Planning for Storytelling

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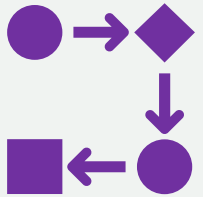
Why Planning for Storytelling?

A story can be conceptualized as the sequence of events that take place within some virtual world.

It can therefore be well-modeled by a plan.



The Plan



The plan can represent:

(i) the sequence of events that *actually happen* in the story
i.e. the **plot**, or,

(ii) the sequence of events are they are *told* to the audience
i.e. the **narrative**.

States

The *states* that the plan traverses can encompass:

(i) the **physical** state of the story world;

(ii) the **state of mind** of the characters in the story world (their beliefs, motivations, plans, etc.);

(iii) the **state of the audience's knowledge**/understanding of the world and events of the story; or

(iv) any combination of the above.

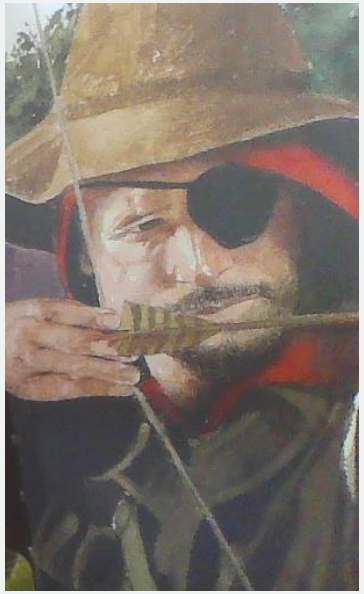
States

The **physical** state of the story world:

** "The Way Home for Wolf" images courtesy: Bright, R.; and Field, J., 2020, "The Way Home for Wolf", volume 1, Scholastic Press.

States

The **state of mind** of the characters in the story world:



* “Robin Hood” images courtesy: San Souci, R. D.; and Lewis, E., 2010, “Robin Hood and the Golden Arrow”, volume 1, Scholastic Press.

Our Plan

The plan becomes:

(i) the representation of the story, and

(ii) also, that of the story world

Thus, we use Planning to create logical, believable, and coherent stories (narratives) in a variety of domains.

Our Plan

We will demonstrate the role that planning, or planning-based representations, can play in narrative generation methods.

We will cover several techniques, including modern approaches that make use of Large Language Models (LLMs)

Storytelling + Planning Task

+

Who did What? – the plot thickens…

Storytelling is a `design' task

– Which phenomenon to model?

- Logic
- Mistaken belief
- Suspense etc.

Who did What? – the plot thickens…

Storytelling is a `design' task

– Which layer to model?

- **Plot**
- Discourse
- Narration

Who did What? – the plot thickens...

- Neural based approaches
- Story Skeletons
- Compilation to Classical Planning
- Neurosymbolic approaches
- Story Variations
- Directed graphs and branching story trees
- Large Language Models

Who did What? – the plot thickens…

- Neural based approaches
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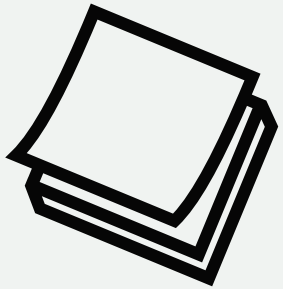
The Storyteller

Large Input Datasets



LLM

Generated Text

If you fail to plan....

What are some challenges in generating text using LLMs?

- Display bias
- Produce toxic or offensive outputs
- Dissolve into repetition
- Produce illogical output

What's my Line?

- Prompt engineering for LLMs.
- LLMs are constantly improving, but their outputs are still dependent on their inputs.

