Adapting the Hypermedia Structure in a Generic Multimedia Adaptation Framework

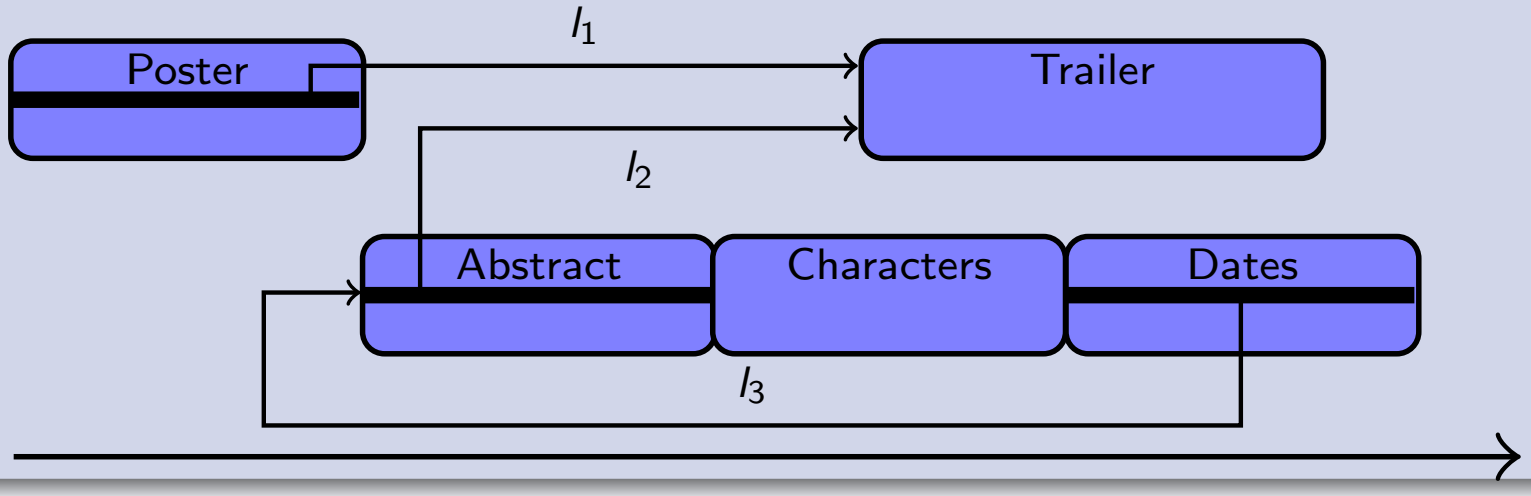
Sébastien Laborie and Jérôme Euzenat

SMAP'06

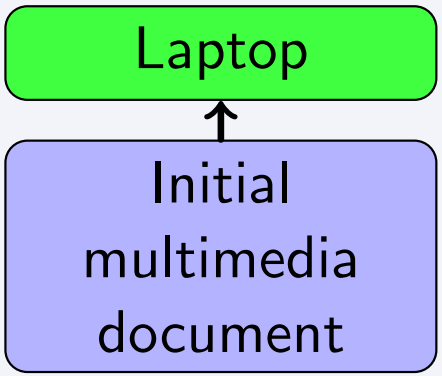
A multimedia document example

A movie trailer presentation

Temporal-hypermedia dimension



Multimedia document adaptation



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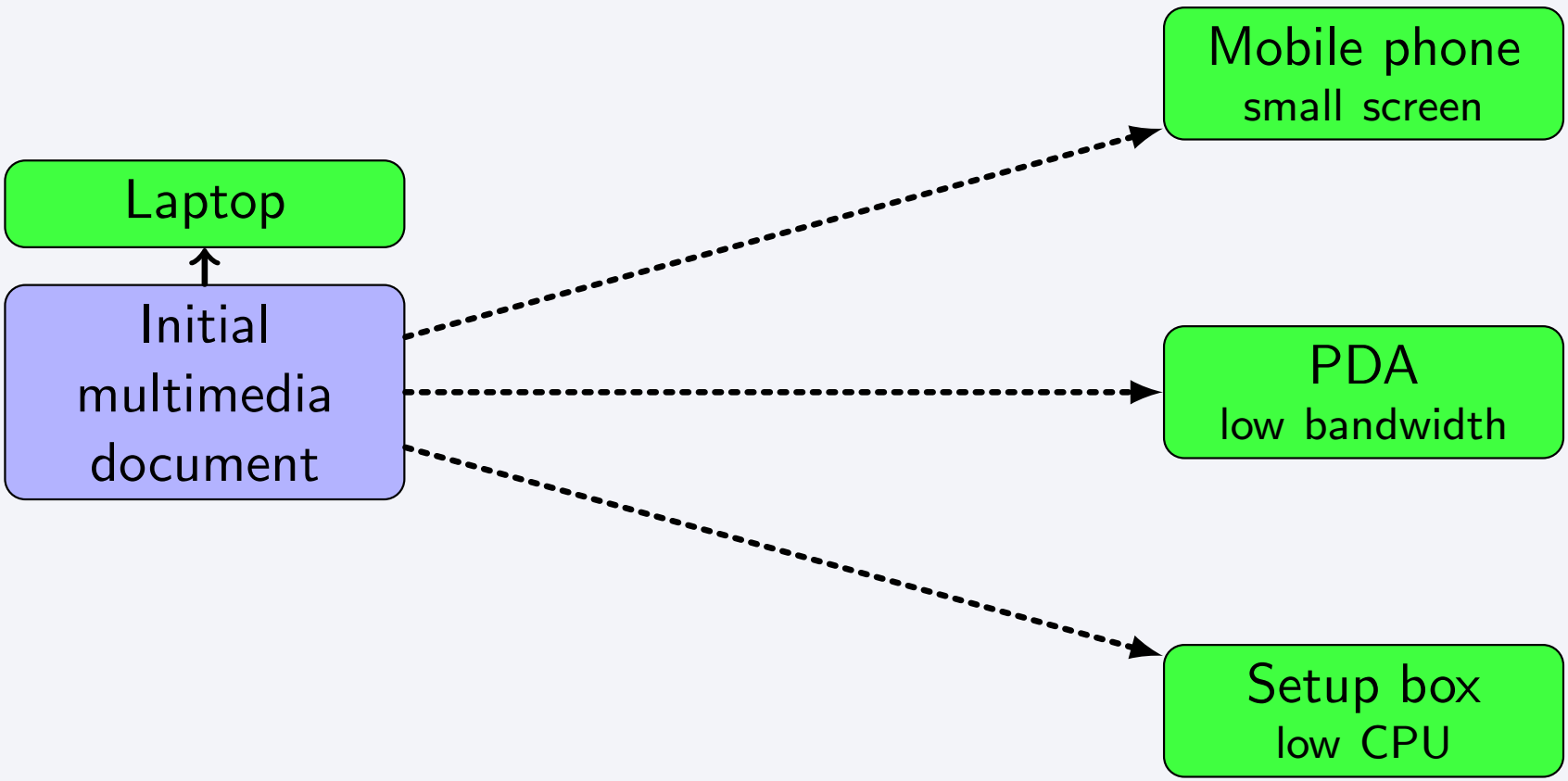
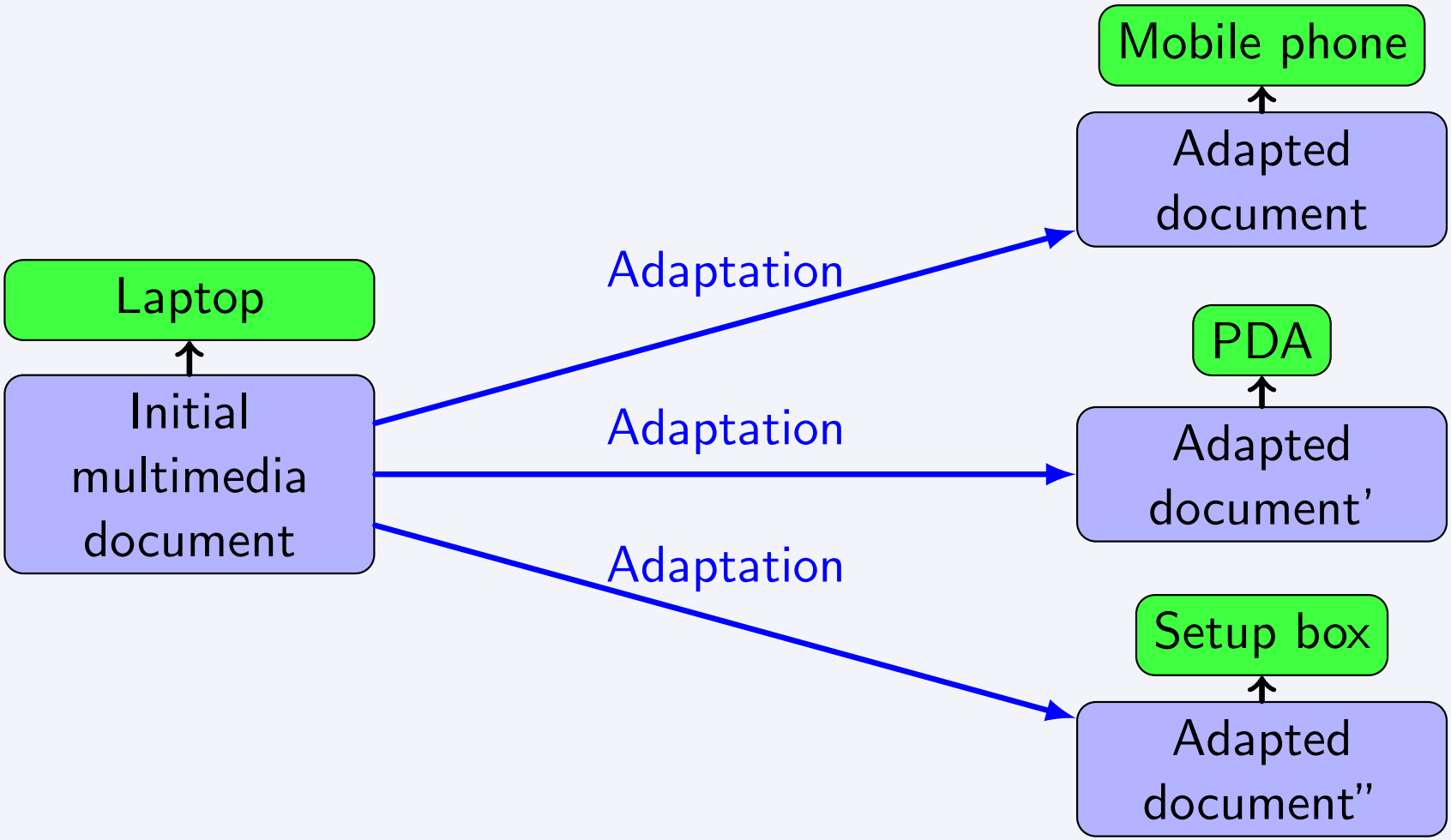
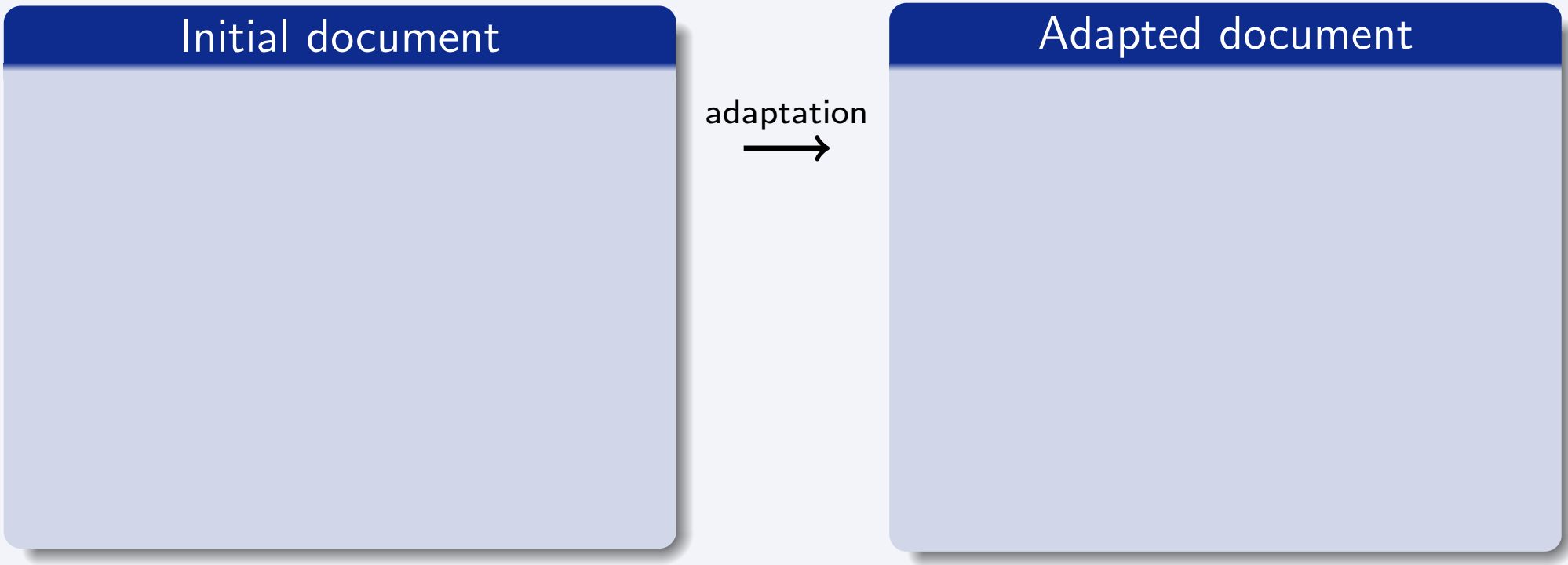


Multimedia document adaptation



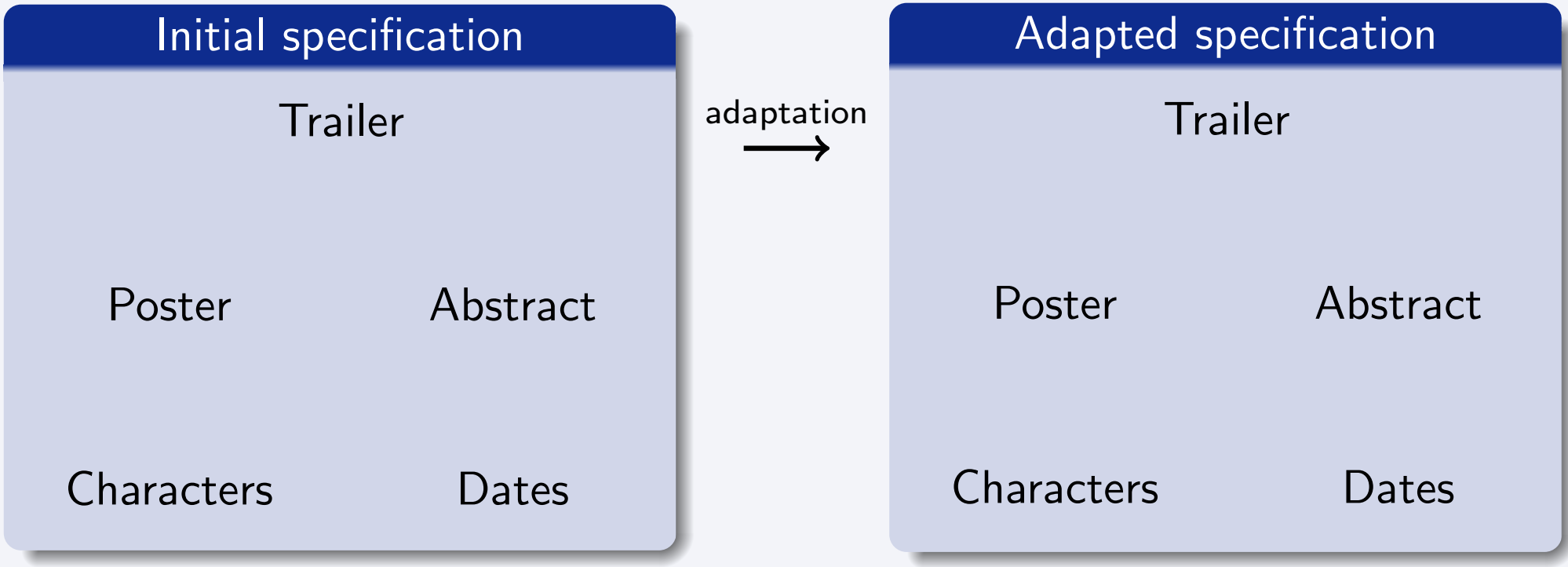
Our adaptation approach

- Adaptation of the multimedia document structure.



Our adaptation approach

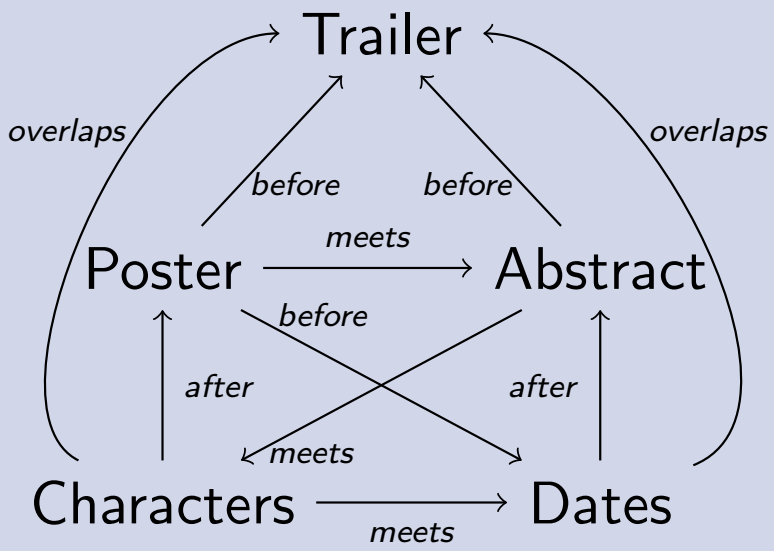
- Adaptation of the multimedia document structure.
- A multimedia document specification is composed of :
  - A set of multimedia objects.



Our adaptation approach

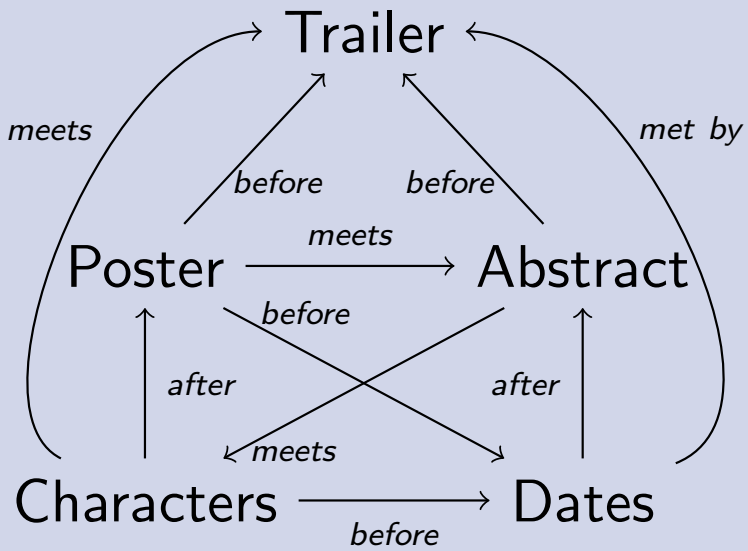
- Adaptation of the multimedia document structure.
- A multimedia document specification is composed of :
  - A set of multimedia objects.
  - A set of relations between multimedia objects.

