What are AI Agents?

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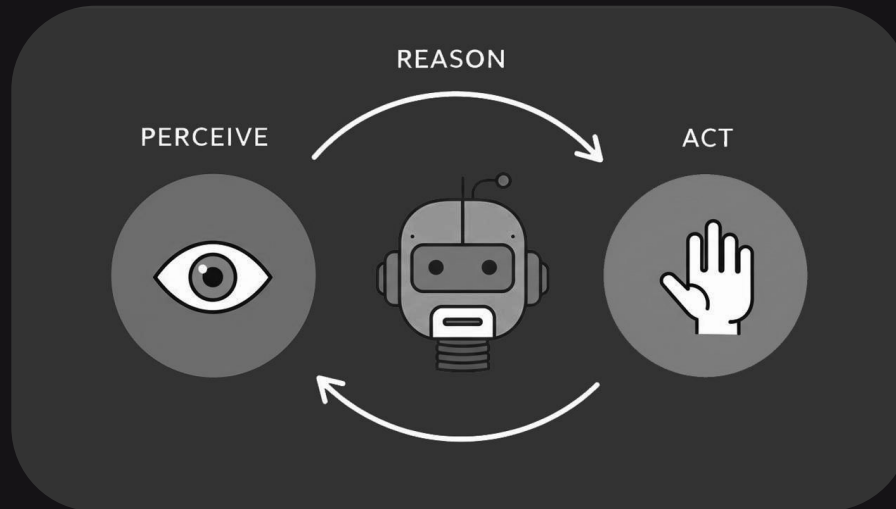
Created & Narrated by:
Dipanjan Sarkar
Head of Community & Principal AI Scientist @ Analytics Vidhya
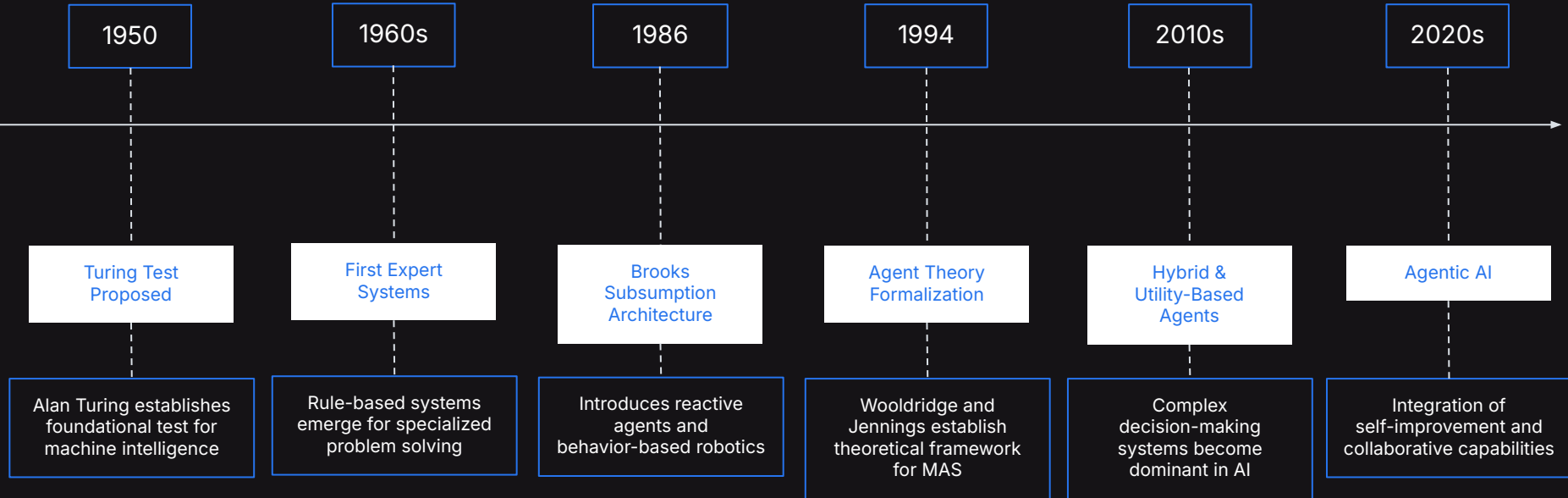Google Developer Expert - ML & Cloud Champion Innovator
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What are AI Agents?

