Change Intent, Extract-Edit-Apply and its Uses

Don Syme in conjunction with all of GitHub Next

Recording of this talk on rewatch

GitHub Next

Researching the future of
software development

githubnext.com

What is GitHub Next?

What

An applied R&D group attached to GitHub, reports to Thomas

Mission

Transform the practice of software development

Mode of Operation

Build, ***Release***, ***Learn***, ***Co-operate***.

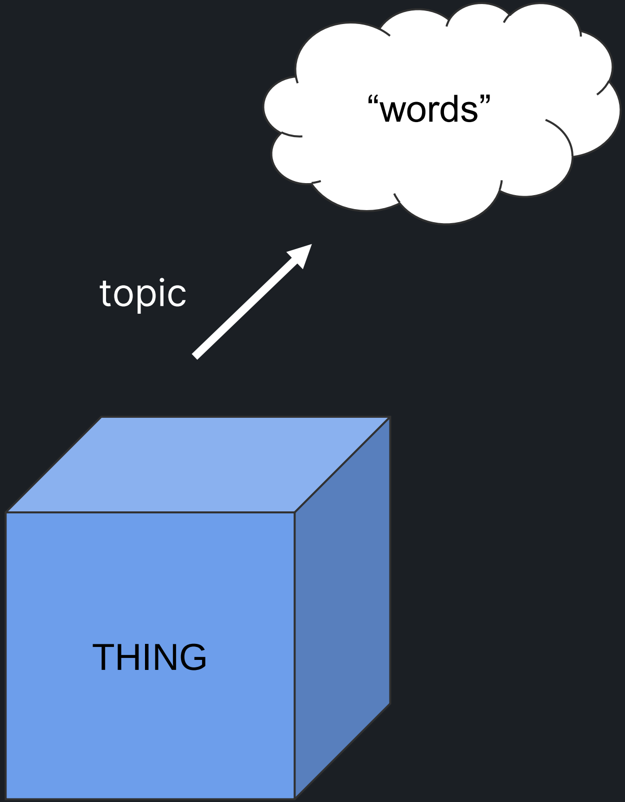
Who

~15 applied LLM/ML experts (many ex-Copilot), UX experts, CS experts

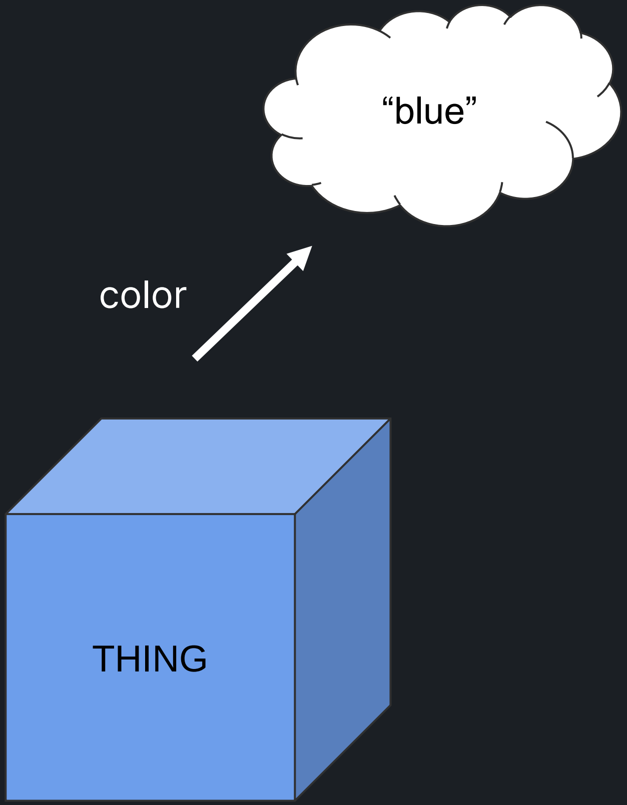
Why this is the right way to run innovative applied R&D

Operates at the Goldilocks distance!

