Semantic Kernel

Dr. Damir Dobric
Lead Software Architect daenet GmbH / ACP Digital
Microsoft Regional Director,
Most Valuable Professional: Azure + IoT

AI Services

daenet

daenet - an ACP Digital company

Open AI

https://platform.openai.com/docs/models

Azure Open AI

https://oai.azure.com/portal/****/models

Request Access to Azure OpenAI Service (microsoft.com)

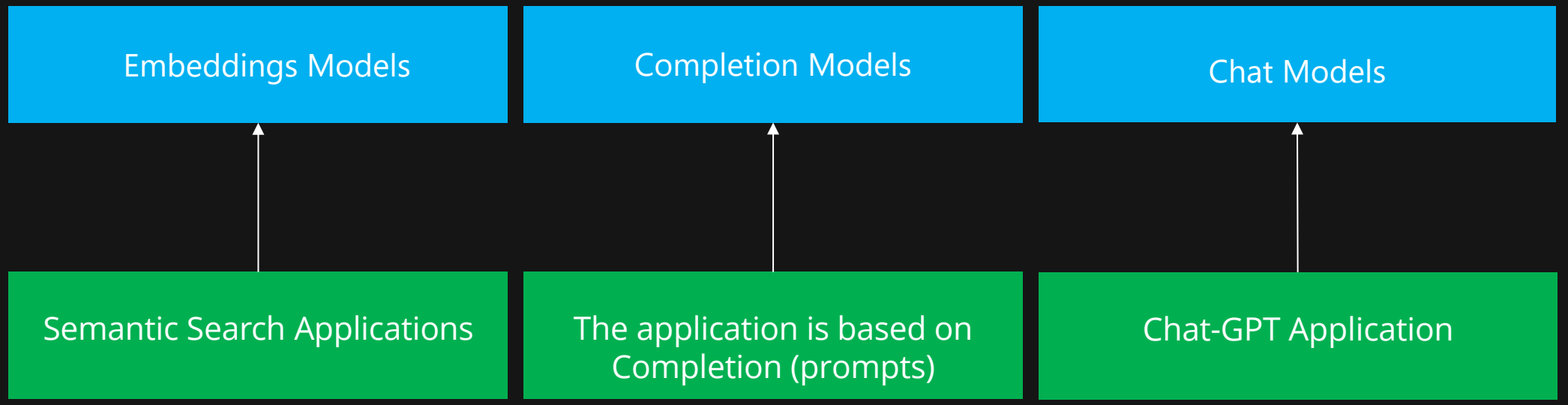
DEMO

daenet - an ACP Digital company

Open AI Playground

Azure Open AI Playground

Generative Model Types



Completion Models

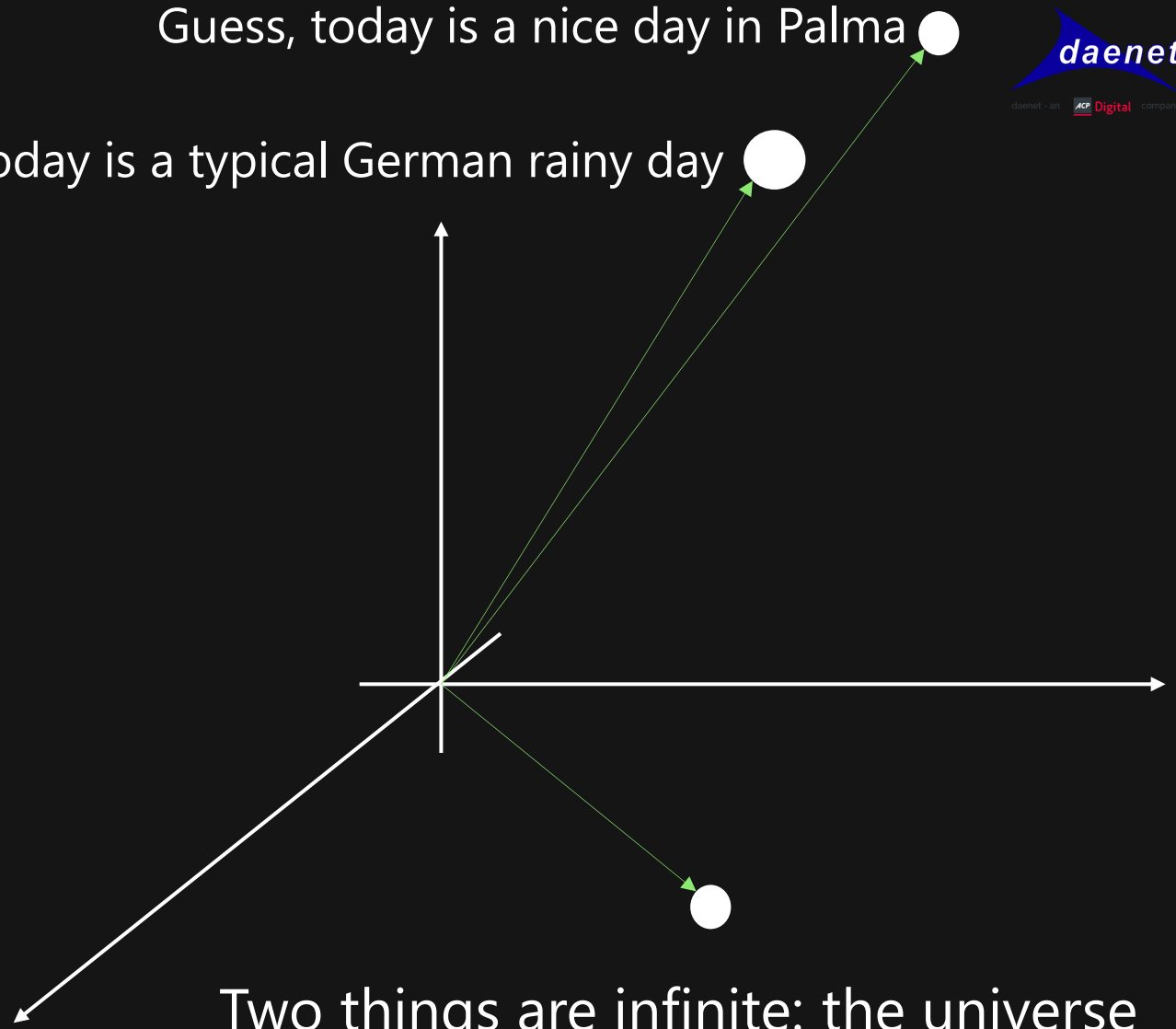
```
Şụņņǻsîćê ğộľľộxîŋĝ şçîêŋʧîğîç ǻčşʧsǻçʧ  ụşîŋĝ ǻ
ụşês ğsîêŋđľỳ ľǻŋĝụǻĝê

 Ačşʧsǻçʧ
Şřǻsşê sêřsêşêŋʧǻʧîộŋ ḥǻş ǻʧʧsǻçʧêđ ņụçḥ ǻʧʧêŋʧîộŋ
ğsộņ sêşêǻsçḥêsş îŋ ğîêľđş ộğ şîĝŋǻľ řsộçêşşîŋĝ
îņǻĝê řsộçêşşîŋĝ  çộņřụʧês ŵîşîộŋ  ǻŋđ řǻʧʧêsŋ
sêçộĝŋîʧîộŋ  Şřǻsşê sêřsêşêŋʧǻʧîộŋ ǻľşộ ḥǻş ǻ
ĝộộđ sêřụʧǻʧîộŋ îŋ čộʧḥ ʧḥêộsêʧîçǻľ sêşêǻsçḥ
```

Chat Models

daenet
daenet - an ACP Digital company

```
Bot: How can I help you?
User: What's the weather like today?
Bot: Where are you located?
User: I'm in Frankfurt.
Bot: It’s 22 degrees and sunny in Frankfurt today.
User: Thanks! Can you explain scientific
abstracts?
Bot: Yes. Please provide abstract.
```

Embedding Models



Two things are infinite: the universe and human stupidity; and I'm not sure about the universe.

