Gen AI in Software Arquitecture

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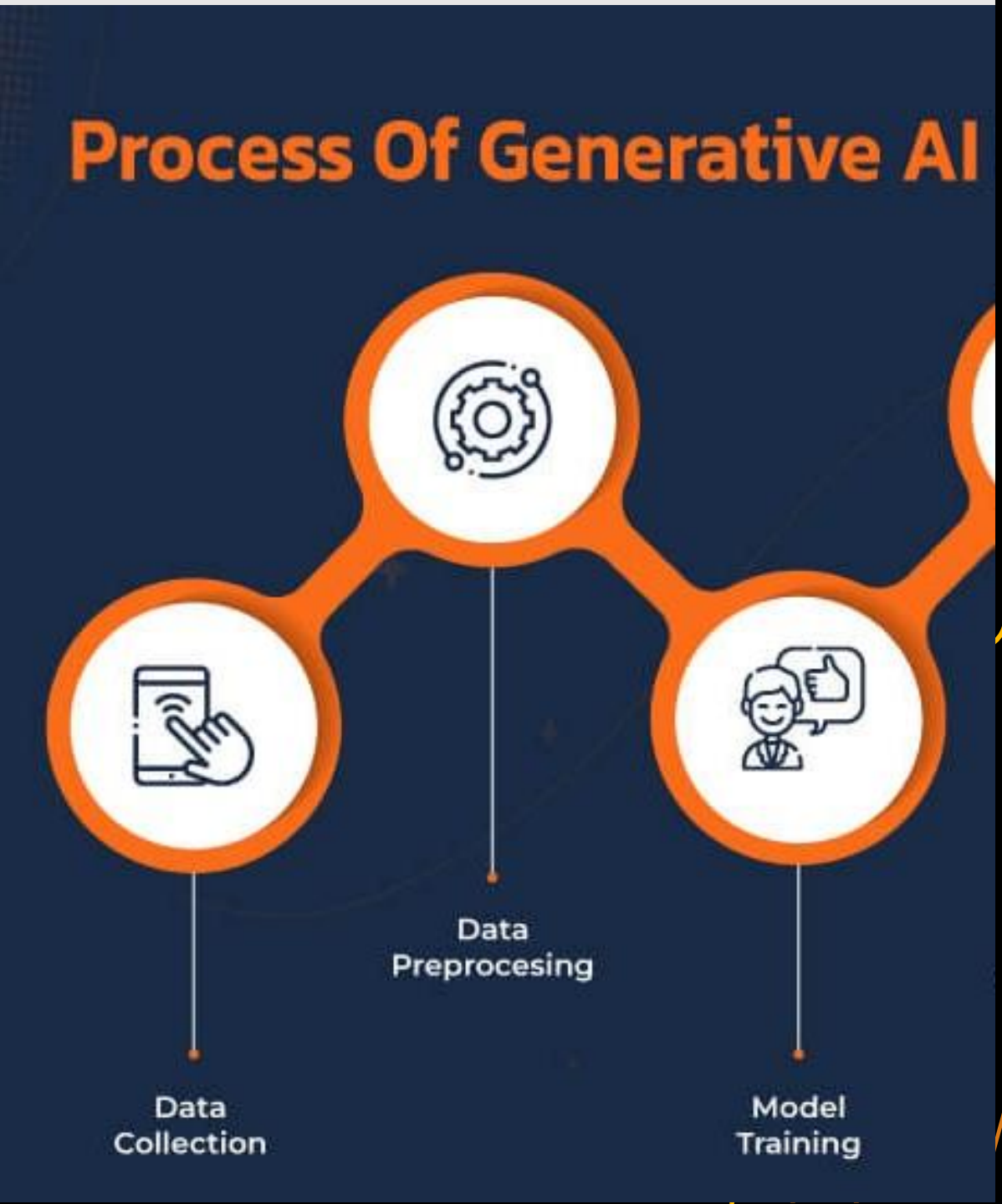
Topics

