workflows using ADK's deterministic template workflow agents.
- Design graph-based workflows using conditional routing, parallel fan-out, and joins.
- Configure coordinator agents and delegation modes for task-based collaboration.
- Ground agents in enterprise data using structured and unstructured data retrieval tools.
- Implement intent-based routing across multiple retrieval sources.
- Explain the benefits of MCP for decoupling agent logic from tool execution, and use `McpToolset` to integrate external MCP-based tools.
- Describe the core capabilities of the Gemini Enterprise Agent Platform and differentiate between Agent Sessions and Agent Memory Bank use cases.
- Deploy agents using the ADK CLI and Agents CLI, and deploy multi-agent systems to Agent Runtime.
- Register and share agents through Gemini Enterprise.

Intended audience

This course is intended for professionals building and deploying enterprise AI agent applications:

- Software Developers and Engineers
- Platform Engineers
- DevOps Engineers
- Technical Architects
- Solutions Architects
- Cloud Architects
- AI/ML Engineers
- Application Developers
- Professionals building AI agent applications
- Professionals responsible for enterprise AI application deployment

Prerequisites

We recommend that attendees of this course have:

- Familiarity with Large Language Models (LLMs) and API integration.
- Understanding of software architecture concepts.
- Familiarity with Python programming and Python-based application development.
- Understanding of basic AI/ML concepts is beneficial.
- Experience working with APIs and cloud-based applications is recommended.
- Familiarity with Google Cloud concepts is beneficial.
- Basic understanding of agentic AI concepts is recommended.

Course outline

Module 1: Introduction to the Agent Development Kit (ADK)

- Overview of the ADK framework and enterprise use cases
- The four core ADK components and their responsibilities
- Component interaction and the agent execution lifecycle
- Configuring a functional agent: agent name, model, and core instruction
- Demo: Four core ADK components and the agent execution lifecycle.
- Guided discussion: Enterprise ADK use cases.

Module 2: Configuring a Simple Agent

- ADK agent requirements and required parameters
- Optional agent parameters
- How agent configuration influences agent behavior
- Demo: Creating a simple ADK agent.
- Guided exercise: Configuring an agent using optional parameters.

Module 3: Using ADK's CLI

- Creating scaffolding for your project with the ADK CLI
- Running the agent locally during development
- Using adk web to test the agent in the browser
- The ADK development loop and how it supports agent development and testing
- Hands-on Lab: Create an ADK agent project and run the agent locally.
- Demo: Testing the agent using adk web.

Module 4: Building Tools

- Automatic schema generation from Python functions
- Tool components: function names, docstrings, and parameter types
- How tool metadata informs the model's reasoning
- Inter-tool dependencies
- Hands-on Lab: Build a custom Python tool with descriptive naming and explicit docstrings.
- Demo: Automatic tool schema generation and tool dependencies.

Module 5: Empowering ADK Agents with Tools

- ToolContext and its role within an ADK tool
- State, flow, and artifacts
- The four capabilities ToolContext provides
- Securely handling authentication through ToolContext
- Managing large data payloads as artifacts
- Hands-on Lab: Implement ToolContext in a custom tool and read and write session state.

Module 6: Session State and Multi-Agent Coordination

- The four session state scopes and their prefixes and lifespans
- Writing state safely using managed contexts
- Persisting agent outputs with the output_key parameter
- State as a coordination mechanism across agents

- Guided exercise: Safe state modification and using `output_key`.
- Design activity: State-based multi-agent coordination.

Module 7: Multi-Agent Orchestration

- When a single agent is not appropriate for complex tasks
- Context window limits, task specialization, and parallelism
- ADK's deterministic template workflow agents
- Selecting an orchestration pattern based on task dependencies
- Demo: Sequential and parallel workflows.
- Scenario activity: Select the appropriate orchestration pattern.

Module 8: ADK 2.0 Graph Workflow

- Graph-based workflow fundamentals: the ADK 2.0 Workflow class, nodes, and edges
- Conditional routing within a graph workflow
- Parallel fan-out architectures
- Using a `JoinNode` to coordinate independent agents running concurrently
- Guided exercise: Conditional routing in a graph workflow.
- Demo: Parallel fan-out and `JoinNode` orchestration.

Module 9: Task-Based Collaboration

- Coordinator agents and defined sub-agents
- The three delegation modes and when to use each
- Creating explicit instructions for accurate request routing
- Collaboration constraints in multi-agent system design
- Guided exercise: Configure a coordinator agent with sub-agents.
- Scenario activity: Route user requests using a coordinator.

Module 10: Grounding and Enterprise Data Integration

- Core grounding concepts and ADK grounding tools
- Structured and unstructured data retrieval
- Grounding risks: schema hallucination and semantic drift
- Multi-source routing and intent-based retrieval selection
- Model Context Protocol (MCP) and decoupling agent logic from tool execution
- Guided exercise: Multi-source routing across retrieval tools.
- Demo: MCP integration using `McpToolset`.

Module 11: Gemini Enterprise Agent Platform

- The four core pillars of the Gemini Enterprise Agent Platform
- Tools and services supporting the agent lifecycle
- Scaling features for agent applications
- Agent Sessions vs. Agent Memory Bank: conversational context and long-term preferences
- Alternative runtime options for agent applications
- Demo: Platform capability walkthrough and scaling agent applications.
- Scenario discussion: Agent Sessions vs. Agent Memory Bank.

Module 12: Deploying with the ADK CLI and Agents CLI

- ADK CLI vs. Agents CLI and selecting the appropriate deployment path
- SDK configuration and deployment sources
- The four stages of the complete agent lifecycle
- Agent descriptions and how they support AI-driven routing during registration
- Sharing agents across the organization
- Hands-on Lab: Deploy a multi-agent system to Agent Runtime.
- Demo: Agent registration and sharing an agent through Gemini Enterprise.

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