



Tell me a story, LLM

Nisha Simon



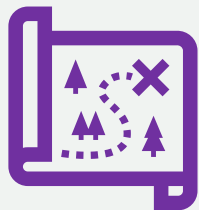
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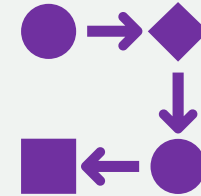
Why Planning for Storytelling?

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 as 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.

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...

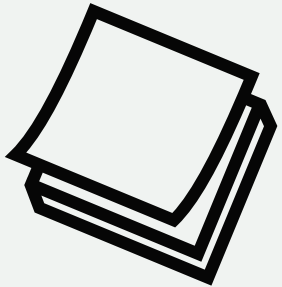
- Neural based approaches
- Story Skeletons
- Compilation to Classical Planning
- Neurosymbolic approaches
- Story Variations
- Directed graphs and branching story trees
- Large Language Models

Who did What? – the plot thickens...

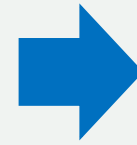
- Neural based approaches
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- Neurosymbolic approaches
- Story Variations
- Directed graphs and branching story trees
- Large Language Models

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.

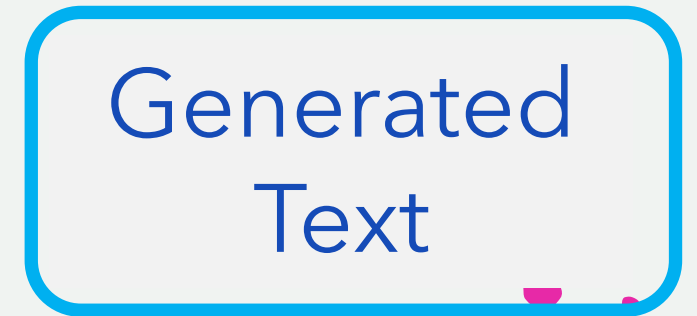
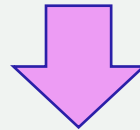
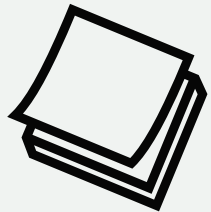
He needs to cross the river. He needs to cross the river. He needs to cross the river.

He needs to cross the river. He needs to cross the river. He needs to cross the river.