Initial specification



adaptation

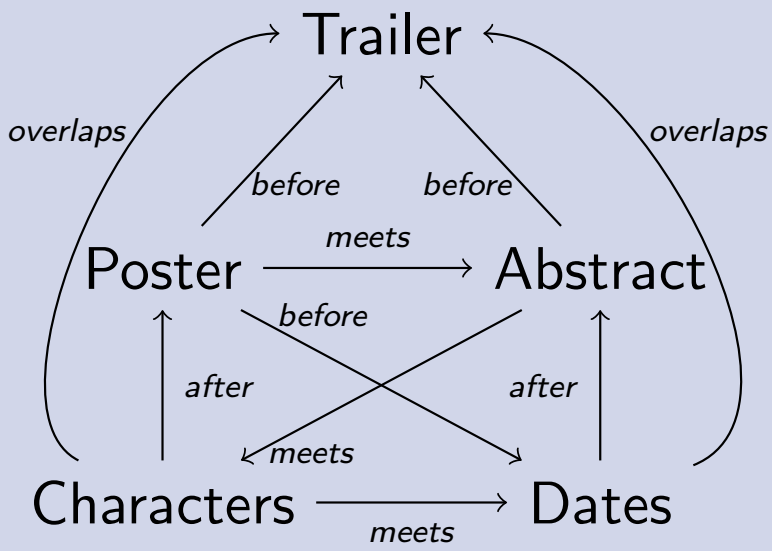
Adapted specification



Our adaptation approach

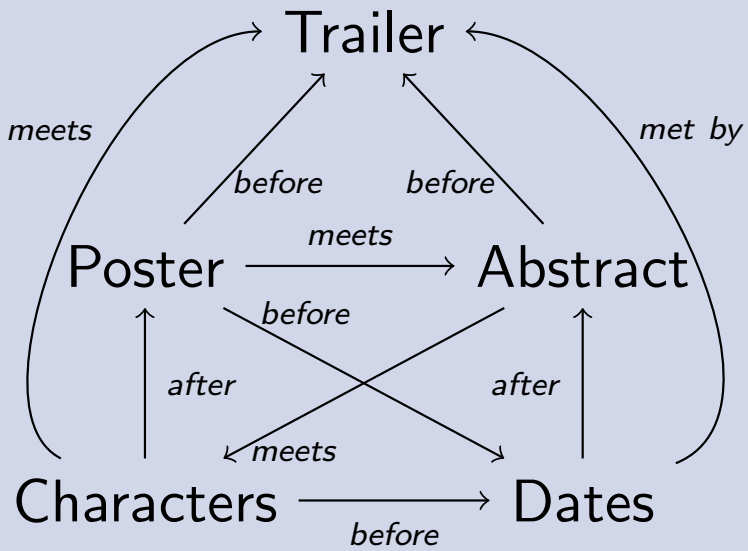
- Adaptation of the multimedia document structure.
- A multimedia document specification is composed of :
  - A set of multimedia objects.
  - A set of relations between multimedia objects.

Initial relation graph



adaptation →

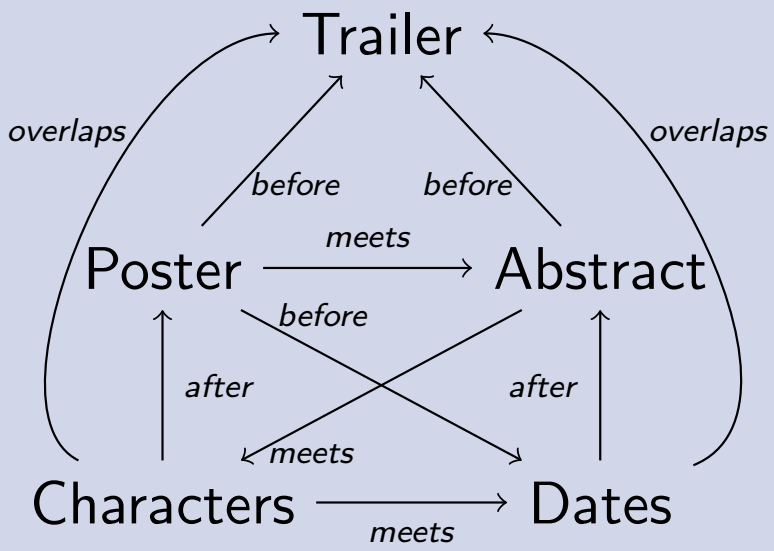
Adapted relation graph



Our adaptation approach

- Adaptation of the multimedia document structure.
- A multimedia document specification is composed of :
  - A set of multimedia objects.
  - A set of relations between multimedia objects.
- The adapted document should be close to the initial one.

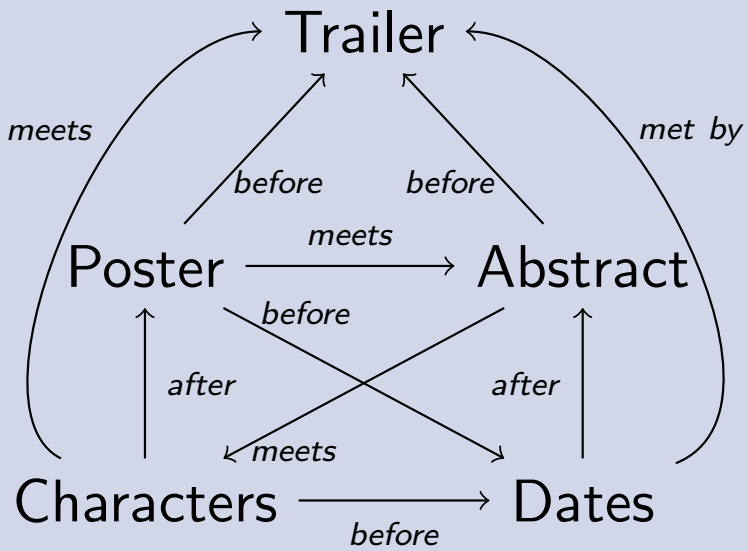
Initial relation graph



adaptation

proximity

Adapted relation graph



What is new in this paper ?

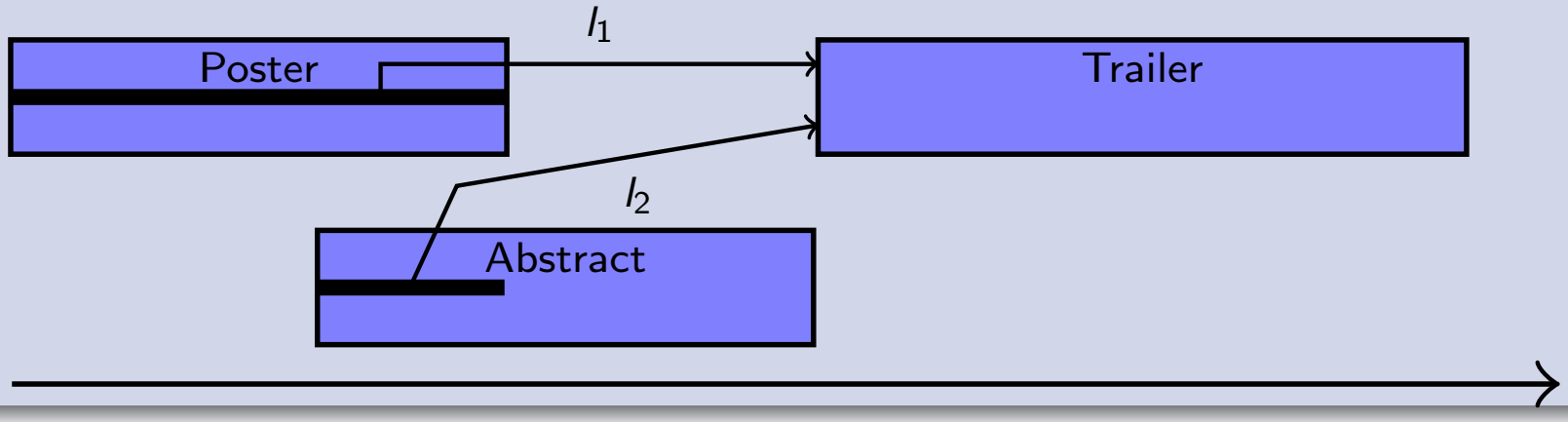
- Adapt the hypermedia dimension.
- Temporal-Hypermedia adaptation.
- Propose an incremental adaptation which takes into account the user interactions.

Outline

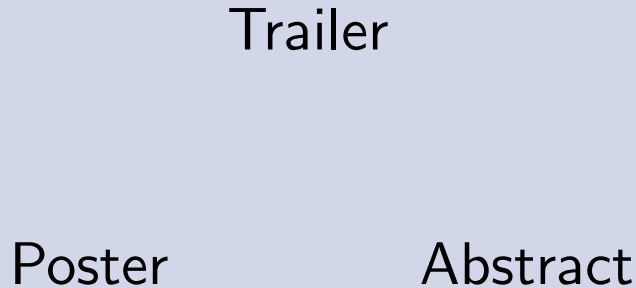
Outline

Hypermedia specification

Temporal-hypermedia dimension

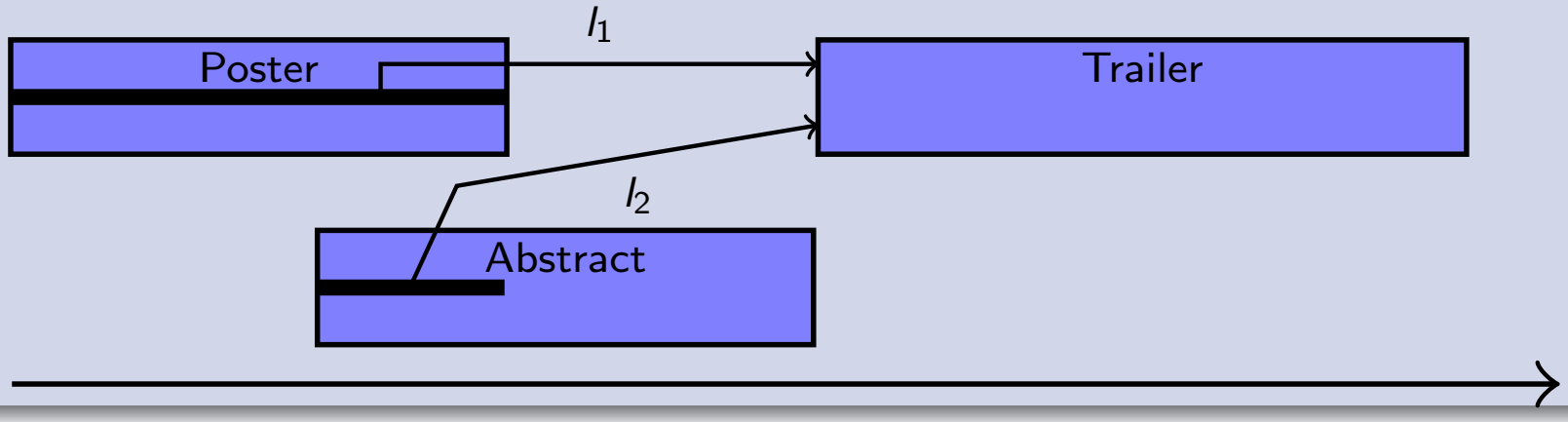


Initial relation graph



Hypermedia specification

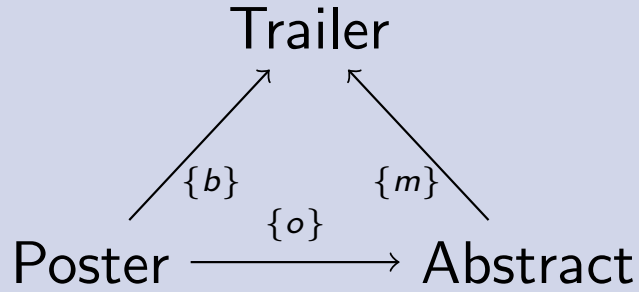
Temporal-hypermedia dimension



Allen interval algebra

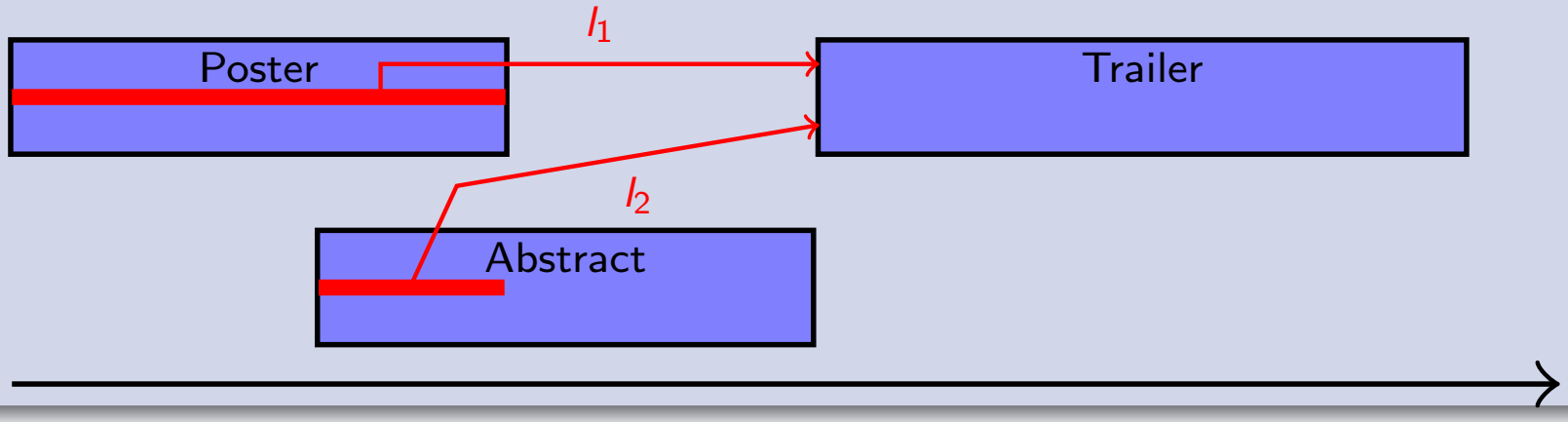
x r y	x / y	y r^{-1} x
before (b)	— —	(bi) after
meets (m)	——	(mi) met-by
during (d)	——	(di) contains
overlaps (o)	——	(oi) overlapped-by
starts (s)	——	(si) started-by
finishes (f)	——	(fi) finished-by
equals (e)	——	(e)

Initial relation graph



Hypermedia specification

Temporal-hypermedia dimension



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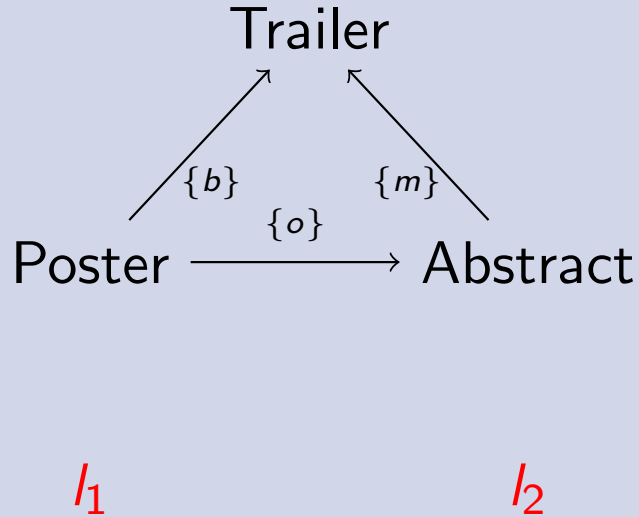
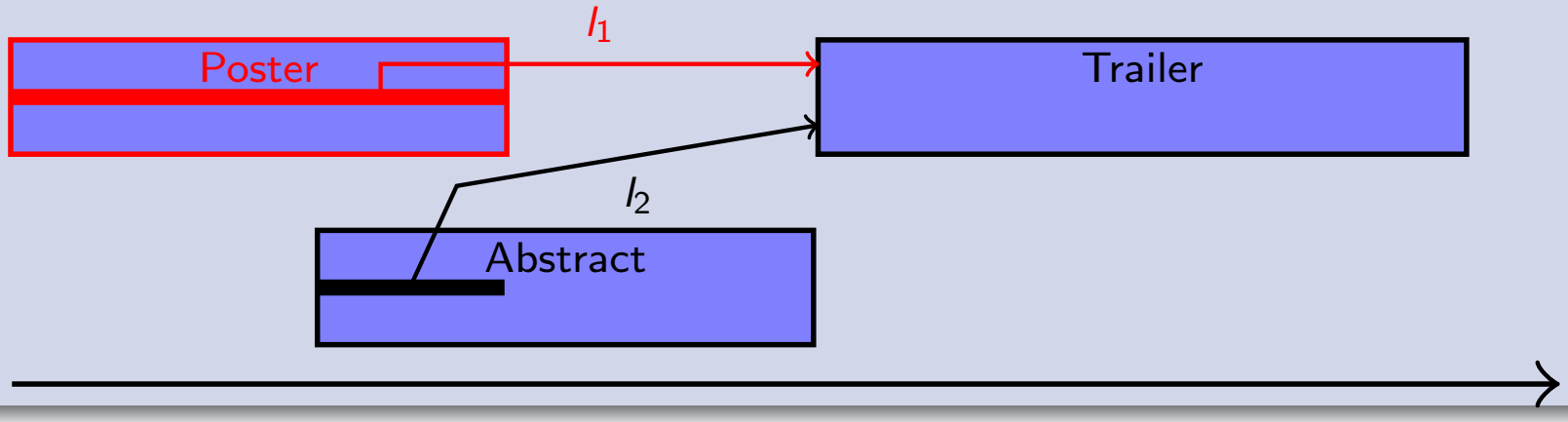