AI Agents are **software entities that operate autonomously** to perceive their environment, make decisions and act to achieve specific goals.
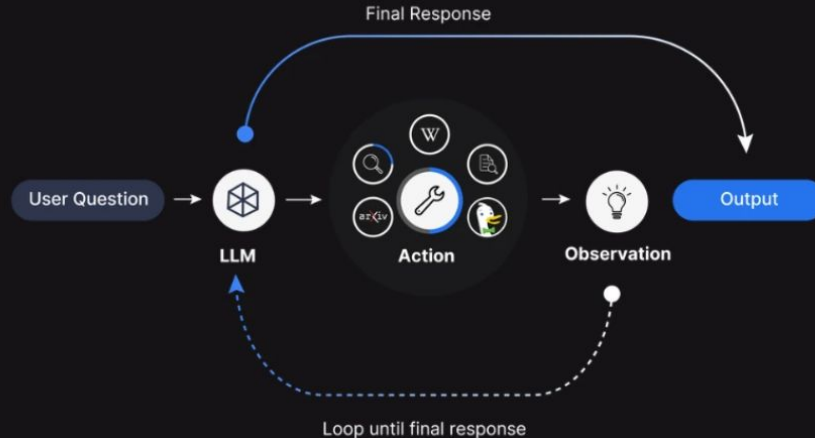
Evolution of AI Agents and Agency

1950	1960s	1986	1994	2010s	2020s
Turing Test Proposed	**First Expert Systems**	**Brooks Subsumption Architecture**	**Agent Theory Formalization**	**Hybrid & Utility-Based Agents**	**Agentic AI**
Alan Turing establishes foundational test for machine intelligence	Rule-based systems emerge for specialized problem solving	Introduces reactive agents and behavior-based robotics	Wooldridge and Jennings establish theoretical framework for MAS	Complex decision-making systems become dominant in AI	Integration of self-improvement and collaborative capabilities

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Traditional Software v/s AI Agents

Traditional Software

```
Input  →  Process  →  Validate  →  Output
```

v/s

AI Agent System

Agentic Design: A New Paradigm

The Importance of Agentic Design

Adapting to Complexity

- Traditional systems struggle with dynamic environments.

- Agentic design thrives by enabling autonomy and proactivity in AI systems.

Scalability and Collaboration

- Multi-agent systems can efficiently divide and conquer tasks.

- Enable distributed intelligence for large-scale applications.

Improved Decision-Making

- AI agents integrate real-time feedback to improve outcomes.

- Examples: *Recommender systems, autonomous navigation.*
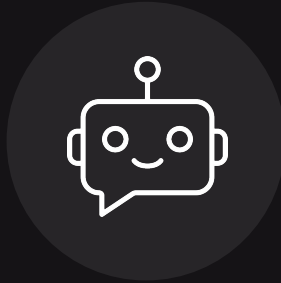
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Agentic Design: A New Paradigm

