Designing A Functional Document Processor

What is a **document**, and what do I do with it?

Alperen Keles

Documents with common substructures exist.

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We are currently **bad** at exploiting such substructures.

Documents with common substructures exist.

We are currently **bad** at exploiting such substructures.

I am working on **exploiting them**, I am at the **very beginning** of that journey, and I would like **your help** with it.

What is a document?

A sequence of letters arbitrarily placed on a 2-dimensional plane.

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Projection of abstract concepts placed on a 2-dimensional plane.

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Projection of abstract concepts placed on a 2-dimensional plane with some **visual structure that conveys relations between the concepts.**

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What is a document?

Projection of abstract concepts placed on a 2-dimensional plane with some visual structure that conveys relations between the concepts.

What kind of relations does the visual structure convey?

What kind of relations does the visual structure convey?

- Sequencing

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A word is a sequence of letters.

A sentence is a sequence of words.

A paragraph is a sequence of sentences.

...

What kind of relations does the visual structure convey?

- Sequencing

- **Grouping**

A word is a sequence of letters.

A sentence is a sequence of words.

A paragraph is a sequence of sentences.

...

What kind of relations does the visual structure convey?

- Sequencing

- Grouping

- **Hierarchy**

> A word is a sequence of letters.
>
> A sentence is a sequence of words.
>
> A paragraph is a sequence of sentences.
>
> ...

How do we create documents?

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create :: [Concept] → 2D-Plane

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Markup Languages: Markdown, Latex, Typst...

How do we create documents?
create :: [Concept] → 2D-Plane

Word Processors: Microsoft Word, Google Docs...

Canvas Editors: Canva, Excalidraw, Tldraw...

Markup Languages: Markdown, Latex, Typst...

Weird Stuff: ObsidianMD, Notion, Excel, Django???

Editing Modes(not to be confused with modal editing)

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edit :: Document → Action → Document

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WYSIWYG(What you see is what you get) editing modes

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WYSIWYG(What you see is what you get) editing modes

Cursor-Based Editing: Microsoft Word, Google Docs…

Selection-Based Editing: Canva, Excalidraw, Tldraw...

Editing Modes(not to be confused with modal editing)
edit :: Document → Action → Document

Markup editing

Editing Modes(not to be confused with modal editing)
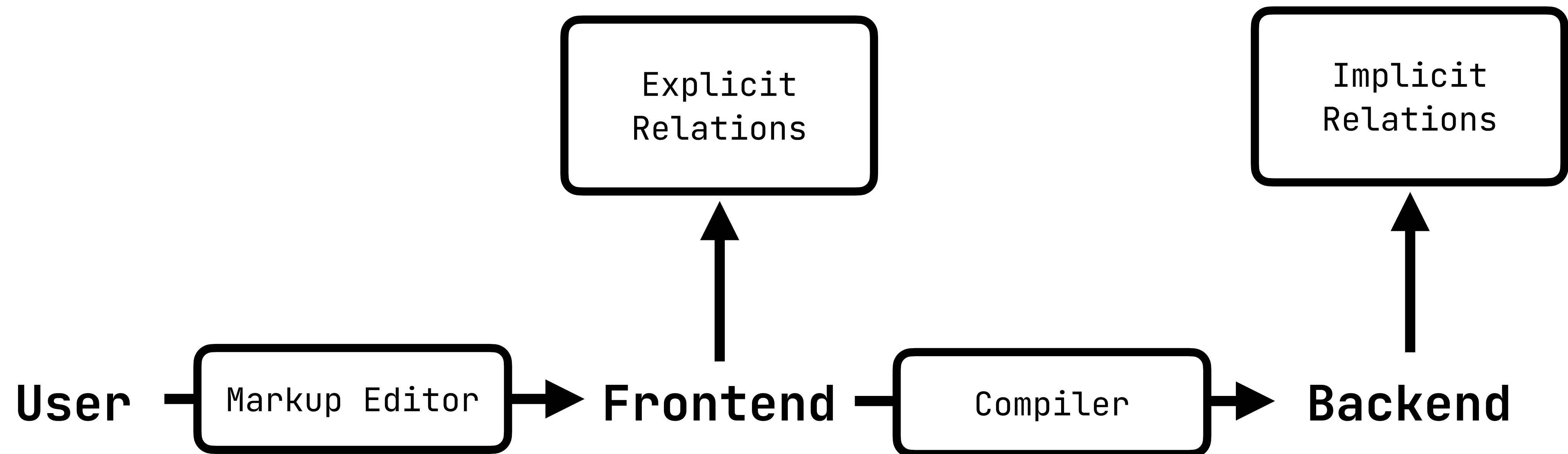edit :: Document → Action → Document

Markup editing

Frontend ━━━━━━━▶ **Backend**

Editing Modes(not to be confused with modal editing)
edit :: Document → Action → Document

Markup editing

User ⟶ **Frontend** ⟶ Backend

Editing Modes(not to be confused with modal editing)

edit :: Document → Action → Document

Markup editing

Editing Modes(not to be confused with modal editing)
edit :: Document → Action → Document

Markup editing

User ── [Markup Editor] ──▶ Frontend ── [Compiler] ──▶ Backend

Editing Modes(not to be confused with modal editing)
edit :: Document → Action → Document

Markup editing

Editing Modes(not to be confused with modal editing)
edit :: Document → Action → Document

Form editing

Editing Modes(not to be confused with modal editing)

edit :: Document → Action → Document

Form editing

Your name:

Your surname:

Do you fancy FP?

Form

Editing Modes (not to be confused with modal editing)

`edit :: Document → Action → Document`

Form editing

```
Your name:

---------



Your surname:

---------



Do you fancy FP?

---------
```

Form

```
Hi, <name> <surname>!

You are <eligibility> to
present at LambdaConf!
```

Template

Editing Modes (not to be confused with modal editing)
edit :: Document → Action → Document

Form editing

Your name:
Alperen

Your surname:

Do you fancy FP?

Form

Hi, Alperen <surname>!

You are <eligibility> to present at LambdaConf!

Template

Editing Modes(not to be confused with modal editing)

edit :: Document → Action → Document

Form editing

Your name:
Alperen

Your surname:
Keles

Do you fancy FP?

Form

Hi, Alperen Keles!

You are <eligibility> to present at LambdaConf!

Template

Editing Modes(not to be confused with modal editing)
edit :: Document → Action → Document

Form editing

Your name:
Alperen

Your surname:
Keles

Do you fancy FP?
Yes

Form

Hi, Alperen Keles!

You are eligible to present
at LambdaConf!

~~Template~~
Document

Templates

Hi, <name> <surname>!

You are <eligibility> to present at LambdaConf!

Templates
Partial Documents/Documents with Holes

```
Hi, <name> <surname>!

You are <eligibility> to
present at LambdaConf!
```

Templates
Partial Documents/Documents with Holes

create :: [Concept] → 2D-Plane

Hi, <name> <surname>!

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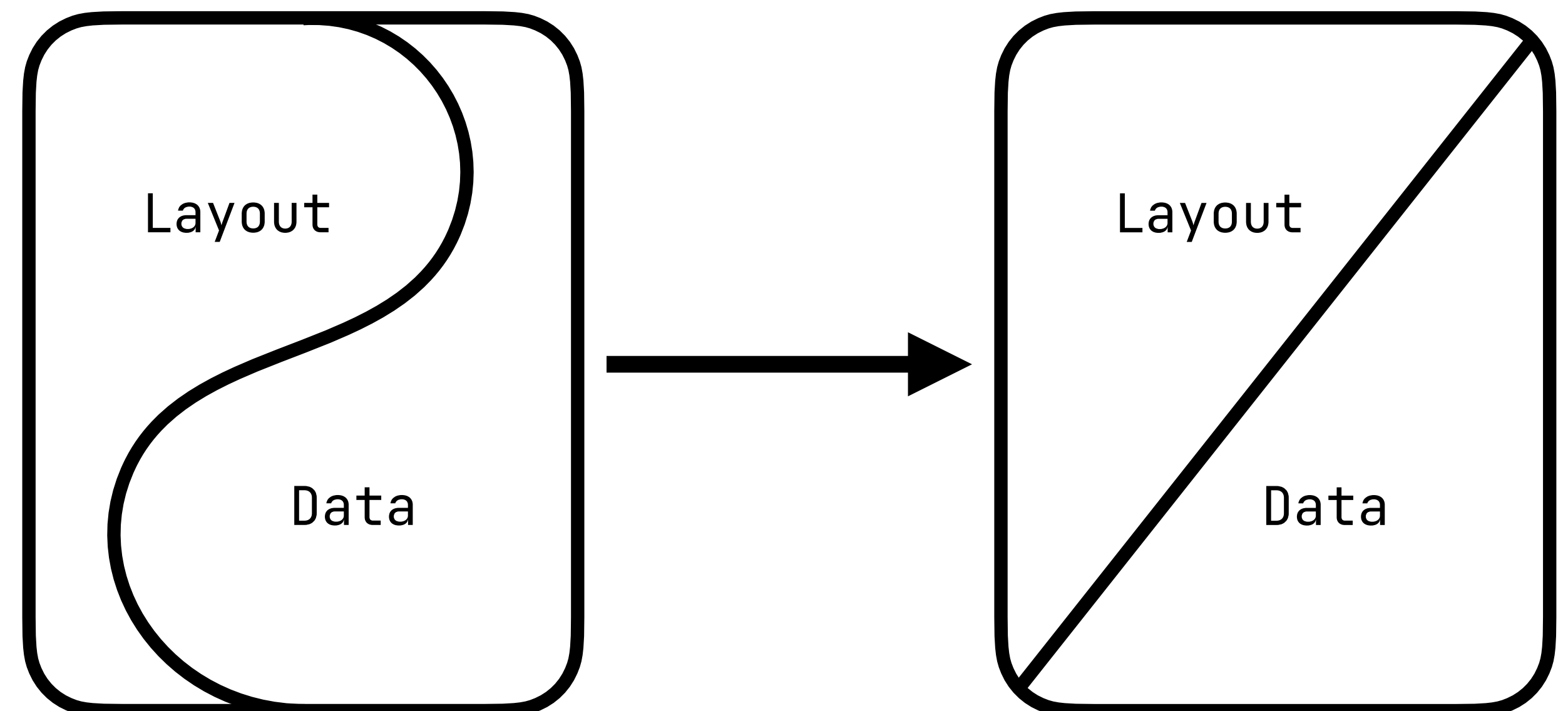
Templates
Partial Documents/Documents with Holes

create :: [Concept] → 2D-Plane

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Hi, <name> <surname>!

