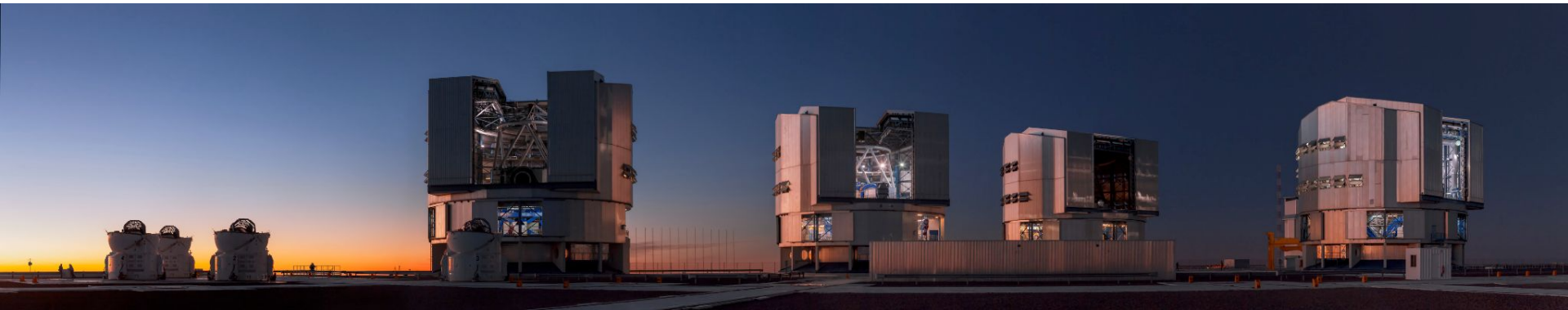


Building LLM-based Systems & Products at Paranal



Engineering with prompts, rather than prompt engineering

Cristóbal Alcázar
MSc in Finance & (not yet) MSc in Data Science



Cristóbal Alcázar

alcazar.cristobal90@gmail.com - alkzar.cl

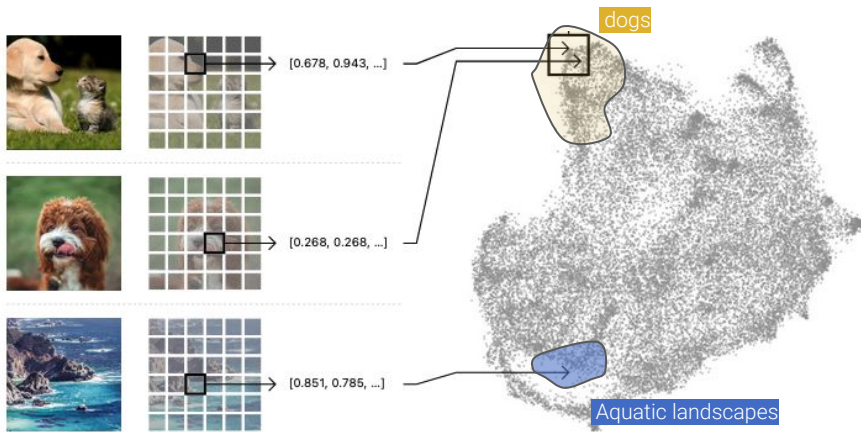
- ❑ MSc (not yet) in Data Science @U. de Chile
- ❑ Current research: diffusion generative models, RLHF. Supervised by Felipe Tobar.
- ❑ MDS7203 Deep Generative Models: Teaching assistant.
- ❑ Hugging Face student ambassador program.
- ❑ Finance and Economic background.
- ❑ Work Experience: 3 years in Macroeconomic Statistics area at the Central Bank of Chile. 2 years at a Fintech joint venture on payments (currently the payment subsidiary of BancoEstado).
- ❑ Currently at @ ESO Paranal Software group (winter-internship 2023).

Context

LLM, embeddings, generative models, context window

Neural Networks and Representation Learning

Learning a simplified numerical representation of complex data



- ❑ **Embeddings:** Vectors representing complex data in a numerical and dense format.
- ❑ **Vector space representation:** Imagine a space where data resides. Within this space, dogs cluster together, forming a distinct neighborhood than cats, but both classes lives in a different district than humans.
- ❑ **Embeddings as a features:** These vectors serve as a foundation for constructing various systems (object recognition, scene detection).

Neural Networks and Representation Learning

End-to-end system, from raw data to task mapping layers.

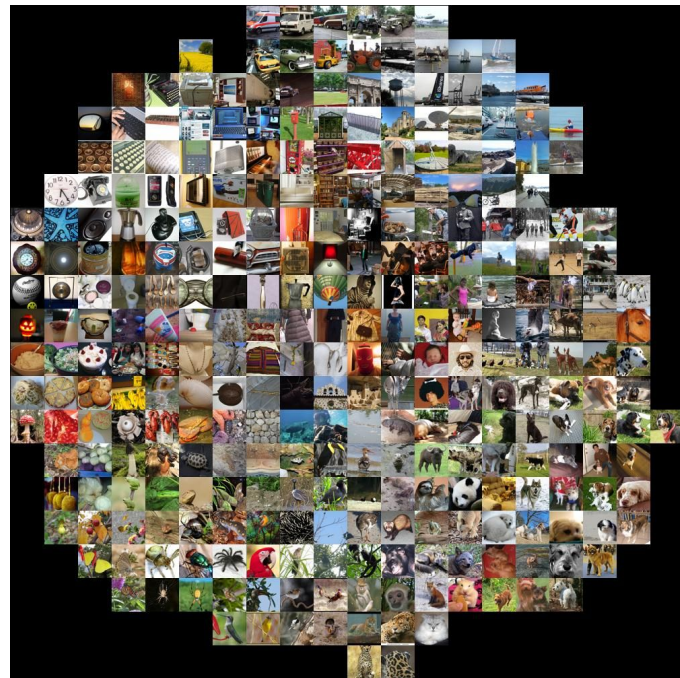
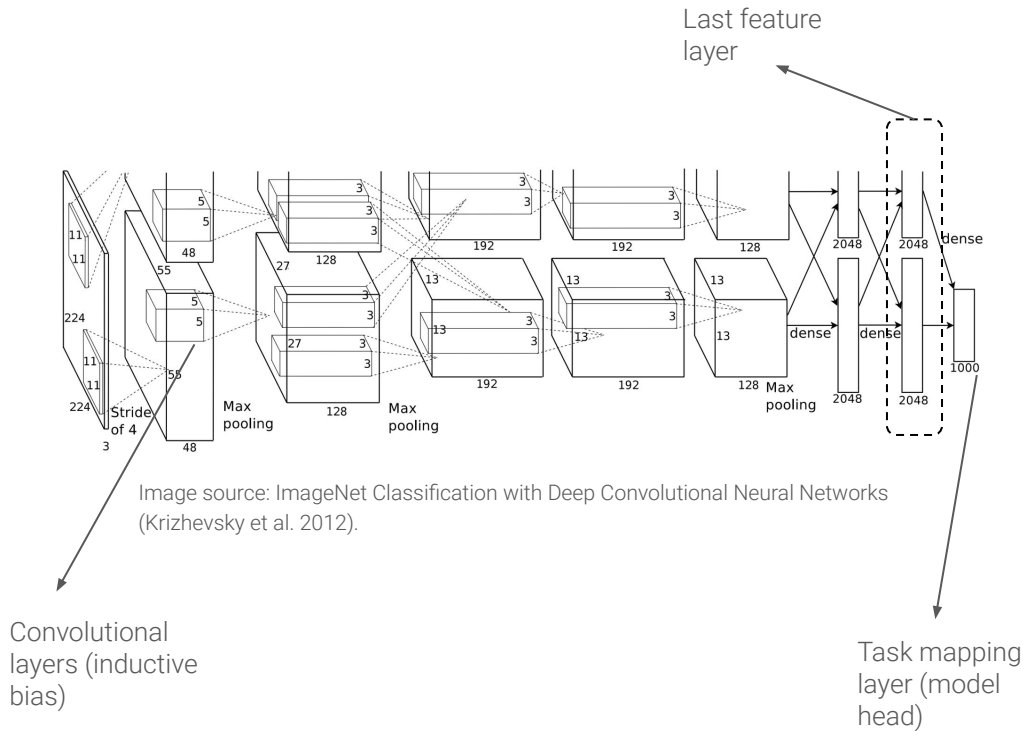
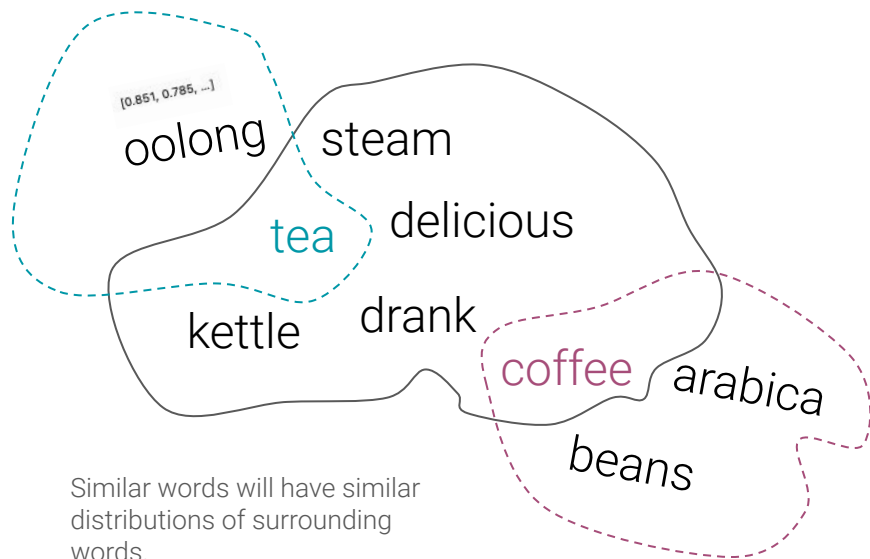


Image source: [t-SNE visualisation of CNN Codes \(Karpathy\)](#)

Vector Semantics and Embeddings

"You shall know a word by the company it keeps" .- Firth, 1957



- ❑ **Distributional hypothesis:** the meaning of a word can be derived from the distribution of contexts in which it appears.
- ❑ **Contextual embeddings:** to capture the semantic of a word or token, context is critical. It's necessary a way to resignify a fix embedding given their context.
- ❑ **More about sequence models:** [Sequence Models with Transformers. A Journey Through Language Models. Current Insights and Practical Applications at Paranal Observatory \(Carvajal, Alcázar 2023\)](#)

2023 NeurIPS Test of Time Award

Distributed Representations of Words and Phrases and their Compositionality (word2vec)

Jeff Dean (@JeffDean)

On behalf of our co-authors Tomáš Mikolov, @ilyasut and Kai Chen, @greg_corrado and I were delighted to accept the #NeurIPS2023 Test of Time Award for the "word2vec" paper (arxiv.org/abs/1310.4546). Thanks to the @NeurIPSConf test of time committee for honoring us with this award!

This work started as an earlier ICLR 2013 workshop paper (arxiv.org/abs/1301.3781) that explored a few different self-supervised techniques for learning word embeddings. The skip-gram approach worked better than others, and we scaled that and explored various alternative loss functions in the NeurIPS paper.

The geometric relationships contained in the trained word embeddings were one thing about this work that I think people found interesting (see images from our talk below).

[Traducir post](#)

We are honored to receive this award

- Thanks to the committee that selected our work! (We're honored!)
- Thanks to our co-authors who couldn't be here today!

Distributed Representations of Words and Phrases and their Compositionality

5. Words as n-dimensional vectors

Expression	Nearest Neighbors
Paris - France > Italy >	Rome
Niger - big > small >	China
water - ocean > Germany >	Strasbourg
Cy - copper > gold >	Au
Windows - Microsoft > Google >	Android

5. Words as n-dimensional vectors

Expression	Nearest Neighbors
Czech > currency >	koruna, Czech crown, Polish zloty
Vietnam > capital >	Hanoi, Ho Chi Minh City, Viet Nam
German > adjective >	affable, affable, affable, affable, affable
Russian > food >	blini, blini, blini, blini, blini
French > airport >	Charles de Gaulle, Orly, Mantes-la-Jolie, Paris-Montparnasse, Paris-Montparnasse

2d PCA visualization of embeddings: Syntactic relationships expressed geometrically

Neon gender

Verb tense

2d PCA visualization of embeddings: Semantic relationships expressed geometrically

Country <=> Capital

Disease <=> Drug

Google AI @GoogleAI · 12 dic. 2023

Congratulations to Jeff Dean, Greg Corrado, & co-authors of the paper "Distributed Representations of Words and Phrases and their Compositionality", for winning the #NeurIPS2023 Test of Time Award! This prize recognizes a highly impactful paper published at NeurIPS 10 years ago.

