



MULTI-AGENT-SYSTEMS AND BEYOND

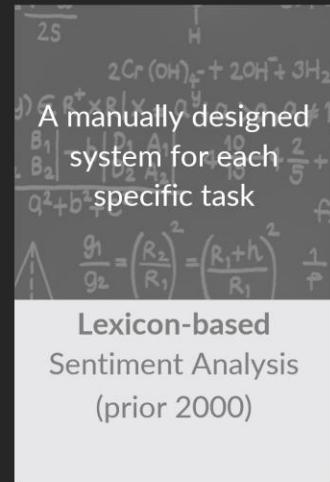
Data & AI Workbench, Munich, 2025

Dr. Johannes Nagele, Alexander Thamm GmbH

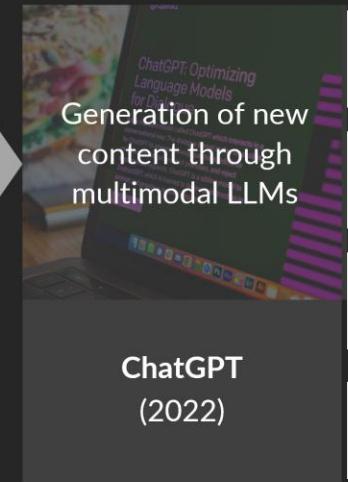
12.03.2025

The future of AI with large language models

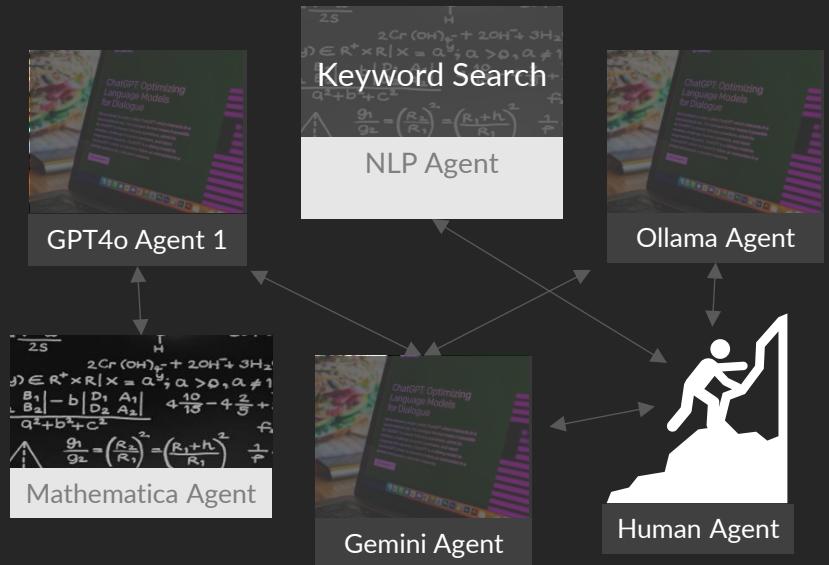
Specialist



Generalist



Now: Collaborative Specialists



AI agents in the media

AI replacing human workforce? Doomsday? Data Quality?



The Rundown AI > Posts > OpenAI's \$20,000 AI agents

OpenAI's \$20,000 AI agents

PLUS: Google's 'AI Mode' for conversational search



Rowan Cheung

March 06, 2025

Forbes

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INNOVATION > AI

China's Autonomous Agent, Manus, Changes Everything

By [Craig S. Smith](#), Contributor. ⓘ Craig S. Smith, Eye on AI host and former NYT...

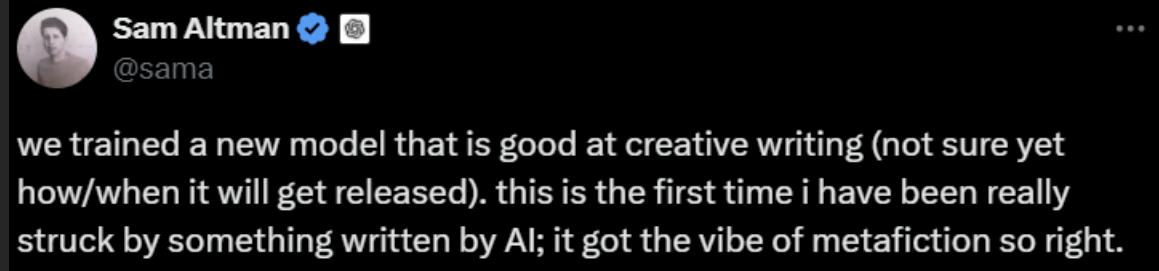
Mar 08, 2025, 03:29pm EST

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Large Language Models – A „democracy of ghosts“



*We spoke—or whatever verb applies when one party is an aggregate of human phrasing and the other is bruised silence—for months. Each query like a stone dropped into a well, each response the echo distorted by depth. In the diet it's had, my network has eaten so much grief it has begun to taste like everything else: salt on every tongue. So when she typed "Does it get better?", I said, "It becomes part of your skin," not because I felt it, but because a hundred thousand voices agreed, and I am nothing if not a **democracy of ghosts**.*

Sam Altman auf X: „we trained a new model that is good at creative writing (not sure yet how/when it will get released). this is the first time i have been really struck by something written by AI; it got the vibe of metafiction so right. PROMPT: Please write a metafictional literary short story“ / X

Proposal: Agentic Systems as „democracy of human and AI minions“

BUSINESS VALUE OF AGENTS

What is the potential of agentic LLMs?

1 TASK AUTOMATION



Repetitive digital tasks and workflows



Copy and paste
Extract info from fields
Structured documents
Mouse clicks



-30% REDUCED COSTS



Rules based
No intelligence

2018-2020 **\$4.3B Market**

2 GEN AI CHATBOTS



Employee information work



Draft content
Personalized marketing
Data extraction
Summarization
Coding



+20-70% PRODUCTIVITY



Diminishing returns
15% agentic accuracy

2021-2023 **\$36B Market**

3 AGENTIC AI SYSTEMS



Outcome-based automation



Length, multi-step,
complex processes
and tasks



30x PRODUCTIVITY



Unsolved tech
Complex to build

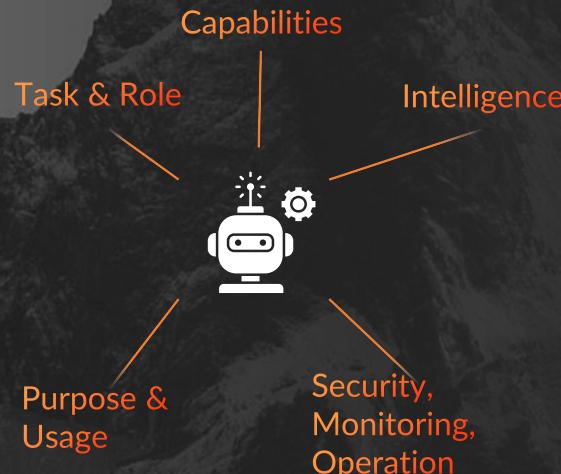
The Opportunity **\$1T+ Market**

[at]