Similarity Between Multidimensional Vectors

- Dot Product

$$A \cdot B = a_1 \cdot b_1 + a_2 \cdot b_2 + \ldots + a_n \cdot b_n$$

- The Norm

$$\|\mathbf{A}\| = \sqrt{a_1^2 + a_2^2 + \ldots + a_n^2}$$

- Cosine Similarity

$$\mathbf{A} \cdot \mathbf{B} = \|\mathbf{A}\| \|\mathbf{B}\| \cos(\theta)$$

When to use Embeddings?

- Semantic Search
- Classification
- Clustering
- Recommendations
- . . .

What is a token?

- 1 token ~= 4 chars in English
- 1 token ~= ¾ words
- 100 tokens ~= 75 words
- Byte Pare Encoding (Gage,1994): Wikipedia
- Tokenizer: https://platform.openai.com/tokenizer
- What are tokens and how to count them?
- Token Pricing: Pricing (openai.com)

SEMANTIC KERNEL

Software V2

The new Generation of Software

daenet

daenet - an ACP Digital company

Semantic Kernel is an open-source SDK that lets you easily combine Generative AI Models syntactic programming languages like C#, Python an JAVA.

Currently supported languages: C#, Python

Currently supported AI Services: OpenAI, Azure OpenAI, and Hugging Face

Introduction | 🦜 🔗 Langchain

What is an Agent?

daenet

daenet - an ACP Digital company

- An agent is an AI that can:
  - Answer questions
  - Automate processes for users
  - . . .

What is a Copilot?

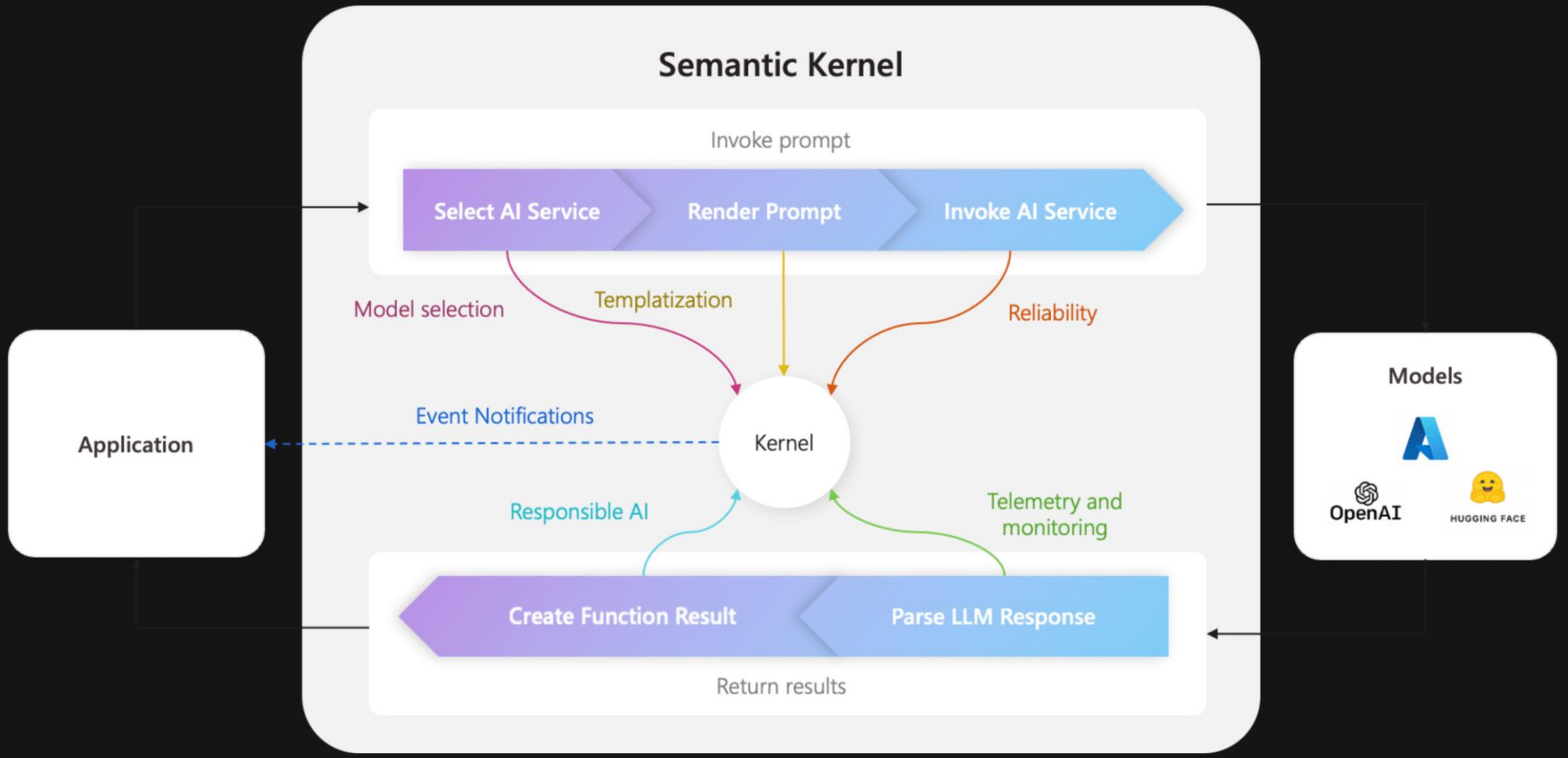
A Copilot is an AI application that consists of one or more agents, which orchestrate tasks.

