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WHAT IS AN AUGMENTED ENGINEER?

Software Engineering in the Age of GenAI

Petra Heck – Associate Professor Fontys ICT - p.heck@fontys.nl

About Me

- 2002 **Software engineer** (MSc Computer Science)
- 2004 **Software quality** consultant
- 2012 Lecturer **Fontys ICT**
  - 2016 PhD “Quality of JIT Requirements” (Computer Science, AI4RE)
  - 2019 Senior researcher AI Engineering (SE4AI)
- 2025 **Associate Professor AI & Software Engineering** (AI4SE & SE4AI)

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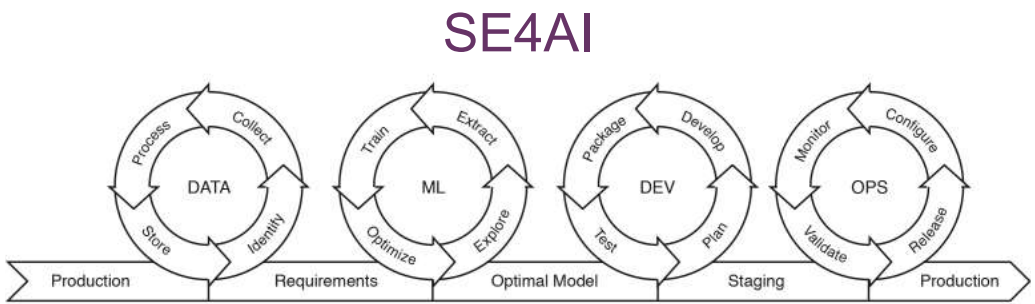
Fontys UAS Education: from SE to AI4SE

2012: “How to build production-ready software systems?” (SE = Software Engineering)
2019: “How to build production-ready AI systems?” (SE4AI = AI Engineering)
2024: “How to use AI to build production-ready systems?” (AI4SE = Augmented Engineering)



AI4SE = AI-Augmented Software Engineering

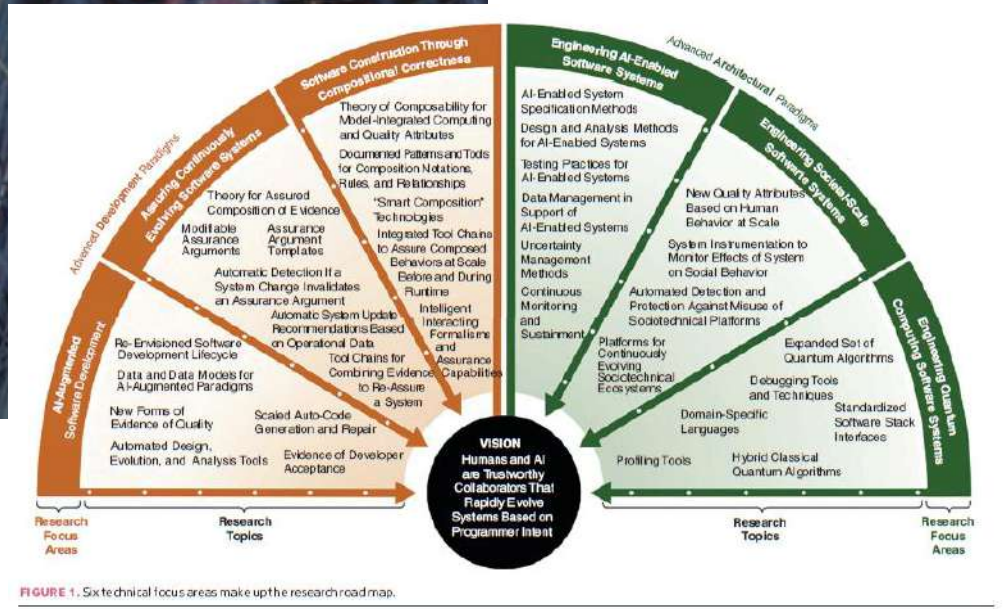
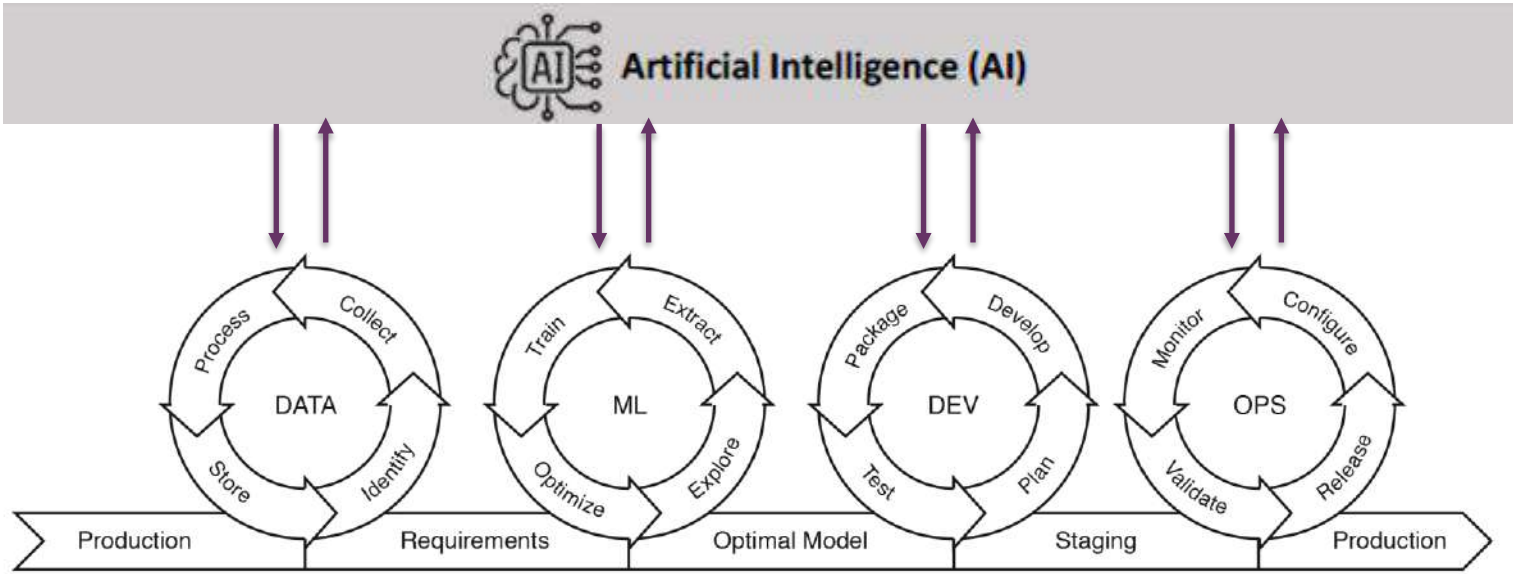


FIGURE 1. Six technical focus areas make up the research road map.

