Multi-agent Orchestration Patterns in Semantic Kernel

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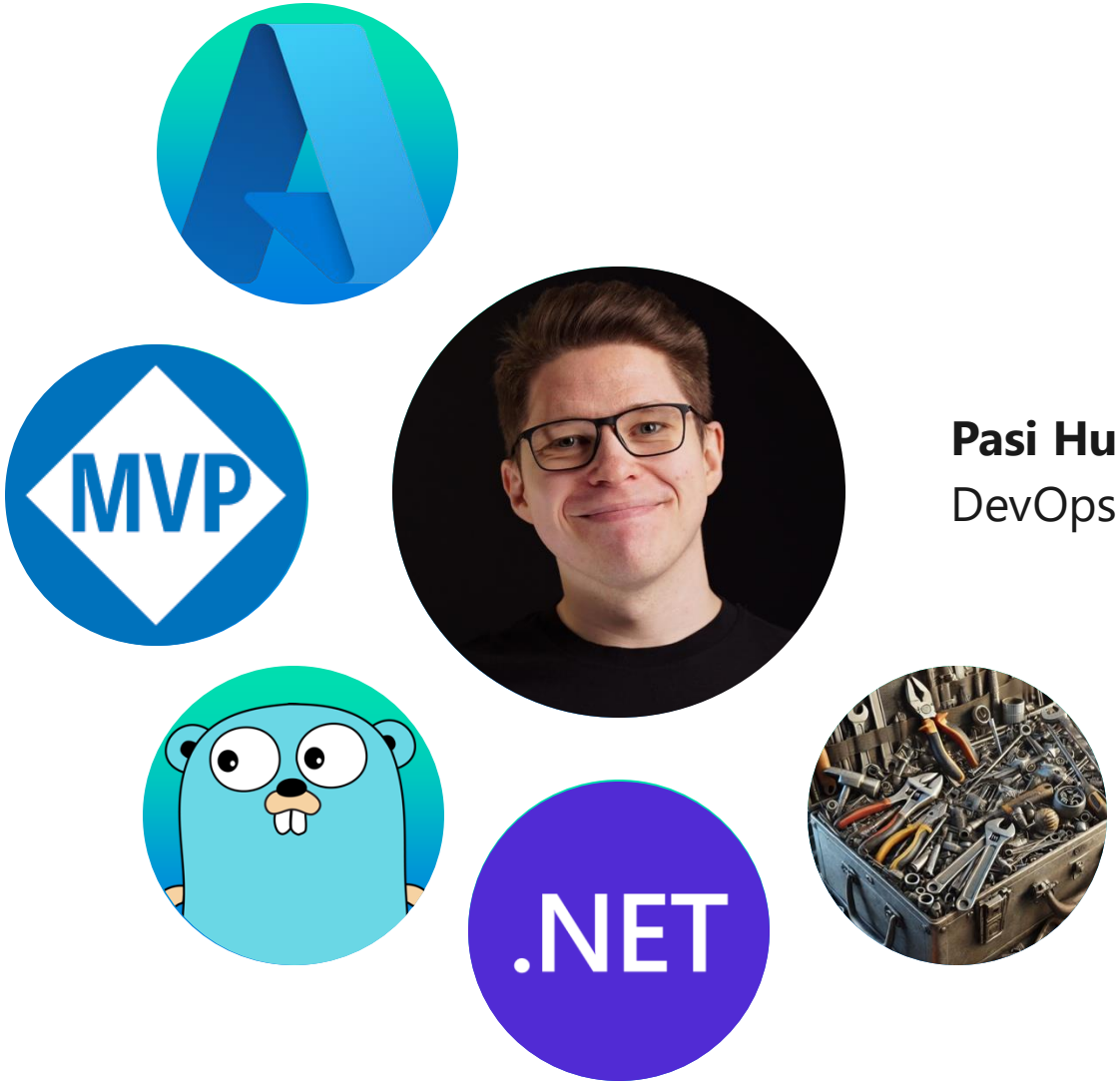

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- Designing, building and managing on Azure since 2011
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- Offices in Finland, Belgium, Denmark, UK & Netherlands
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In this presentation...