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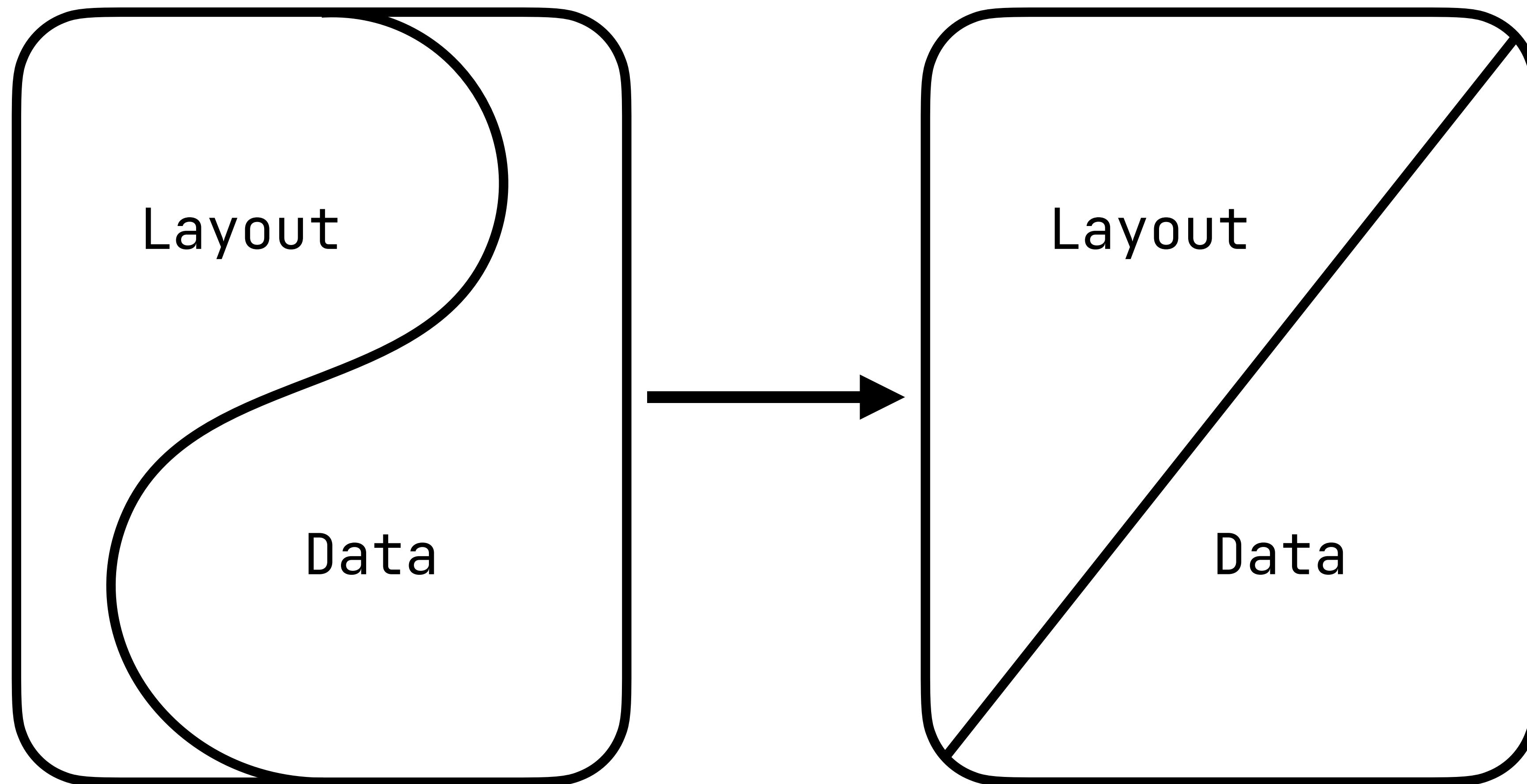
Templates
Partial Documents/Documents with Holes

create :: [Concept] → 2D-Plane

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Hi, <name> <surname>!

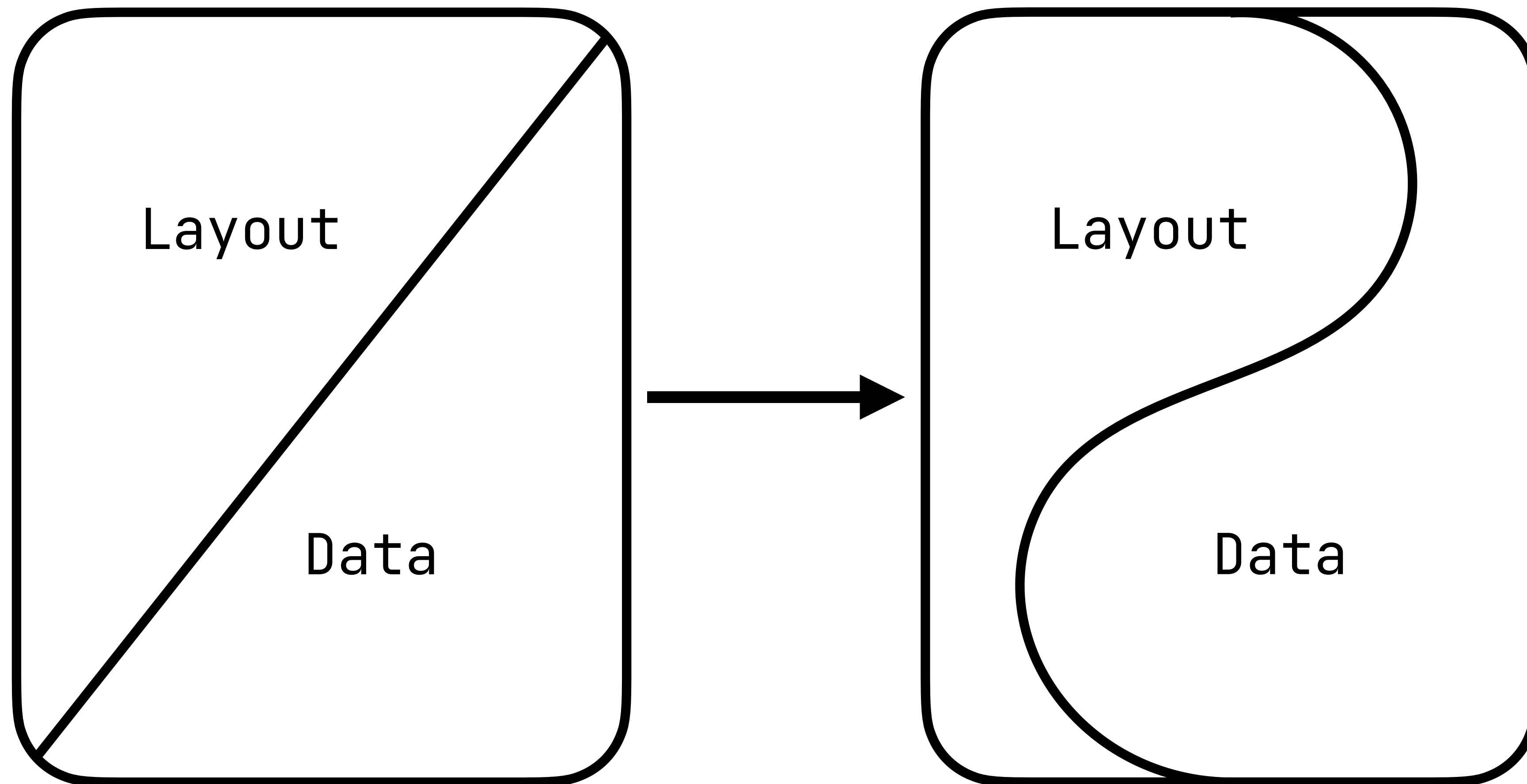You are <eligibility> to present at LambdaConf!