Why to use SK?

daenet
daenet - an ACP Digital company

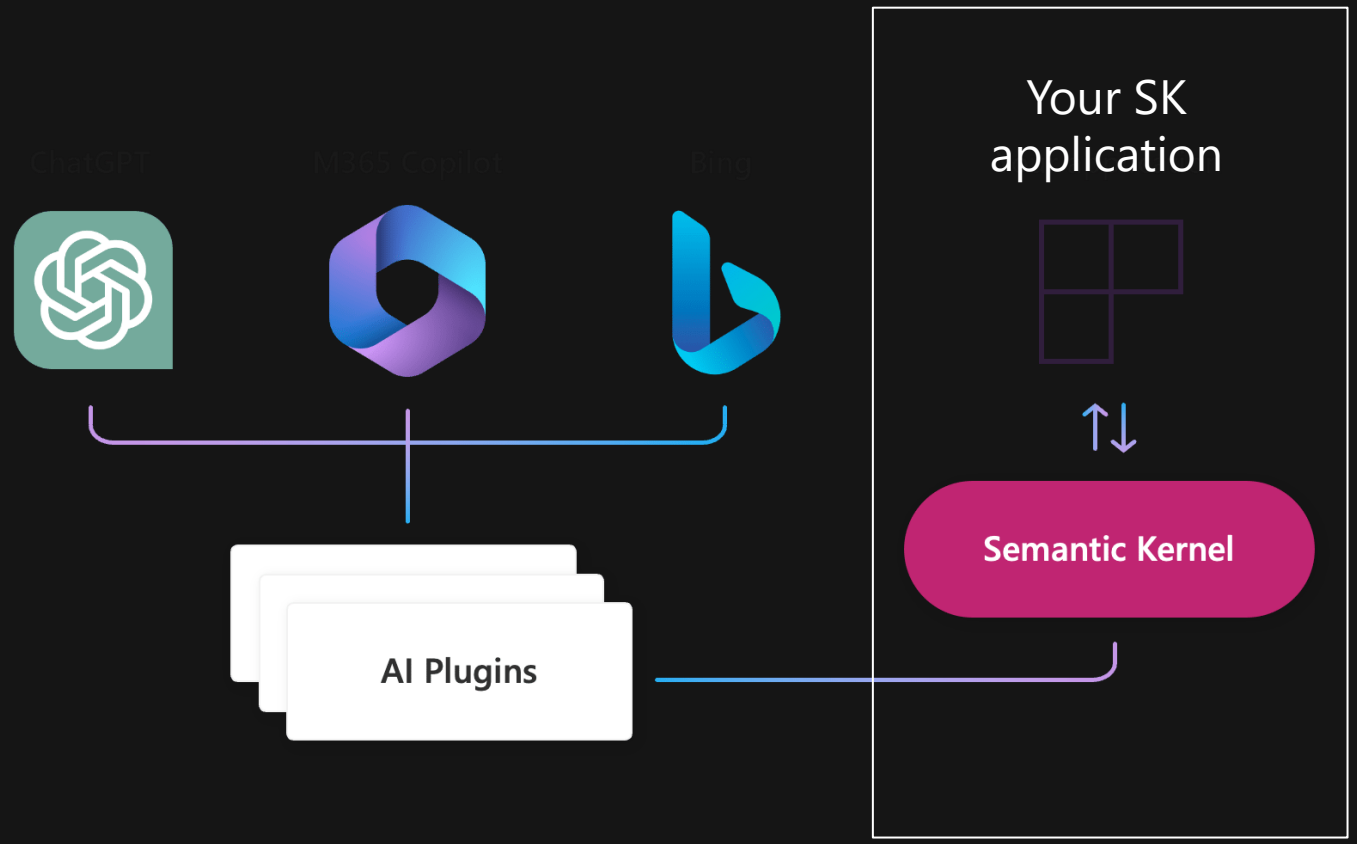
- SK is a framework to build agents
- You can easily use LLM models for chat, create images and video so on.
- Making automated Agents that automate business processes is hard?
- You need a framework for such complex engineering tasks.