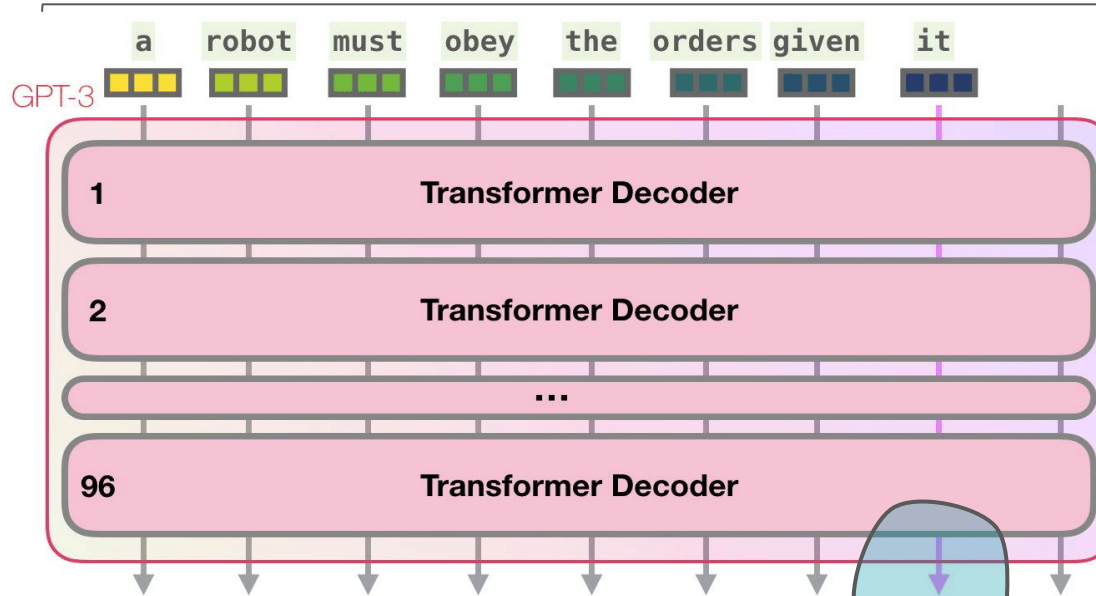
I'm Jeff Dean who will give the test of time a war talk. Thank you very much. I'm Jeff.

A Neural Network to predict the next token in the sequence

Generative Pre-trained Transformer (GPT)









Embeddings are recalibrated based on the distributional hypothesis established by the context window.

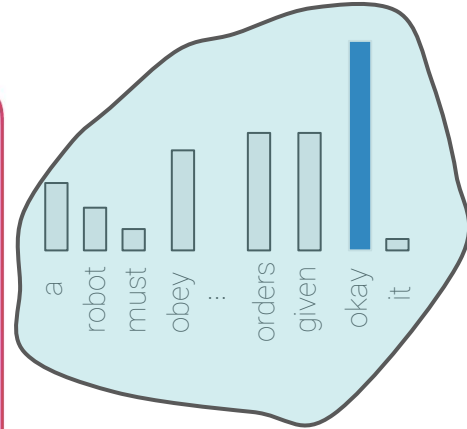
<<Context window>>



Embedding

Vocabulary

a	
robot	
must	
obey	
the	
orders	
given	
...	
it	



A multinomial distribution is determined by the current state of the sequence within the context window.

How to Achieve a ChatGPTish Model?

Involved at least 2 training stages and result in a lossy compression about 5 order of magnitude



every
~year

Stage 1: Pretraining

1. Download ~10TB of text.
2. Get a cluster of ~6,000 GPUs.
3. Compress the text into a neural network, pay ~\$2M, wait ~12 days.
4. Obtain **base model**.



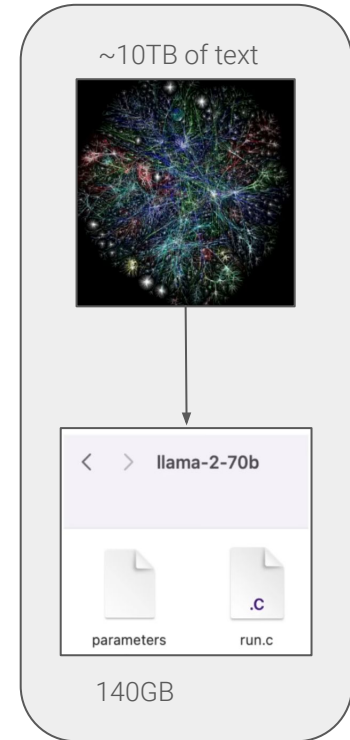
<USER>
Can you write a short introduction about the relevance of the term "monopsony" in economics? Please use examples related to potential monopsonies in the labour market and cite relevant research.

<ASSISTANT>
"Monopsony" refers to a market structure where there is only one buyer for a particular good or service. In economics, this term is particularly relevant in the labor market, where a monopsony employer has significant power over the wages and working conditions of their employees. The presence of a monopsony can result in lower wages and reduced employment opportunities for workers, as the employer has little incentive to increase wages or provide better working conditions...

every
~week

Stage 2: Finetuning

1. Write labeling instructions
2. Hire people (or use [scale.ai](#)), collect 100K high quality ideal Q&A responses, and/or comparisons.
3. Finetune base model on this data, wait ~1 day.
4. Obtain **assistant model**.
5. Run a lot of evaluations.
6. Deploy.
7. Monitor, collect misbehaviors, go to step 1.



Source: [Intro to Large Language Models \(Karpathy 2023\)](#)

Resource - [Llama 2: Open Foundation and Fine-Tuned Chat Models \(paper\)](#)

Zero-shot prompt

Just feed the task text to the model and ask for results.

Text: i'll bet the video game is a lot more fun than the film.

Sentiment: [MODEL COMPLETION]

Few-shot prompt

High-quality task demonstrations, showcasing input-output pairs. **Pros:** enhance comprehension of human intent and expected answer criteria. **Cons:** increase token consumption and context length limitations.

Text: (lawrence bounces) all over the stage, dancing, running, sweating, mopping his face and generally displaying the wacky talent that brought him fame in the first place.

Sentiment: positive

Text: despite all evidence to the contrary, this clunker has somehow managed to pose as an actual feature movie, the kind that charges full admission and gets hyped on tv and purports to amuse small children and ostensible adults.

Sentiment: negative

Text: i'll bet the video game is a lot more fun than the film.

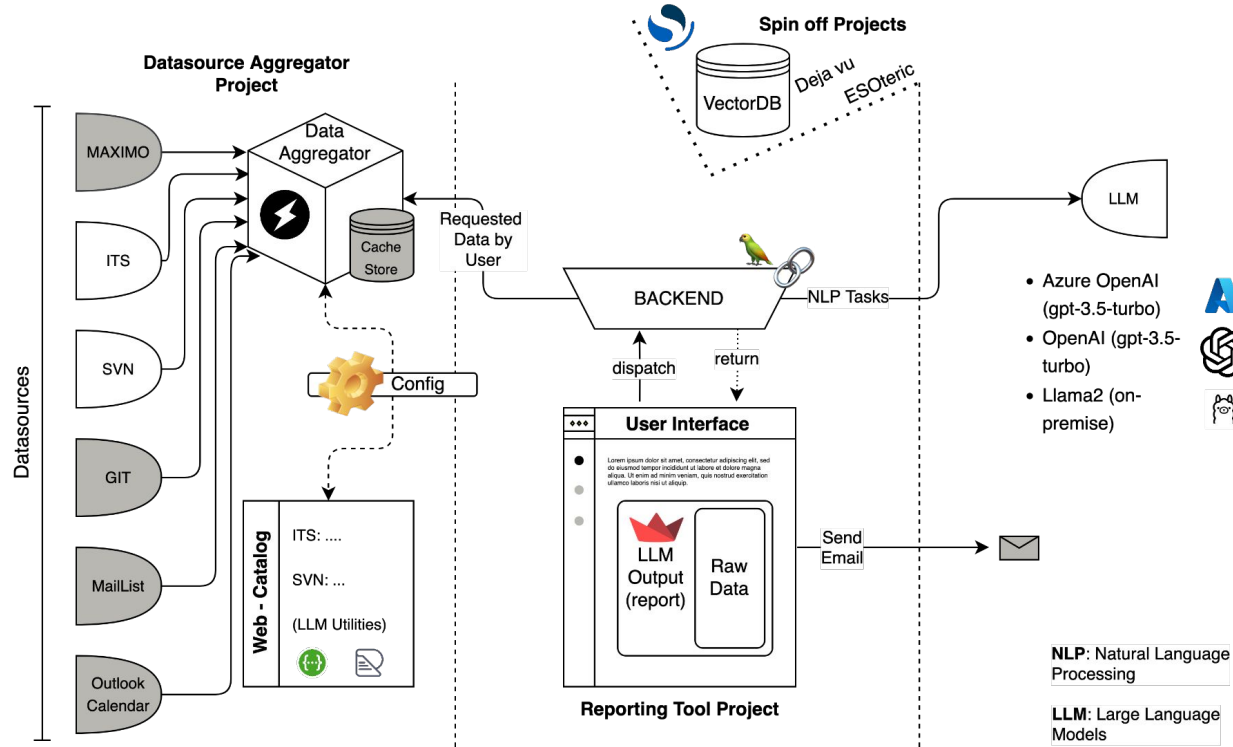
Sentiment: [MODEL COMPLETION]

The Internship

In a nutshell

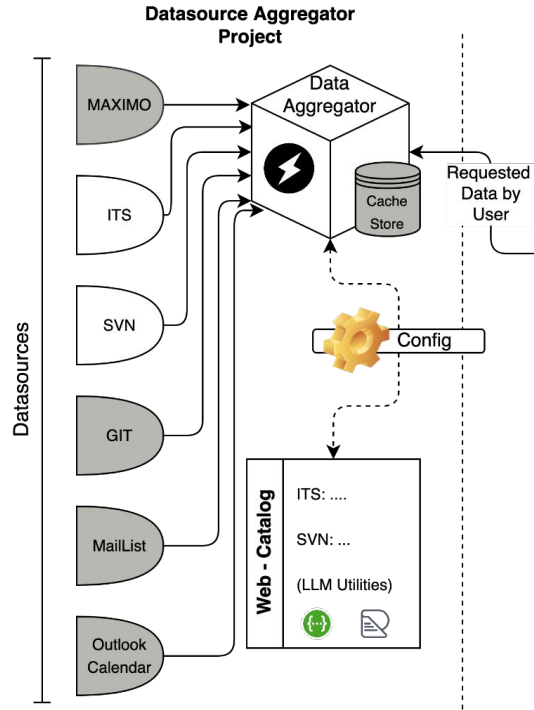
Internship Overview

Datasource Aggregator - Reporting Tool - Spin off Projects



Datasource Aggregator

A comprehensive API featuring various endpoints for retrieving specific data from diverse sources



- ❏ **Aggregator:** connecting different data sources.
- ❏ Specific interaction with **data sources** (e.g., obtaining a ticket for a user).
- ❏ Independent project; Reporting Tool is the first service...

Get Issues By User Between

Returns issues related to a specific ITS (Jira) user within a time range between `from_date` and `to_date`.

Parameters:

- `jira_user` (str): The ITS (Jira) user to retrieve issues for.
- `from_date` (str): The date to retrieve issues from. Format: YYYY-MM-DD.
- `to_date` (str): The date to retrieve issues to. Format: YYYY-MM-DD or 'HEAD' for the current date.

Returns:

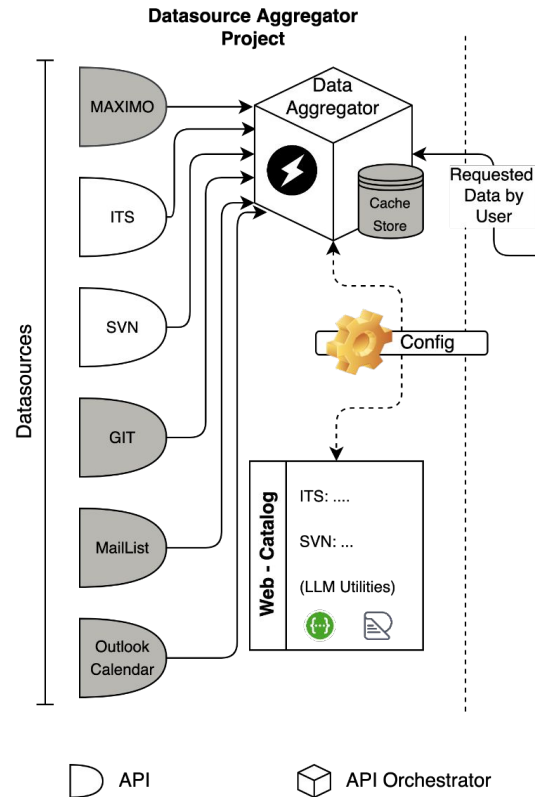
- `List[JiraIssue]` : A list of parsed ITS (Jira) issues.

QUERY PARAMETERS

<code>jira_user</code>	string (Jira User) Default: "jaraneda" The ITS (Jira) user to retrieve issues for.
<code>from_date</code>	string (From Date) Default: "2023-11-25" The date to retrieve issues from.
<code>to_date</code>	string (To Date) Default: "2023-12-25" The date to retrieve issues to. You can use 'HEAD' to retrieve issues up to the current date.