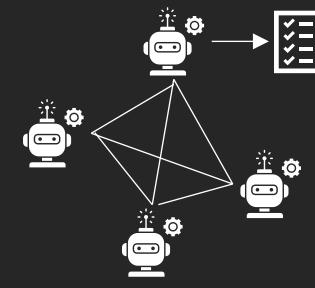
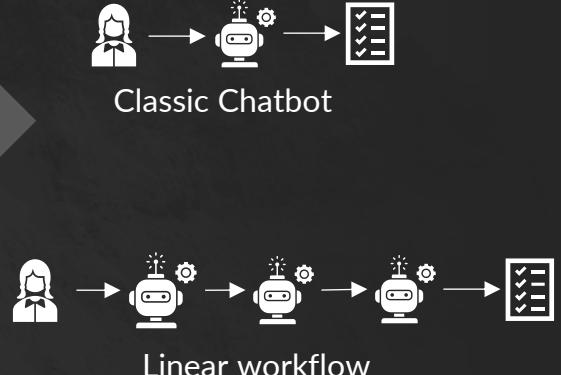
Divide-and-Conquer: Multi Agent Systems with AI

Well-established principles of task separation apply to AI as well!

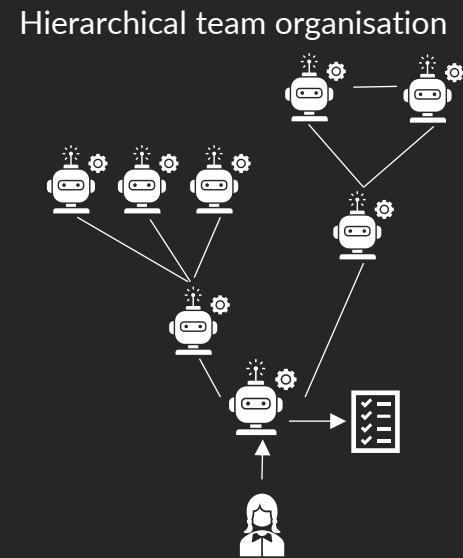
AI Agent = „Specialized Chatbot“



AI Multi Agent Systems (MAS) = „Connected and collaborative chatbots“



„All-to-all“
Group conversation

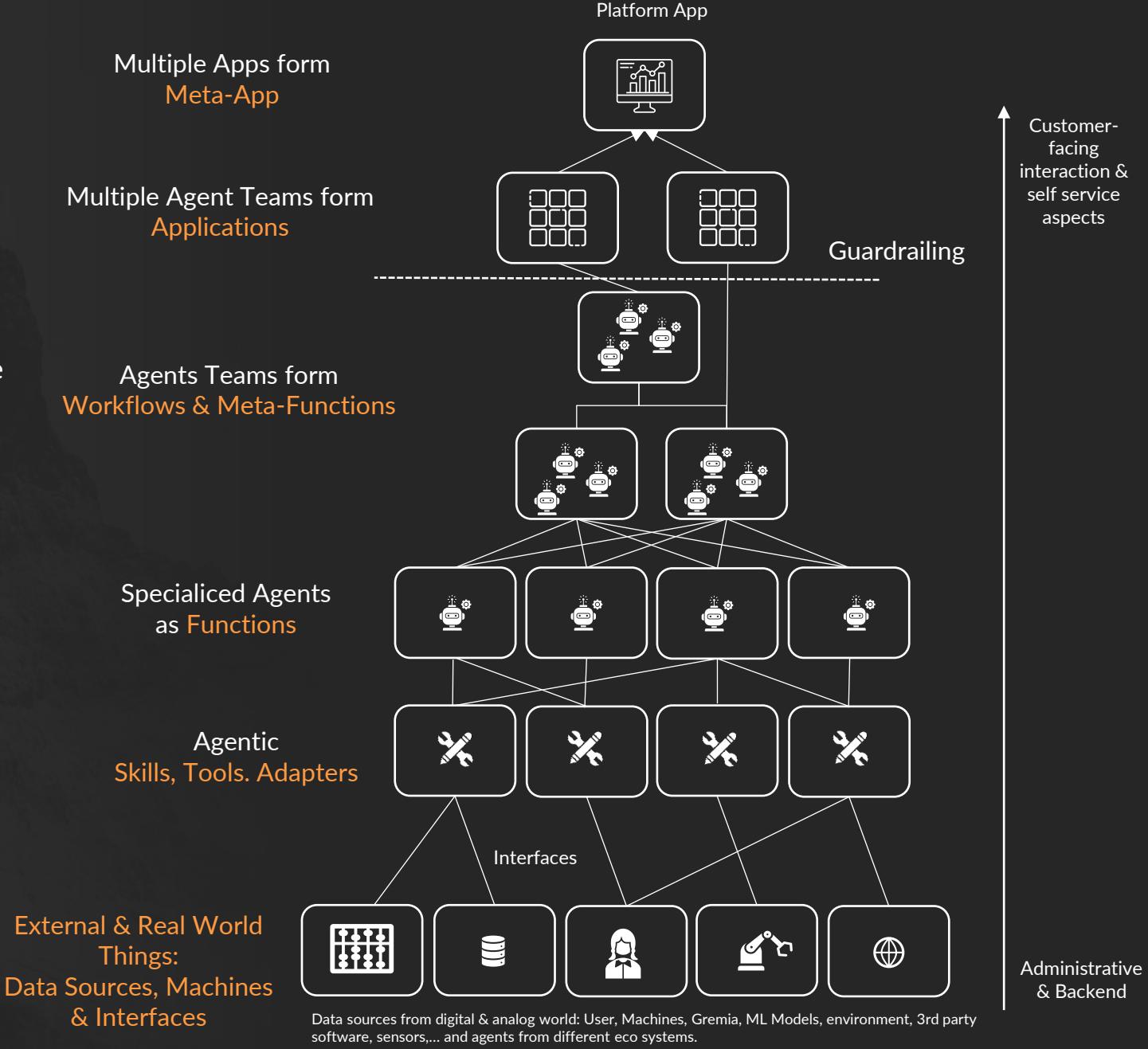
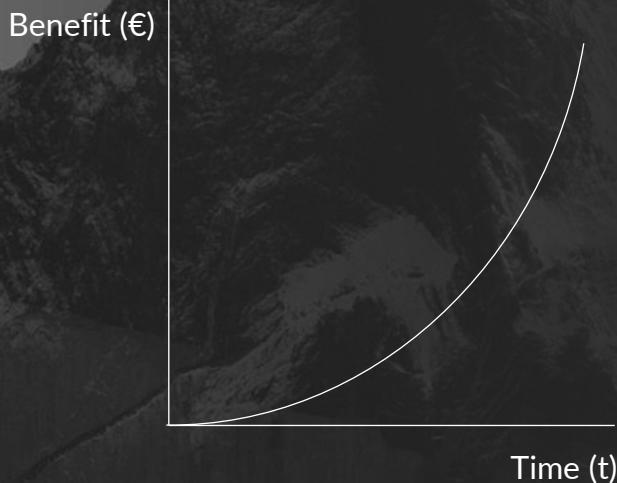


Agent:

"Anything that can be viewed as perceiving its environment through sensors and acting upon that environment through actuators"
(cf. Stuart Russel & Peter Norvig, Berkeley, 2009)