Hypermedia specification

Temporal-hypermedia dimension



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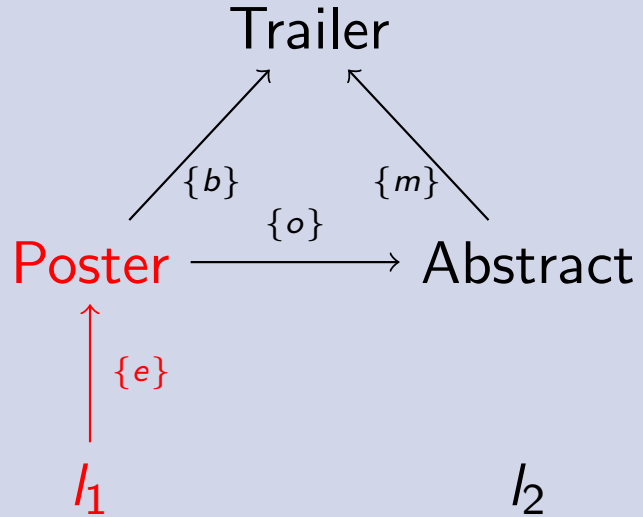
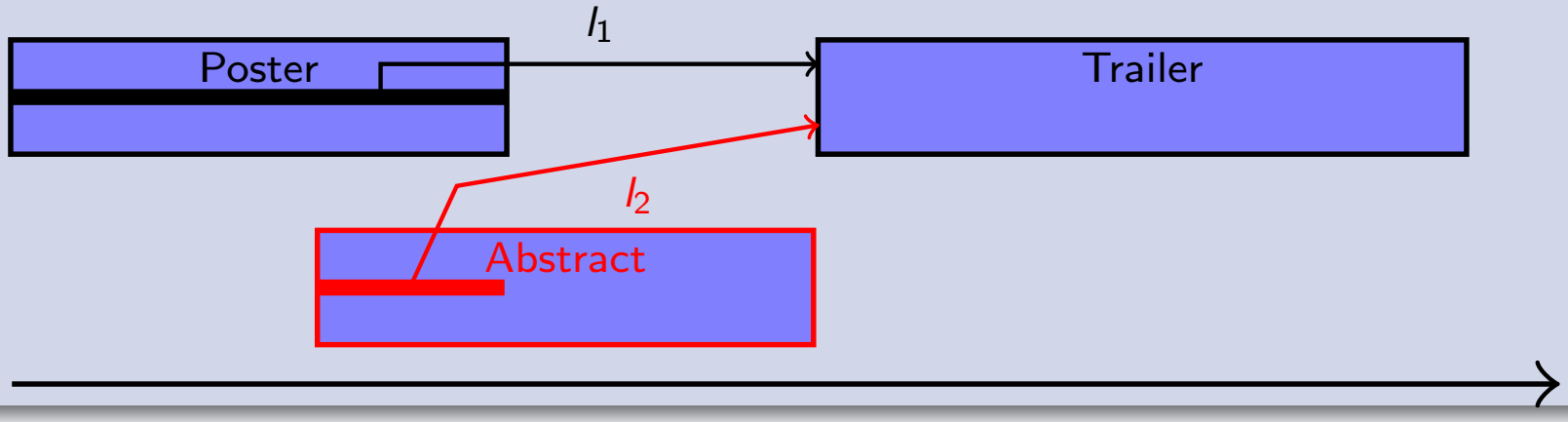


Hypermedia specification

Temporal-hypermedia dimension



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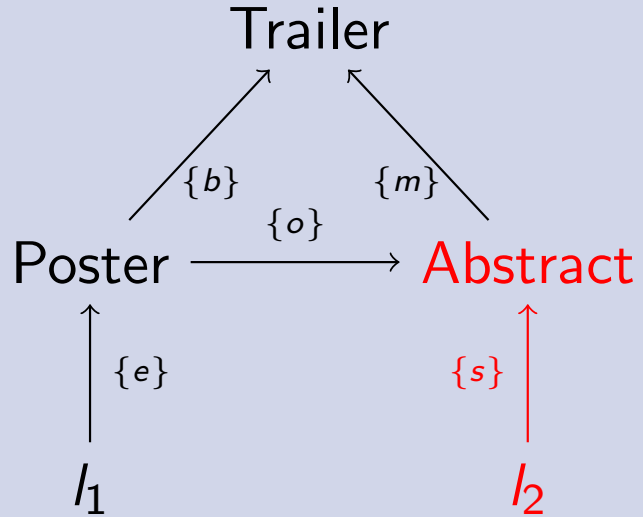
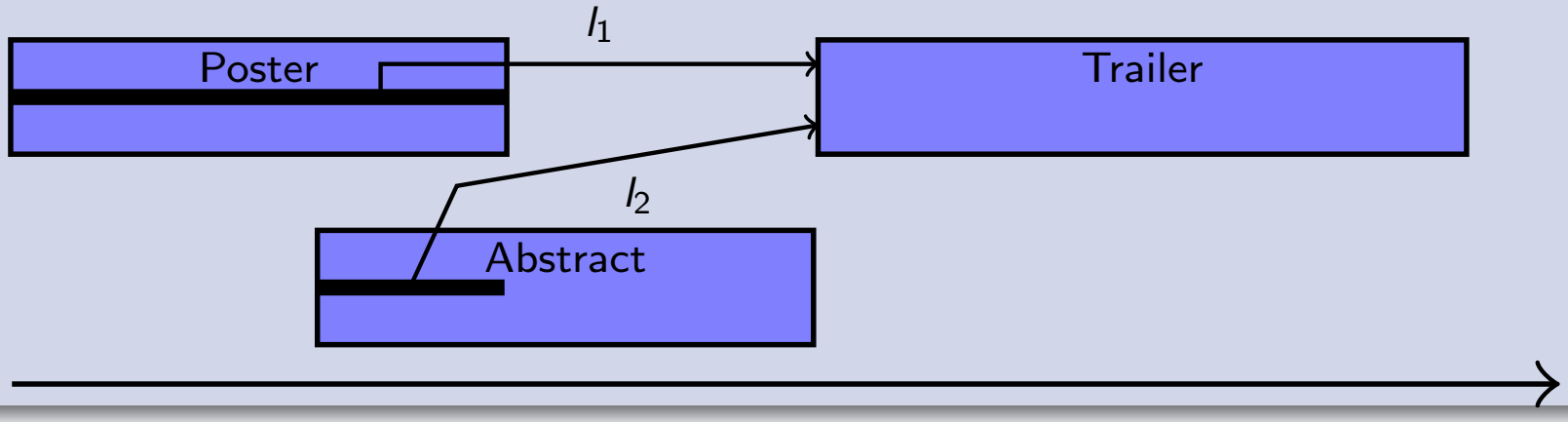


Hypermedia specification

Temporal-hypermedia dimension



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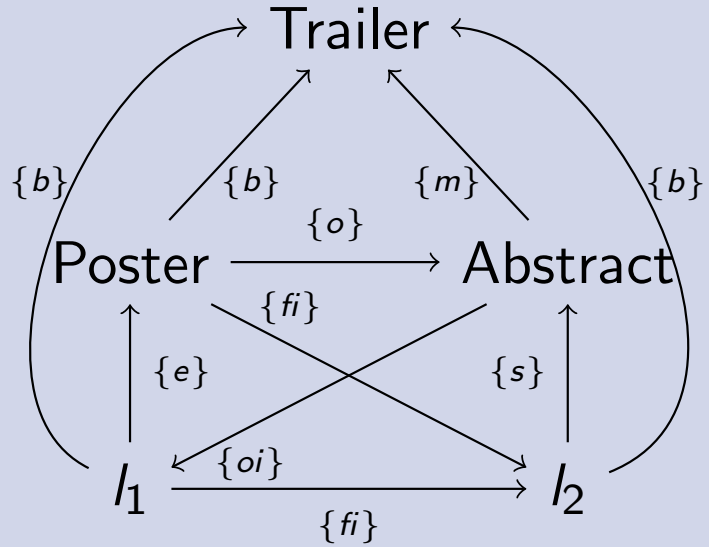
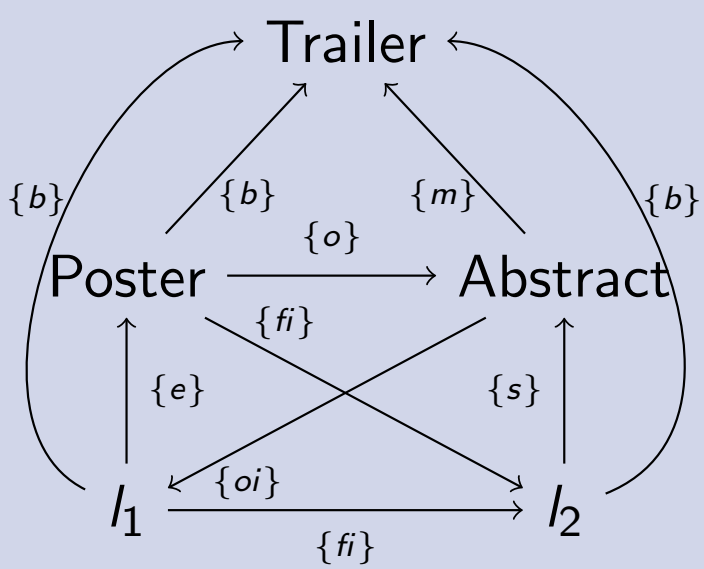
Initial relation graph



Hypermedia adaptation

- Identify the target device profile (e.g., only one button).

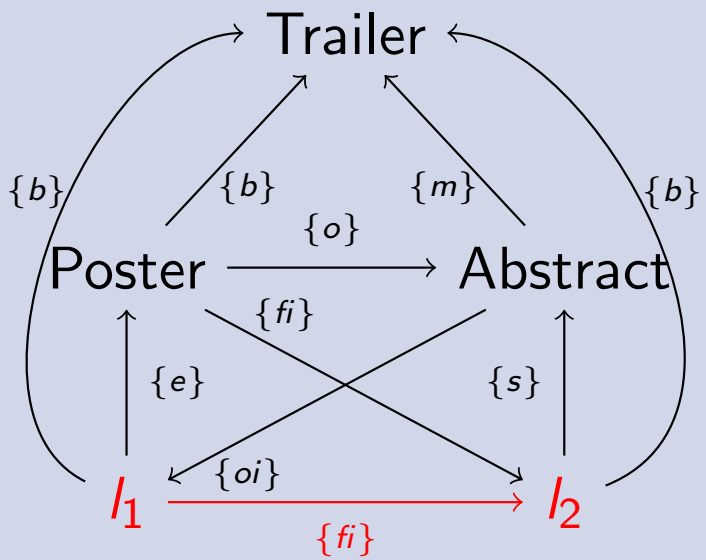
Initial relation graph



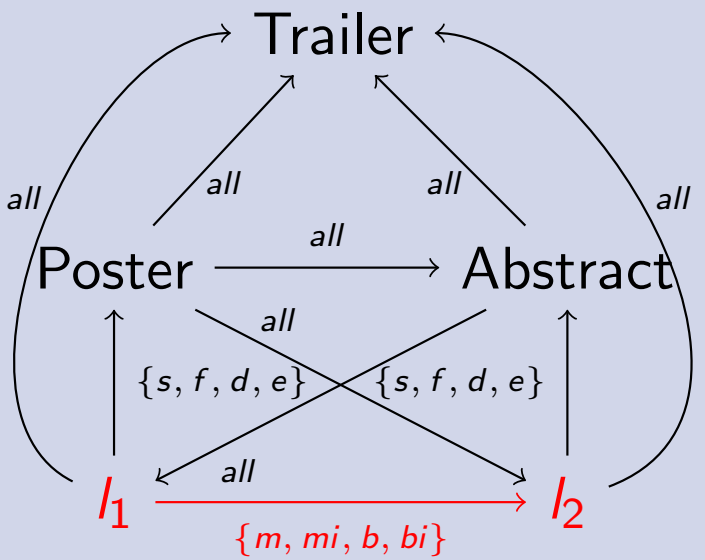
Hypermedia adaptation

- Identify the target device profile (e.g., only one button).
- Identify the possible relations according to the profile :
  - Overlapping links are impossible at a time.

Initial relation graph



Possible relation graph



Hypermedia adaptation

- Identify the target device profile (e.g., only one button).
- Identify the possible relations according to the profile :
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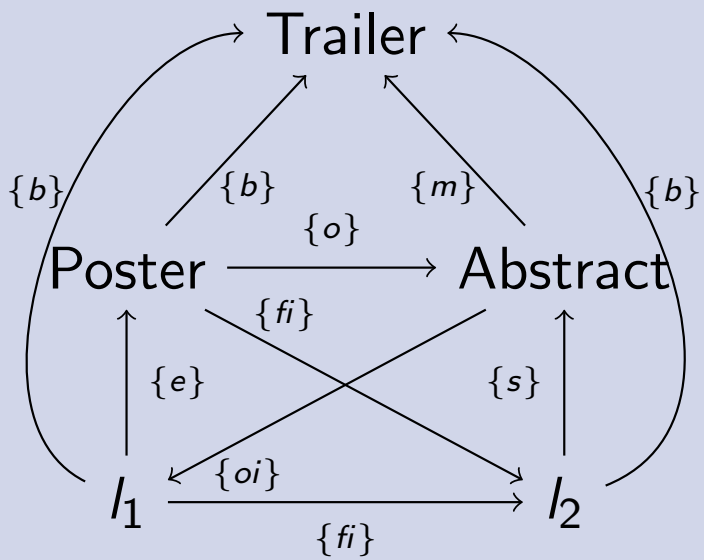
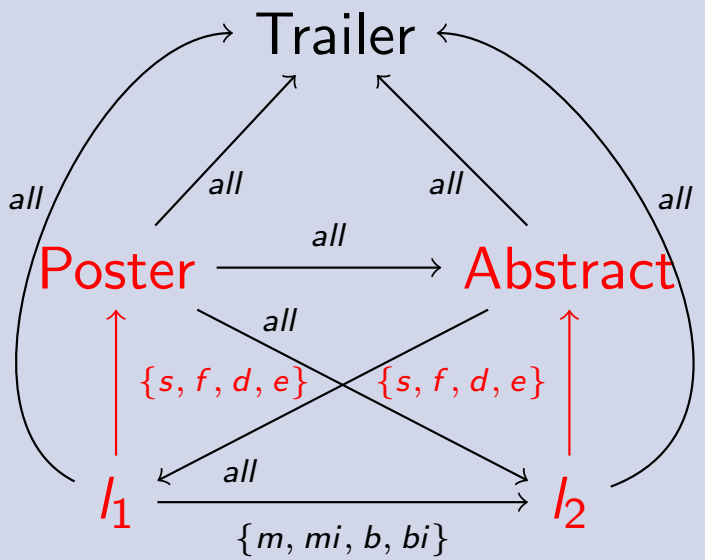
  - A link belongs to a multimedia object.

Initial relation graph



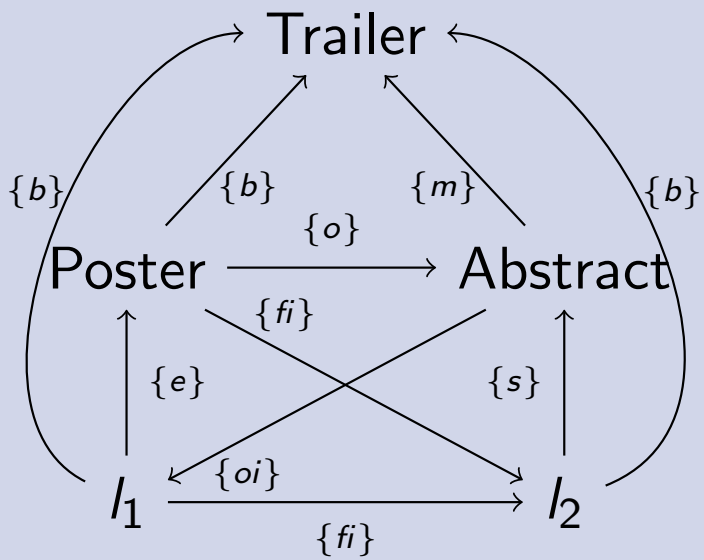
Possible relation graph



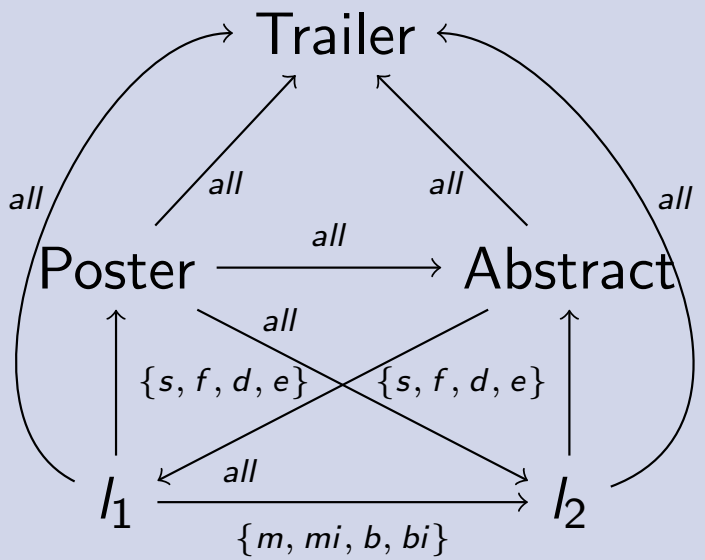
Hypermedia adaptation

- Identify the target device profile (e.g., only one button).
- Identify the possible relations according to the profile :
  - Overlapping links are impossible at a time.
  - A link belongs to a multimedia object.
- Compute adapted solutions close to the initial document.
  - Preserve a maximum of relations.