He needs to cross the river. He needs to cross the river

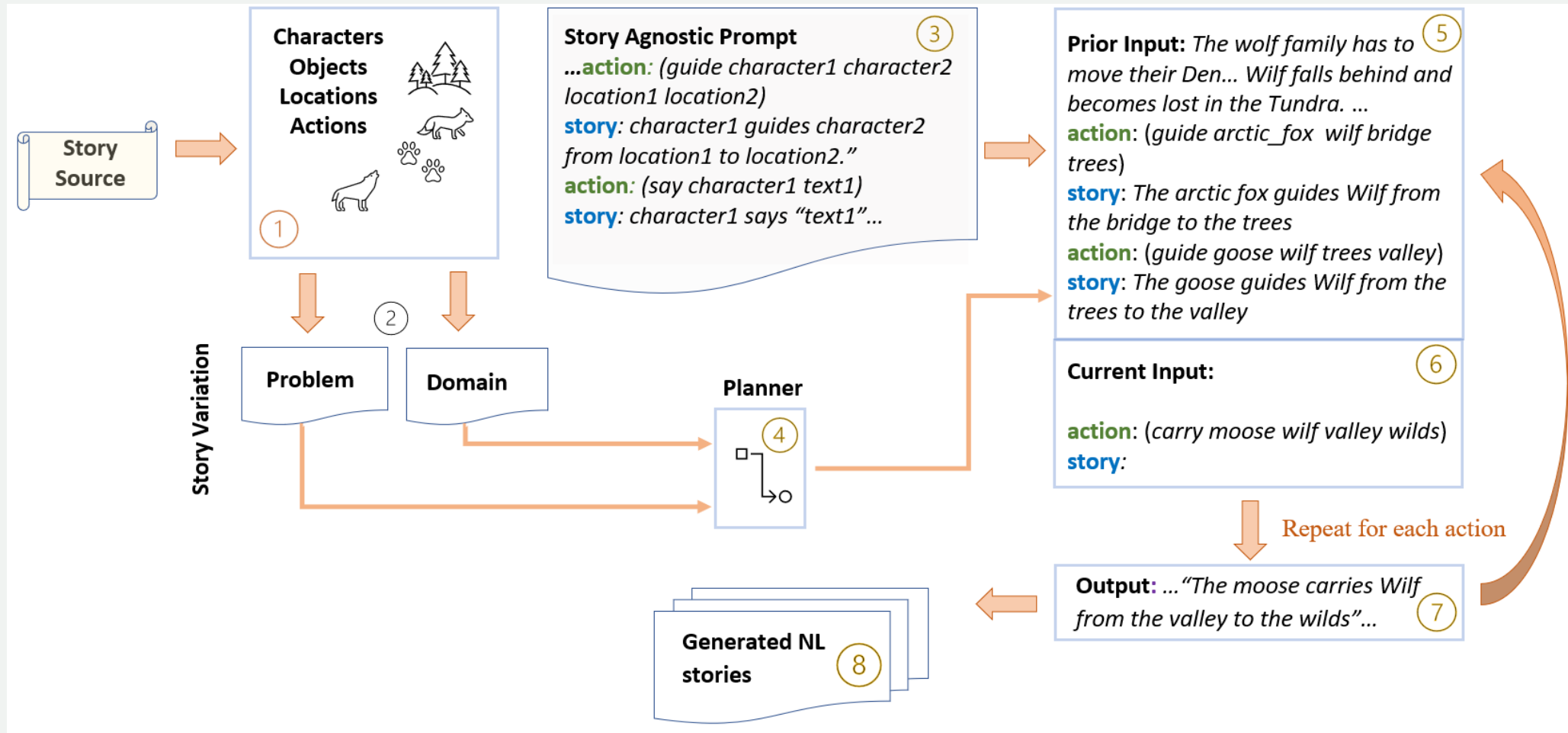
The Storyteller

Large Input Datasets

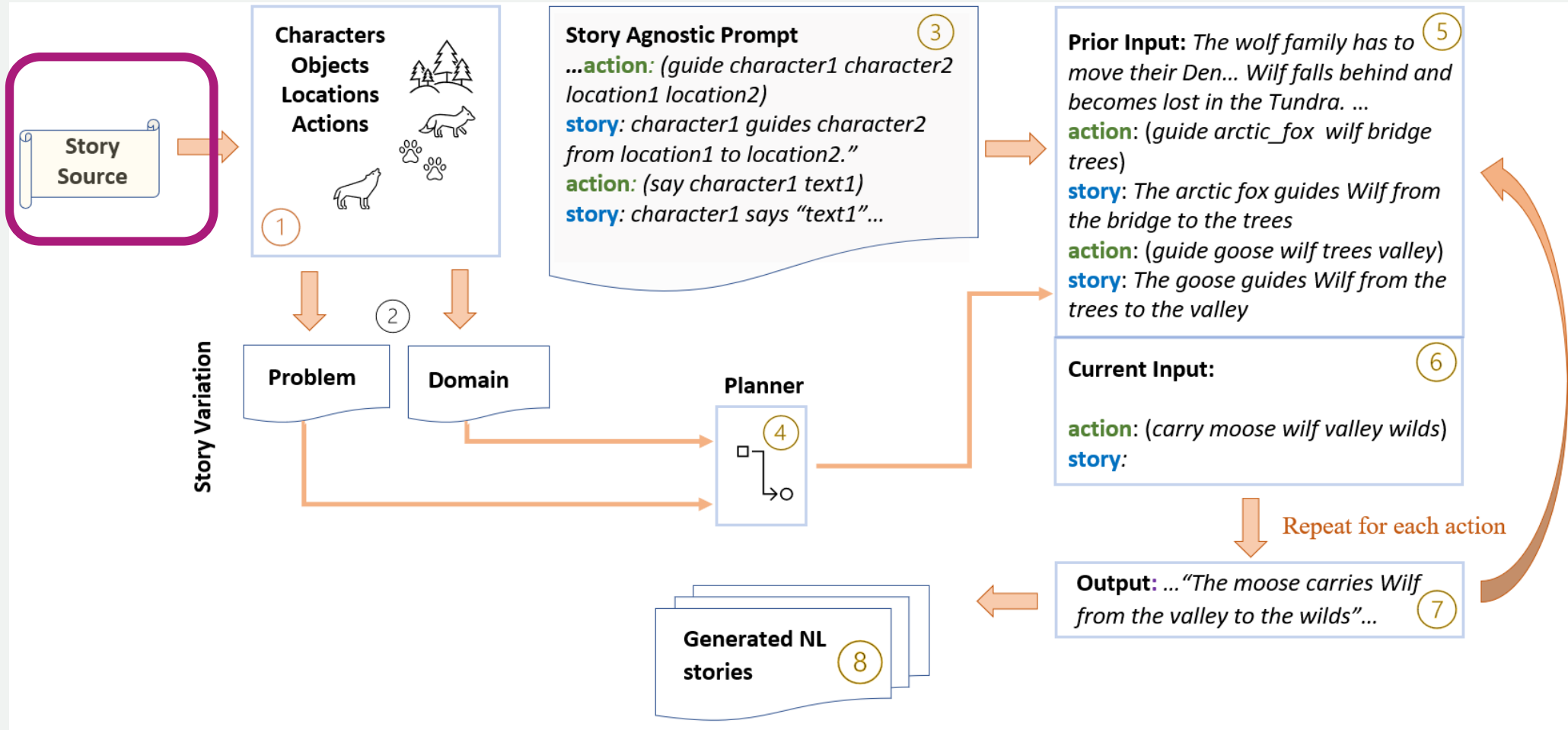


Here's where I come in!