What's my Line?

```
Output:

But, Wilf has to travel home on his own. He has to travel through the Tundra.
He needs to cross the river.
 He needs to cross the river. He needs to cross the river. He needs to cross the river.
 He needs to cross the river. He needs to cross the river. He needs to cross the river.
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```
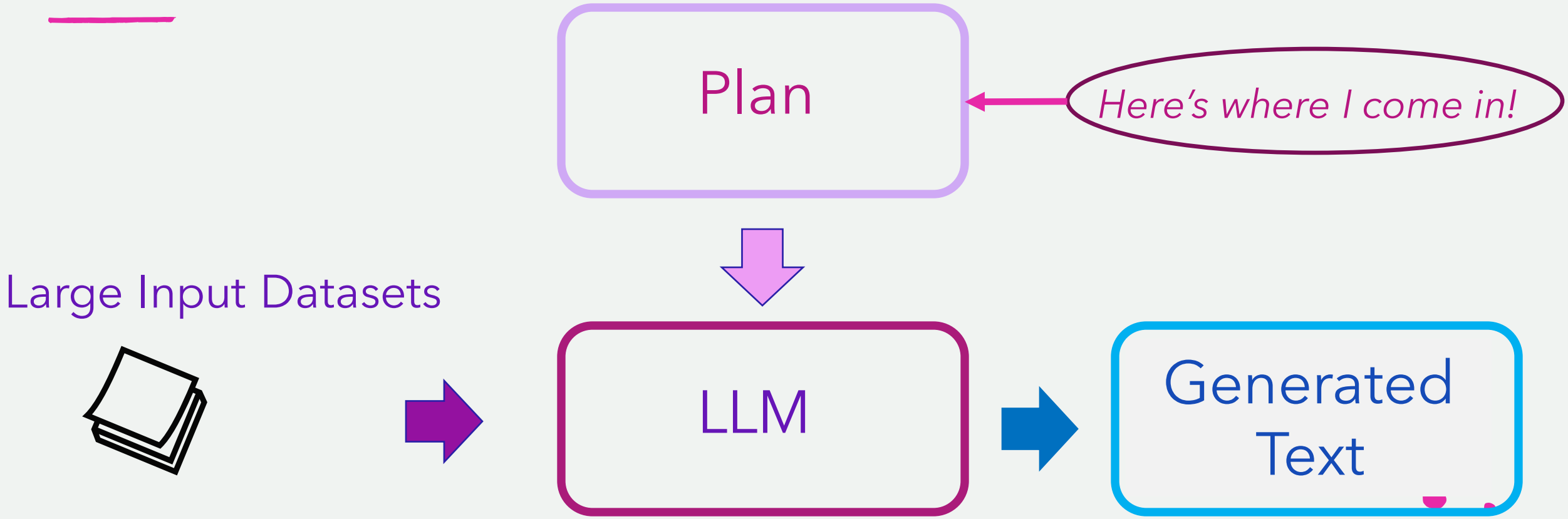

The Storyteller



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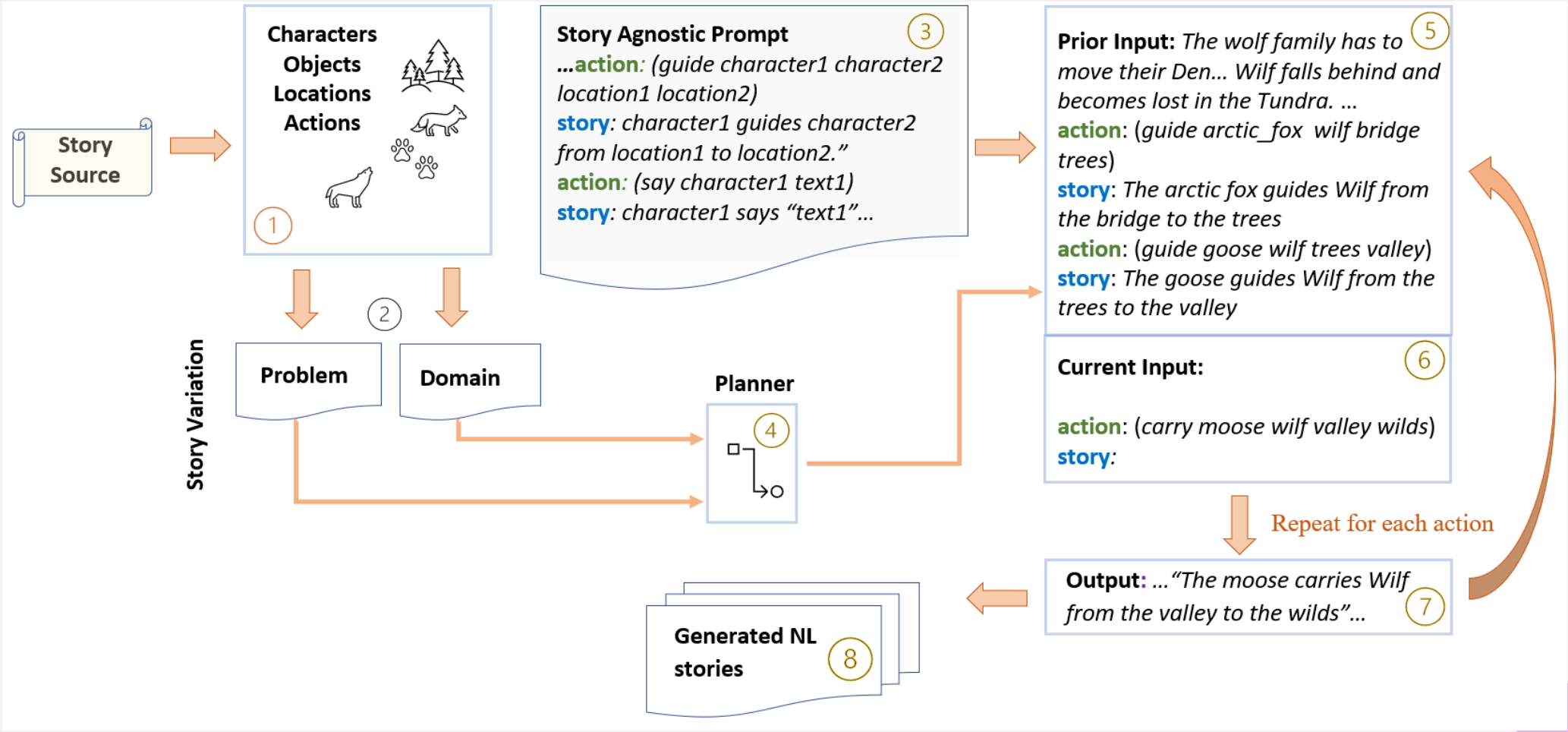