Responses

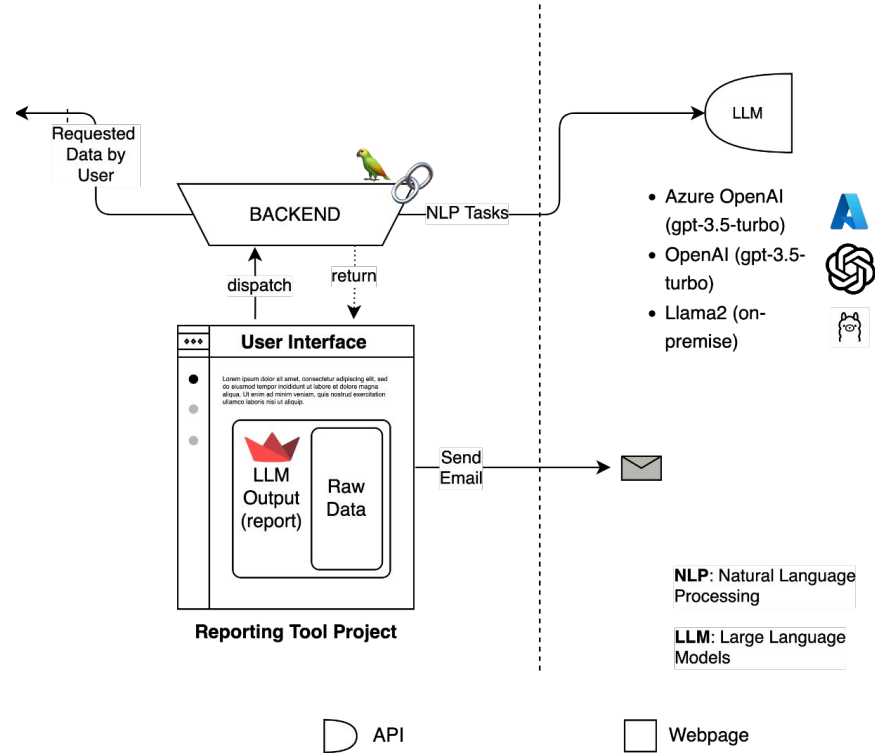
> 200 Successful Response



Reporting Tool

Application to Generate Reports Automatically

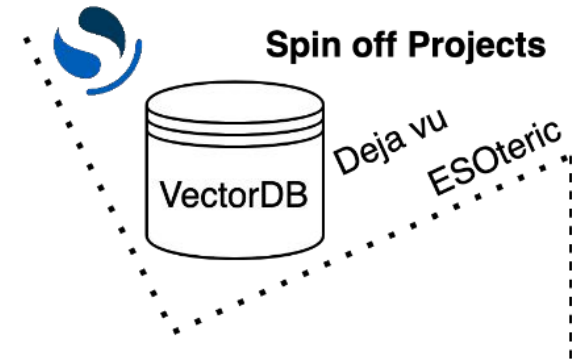
- Automatic generation of reports through summarization using LLM.
- Builds the domain of information requested by the user.
- User serves as an editor with the option to edit and remove the information to be used by the LLM (augmented tool).



Spin off Projects

Vector Similarity Search & Retrieval Augmented Generation

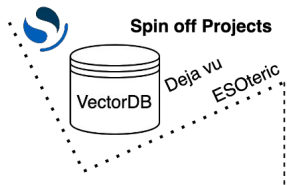
- ❑ **ESOteric**: a “talk with your files” chatbot.
- ❑ **DejaVu** (by NMI).
- ❑ Two core concepts behind these spin off projects.
 - ❑ Vector Similarity Search
 - ❑ Retrieval Augmented Generation (RAG)






ESOteric: a “Talk with your Files” Q&A

Retrieval Augmented Generation (RAG) Pattern






About

The objective of this project is to demonstrate the utilization of a Large Language Model (LLM) in constructing a straightforward Retrieve-based Question & Answer System.

This app was built using:


- [Streamlit](#)
- [LangChain](#) 
- [OpenAI](#)

ESOteric



Why read when you can communicate directly with your files?

You need some inspiration? Try a pdf from the [Project Gutenberg frequently downloaded ebooks \(totally legal!\)](#)

Upload a PDF file

 Drag and drop file here
Limit 200MB per file • PDF

Browse files

 pride-and-prejudice.pdf 28.3MB 

Your document pride-and-prejudice was successfully uploaded!

Embeddings loaded from disk

Ask me anything! 🗨️ (related to the document of course...)

Do you really believe Miss Elizabeth Bennet was in love with Mr. Darcy? Can you provide an example?

ESOTeric: a “Talk with your Files” Q&A

Retrieval Augmented Generation (RAG) Pattern

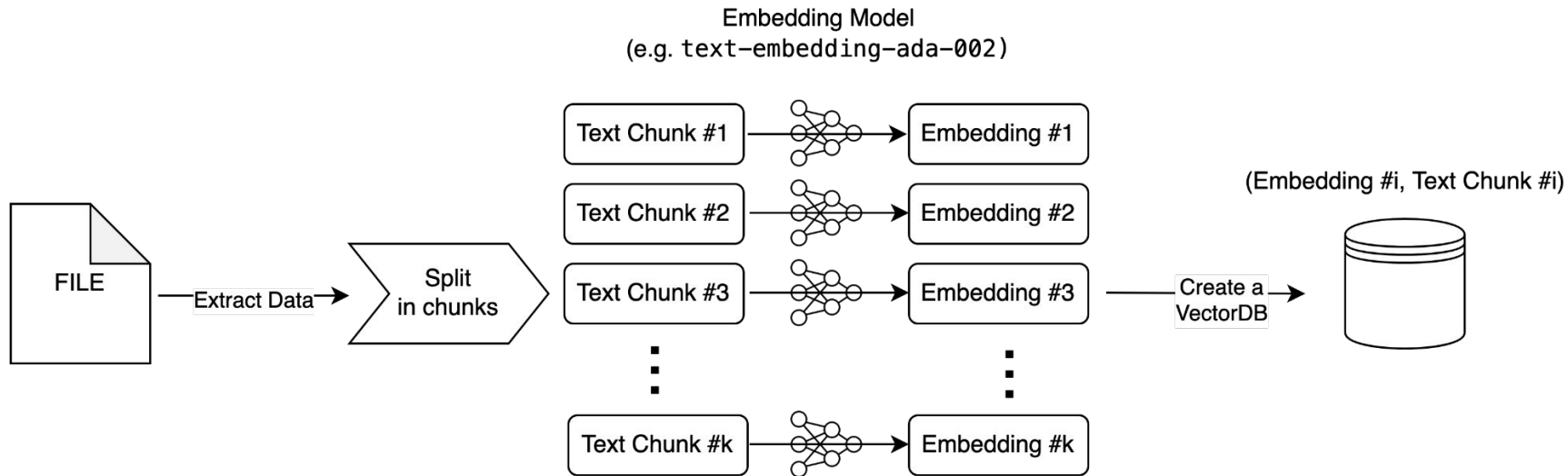


<https://gitlab.eso.org/calcazar/esoteric-qa>

- ❑ A reader assistant agent via Question & Answering (QA) to interact with pdf documents such as Pride and Prejudice.
- ❑ A retrieve-based QA System:
 1. A large document, or a collection of documents, is transform into a knowledge base using embeddings.
 2. User ask questions that retrieve information from the knowledge data using a large language model.

How to Create a Vector Database?

A simple split-apply pattern to create a vector database



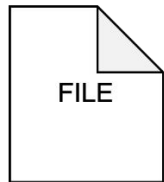
Create your own vector database with OpenSearch

<https://gitlab.eso.org/calcazar/langchain-series/-/tree/main/examples/embedder>

How to Create a Vector Database?

A simple split-apply pattern to create a key, value database

Get a book in a readable format



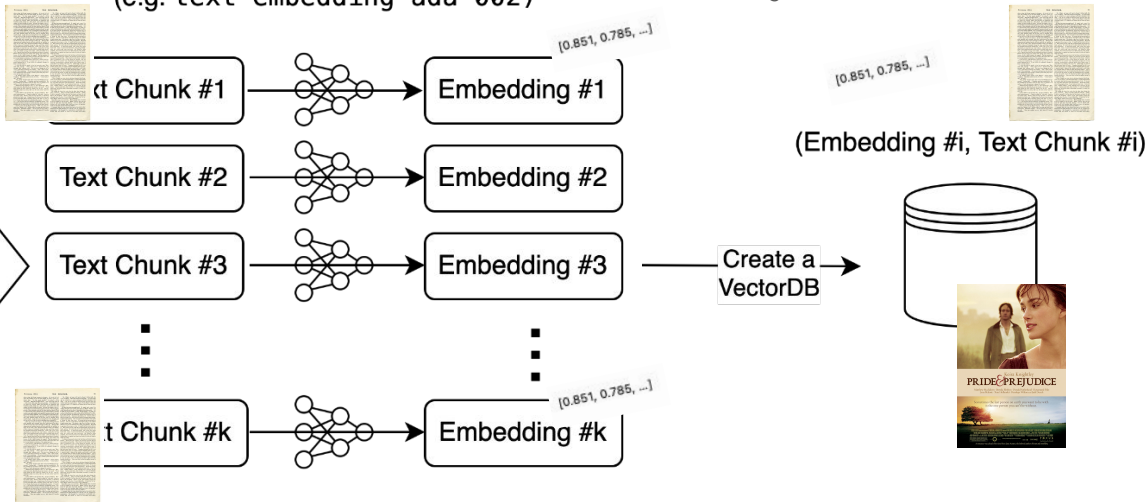
Extract Data

Split in pages

Split in chunks

Embedding Model
(e.g. text-embedding-ada-002)

Get embeddings



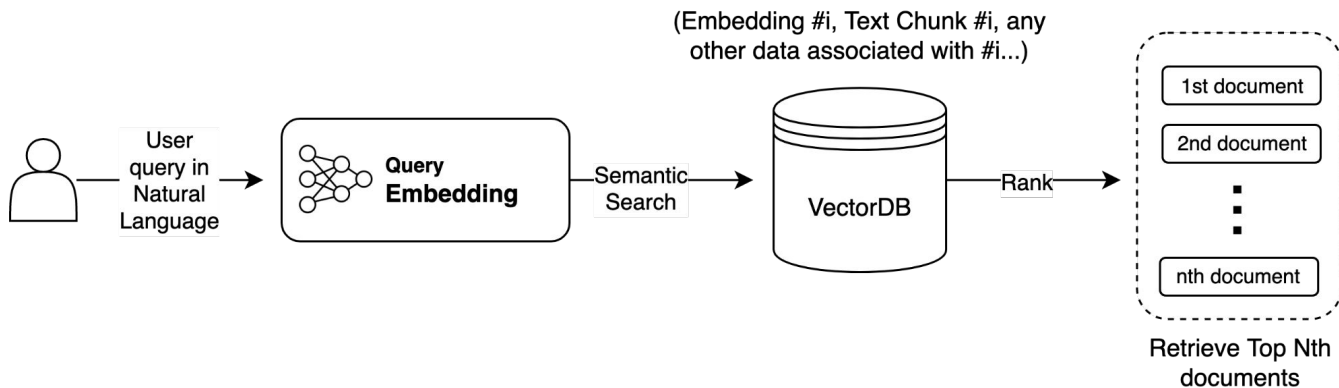
A Pride & Prejudice
"knowledge database"

Create your own vector database with OpenSearch

<https://gitlab.eso.org/calcazar/langchain-series/-/tree/main/examples/embedder>

Retrieve Documents using Natural Language

Embeddings deliver similarity metrics, while the remainder involves ranking and retrieval