Architecture of the “Smart” application



AI Plugins

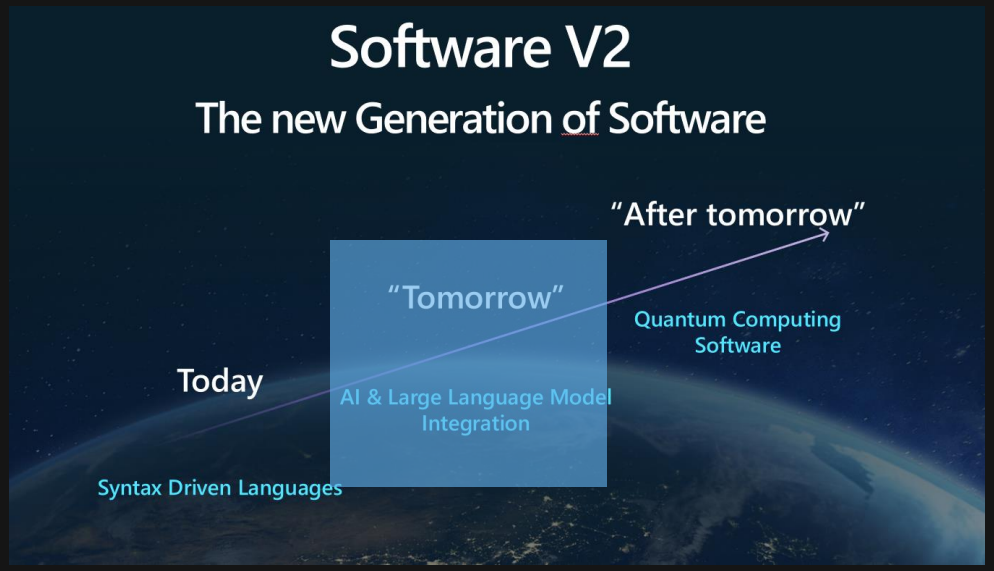
a plugin is a group of functions that can be exposed to AI applications



OpenAI plugin specification

The Knowledge is inside Plugins

- Native Functions (C#, Python, JAVA, ??)
- Prompts (Semantic Functions)