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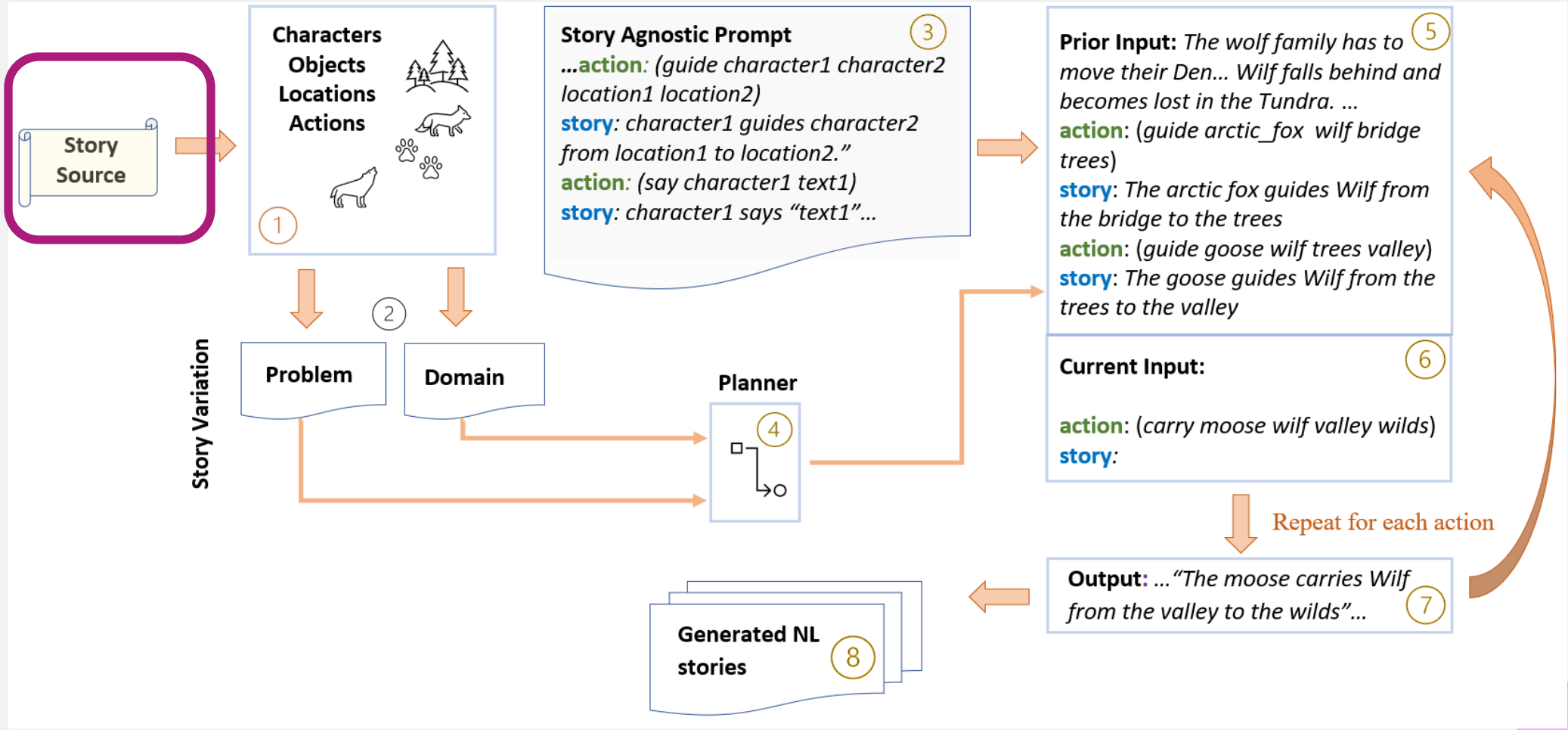

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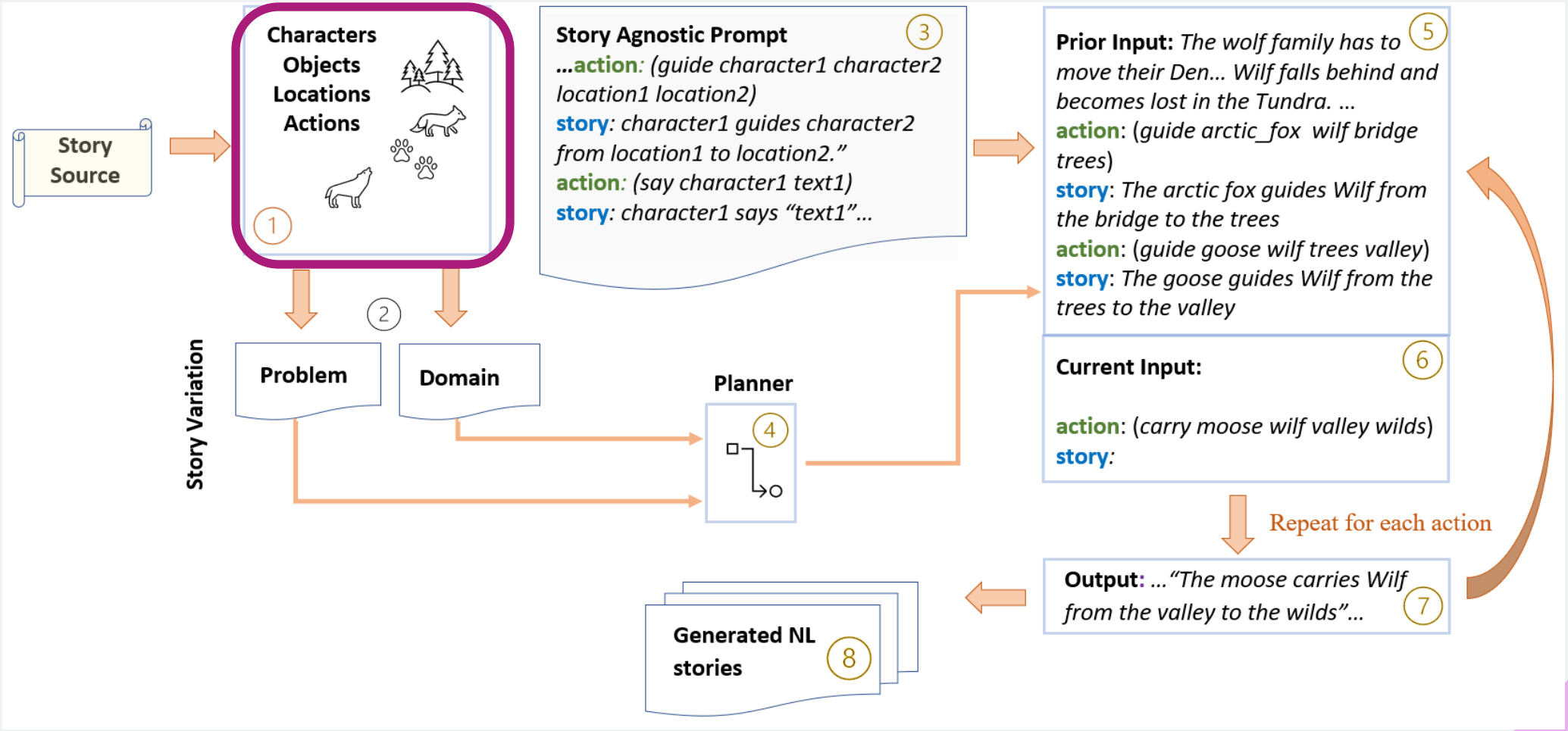

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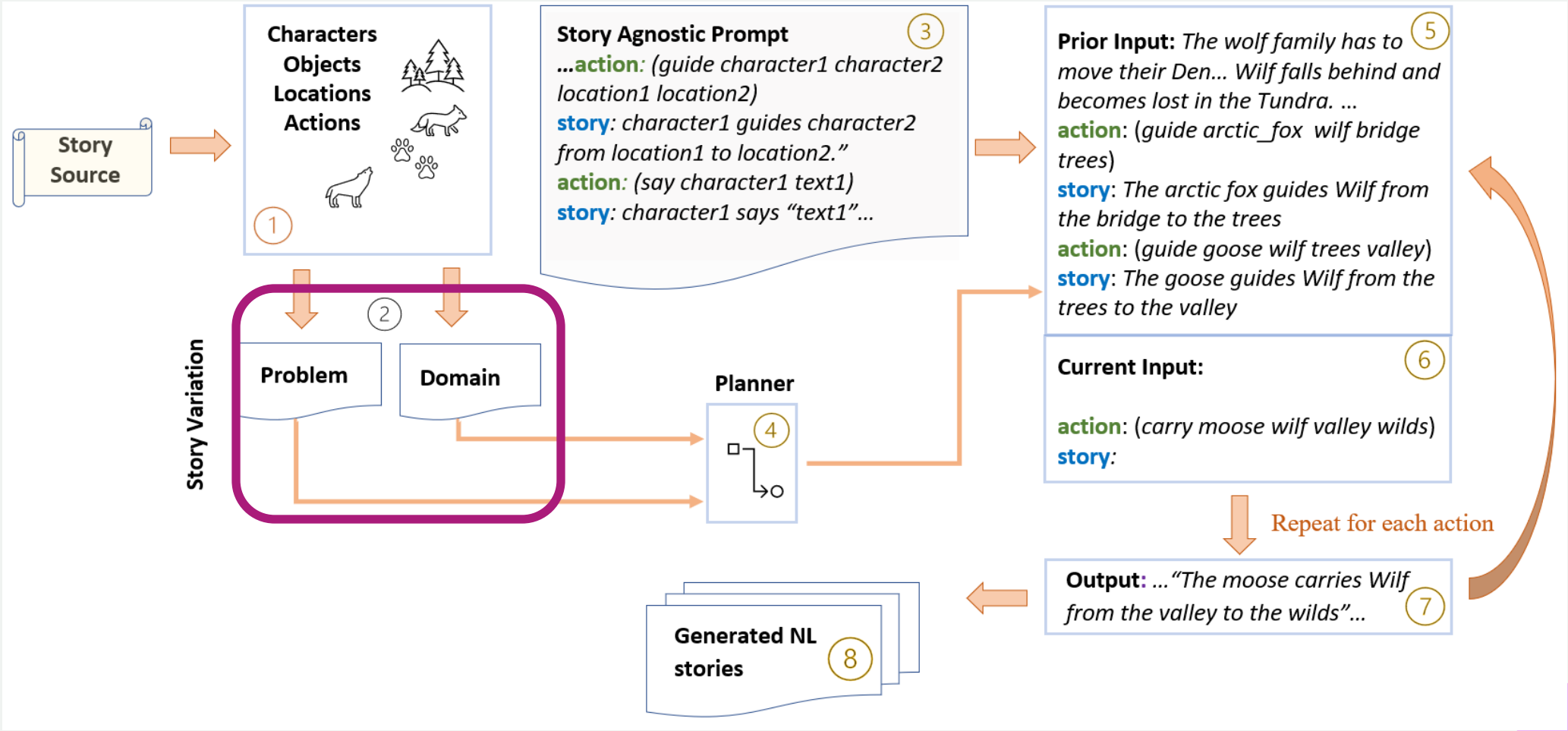

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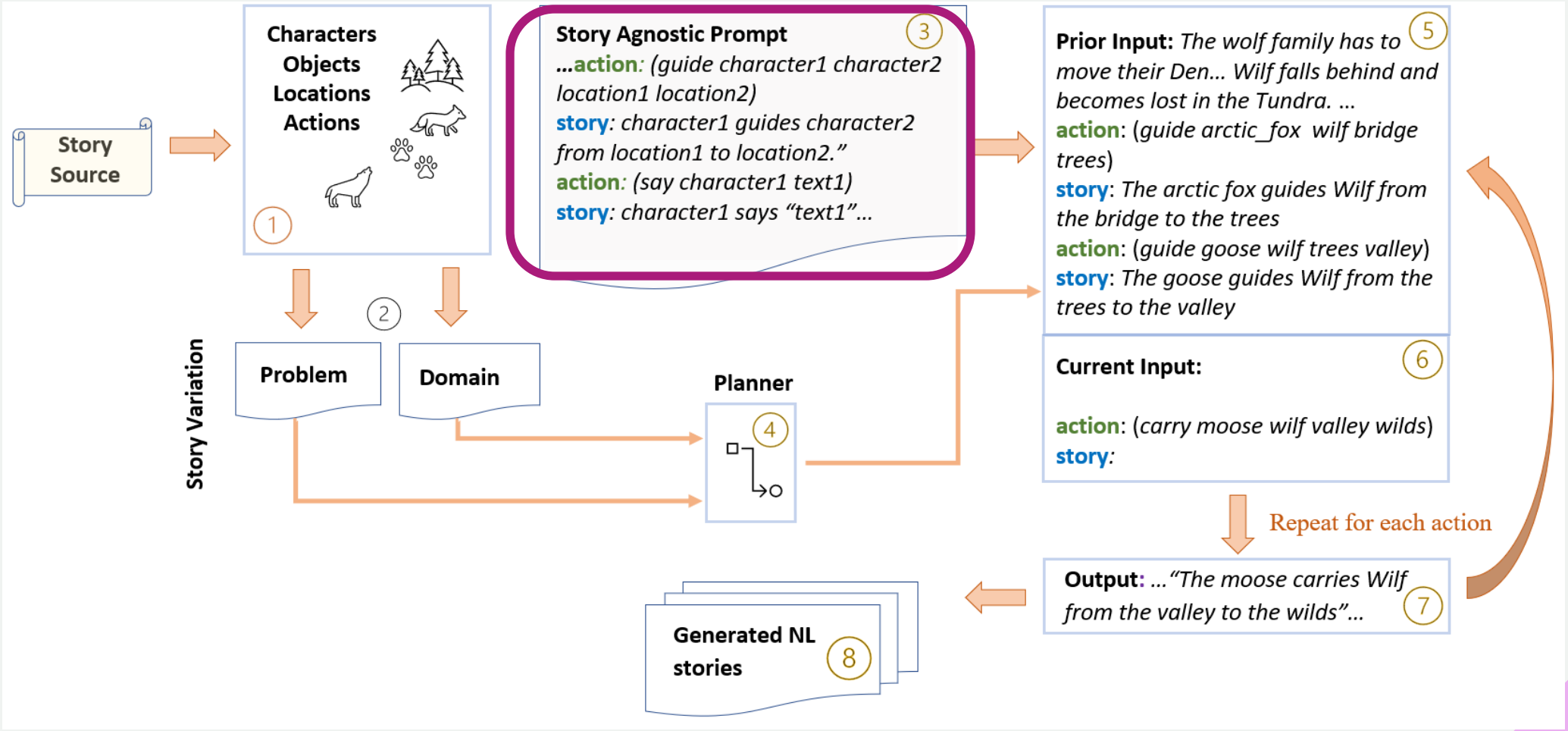

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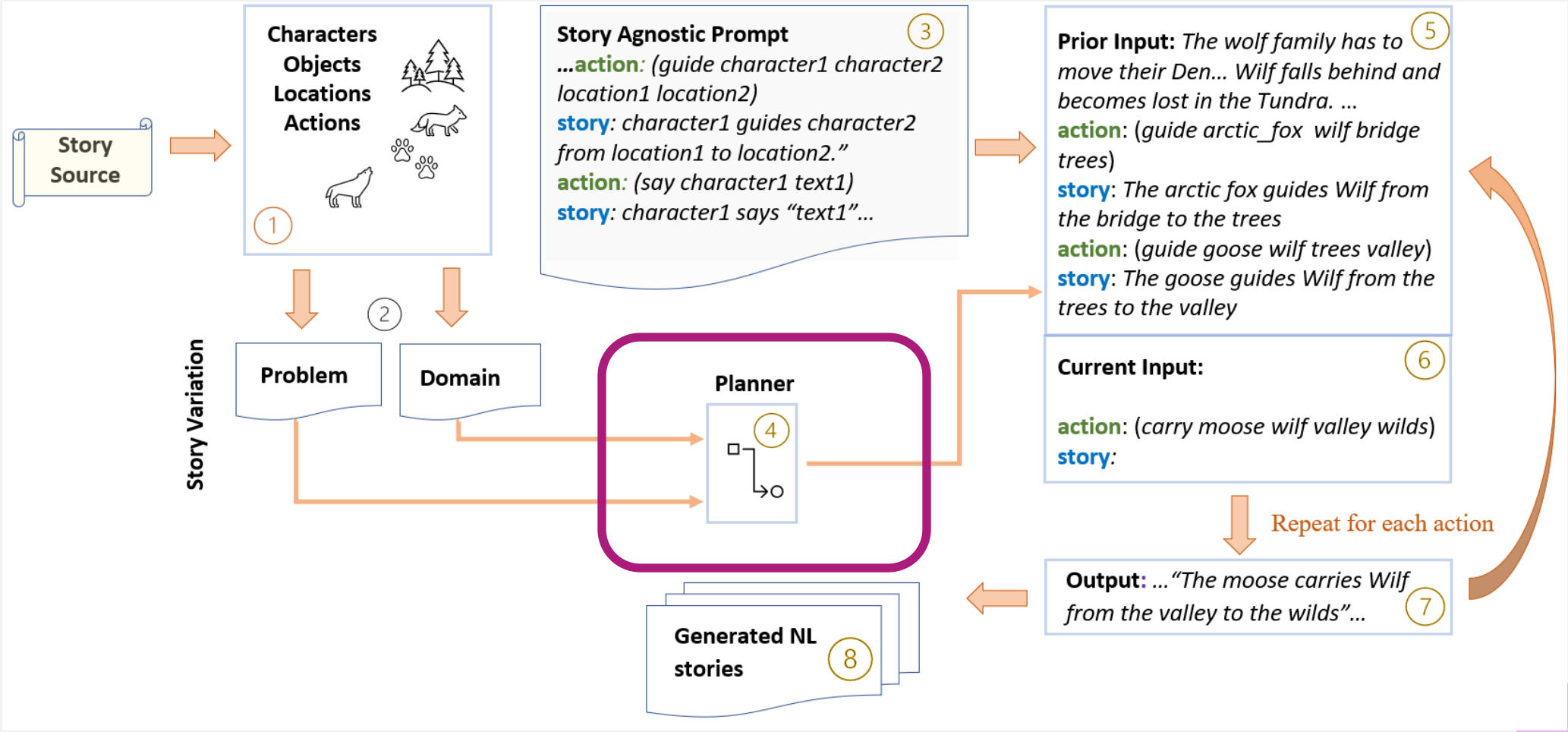

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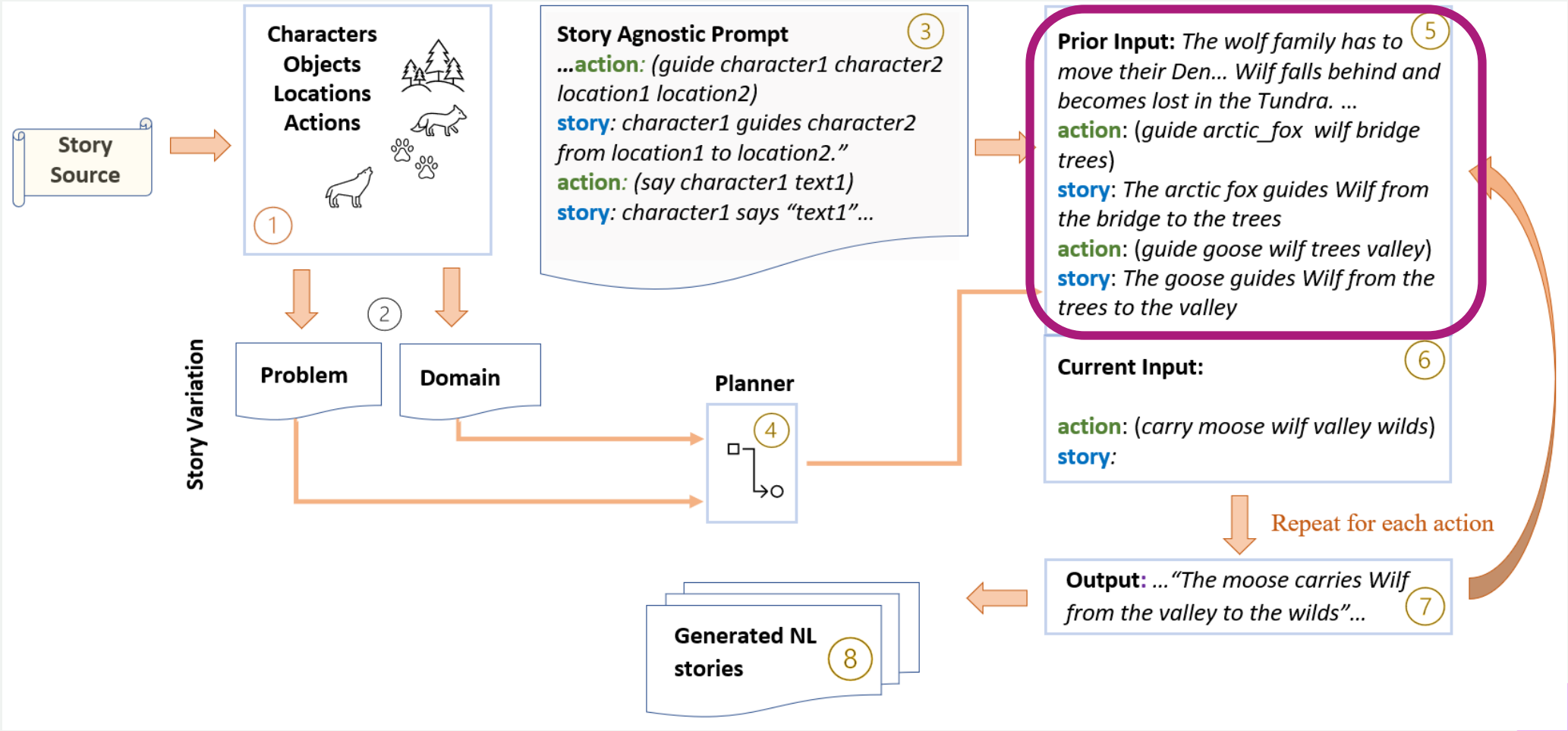