The Concept



The Concept



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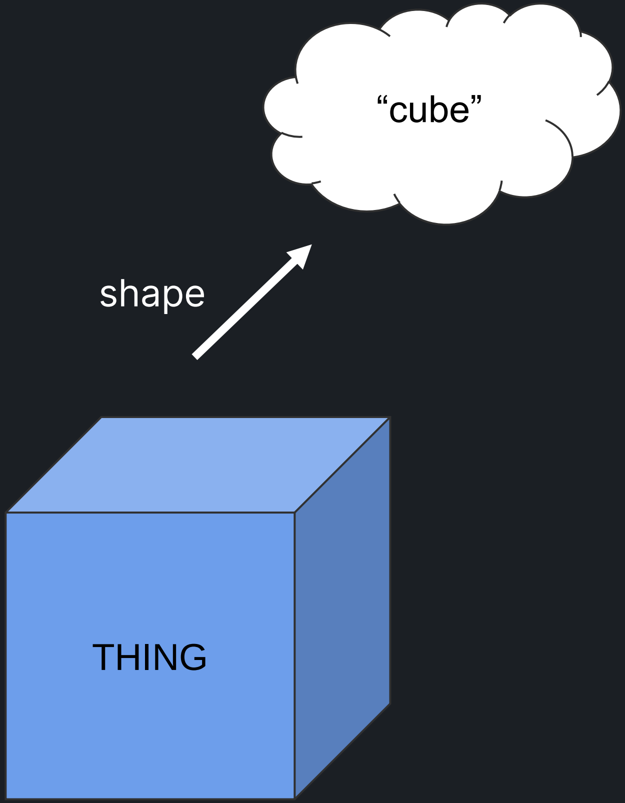

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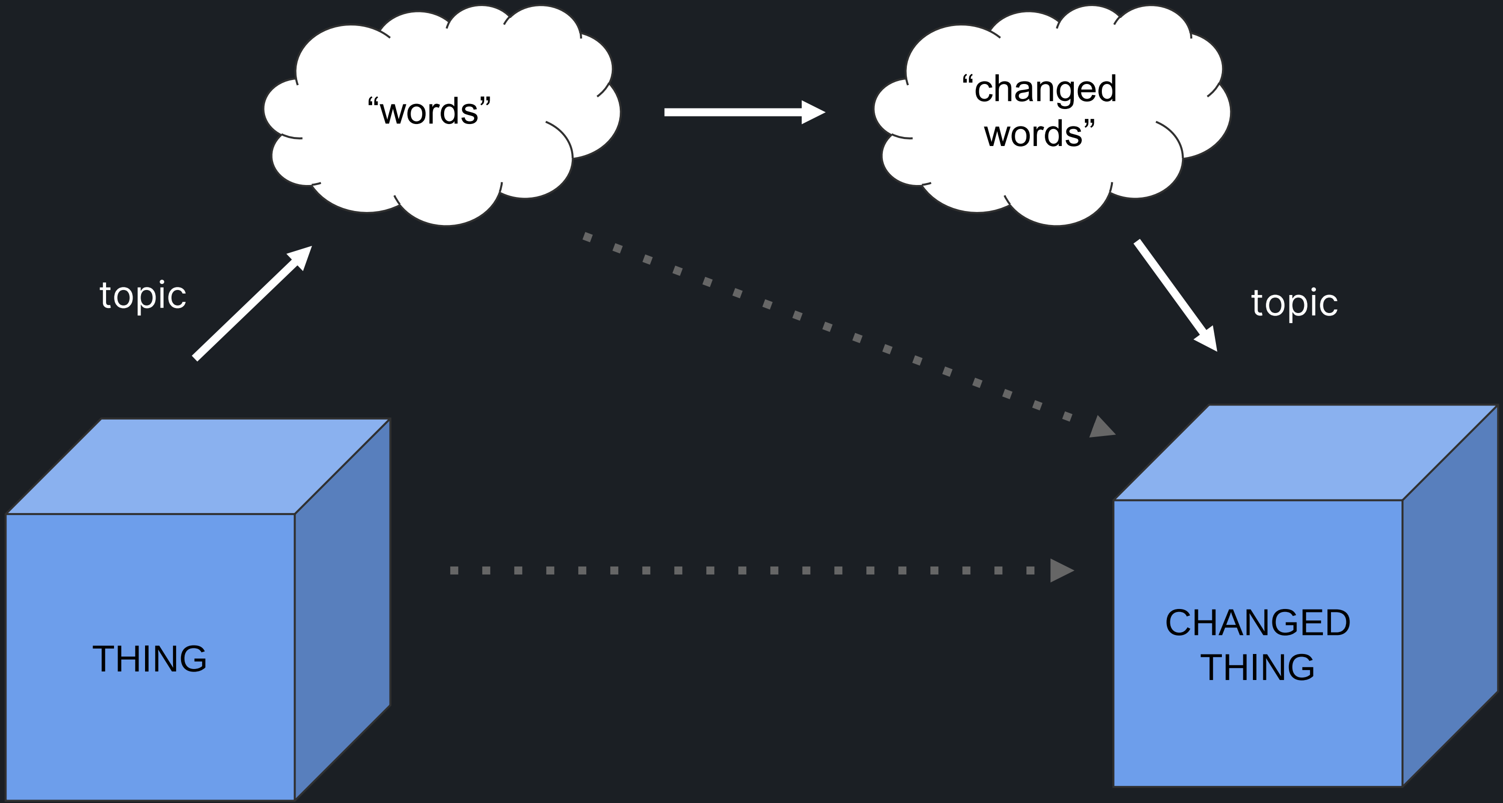