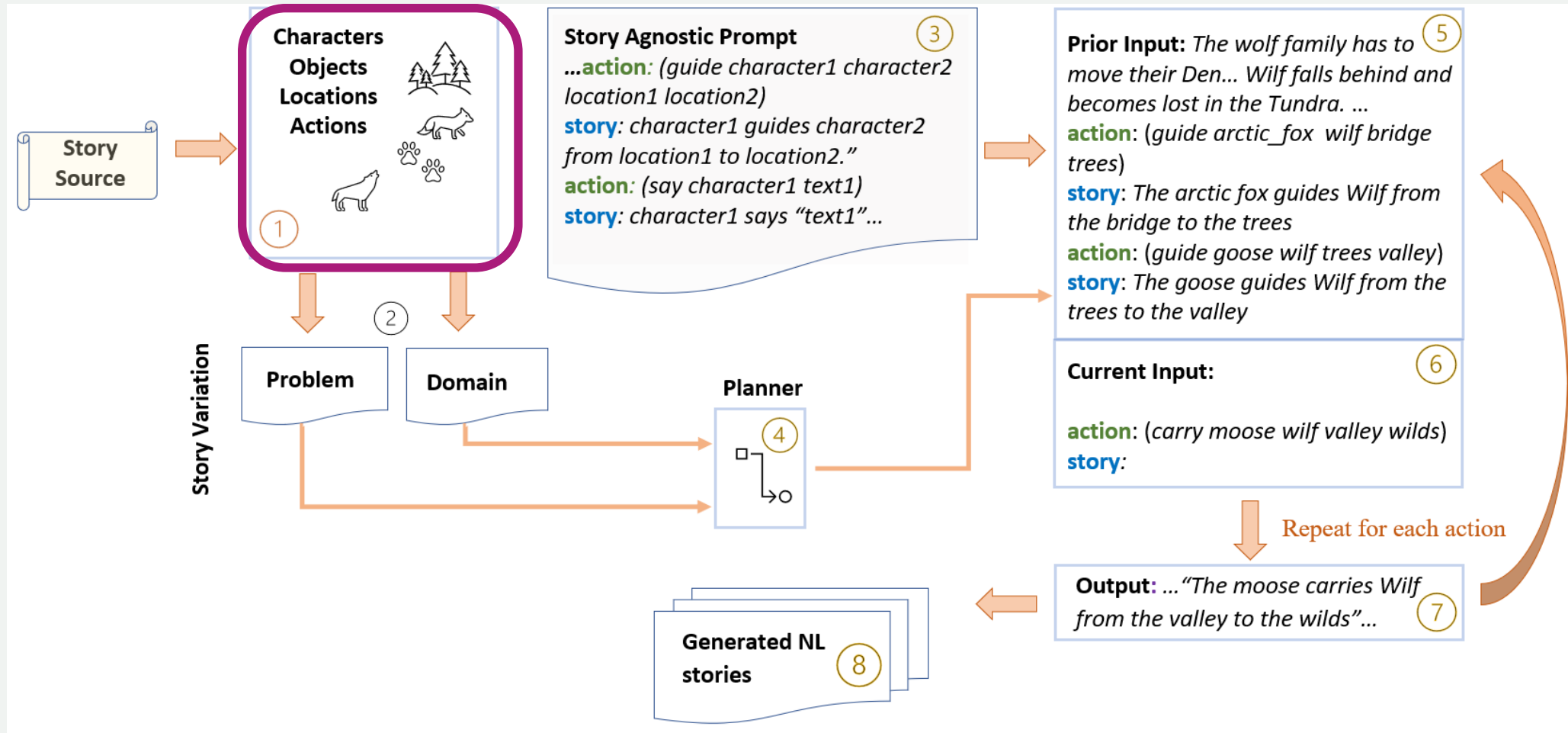
The Storyteller



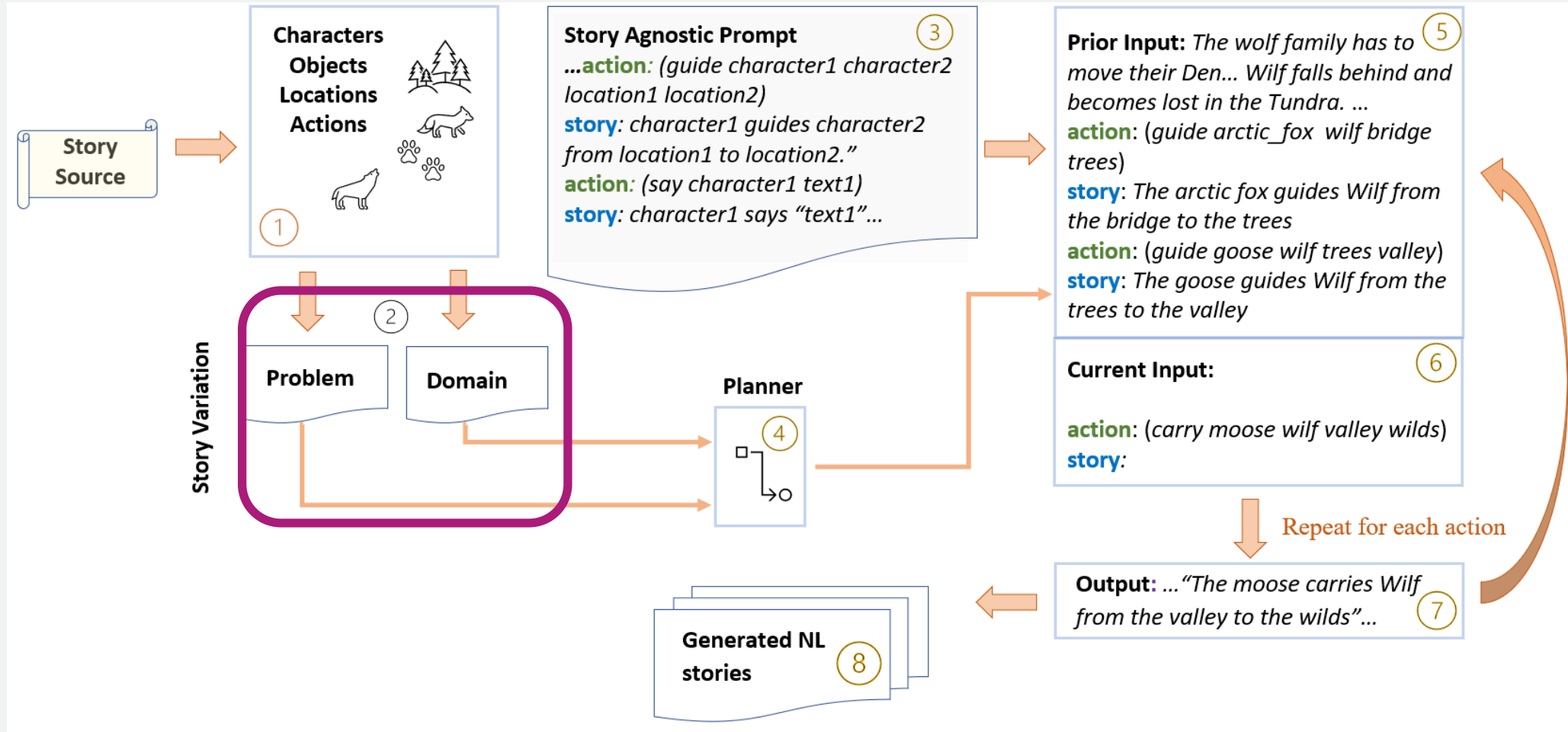
The Storyteller