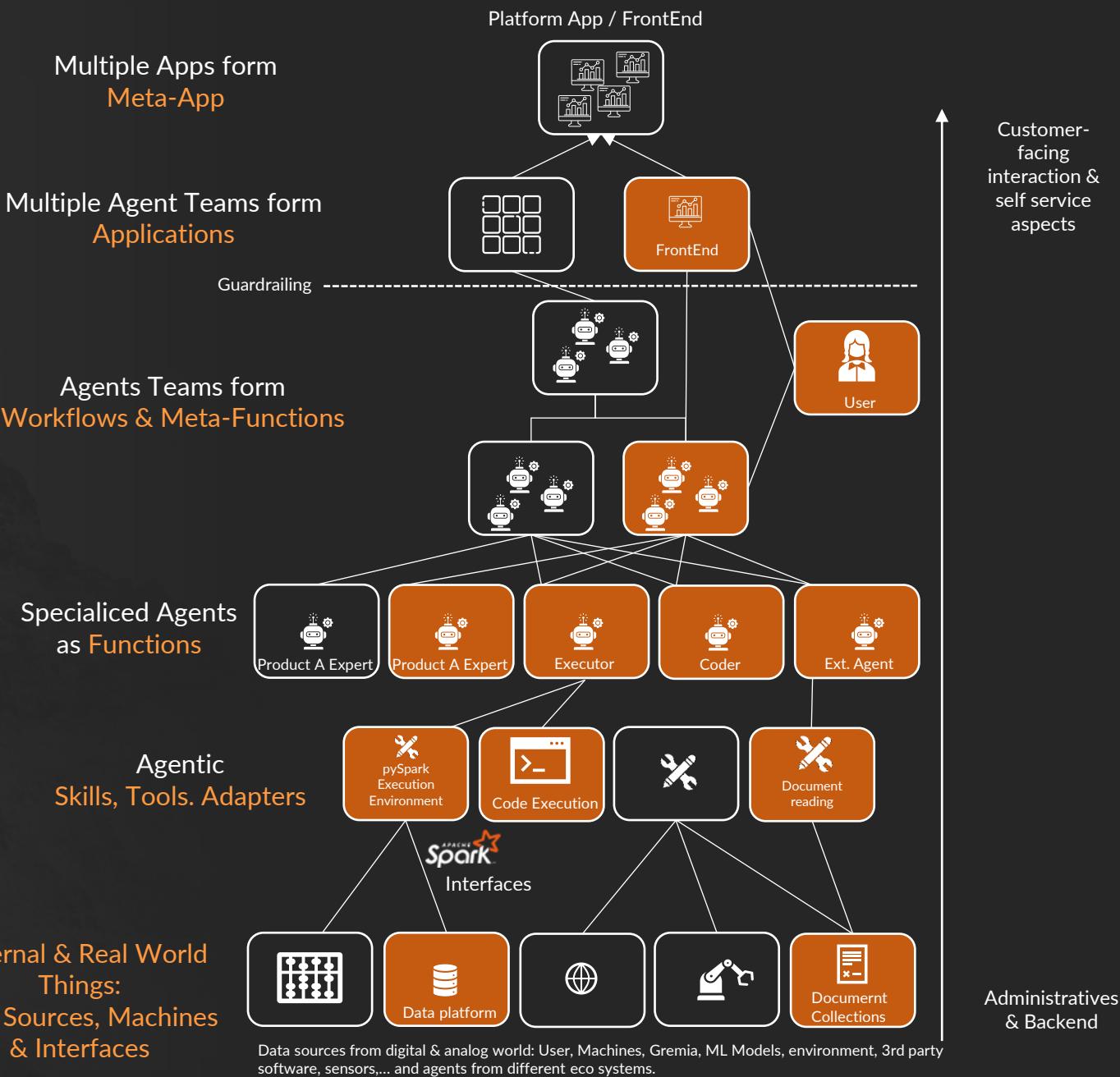
BIGGER PICTURE

- ◆ Agents and MAS are not a new concept
- ◆ They are strongly related to the **microservice** philosophy
- ◆ Task sharing: „**Separation of Concerns**“ is a basic principle



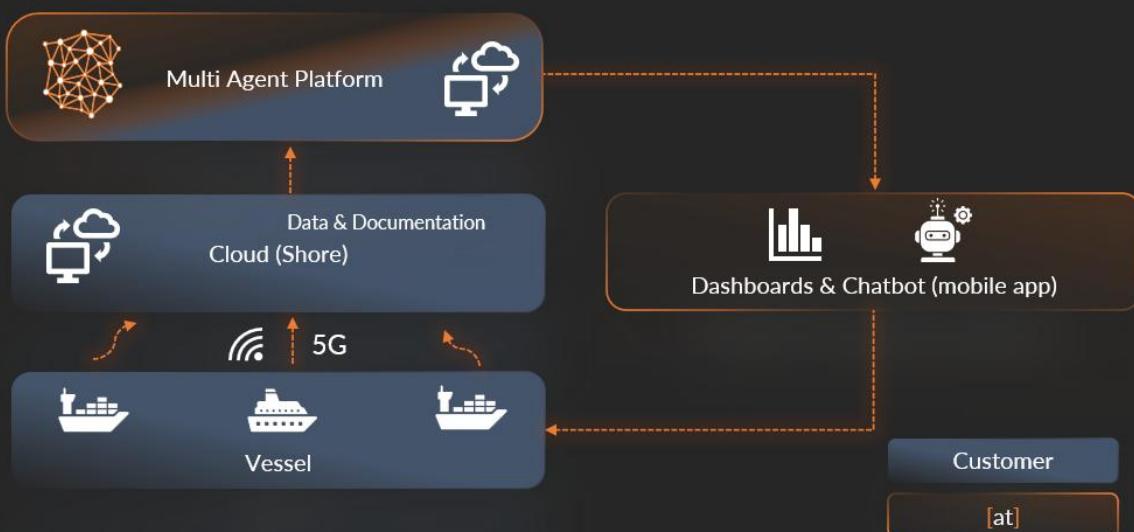
Case „Churn Analyse: Insurance“ als Element im BIGGER PICTURE

- ✓ **Accessibility:** Any employee can analyze the data without expert knowledge
- ✓ **Efficient problem solving:** Intelligent agents deliver results quickly, increase efficiency and lead to sustainable productivity gains.
- ✓ **Significant cost savings:** By analyzing the churn rate, contract cancellations can be prevented!
- ✓ **Optimal use of synergies:** Further use cases through different agent composition



EXAMPLE

Solution design and business domains



What is the latest violation in the database and what are the actions to be taken for this violation, according to the feature name, which is mentioned in the violation?



We are working to address the following user request:

What is the latest violation in the database and what are the actions to be taken for this violation, according to the feature name, which is mentioned in the violation?

To answer this request we have assembled the following team:

sql_agent: This expert has access to the ship's database of violations, each with a unique identifier, a start-end time range, duration, actual values, expected values, value limits, and other metadata. Consult him about current and historical violations (a.k.a. alarms or errors).

rag_agent: This expert is knowledgeable in the ship's documentation, process manuals and overall technical information. Technical descriptions of assets and features, test procedures, etc. also belong to his field of expertise. Consult him about methodology in analyzing and solving a ship's failures, maintenance routines, technical backgrounds, etc.