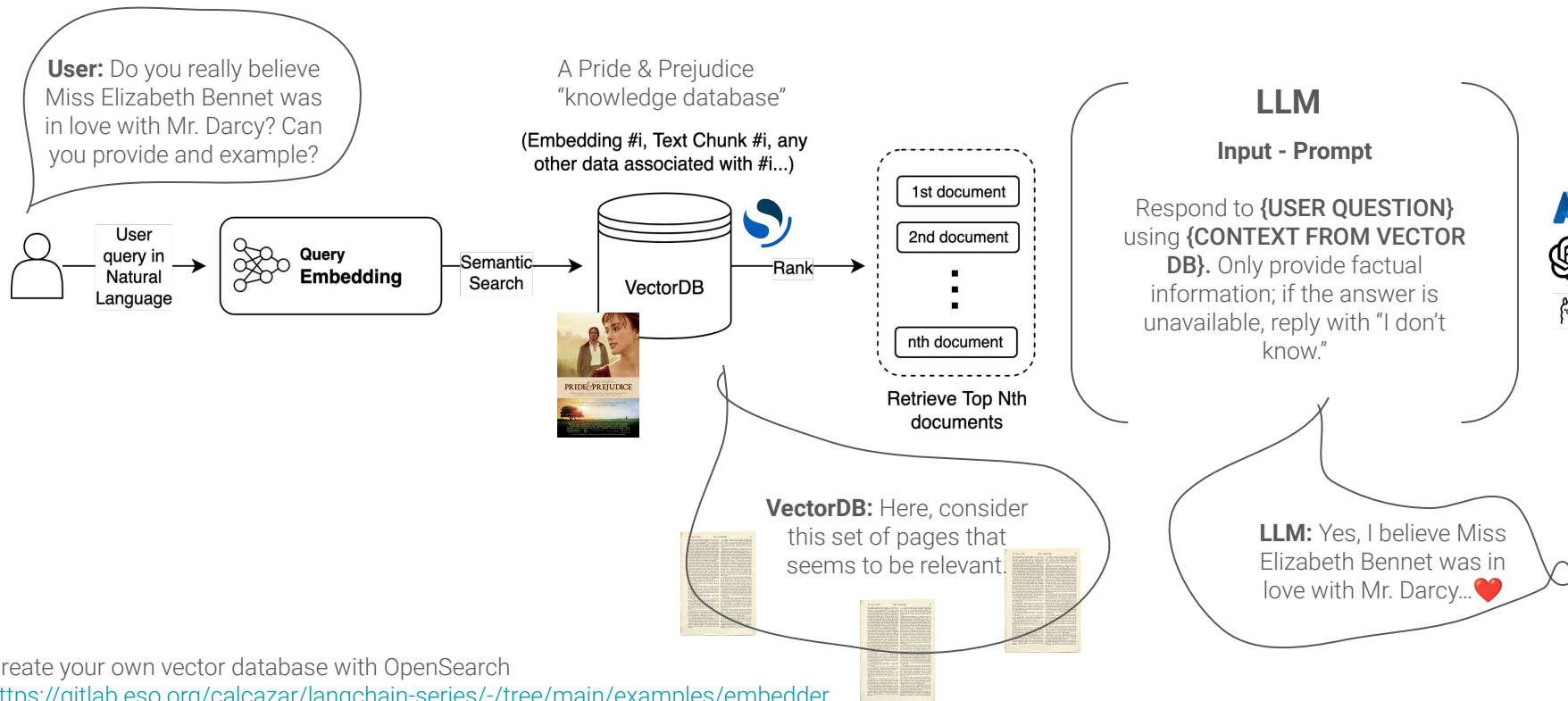


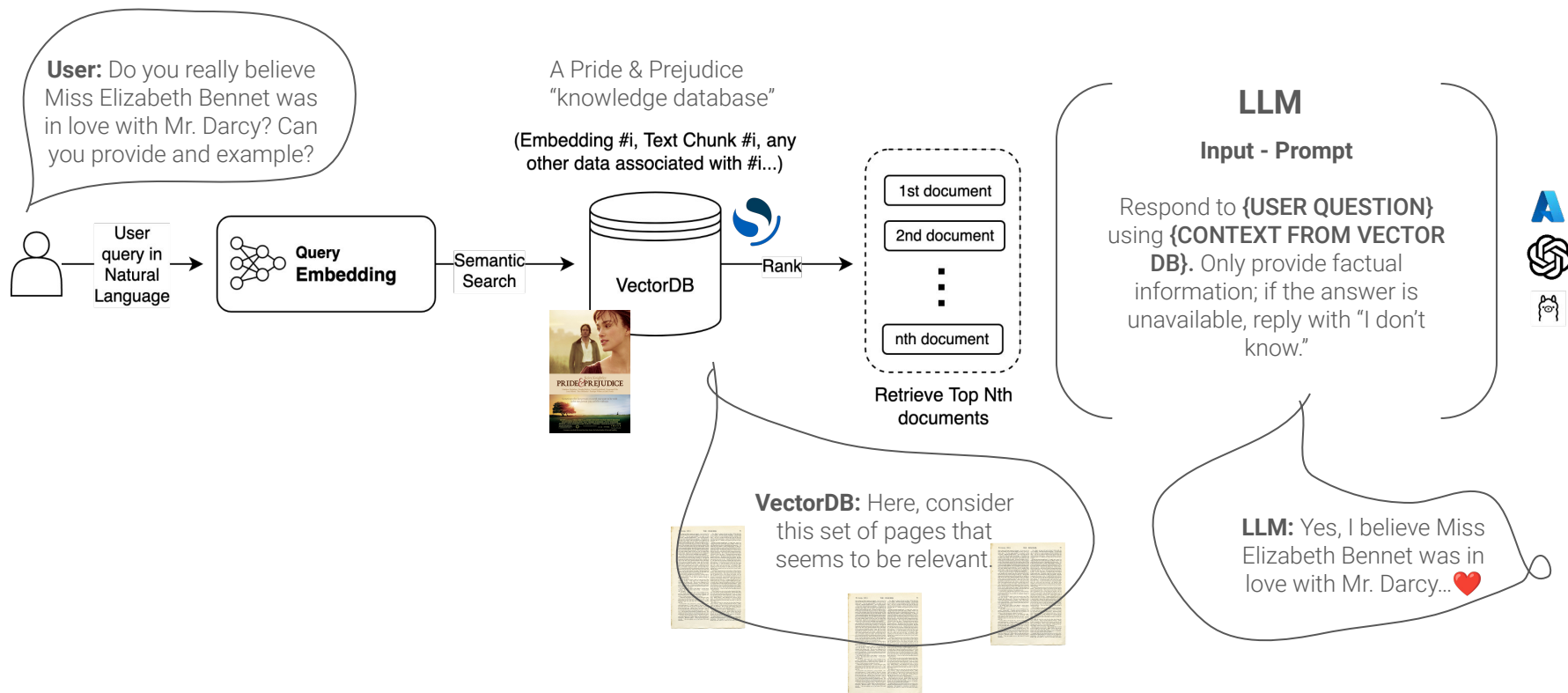
Create your own vector database with OpenSearch

<https://gitlab.eso.org/calcazar/langchain-series/-/tree/main/examples/embedder>

Retrieval Augmented Generation

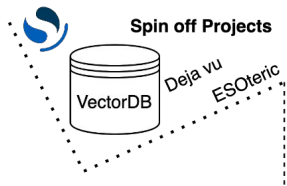
Improve LLM input by retrieving and incorporating pertinent data from a vectorDB







ES0teric sample responses



Ask me anything! 🗨️ (related to the document of course...)

Do you really believe Miss Elizabeth Bennet was in love with Mr. Darcy? Can you provide an example?

Do you really believe Miss Elizabeth Bennet was in love with Mr. Darcy? Can you provide an example?

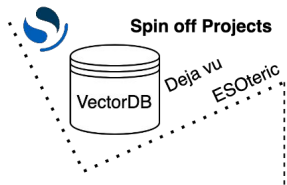
Yes, I believe Miss Elizabeth Bennet was in love with Mr. Darcy. An example of this is when Mr. Darcy tells Miss Bingley that Miss Elizabeth Bennet is his favorite lady, and Miss Bingley is surprised by this revelation.

Ask me anything! 🗨️ (related to the document of course...)

Why is Lizzy Mr. Bennet's favorite daughter?

Why is Lizzy Mr. Bennet's favorite daughter?

Based on the given context, it is not explicitly stated why Lizzy is Mr. Bennet's favorite daughter.



DejaVu: A Vector Similarity Search for ITS Issues

A practical and clean application of vectorDB, by NMI



The screenshot shows the web application interface for DejaVu. The browser address bar displays `wgsdlab3.pl.eso.org:8501`. The page has a dark theme and is divided into two main sections. The left section contains an illustration of a person in a trench coat holding a map, with the text "How Does it Work?" and "DejaVu works by doing a similarity search in a database of embedding vectors computed from Jira issues." Below this is "Embeddings Database Info" stating it is connected to a database at `wgsdlab3.pl.eso.org:9244`. The right section is titled "DejaVu" and "Have I seen this issue before...?". It includes a description: "Tool for retrieving the top n most similar issues." and a text input field for an issue key or URL with the example `"PR-174576"` or `"https://wits.pl.eso.org/browse/PR-111311"`. Below the input field is a "Number of issues to retrieve" section with a slider set to 5.

Source: <https://scgitlab.sc.eso.org/nmiranda/dejavu>

Automate Report Generation

How we build a system that take relevant information, categorize, and summarize from the users' perspective?

Reporting Tool

Application to Generate Reports Automatically

Enter your username

Select the period of the report:

☒ Last X days

☐ Start/End date

Select the number of days to retrieve the last information

13

Select the display style for JIRA summaries:

☒ Verbose

☐ Minimalist

Hide SVN commits that has these keywords (separated by comma)

Automatic_backup, Autom.

Max number of lines changed to display for each SVN commit

2

Model Temperature

0.00

0.00 1.50

Reporting Tool

Devouringly digest your ITS tickets like fast food 🍔🍕🌭, but with the nourishment of a wholesome breakfast 🍳. Save your valuable time for what truly matters 🧘🏻🌟...

ITS tickets	Start Date	End Date
31	2024-01-12	2024-01-25

SVN commits

22

ITS Tickets related to the following components: PIONIER, GRAVITY, VLTi, MATISSE, ESPRESSO

ITS Ticket ids: [PR-187090](#), [PR-187087](#), [CCB-1003164](#), [PR-187102](#), [ER-183983](#), [PR-186711](#), [PR-187106](#), [PR-187140](#), [PR-184737](#), [PR-187086](#), [ER-183979](#), [ER-183980](#), [ER-183814](#), [ER-183121](#), [PR-187135](#), [PR-187136](#), [PR-187112](#), [PR-184847](#), [PR-186284](#), [PR-187133](#), [WR-1](#), [CCB-1003237](#), [CCB-1003260](#), [ER-183927](#), [ER-183977](#), [ER-183976](#), [ER-183975](#), [ER-183974](#), [ER-183973](#), [ER-183929](#), [ER-183928](#)

[End of Turno](#) [Help?](#)

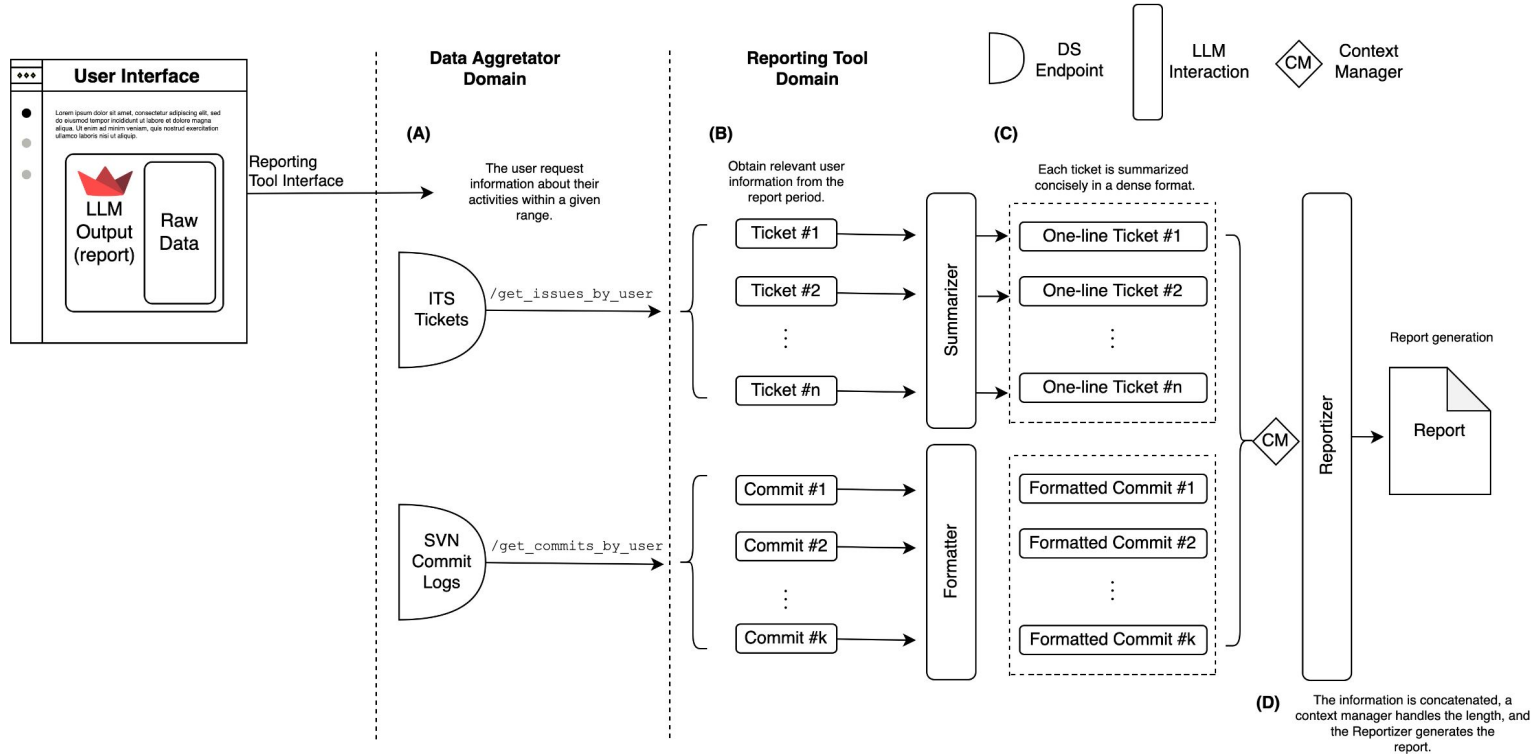
1 Your ITS Tickets since 2024-01-12

You can revise the summary and metadata generated from your recent JIRA tickets. Add any missing information or correct impressions. Once done, click 'Generate EoT Report' for your updated report.