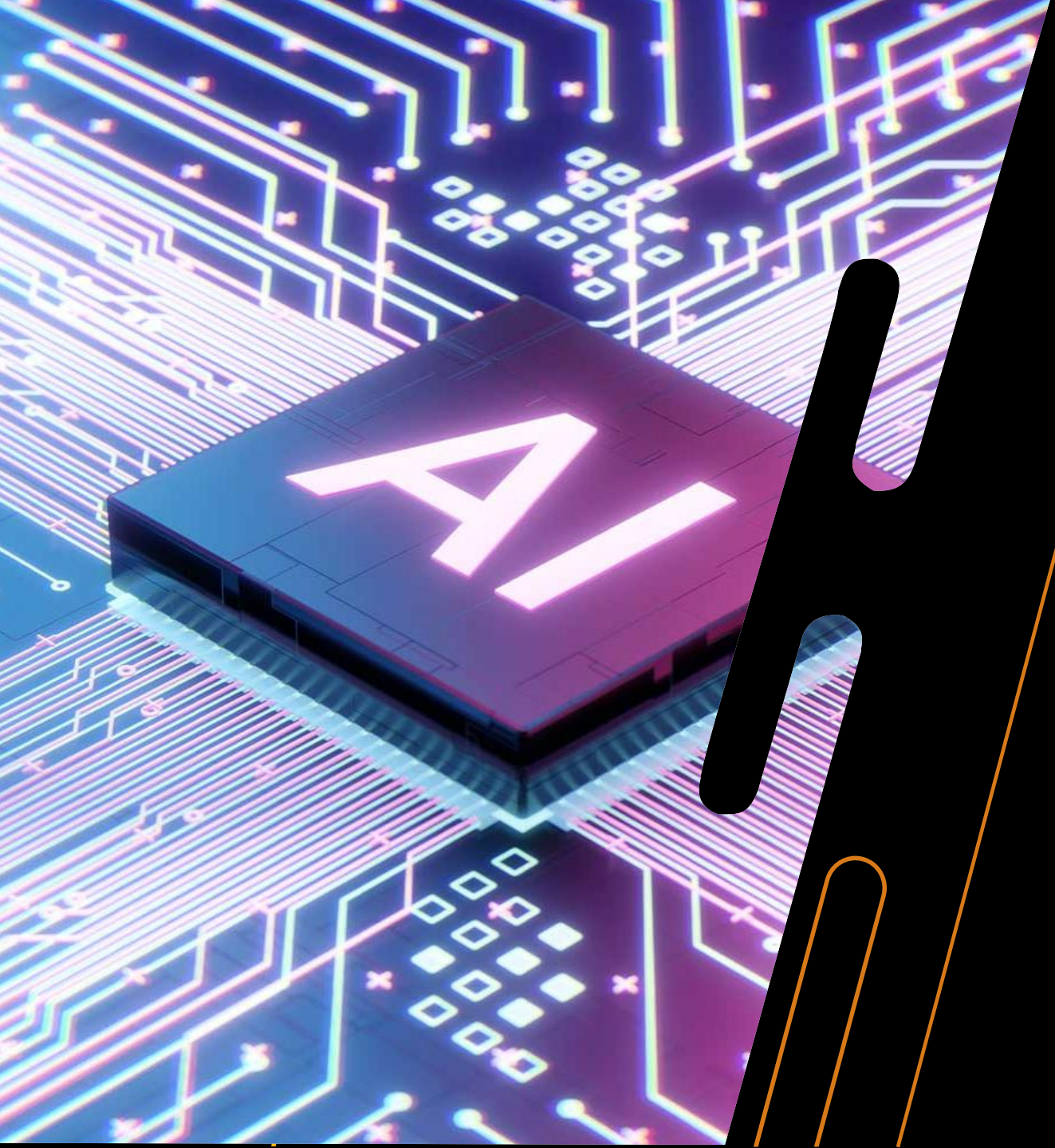
01. **What is Generative AI?**
02. The Impact of GenAI on Software Architecture
03. The Role of the Software Architect with GenAI
04. Use Cases of GenAI in Software Architecture
05. Challenges and Opportunities



What Generative AI is?