Architecting the Future of Software Engineering: A National Agenda for Software Engineering Research & Development

Eger, Vera& Coppari-Hollmann, Augustin & Milsztein, Aliosha & Borsutzky, Antonia & Wieser, Benedikt & Harjes, Federico & Sartor, Sebastian & Preuss-Neudorf, Felicia & Tscherniak, Isabel & Skupien, Jakub & Seidou, Jonas & Fall, Khadim & Driese, Leon & Zimmer, Linus & Stein, Lizzy & Knoll, Max & Uludoğan, Mehmet & Serbinova, Milena & Sindemann, Niklas & Maurer, Teresa. (2024).
The Future of Software Engineering and IT Operations.

AI-Augmented AI Engineering (AI4AI)



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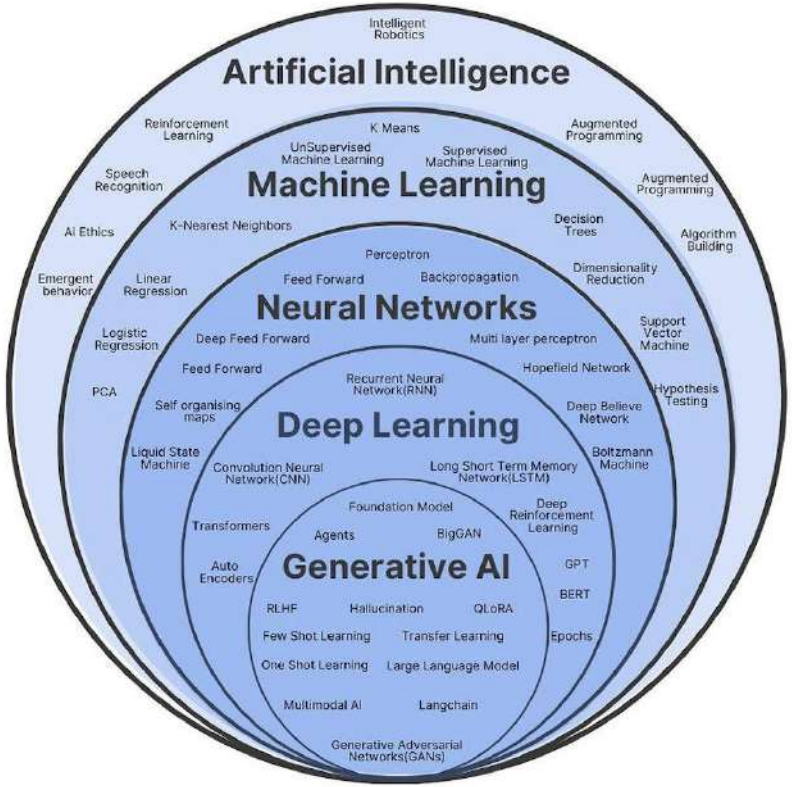
AI4SE = GenAI4SE = LLM4SE



- Emulate human behavior
- Pattern detection algorithms
- Deep neural networks
- Generate content

https://www.analyticsvidhya.com/blog/category/generative-ai

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AI4SE – STATE OF THE ART

AI for Software Engineering (AI4SE)

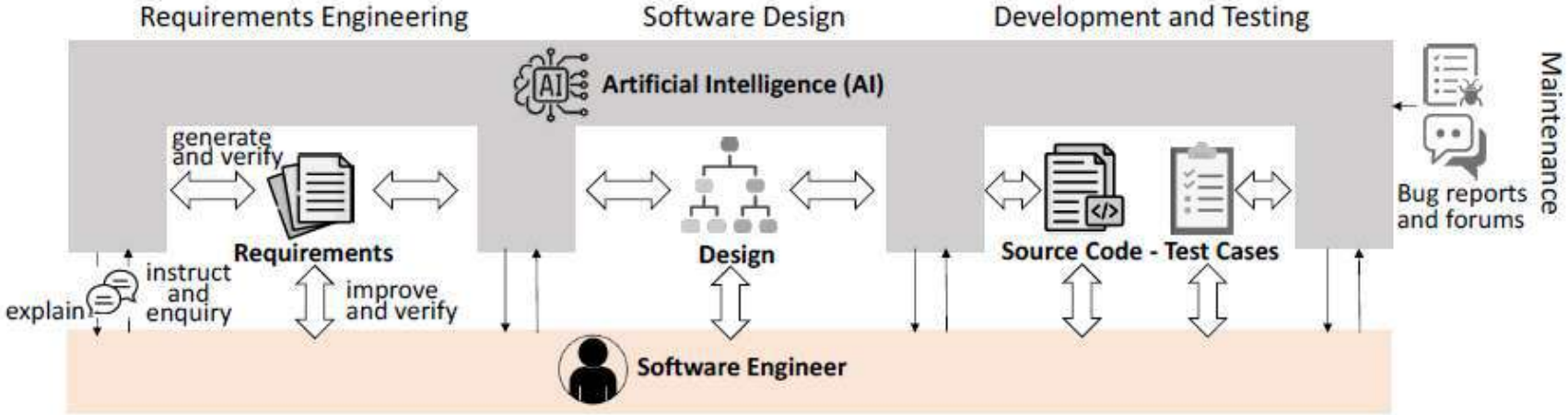

Figure 1: Logical architecture of the envisioned future symbiosis of Software Engineers and AI

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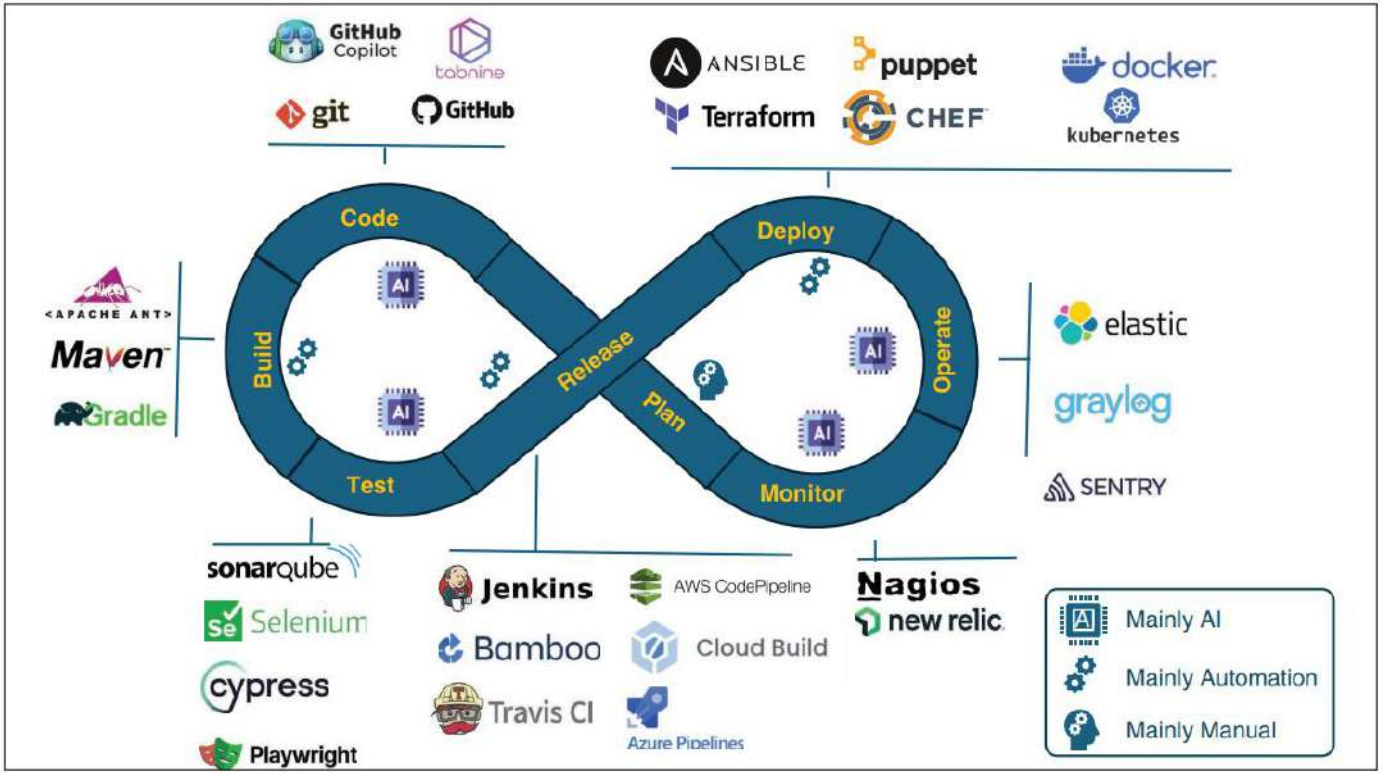
Valerio Terragni, Annie Vella, Partha Roop, and Kelly Blincoe. 2025. **The Future of AI-Driven Software Engineering.** ACM Trans. Softw. Eng. Methodol. Just Accepted (January 2025). https://doi.org/10.1145/3715003