Modern Applications of Agentic Design

Autonomous Vehicles

Proactive navigation and reactivity to environment changes

Virtual Assistant

Seamless interaction and goal-oriented task execution.
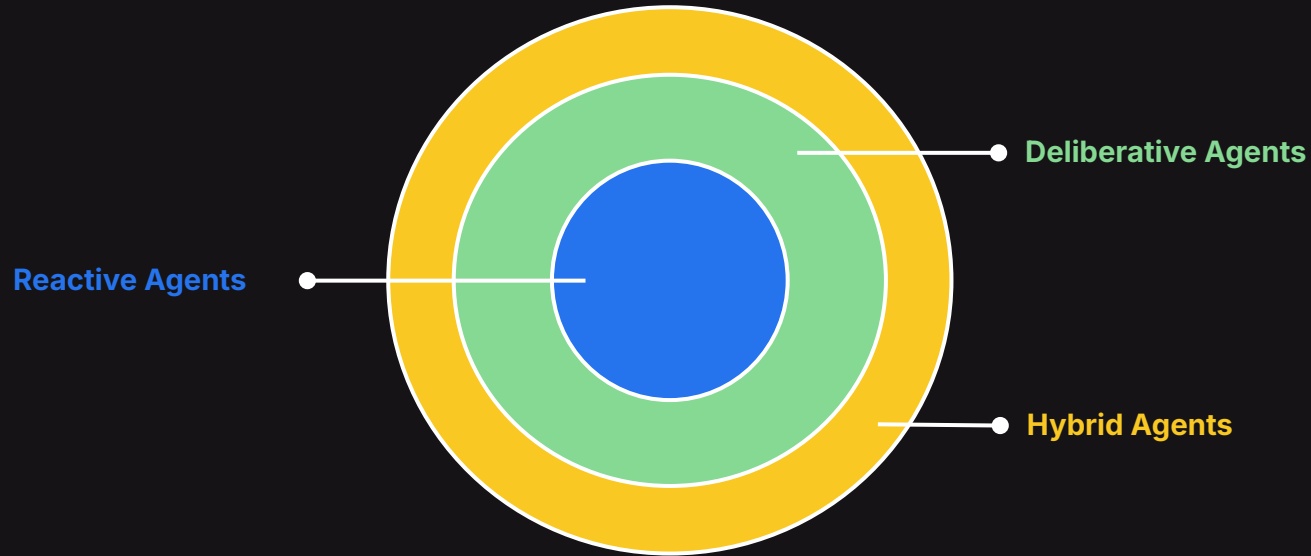
Healthcare AI

Proactive patient monitoring and adaptive diagnostics

E-commerce

Intelligent agents for dynamic pricing, inventory management, and personalized recommendations

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Types of AI Agent Models

Reactive Agents

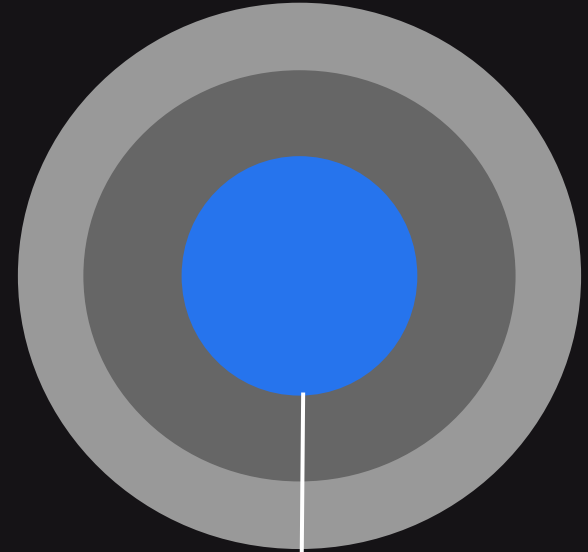Deliberative Agents

Hybrid Agents

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Types of AI Agent Models

Reactive Agents: Reactive AI agents are the digital equivalent of reflexes. They operate on a straightforward principle: perceive the environment and react immediately.

- Features:
    - Simple and fast decision-making
    - Lack of long-term planning

- *Example: Simple reflex agents like game bots reacting to player moves.*

- Simple reflex actions
- Stimulus-responses
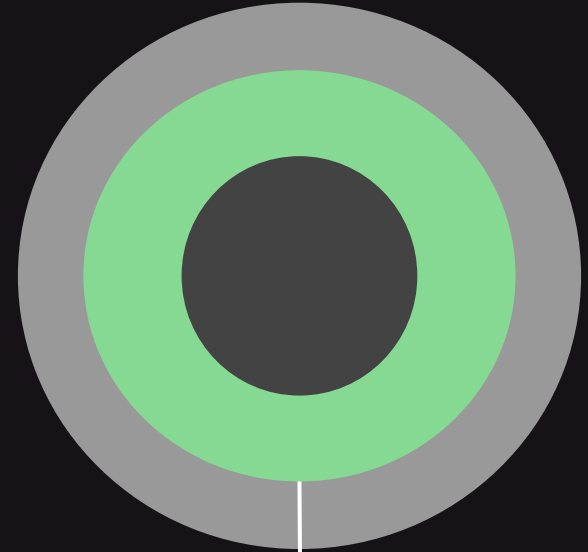- No internal state

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Types of AI Agent Models

Deliberative Agents: Agents that use reasoning and planning to achieve their goals.

- Features:
    - Maintains an internal model of the environment.
    - Uses goal-directed behavior and decision-making.