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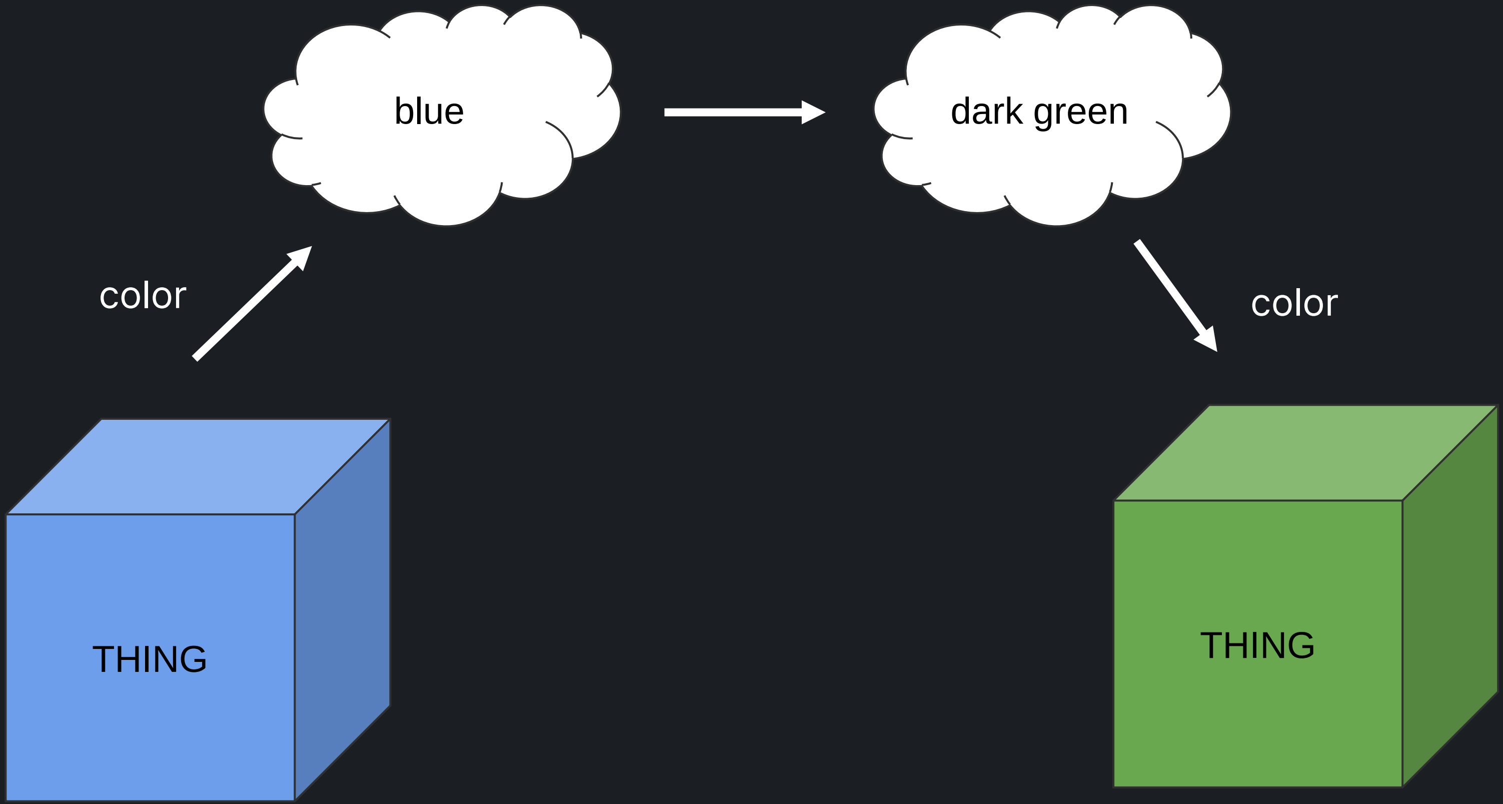