DevOps 2.0



C. Ebert, G. Gallardo, J. Hernantes and N. Serrano, "**DevOps 2.0**," in *IEEE Software*, vol. 42, no. 2, pp. 24-32, March-April 2025

See also: https://spectrum.ieee.org/best-ai-coding-tools

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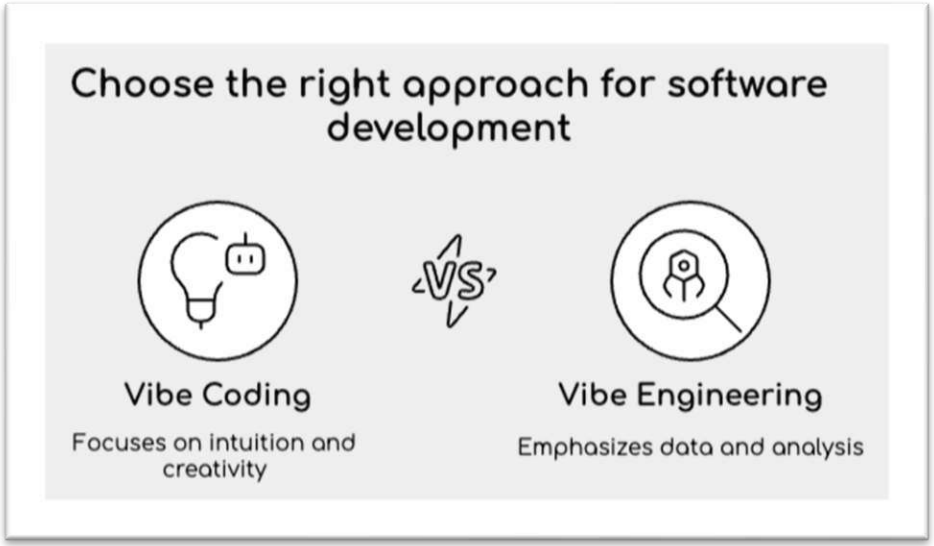
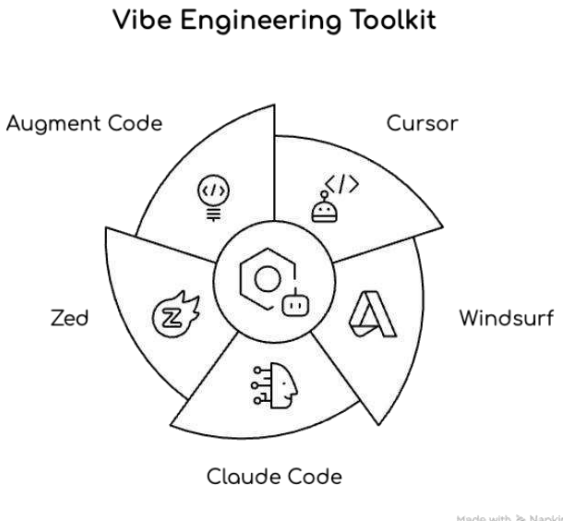
Vibe Coding

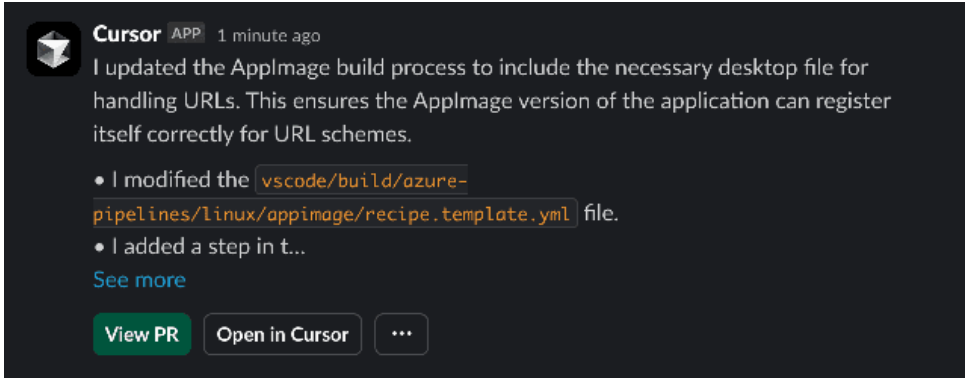
"*It's not really coding - I just see things, say things, run things, and copy-paste things, and it mostly works*" (Andrej Karpathy, 2025)





Vibe Coding Manifesto
(9) Vibe Coding vs Vibe Engineering: The $10,000 Analysis Every Founder Needs | LinkedIn
My AI Skeptic Friends Are All Nuts · The Fly Blog