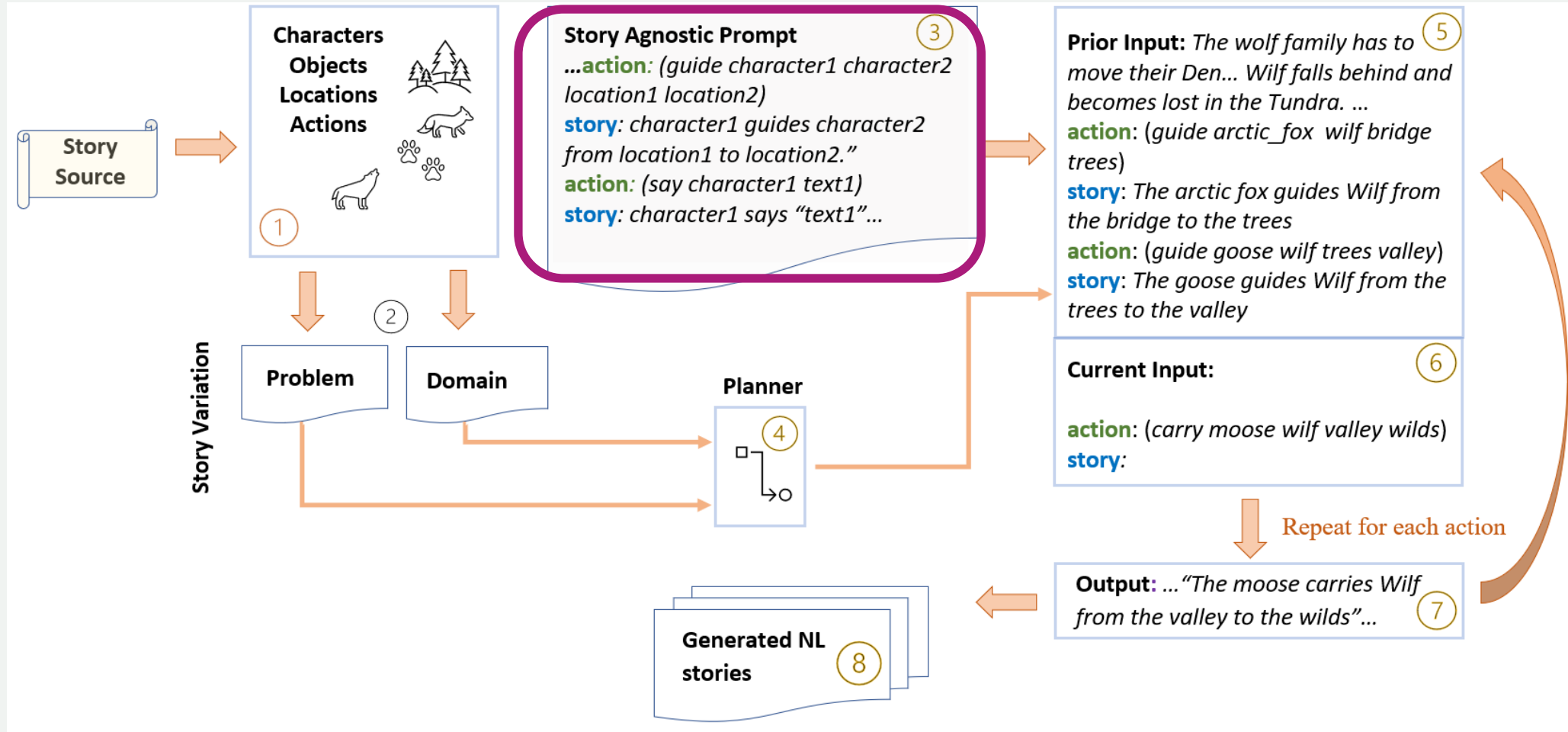
The Storyteller



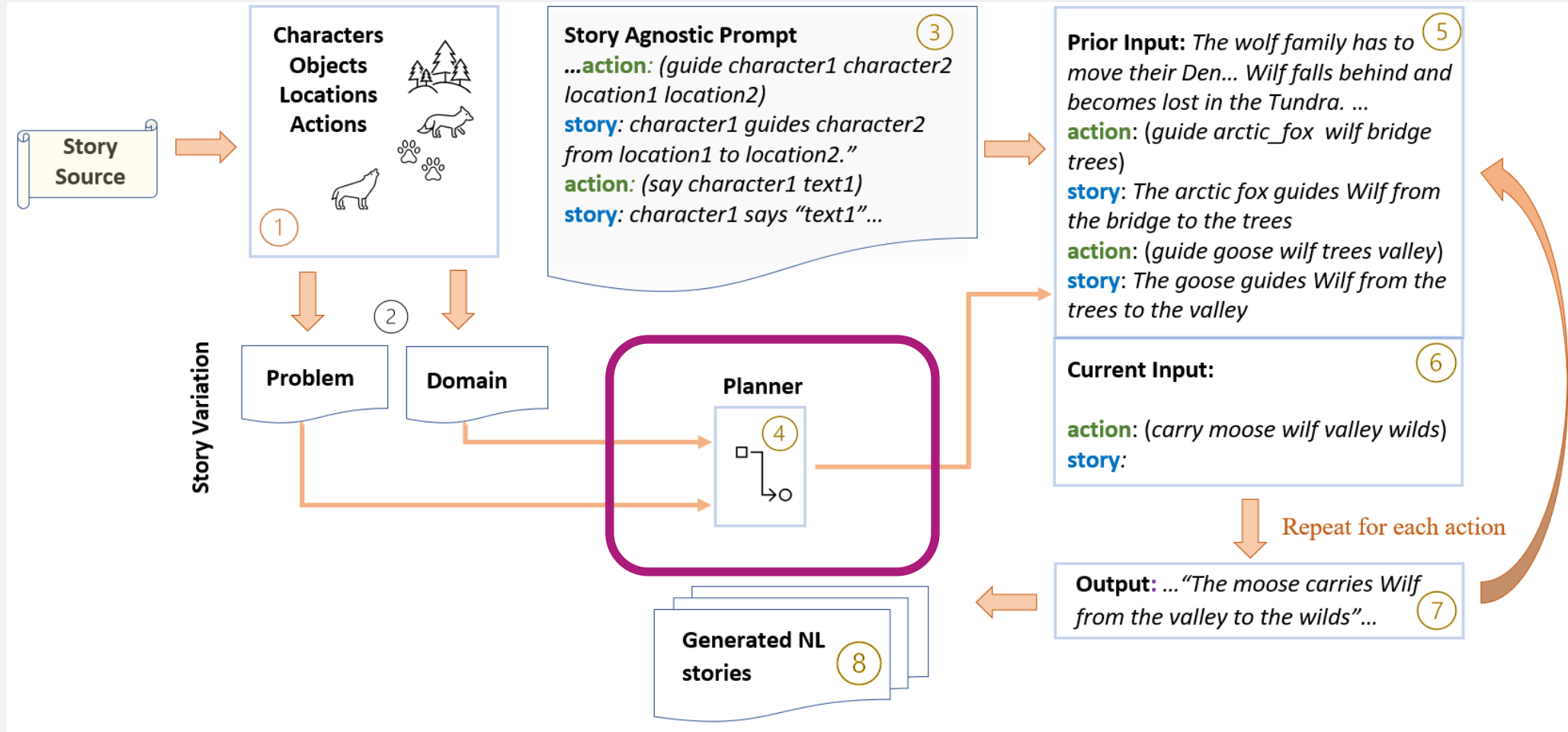
The Storyteller



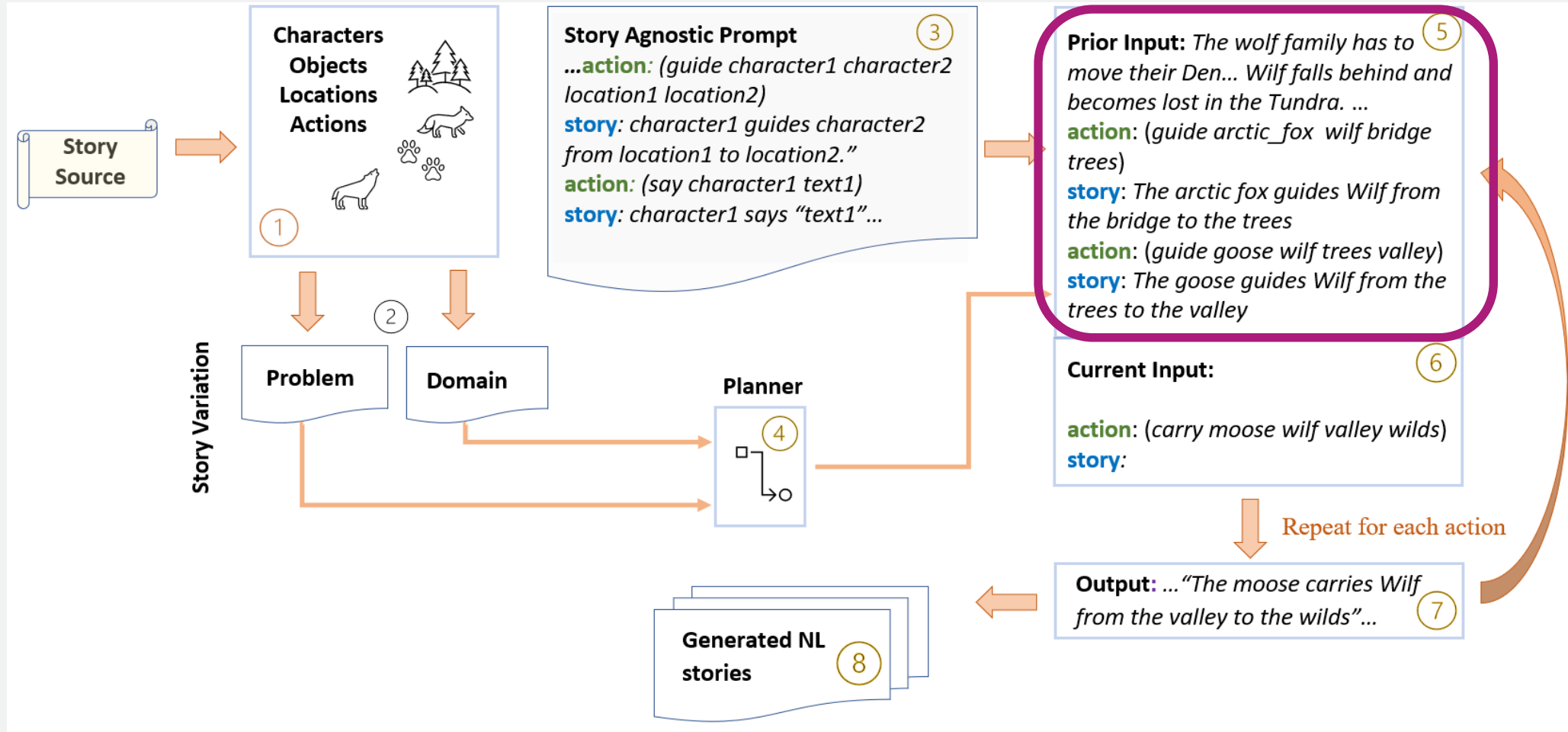