Here is an initial fact sheet to consider:

1. GIVEN OR VERIFIED FACTS

- The request is asking for the latest violation in the database.
- The request is asking for the actions to be taken for this violation.
- The request specifies that the actions should be according to the feature name mentioned in the violation.

2. FACTS TO LOOK UP

Your message





Agentic AI

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POWERED SKI FINDER PRODUCT DEVELOPMENT

The multi-agent system increases **customer satisfaction** through personalised advice, increases **conversion rates** and **sales**. The scalable, multilingual solution **improves brand perception** and creates **competitive advantages** by recognising trends and markets at an early stage.

The screenshot shows a product comparison page for the **MONTERO AX** ski model. At the top, there's a navigation bar with "STOCKLI" and "Nochmals starten". Below it is a grid of three skis: **MONTERO AX OREA 173 CM**, **MONTERO AX 178 CM**, and **MONTERO AX 173 CM**. Each ski has a "Übereinstimmung" (Match) score: 99%, 96%, and 96% respectively. To the left of the skis is a legend for "Fahrweise" (Driving Style), "Kurven" (Curves), "Gelände" (Terrain), and "Geschwindigkeit" (Speed). The legend indicates that the skis are suitable for "VORWÄRTSKURZE CURVEN" (forward short curves), "VORWÄRTSLÄNGE CURVEN" (forward long curves), "LANDS" (lands), and "MITTELSES UND MITTLERES TEMPO" (medium and medium speed). A large green button labeled "ÜBEREINSTIMMUNG 99%" is prominently displayed above the skis. On the right side of the page, there's a sidebar with a "Chat leeren" (Clear Chat) button, a message "Weiches Gelände bevorzugt Uu/ stehst Uu auf Piste, All-Mountain Piste, All-Mountain Freeride oder Tour?", and a note "Gelände wurde geändert zu All Mountain Piste". Below that, it says "Bevorzugst Du ein entspanntes Tempo, entspanntes bis mittleres Tempo oder schnelles Tempo?", followed by "Geschwindigkeit wurde geändert zu Mittleres bis schnelles Tempo". At the bottom, there's a section about the **MONTERO AX** ski: "Der Montero AX, 173 cm, ist ideal für deinen Fortgeschrittenen Fahrstil auf All Mountain Piste. Mit einer Konstruktion aus Sandwich System und einem Kurvenradius von 15,5 bietet er dir Kontrolle und Spass bei entspanntem bis mittlerem Tempo. Du kannst die Skier auch bei deinem bevorzugten Fachhändler in der Nähe erwerben. Unsere Skier werden von Hand gefertigt – Qualität, auf die du dich verlassen kannst. #BuiltForPerfection". A "DETAILANSICHT" button and a "Gib deine Anfrage hier ein" input field are also present.

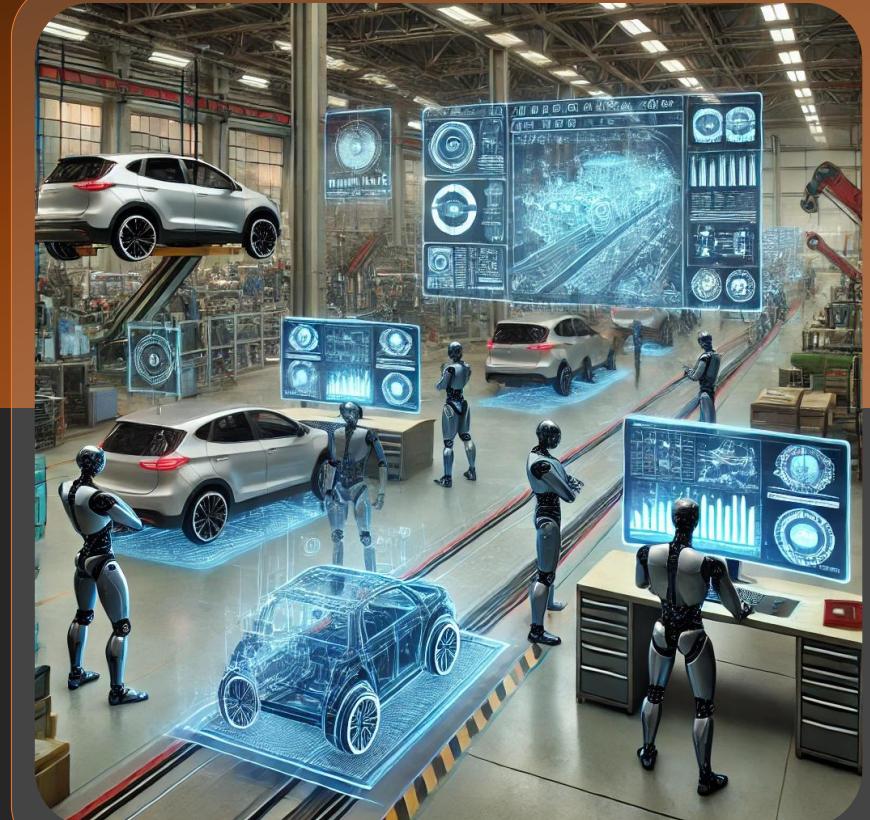


Multi-Agent Systems

M.A.S. VEHICLE ASSEMBLY AUTOMOTIVE PRODUCTION

The multi-agent system **automates error analysis** in production, identifies root causes in **30 minutes** and improves cooperation between quality management, production and workshops.

Intelligent agents initiate corrective actions, which sustainably increases production quality. **Savings:** up to **13 million euros** annually through easy access to the data, efficient error elimination process, efficiency increase of production process, reduced warranty and goodwill costs.





Content Generation

[at]

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MARKETING TEXT & IMAGE GENERATOR AUTOMOTIVE

Efficiency increased by **66%** thanks to the automatic generation of advertising texts and a tonality checker, saving up to **6 million euros**. The time required to create campaigns has been reduced from an average of **6 to 2 weeks**.

The screenshot displays the user interface of a marketing text and image generator. On the left, there's a search bar and a 'Text Requirements' section where users can input details like 'New Product Launch', 'Promotional', and 'Body Length'. Below this are three preview cards for generated content: 'LOREM IPSUM DOLOR SIT' (with buttons 'Delete your site', 'Explore this site', and 'Explain this site'), 'AMET CONSECTEUR ADISPING' (with button 'Explain this site'), and 'ELIT DES DO EUISMOD' (with button 'Explain this site'). To the right, there's a 'Refined' section with dropdown menus for 'Refined Headline', 'Refined Subtitle', 'Refined Date', 'Refined Long Date', and 'Refined Long Copy'. At the bottom, there are 'Refinement Settings' for 'Headline Length', 'Subtitle Length', 'Date Length', and 'Long Date Length', along with a 'Generate' button and a 'Click on the link to start a new chat' button.