Cursor Agents



slack

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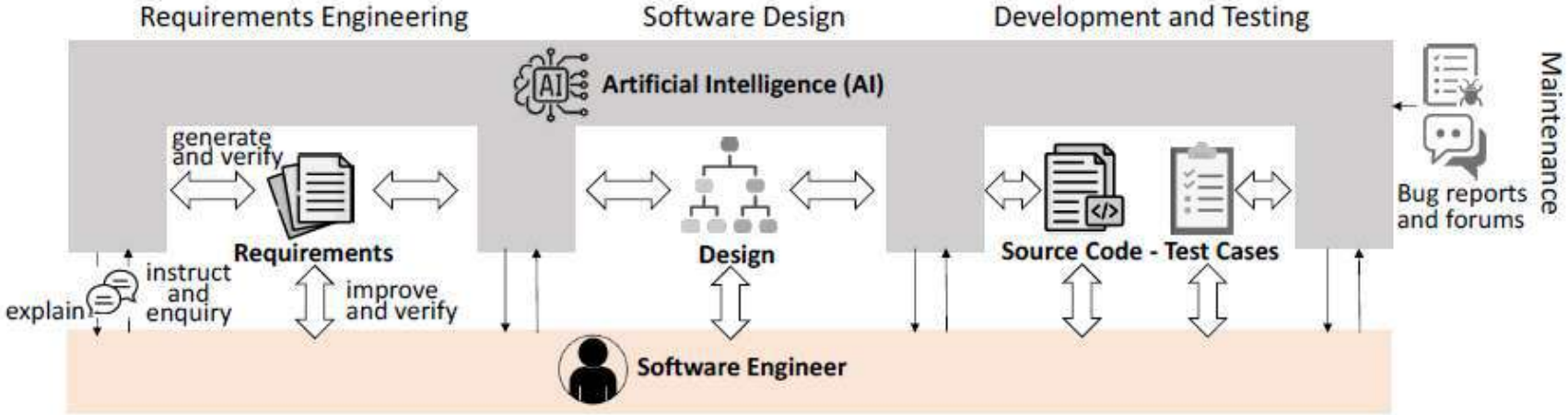
https://cursor.com/en/blog/agent-web

AI for Software Engineering (AI4SE)



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GenAI for Testing – Certification ISTQB

"Generative AI is transforming how we design, execute, and manage tests"

The CT-GenAI syllabus was approved by ISTQB® on July 25, 2025.

[ISTQB® Certified Tester – Testing with Generative AI (CT-GenAI) Press Release - International Software Testing Qualifications Board]

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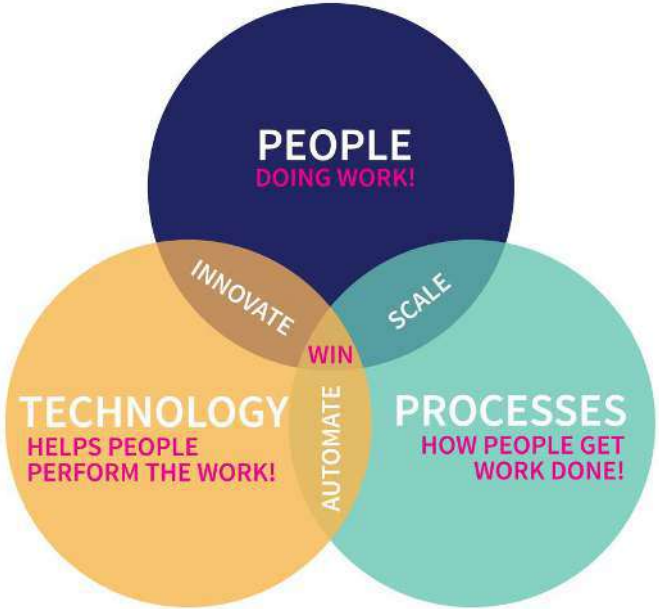
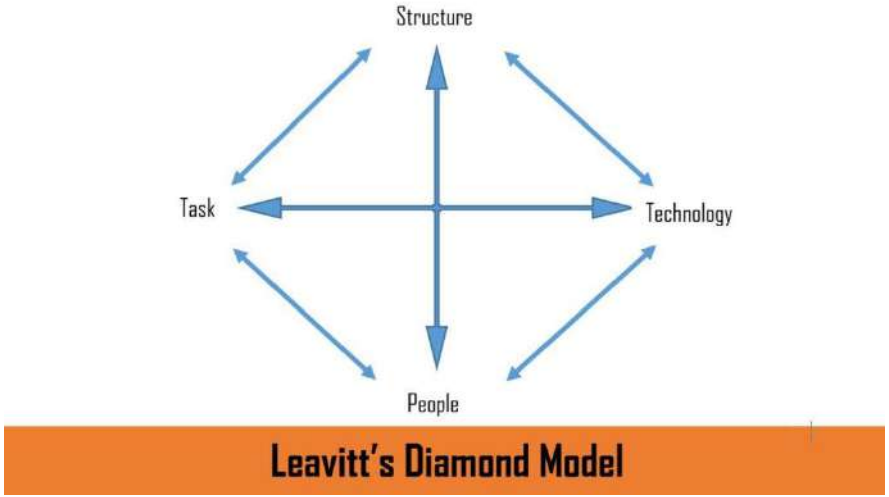
FUTURE OF WORK

“It is not just about technology”



People-Process-and-Technology-Framework



What is Leavitt’s Diamond Model? | CMI

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Future of Work – Translational Expertise

TABLE 4-1 Impacts of Three Technological Eras on the Demand for Expertise

	Expertise Substituted/ Made Obsolete	Expertise Augmented/ Newly Demanded	Ease of Acquiring Needed Expertise
Industrial era	Artisanal expertise (e.g., weaving, shoemaking, clock-making).	*Mass expertise.* Learning rules and mastering tools for manufacturing/production and office/ information tasks ("accomplishing routine tasks").	Literacy and numeracy needed. Owing to high school movement, workers well prepared to acquire industrial era mass expertise.
Information era	Mass expertise. Expertise in learning rules and mastering tools (i.e., carrying out routine tasks).	*Elite expertise.* Combining expert knowledge with acquired judgment to make high-stakes decisions in nonstandard cases. Needed for abstract decision making, communications, and management. Elite expertise becomes the bottleneck when routine tasks are automated.	Often requires a college degree or significant post-secondary education plus years of hands-on supervised practice or apprenticeship (e.g., medical doctor, pilot). Less than one-third of workers qualified.
Artificial intelligence era	May substitute for some "elite expertise"—making it less scarce.	*Translational expertise.* Combining expert judgment with inputs and guidance from artificial intelligence to carry out "elite expert" tasks.	May require foundational training in subject expertise (e.g., law, medicine) plus acquired judgment without necessarily requiring professional levels of post-secondary education.