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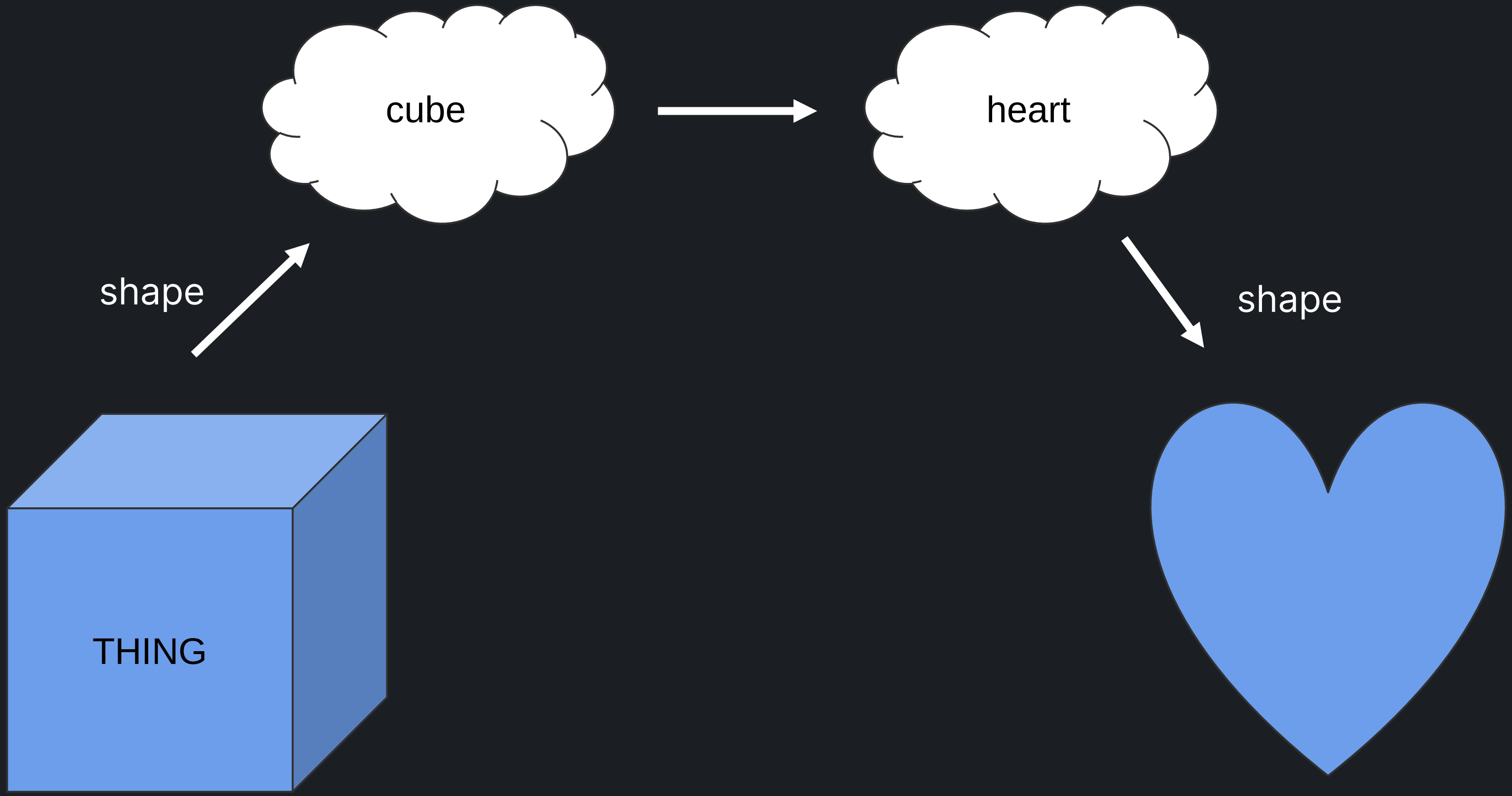