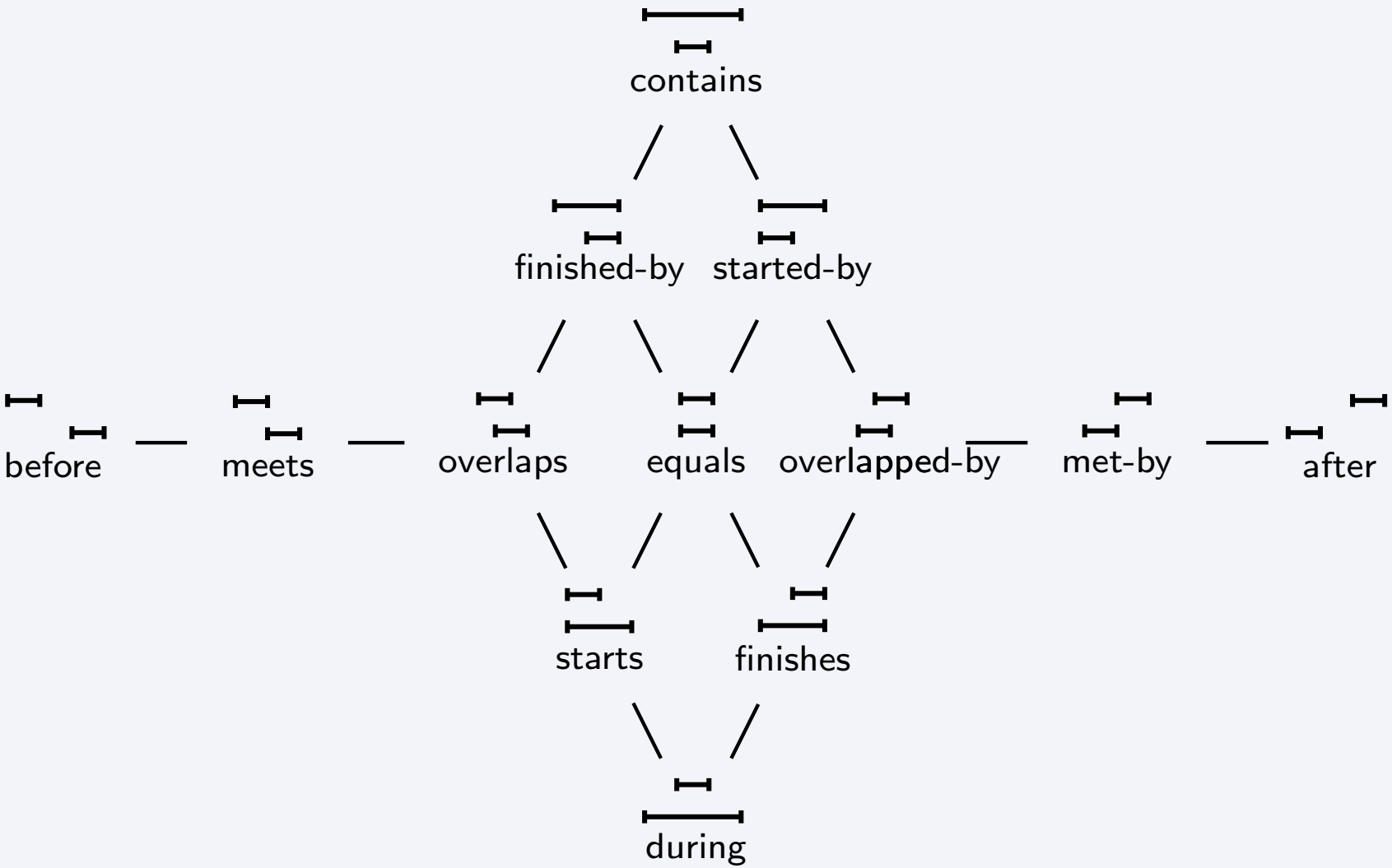
Initial relation graph



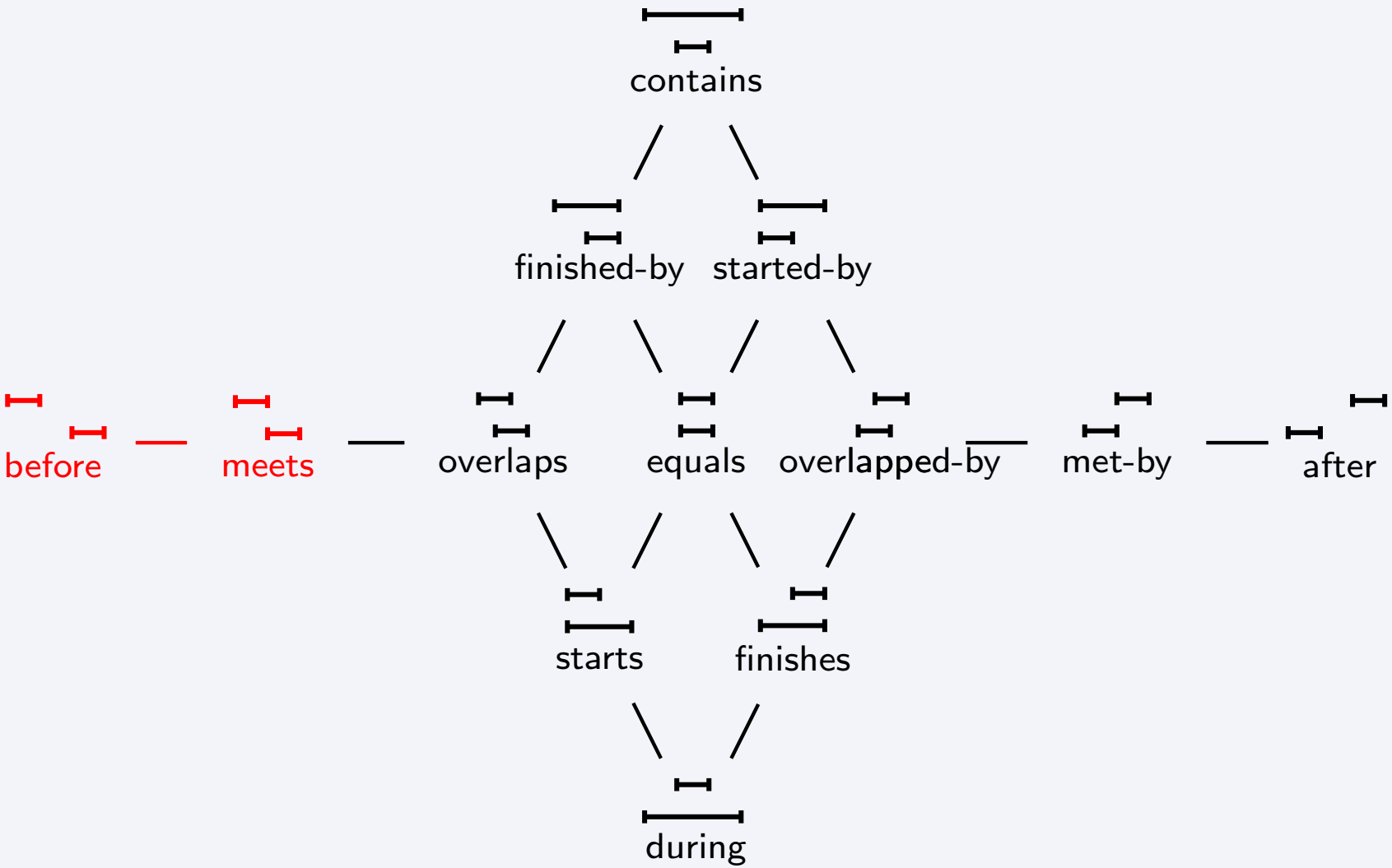
Possible relation graph



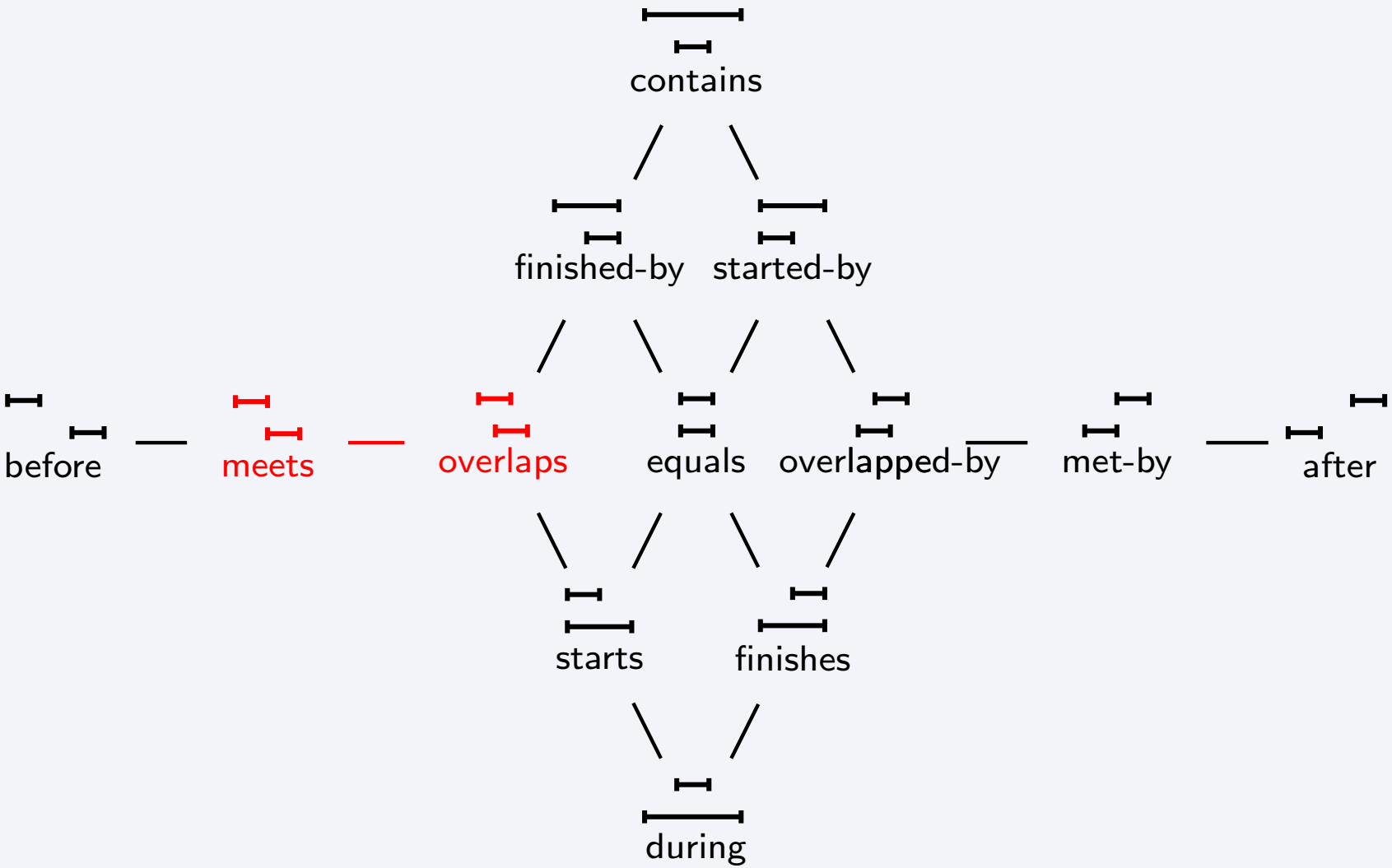
Temporal proximities



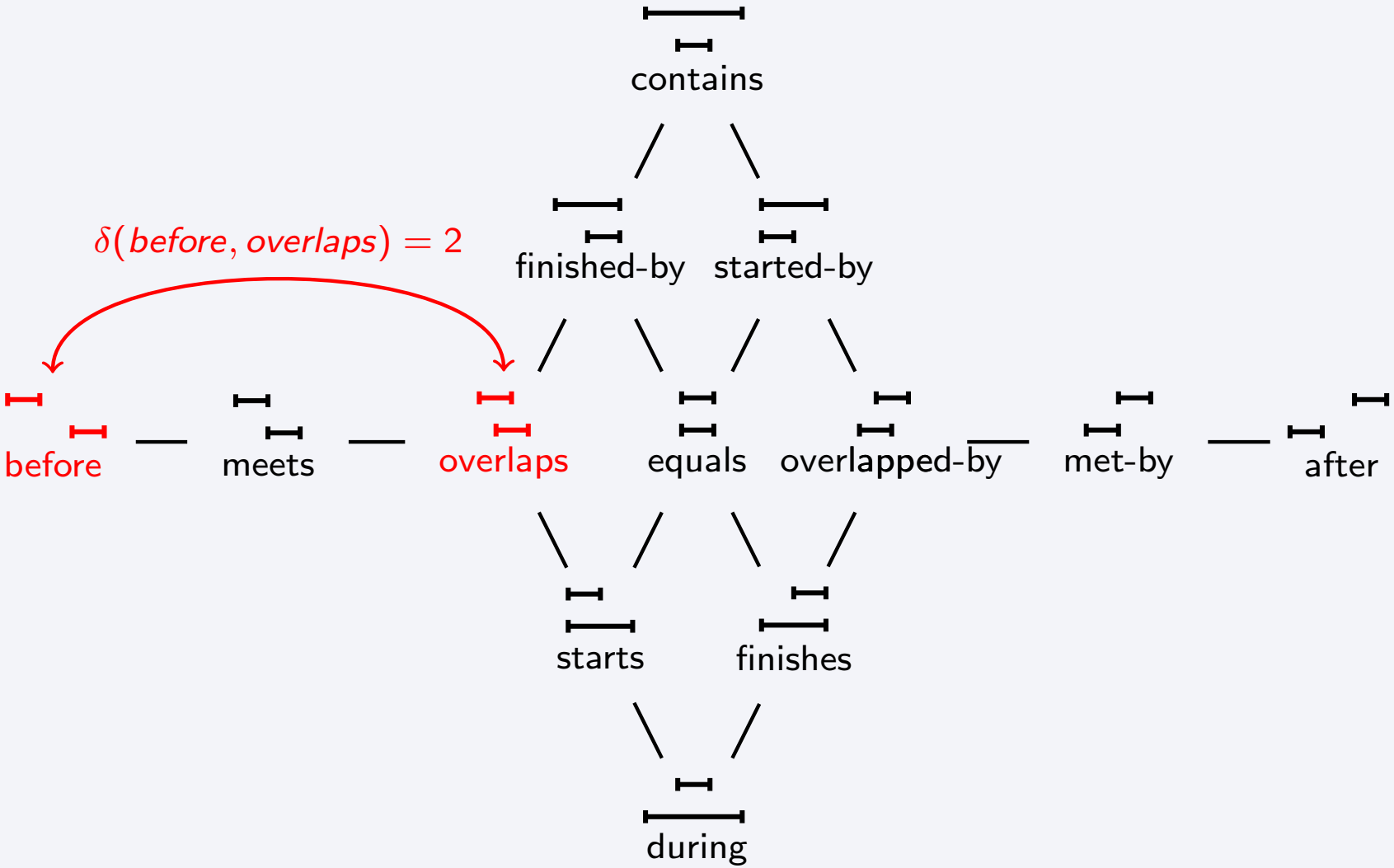
Temporal proximities



Temporal proximities



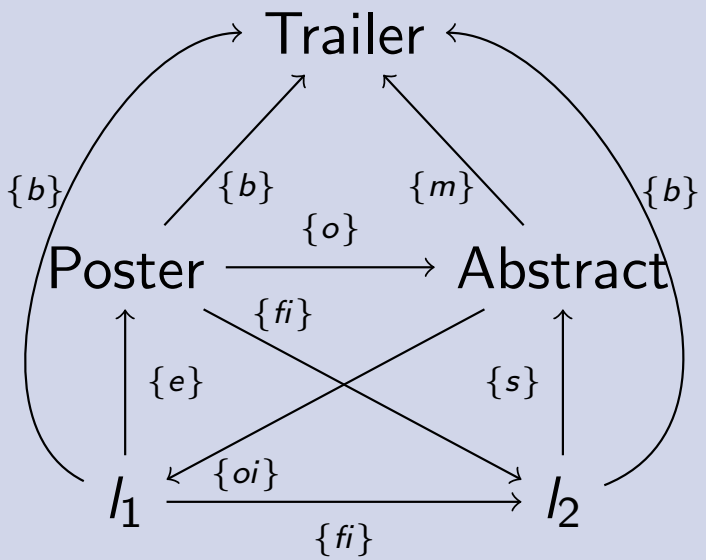
Temporal proximities



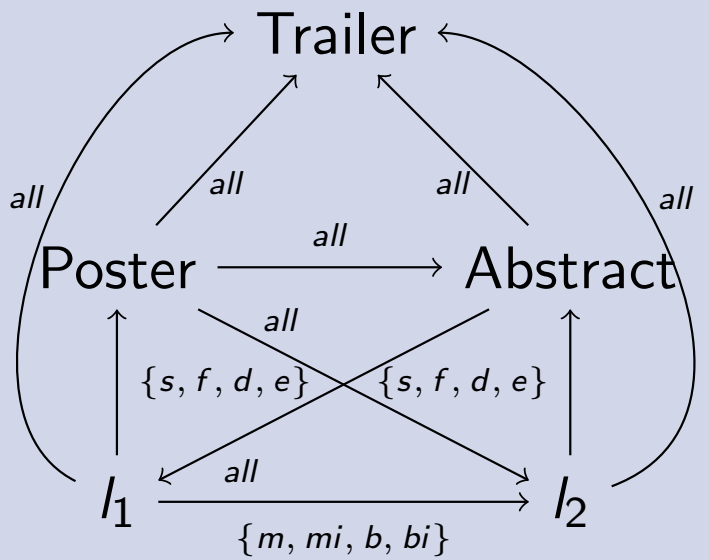
Hypermedia adaptation

- Compute adapted solutions close to the initial document.

Initial relation graph



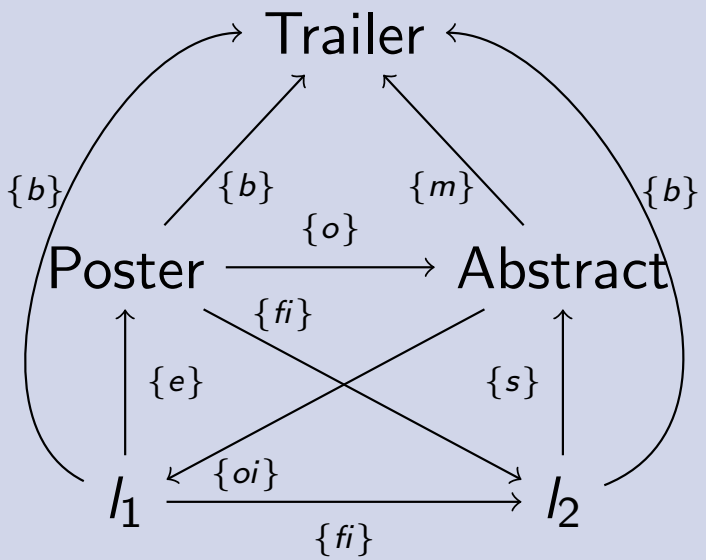
Possible relation graph



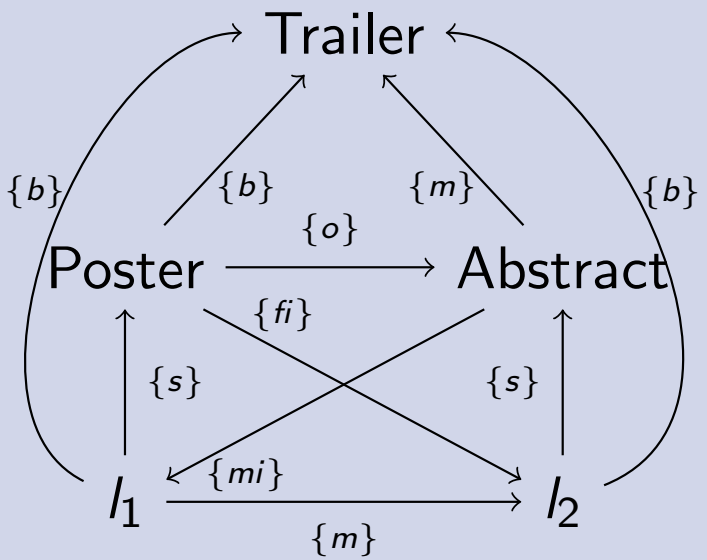
Hypermedia adaptation

- Compute adapted solutions close to the initial document.
  - Generate consistent possible relation graphs.