A type of artificial intelligence that:

- Creates content
- Based on patterns of data collected
- Replicate behavior of those patters

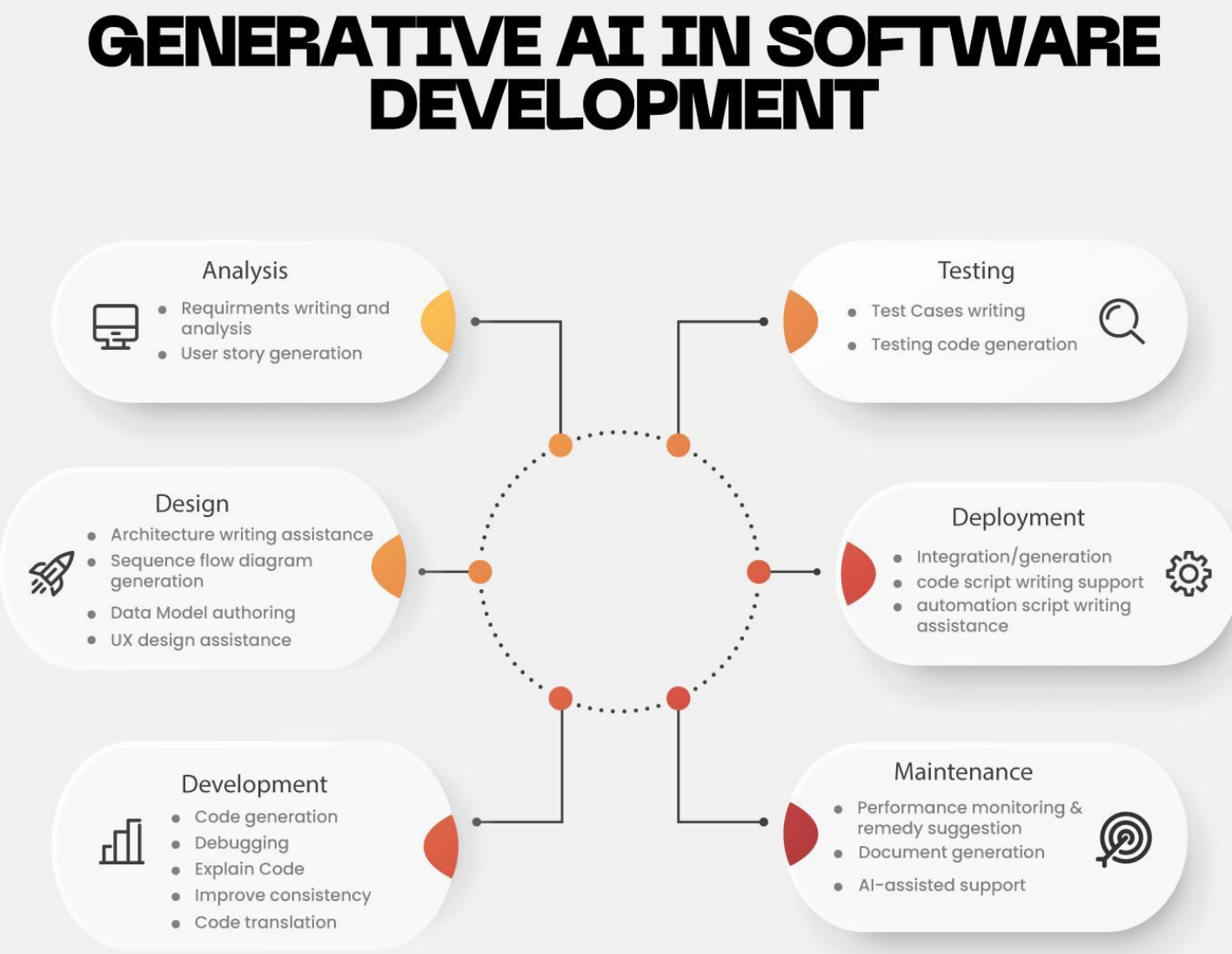


Examples of GenAI

- **GPT-3** and **GPT-4** from OpenAI
- **DALL-E** and **MidJourney** for images
- **Jukedeck** and **Amper Music** for music