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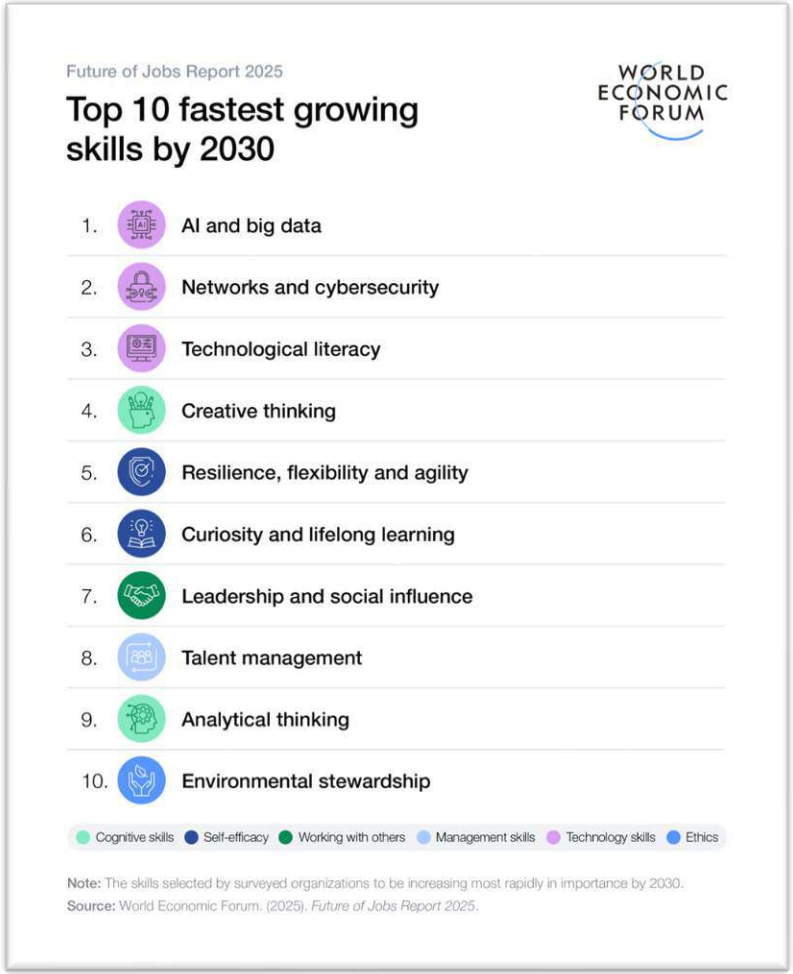
Future Skills

1. **BEING** - Relationship to Self
2. **THINKING** - Cognitive Skills
3. **RELATING** - Caring for Others and The World
4. **COLLABORATING** - Social Skills
5. **ACTING** - Enabling Change

[Framework – Inner Development Goals]

[(11) Why AI Literacy Will Go the Way of the Floppy Disk | LinkedIn]



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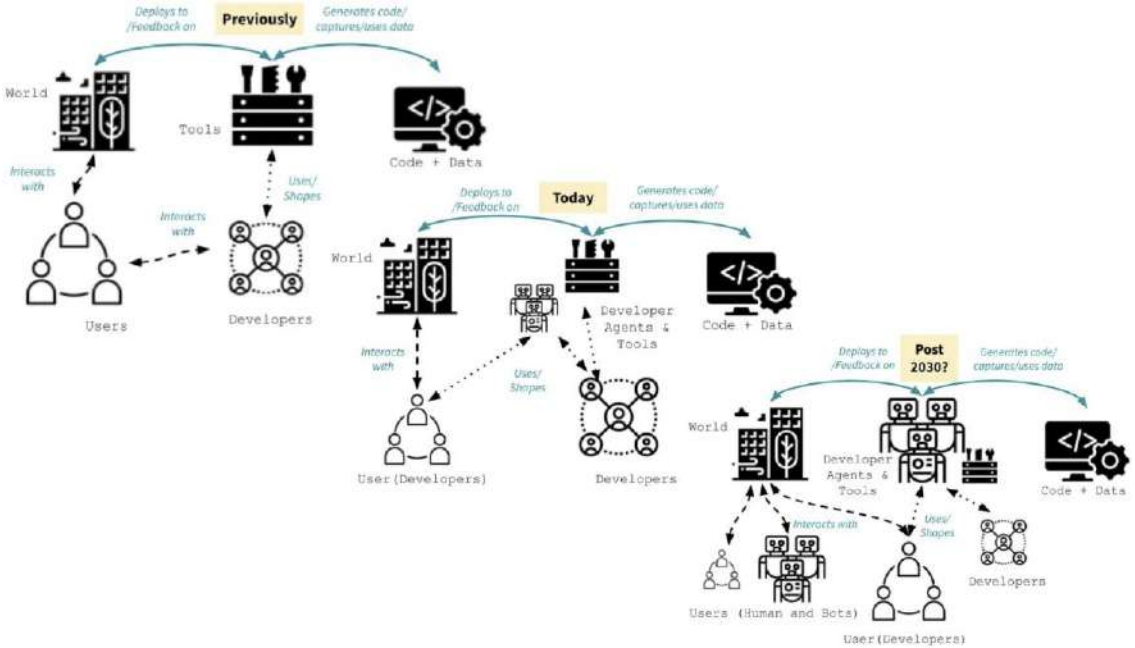
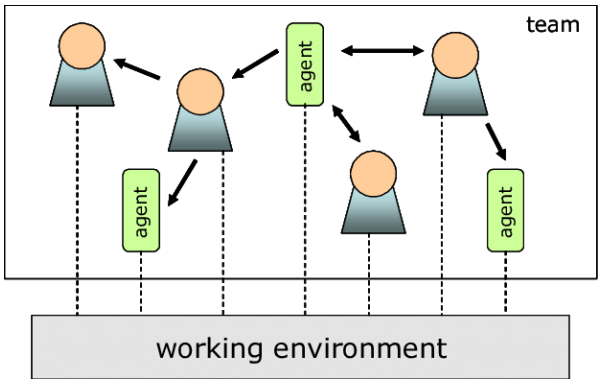
Disruptive Effects of AI on SE





Neef, Martijn. (2006)**. A Taxonomy of human - agent team collaborations**

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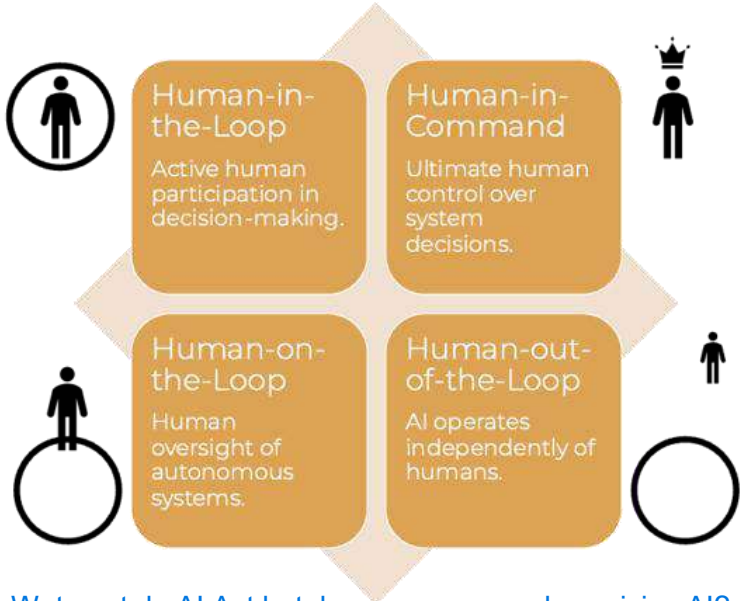
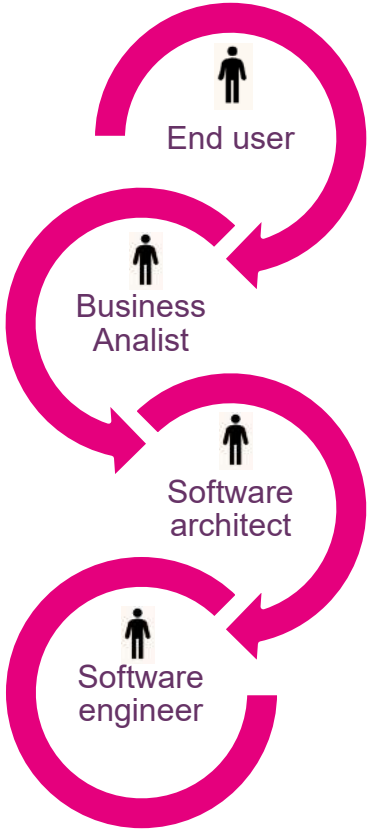
Silvia Abrahão, John Grundy, Mauro Pezzè, Margaret-Anne Storey, and Damian A. Tamburri. 2025.
Software Engineering by and for Humans in an AI Era. ACM Trans. Softw. Eng. Methodol. 34, 5, Article 129 (June 2025), 46 pages. https://doi.org/10.1145/3715111

From Human-in-the-loop to Human-in-the-spiral



Wat gaat de AI Act betekenen voor onze hoogrisico AI?