- Examples: Route planners for navigation systems.

- Planning and Reasoning
- Goal-oriented behavior
- Internal world model

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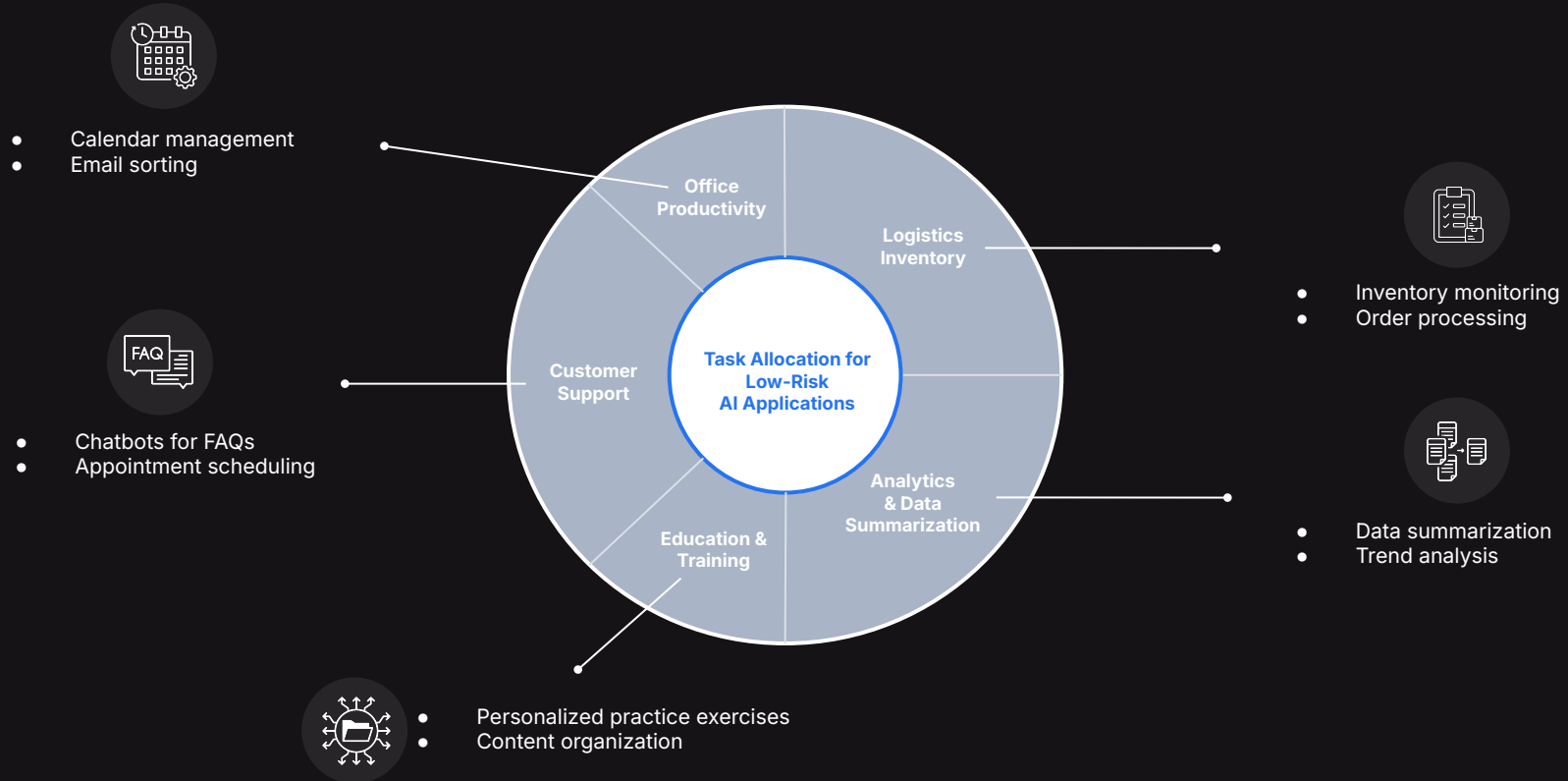
Types of AI Agent Models

Hybrid Agents: Agents that combine reactive and deliberative approaches to leverage the benefits of both.

