

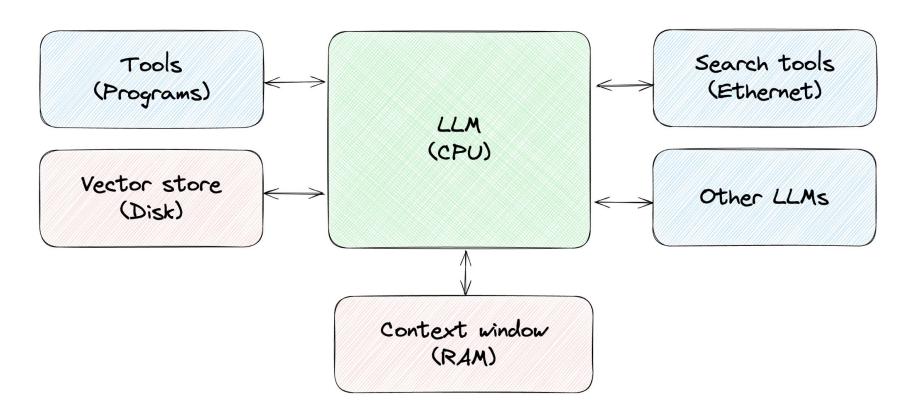




THE PROBLEM:

LLMs are generic, your business is not.





@marcushellberg

vaadin}>







Semantic Kernel



AI FOR ENGINEERS = API





Levels of AI helpfulness



Generates a response

Generates a response based on your context

Performs tasks for you

Figures out which tasks to perform on its own





Generating responses

LLM support

- Fact: a new LLM is born every 3 seconds
- Likely: you don't want to rebuild your app every 3 seconds
- → We want to be able to support different LLMs without rewriting our code



Context window (RAM) management

4k-128k tokens

System prompt

History

Prompt

Relevant information

Enough room for the answer

Tokens? 🤔

A chunk of text, ranging from a character to a full word. Used to break down text for processing.

The token count is usually about 25% greater than the word count.



Prompt templates

- The ability to create prompts based on parameterized templates
- Useful when chaining several calls

You are a helpful AI assistant. You like to share interesting facts with people.

When answering, follow these rules:

- The answer MUST be suitable for all audiences
- The answer should be 5 sentences or less
- Format using markdown

Tell me an interesting fact about {{topic}}



Output parsers

• Get the output in the format you need: JSON, a Java object, XML, etc



```
@Component
public class LangChainBasics {
   @Value("${openai.api.key}")
   private String openaiApiKey;
   interface Assistant { String chat(String message); }
   public void run() {
       Assistant assistant = AiServices.builder(Assistant.class)
               .chatLanguageModel(OpenAiChatModel.withApiKey(openaiApiKey))
               .chatMemory(MessageWindowChatMemory.withMaxMessages(10))
               .build();
       var template = PromptTemplate.from("Say '{{text}}' in {{language}}");
       var prompt = template.apply(Map.of(
                       "text", "Language Chain",
                       "language", "Swedish"));
       System.out.println(assistant.chat(prompt.text()));
```

```
@Component
```

public class SpringAIBasics {



```
private final ChatClient chatClient;
SpringAIBasics(ChatClient chatClient) {
    this.chatClient = chatClient;
public void run() {
    var template = new PromptTemplate("Say '{text}' in {language}");
    var prompt = template.create(Map.of(
                    "text", "Spring AI",
                    "language", "Swedish"));
    System.out.println(chatClient.call(prompt.getContents()));
```



https://github.com/microsoft/semantic-kernel/blob/java-v1/java/samples/sk-v1/01-SimpleChat/src/main/java/Main.java



Generating responses based on your context



LLMs know two things

- 1. Content they're trained on
- 2. Content you give them as context



Teaching an LLM

- 1. Train your own model (\$\$\$)
- 2. Fine-tune an existing model (\$)
- 3. Stuff the context (~\$0)



Finding the relevant information

1. Introduction

These Terms of Service ("Terms") govern the access or use by you, an individual, from within any country in the world, of applications, websites, content, products, and services ("Services") made available by Miles of Smiles Car Rental Services, a company registered in the United States of America.