- Very short intro to Semantic Kernel
- Overview of SK orchestration patterns: Sequential, Concurrent, Group Chat, Handoff, Magentic
- What each pattern enables and when to use it in real workflows
- How to implement these patterns in C#

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Semantic Kernel

- Microsoft's **production ready** SDK for building Pro-Code AI applications
- Works with **many AI providers and copilots** (Copilot Studio, AI Foundry, AWS Bedrock, OpenAI, etc.).
- Lets you create **extensible agents** with plugins, filters, and controlled execution
- Designed for **developers**: available in .NET, Python, Java
- Built-in support for memory, embeddings, observability, prompt templates and much more
- **More control**, **more features** vs tools like Azure AI Foundry Agent Service or Copilot Studio

Agents

```
var scaffolder = AgentUtils.Create(
    name: "Scaffolder",
    description: "Suggests initial project structure, layers, and TODOs to get started.",
    instructions: "Describe the service skeleton and TODOs.",
    kernel: kernel);
```

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Kernel & Plugins

```
kernelBuilder.AddAzureOpenAIChatCompletion(
    deploymentName: options.Deployments.Llm,
    endpoint: options.Endpoint,
    credentials: credential);
```

```
public sealed class DevWorkflowPlugin
{
    [KernelFunction, Description("Generate OpenAPI from story and AC")]
    0 references
    public string Oas_Generate(
        [Description("story id")] string story,
        [Description("acceptance JSON")] string acceptance)
        => "DO SOMETHING HERE";
```

```
designAgent.Kernel.ImportPluginFromObject(new DesignPlugin(), nameof(DesignPlugin));
```