Initial relation graph



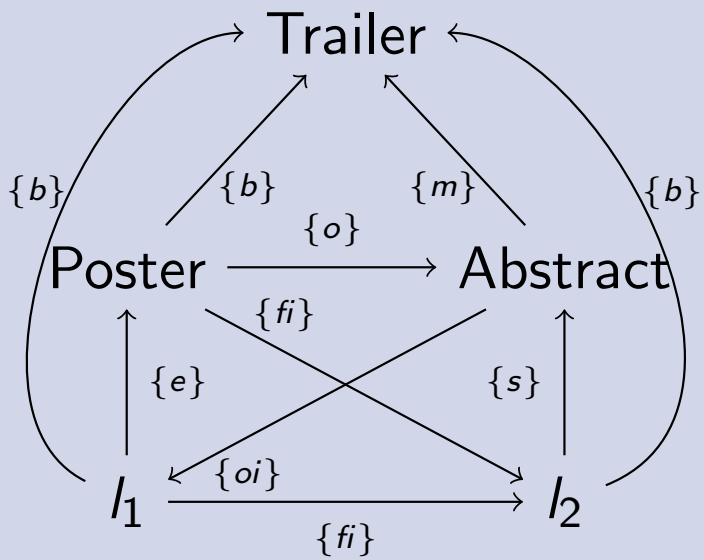
Consistent possible relation graph



Hypermedia adaptation

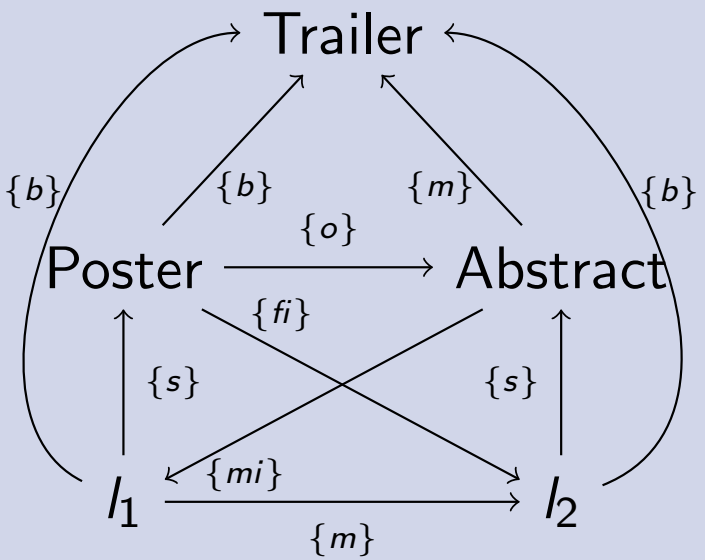
- Compute adapted solutions close to the initial document.
  - Generate consistent possible relation graphs.
  - $distance = \sum_{i=1}^{n} \delta(r_i, p_i)$.

Initial relation graph



distance ⟷

Consistent possible relation graph



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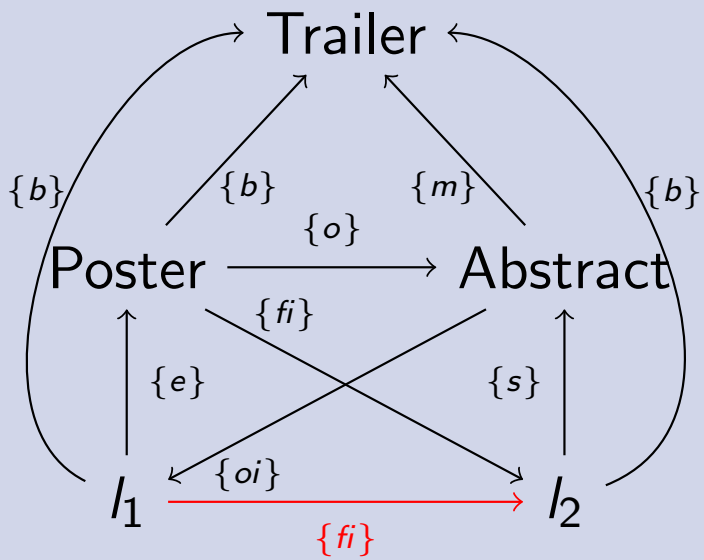
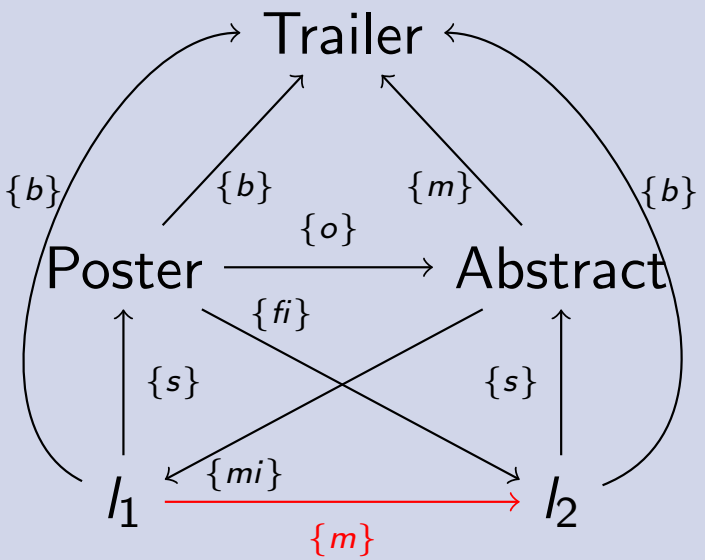


distance ⟷

Consistent possible relation graph



distance = 2

Hypermedia adaptation

- Compute adapted solutions close to the initial document.
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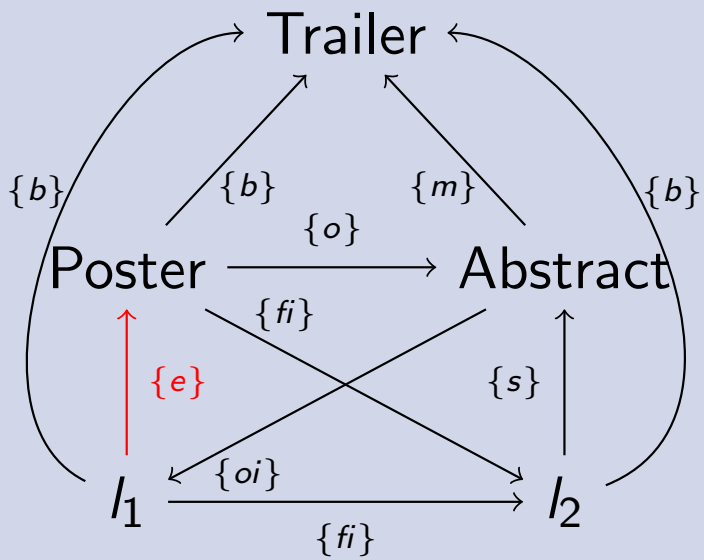
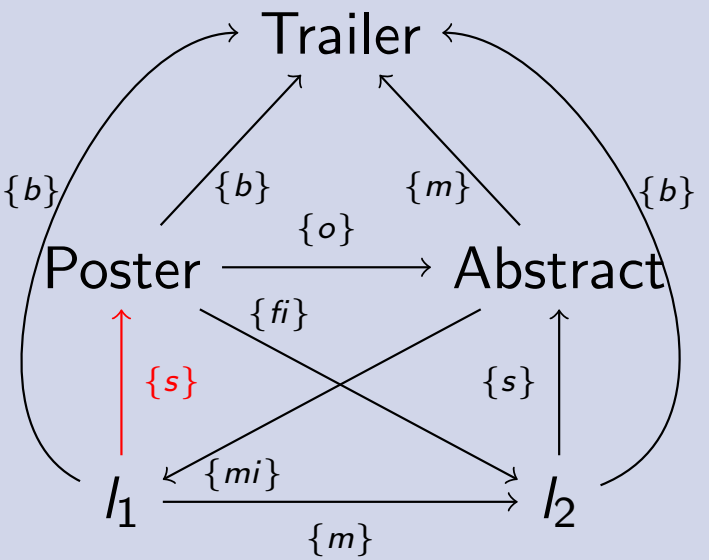
Initial relation graph



distance ⟷

Consistent possible relation graph

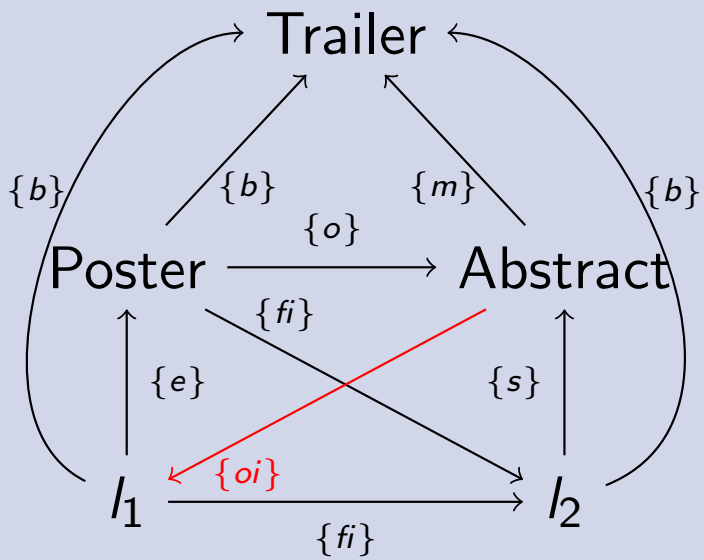


$$distance = 2 \ + 1$$

Hypermedia adaptation

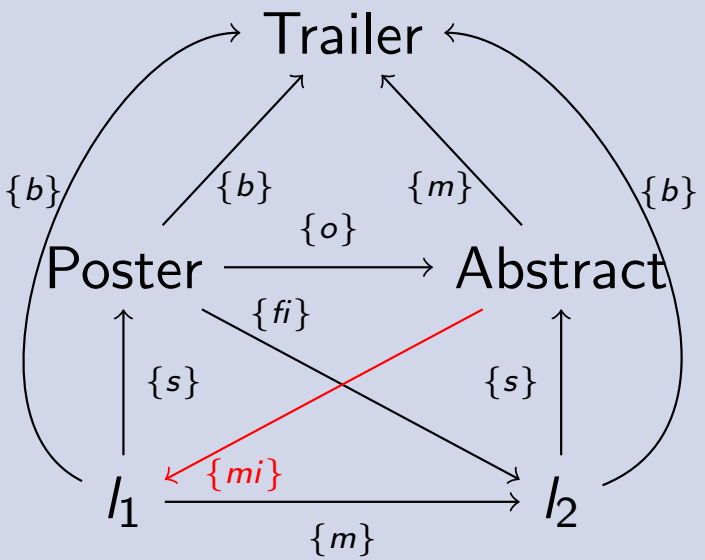
- Compute adapted solutions close to the initial document.
  - Generate consistent possible relation graphs.
  - $distance = \sum_{i=1}^{n} \delta(r_i, p_i)$.

Initial relation graph



distance ⟷

Consistent possible relation graph



$$distance = 2 + 1 + 1$$

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  - $distance = \sum_{i=1}^{n} \delta(r_i, p_i)$.

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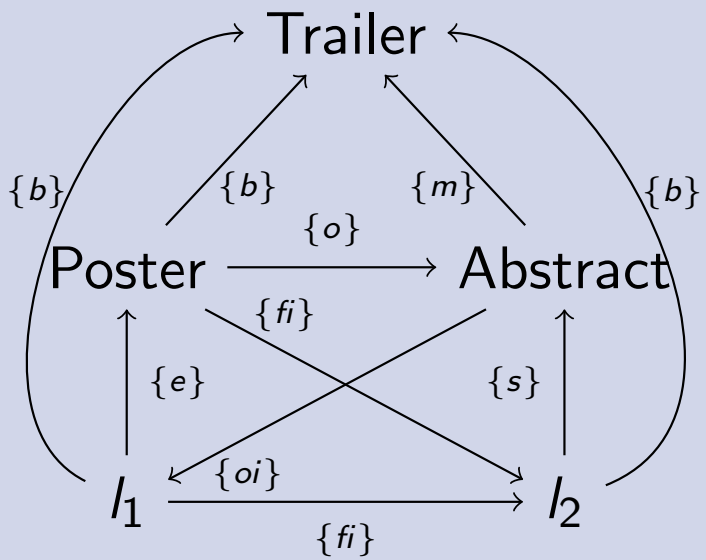

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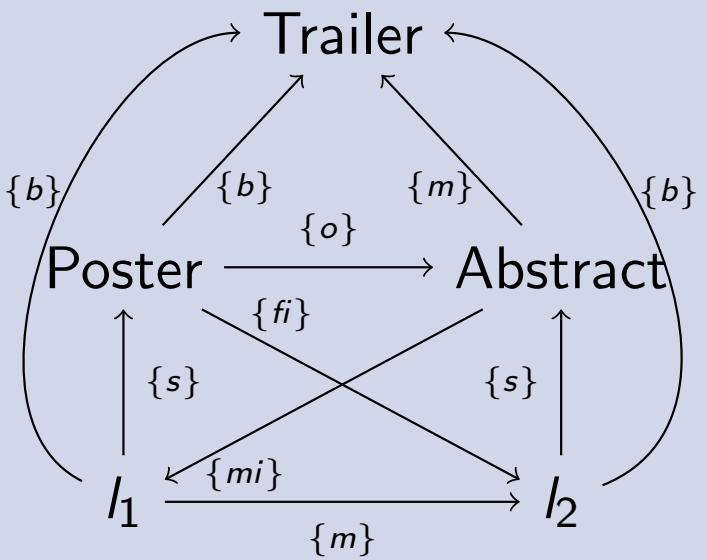

$$\text{distance} = 2 + 1 + 1 = 4$$

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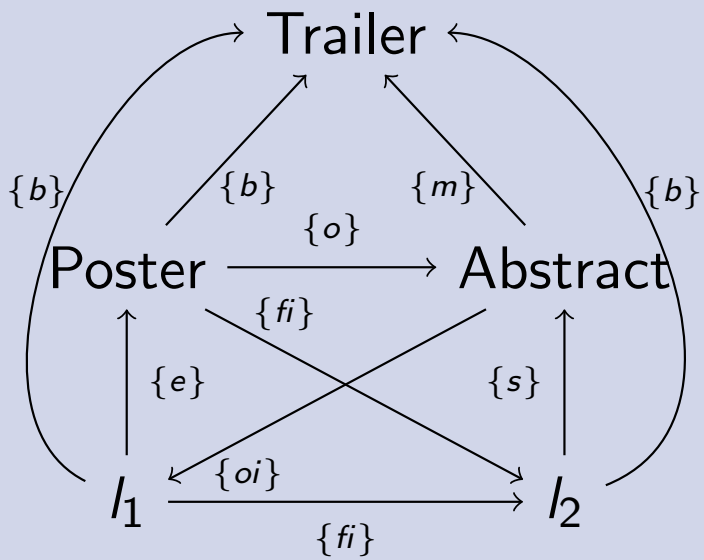
  - $distance = \sum_{i=1}^{n} \delta(r_i, p_i)$.