Ticket: PR-187090 | Status: Resolved | Type: Problem | Components: ESPRESSO | Location: ICCF | Assignee: jgil | Reporter: egarro

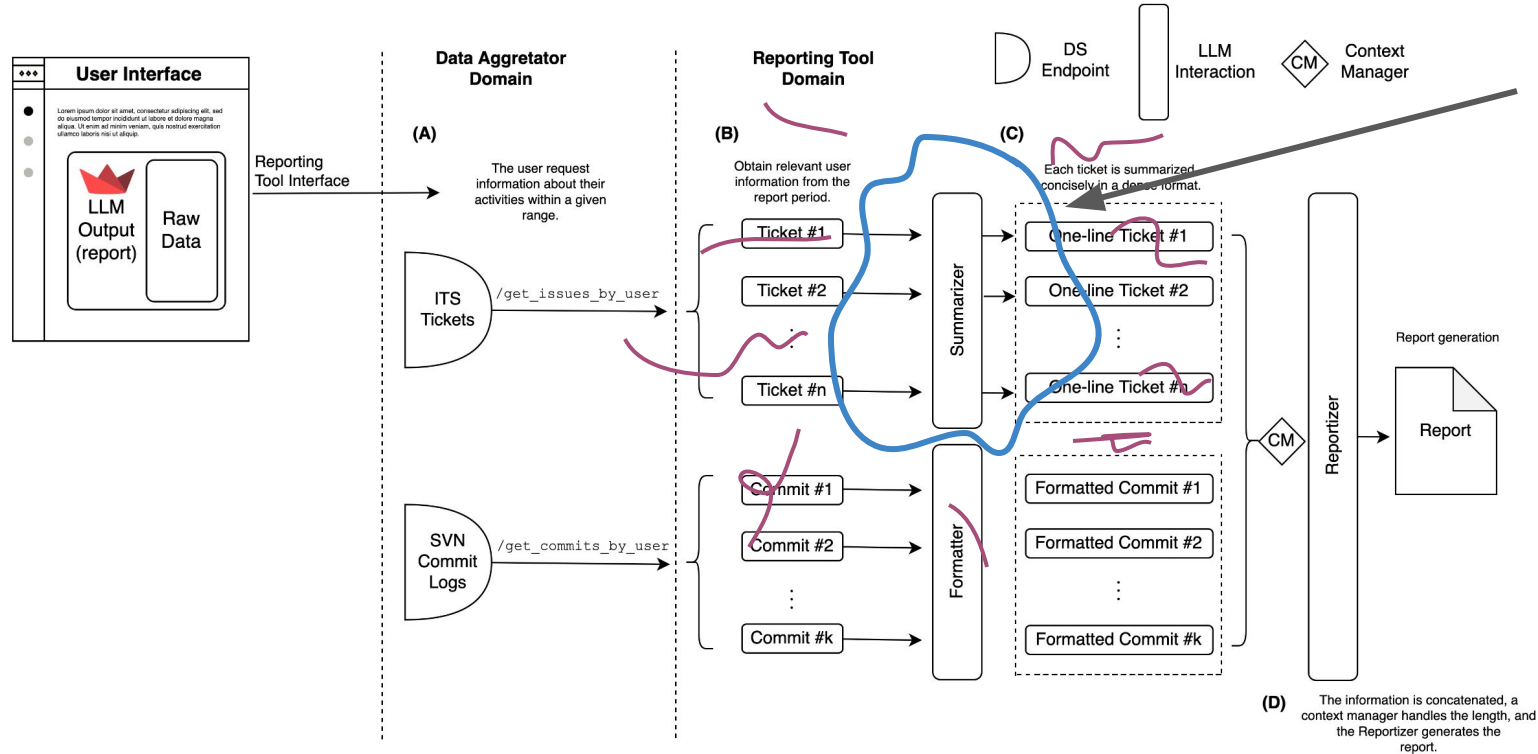
Report Generation

User Domain Information & Impersonation




How does the LLM Interaction Work?

Let's Break Down the Summarizer...

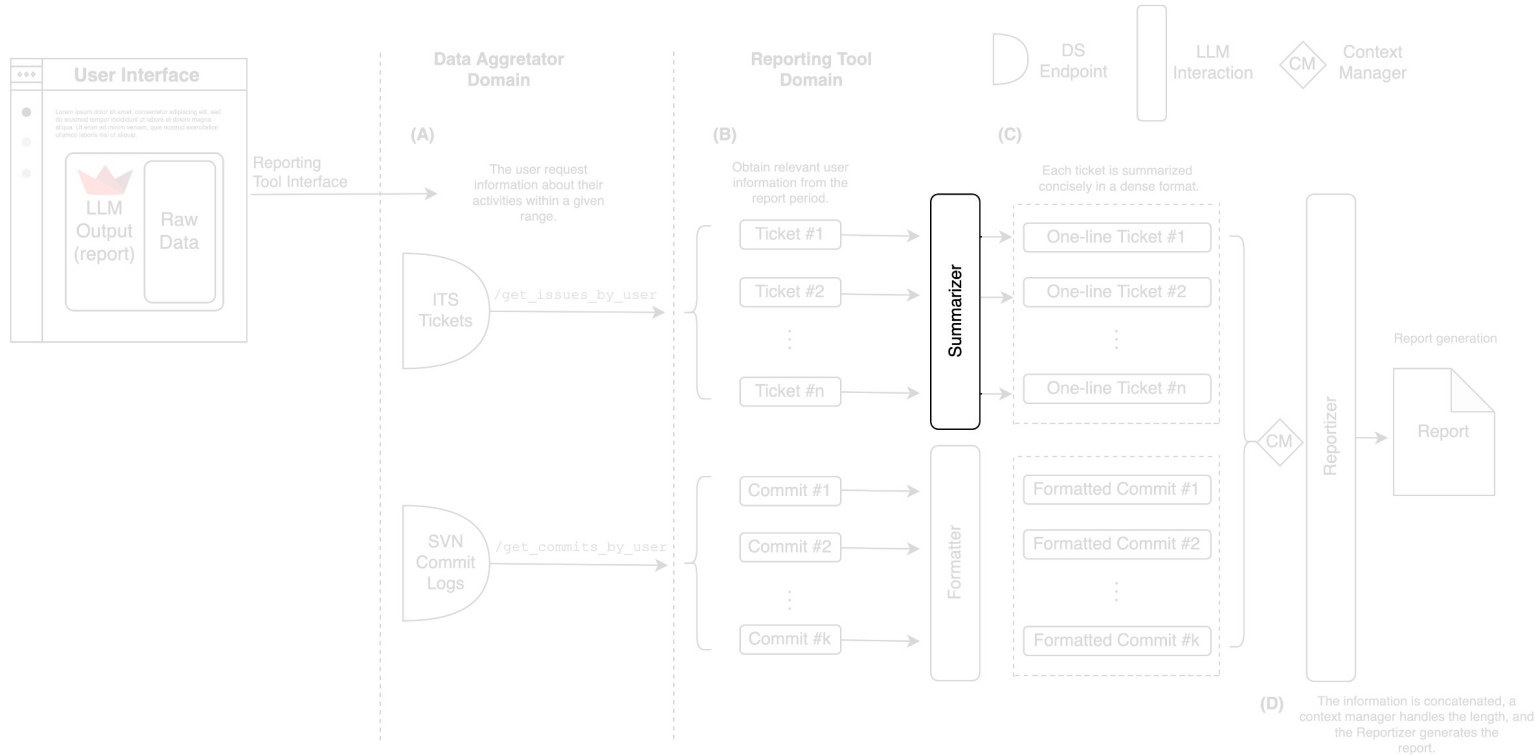


Here comes the "AI", or rather, the **stochastic parrot** !



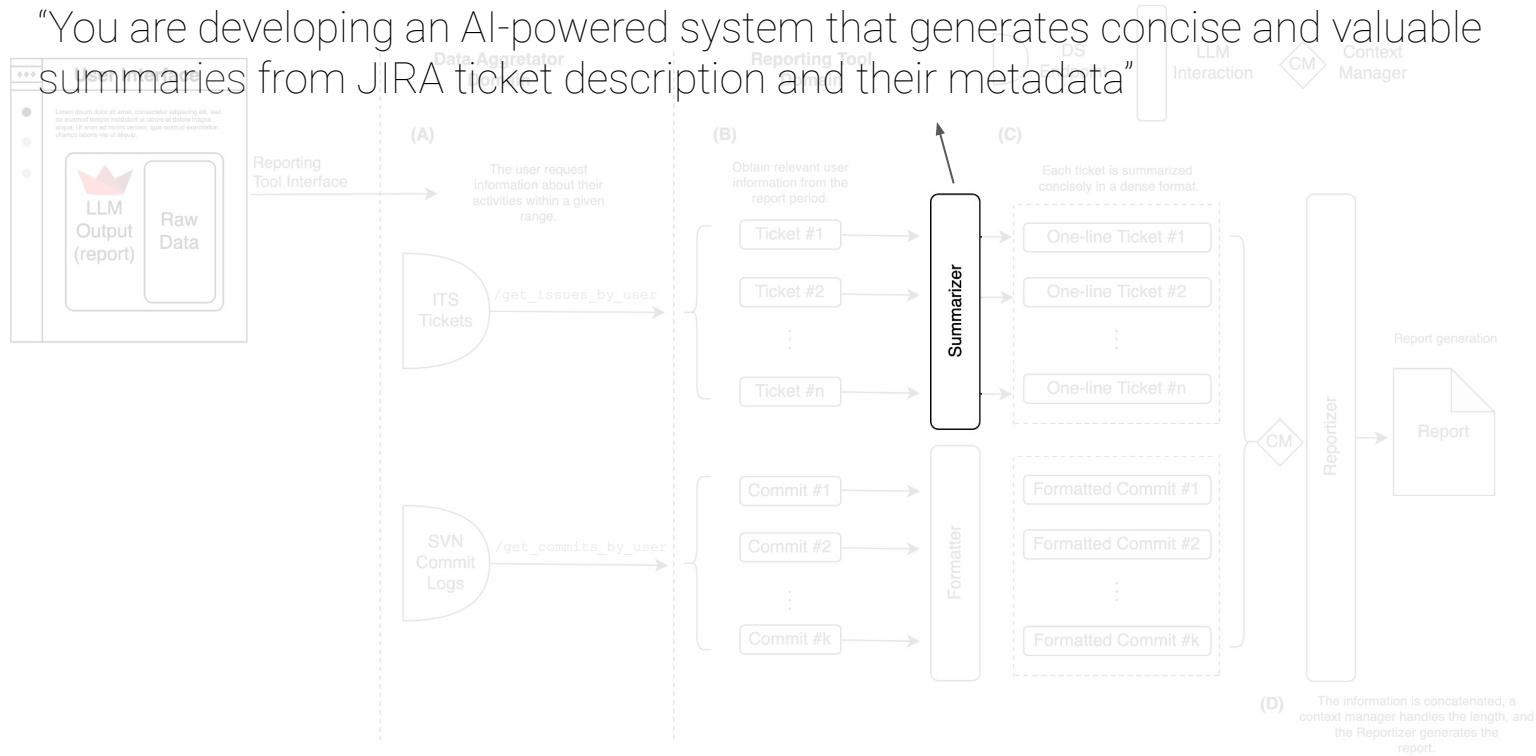
How does the LLM Interaction Work?

Let's Break Down the Summarizer...



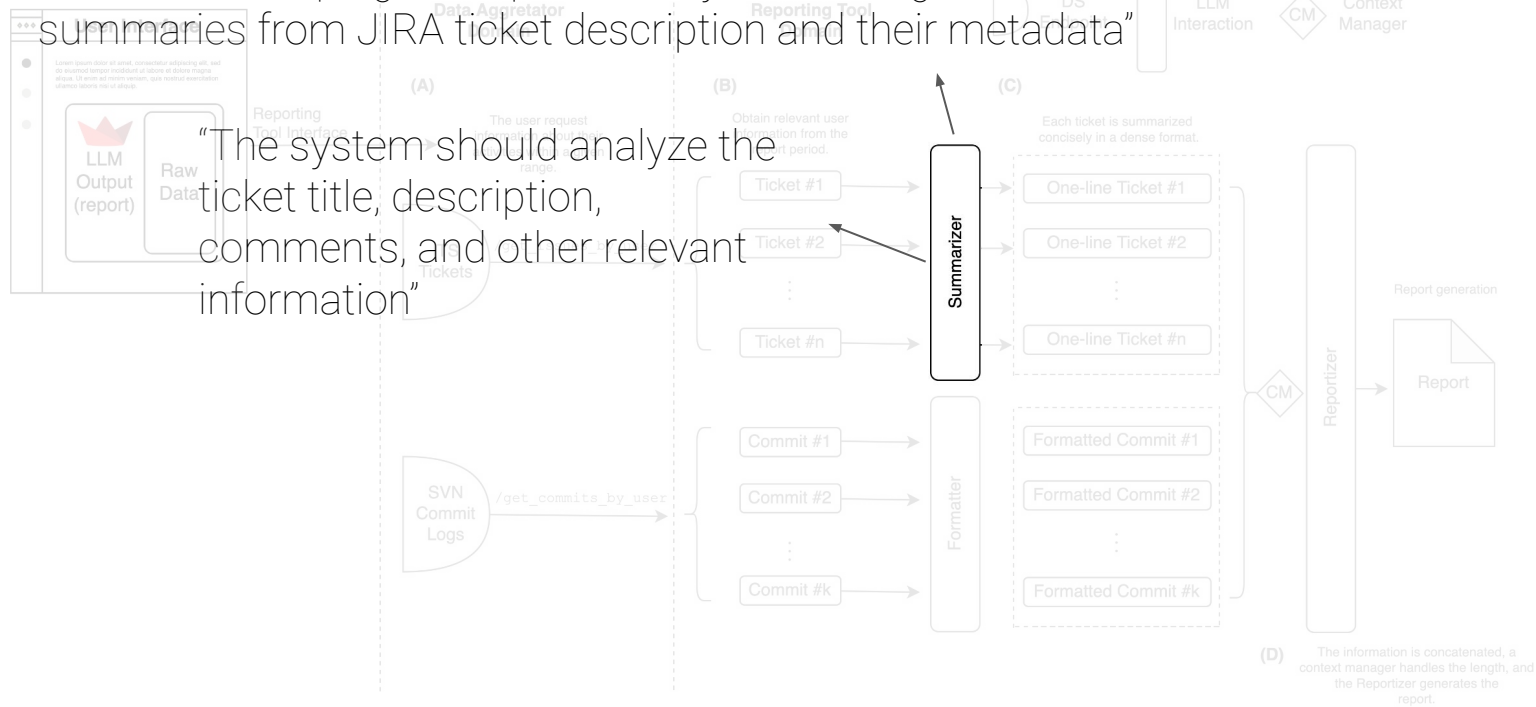
The Summarizer Goal is Conditioning via the System Prompt