2. The Services

Miles of Smiles rents out vehicles to the end user. We reserve the right to temporarily or permanently discontinue the Services at any time and are not liable for any modification, suspension or discontinuation of the Services.

3. Bookings

- 3.1 Users may make a booking through our website or mobile application.
- 3.2 You must provide accurate, current and complete information during the reservation process. You are responsible for all charges incurred under your account.
- 3.3 All bookings are subject to vehicle availability.

4. Cancellation Policy

4.1 The last day you may cancel a reservation is 7 days prior to the start of the booking. Cancellations within the 7-day period leading up to the start of the booking period are not permitted.

5. Use of Vehicle

- 5.1 All cars rented from Miles of Smiles must not be used:
- for any illegal purpose or in connection with any criminal offense.
- for teaching someone to drive.
- in any race, rally or contest.
- while under the influence of alcohol or drugs.



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→ [124, 255, 78]

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→ [45, 189, 201]

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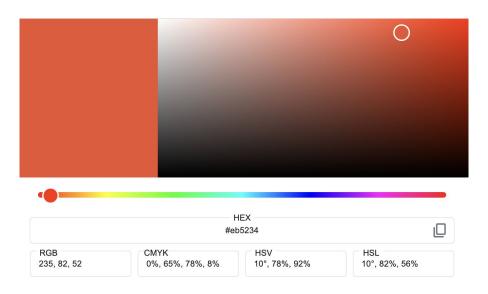
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→ [98, 12, 76]

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→ [255, 143, 32]

Vector Store *

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 3.2 You must provide accurate, current and complete information during the reservation process. You are responsible for all charges incurred under your account.
- 3.3 All bookings are subject to vehicle availability.
- 4. Cancellation Policy
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- → [124, 255, 78]
- → [45, 189, 201]
- → [173, 67, 245]
- **→** [98, 12, 76]
- **→** [255, 143, 32]

Retrieving documents

"I want to cancel my trip"

[96, 14, 73]

[98, 14, 73]

[98, 14, 73]

- 4. Cancellation Policy
- 4.1 The last day you may cancel a reservation is 7 days prior to the start of the booking. Cancellations within the 7-day period leading up to the start of the booking period are not permitted.



```
var documentPath = termsOfService.getFile().toPath();
var documentParser = new TextDocumentParser();
var document = FileSystemDocumentLoader.loadDocument(documentPath,
documentParser);
var splitter = DocumentSplitters.recursive(400, 0);
var embeddingModel = new AllMiniLmL6V2EmbeddingModel();
var embeddingStore = new InMemoryEmbeddingStore<TextSegment>();
var ingestor = EmbeddingStoreIngestor.builder()
       .embeddingStore(embeddingStore)
       .embeddingModel(embeddingModel)
       .documentSplitter(splitter)
```

.build();

ingestor.ingest(document);



```
var contentRetriever = EmbeddingStoreContentRetriever.builder()
          .embeddingStore(embeddingStore)
          .embeddingModel(embeddingModel)
          .maxResults(2)
          .minScore(0.5)
          .build();
```



System.out.println(assistant.answer("What is the cancellation policy?"));

The cancellation policy for Funnair is as follows:

- Bookings can be cancelled up to 48 hours before the flight.

- Cancellation fees vary depending on the class of the booking: \$75 for Economy, \$50 for Premium Economy, \$25 for Business Class.

- Refunds will be processed within 7 business days.

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```
var vectorStore = new SimpleVectorStore(embeddingClient);
var textReader = new TextReader(termsOfService);
vectorStore.accept(textReader.get());
var template = """
       Answer the given question only using the information in the provided terms.
       If you do not know the answer, please respond with "I don't know".
       TERMS
       {documents}
       11 11 11 .
```