Layout

Data

Templates
Partial Documents/Documents with Holes

```
Hi, <name> <surname>!

You are <eligibility> to
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```

create :: [Concept] → 2D-Plane

edit :: Document → Action → Document

Layout

Data

Layout

Data

Templates
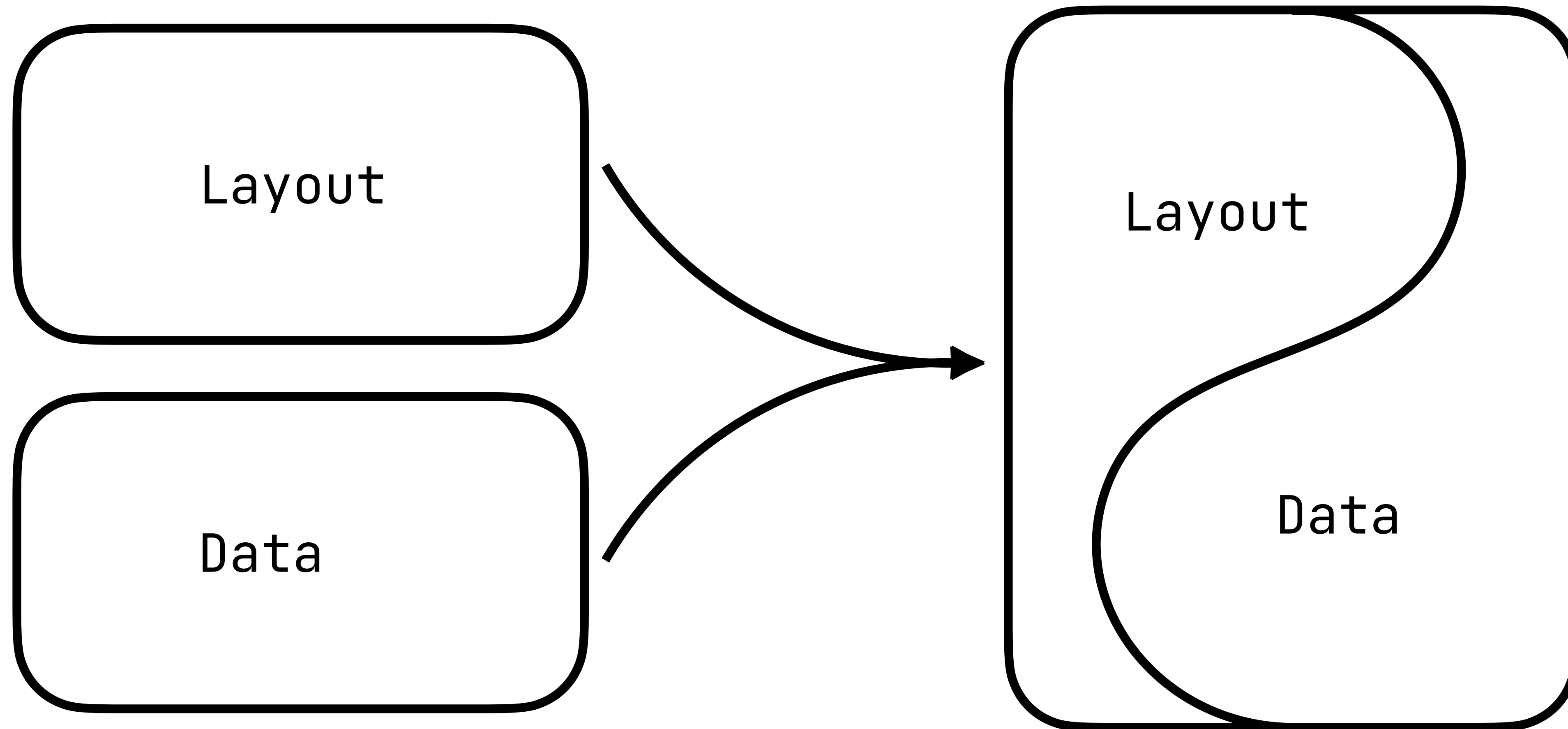## Partial Documents/Documents with Holes

Layout

Data

Layout

Data

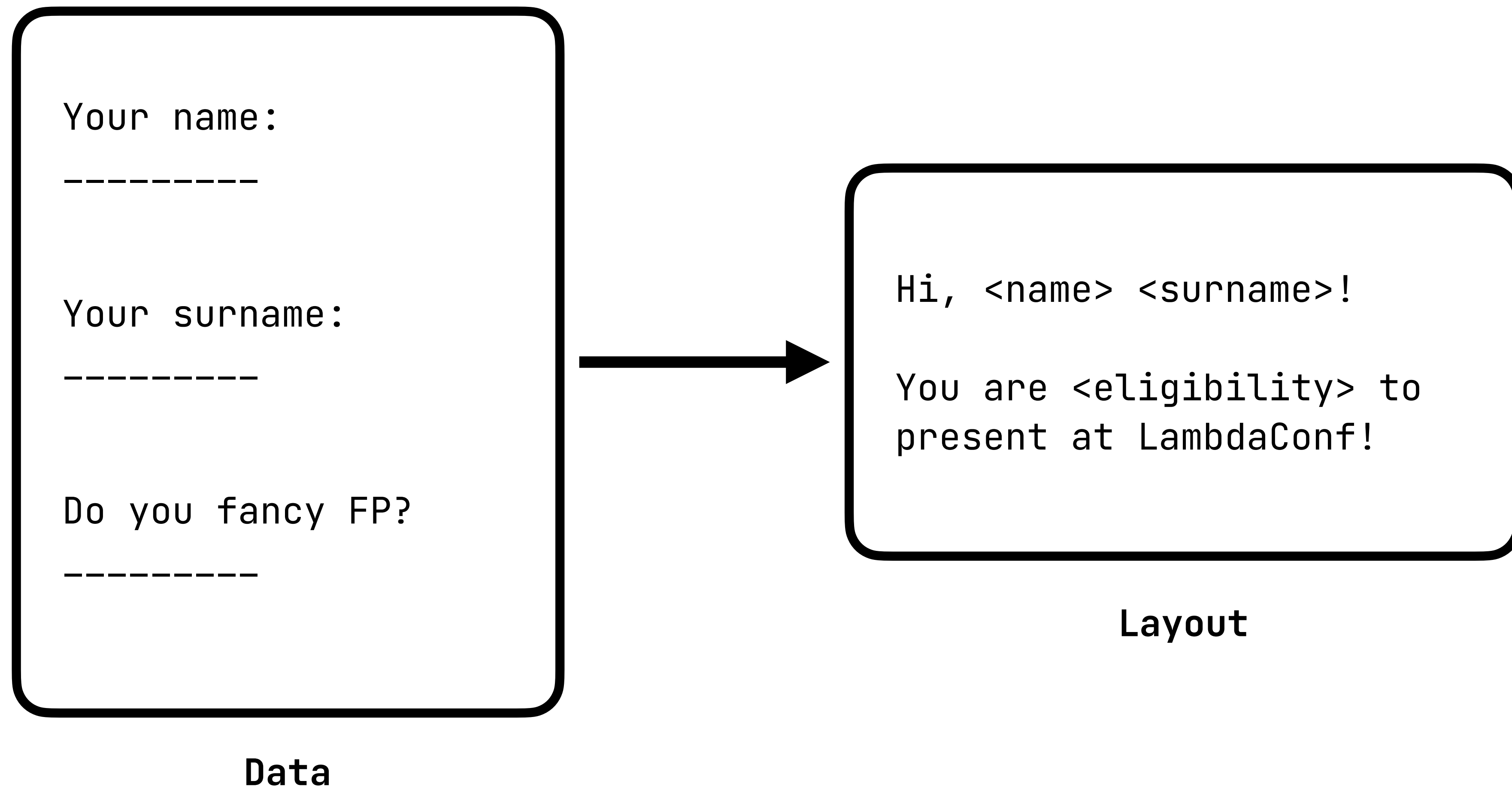**Templates**
Partial Documents/Documents with Holes

Templates
Partial Documents/Documents with Holes

Templates
Partial Documents/Documents with Holes

Your name:

_____

Your surname:

_____

Do you fancy FP?

_____

Data

Hi, <name> <surname>!

You are <eligibility> to present at LambdaConf!

Layout

Nested Templates
Partial Documents with Partial Documents inside

Alperen Keles

Education

Computer Science Ph.D.   2021-2026
University of Maryland

Computer Engineering B.S   2017-2021
Middle East Technical University

Work Experience

Research Intern   2024-2024