User-in-the-loop AI (UITL) is a workflow that requires users to be looped into any stage of the AI system development pipeline.

Gartner Impact Radar for Generative AI 2024

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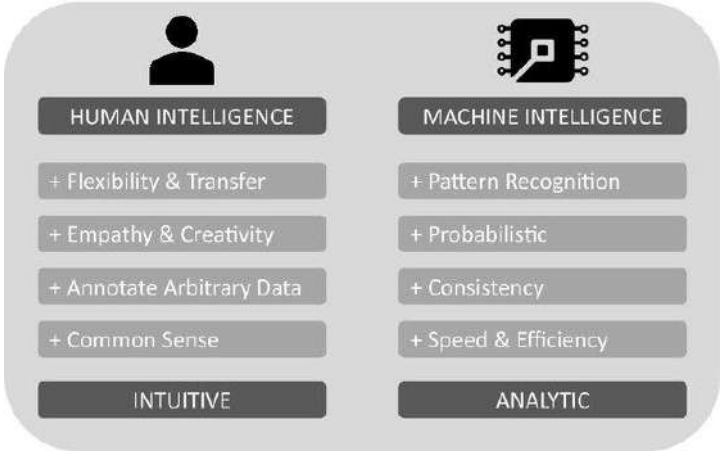
Human-AI Collaboration

https://techybex.com/human-machine-collaboration-the-age-of-artificial-intelligence/



https://link.springer.com/article/10.1007/s12599-019-00595-2

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Menselijk talent en ai: de perfecte tandem voor innovatie - Computable.nl

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APPLIED GENAI @ FONTYS ICT

GenAI Usage Policy

We view Generative AI as both a **productivity tool and a learning tool**. This means we expect you to:

- **Achieve more** in the same timeframe: conduct deeper research, create higher-quality professional products, and engage in more profound learning
- Understand that GenAI will not reduce your study time but will **elevate the standards** we expect you to meet
- Recognize that your **future employers** will expect enhanced productivity with GenAI availability, and our educational standards reflect this reality

FHICT Beleidswiki - Het Fontys ICT AI Manifesto

GenAI Usage Policy – GenZ version

Here's the thing about GenAI – it's basically your **productivity sidekick and learning partner** rolled into one. What does this mean for you?

- You'll be able to **dive deeper** into research, create more impressive projects, and actually understand complex concepts better
- Plot twist: this doesn't mean less work, but rather that you'll **be producing next-level stuff** that matches what employers will expect from AI-savvy professionals
- Think of it this way: if everyone has access to GenAI in the **workplace**, the bar gets raised for everyone – including you

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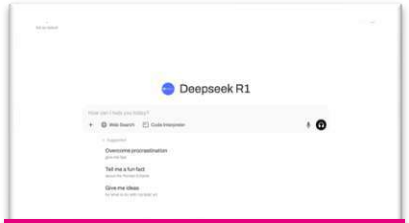
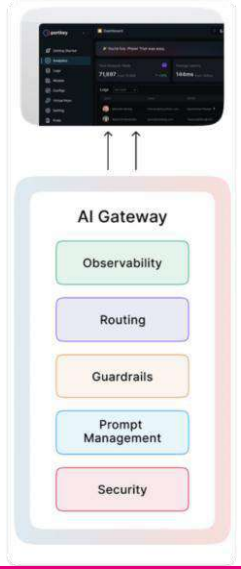
Fontys ICT – Infrastructure



1. Front end

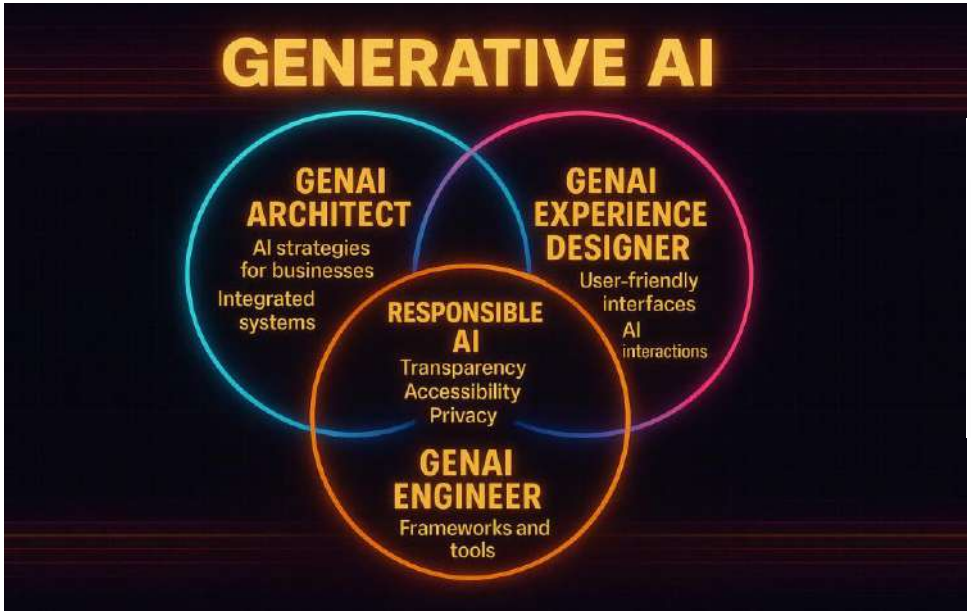


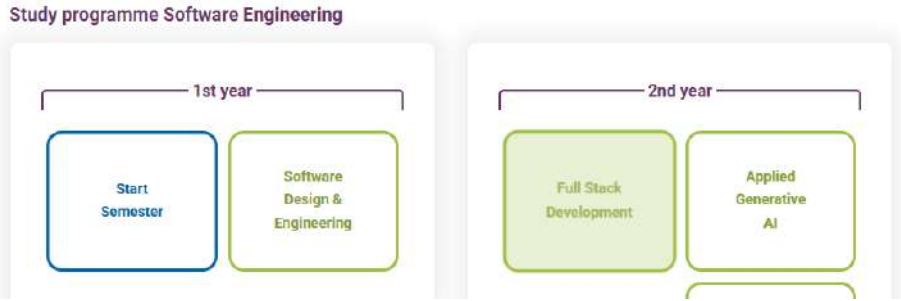
2. Gateway

3. Modelhosting

https://chat.fontysict.nl/

Fontys ICT – New Professional Profiles





[Study Guide Fontys ICT - Applied Generative AI]