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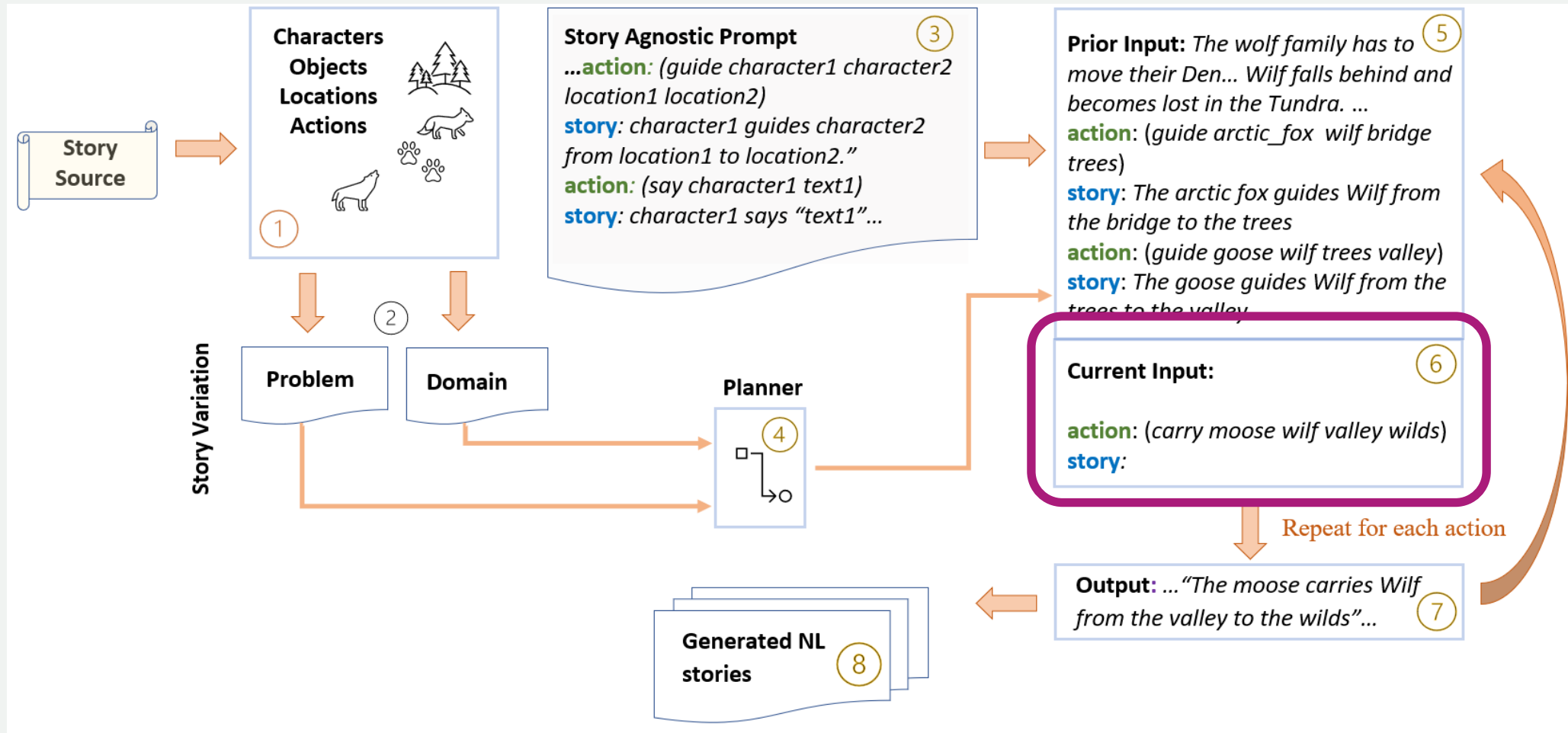
The Storyteller