Bloomberg

Applied Science Intern   2023-2023
Amazon Web Services

Applied Science Intern   2022-2022
Amazon Web Services

Nested Templates
Partial Documents with Partial Documents inside

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<u>Education</u>

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→

Alperen Keles

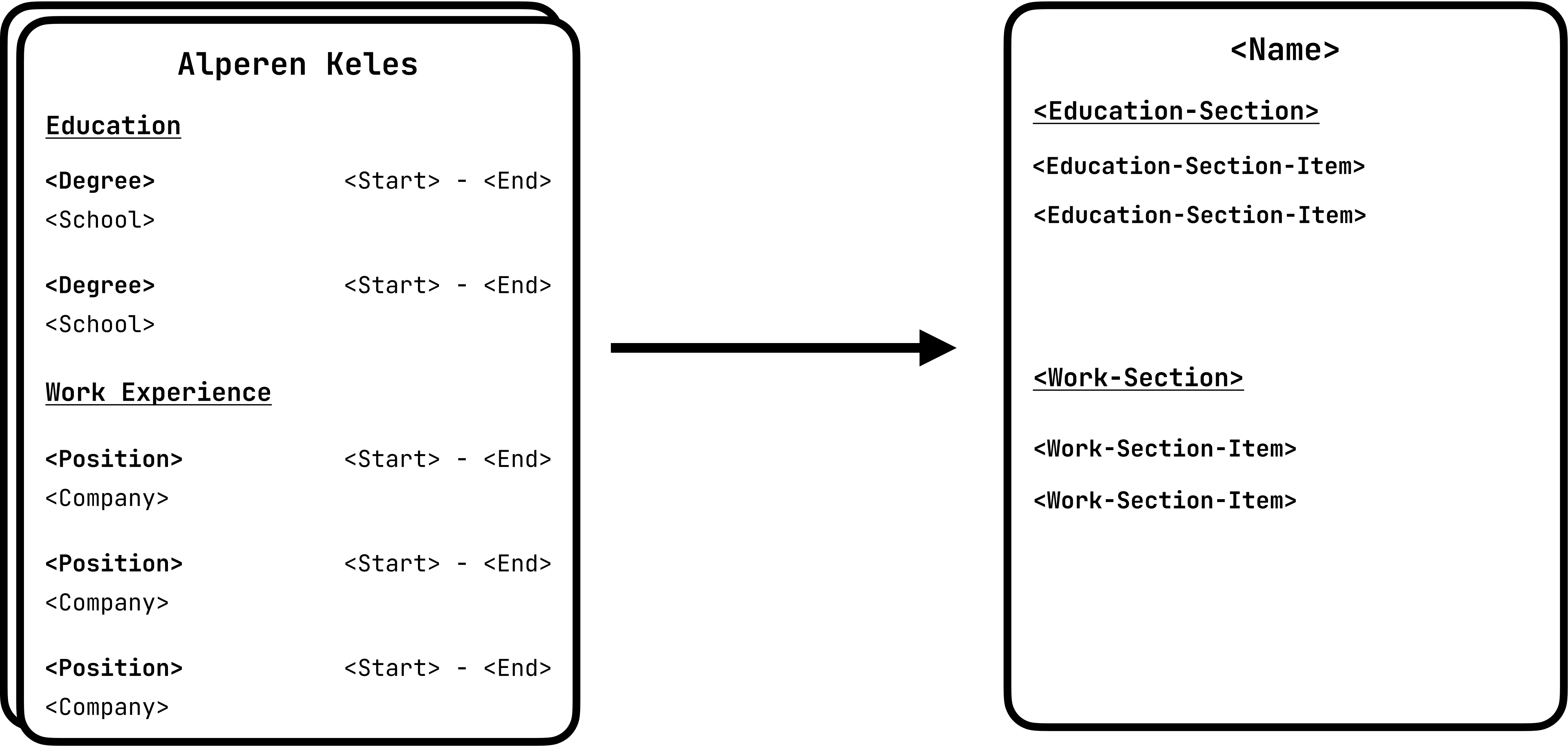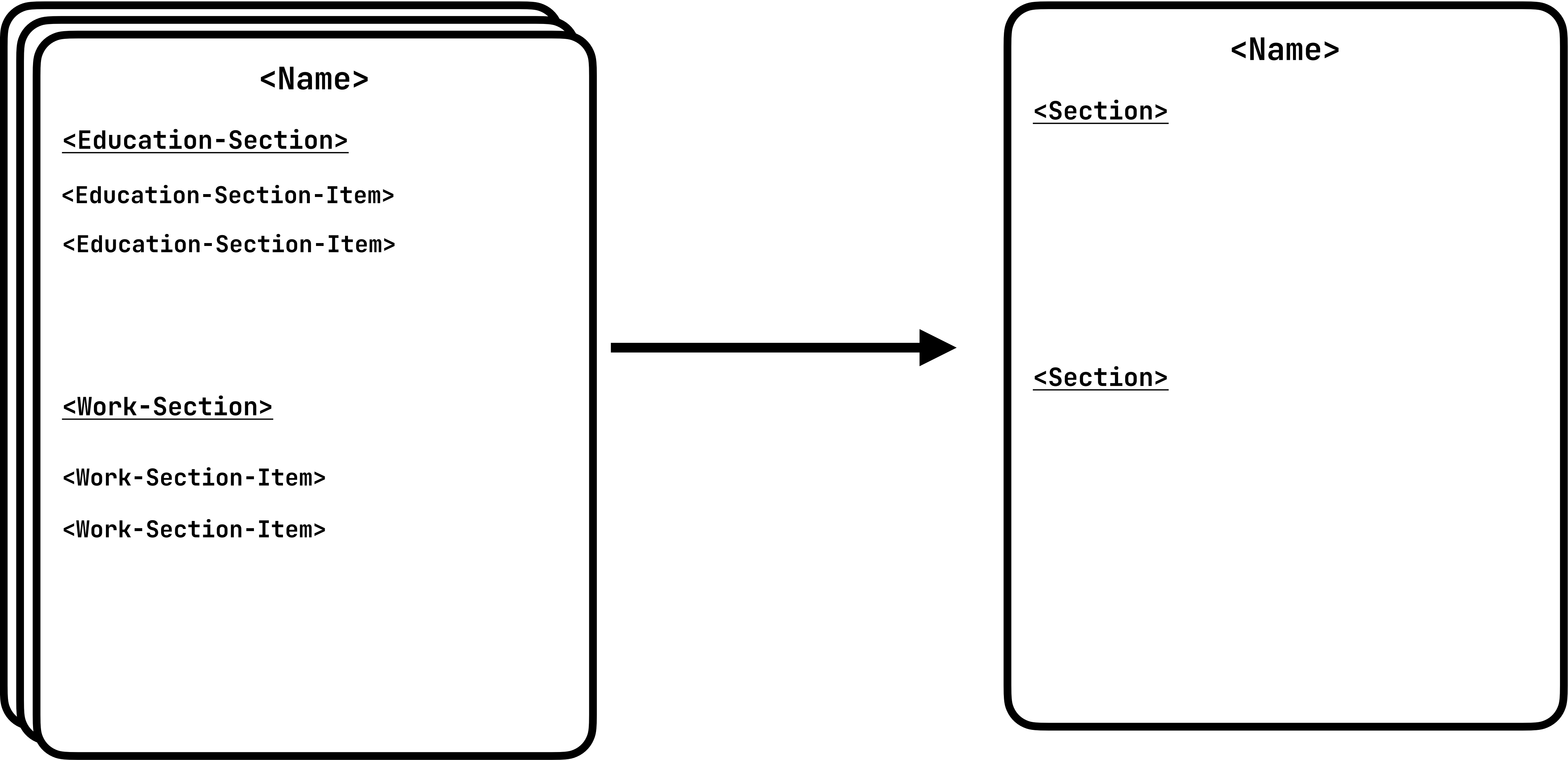<u>Education</u>

<Degree>   <Start> - <End>
<School>

<Degree>   <Start> - <End>
<School>

<u>Work Experience</u>

<Position>   <Start> - <End>
<Company>

<Position>   <Start> - <End>
<Company>

<Position>   <Start> - <End>
<Company>

Nested Templates
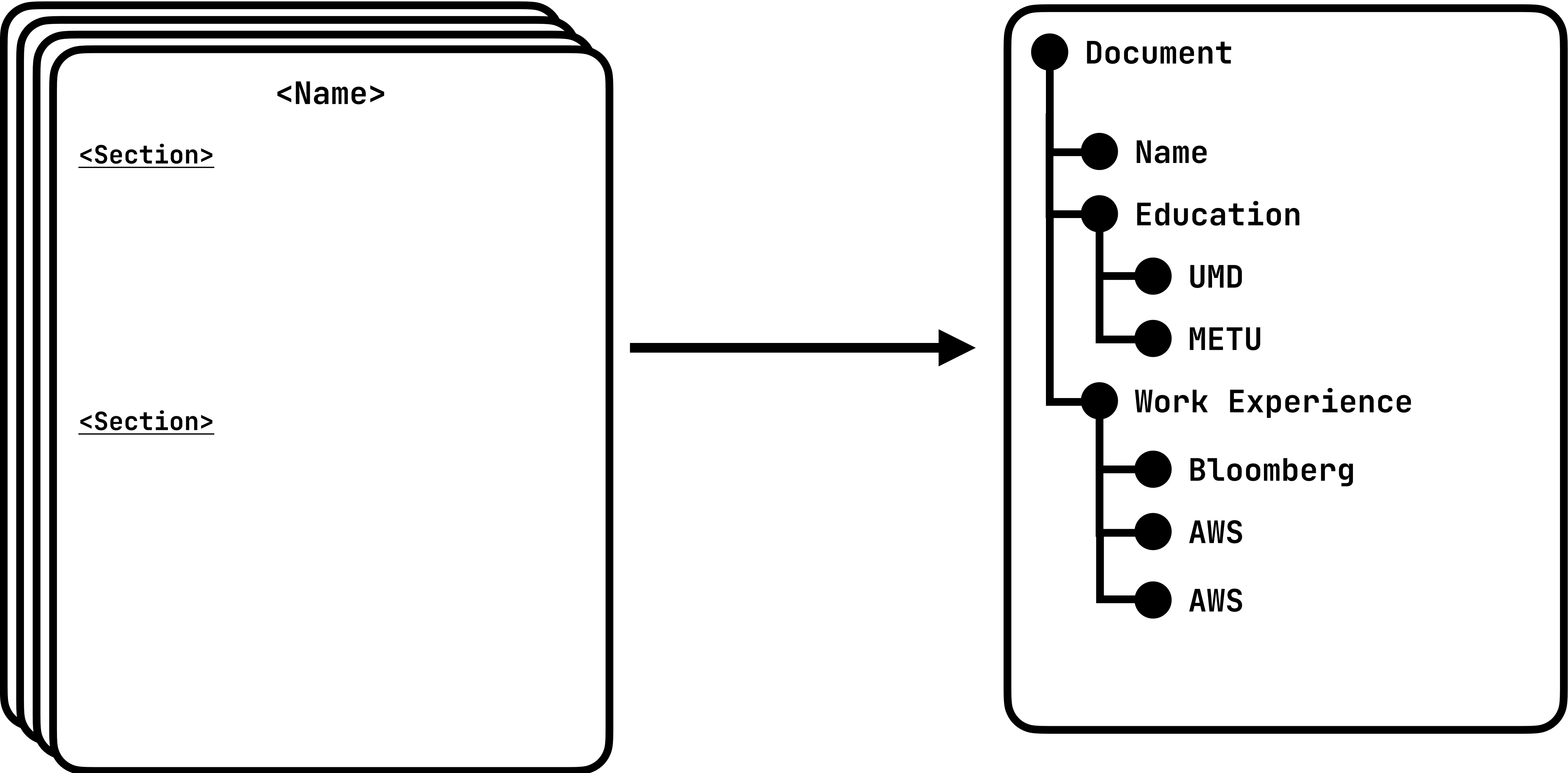## Partial Documents with Partial Documents inside

Alperen Keles

Education

<Degree>   <Start> - <End>
<School>

<Degree>   <Start> - <End>
<School>

Work Experience

<Position>   <Start> - <End>
<Company>

<Position>   <Start> - <End>
<Company>

<Position>   <Start> - <End>
<Company>

→

<Name>