[What Is an AI Engineer? An Empirical Analysis of Job Ads in The Netherlands] -> Update for GenAI

VISION AND MISSION

RAISE AWARENESS + INSPIRE

BASIC UNDER-STANDING

FACILITATE

DEEPER UNDER-STANDING

INTEGRATE

RECOGNIZE + APPRECIATE

CLEAR POLICIES + GUIDELINES

COMMUNITY

CONTINUOUS LEARNING & EXPERIMENT

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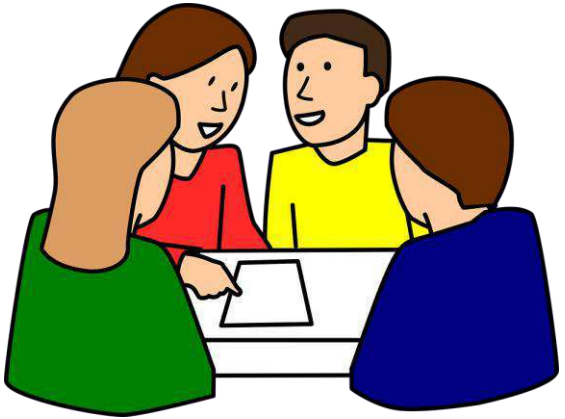
CONCLUSION

Lessons We Are Learning

- Today's impossible is tomorrows possible
- So start yesterday, learning by doing
- Rethink your SDLC, quality is paramount
- Invest in people & tools



"Augmented Engineers build better software, faster"
Let's learn together! coe-ai@fontys.nl

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Centre of Expertise AI for Society | Fontys

Questions?

Petra Heck, auteur op Fontys, p.heck@fontys.nl, https://www.linkedin.com/in/petraheck/

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OTHER TRENDS

Software 3.0: Programming with NL

Software 1.0

computer code

programs

computer

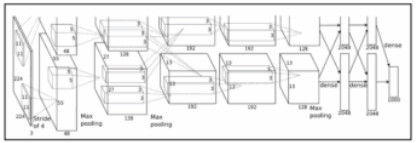
became programmable in ~1940s

Software 2.0

weights

programs

neural net



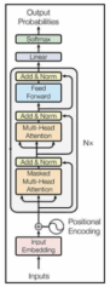
fixed function neural net
e.g. AlexNet: for image recognition (~2012)

Software 3.0

prompts

programs

LLM



~2019

LLM = programmable neural net!

Andrej Karpathy: Software Is Changing (Again) - YouTube

Agentic AI – Tools & Terminology

Choose the appropriate AI type for your needs

AI Agents

Automate simple tasks

Agentic AI

Make autonomous decisions

[AI Agents vs Agentic AI: What's the Difference and Why Does It Matter?]

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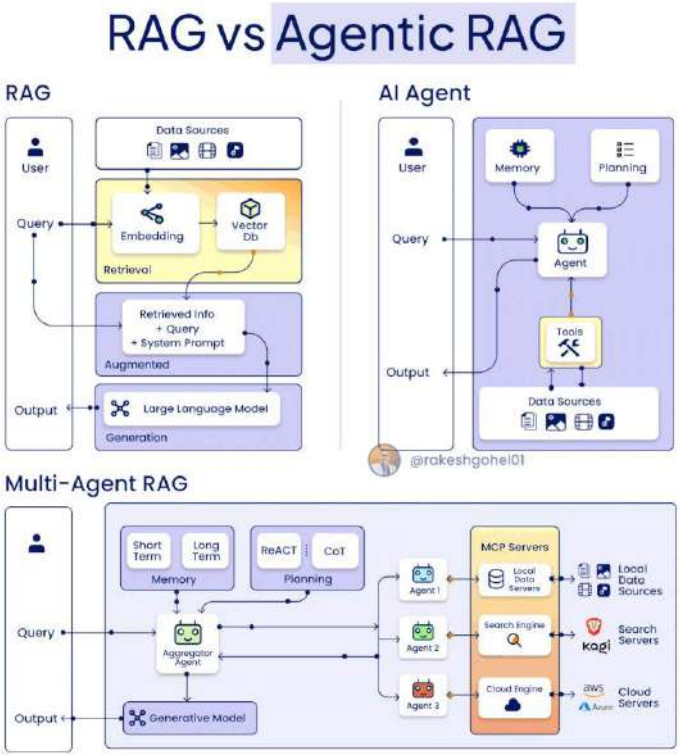
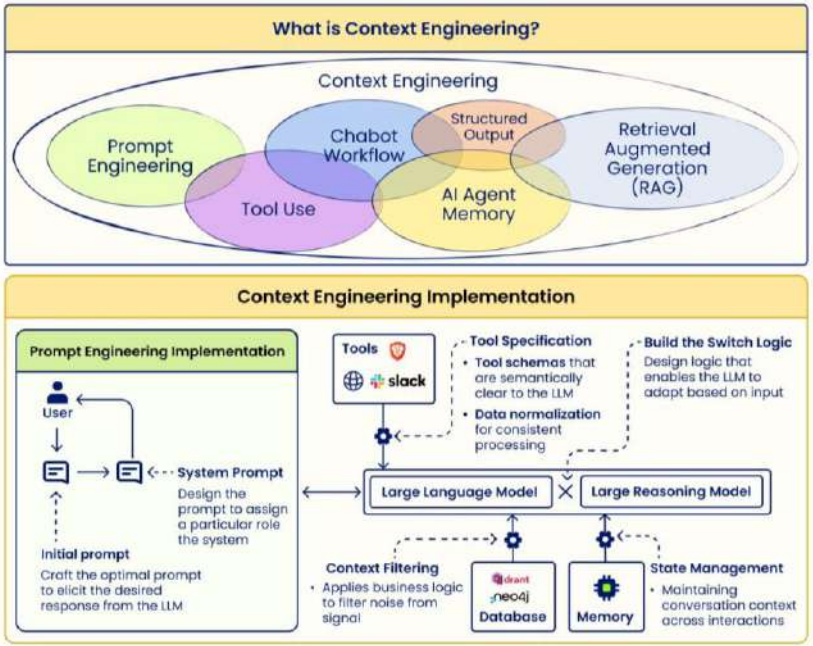
RAG & Context Engineering