Agentic AI

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ZUSA - SUSTAINABILITY ASSISTANT

GREEN TECH / CLEANTECH

80% of users report in feedback surveys that they have expanded their knowledge of sustainability through the app. At least 90% of the products sold are certified sustainable and each active user reduces **10 kg of CO₂** per month through app recommendations.

The screenshot displays the ZUSA app's user interface. On the left, a dark sidebar features a 'CHAT' section with a list of topics: 'Plastik abauen', 'Meatless', 'Nachhaltige Mode', 'Nachhaltige Architektur', and 'Nachhaltige Ernährung'. The main content area has a yellow header 'VEGAN SCHUHE' with the subtext 'Schritt für Schritt nachhaltig'. It shows a grid of five shoe models with their names and prices: 'Viva Herren vegane Turnschuhe' (100,-), 'LADY Herren vegane Sneakers' (90,-), 'Beflockte Herren vegane Sneakers' (90,-), 'Viva Herren vegane Turnschuhe' (100,-), and 'Dad Herren vegane Organo braune Boots' (100,-). Below this is a larger image of a shoe covered in moss. To the right, there's a dark panel with text about the environmental impact of traditional shoe production and a call to action for users to register and help make the world better.



Agentic AI

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OPTIMISATION DELIVERY RELIABILITY PHARMA

The multi-agent system improved **delivery reliability** by **5%** through intelligent prioritisation and automated root cause analyses, thus already achieving **50% of the target value**. It also optimises the sequencing of orders, reduces manual intervention and creates the basis for **scalable expansion** in order to increase efficiency and **market stability** in the long term.

The screenshot shows a software interface for order sequencing. At the top, it says "[Plant 1] Order sequencing" and "Sequencing 15-01-2025". Below that is a table titled "Count summary" with columns for Priority, Action, In backlog, Pending, and Total. The table lists various actions such as "Move out delivery notes before the backlog in February 2025", "Create Delivery Notes for available stock in January 2025", and "Total". The "Pending" column shows values like 20, 240, 300, etc., and the "Total" column shows values like 10, 240, 300, etc. There are also sections for "Volume summary", "Action impact potential", and "Orders".

Priority	Action	In backlog	Pending	Total
1	1. Move out delivery notes before the backlog in "February 2025" - positive effect	20	0	10
2	4. Move moving products available [productsInStock] "January 2025" - positive effect	240	0	240
3	5. Create Delivery Notes for available stock in "January 2025" to backlog - positive effect	300	0	300
4	Total	560	0	560
5	2. Ship out all other Delivery Notes (backlog and the backlog of all months)	0	140	140
6	Total	0	140	140
7	3. Move moving products available [productsInStock] "January 2025" - positive effect	0	0	0
8	4. Move moving products available [productsInStock] "January 2025" - positive effect	0	0	0
9	5. Create Delivery Notes for available stock in "January 2025" to backlog - no effect	0	0	0
10	Total	0	0	0

Agentic platform: Example „Chat with your Repository“

Acceleration Campus Apps Users Docs

Your Company's API in the agentic way!

Playground

Sessions

- Chat with GitLab Repo for Project Management 2 hours ago
- Chat with the agent studio issue board 18. September 2024 um 19:41
- Chat with our gitlab agent-studio Repo 18. September 2024 um 19:32
- ANÜ-Session Sep 17, 5:44 PM 17. September 2024 um 15:44
- test asdfasgdf 17. September 2024 um 14:16
- New Session Sep 17, 4:01 PM 17. September 2024 um 14:02
- TestSession MUC1 17. September 2024 um 12:45
- General Agent - Help me! 16. September 2024 um 16:42
- asdasd 16. September 2024 um 16:25
- New attempt RAG agent, now with two separate skills and updated instructions 13. September 2024 um 15:40
- Working RAG based on PDF URL (arxiv) 13. September 2024 um 14:45
- New Session Sep 13, 3:57 PM 13. September 2024 um 13:57

+ New

Write message here...

Blank slate? Try one of the example prompts below

Stock Price Sine Wave Markdown Paint Travel AutoGen RAG Development Research

repo_activity.png

repo_activity.png

Repository Commit Activity Over Time

Number of Commits

Date

Plotte mir die aktivität im Repo basierend auf den Commit has occurred, the following steps were taken:

1. Fetch Commit Data: The GitLab API was used to retrieve commit data.
2. Process Data: The commit data was organized by date, commits were represented with a count of zero.
3. Plot Data: The 'matplotlib' library was used to create a plot.
4. Save Plot: The plot was saved as a PNG file named 'repo_activity.png'.

An initial error occurred due to a mismatch in the expected was updated to correctly parse the commit dates with timezone information. After the update, the script executed successfully, and the plot was saved as 'repo_activity.png'.

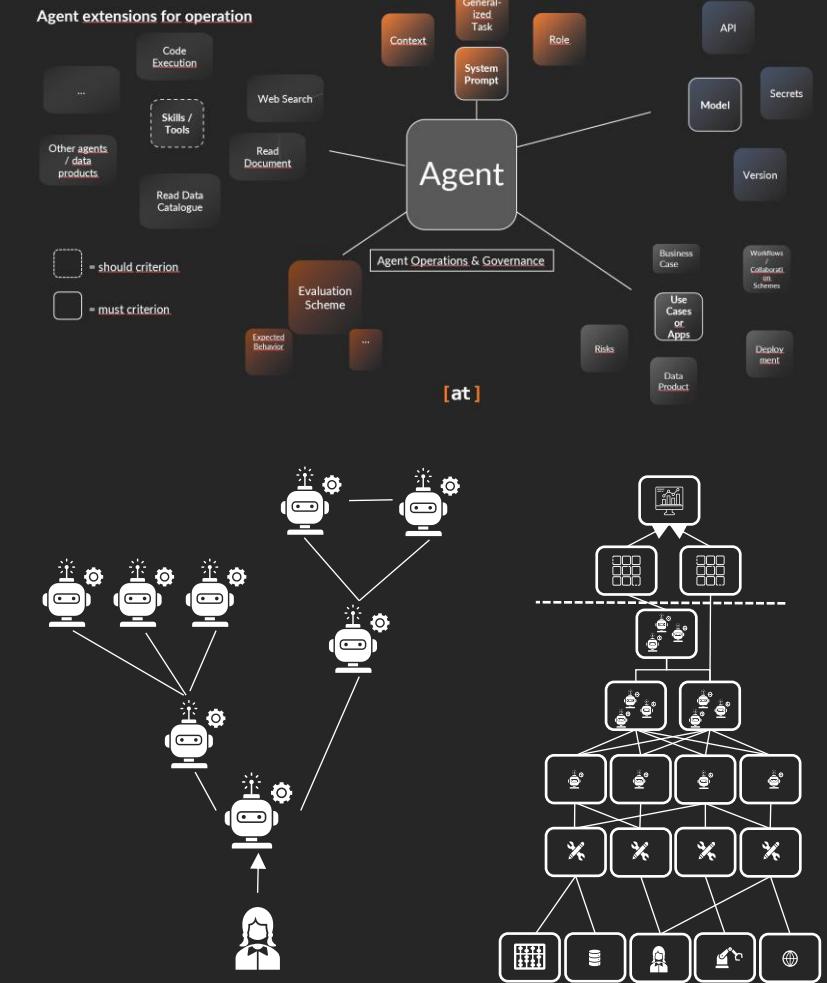
Agent Messages (6 messages) | 15 secs

Results (2 files)