GenAI in Software Development

- Generate code
- Assist in technical documentation
- Create quality tests



Source: Medium

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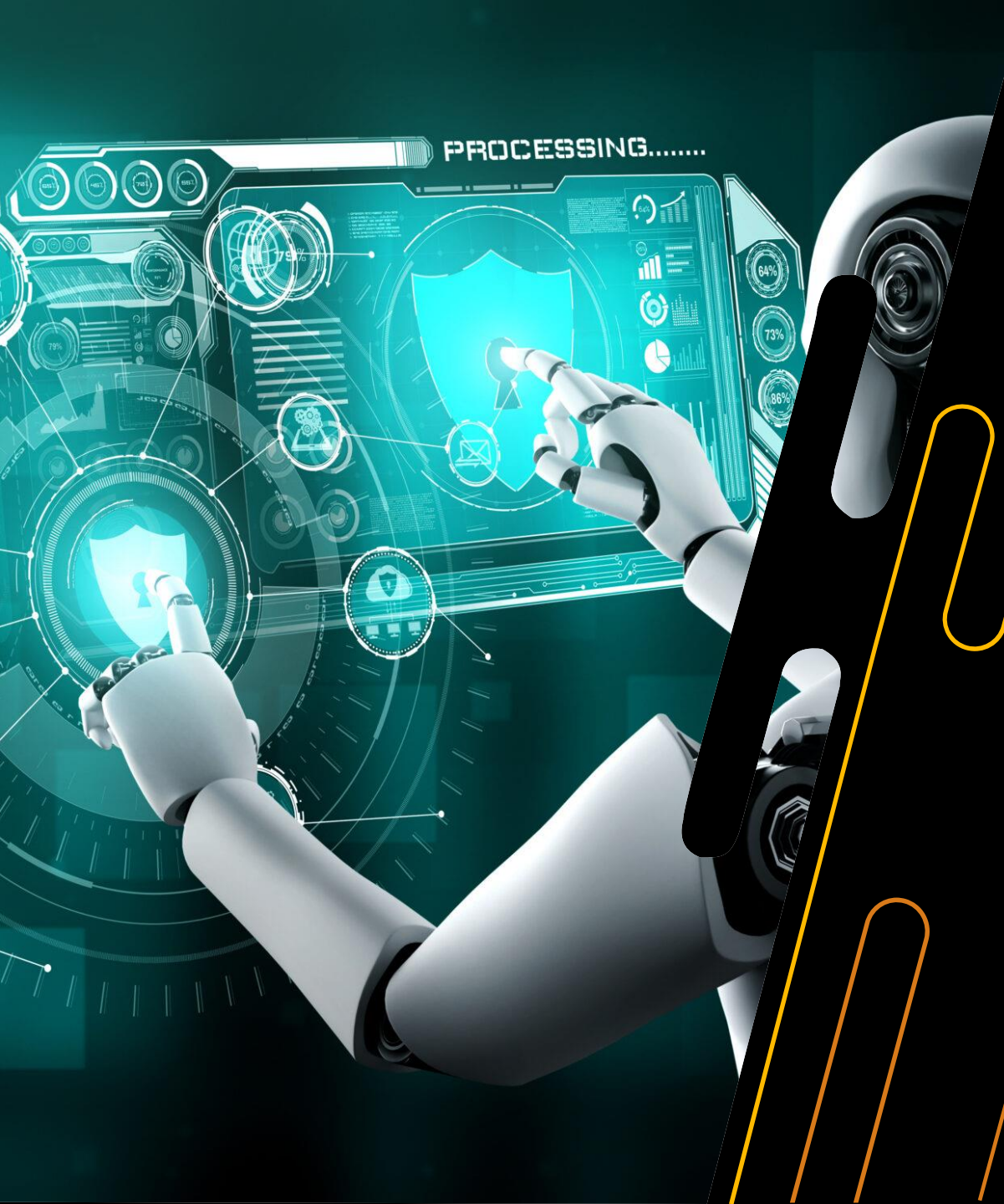
Routine tasks

GenAI automates some routine architecture tasks:

- It excels at automating code summarization, log extraction, code generation, test cases, code repair…
- This allows architects to focus on higher-level design and strategic decisions



Bridging the abstraction gap

GenAI can bridge the gap between abstraction and implementation:

- Bridges diagrams and models and actual code implementations
- It can generate code snippets and structures
- Can improve traceability reducing the Ivory Tower Architect problem

Focus shift for architects

A shift in focus:

- Architects should pay attention to ensure that the implemented system conforms to the architecture
- GenAI assists in evolving the system based on architectural decisions and the ongoing evolution of the codebase.