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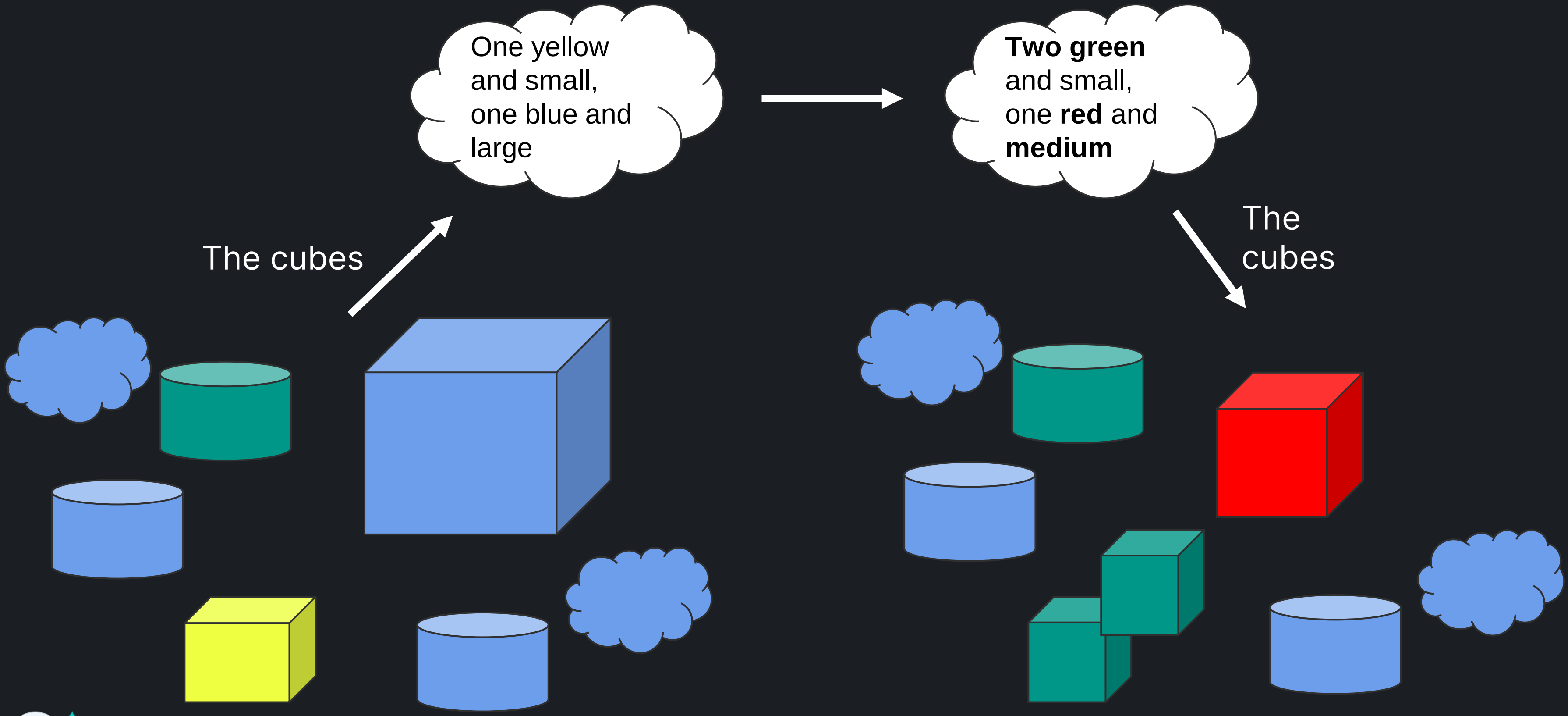