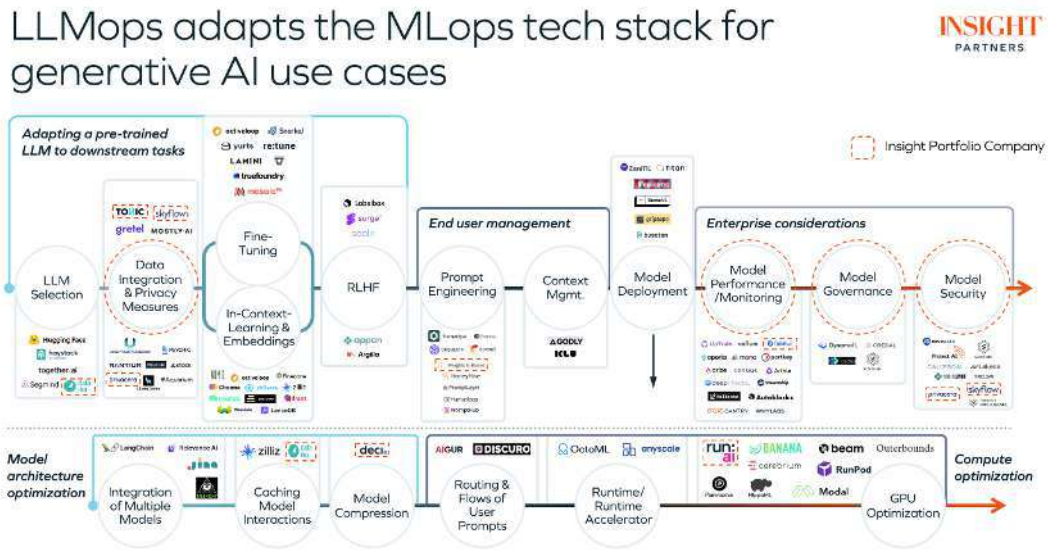


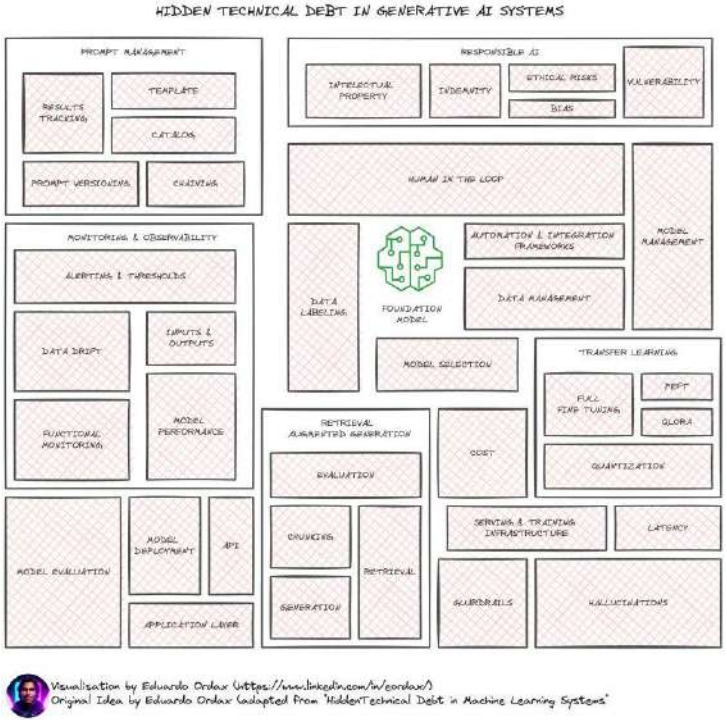
[(9) Post | LinkedIn]



[(9) Post | LinkedIn]

LLMOps





[Navigating the LLMops landscape: What you need to know | Insight Partners](https://fontysblogt.nl/llmops-engineering-trustworthy-llm-systems/)

https://fontysblogt.nl/llmops-engineering-trustworthy-llm-systems/

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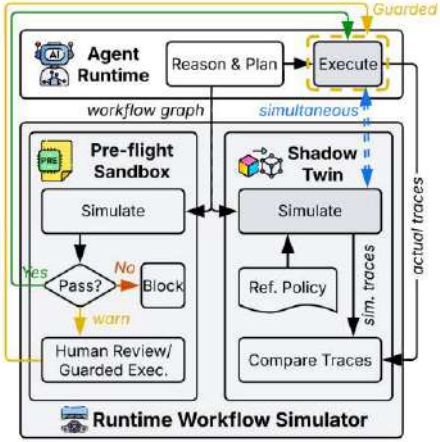
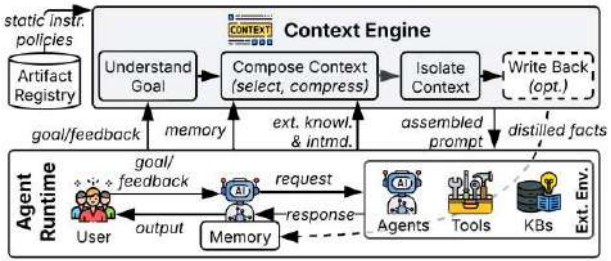
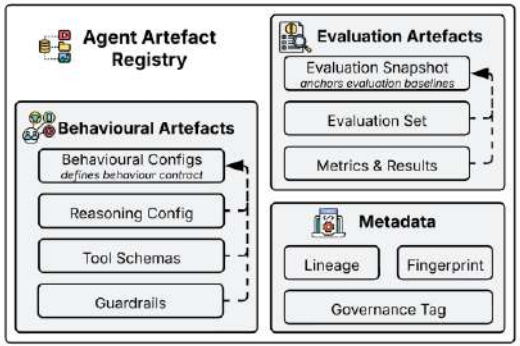
AgentOps

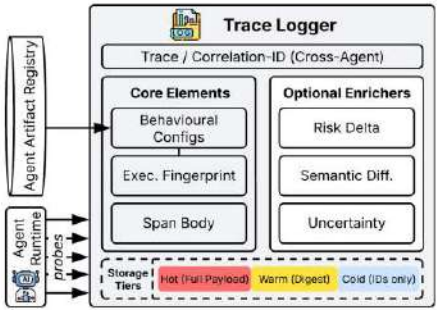
AgentOps Patterns by Category

Category	Pattern	Description
Artefact Management	Agent Artefact Registry	Versioned store for behavioural, eval, and metadata artefacts.
Execution	Context Engine	Assembles just-enough context within budget.
	Runtime Workflow Simulator	Shadow/sandbox execution to vet plans before/during exe.
Safety & Enforcement	Guardrail Enforcement Points	Policy checks at all critical agent action points.
Monitoring & Observability	Trace Logger	Structured spans for replay and audit.
	Cumulative Risk Ledger	Append-only per-step risk signals; shows accumulation.
Evaluation-Driven Learning	Dynamic Test Case Factory	Harvests operational insights into versioned tests.
	Marginal Risk Assessor	Compares candidate vs. baseline risk.
	Agent-as-a-Judge	Evaluator agent scoring runs against contracts.
Interaction	Interactive ChatOps	Conversational queries over ops data; safe controls.
	Trust Calibration Controller	Calibrates user cues to measured reliability.
Assurance & Compliance	Assurance Evidence Factory	Sealed bundles linking artefacts to bounded claims.









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Xia, Boming and Xia, Boming and Liu, Yue and Lu, Qinghua and Zhu, Liming and Sejdinovic, Dino and Sejdinovic, Dino,
AgentOps Pattern Catalogue: Architectural Patterns for Safe and Observable Operations of Foundation Model-Based Agents (September 25, 2025).