Potential pitfalls and mitigation

Avoiding pitfalls: Design First!

- There's a risk of focusing too much on code generation and losing sight of the overall system design and structure
- It's crucial to focus on the design and behavior of the system, not just the implementation details

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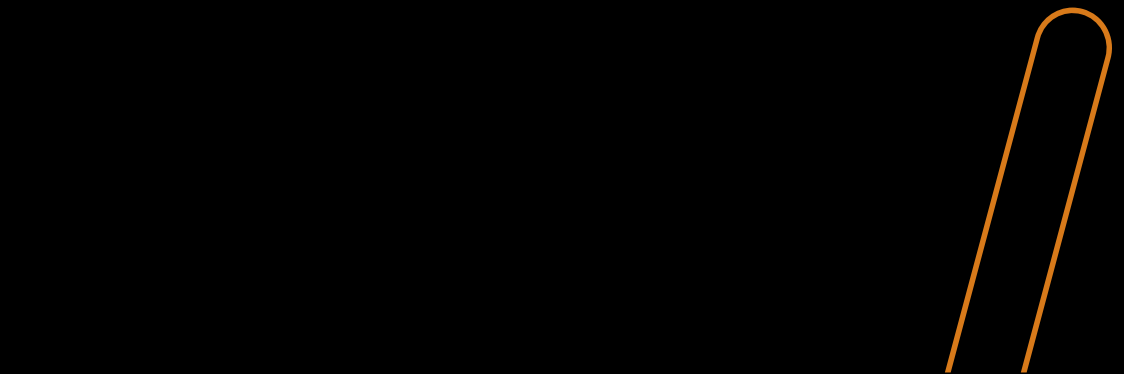
How to implement GenAI on Architectural decisions?



How GenAI Accelerates Architectural Workflows

- **Code Summarization**
- **Code-to-Architecture Translation**
- **Q&A for Codebases**
- Ask context-aware questions (e.g., “How does the authentication service interact with the API gateway?”)

Fine-Tuning for Business Needs

Customizing GenAI for Your Domain

- **Why Fine-Tune?**
  - Unique business rules, codebases, architectural approaches.
- **Challenges:**
  - Data privacy, security, and avoiding model hallucinations.

Validating Responses & Refining Prompts

Trust but Verify: The Architect's New Mantra

- **Check Correctness**
  - LLM outputs are probabilistic, you need systems or user itself to validate their outputs.
- **Iterative Prompt Engineering**
  - Better prompts, approaches highly increase accuracy of the LLMs.
  - Example: Asking for better architecture ❌ Explaining AI downsides of your architecture and wanting some advices. ✅

Human-AI Collaboration

Stronger Together

- **Partnership, Not Replacement:**
- AI can be used as time saver like code completition, summarization.
- But at some tasks like decision making AI can be used as a helper.