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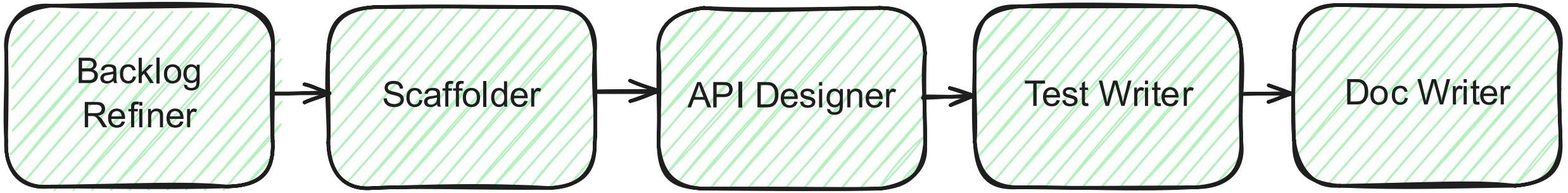
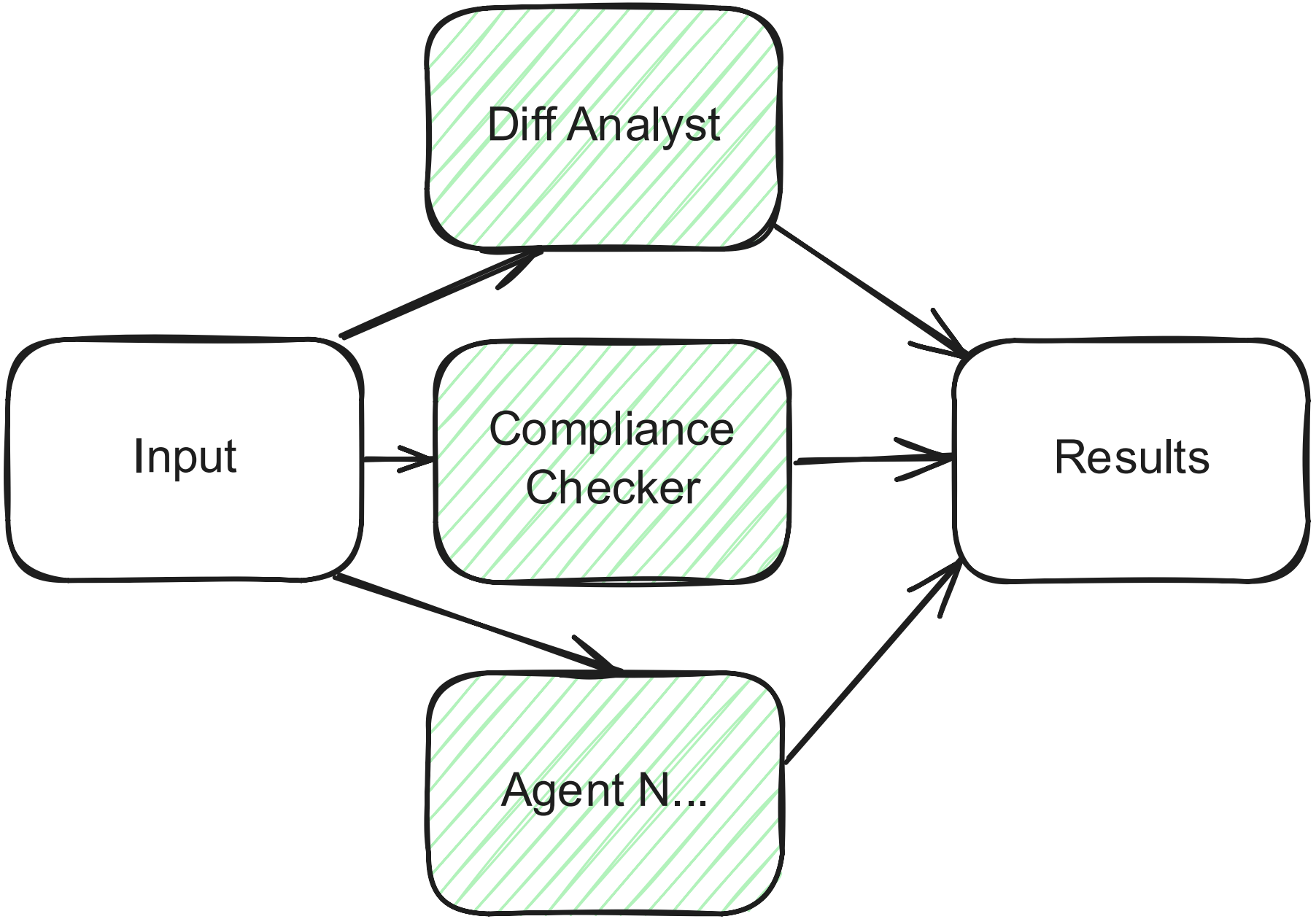
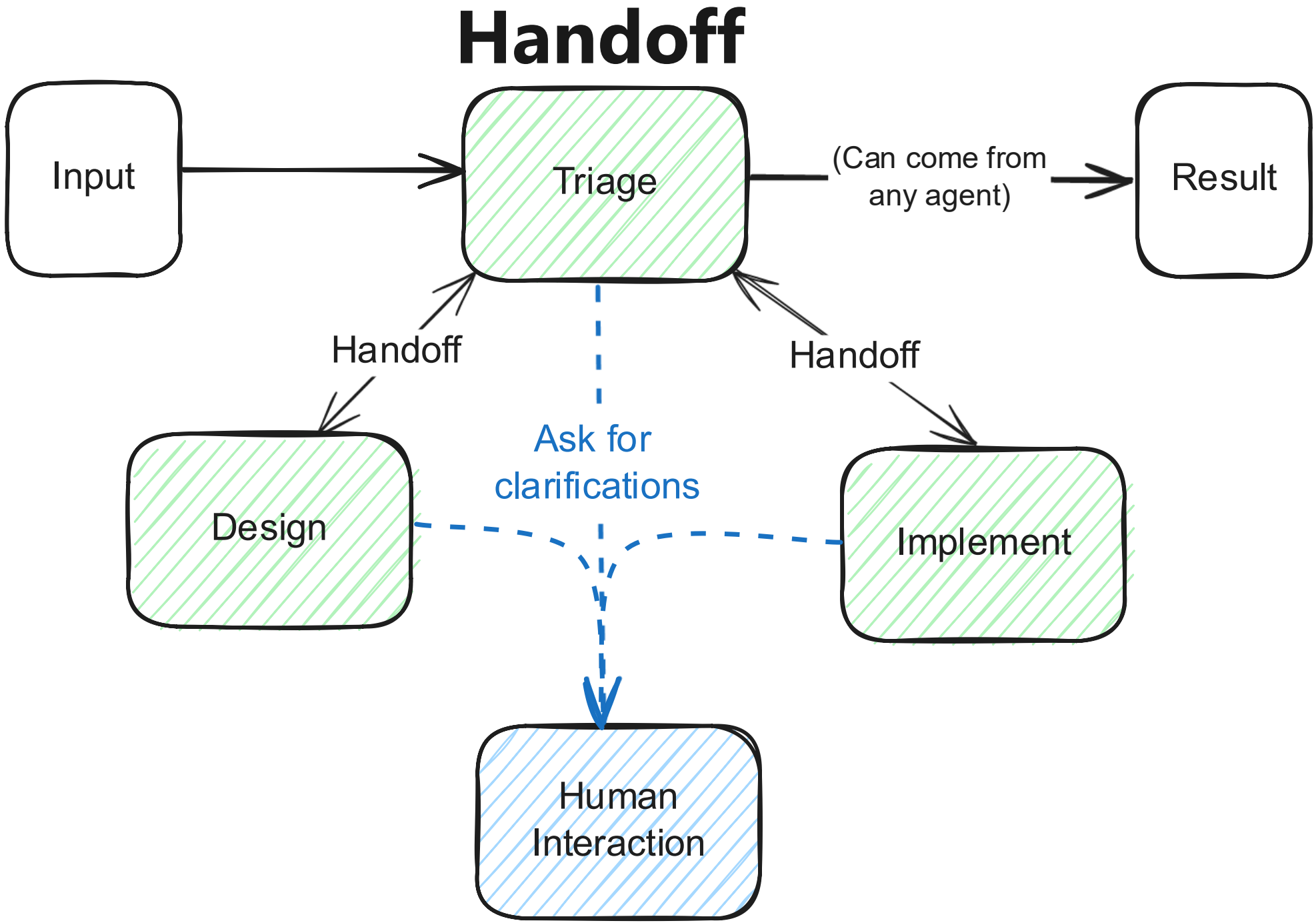
Orchestration Patterns