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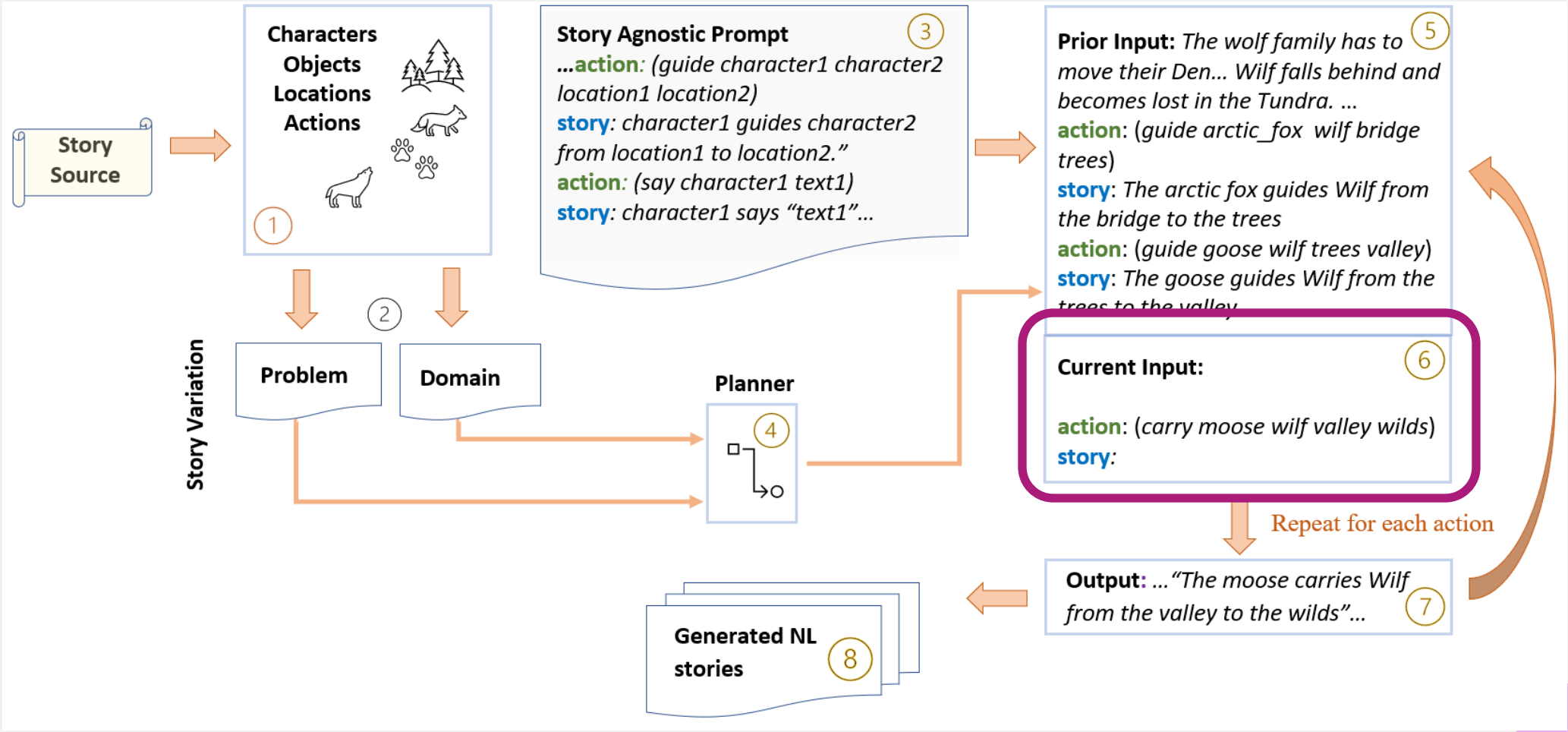

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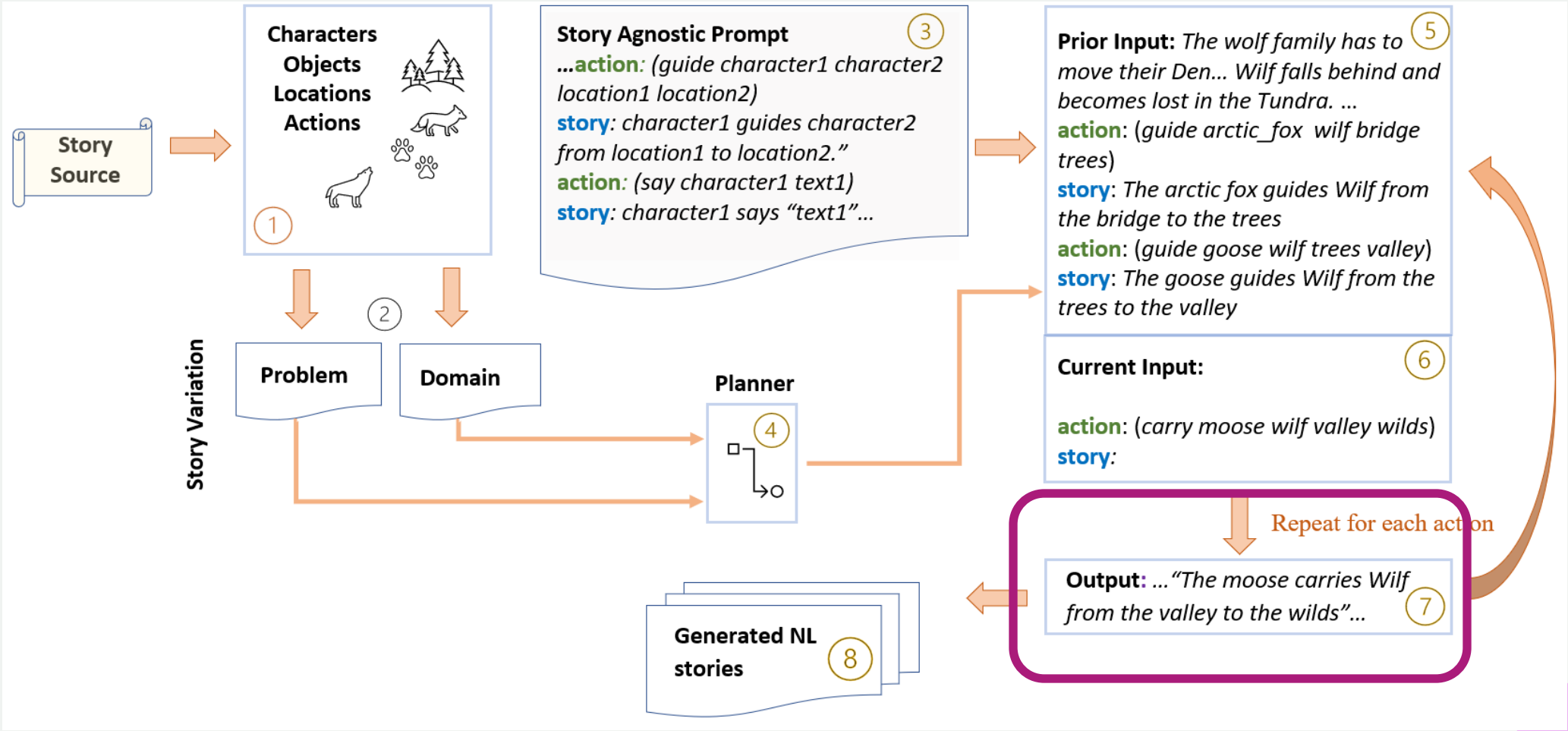

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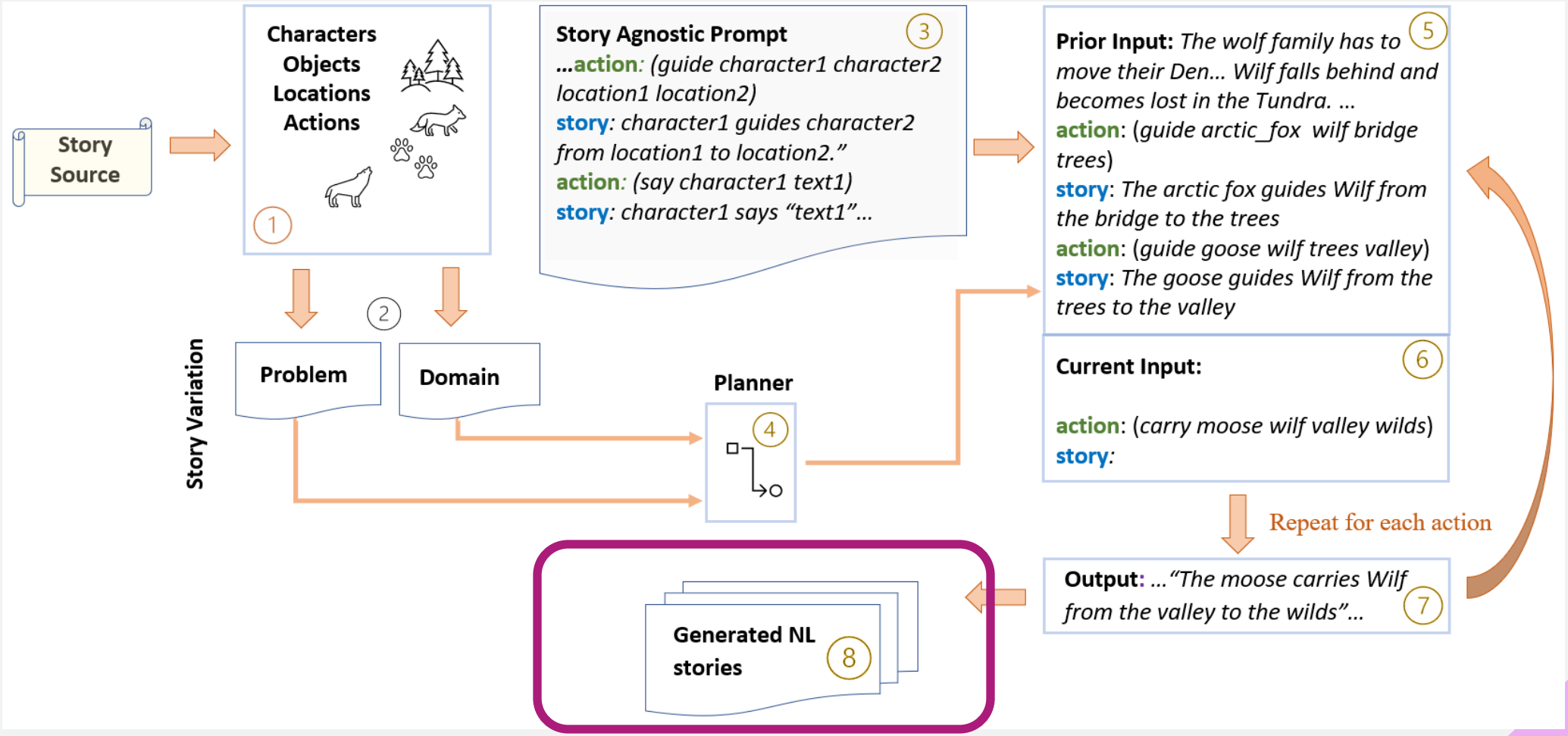


Tell me a Story

Initial Story: The Way Home for Wolf

Characters: wilf, goose, moose...
Objects: --
Verbs: guide, carry...

Tell me a Story

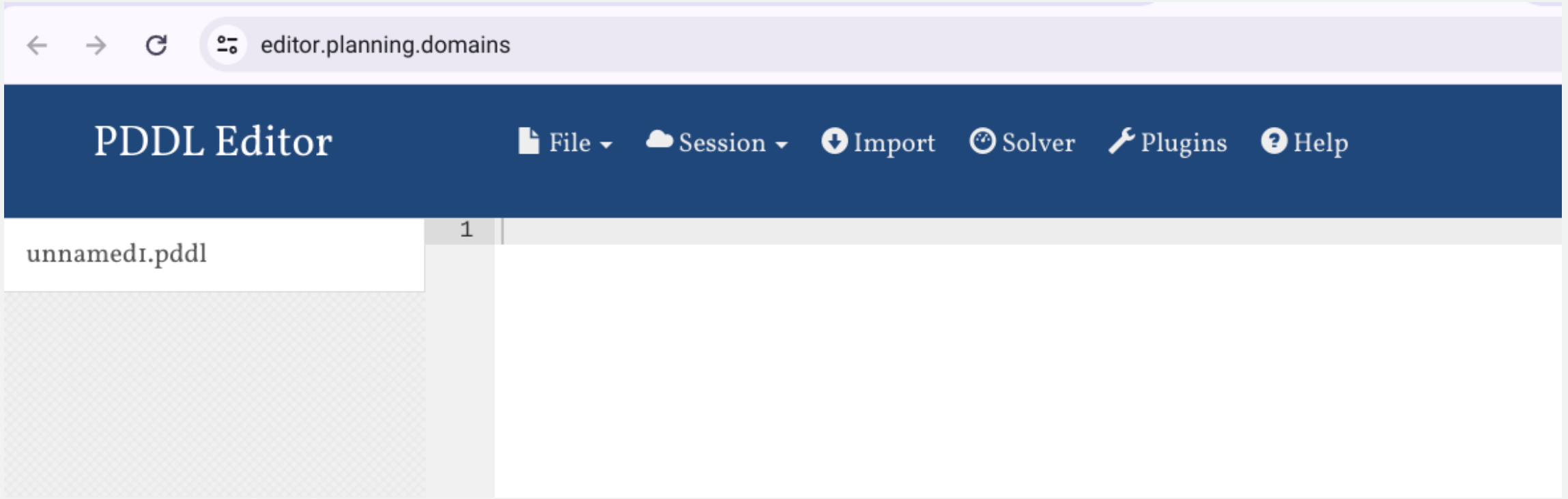
Let's write some pddl...

In a browser, open the pddl online editor (load your own files):
https://editor.planning.domains/

Or