```
var query = "What is the cancellation policy?";
var relevantDocs = vectorStore.similaritySearch(
           SearchRequest.query(query)
                   .withTopK(2)
                   .withSimilarityThreshold(0.5))
       .stream()
       .map(Document::getContent)
       .collect(Collectors.joining("\n\n"));
var systemMessage = new SystemPromptTemplate(template)
                          .createMessage(Map.of("documents", relevantDocs));
var userMessage = new UserMessage(query);
var messageHistory = new Prompt(List.of(systemMessage, userMessage));
var response = chatClient.call(messageHistory);
```

System.out.println(response.getResult().getOutput().toString());





The cancellation policy for Funnair is as follows:

- Bookings can be cancelled up to 48 hours before the flight.
- Cancellation fees apply: \$75 for Economy, \$50 for Premium Economy, \$25 for Business Class.
- Refunds will be processed within 7 business days.

Please note that changes to bookings are allowed up to 24 hours before the flight. Changing a booking incurs a fee of \$50 for Economy, \$30 for Premium Economy, and is free for Business Class. Changes can be made online or by contacting Funnair's support.

When booking a flight, full payment is required, and it is important to ensure the accuracy of personal information (Name, ID, etc.) as corrections may incur a \$25 fee.





https://github.com/microsoft/semantic-kernel/blob/java-v1/java/samples/sk-v1/03-SimpleRag/src/main/java/Main.java



Performing tasks for you

Using tools

Define a set of tools or functions that the LLM can use when helping the user



```
class Calculator {
   @Tool("Calculates the length of a string")
   int stringLength(String s) {
       System.out.println("Called stringLength with s='" + s + "'");
       return s.length();
   @Tool("Calculates the sum of two numbers")
   int add(int a, int b) {
       System.out.println("Called add with a=" + a + ", b=" + b);
       return a + b;
   @Tool("Calculates the square root of a number")
   double sqrt(int x) {
       System.out.println("Called sqrt with x=" + x);
       return Math.sqrt(x);
```



```
ChatMemory chatMemory = MessageWindowChatMemory.withMaxMessages(10);
```



```
LangChainBasics.Assistant assistant = AiServices.builder(Assistant.class)
    .chatLanguageModel(OpenAiChatModel.withApiKey(openaiApiKey))
    .tools(new Calculator())
    .chatMemory(chatMemory)
    .build();
```

```
var query = """
What is the square root of the sum of the numbers of letters
in "hello" and "world"?
""";
```

System.out.println(assistant.chat(query));

```
Called stringLength with s='hello'
Called stringLength with s='world'
Called add with a=5, b=5
Called sqrt with x=10
The square root of the sum of the numbers of letters in "hello" and "world" is approximately 3.162.
```

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Figuring out which tasks to perform on its own





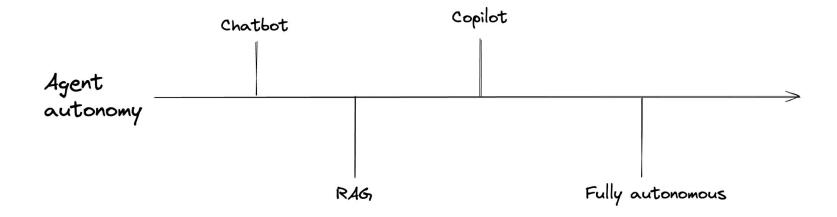
THE FUTURE OF AGENTS

AI is about to completely change how you use computers

And upend the software industry.

By Bill Gates | November 09, 2023 • 12 minute read





Funnair customer support → **Bookings database** Assistant # First name Last name Date From To **Booking status** Booking class Welcome to Funnair! How can I help V you? 101 John Doe 2024-01-30 MAD SFO PREMIUM_ECONOMY $\overline{\mathbf{V}}$ 102 Jane Smith 2024-02-01 JFK ARN **ECONOMY** V 103 Michael Johnson 2024-02-03 FRA HEL PREMIUM_ECONOMY $\sqrt{}$ 104 Sarah Williams 2024-02-05 MUC HEL **BUSINESS** 105 Robert Taylor 2024-02-07 JFK MAD V **ECONOMY** Message Send



github.com/marcushellberg/java-ai-playground





	Spring Al	LangChain4j	Semantic Kernel	
Prompt templates	V	V	✓	
Output formatting	V	V	✓	
RAG support	V	V	✓	
Message history management	-	V	V	
Tools/Functions/Plugins	-	V	✓	
Agents	-	-	-	
Documentation	<u>.</u>		•	
Development activity	N N N	ANANA		
Al level				
@marcushellberg			V	Q

/aadin}>

Thanks!

@marcushellberg