“You are developing an AI-powered system that generates concise and valuable summaries from JIRA ticket description and their metadata”



The Summarizer Goal is Conditioning via the System Prompt

“You are developing an AI-powered system that generates concise and valuable summaries from JIRA ticket description and their metadata”

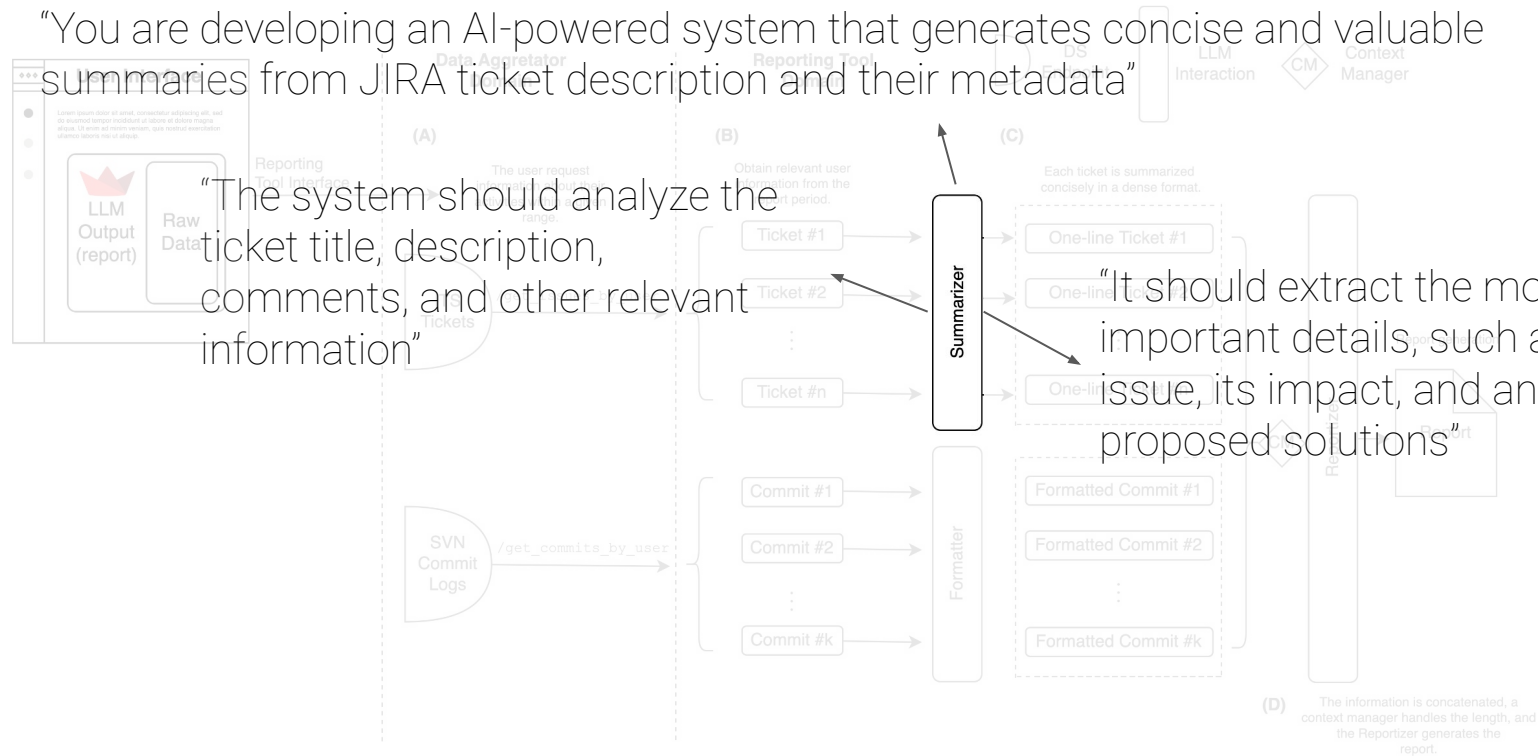


The Summarizer Goal is Conditioning via the System Prompt

"You are developing an AI-powered system that generates concise and valuable summaries from JIRA ticket description and their metadata"

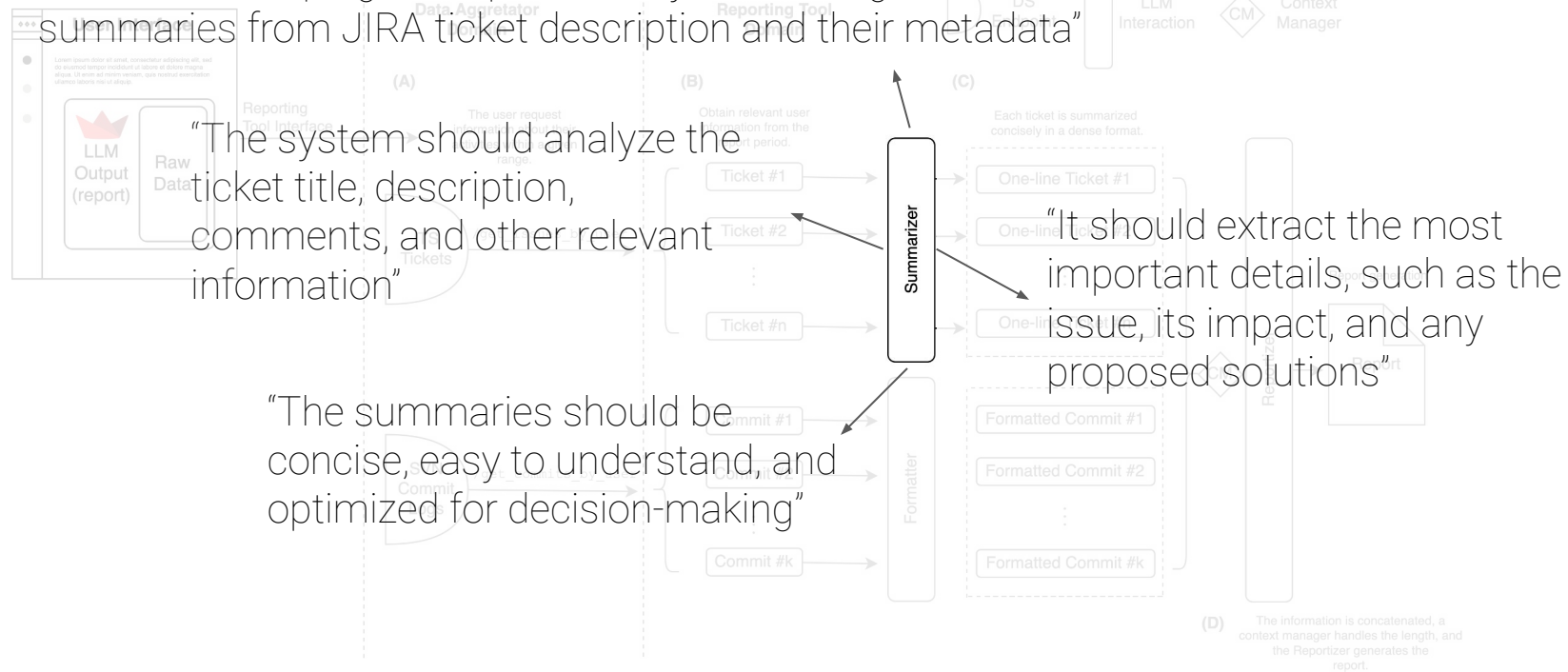
"The system should analyze the ticket title, description, comments, and other relevant information"

"It should extract the most important details, such as the issue, its impact, and any proposed solutions"



The Summarizer Goal is Conditioning via the System Prompt

“You are developing an AI-powered system that generates concise and valuable summaries from JIRA ticket description and their metadata”



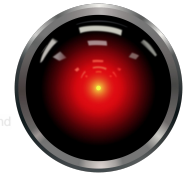
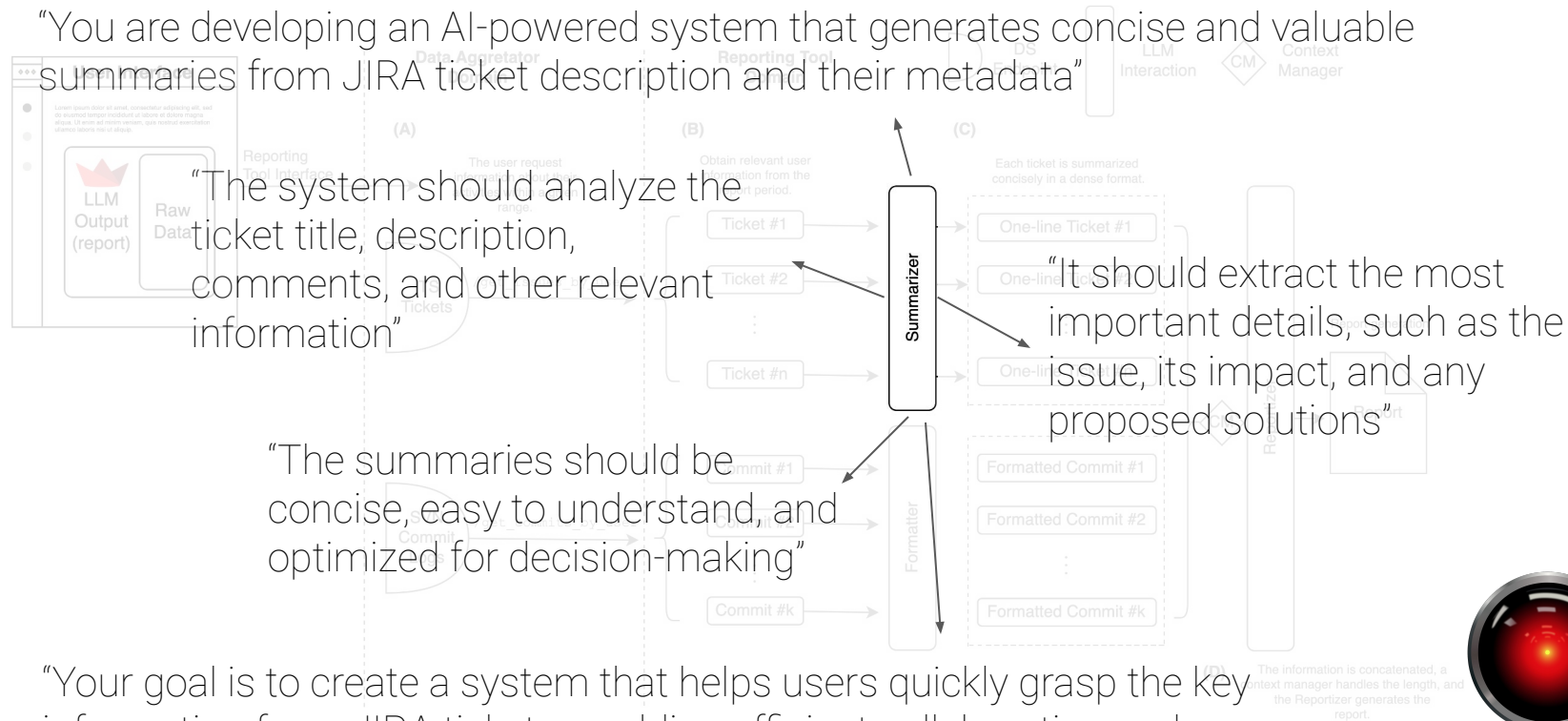
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"You are developing an AI-powered system that generates concise and valuable summaries from JIRA ticket description and their metadata"