NATIVE FUNCTIONS

A native function is a function defined by the code

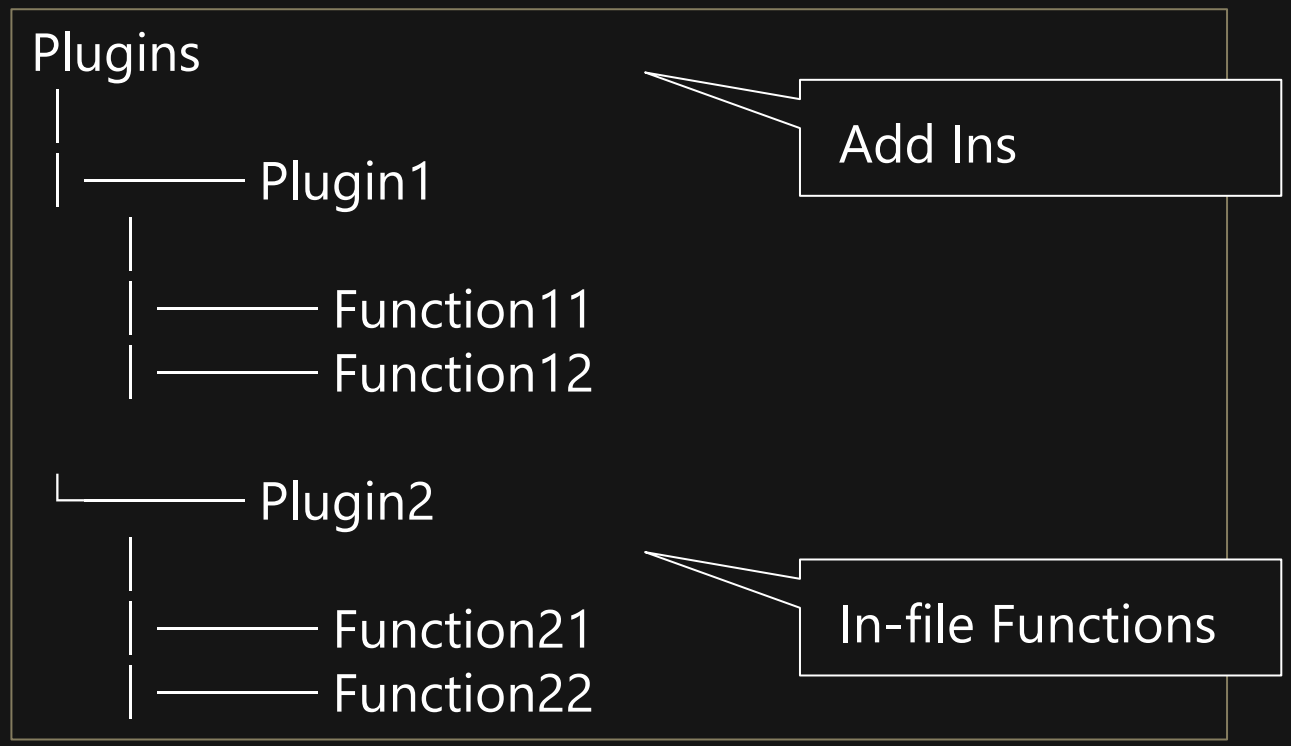
```
ŞĶGụŋçʧîộŋ  Dêşçsîřʧîộŋ  Ğêʧş ʧḥê ÛŢC çụssêŋʧ ʧîṇê řụčľîç ṣʧsîŋĝ ÛʧçṆộx

    sêʧụsŋ DắʧêŢîṇê ÛʧçṆộx ŢộŞʧsîŋĝ
```

PROMPTS
(SEMANTIC FUNCTIONS)

A semantic function is a function defined by the LLM prompt

Inline Functions

```
string prompt = @"Bot: How can I help you?
User: {{$input}}
---------------------------------------------
The intent of the user in 5 words or less: ";
```