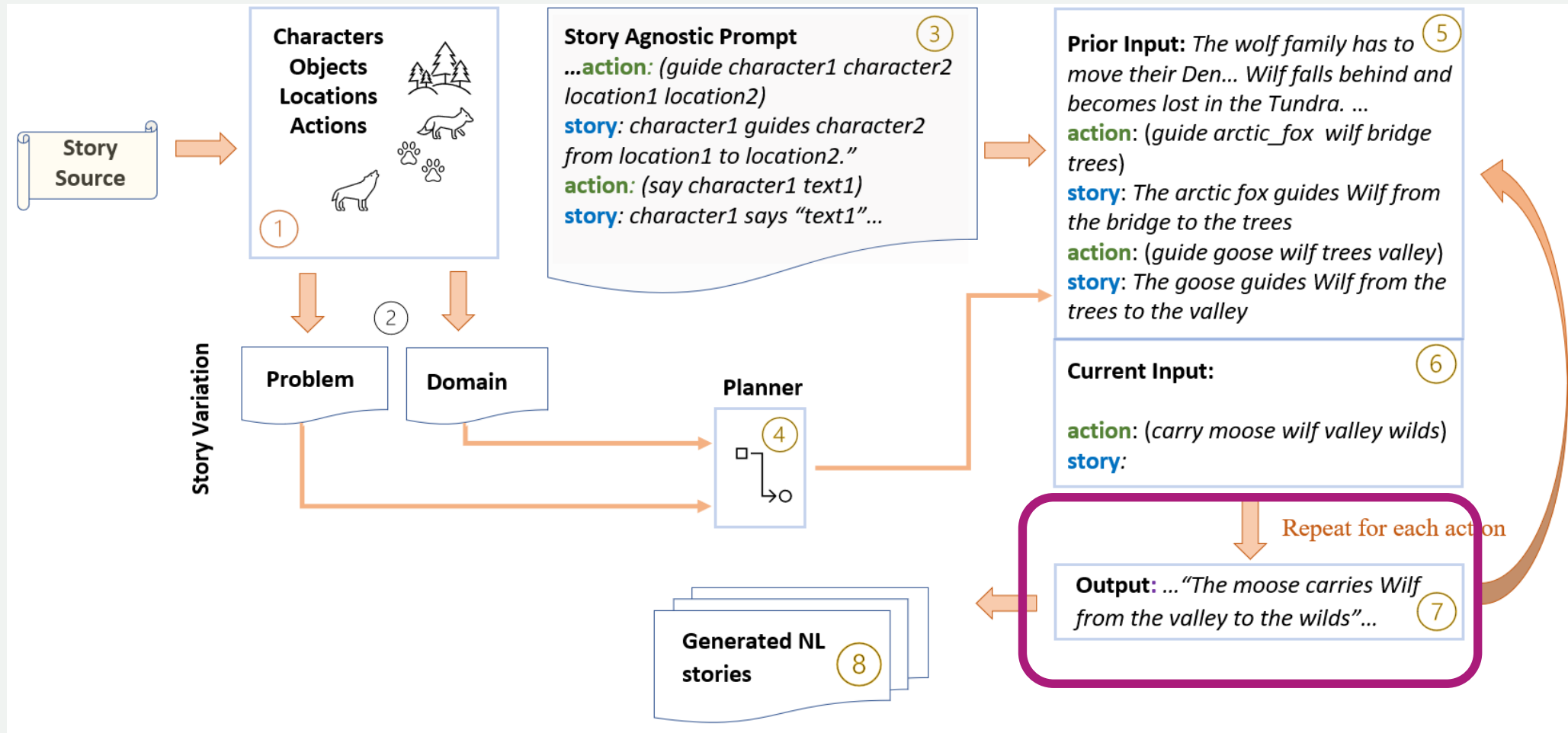
The Storyteller



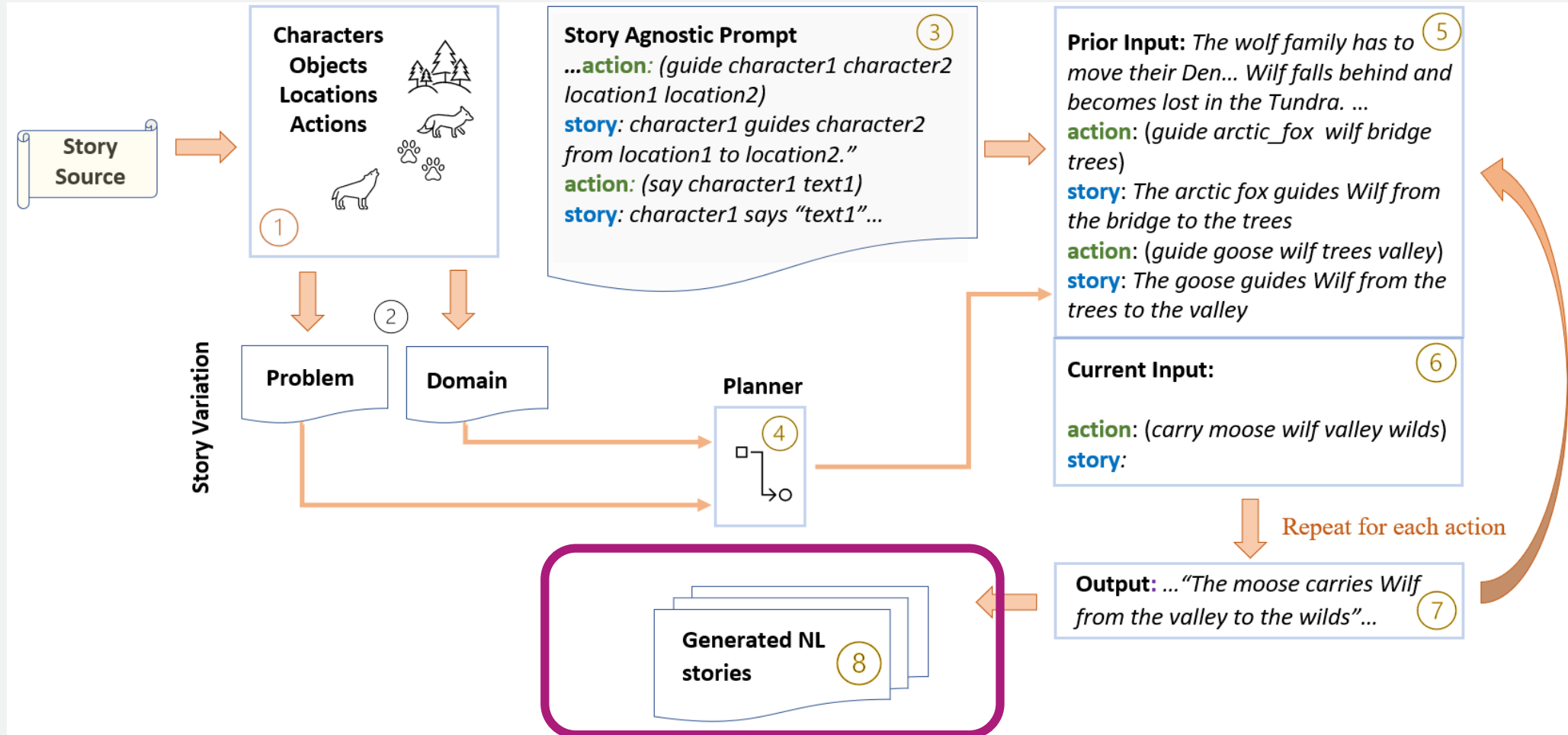
The Storyteller



The Storyteller



The Storyteller



Tell me a Story

Initial Story: The Way Home for Wolf

Let's hear a story about Wilf:

<https://www.youtube.com/watch?v=Sqq8Hoz37VQ> *