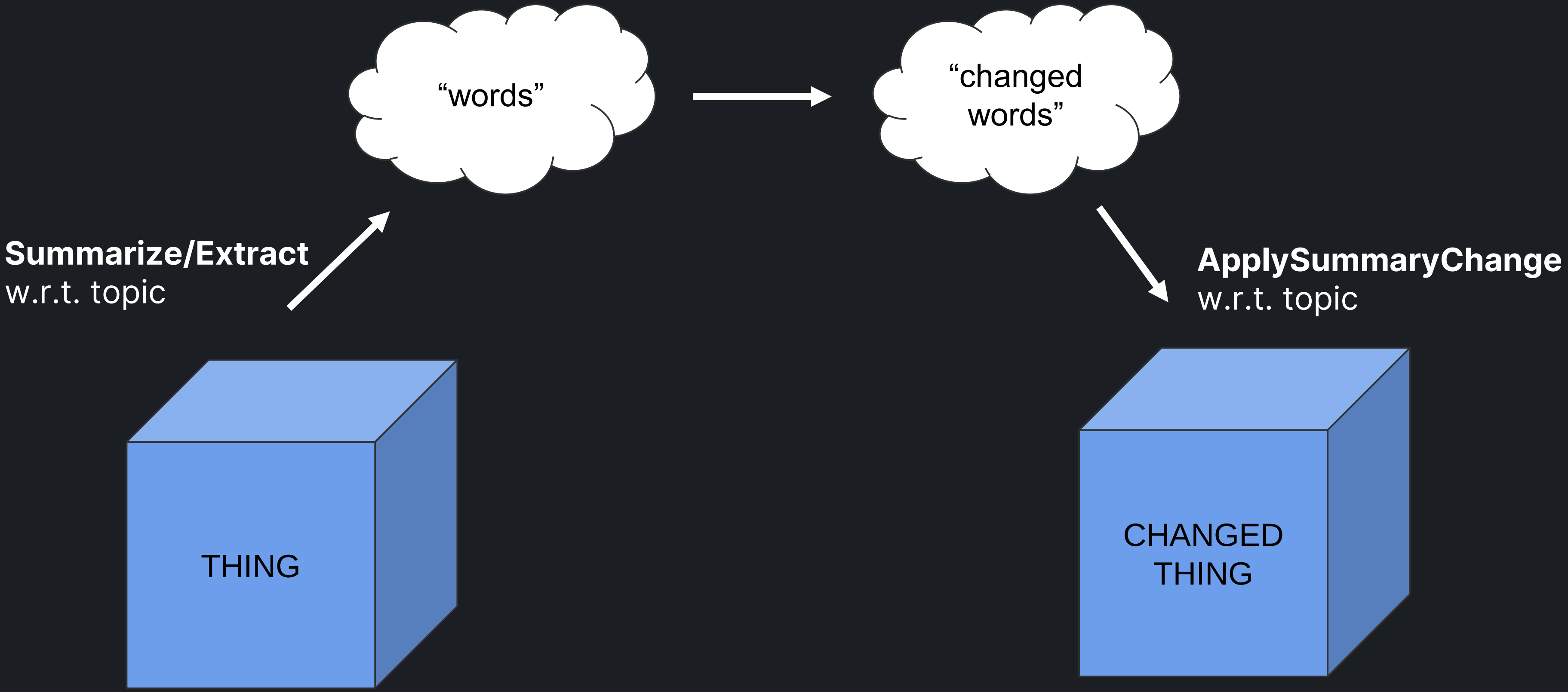
The cubes

One yellow and small, one blue and large

Two green and small, one red and medium

The cubes

The Concept



“words”

“changed words”

Summarize/Extract w.r.t. topic

ApplySummaryChange w.r.t. topic

THING

CHANGED THING

Principles

- Change is described in **language**
- **Specifications** are **ephemeral**
- There are **many possible specifications**, one for each topic
- Embrace the **fluidity** and **power** of **words**
- The model both **hides** and **fills in** the details