<Education-Section>

<Education-Section-Item>

<Education-Section-Item>

<Work-Section>

<Work-Section-Item>

<Work-Section-Item>

Nested Templates
Partial Documents with Partial Documents inside

\<Name\>

\<Education-Section\>

\<Education-Section-Item\>

\<Education-Section-Item\>

\<Work-Section\>

\<Work-Section-Item\>

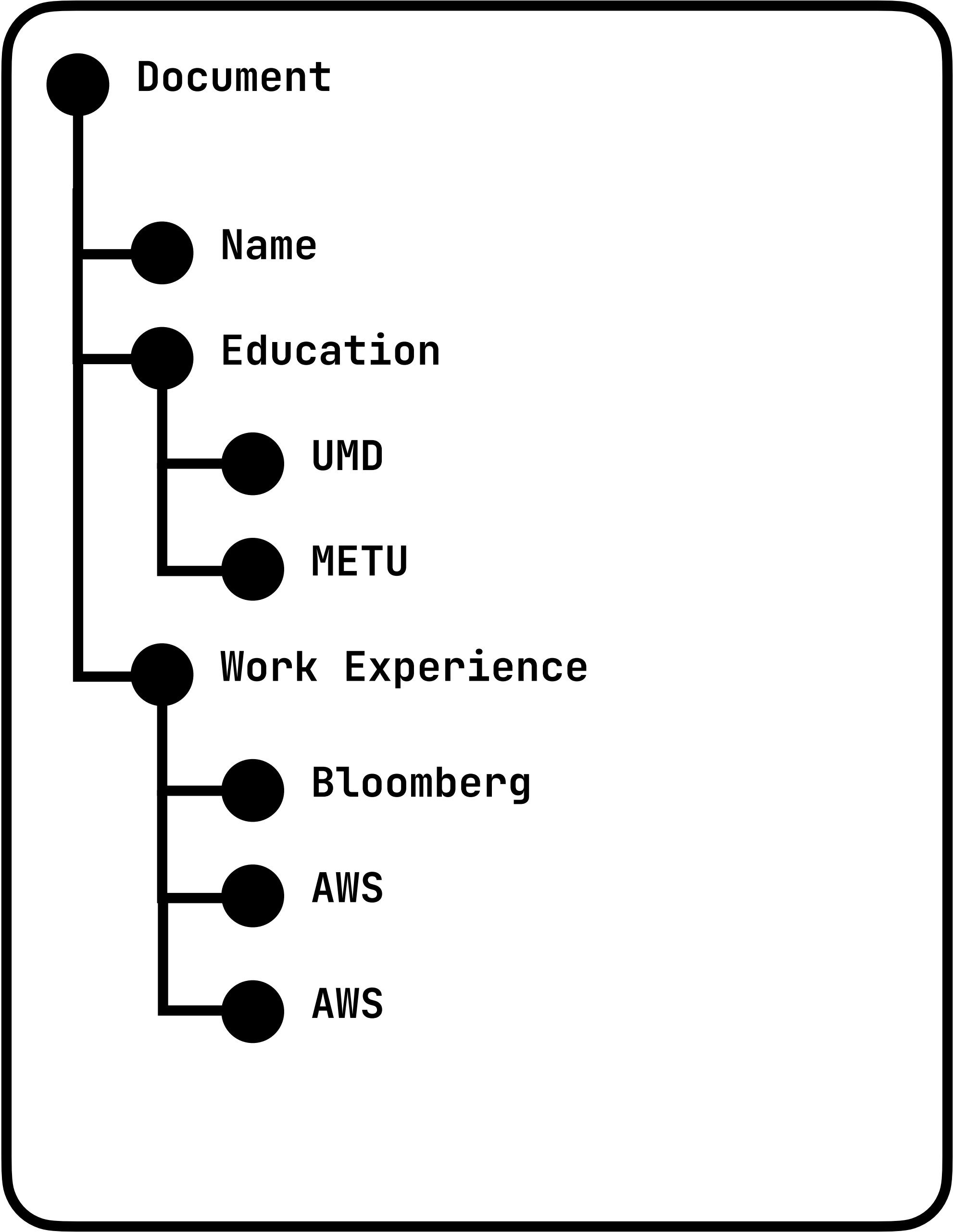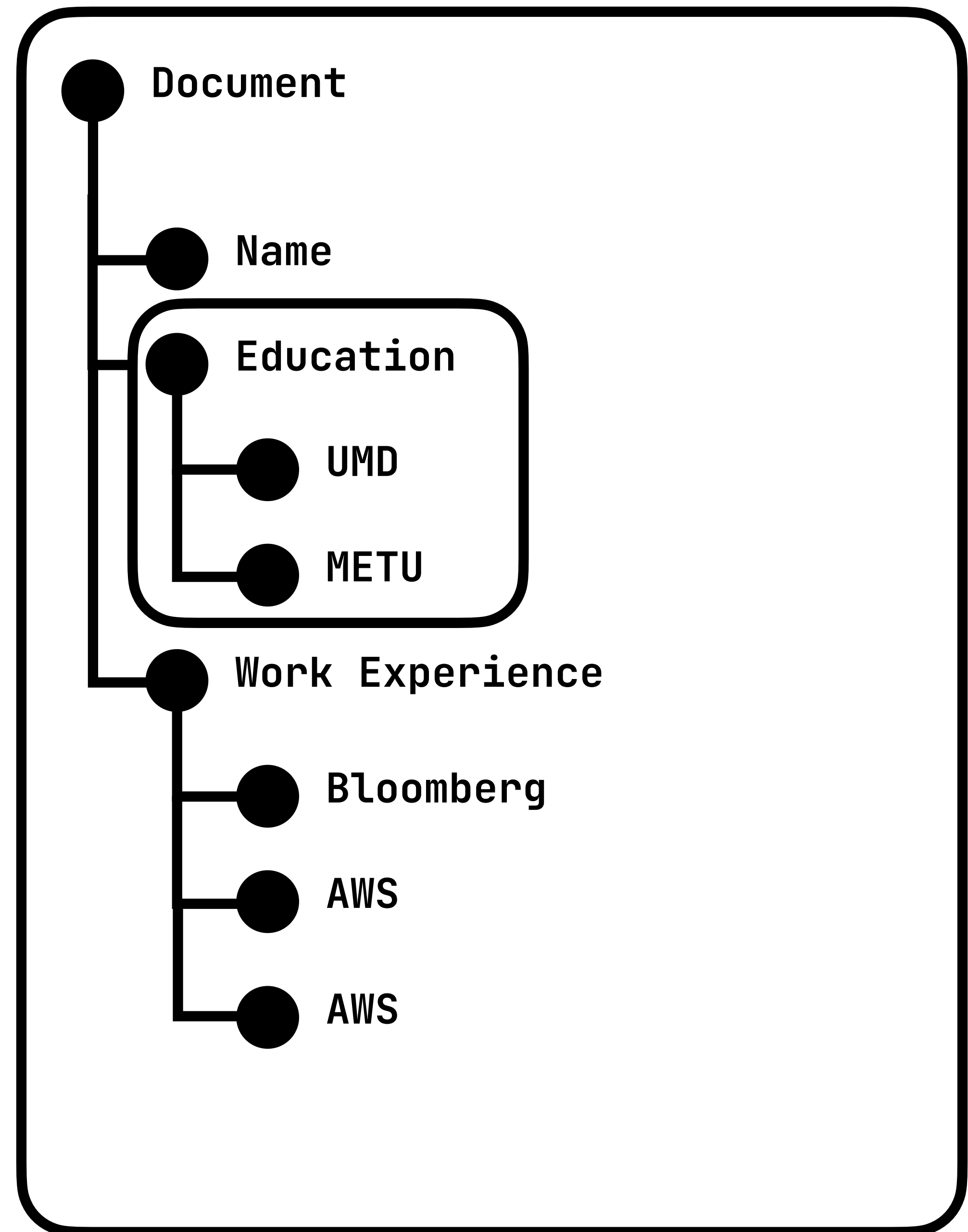\<Work-Section-Item\>

\<Name\>

\<Section\>

\<Section\>

Nested Templates
Partial Documents with Partial Documents inside
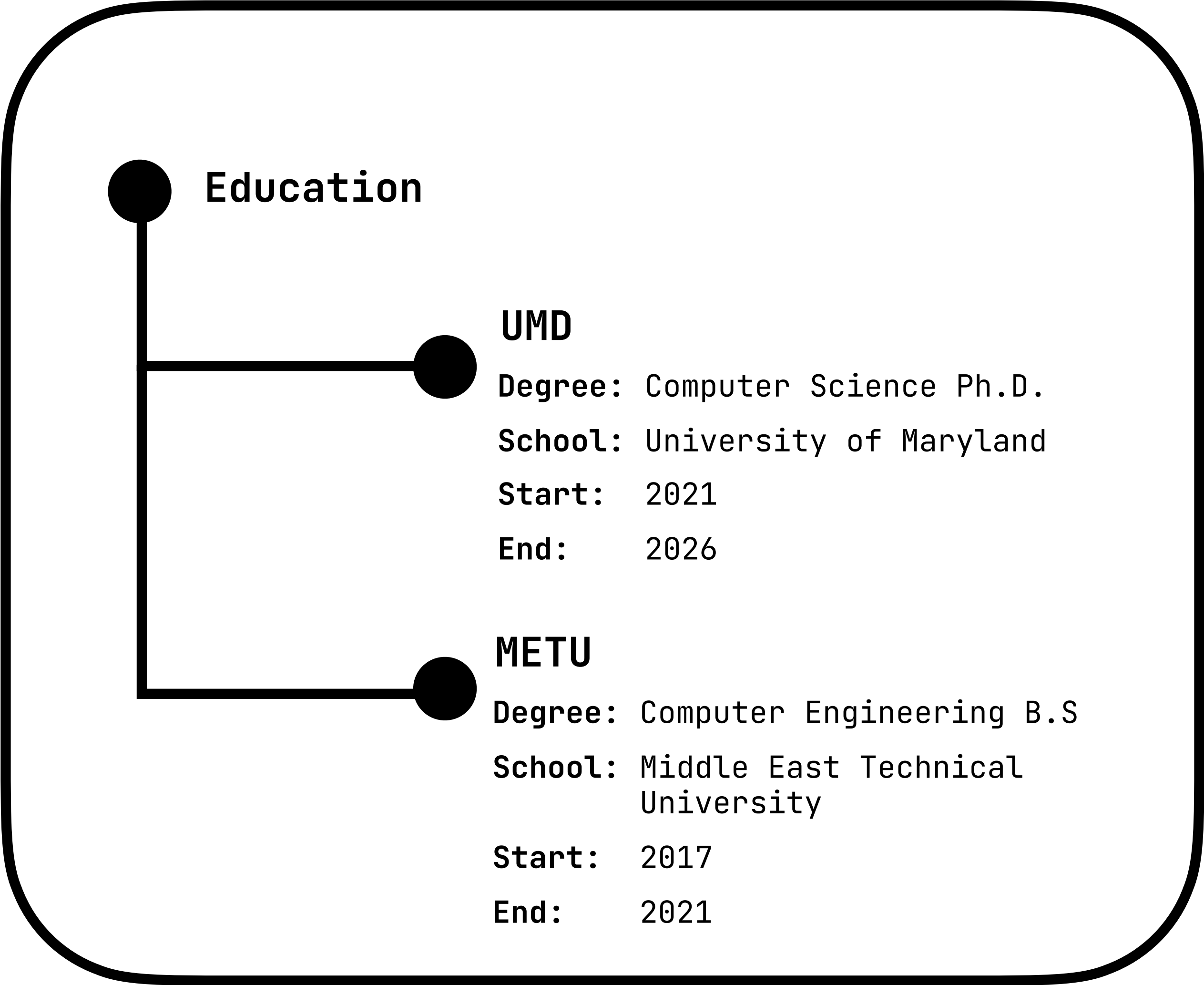
Form Editors

Editing Nested Templates

Form Editors

Editing Nested Templates

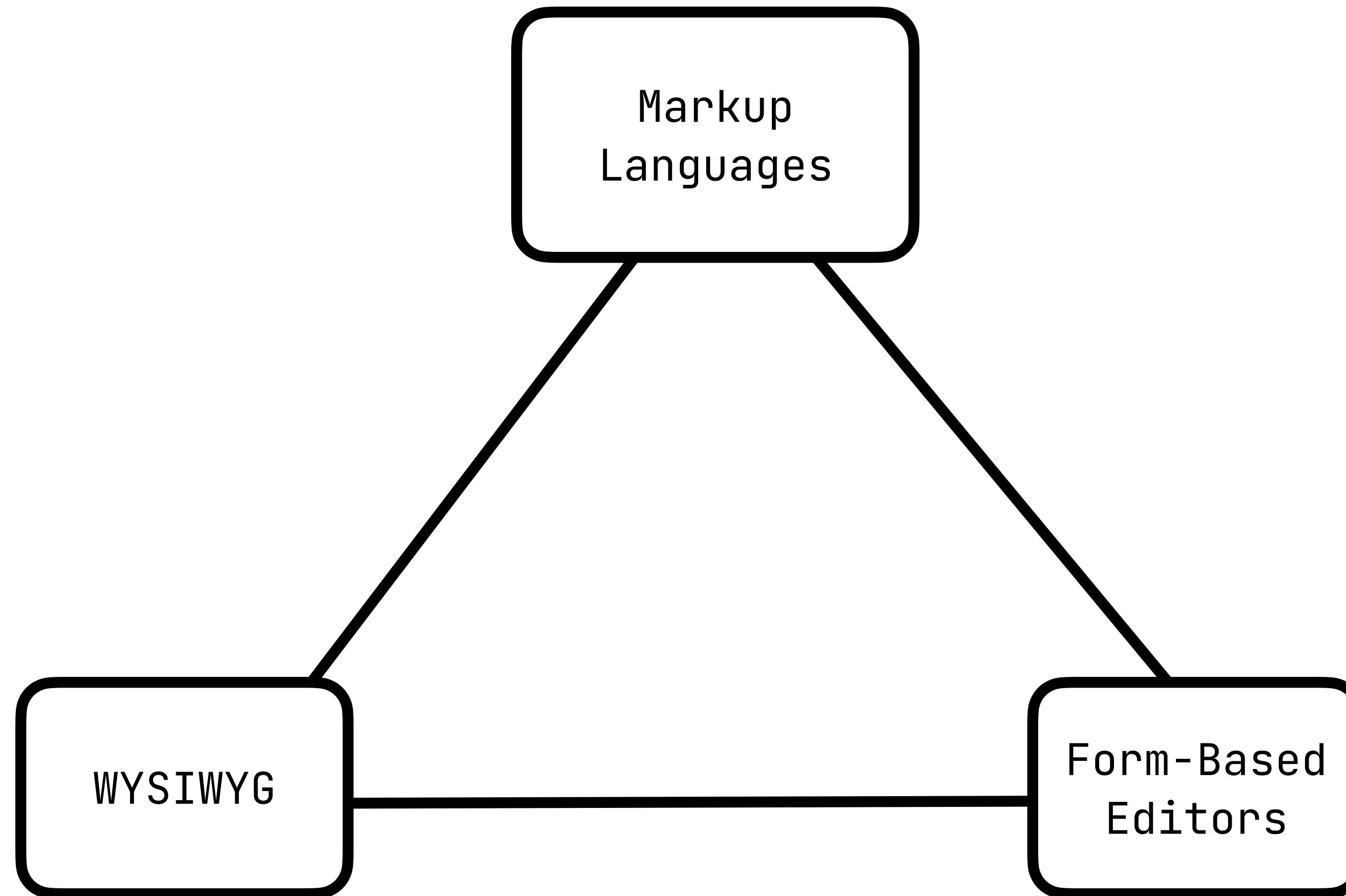Document
Name
Education
UMD
METU
Work Experience
Bloomberg
AWS
AWS
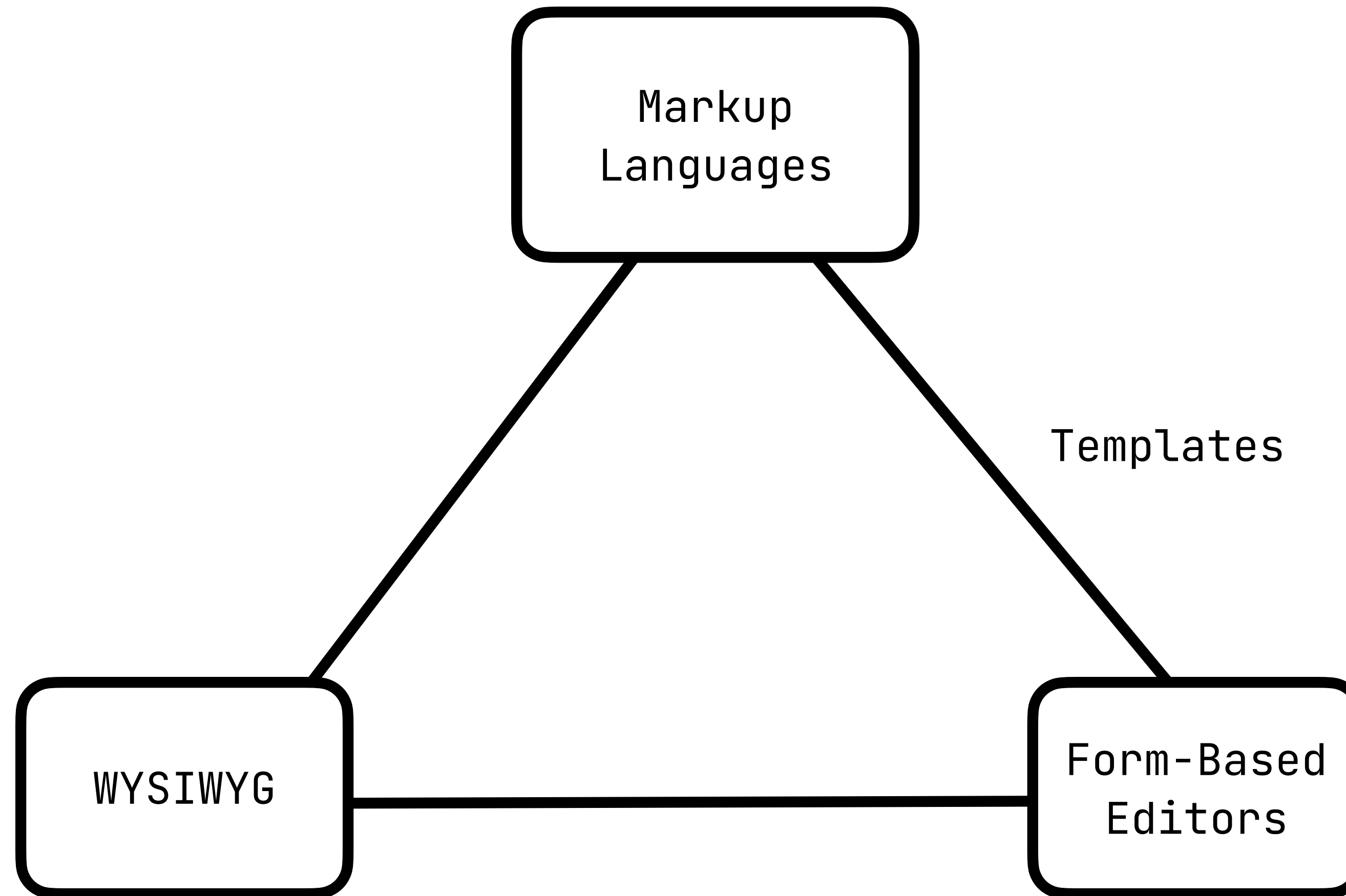
Form Editors

Editing Nested Templates

- **Education**
  - **UMD**
    - **Degree:** Computer Science Ph.D.
    - **School:** University of Maryland
    - **Start:** 2021
    - **End:** 2026
  - **METU**