(The authors claim no responsibility for the content of external sites)*

Tell me a Story

Initial Story: The Way Home for Wolf

Now let's extract the story elements:

Characters:

Objects:

Verbs:

Tell me a Story

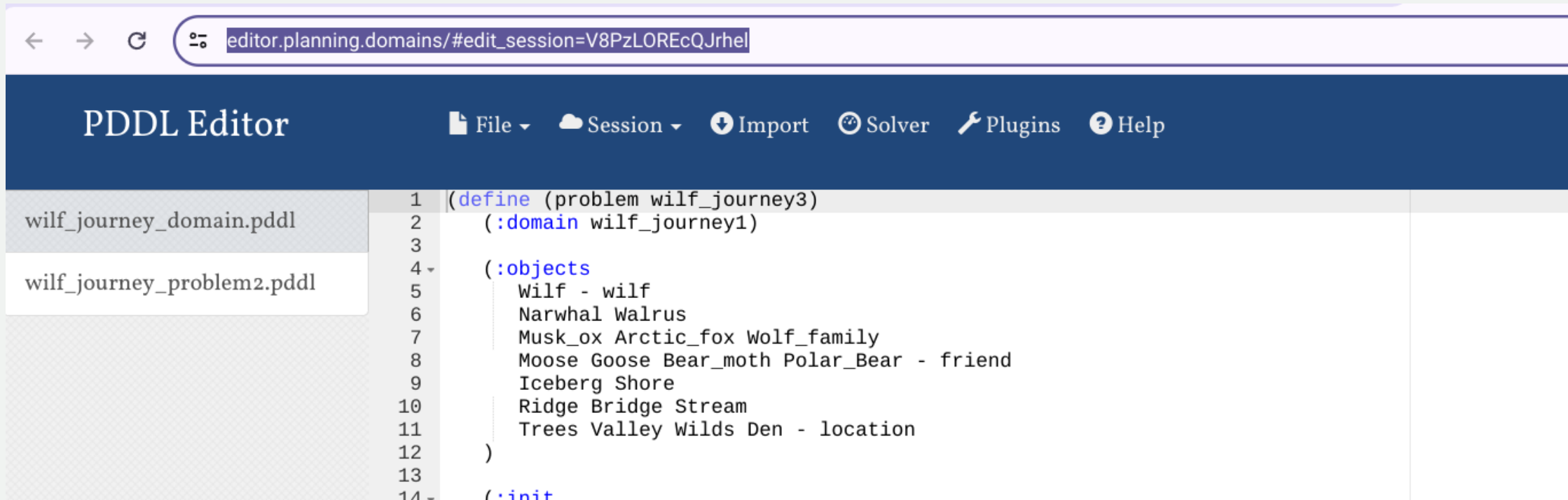
Initial Story: The Way Home for Wolf

Characters: wilf, goose, moose...

Objects: --

Verbs: guide, carry...