Rationale

- Edit > Create-from-scratch
    - (also, create-from-scratch is a special case of editing)
- People lack the **terms of discourse** to describe the change they want
    - The **topic of focus** pins us down to a particular slice
    - The **extraction** describes the thing as it is
    - The **edit** describes how we want it to be

Demo

Notes

- Summarization the inverse of generation
  - “Extract” is summarization w.r.t. topic
  - “Apply” is generation-of-change w.r.t. topic
- “Extract” seems independently useful
  - Has similarity with Chat
- “Apply” utilises hallucination well!
  - “Fill in the details, I’ll check what you do”

The Fundamental Theorem of Chat

For any *context* and *question* there is a most-natural* *answer*

We let the AI work this out

**(in reality a whole manifold of them)*

The Fundamental Theorem of EEA

For any *thing* and *topic* there is a most-natural* *summary*

For any *thing*, *topic*, *summary* and *changed-summary*, there is a most-natural* *changed-thing*

We let the AI work these out

**(in reality a whole manifold of them)*

The Fundamental Theorem of Change Intent

For any *thing* and *change-intent*, there is a most-natural* *changed-thing*

We let the AI work this out

**(in reality a whole manifold of them)*

Foundational techniques and challenges

- Extracting initial change intent
- Iterative lowering of change intent
- Partial repository selection
- Partial repository rewriting

Foundational techniques and challenges

- **Extracting initial change intent**
  - Multiple possible ways to extract change intent
  - User and AI in co-operation, iteratively
- **Iterative lowering of change intent**
- **Partial repository selection**
- **Partial repository rewriting**

Foundational techniques and challenges

- **Extracting initial change intent**
- **Iterative lowering of change intent**
  - Change Intent → Plan → Changes
  - Iteration and clarification
  - User and AI in co-operation
- **Partial repository selection**
- **Partial repository rewriting**

Foundational techniques and challenges

- **Extracting initial change intent**
- **Iterative lowering of change intent**
- **Partial repository selection**
    - Crucial for almost every AI feature
    - Based on topic, plan etc, manual selection as backup
    - Challenging to scale to truly massive repositories
- **Partial repository rewriting**

Foundational techniques and challenges

- **Extracting initial change intent**
- **Iterative lowering of change intent**
- **Partial repository selection**
- **Partial repository rewriting**
    - A key bottleneck, will definitely limit uses
    - Very challenging to localize and scale
    - Currently file-by-file, ~24K token prompt, ~8K reply
    - The ideal: selectively rewrite parts of files and fold back

Change Intent and its Sources

- **Change Intent** is the oil that drives these experiences
- **Editing ephemeral specifications** is one source
  - It is slightly unnatural, but very general
  - Naturally iterative
  - Kind of addictive once you get used to it
- There are alternative sources
  - **Command**: “Just do what I say”
  - **Chat**: “Tell me about the change you want, let’s clarify a plan”
  - **Issues**: “I looked at this issue, here’s what I see”

Towards a Semantic Workspace: Aspirations

- Allow engagement with software at the conceptual, semantic level
  - Iterate and lower to concrete changes
  - Ideally allow continual iteration with a dev/test/run loop
  - Ideally multiplayer
  - Ideally automatically scalable
- Attempt to escape the gravity of free-form chat
  - A definite object of study (a repository)
  - A definite outcome (lowered change intent)
  - If we allow chat, it will focus on change intent and planning

Towards a Semantic Workspace: Key User Tasks

Experienced developers on github.com sketching things that are unfamiliar or routine and involve multiple changes

- “I didn’t know where to begin with this”
- Changes in unfamiliar repositories
- Feature sketching
- Issue solving
- Unit-test creation, esp legacy code
- Documentation generation

Towards a Semantic Workspace: Key Challenges

- Getting Closer to the Dev Loop
  - **Web delivery** for generality and simplicity
  - Eventually **IDE delivery** to get closer to the dev loop
  - **Issue-first** workflows
  - Utilise **codespaces** as a general runtime for dev/test loop
- Scaling
  - Automatic file selection is key but ours is weak

Give it a go!

- Send us your github handle, we'll get you added
  - If you promise to write weekly notes
- Demonstrator only!
  - Small-medium repos only
  - Everything may/will change
- Currently https://eeaplay.azurewebsites.net/
  - Web address will change!

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