- Features:
    - Reactive for immediate responses.
    - Deliberative for complex, goal-oriented planning.

- Examples: Autonomous vehicles: React to obstacles in real-world while planning long-term routes.

- Combining reactive and deliberative capabilities
- Layered Decision Making
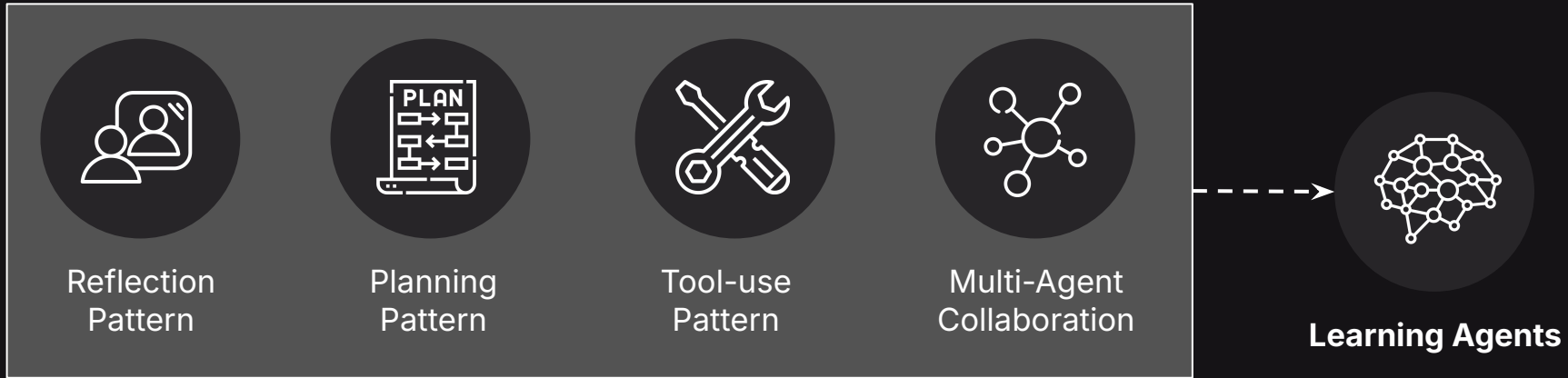- Adaptive

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Transformative Impact of AI Agents

- Calendar management
- Email sorting

- Chatbots for FAQs
- Appointment scheduling

Office
Productivity

Logistics
Inventory

Customer
Support

**Task Allocation for
Low-Risk
AI Applications**

Analytics
& Data
Summarization

Education &
Training

- Inventory monitoring
- Order processing

- Data summarization
- Trend analysis

- Personalized practice exercises
- Content organization

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Exploring Types of AI Agents

Agent Type	Decision Basis	Strengths	Limitations
Simple Reflex	Pre-defined rules	Fast and efficient	Limited adaptability
Model-Based	Internal model and history	Can handle complex environments	Computationally intensive
Goal-Based	Objectives and planning	Goal-oriented flexibility	May lack efficiency in decision-making
Utility-Based	Goal optimization with utility	Balances multiple objectives	Requires detailed utility models
Learning Agents	Experience and feedback	Improves over time and adapts to change	Needs time and data to learn effectively.

The 4 Main Types of Design Patterns

GenAI augments traditional agent capabilities to enable new patterns of

Reflection Pattern

Planning Pattern

Tool-use Pattern

Multi-Agent Collaboration

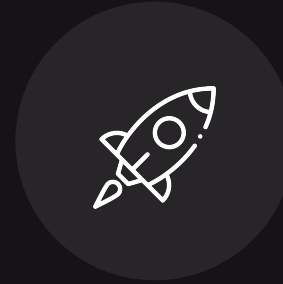**Learning Agents**

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Why GenAI Transforms AI Agents: A New Paradigm

Traditional Agent Limitations

- Fixed rule sets and static models
- Limited contextual understanding
- Inflexible decision process
- Poor adaptation to uncertainty

GenAI based Agents

- Dynamic solution generation
- Contextual awareness
- Interactive learning
- Multi-modal capabilities

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GenAI enables a fundamental shift from rigid, pre-programmed agents to dynamic, adaptive, and collaborative systems.

Thanks!