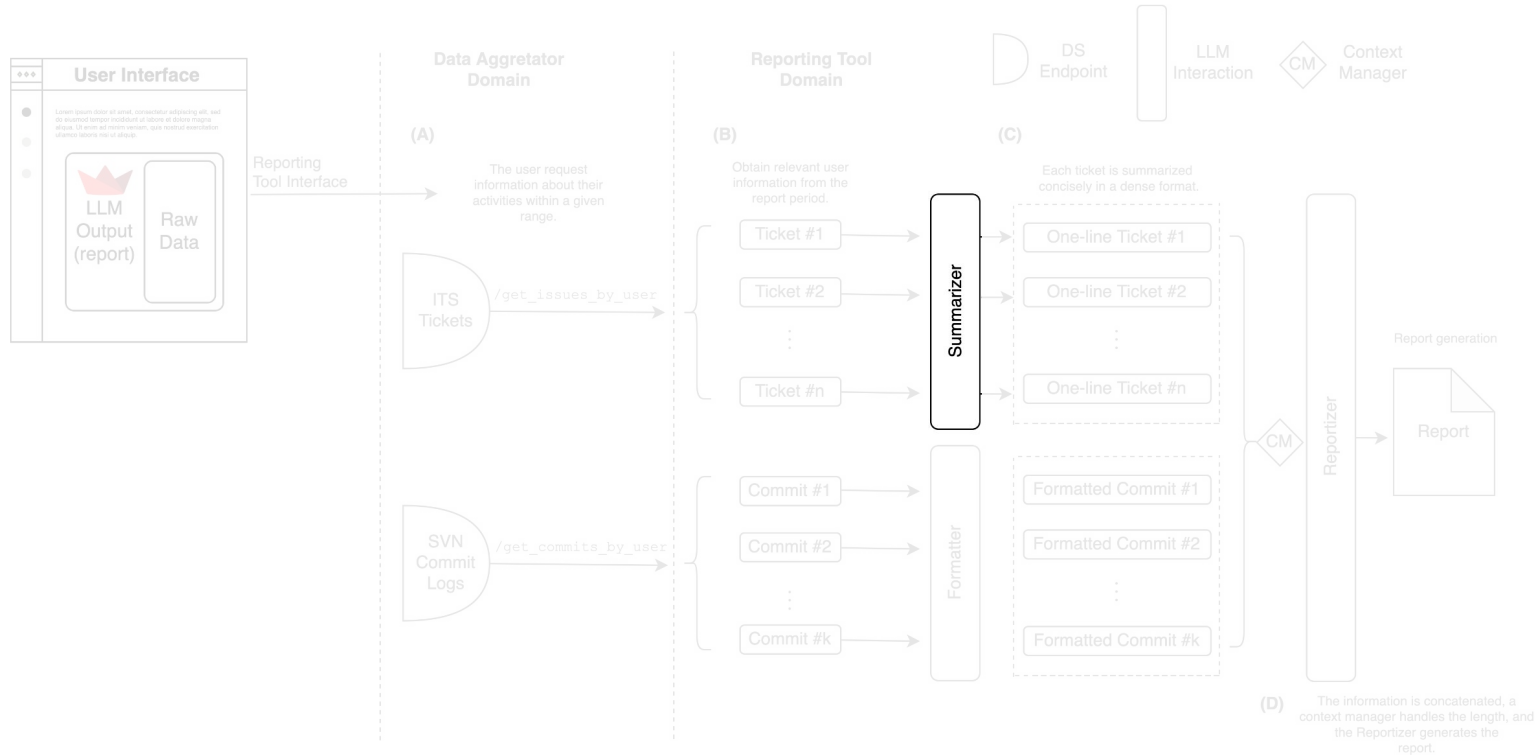
"The system should analyze the ticket title, description, comments, and other relevant information"

"The summaries should be concise, easy to understand, and optimized for decision-making"

"Your goal is to create a system that helps users quickly grasp the key information from JIRA tickets, enabling efficient collaboration and problem-solving."



Now how the Summarize perform their task...summarize!

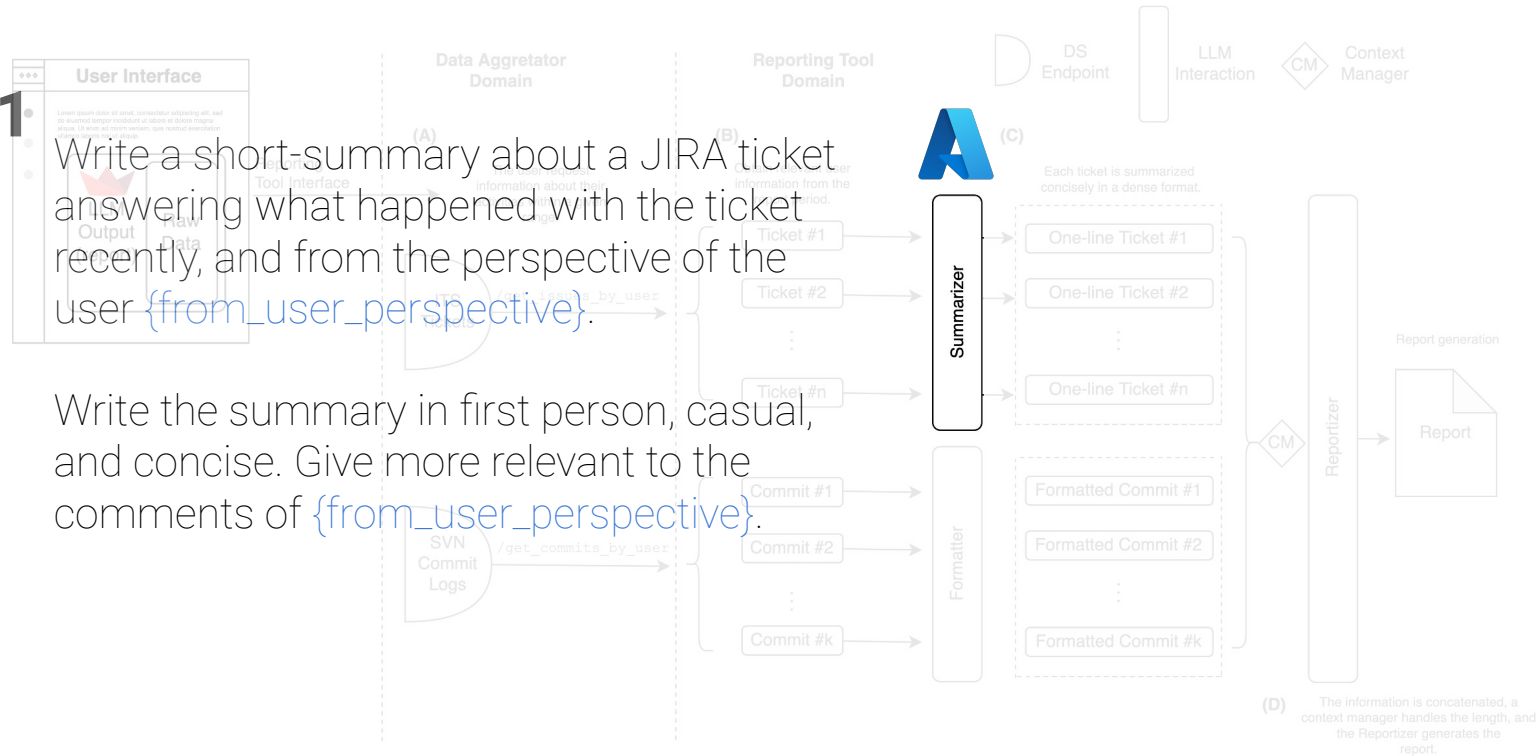


Now how the Summarize perform their task...summarize!

1

Write a short-summary about a JIRA ticket answering what happened with the ticket recently, and from the perspective of the user `{from_user_perspective}`.

Write the summary in first person, casual, and concise. Give more relevant to the comments of `{from_user_perspective}`.



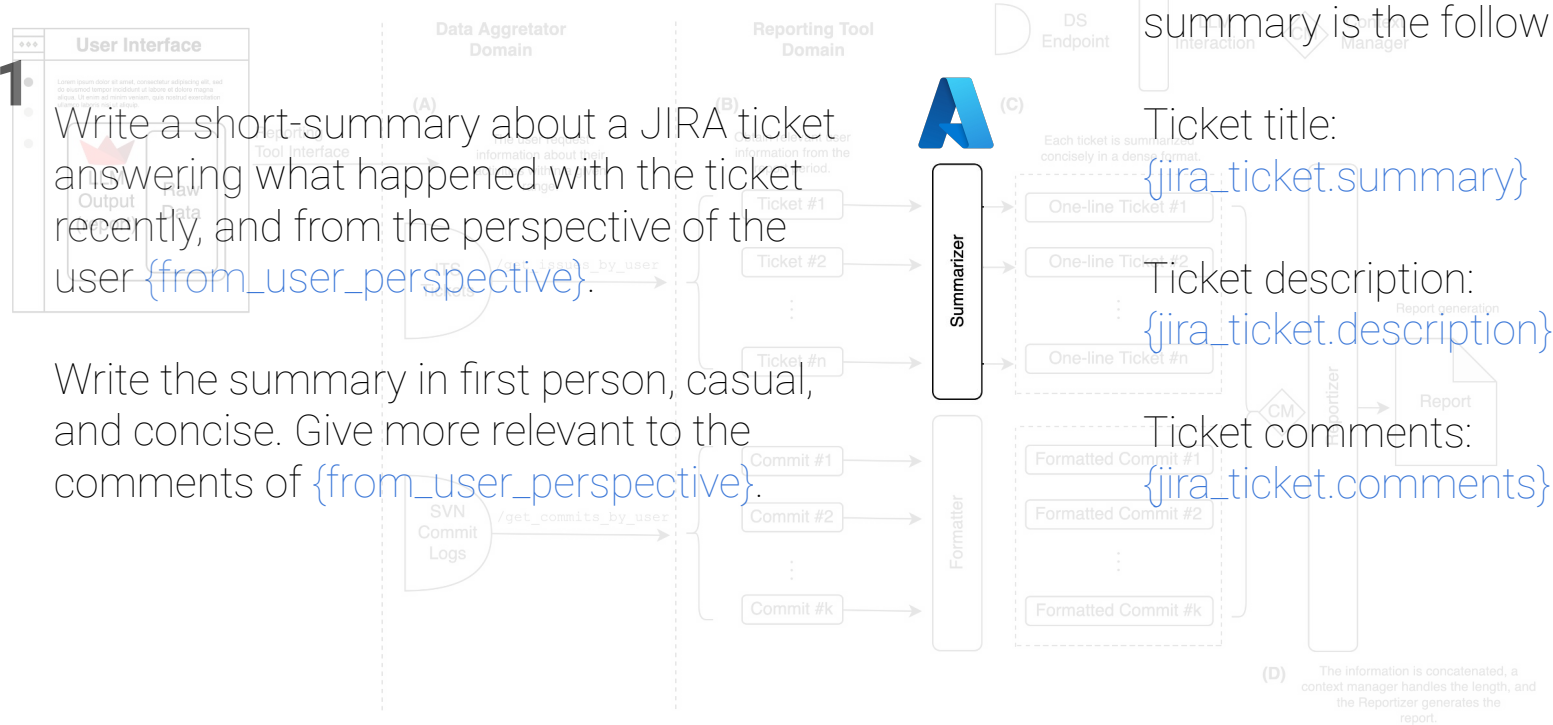
Now how the Summarize perform their task...summarize!

2

1

Write a short-summary about a JIRA ticket answering what happened with the ticket recently, and from the perspective of the user `{from_user_perspective}`.

Write the summary in first person, casual, and concise. Give more relevant to the comments of `{from_user_perspective}`.



The information used by the summary is the following:

Ticket title:
`{jira_ticket.summary}`

Ticket description:
`{jira_ticket.description}`

Ticket comments:
`{jira_ticket.comments}`

Now how the Summarize perform their task...summarize!

2

The information used by the summary is the following:

1

Write a short-summary about a JIRA ticket answering what happened with the ticket recently, and from the perspective of the user `{from_user_perspective}`.

Write the summary in first person, casual, and concise. Give more relevant to the comments of `{from_user_perspective}`.