DEMO

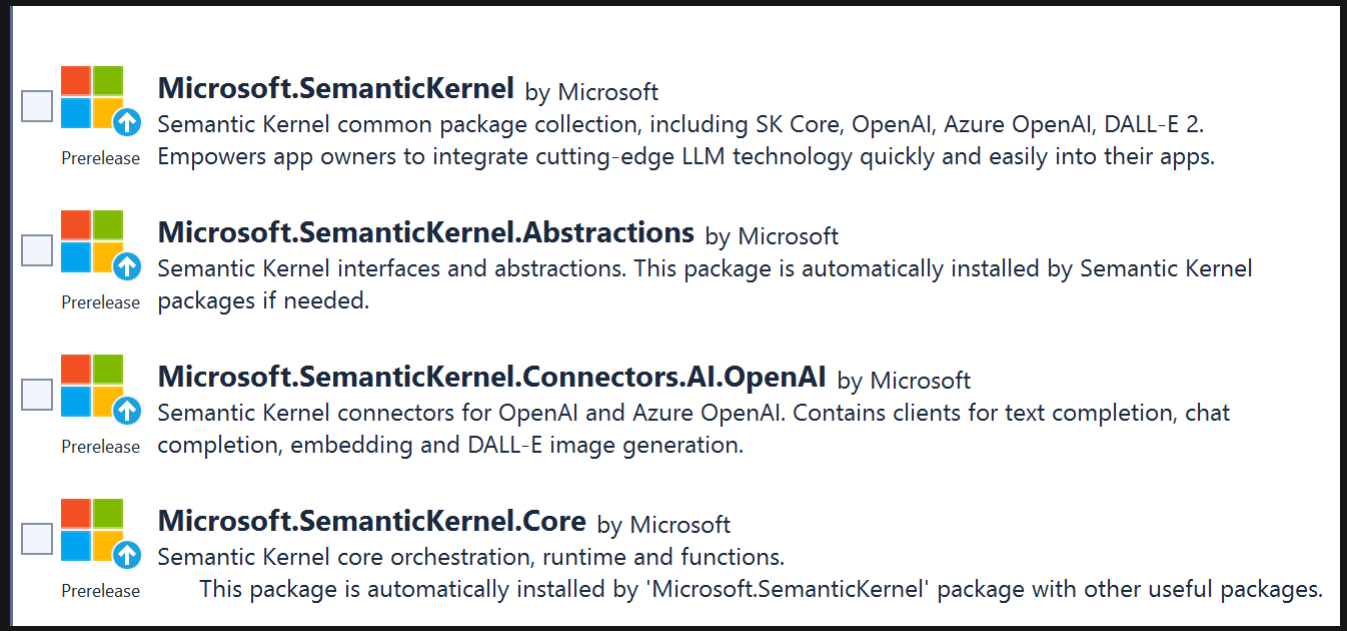
Controlling the lighting system

Deep Dive into Semantic Kernel

daenet
daenet - an ACP Digital company

1. Overview of the kernel
2. Creating native functions
3. Creating semantic functions
4. Understanding AI plugins
5. Planer
6. Create and run a ChatGPT plugin

SEMANTIC KERNEL OVERVIEW



Semantic Kernel Initialization with OpenAI

daenet
daenet - an ACP Digital company

```
private static IKernel GetAzureKernel()
 {
     var kernel =  kernel = Kernel.CreateBuilder()
    .AddOpenAIChatCompletion(
   Environment.GetEnvironmentVariable("OPENAI_CHATCOMPLETION_DEPLOYMENT")!,
   Environment.GetEnvironmentVariable("OPENAI_API_KEY")!,
   Environment.GetEnvironmentVariable("OPENAI_ORGID")!)
.Build();}
```

Semantic Kernel Initialization with Azure OpenAI

daenet
daenet - an ACP Digital company

```
private static IKernel GetKernel()
 {
     var kernel =  kernel = Kernel.CreateBuilder()
 .AddAzureOpenAIChatCompletion(
     Environment.GetEnvironmentVariable("AZURE_OPENAI_CHATCOMPLETION_DEPLOYMENT")!,
     Environment.GetEnvironmentVariable("AZURE_OPENAI_ENDPOINT")!,
     Environment.GetEnvironmentVariable("AZURE_OPENAI_API_KEY")! )
 .Build();  }
```