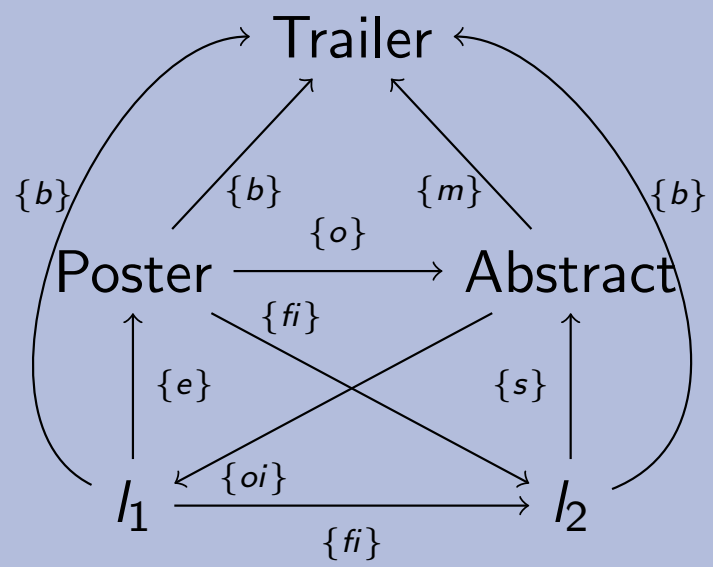
Initial relation graph



distance ⟷

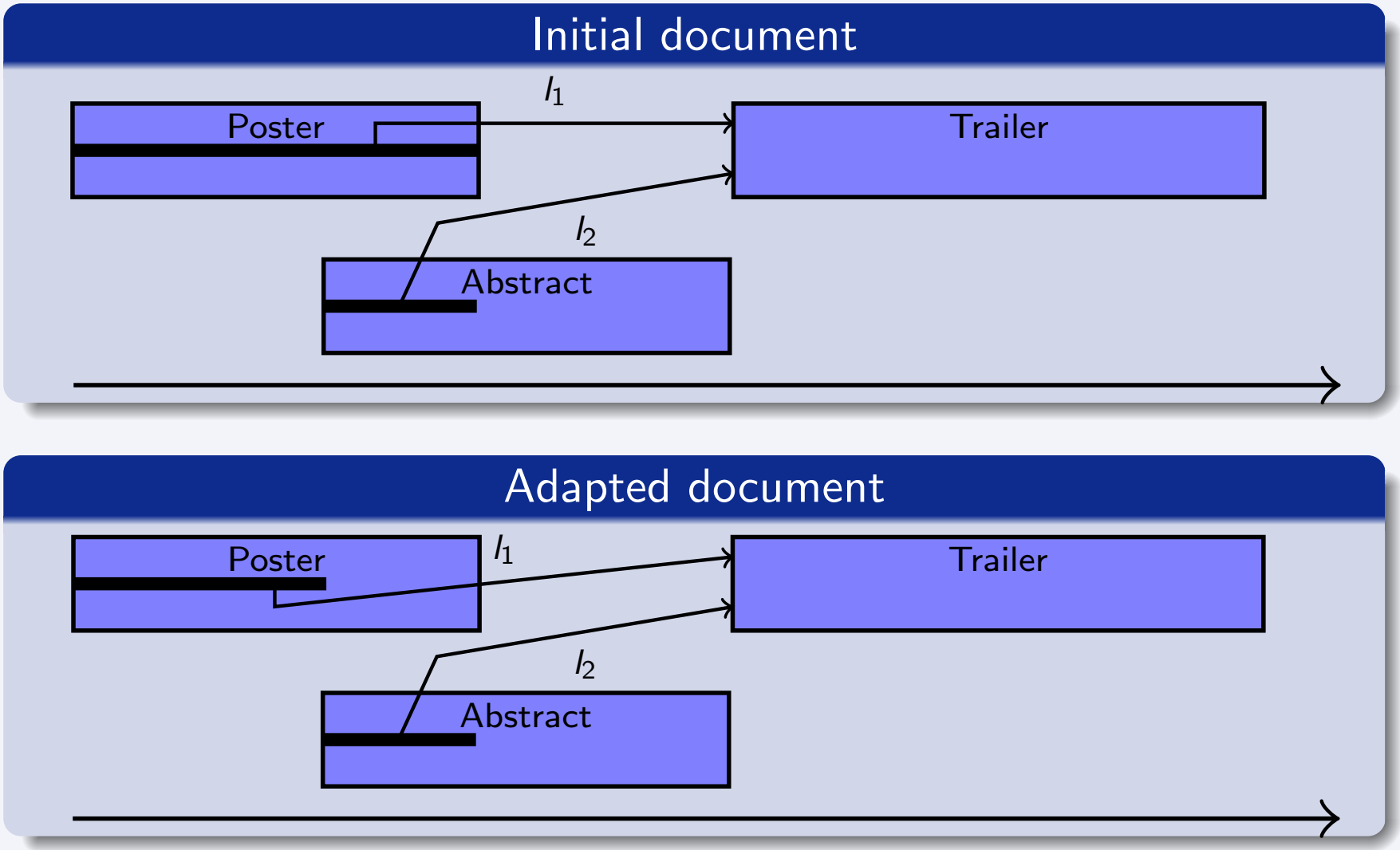
Consistent possible relation graph

An adapted solution



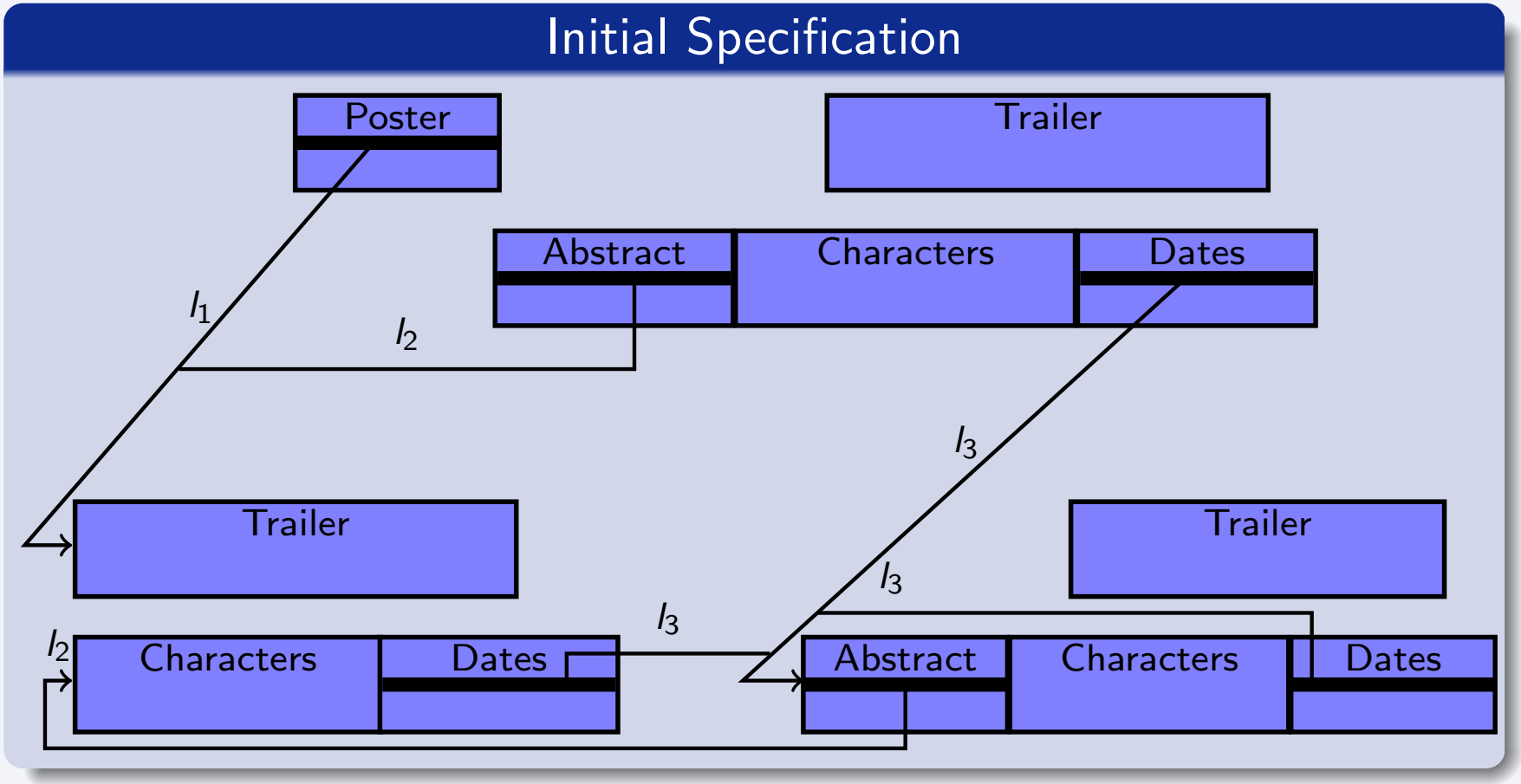
$$\text{distance} = 2 \ + 1 \ + 1 \ = 4 \text{ (minimal)}$$

A possible adapted execution



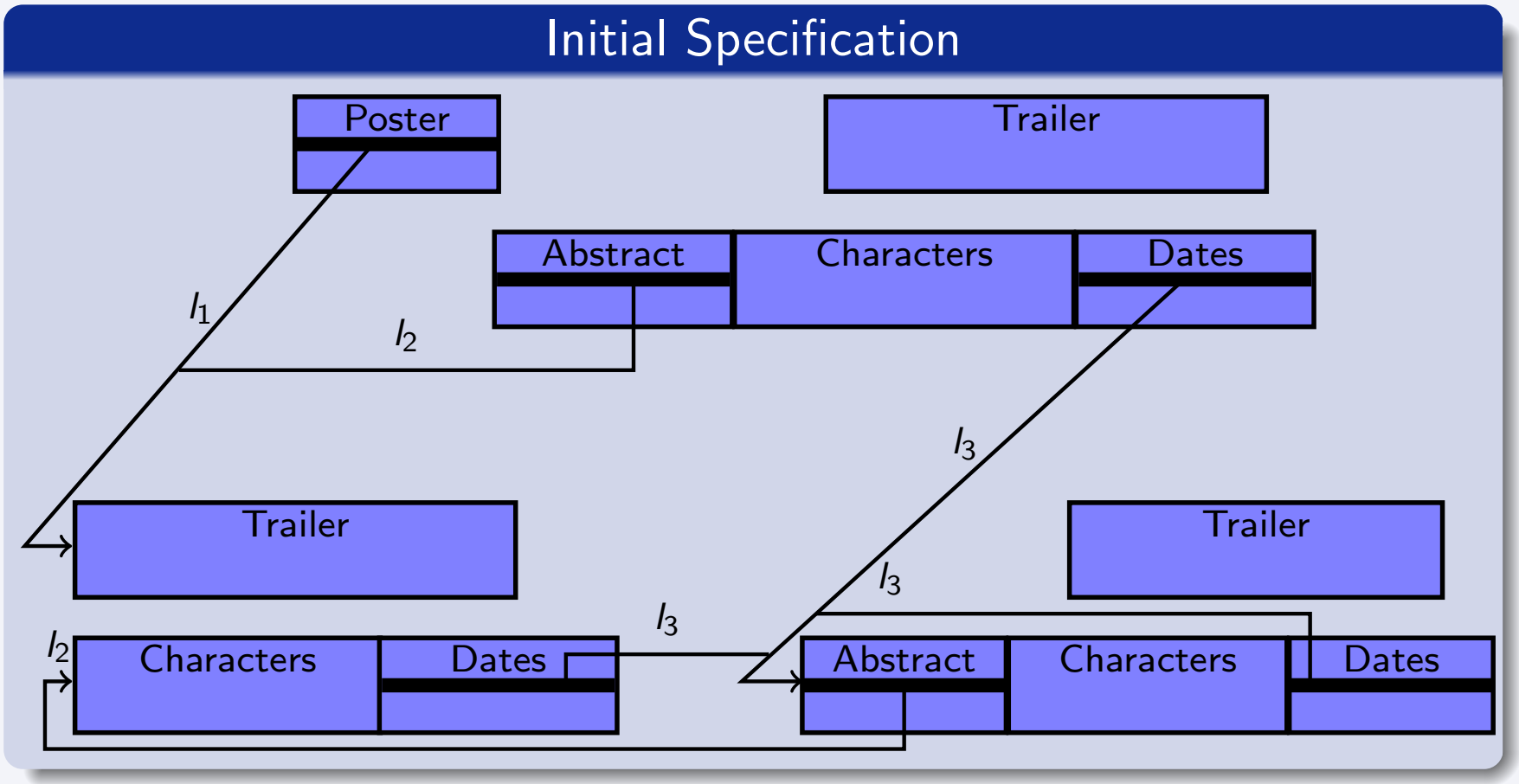
Outline

The Hypermedia Structure



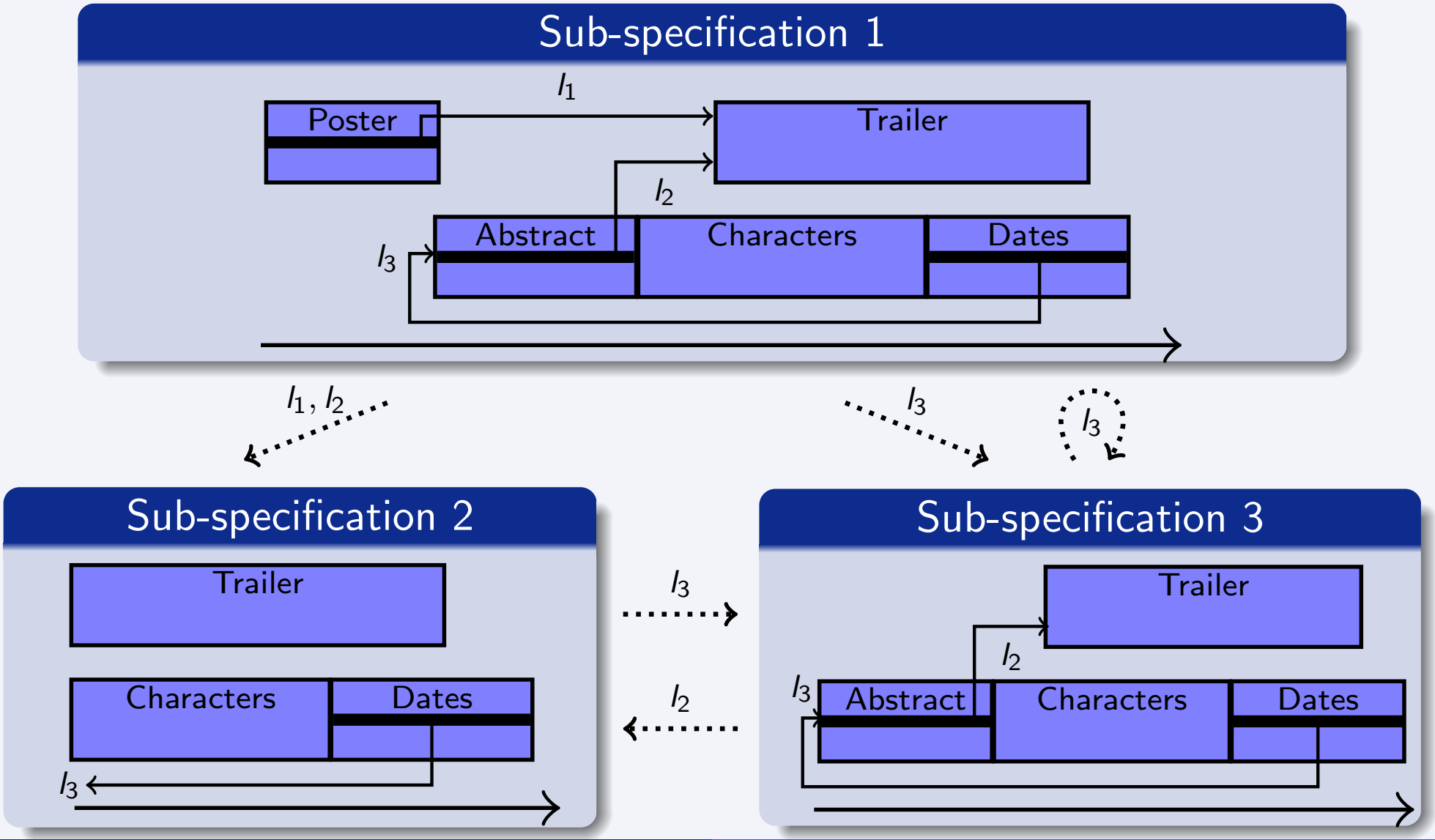
The Hypermedia Structure

- Difficult to adapt with our adaptation approach.
  - Different timelines with different relations and objects number.



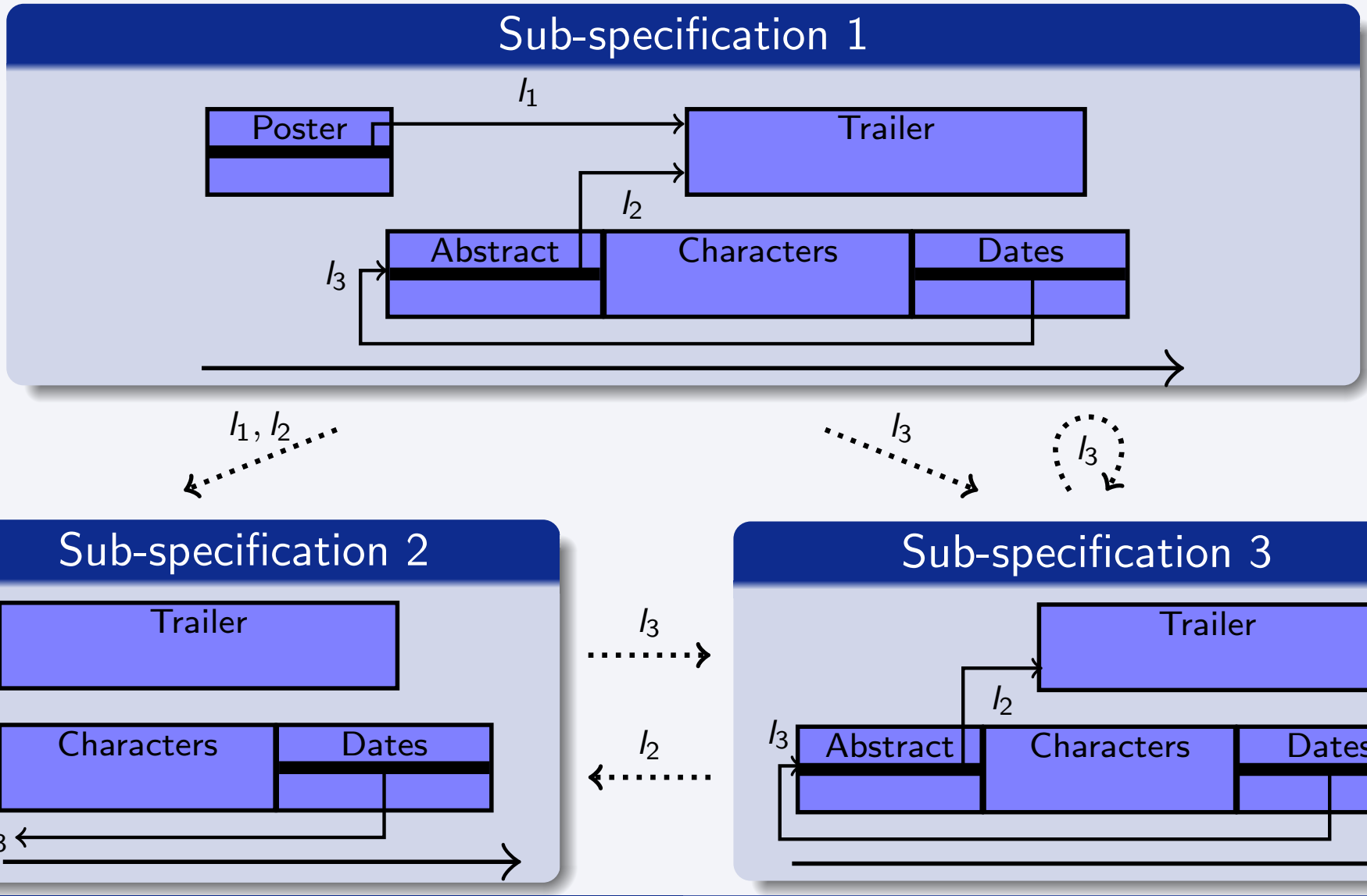
The Hypermedia Structure

- Identify all sub-specifications to preserve our approach.



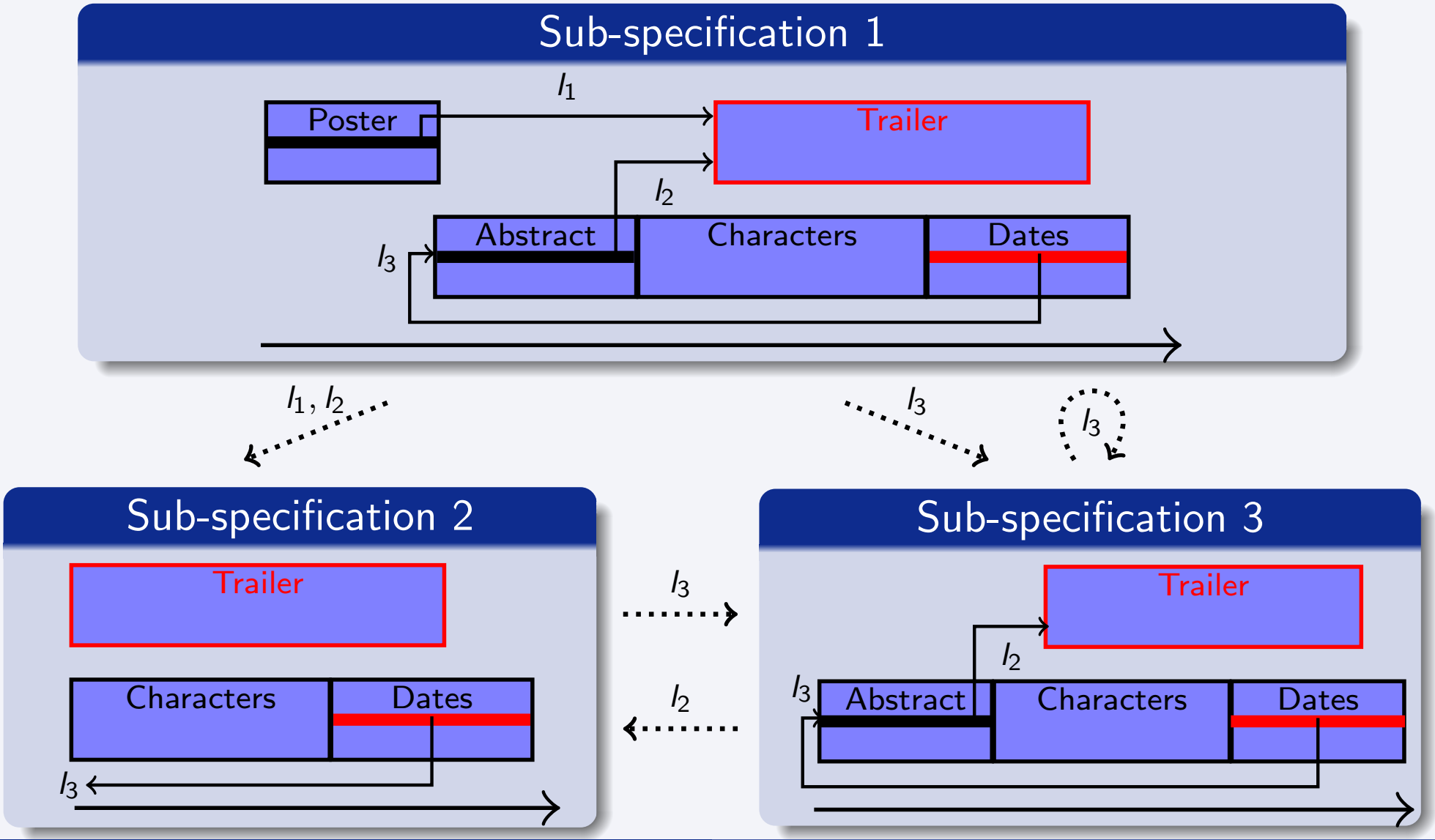
Adapting all sub-specifications at once

- Identify the target device profile.