Sequential

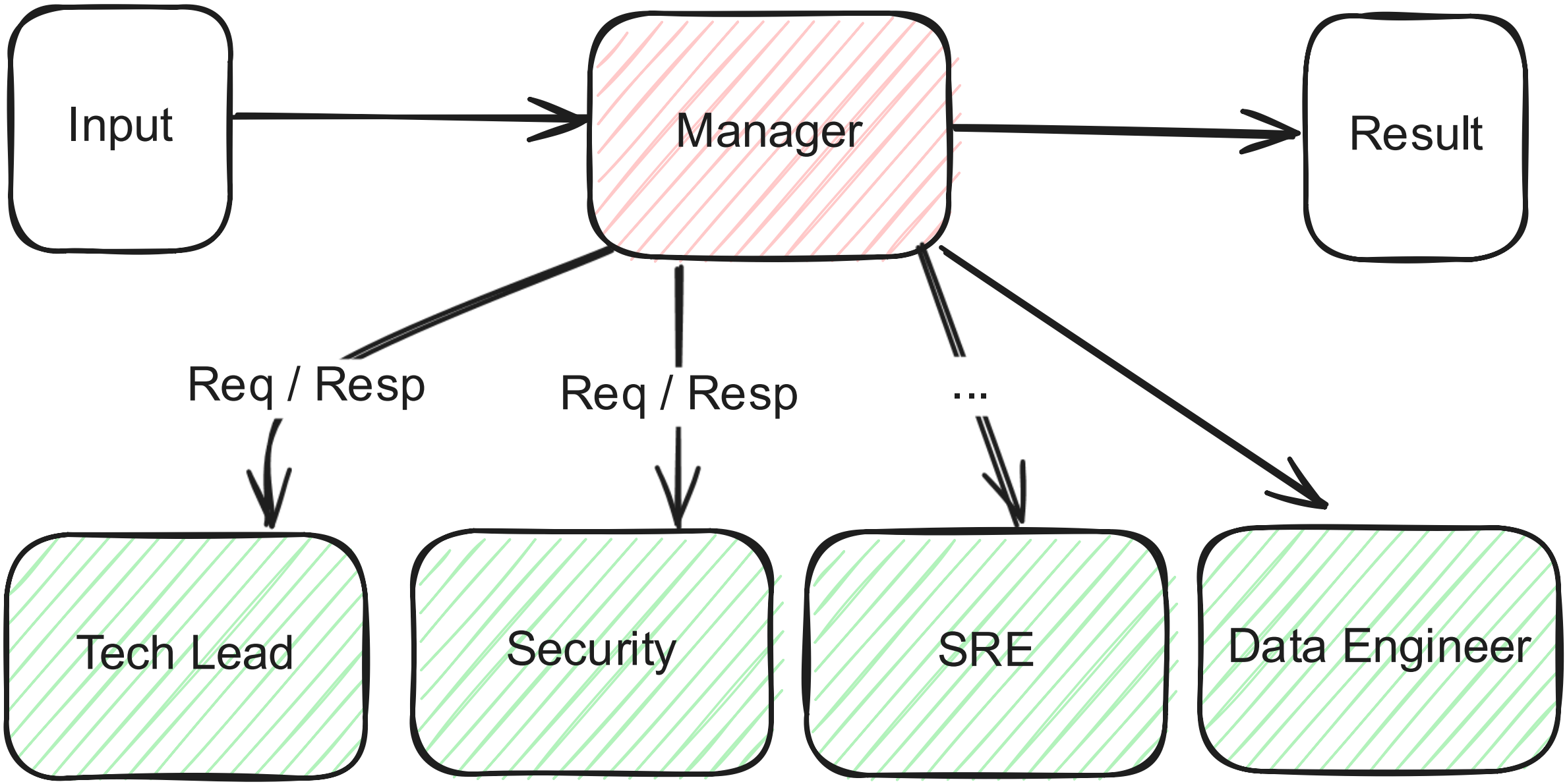

Backlog Refiner
Scaffolder
API Designer
Test Writer
Doc Writer

Concurrent

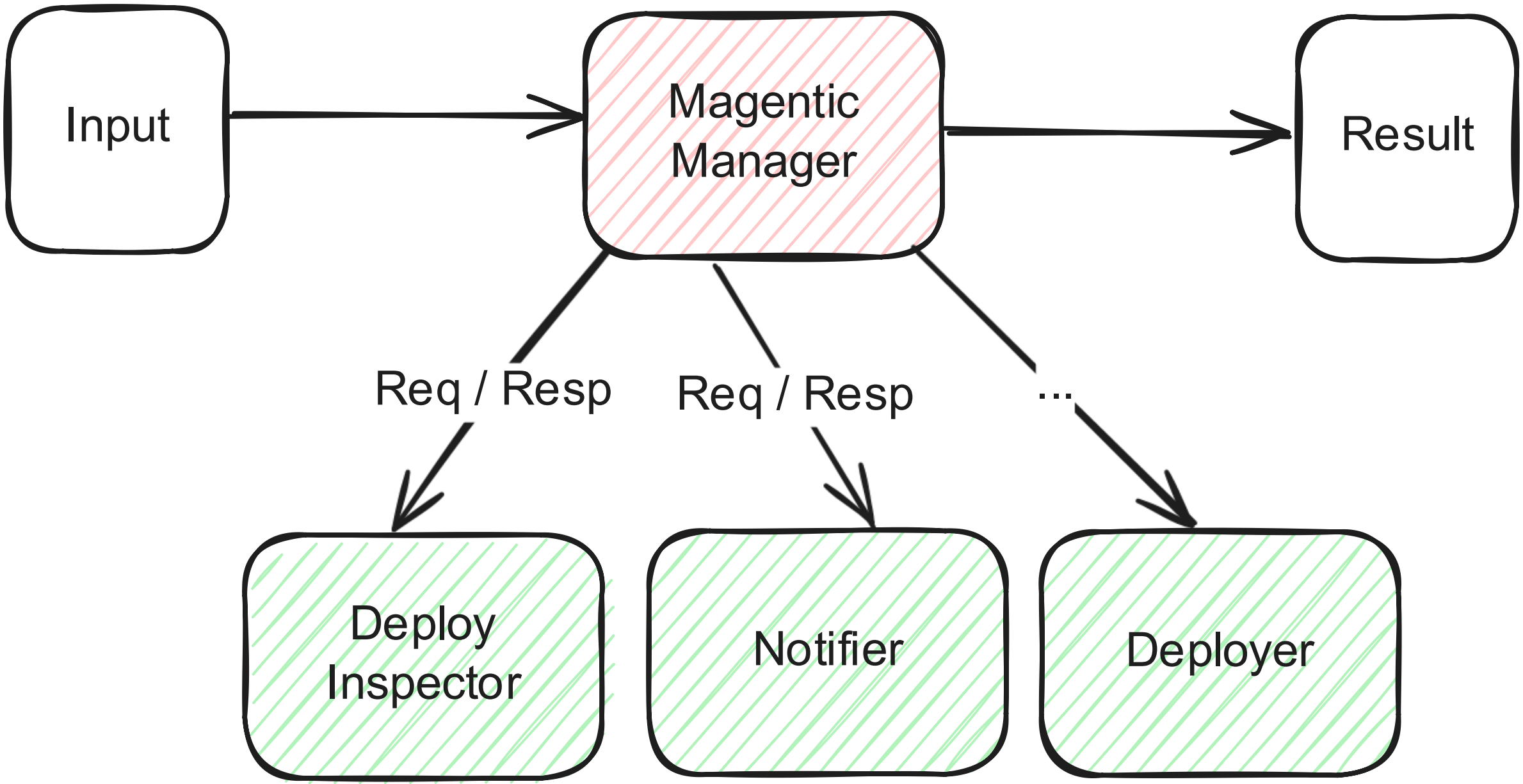


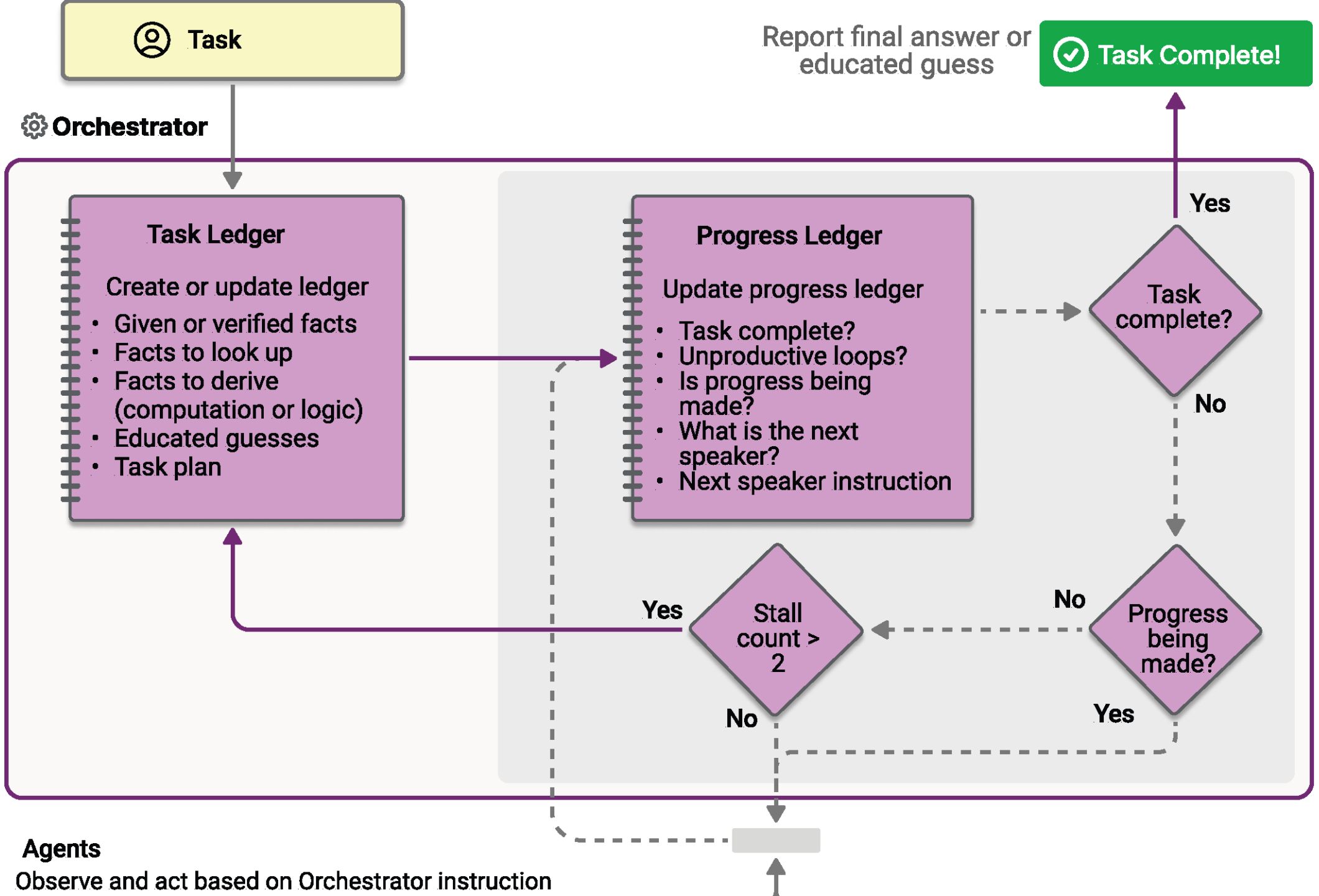

Handoff
Input
Triage
(Can come from any agent)
Result
Handoff
Handoff
Ask for clarifications
Design
Implement
Human Interaction

Group Chat


Input
Manager
Result
Req / Resp
Req / Resp
...
Tech Lead
Security
SRE
Data Engineer

Magentic Orchestration




Task
Orchestrator
Report final answer or educated guess
Task Complete!
Task Ledger
Create or update ledger
• Given or verified facts
• Facts to look up
• Facts to derive (computation or logic)
• Educated guesses
• Task plan
Progress Ledger
Update progress ledger
• Task complete?
• Unproductive loops?
• Is progress being made?
• What is the next speaker?
• Next speaker instruction
Task complete?
Yes
No
Progress being made?
No
Yes
Stall count > 2
Yes
No
Agents
Observe and act based on Orchestrator instruction

Code

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