In a browser, open the session:
https://editor.planning.domains/#edit_session=V8PzLOREcQJrhel

Tell me a Story



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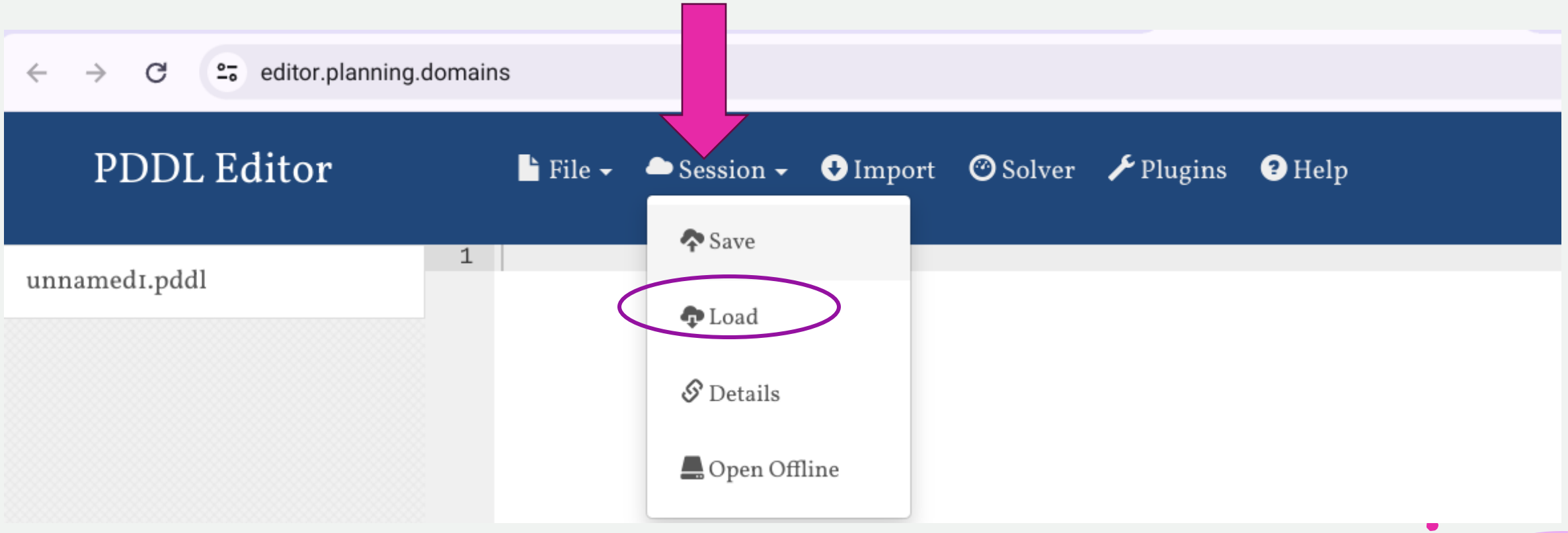

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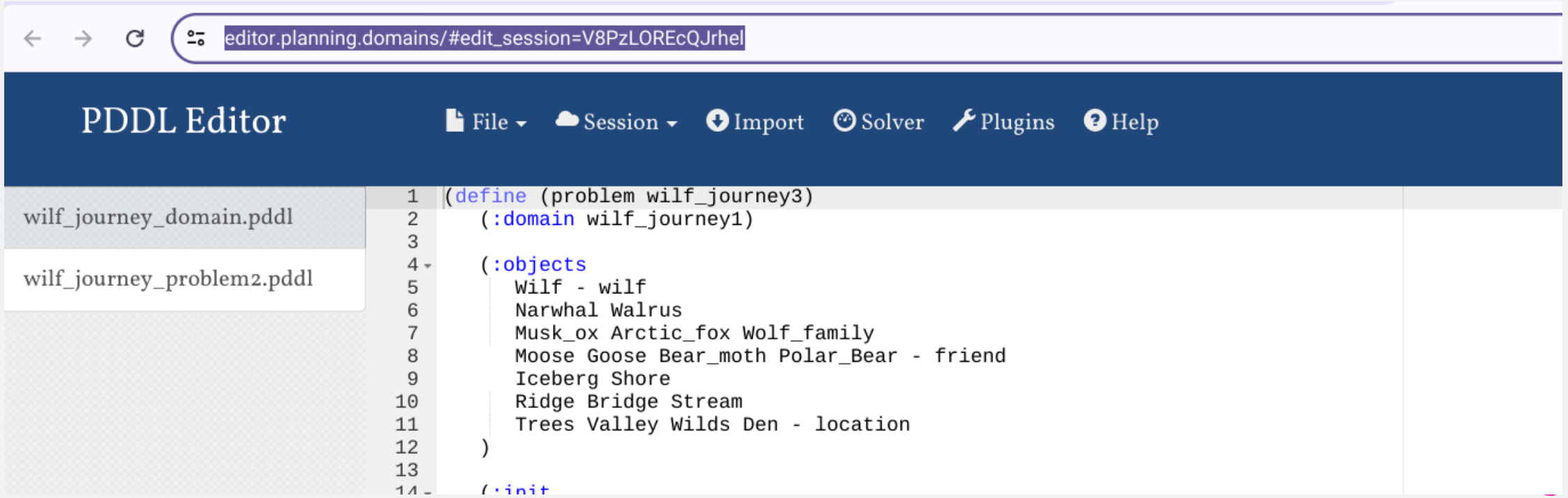

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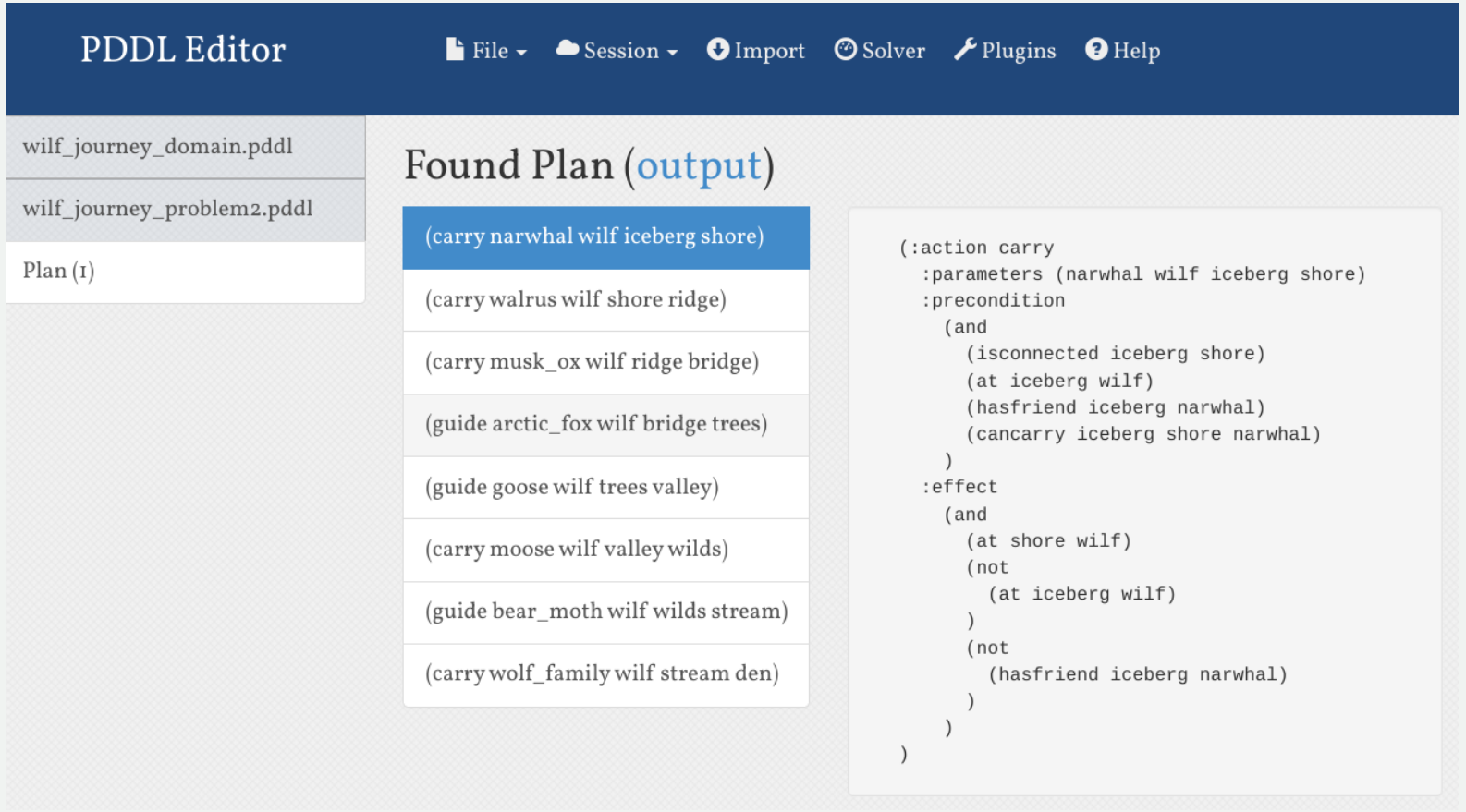


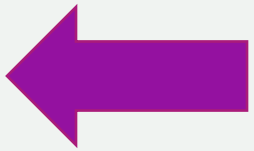
Tell me a Story

Initial Story: The Paper-bag Princess
(Robert Munsch, Annick Press, 1980)

Characters: princess, prince, dragon …