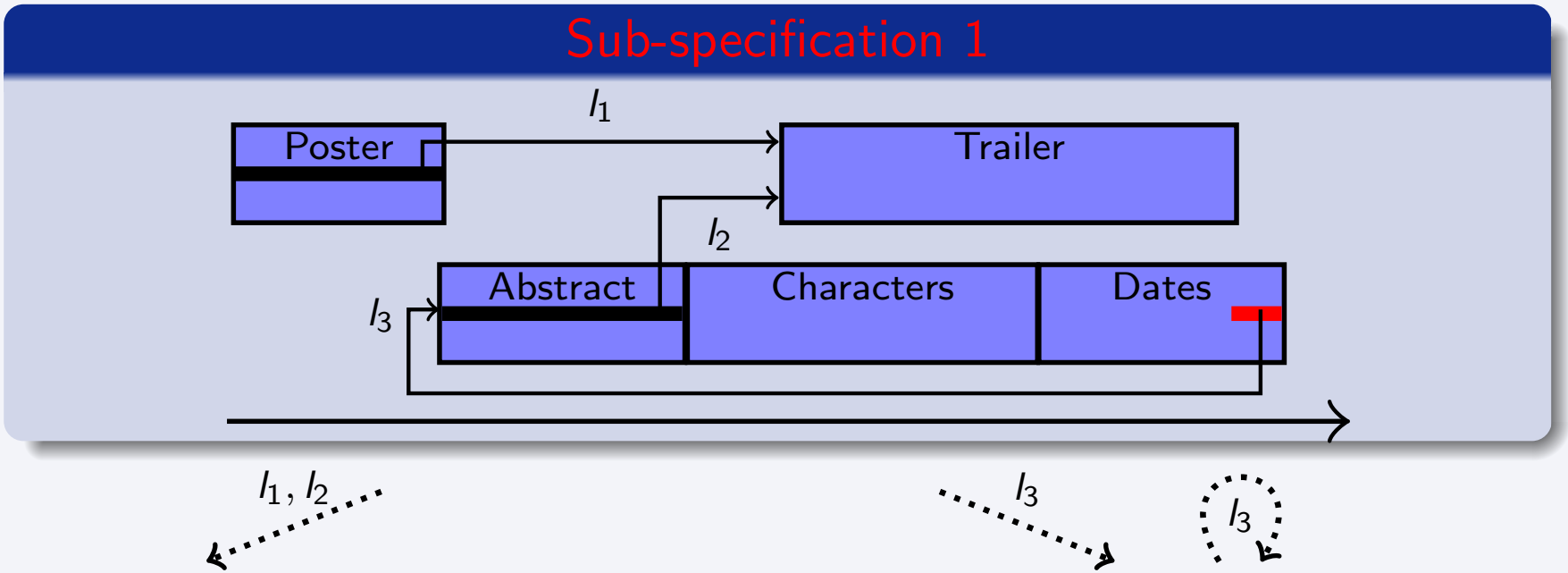
Adapting all sub-specifications at once

- Profile = Impossible to select a link during a video.



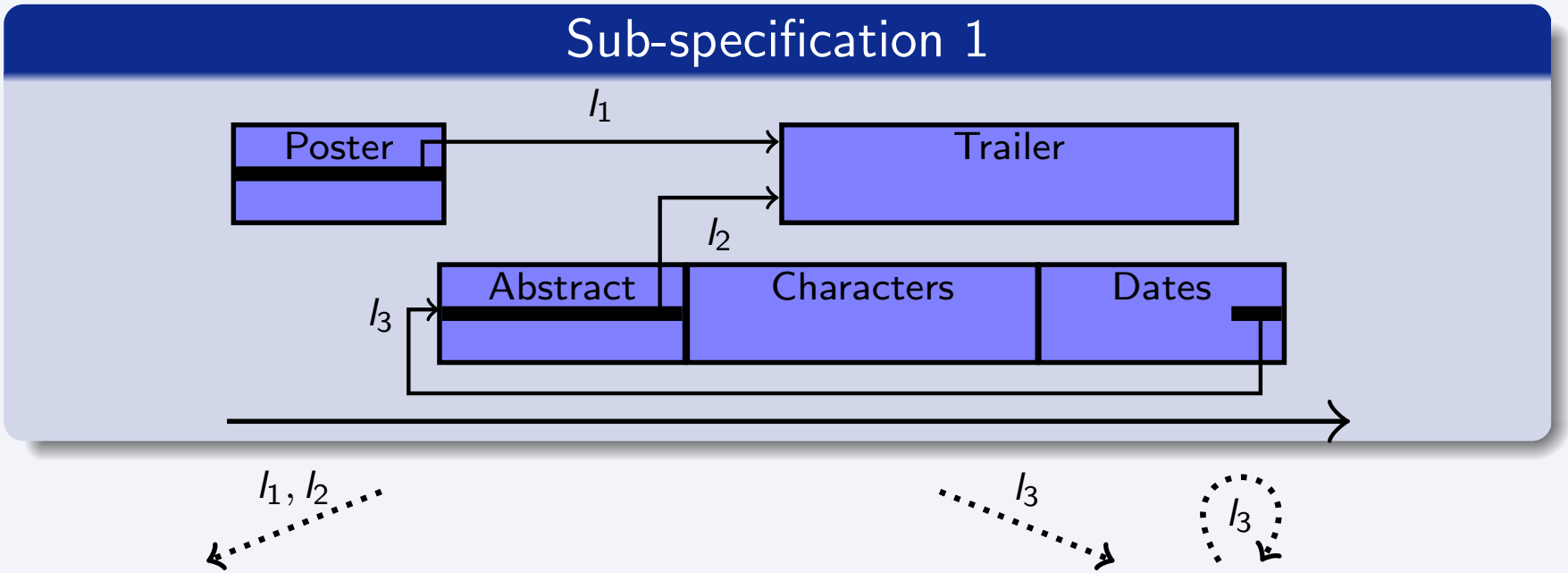
Adapting all sub-specifications at once

- Adapt each sub-specification.



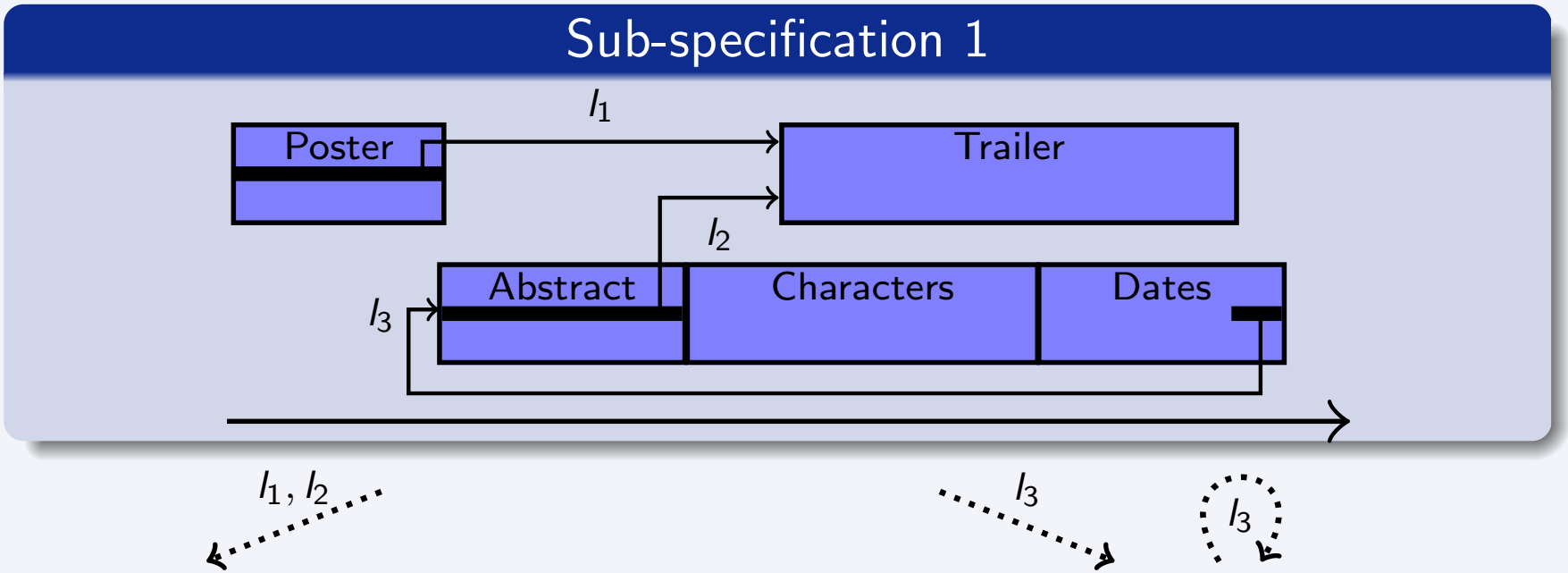
Adapting all sub-specifications at once

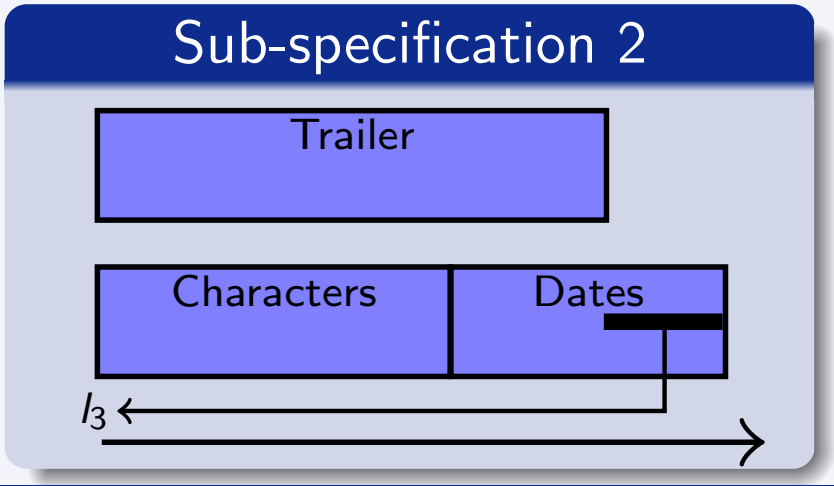
- Adapt each sub-specification.

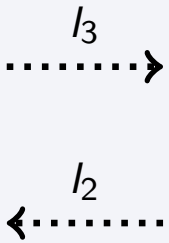


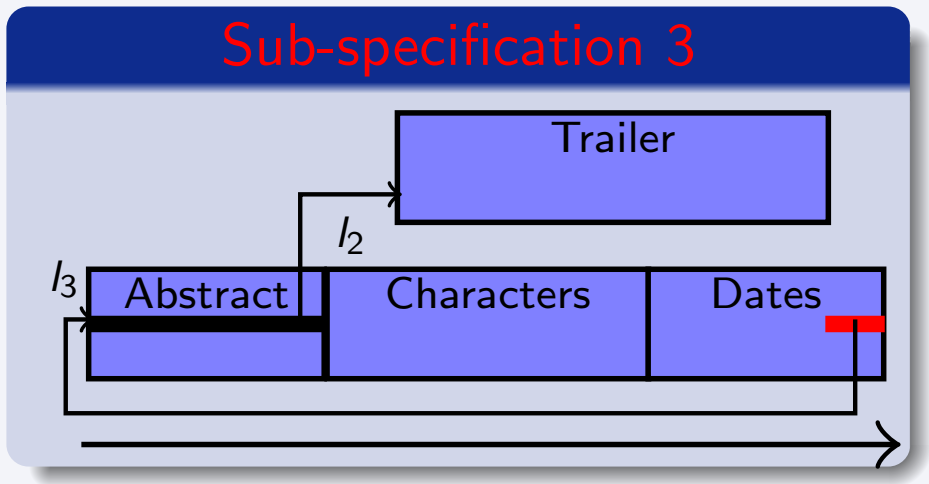
Adapting all sub-specifications at once

- Adapt each sub-specification.









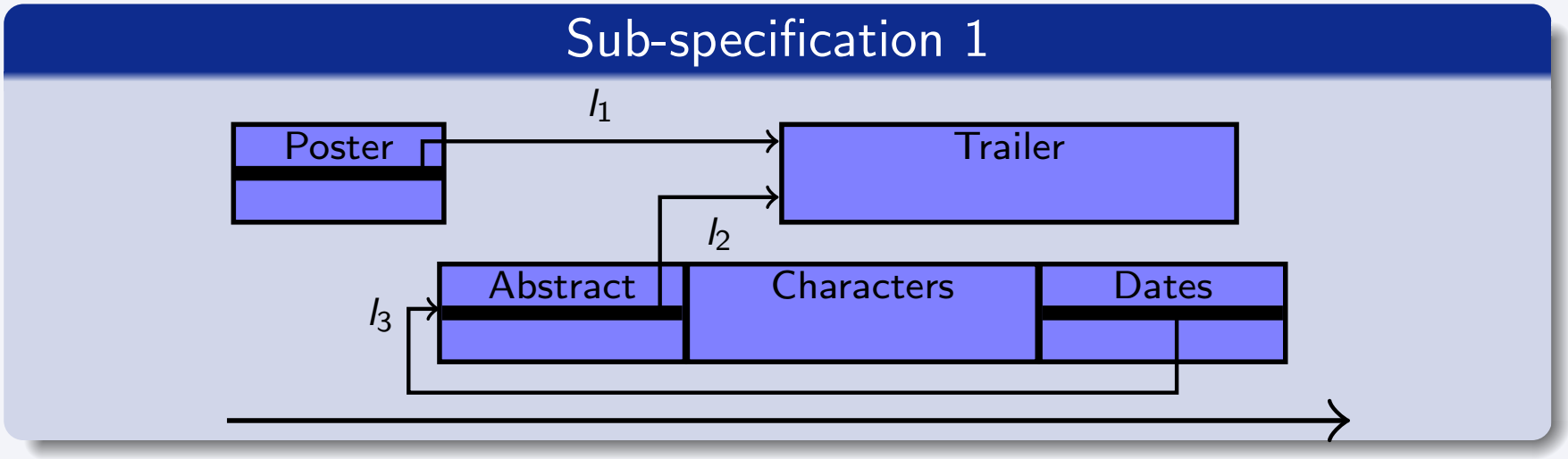
Drawbacks

- Some sub-specifications are adapted even if there are not executed.
- If the profile changes during the user interactions, all sub-specifications have to be adapted again.
- Parts of several sub-specifications are adapted several times.

Outline

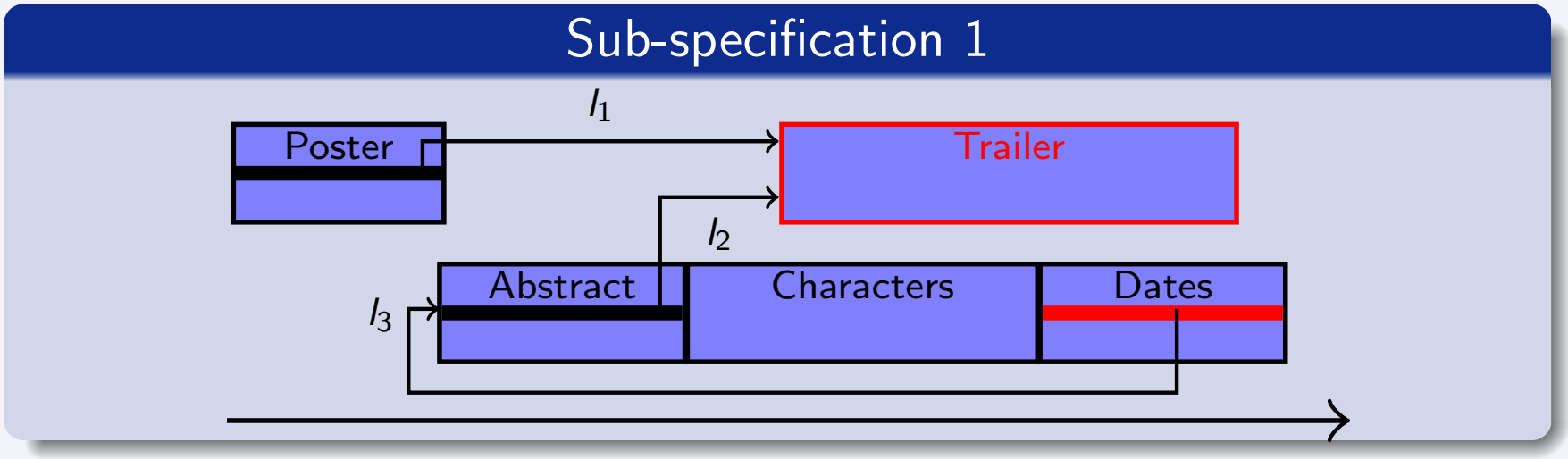
Incremental adaptation

- Start from an initial sub-specification.



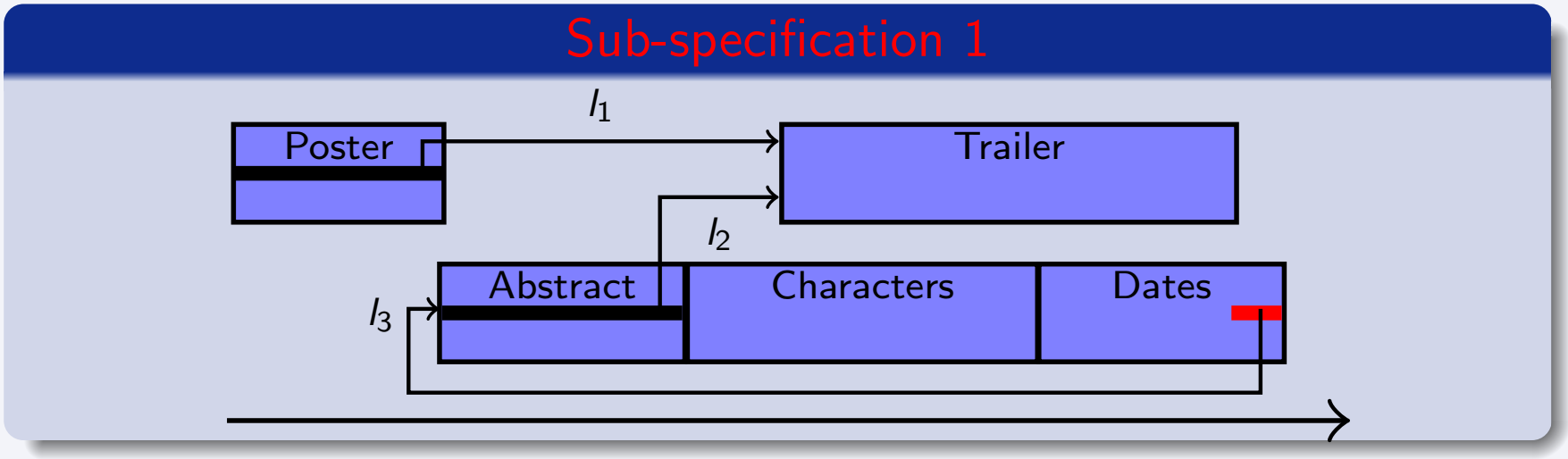
Incremental adaptation

- Impossible to select a link during a video.