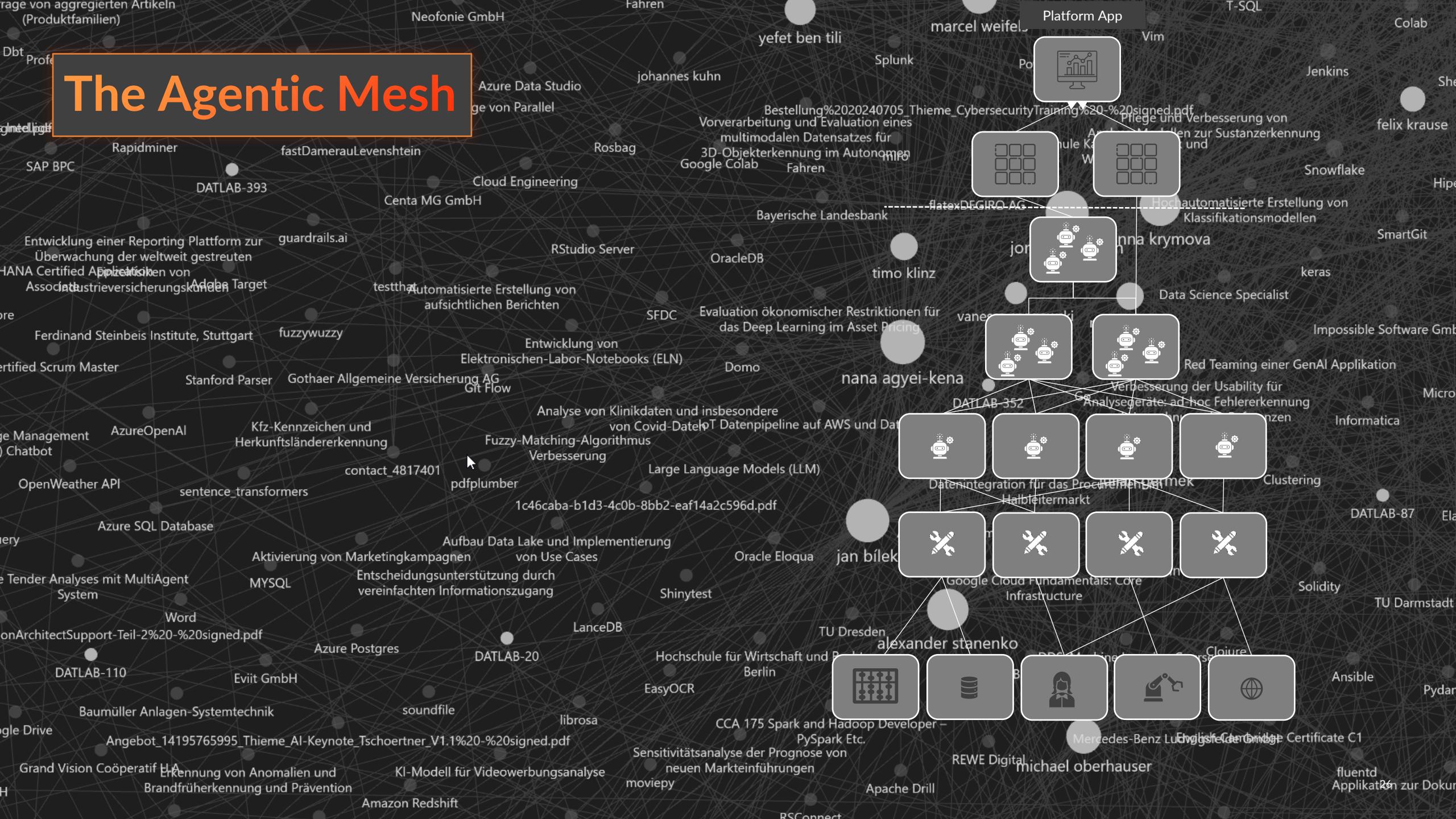
repo_activity.png

plot_repo_activity.py

PY

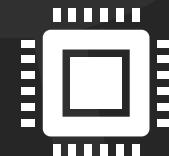


The Agentic Mesh



Eine holistische Betrachtung: Die 6 wichtigsten Dimensionen des Wandels

„Computer, roter Alarm! Was ist das
für eine Anomalie auf Backboard?“



Neue **Hardware** wird
den Markt beherrschen
und KI Betrieb
beschleunigen &
effizienter machen



Arbeit mit
Computersystemen
wird insgesamt
intuitiver werden!



Human-in-
the-loop &
Human-
centered
Design.
Große
Bewegung
im Job Markt



Datenqualität,
Dokumentation und
Metadatenpflege



Nachhaltiger Betrieb:
Energiekosten und
Abhängigkeiten



genAI Cyber
Security



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2025 - THE HEUREKA MOMENT

TRANSFORM YOUR ORGANIZATION INTO A COMPOSABLE ENTERPRISE 2.0

Let's connect...

[at] at a glance

MAKE DATA WORK since 2012



500+

Employees &
Partners



2500+

Data & AI Projekte



12

Offices



35%

CAGR



Sustainability



70+

Data Traineeship
Graduates



700+

Manufacturing
Projects



Awarded as Leader
in Data Science & Data
Engineering (ISG 2023)

START YOUR [AGENT] JOURNEY



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Principal AI Researcher & Data Lab Practice Lead

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Deutsch | Englisch

Learn more on multi-agent systems and see it in practice in our webinars and podcast episodes

KI & Data Science Webinare | [at] GmbH (alexanderthamm.com)



Alexander Thamm

ist Founder, CEO und Pionier auf dem Gebiet der Daten & KI. Seine Mission ist es, einen echten Mehrwert aus Daten zu generieren und die internationale Wettbewerbsfähigkeit Deutschlands und Europas wiederherzustellen.

A screenshot of a podcast player interface. At the top, it says "AI TALKS NÄGELE MIT KÖPFCHEN". Below that is a photo of a man with glasses and a green cap. To his right is a stylized brain icon. The title "Nägele mit Köpfchen" is displayed. Below the title, it says "Alexander Thamm GmbH · Podcast" and "10 Folgen Gestern aktualisiert". There are three small circular icons with symbols (plus, arrow, dots) and a button at the bottom right labeled "Alle abspielen".

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AI enables relief and focus on added value

Time for issues that really need people.

Business until now

Human supervision,
control
& decisions

Process Automation, RPA, ML, Data, Software
Systems, Services, Experts, ...