    - **Degree:** Computer Engineering B.S
    - **School:** Middle East Technical University
    - **Start:** 2017
    - **End:** 2021

Document Editor Trilemma

Document Editor Trilemma

Document Editor Trilemma

Markup
Languages

WYSIWYG

Form-Based
Editors

Templates

Document Editor Trilemma

Markup Languages

WYSIWYG

Form-Based Editors
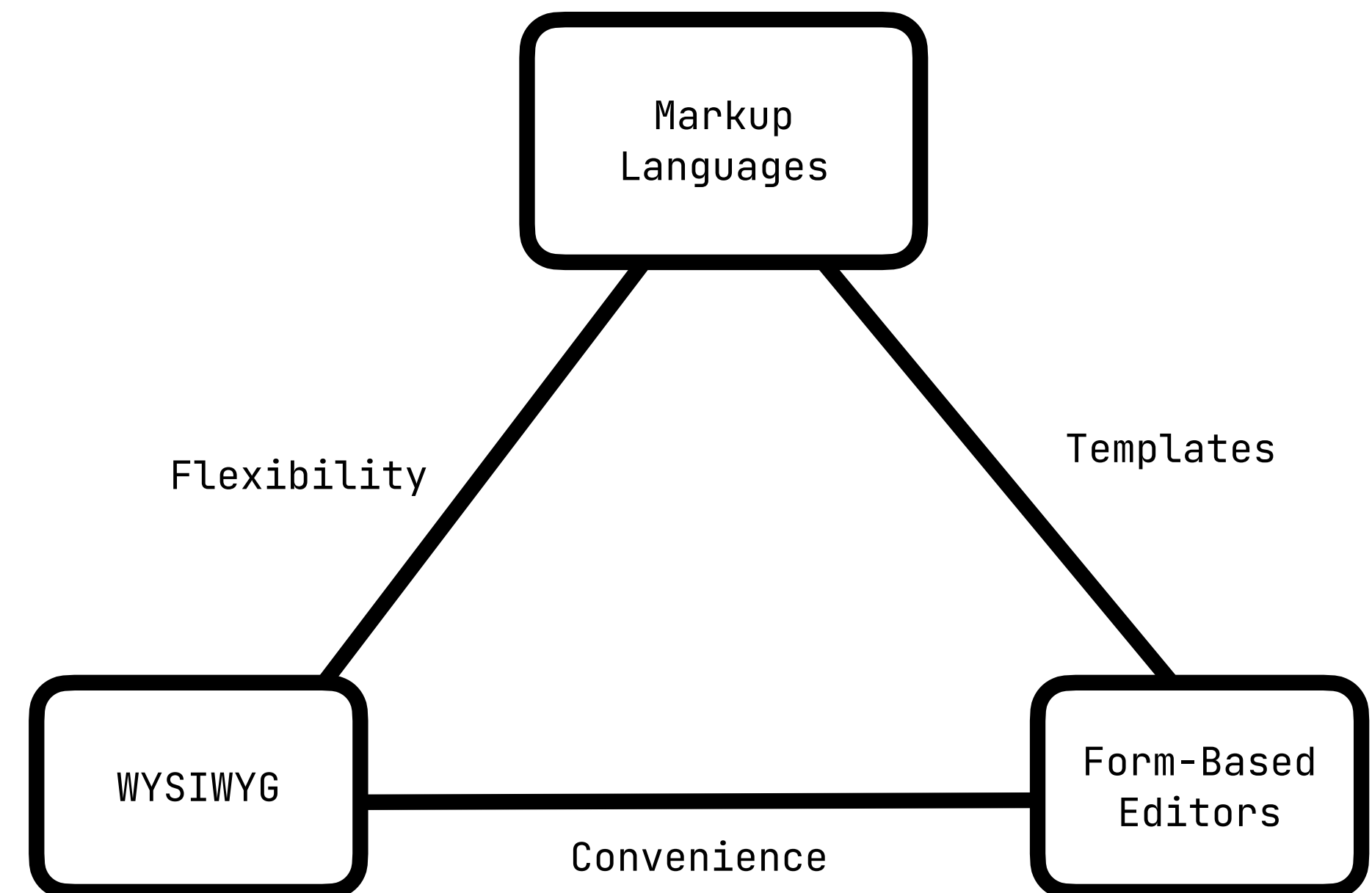
Flexibility
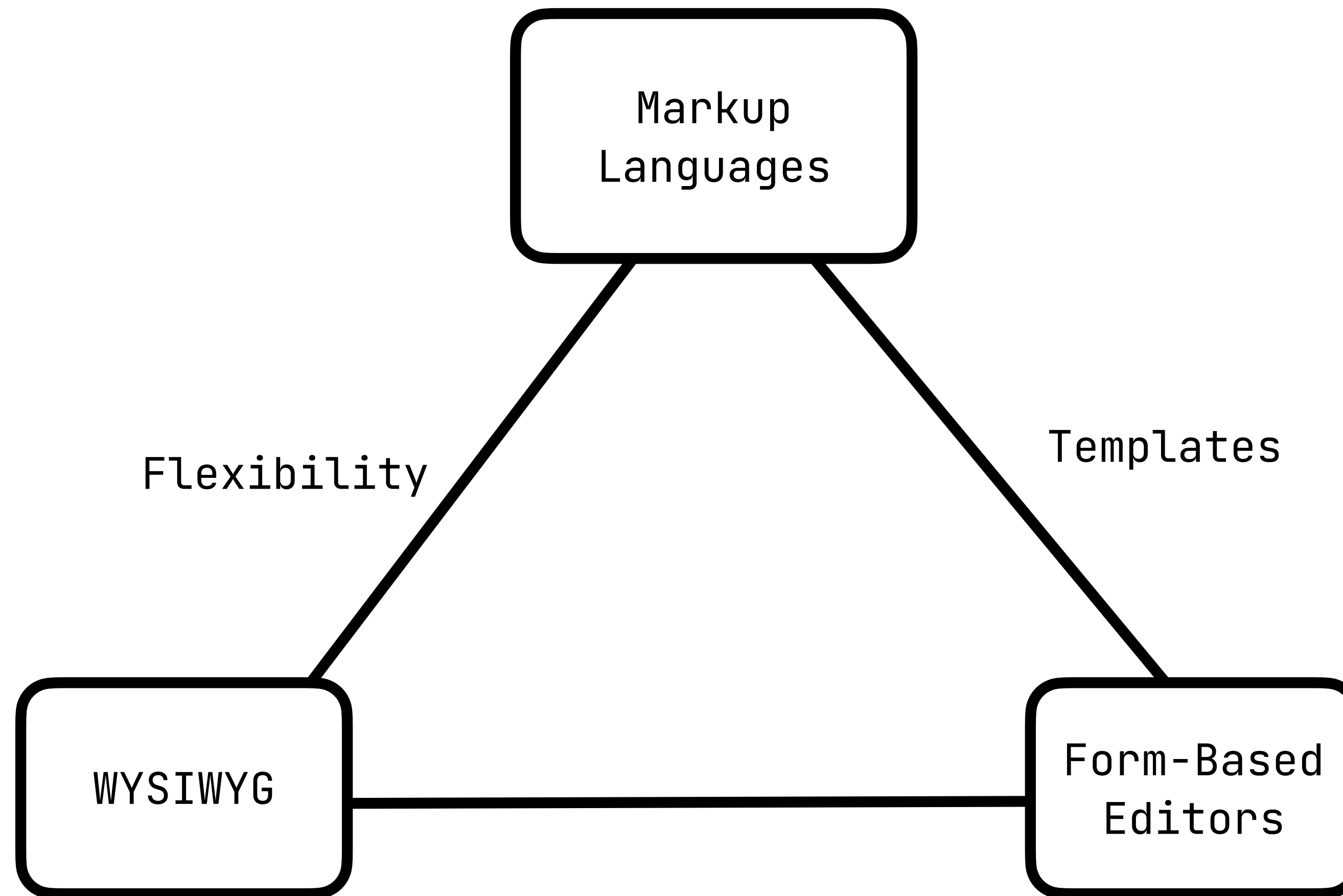
Templates

Document Editor Trilemma
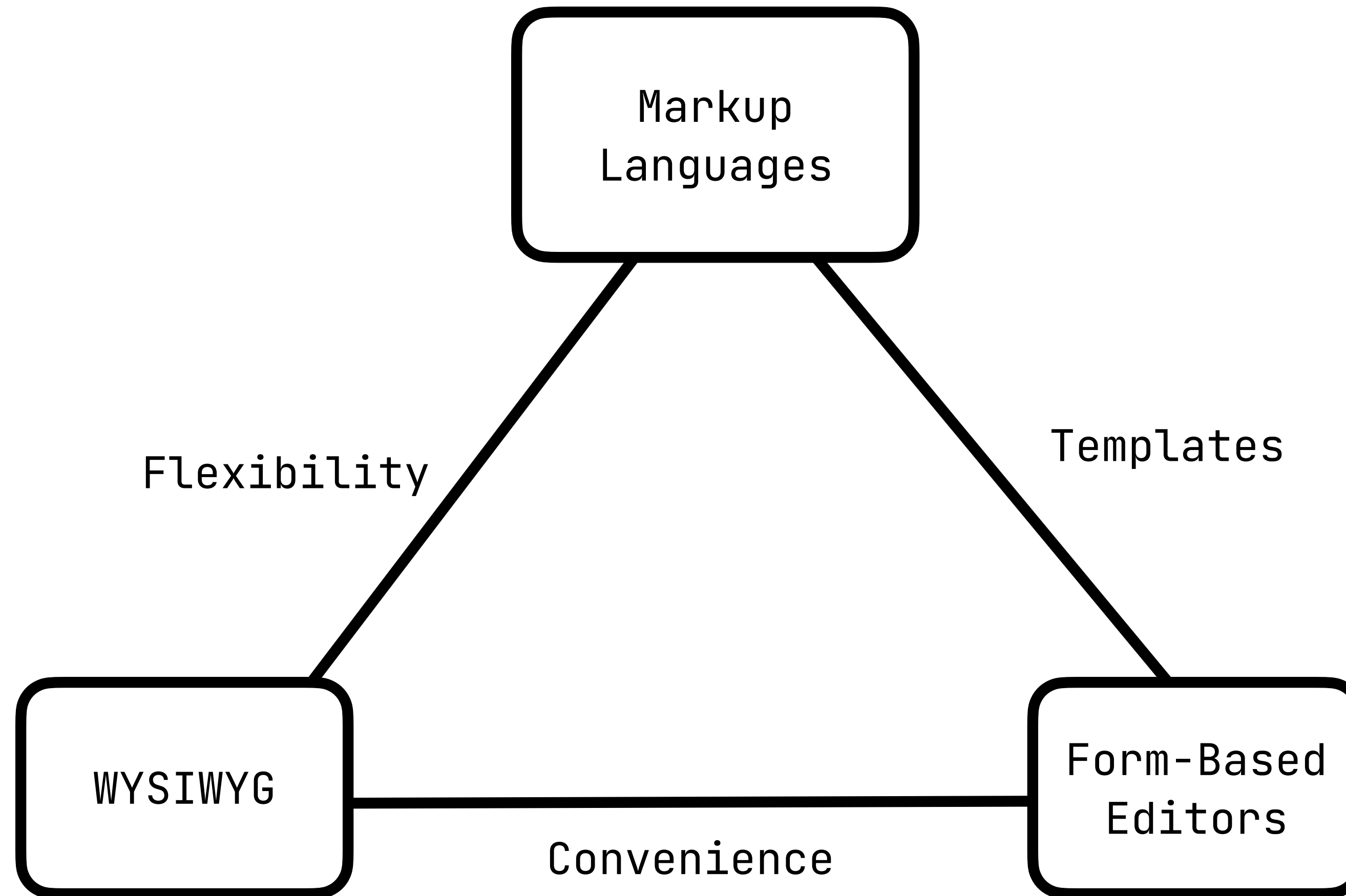
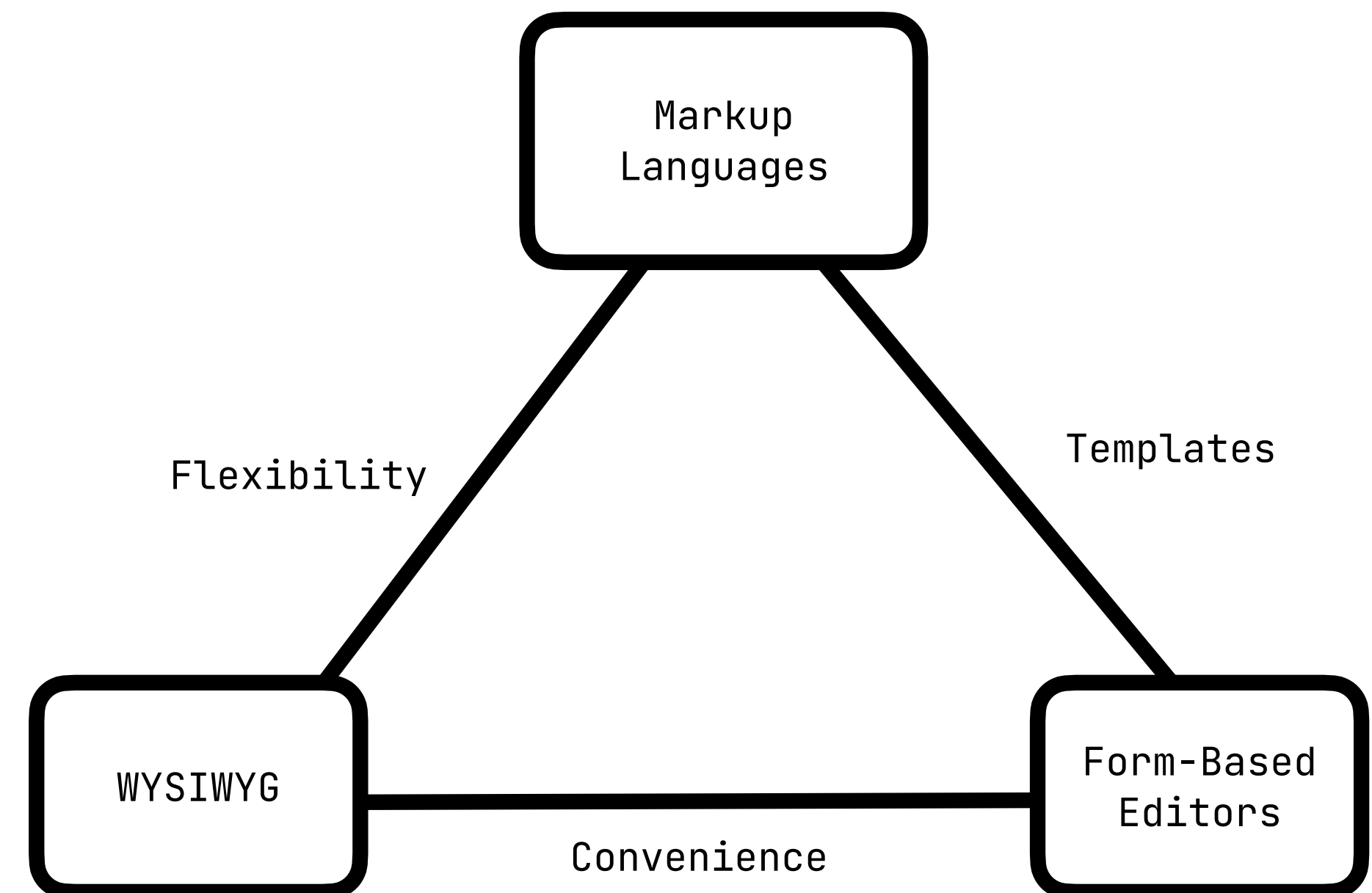# Document Editor Trilemma

What about Cross Paradigm Editors?

Document Editor Trilemma

What about Cross Paradigm Editors?

ObsidianMD: WYSIWYG Markdown

Notion: Multi-view tables

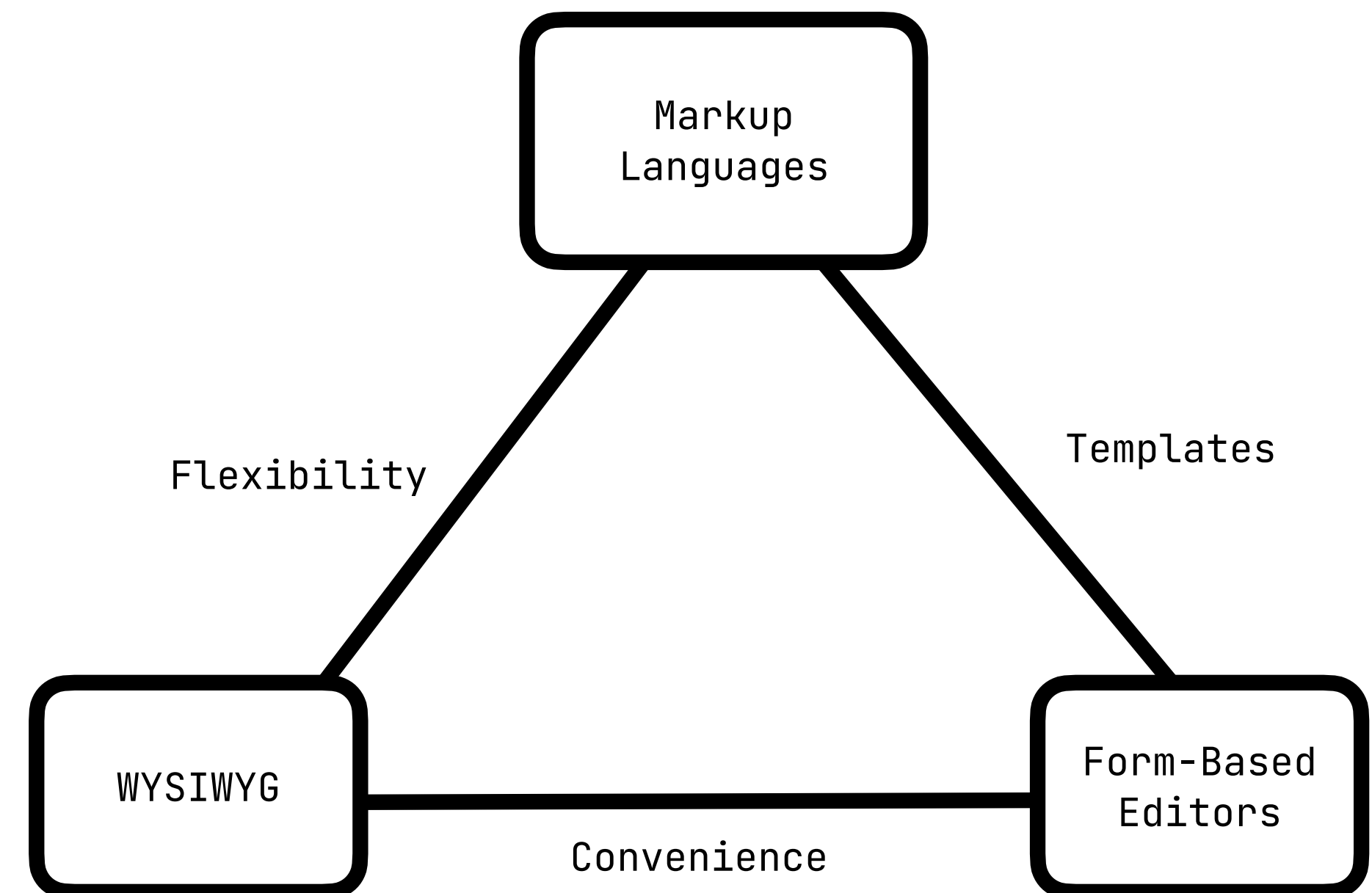**GDocs:** Template variables

Document Editor Trilemma

What about Cross Paradigm Editors?

ObsidianMD: WYSIWYG Markdown

Notion: Multi-view tables

GDocs: Template variables

Web Frameworks: JSX, Jinja, Php

A New Cross Paradigm Editor