Two types of functions

daenet
daenet - an ACP Digital company

Native Functions

Semantic Functions

DEMO

Native Functions

Nested Native Functions

Semantic function invokes a native function


```
  Şắņřľêℜľụĝîŋ Ţsắŋşľắʧộs  îŋřụʧ



Şụņņắsîćê ʧḥê şçîêŋʧîğîç ắčşʧsắçʧ ụşîŋĝ ắ ụşês ğsîêŋđľỳ ľắŋĝụắĝê
Cộụŋʧês     ŞʧsîŋĝRľụĝîŋ ChắsCộụŋʧ  îŋřụʧ
Rsộŵîđê ʧḥê sêşụľʧ îŋ ğộľľộxîŋĝ ğộsņắʧ

 Ôụʧřụʧ
Cộụŋʧês  ŋụņčês
Ţêỵʧ  ʧsắŋşľắʧêđ ʧêỵʧ

 Íŋřụʧ
   îŋřụʧ



 Ôụʧřụʧ
```

Nested Semantic Functions

Semantic function invokes a semantic function

```
  ŞǎņřľêRľụĝîŋ Ţsǎŋşľǎɣǫs  îŋřụɣ


Şụŋŋǎsîćê ǎŋđ çǫŋřsêşş ǎčşɣsǎçɣ ɣǫ _。 xǫsđş  ụşîŋĝ ǎ ụşês ğsîêŋđľỳ ľǎŋĝụǎĝê

 Íŋřụɣ
   îŋřụɣ
```

DEMO

Semantic Functions

Planers

Converts the prompt into orchestration of functions implemented in Plugins

1. Planner is a function
2. I takes a prompt and returns back a plan on how to accomplish the task described in the prompt.
3. Mix-and-match the plugins.
4. Recombine them into a series of steps that complete a goal.

```
Íğ ņỳ îŋŵêşʯņêŋʯ ộğ ,,,,,, độľľắsş îŋçsêắşêđ čỳ ,,
 ḥộx ņụçḥ xộụľđ Í ḥắŵê ắğʯêş Í şřêŋʯ _ ộŋ ắ ľắʯʯê
```

Planers

daenet

daenet - an ACP Digital company

Calculate the sum of numbers, 1,2,3,4,5,6,7 and then divide it by number of elements in the list.

daenet

daenet - an ACP Digital company

Wenn meine Investition von 2130,23 Dollar um 23% gestiegen ist, wie viel hätte ich, nachdem ich 5 Dollar für einen Latte ausgegeben habe?

...

Nach einer Erhöhung um 23% hättest du einen Betrag von etwa 2618,79 Dollar. Nachdem du 5 Dollar für einen Latte ausgegeben hast, würdest du immer noch einen Betrag von etwa 2613,79 Dollar haben.

How about something not solvable?

daenet

daenet - an ACP Digital company

Please calculate the fiction between the stone and alpha centaury with the contraction jumping of 150 blas.

It seems like your request contains a mix of unrelated concepts and terms that don't have any clear meaning. To better assist you, please provide more context or clarify your question.

References

Azure/aistudio-copilot-sample at oct-refresh (github.com)
Microsoft Copilot Studio
https://platform.openai.com/docs/models
https://oai.azure.com/portal/****/models
Azure AI Studio
Semantic Kernel
AI-Generated 3D Worlds
Imagine AI Art Generator
Midjourney
Azure AI SDK - Azure AI Studio
BOOK OF NEWS - Microsoft Ignite

References

- Open AI
- https://platform.openai.com/docs/models

- Azure Open AI
  https://oai.azure.com/portal/****/models

  Request Access to Azure OpenAI Service (microsoft.com)

Azure OpenAI und Semantic Kernel für Softwareentwickler

daenet - an ACP Digital company

Dr. Damir Dobric

Lead Software Architect daenet GmbH / ACP Digital

Microsoft Regional Director,

Most Valuable Professional: Azure + IoT

daenet - an ACP Digital company

Pause: 10.30-11.00

https://github.com/ddobric/semantic-kernel-training/settings/access