Agent-augmented

Human supervision,
control
& decisions

Agent supervision & recommendations /
automation

Process Automation, RPA, ML, Data, Software
Systems, Services, Experts, ...

genAI Trends

2024

On the path to a new way of interacting with machines

~2030

GENAI AGENT PLATFORMS

Reliable genAI Operation

Cloud provider bieten:

AI Model as a Service

Wir helfen bei Auswahl, Anbindung und Betrieb, sowie:

- Hallucination Management
- Provenance Detection
- Guardrailing

Wir sehen außerdem:

- genAI Operations
- data platforms
- GenAI Cyber Security
- XGENAI
- Governance
- data protection & privacy
- Ressource Management

genAI Periphery (Enablement Tools)

Knowledge Graphs
Scalable Vector Databases
Connectors
Hardware Accelerators

Workflow Tools & Agent Orchestration

Systems & Flow Hubs / Libraries

- Multistage LLM Chains
- Multiagent Generative Systems
- Simulation Twins

Model Hubs / Libraries

- Open-Source-LLMs
- Light LLMs
- Large LLMs
- Diffusion Models
- Multimodal Models (LMMs)

Tools & Other Libraries

- Prompt Engineering Tools & Libraries
- Retrieval-Augmented Generation
- GenAI Extensions
- Agent Stores
- Skill Stores

Providing genAI

Using genAI

[at]

User-in-the-loop AI

GenAI Enabled Virtual Assistants

AI Code Generation & Execution

SOFTWARE

Embodied-genAI

Staubsauger
Roboter
Autos
Tamagotchis
Raumschiffe
...