Tail: A Typed and Structured Document Editor

A New **Cross Paradigm Editor**
Tail: A Typed and Structured Document Editor

Data Schemas

Layout
Schemas

A New **Cross Paradigm Editor**
Tail: A Typed and Structured Document Editor

Data Schemas

Layout
Schemas

Company: String
Start: Year
End: Year
Position: String
Text: MultilineString
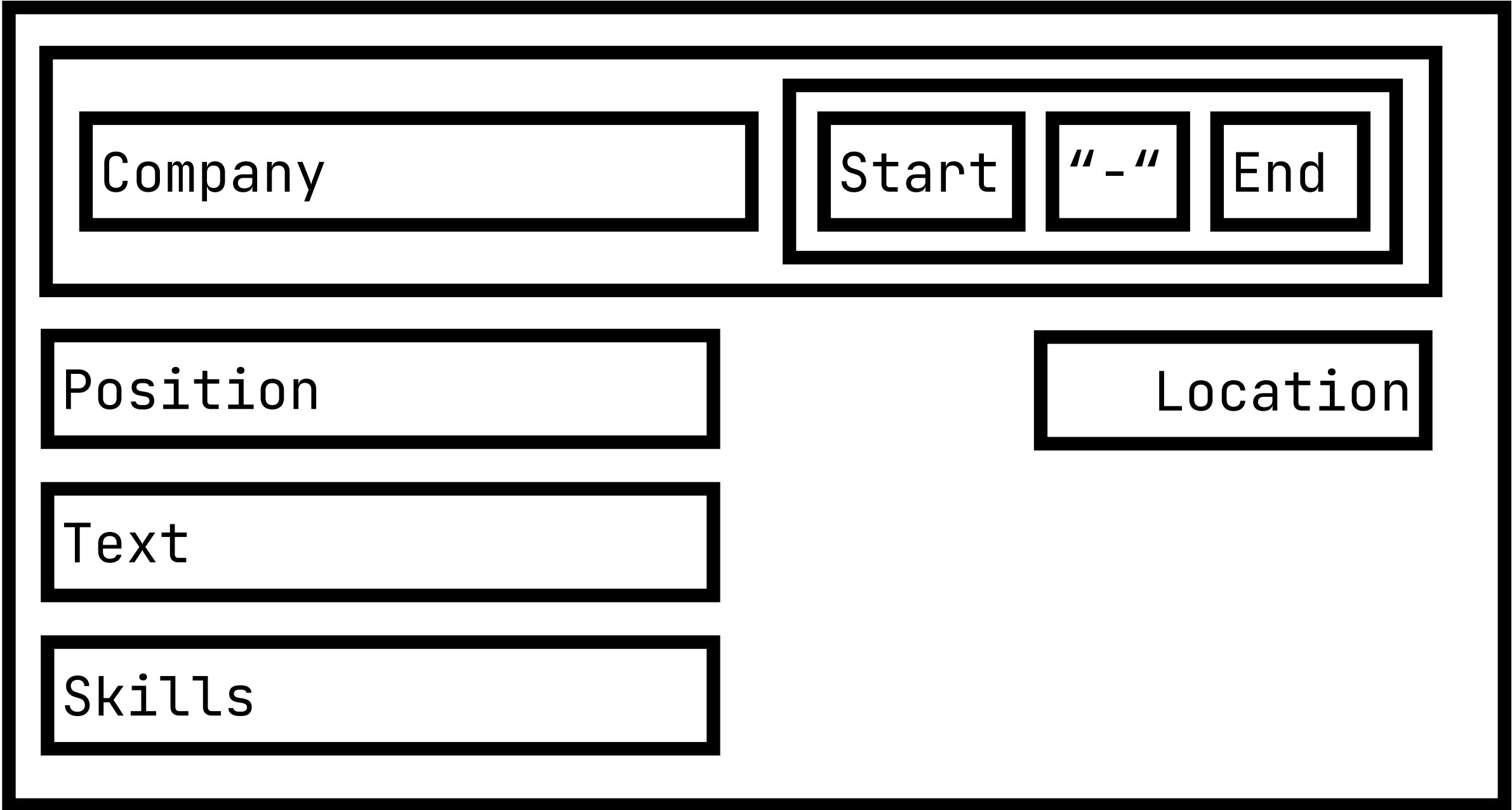**Skills:** List<String>
Location: String

A New **Cross Paradigm Editor**
Tail: A Typed and Structured Document Editor

Data Schemas

Layout Schemas

Company: String
Start: Year
End: Year
Position: String
Text: MultilineString
Skills: List<String>
Location: String

Company   Start "-" End

Position   Location

Text

Skills

A New Cross Paradigm Editor
Tail: A Typed and Structured Document Editor[1]

1. Create document templates.

[1] https://cvdl-editor.vercel.app/

A New Cross Paradigm Editor
Tail: A Typed and Structured Document Editor[1]

1. Create document templates.

2. **Given a template, you can derive an editor for it.**

3. Given an editor, you can create a document with it.

[1] https://cvdl-editor.vercel.app/

A New Cross Paradigm Editor
Tail: A Typed and Structured Document Editor[1]

It's Demo Time!

[1] https://cvdl-editor.vercel.app/

A New Cross Paradigm Editor
Tail: A Typed and Structured Document Editor[1]

1. Create document templates.

2. **Given a template, you can derive an editor for it.**

3. Given an editor, you can create a document with it.

4. A full template system with arbitrarily nested templates[2]

5. Applying similar techniques to JSX.

6. Making Tail a community project.

[1] https://cvdl-editor.vercel.app/
[2] http://alperenkeles.com/documents/tail.pdf

A New Cross Paradigm Editor
Tail: A Typed and Structured Document Editor

Demo Webpage[1]

POPL'24 SRC

Github[3]

Extended Abstract[2]

Email: akeles@umd.edu

Twitter: @keleessss

Github: @alpaylan

[1] https://cvdl-editor.vercel.app/
[2] https://alperenkeles.com/documents/tail.pdf
[3] https://github.com/alpaylan/cvdl