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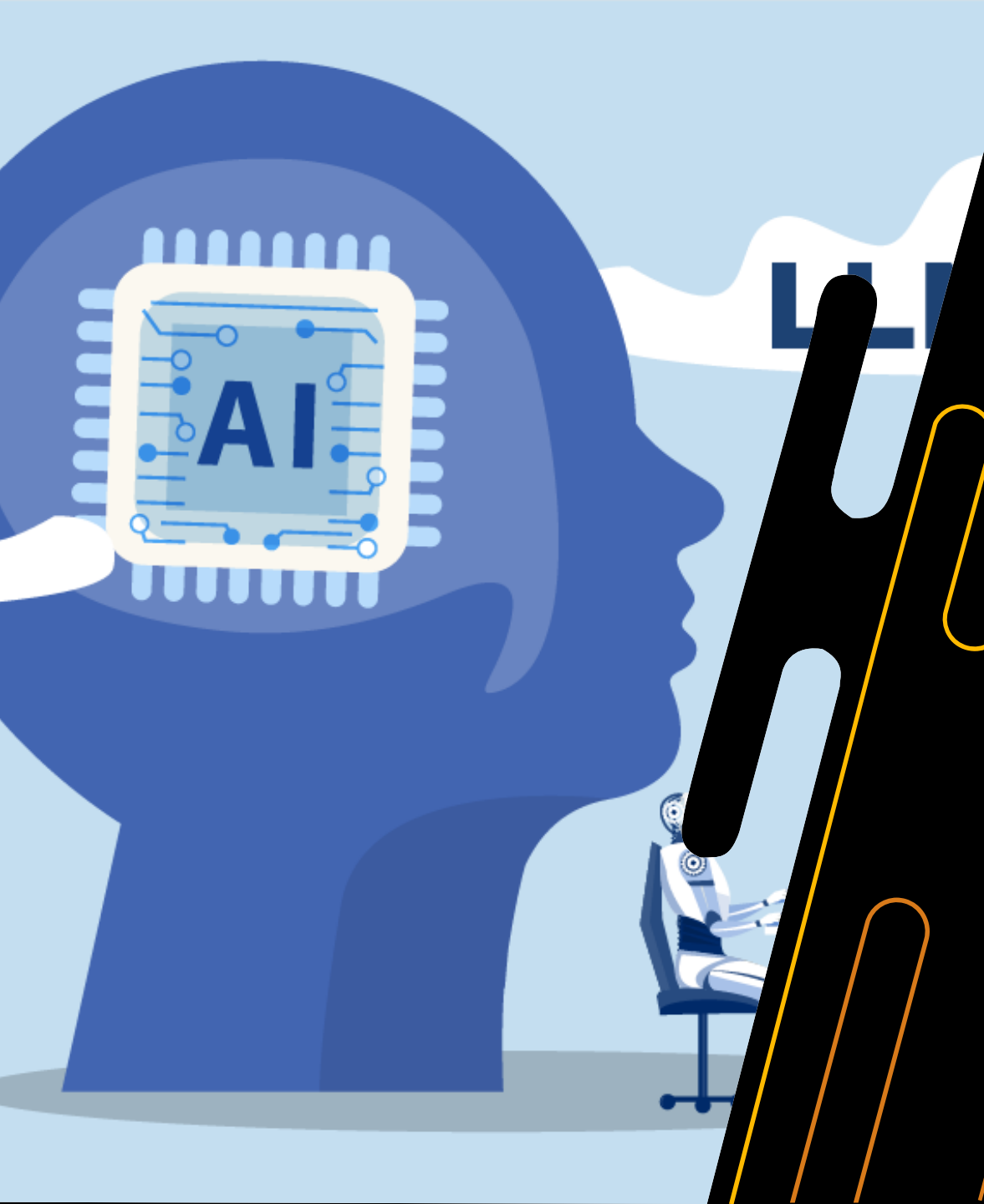
Enhanced design exploration

How GenAI helps:

- Documentation generation
- Summarization
- Find critical elements from large textual documents



Knowledge sharing

Make learning easier

- Quickly generate examples with explanations for complex architectural concepts
- Reduces gap between senior architects and developers

Decision making

Help software architects

- Mine architectural decisions from existing systems and documents
- Understand past decisions
- Avoid repeating mistakes

Code generation

Desing constrained

- Generate code following a pre-stablished architectural pattern
- Simplify pattern adherence by generating an implementation-level guideline
- Test generation

Refactoring

- Refactoring legacy code to new language/framework
- Adapting to new architectural decisions

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Challenges

- Code generated is not always accurate
- Limited scope and restricted context
- Probabilistic behavior
- Will not always generate the same answer for the same question

Opportunities

- Good at generating documentation and analyze code
- Acceleration of development and reduce the time in menial tasks
- Good recommendations based on previous decisions

Thank you