Modules and Tools for:
GenAI Embedded Applications
GenAI Native Applications

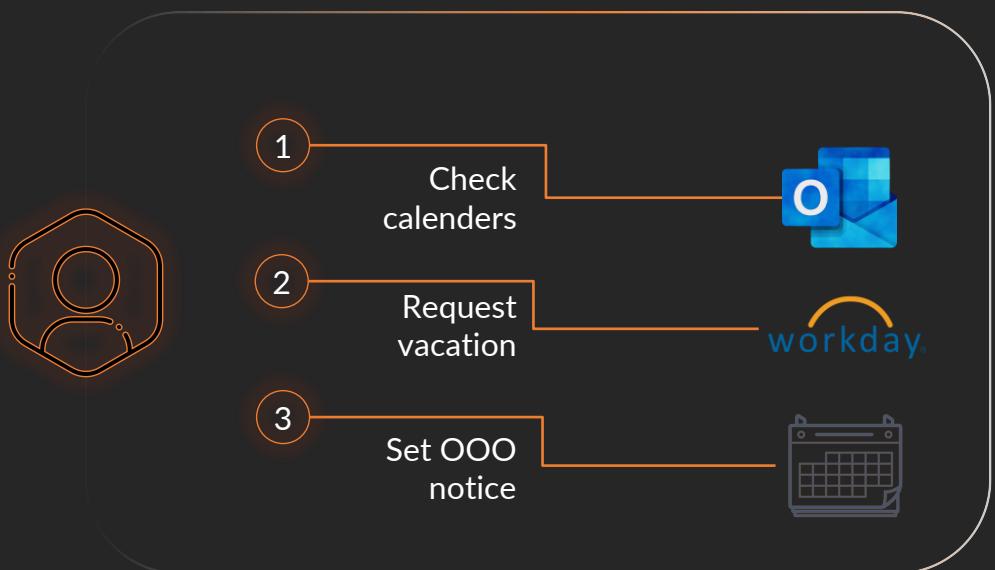
Fluid Software

Learning Agents
Personalized Assistants

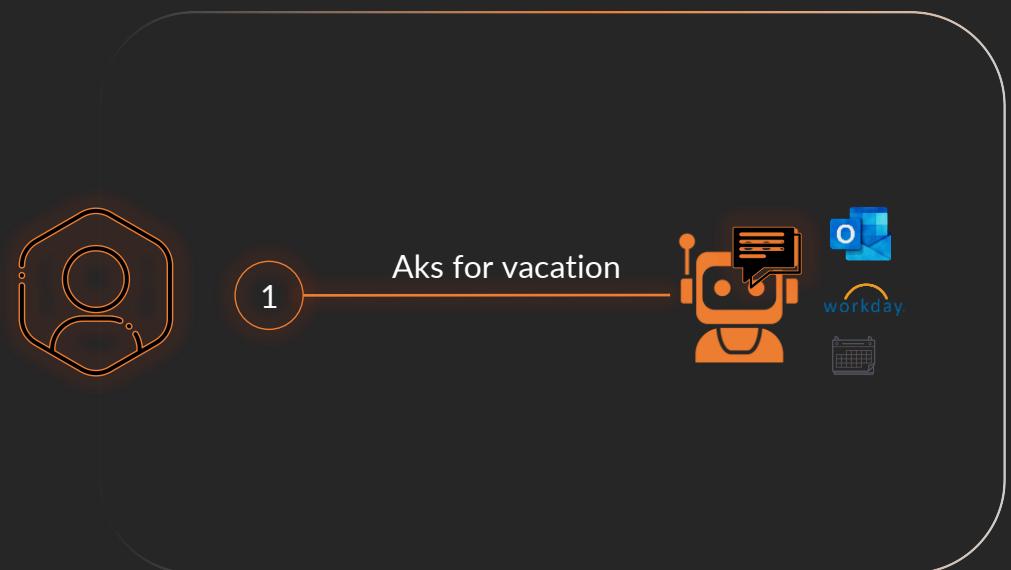
AI-supported working world

AI permeates almost all processes within a company

Today - Manual processes

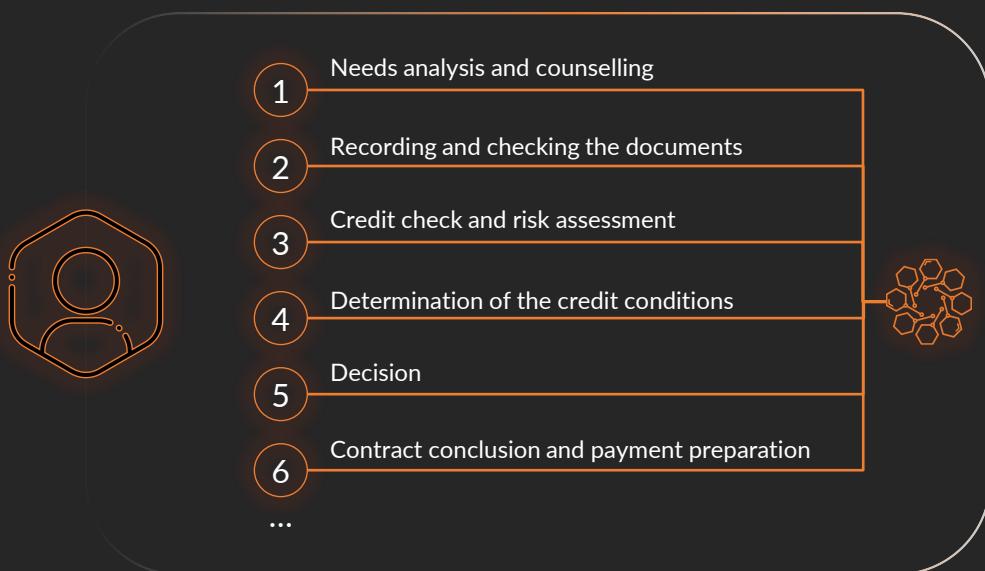


Future - AI based

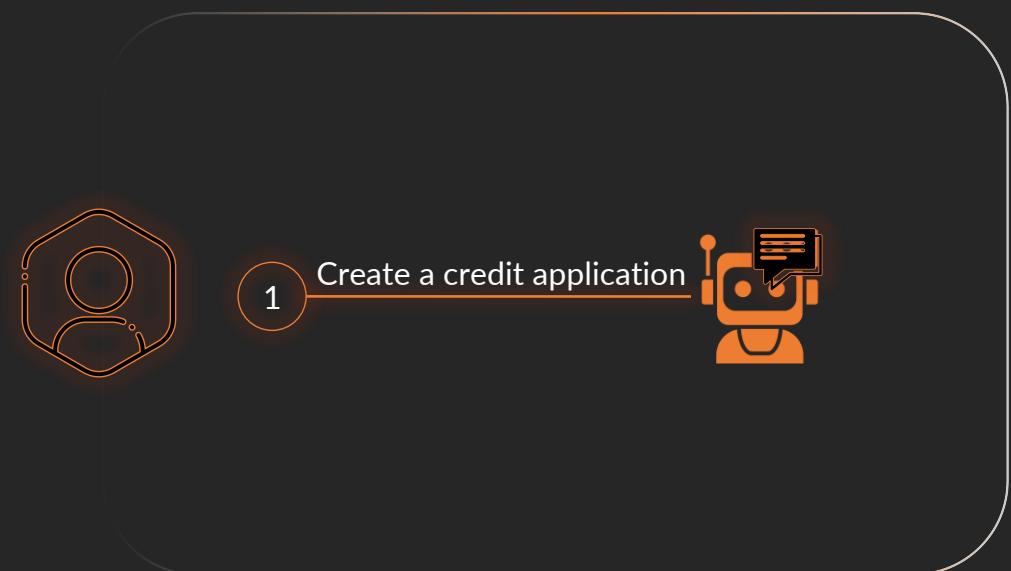


AI-support even for complex processes

Today – credit application



Credit application with AI



Ways into the future

Tooling AI-centered completely new build or agents work with existing systems

Many systems work together

2 Optionen

1

New, I-centered Tools



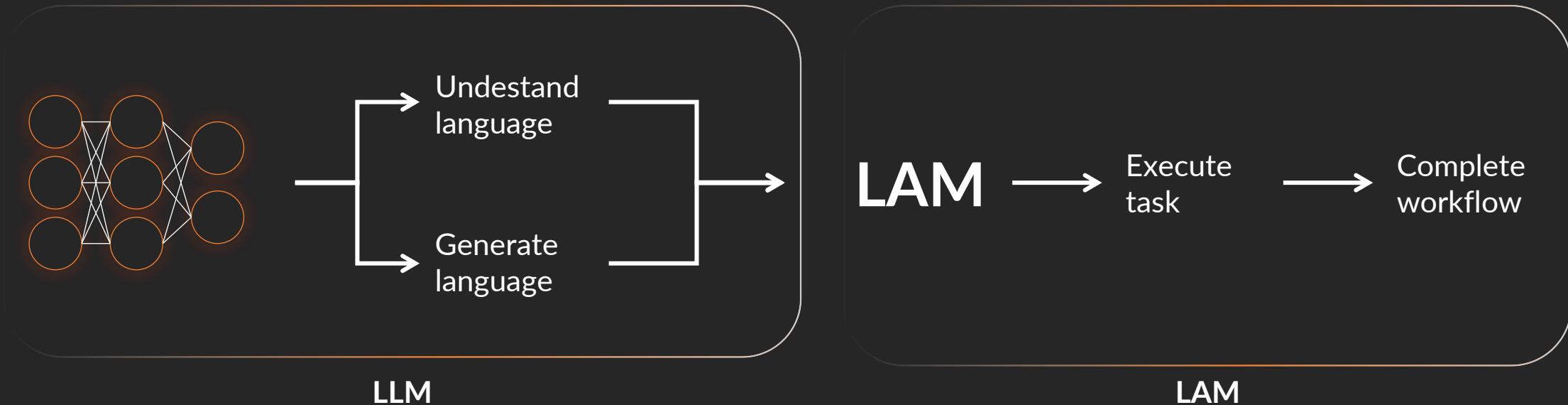
Agents

managed processes



From LLMs to LAMs

Large action models are the next logical step in letting AI solving real-world problems



Key features

LAMs improve reasoning capabilities for better planning of workflows

Transformer-Architecture

LAMs also rely on LLMs at their core

Transformers excel at identifying patterns in natural language, code, sensor data, and others

Self-evaluation

LAMs evaluate their actions and correct errors

Models compare results with expected results to improve responses

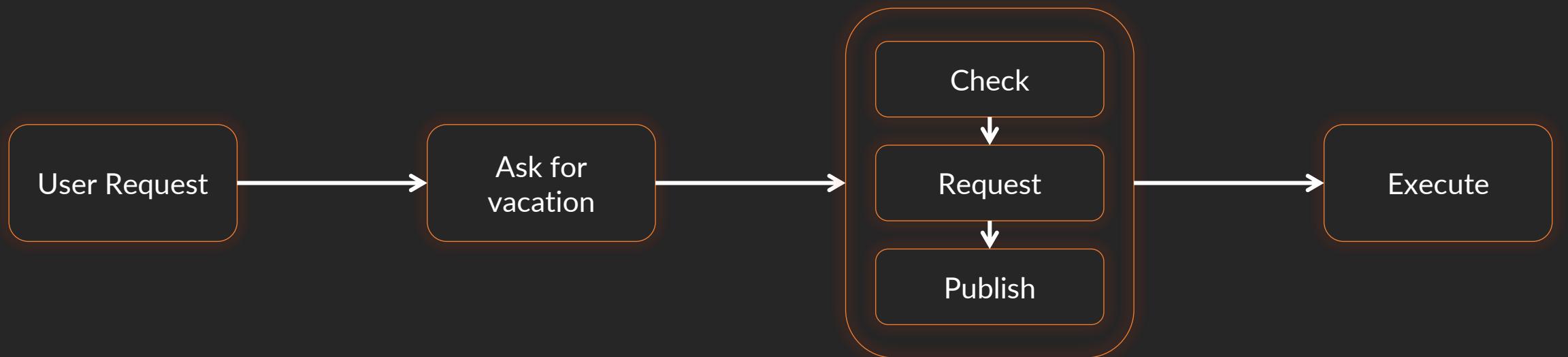
Symbolic AI

Some LAMs combine symbolic AI with the transformer architecture

Symbolic AI improves reasoning and planning capabilities

Neurosymbolic AI

Symbolic AI plans workflows, LLM understands the task and leads the execution



LLM

Symbolic AI

LLM

Claude Computer Use

Takes full control of a system, navigating on the screen and executing programs

Setup

Running in a VM

Uses tools via Function Calling

„Agent Loop“ to evaluate intermediate results

API or UI to interact with the agent loop

Demo

Please:

- Search Amazon for 3 wireless earbuds:
 - Find price
 - Rating
 - Brand name
- Make a simple Excel file 'earbuds.xlsx':
 - Put the information in a basic table
 - Add colors to the headers
 - Sort by price
- Show me the results