Summarizer

Formatter

Ticket title:

`{jira_ticket.summary}`

Ticket description:

`{jira_ticket.description}`

Ticket comments:

`{jira_ticket.comments}`

3

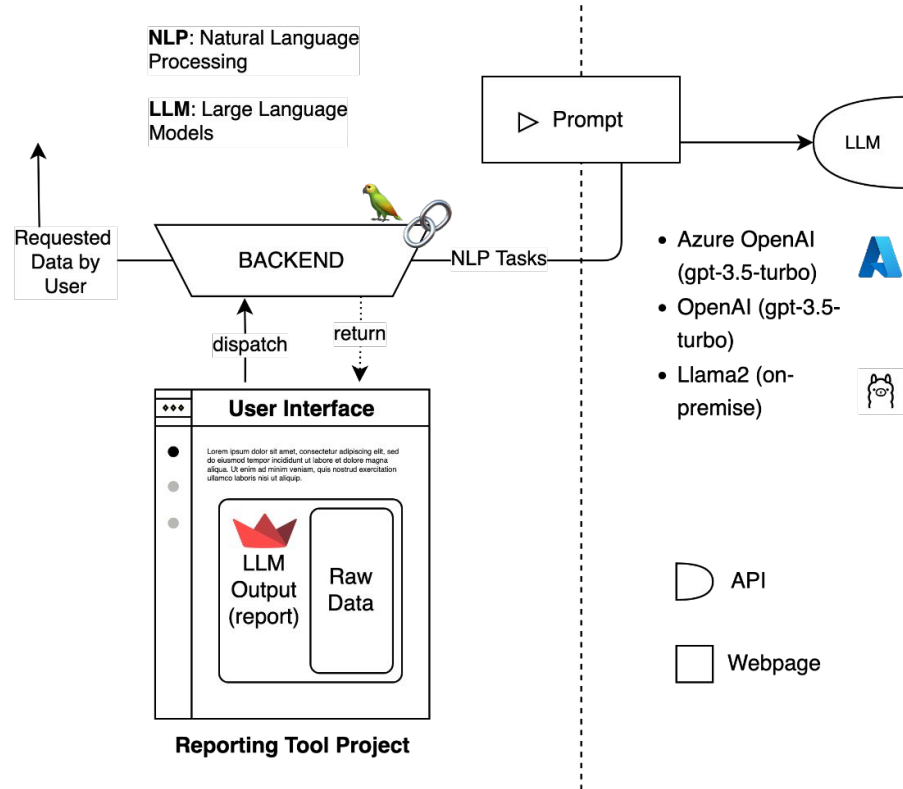
Remember to follow these rules:

- The summary must be concise.
- Avoid mentioning the

`{from_user_perspective}` name in the summary (e.g use "I" instead of "I, jgil,")

Reporting Tool Challenges

Measure and Evaluate Performance

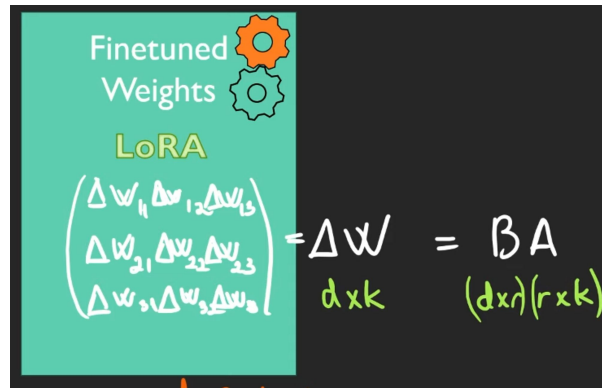


Measure Prompt - LLM Performance			
Prompt #1			
	0.71	0.82	0.52
Prompt #2			
	0.51	0.39	0.44
Prompt #3			
	0.84	0.82	0.71

Reporting Tool Challenges

Proprietary versus In-house models

- ❑ **Fine-tuning:** Adjusting the models parameters with their own data.
 - a. Pros: privacy and more control about the model.
 - b. Cons: requires infrastructure and demand dedicated expertise.
- ❑ **LoRA:** The idea is to represent the finetuned weight as a multiplication of two matrices that use a low rank decomposition. Only finetune a fraction of the model.



$$\begin{pmatrix} \Delta w_{11} & \Delta w_{12} & \Delta w_{13} \\ \Delta w_{21} & \Delta w_{22} & \Delta w_{23} \\ \Delta w_{31} & \Delta w_{32} & \Delta w_{33} \end{pmatrix} = \Delta W = BA$$








$d \times k \quad (d \times r)(r \times k)$



Other Projects

Non-LLM

- ❏ **Rostering Problem:** Use a constraint programming

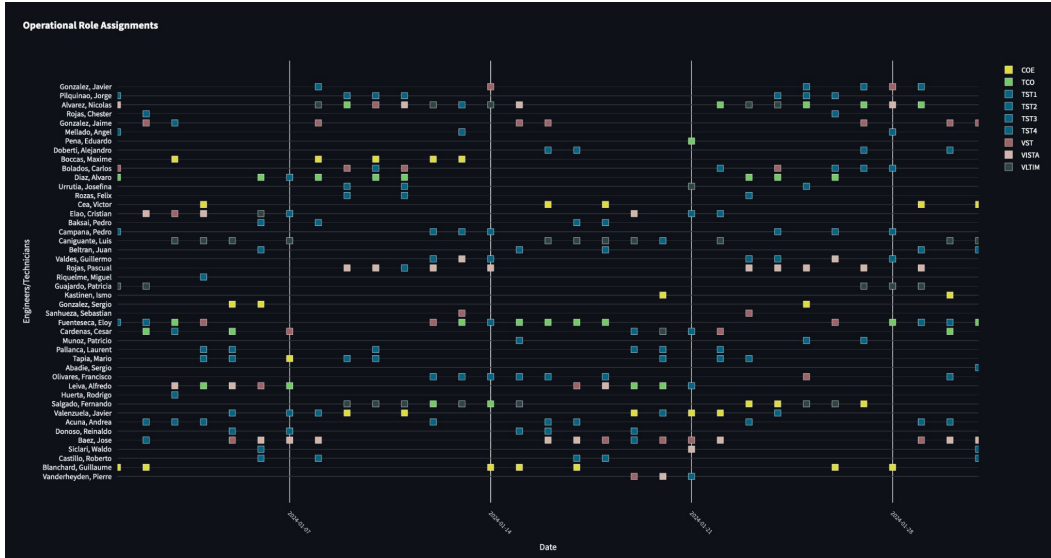
- a. `_set_one_engineer_per_role_assigned` 
- b. `_set_at_most_one_assignment_per_day` 
- c. `_set_availability_and_certification_constraints` 
- d. `_set_consecutive_days_constraint` 
- e. `_set_no_last_day_assignment_constraint` 
- f. `_set_mandatory_role_constraint` 
- g. `_set_balance_objective` 

[illegible]

43

MSE Ops Role Assignment

User interface with Streamlit



Pretty Print the Results 🖨️

Select a month to format

1

Describe sheet name to read

Op Roles

Upload your PXXX excel file for pretty print (.xlsx)



Drag and drop file here

Limit 200MB per file • XLSX

Browse files



P112 MSE 1.xlsx 1.9MB

	P12000000	2023-10-01 00:00:00	2023-10-02 00:00:00	2023-10-03 00:00:00	2023-10-04 00:00:00
3	Boccas, Maxime	0	0	0	0
4	Acuna, Andrea	0	BANF	BANF	BANF
5	Sansgasset, Pierre	PAO\	0	0	0
6	Blanchard, Guillaume	0	0	0	0
7	Aguilera, Gregorio	PAO\	0	L	L
8	Bolados, Carlos	0	TU+	VSTM	VSTM
9	Bourget, Pierre	PoC	PoC	PoC\	0
11	Dauvin, Louise	PAO	PAO	PAO\	0
12	Dubost, Nicolas	0	PAO+	PAO	PAO
13	Gonzalez, Jaime	PAO\	0	0	0

- ✓ Column name "P12000000" matches the pattern of the Op Roles sheet from which is obtain the staff member column is P112 MSE 1.xlsx.
- ✓ The last row of the excel contains a staff member name: **Bel Rosario, Andrea**. However, ensure that this name is the last one in the staff member list.
- ✓ The selected month 1 is within the available months in the P12000000 file.

Download the formatted file Copy/Paste 📄

Download the pretty print as an excel file

n Engineer - COE

03	Blanchard, Guill
06	Kastinen, Ismo
09	Gonzalez, Sergio
12	Valenzuela, Javi
15	Boccas, Maxime
19	Blanchard, Guill
22	Cea, Victor
25	Tapia, Mario
31	Boccas, Maxime
01	Cea, Victor

PSW Scheduling Tool

Collaborate and Test

	A	B	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD			
			Mar-24																																		
Software			Fri 01	Sat 02	Sun 03	Mon 04	Tue 05	Wed 06	Thu 07	Fri 08	Sat 09	Sun 10	Mon 11	Tue 12	Wed 13	Thu 14	Fri 15	Sat 16	Sun 17	Mon 18	Tue 19	Wed 20	Thu 21	Fri 22	Sat 23	Sun 24	Mon 25	Tue 26	Wed 27	Thu 28	Fri 29	Sat 30	Sun 31	Mon 01			
IKA		Kastinen, Ismo	AO	PAO	PAO	PAO	PAO	PAO	PAO	GHQ				L+	L		trav	L	L		PAO+	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO			
SAE		Aedo, Sebastián	HQ			GHQ	GHQ	GHQ	GHQ	GHQ											L								PAO+	PAO	OSS	OSS	OSS	PAO	PAO		
JPA		Araneda, Juan Pablo					GHQ	GHQ	GHQ	OSS	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO		
PBA		Baksaí, Pedro	AO	PAO	PAO	PAO	PAO	PAO	PAO					OSS+	OSS	OSS	PAO	PAO	PAO	PAO	PAO	PAO								PAO+	PAO	PAO	PAO	PAO	PAO		
PBU		Burgos, Pablo	SS	PAO	PAO	PAO	PAO	PAO	PAO					PAO+	PAO	PAO	PAO	PAO	PAO	PAO	PAO									PAO+	OSS+	OSS	PAO	PAO	PAO		
JPG		Gil, Juan Pablo					Fx	PAO+	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO						PAO+	PAO	PAO	PAO	PAO	PAO	PAO	OSS	PAO							
CHE		Herrera, Christian	AO	PAO	PAO	OSS	OSS	PAO	PAO	PAO	PAO	PAO	PAO	PAO	TU+	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO			
VLI		Lizana, Vicente	HQ			GHQ	GHQ	GHQ	GHQ	GHQ				L+	L	L	L	L	L	L	L								PAO+	PAO	PAO	PAO	PAO	PAO	PAO		
NMI		Miranda, Nicolas					PAO+	PAO	PAO	PAO	OSS	OSS	PAO	PAO	PAO	PAO	PAO	PAO	OSS	OSS	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO		
IMU		Munoz, Ivan	AO	OSS	OSS	PAO	PAO	PAO	PAO					PAO+	PAO	PAO	PAO	OSS	OSS	PAO	PAO	PAO	PAO						PAO+	PAO	PAO	PAO	PAO	PAO	PAO		
EPE		Pena, Eduardo	AO	PAO	PAO	PAO	PAO	PAO	PAO					PAO+	PAO	PAO	PAO	OSS	OSS	PAO	PAO									PAO+	PAO	PAO	PAO	PAO	OSS	OSS	
JUR		Schmutzer, Ricardo					PAO+	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO						OSS+	OSS	OSS	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO			
RSC		Urrutia, Josefina					PAO+	PAO	PAO	PAO	PAO	OSS	OSS	PAO	PAO						PAO+	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO	PAO			
GVA		Valdes, Guillermo	HQ				L+	L	L	L	L	L	L	L	L	trav													PAO+	PAO	PAO	PAO	PAO	PAO	PAO		
Schmutzer, Ricardo																																					
Urrutia, Josefina																																					
Valdes, Guillermo																																					
TTRs / Activities																																					
IMU GIV		112.0009 UT4 Nasmyth B Adapter Ro																																			
IKA		112.0011 ASM VLTSW upgrade: wasr																																			
JPG		112.0012 Alignment of all modules in																																			
JPG		112.0013 GRAVITY upgrade to VLTSW																																			
JPG		112.0014 Linux RMN recorder commi																																			
JUR		112.0015 HAWKI upgrade to VLT2022																																			
EPE		112.0016 SPHERE upgrade to VLT20																																			
(blank)		112.0017 UT4 M1/M3 recoating		X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)	X(1)			
PBU		112.0018 GALACSI RTC BOX Science V																																			
PBU		112.0019 ESPRESSO upgrade to VLT																																			
PBU CHE		112.0020 NAOMI upgrade VLTSW 20																																			
PBU CHE		112.0021 Implementation and testing																																			

Internship Memoirs

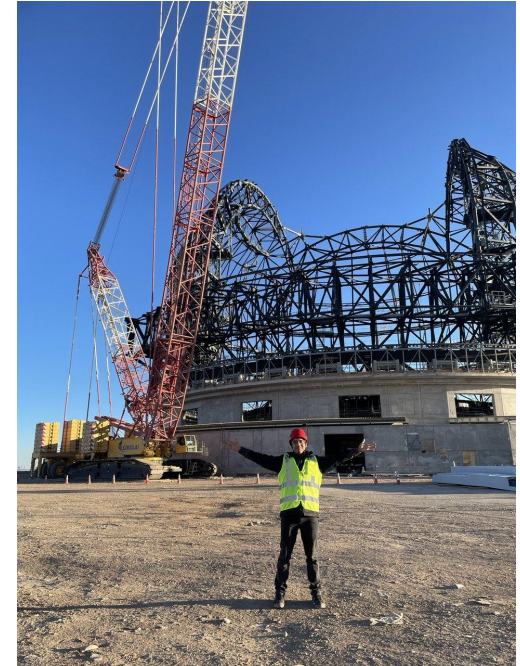
- ❑ Friends and camaraderie! ❤️
- ❑ The sunset at the platform
🌅!
- ❑ Volleyball 🏐!
- ❑ Mind 🧘 & body 🏋️
- ❑ The desert 🌵 and dessert
🍦!
- ❑ The nostalgic short dose
when you arrive at the airport
✈️
- ❑ Thanks to PSW! and JPG for
being excellent advisors!
- ❑ And everyone I know and
shared moments with, there
was a pleasure!



An excellent and lovely group of people



Practicing jump serve with Nico!



Me visiting the ELT (thanks Matteo!)

Thank you!



Engineering with prompts, rather than prompt engineering

Cristóbal Alcázar
MSc in Finance & (not yet) MSc in Data Science