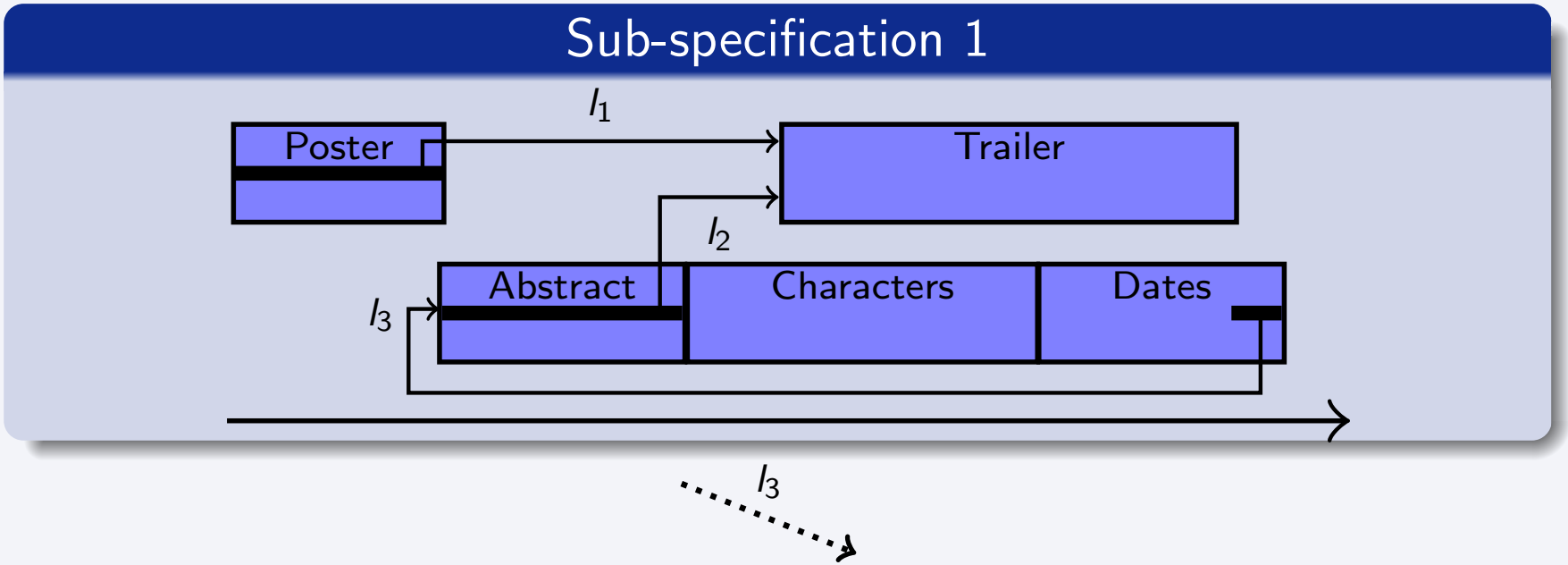
Incremental adaptation

- Adapt the sub-specification.



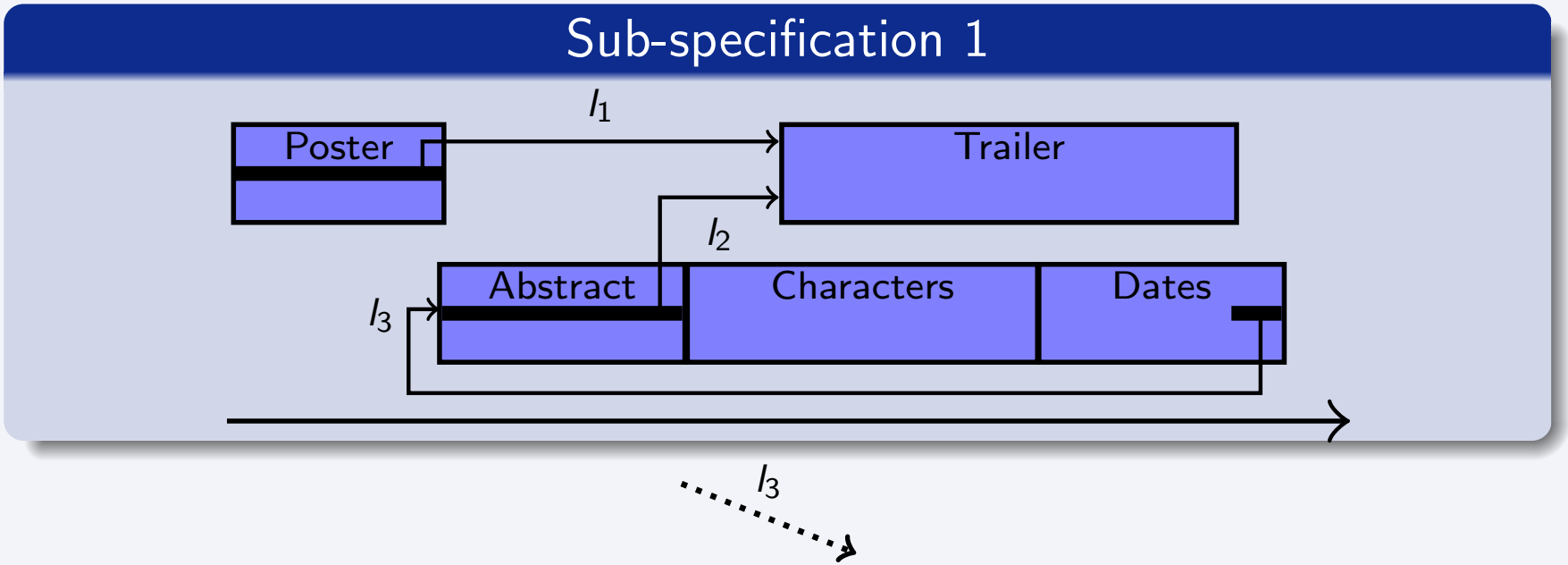
Incremental adaptation

- The user selects the link l_3.



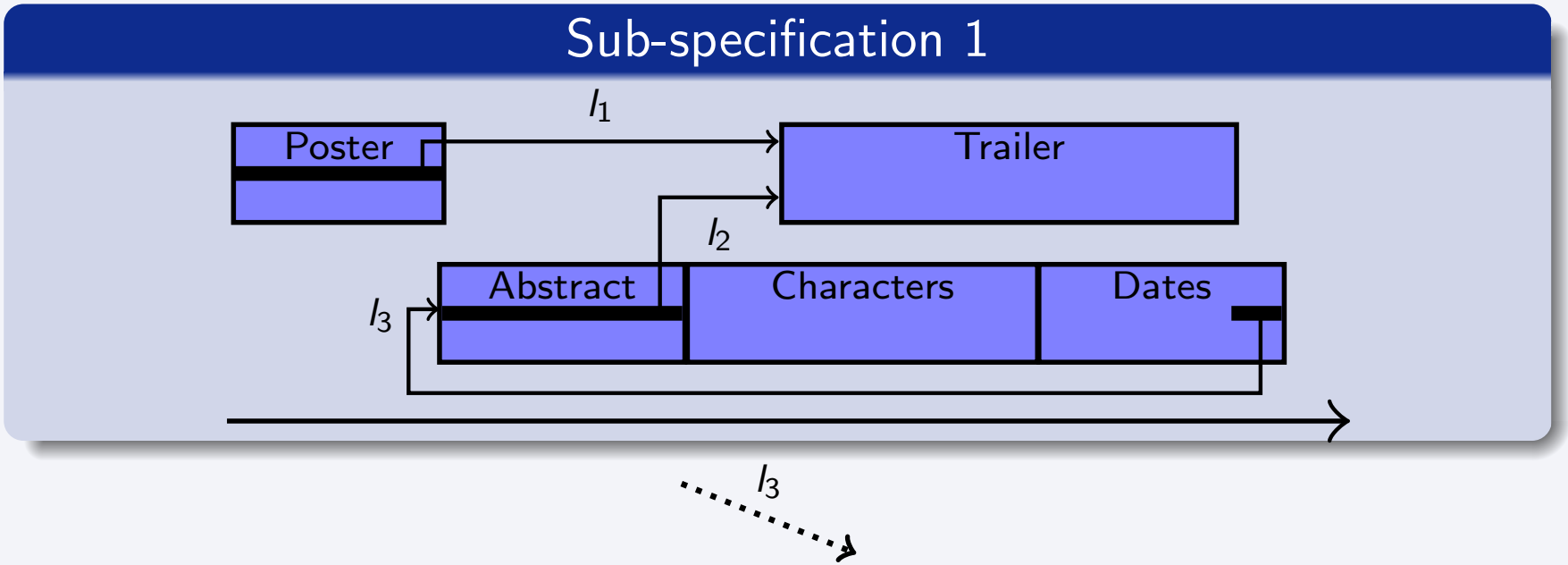
Incremental adaptation

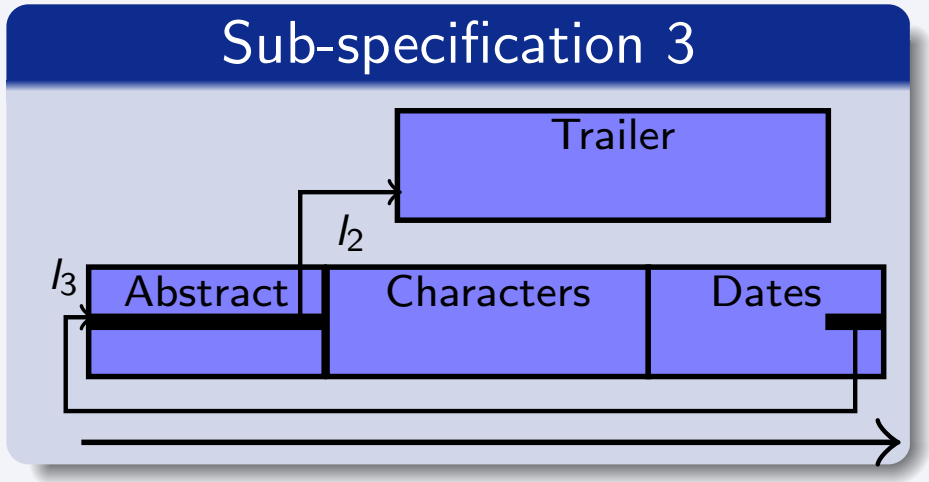
- Generate the sub-specification according to the previous one.



Incremental adaptation

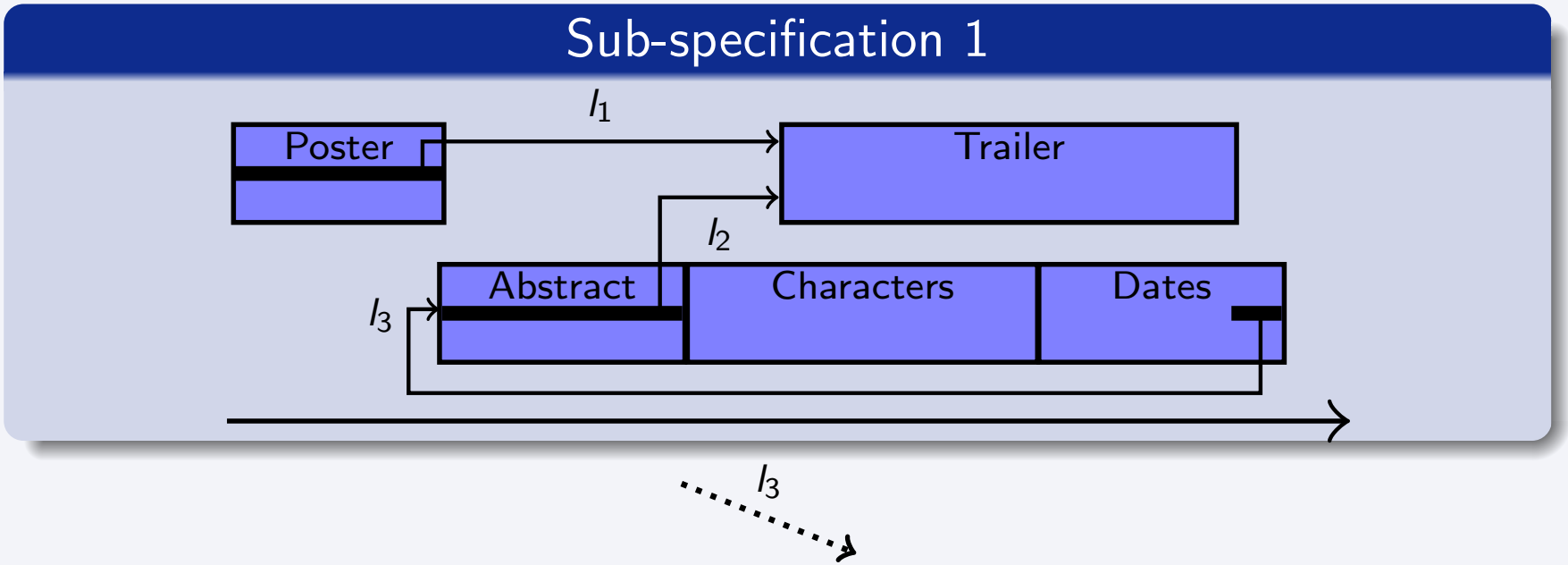
- Impossible to select a link during a video.

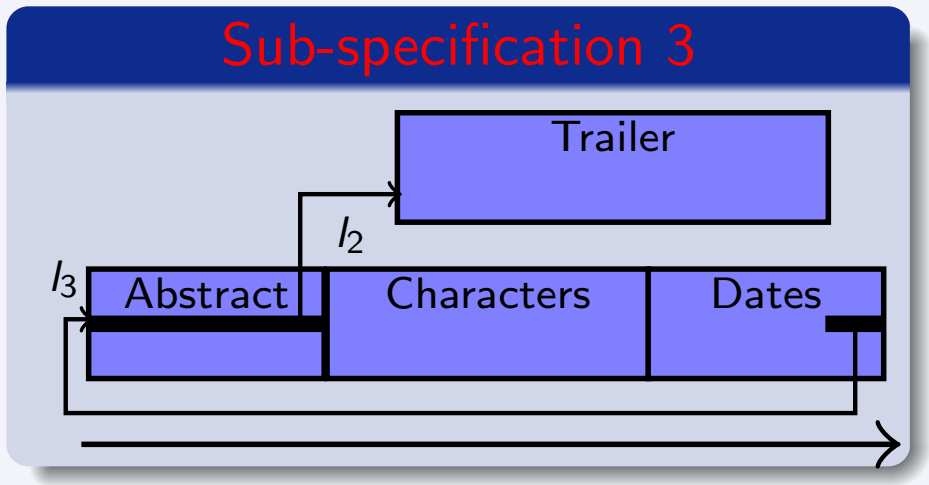




Incremental adaptation

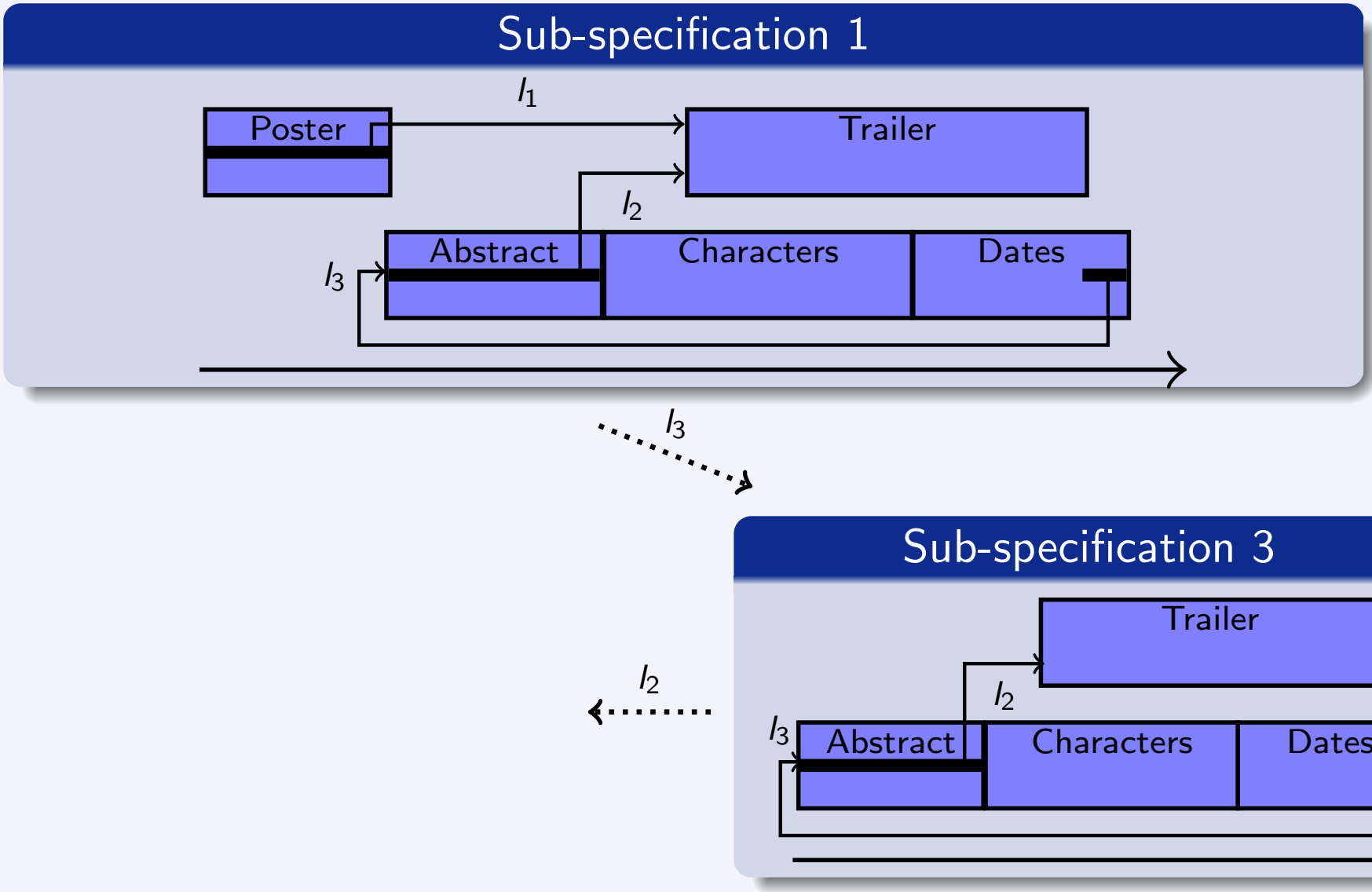
- No adaptation is needed.





Incremental adaptation

- and so on...



Outline

Conclusion and future works

Conclusion :

- A uniform approach to deal wih the adaptation problem.
  - temporal-hypermedia.
- Proposition of an incremental adaptation which takes into account the user interactions.

Future Works :

- Extend the framework by adding or deleting objects.
- Adapt standard multimedia description languages (e.g., SMIL).

Questions ?

Thank you for your attention !

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