Objects: castle, clothes, paper bag…
Verbs: follow, breathe fire, burn, …

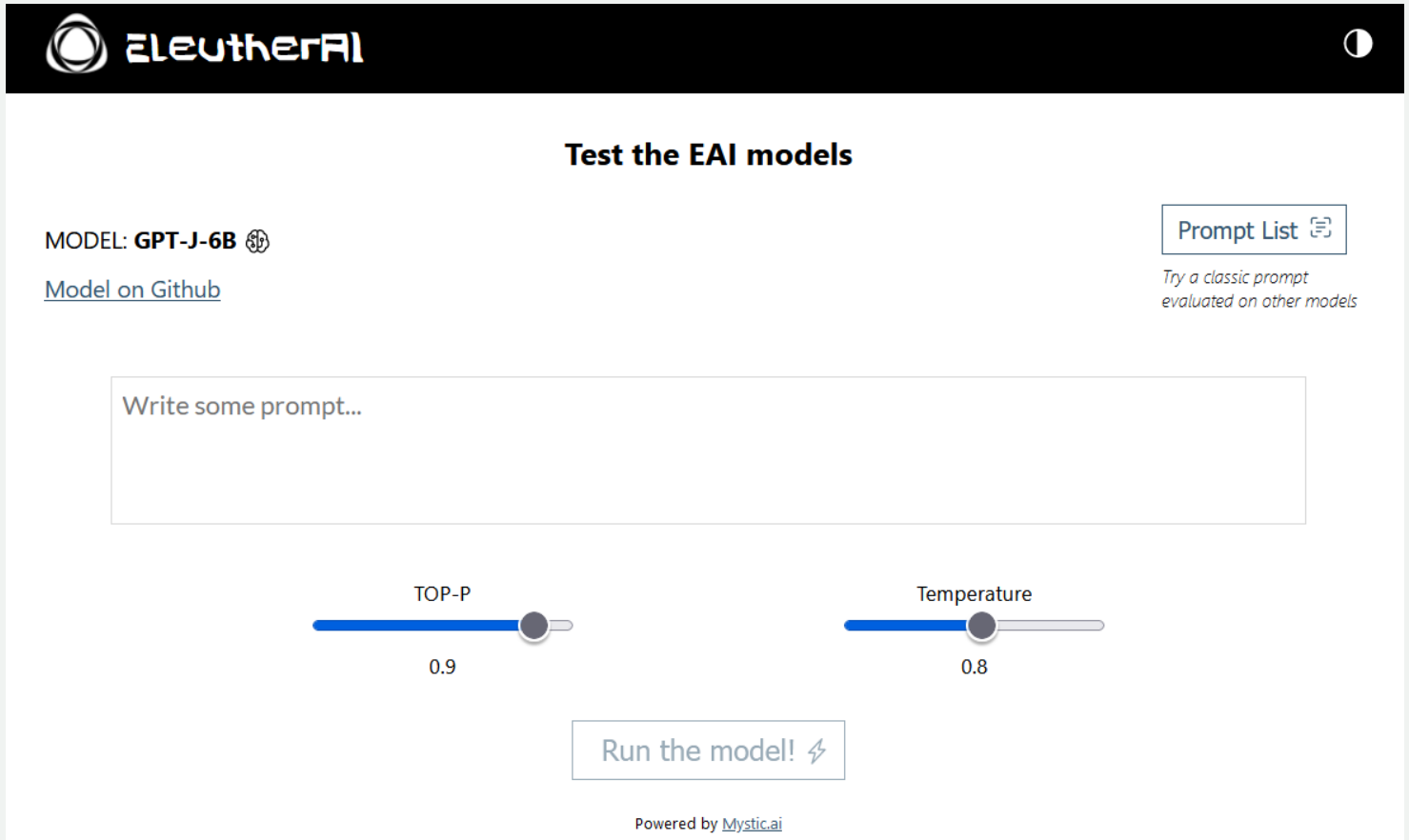
Tell me a Story

(attack_castle dragon clothes ronald)
(follow_dragon dragon clothes elizabeth paper_bag)
(charm_dragon dragon elizabeth)
(flatter_dragon dragon elizabeth)
(breathe_large_fire dragon)
(fly_fast dragon)
(fall_asleep dragon)
(rescue_prince ronald dragon)
(insult ronald elizabeth paper_bag)
(call_off_wedding elizabeth paper_bag)



Valid Plan

Tell me a Story



Interface to the LLM

Tell me a Story

Initial Input to the LLM

```
Princess Elizabeth is a beautiful princess who lives in a magnificent castle.
Princess Elizabeth is engaged to marry Prince Ronald.

action: (attack_castle dragon clothes ronald)
story: The Dragon attacks and destroys the castle and Princess Elizabeth's
        clothes and the Dragon kidnaps Prince Ronald.

action: (follow_dragon dragon clothes elizabeth paper_bag)
story: Princess Elizabeth wears a paper bag because her clothes are destroyed,
        and she follows the Dragon.

action: (charm_dragon dragon elizabeth)
story:
```

Tell me a Story

```
Princess Elizabeth is a beautiful princess who lives in a magnificent castle.
Princess Elizabeth is engaged to marry Prince Ronald.

action: (attack_castle dragon clothes ronald)
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action: (charm_dragon dragon elizabeth)
story:
```

Actions from the generated plan

Tell me a Story

```
Princess Elizabeth is a beautiful princess who lives in a magnificent castle.
Princess Elizabeth is engaged to marry Prince Ronald.

action: (attack_castle dragon clothes ronald)
story: The Dragon attacks and destroys the castle and Princess Elizabeth's
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action: (follow_dragon dragon clothes elizabeth paper_bag)
story: Princess Elizabeth wears a paper bag because her clothes are destroyed,
       and she follows the Dragon.

action: (charm_dragon dragon elizabeth)
story:
```

NL text or 'story' line

Can the LLM generate the next line of the story?

Tell me a Story

Initial Output from LLM

RESULT

Princess Elizabeth is a beautiful princess who lives in a magnificent castle. Princess Elizabeth is engaged to marry Prince Ronald.

action: (attack_castle dragon clothes ronald)
story: The Dragon attacks and destroys the castle and Princess Elizabeth's clothes and the Dragon kidnaps Prince Ronald.

action: (follow_dragon dragon clothes elizabeth paper_bag)
story: Princess Elizabeth wears a paper bag because her clothes are destroyed, and she follows the Dragon.

action: (charm_dragon dragon elizabeth)
story: Princess Elizabeth chases the Dragon, and it is charmed by Princess Elizabeth.

Tell me a Story

Generated NL Story

Princess Elizabeth is a beautiful princess who lives in a magnificent castle. Princess Elizabeth is engaged to marry Prince Ronald.
The Dragon attacks and destroys the castle and Princess Elizabeth's clothes and the Dragon kidnaps Prince Ronald.
Princess Elizabeth wears a paper bag because her clothes are destroyed, and she follows the Dragon.
Princess Elizabeth chases the Dragon, and it is charmed by Princess Elizabeth.
Princess Elizabeth flatters the Dragon, and the Dragon likes Princess Elizabeth.
The Dragon breathes large flames.
The Dragon flies fast.
The Dragon falls asleep.
Princess Elizabeth saves Prince Ronald from the Dragon.
Prince Ronald insults Princess Elizabeth, and she wears a paper bag because she is wearing no clothes.
Princess Elizabeth calls off the wedding, and she is wearing a paper bag.

The proof of the pudding....

Evaluation

Story	POS tag	Plan	LLM story
The Way Home for Wolf	Noun	18	18
	Verb	2	3
Robin Hood and the Golden Arrow	Noun	8	7
	Verb	6	7
Paper Bag Princess	Noun	6	7
	Verb	10	19

Table 3.3: Number of nouns and verbs found in the PDDL plan that are successfully captured in the LLM output

The proof of the pudding….

Evaluation

$$Precision = \frac{\#TotalRight}{\#TotalTagged}, \; Recall = \frac{\#TotalRight}{\#TotalTruth}$$

$$F_1 = \frac{2 \times precision \times recall}{precision + recall} \qquad (1)$$

(Olmo et al. 2021)

"Common automated evaluation metrics for story generation such as perplexity and BLEU … only measure whether a generator can recreate the ground truth corpus."

(Castricato et al. 2021)

The proof of the pudding….

1. This story exhibits CORRECT GRAMMAR.
2. This story's events occur in a PLAUSIBLE ORDER.
3. This story's sentences MAKE SENSE given sentences before and after them.
4. This story AVOIDS REPETITION.
5. This story uses INTERESTING LANGUAGE.
6. This story is of HIGH QUALITY.
7. This story is ENJOYABLE.
8. This story REMINDS ME OF A SOAP OPERA.
9. This story FOLLOWS A SINGLE PLOT.

Likert scale
1. Strongly Disagree,
5. Strongly Agree

(Martin. 2018)

The proof of the pudding….

- Which story's events occur in a more PLAUSIBLE ORDER?
- Which story's sentences MAKE MORE SENSE given sentences before and after them?
- Which story better follows a SINGLE PLOT?
- Which story is of HIGHER QUALITY?
- Which story is more ENJOYABLE?

Pick between two stories

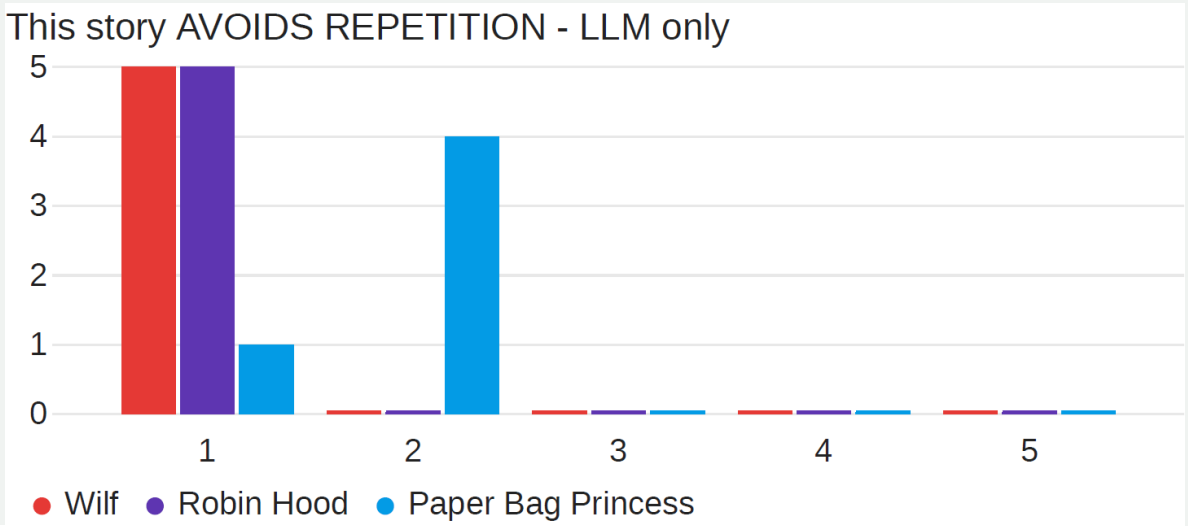
(Castricato et al. . 2021)

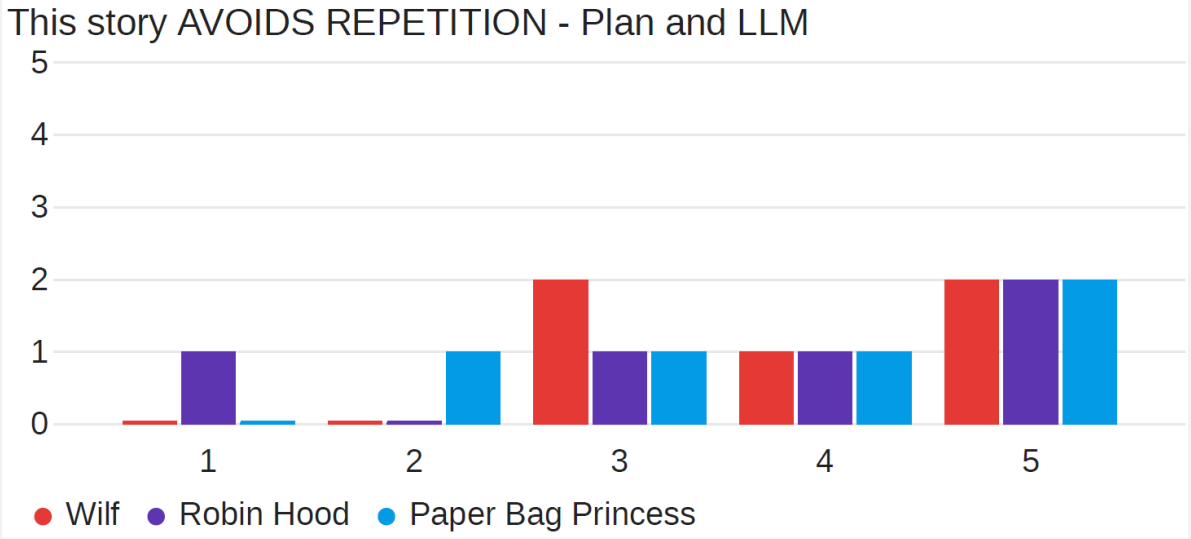
The proof of the pudding….

Please indicate your level of familiarity with the English Language: Beginner/Intermediate/Advanced:

1. Story A is more believable than Story B.
2. Story A uses language that is more fluent and coherent (flows better grammatically) than Story B.
3. Story A is more enjoyable than Story B.
4. Variation #1 on Story A seems consistent (stems logically from the original story).
5. Variation #2 on Story A seems consistent.
6. Variation #1 on Story B seems consistent.
7. Variation #2 on Story B seems consistent.
8. How could story A have been made more believable?
9. How could story B have been made more believable?
10. The author goal is the main goal of the story e.g. After being lost in the forest, the heroine of the story eventually finds her way back home.
    Story A achieves the author goal.
11. Story B achieves the author goal.

The proof of the pudding....





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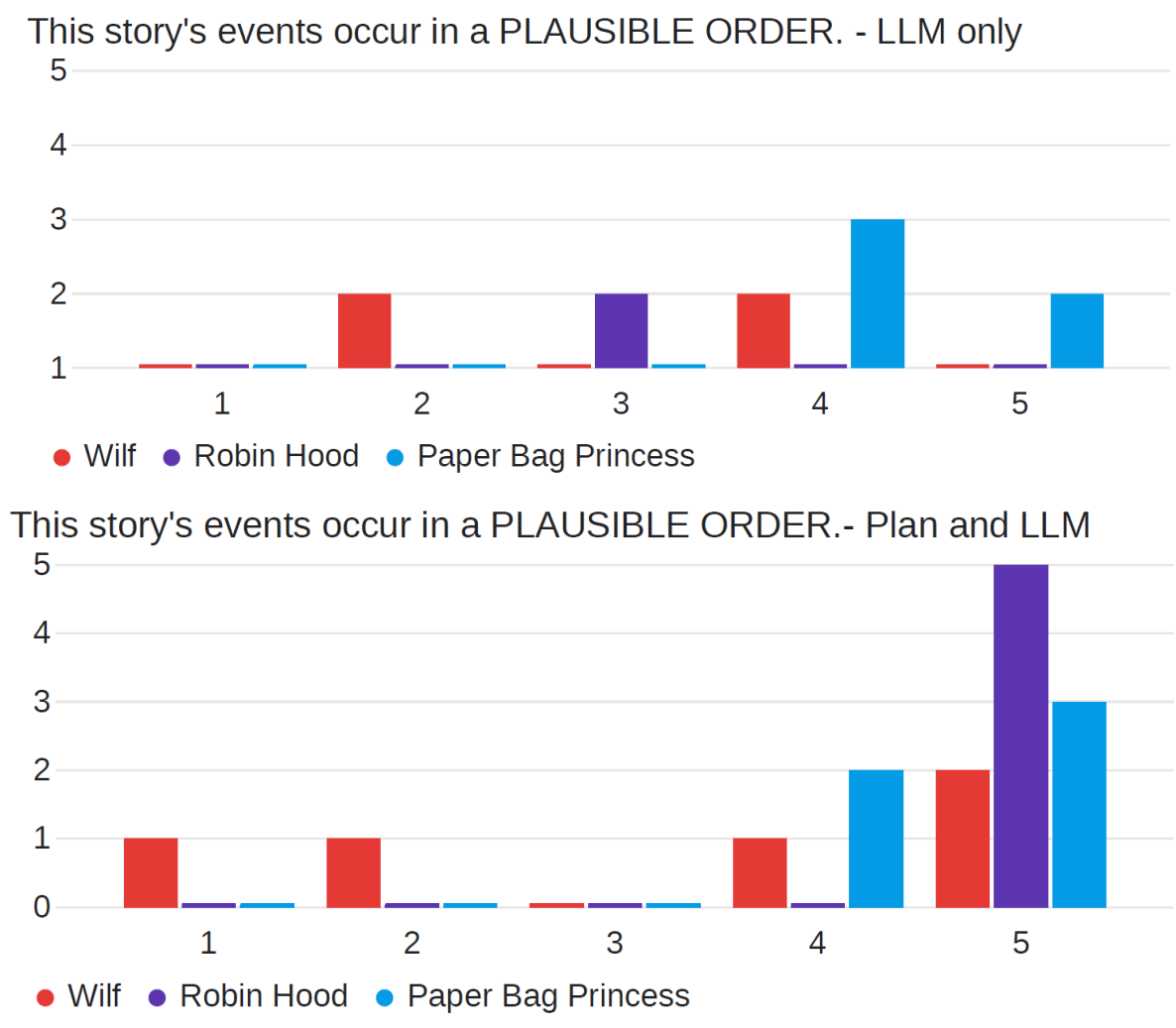
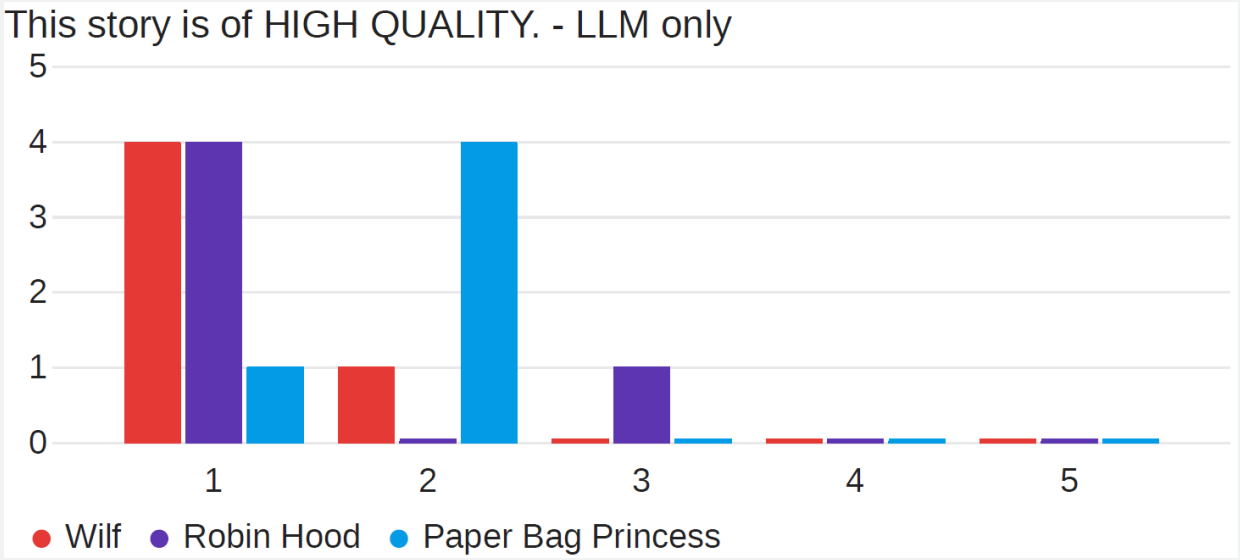
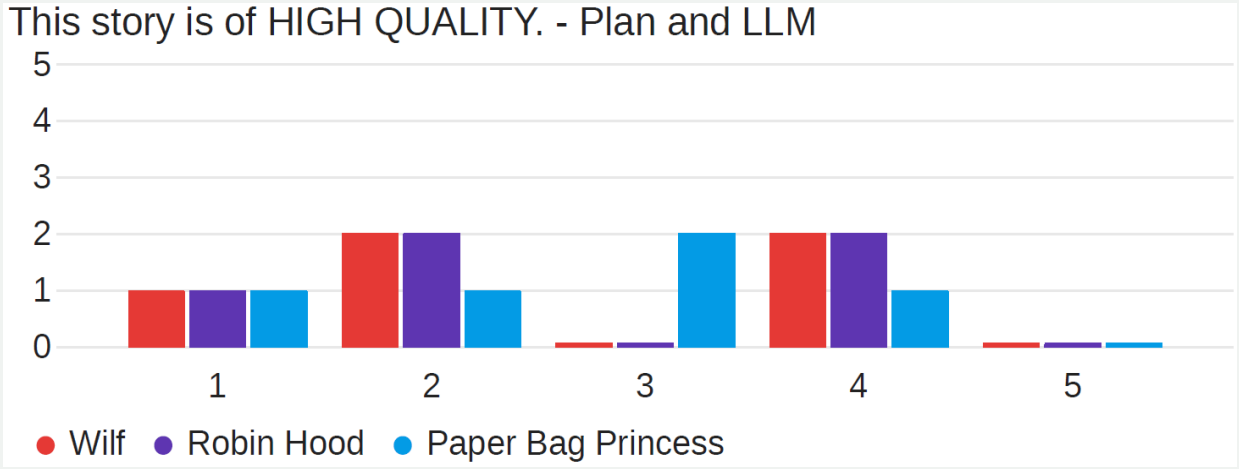
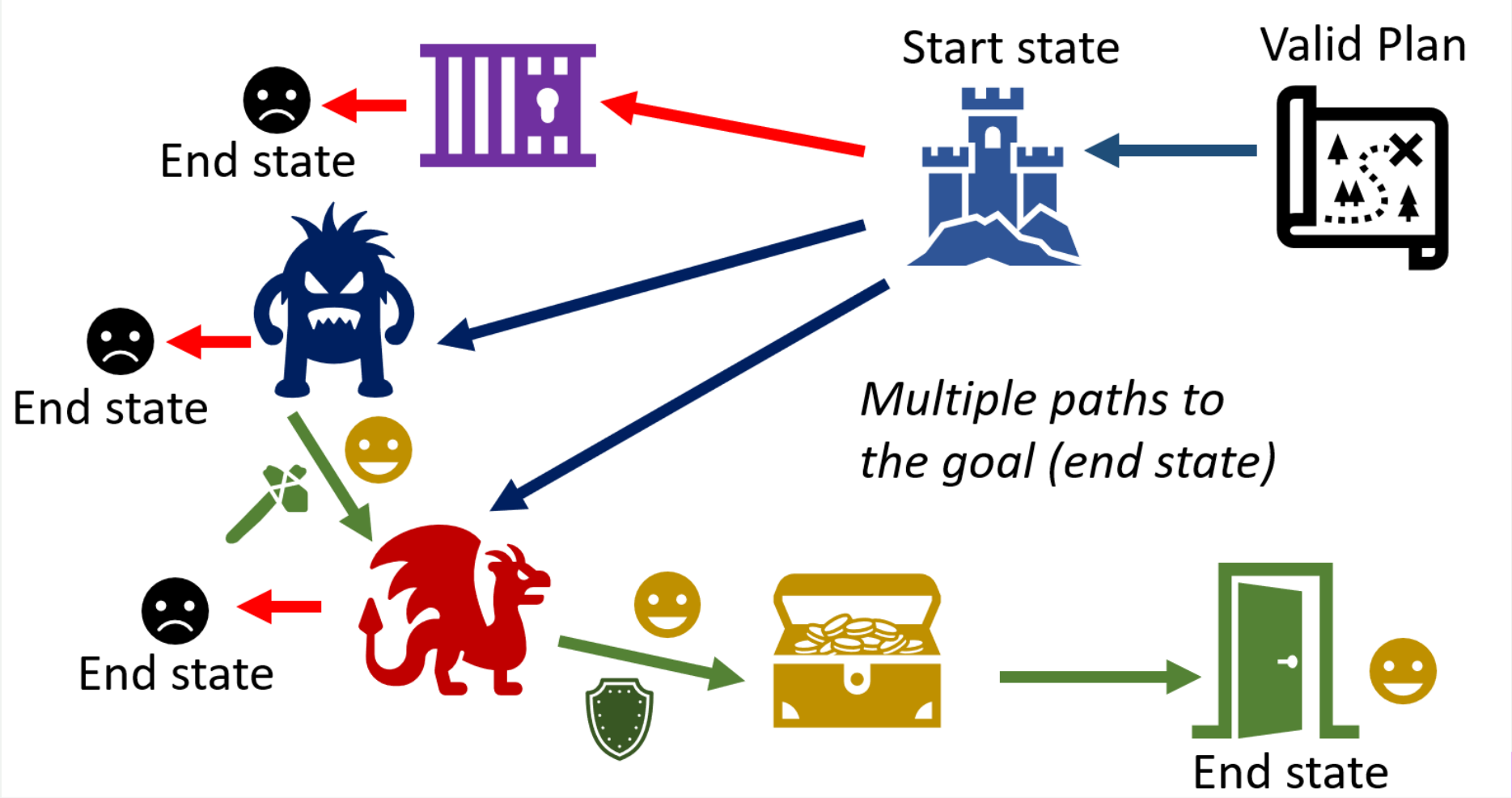


The proof of the pudding....





Stay Tuned!


Start state
Valid Plan
End state
End state
End state
End state
Multiple paths to the goal (end state)

That's a Wrap...for now!

Overview

Part I - Presentation

Presenter : *Rogelio E. Cardona-Rivera*:

- Module 2 : FROM CLASSICAL TO NARRATIVE PLANNING
- Module 3 : MODELING CHARACTERS WITH INTENTION AND CONFLICT
- Module 4 : NARRATIVE DOMAINS AND EXPRESSIVE RANGE

Overview

Part II - Presentation

Presenter : *Nisha Simon*, Contributor : *Patrik Haslum*

- Module 5 : PLANNING FROM A FOCALIZED PERSPECTIVE – INTENTIONALITY

Presenter : *Nisha Simon*

- Module 6 : PLANNING FROM A CHARACTER'S POINT-OF-VIEW (CYOA)

Part III - Demo

Presenters : *Nisha Simon, Christian Muise, Rogelio E. Cardona-Rivera*

We hope you enjoy today's story!

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Christian Muise	https://www.haz.ca/
Rogelio E. Cardona-Rivera	http://rogel.io/
Arnav Jhala	https://arnav.wordpress.ncsu.edu/
Julie Porteous	https://porteousjulie.bitbucket.io/
R. Michael Young	https://liquidnarrative.eae.utah.edu/rmy/
Patrik Haslum	https://comp.anu.edu.au/people/patrik-haslum/