Tell me a Story



The screenshot shows a web browser window with the URL `editor.planning.domains/#edit_session=V8PzLOREcQJrhel`. The page title is "PDDL Editor". The navigation bar includes "File", "Session", "Import", "Solver", "Plugins", and "Help". The code editor displays the following PDDL code:

```
1 (define (problem wilf_journey3)
2   (:domain wilf_journey1)
3
4   (:objects
5     Wilf - wilf
6     Narwhal Walrus
7     Musk_ox Arctic_fox Wolf_family
8     Moose Goose Bear_moth Polar_Bear - friend
9     Iceberg Shore
10    Ridge Bridge Stream
11    Trees Valley Wilds Den - location
12  )
13
14  (:init
```


Tell me a Story

PDDL Editor File Session Import Solver Plugins Help

wilf_journey_domain.pddl
wilf_journey_problem2.pddl
Plan (1)

Found Plan (output)

- (carry narwhal wilf iceberg shore)
- (carry walrus wilf shore ridge)
- (carry musk_ox wilf ridge bridge)
- (guide arctic_fox wilf bridge trees)
- (guide goose wilf trees valley)
- (carry moose wilf valley wilds)
- (guide bear_moth wilf wilds stream)
- (carry wolf_family wilf stream den)

```
(:action carry
:parameters (narwhal wilf iceberg shore)
:precondition
  (and
    (isconnected iceberg shore)
    (at iceberg wilf)
    (hasfriend iceberg narwhal)
    (cancarry iceberg shore narwhal)
  )
:effect
  (and
    (at shore wilf)
    (not
      (at iceberg wilf)
    )
    (not
      (hasfriend iceberg narwhal)
    )
  )
)
```

Tell me a Story

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

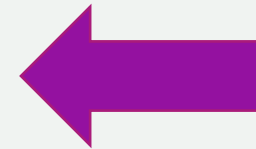
Characters: princess, prince, dragon ...

Objects: castle, clothes, paper bag...

Verbs: follow, breathe fire, burn, ...

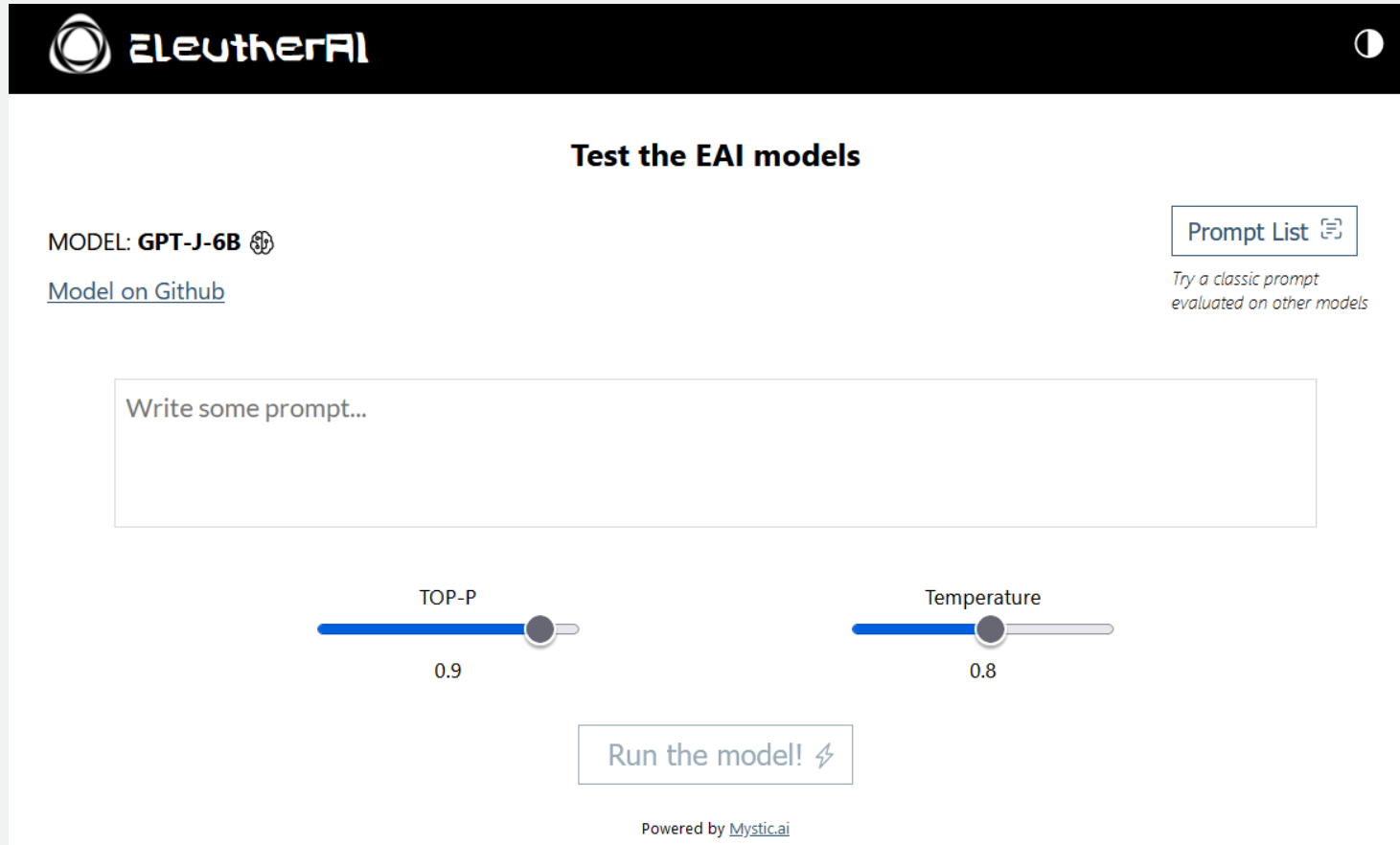
Tell me a Story

(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



The screenshot shows the EleutherAI web interface. At the top left is the EleutherAI logo. The main heading is "Test the EAI models". Below this, the model is identified as "MODEL: GPT-J-6B" with a link to "Model on Github". To the right is a "Prompt List" button with a subtext "Try a classic prompt evaluated on other models". A large text input field contains the placeholder "Write some prompt...". Below the input field are two sliders: "TOP-P" set to 0.9 and "Temperature" set to 0.8. A "Run the model!" button with a lightning bolt icon is positioned below the sliders. At the bottom center, it says "Powered by [Mystic.ai](#)".

← 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)
```

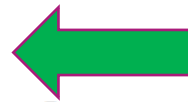
```
story:
```

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)

story: The Dragon attacks and destroys the castle and Princess Elizabeth's clothes and the Dragon kidnaps Prince Ronald.



Actions from the generated plan

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)

NL text or 'story' line

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:

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

$$\textit{Precision} = \frac{\#TotalRight}{\#TotalTagged}, \textit{Recall} = \frac{\#TotalRight}{\#TotalTruth}$$
$$F_1 = \frac{2 \times \textit{precision} \times \textit{recall}}{\textit{precision} + \textit{recall}}$$

(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:

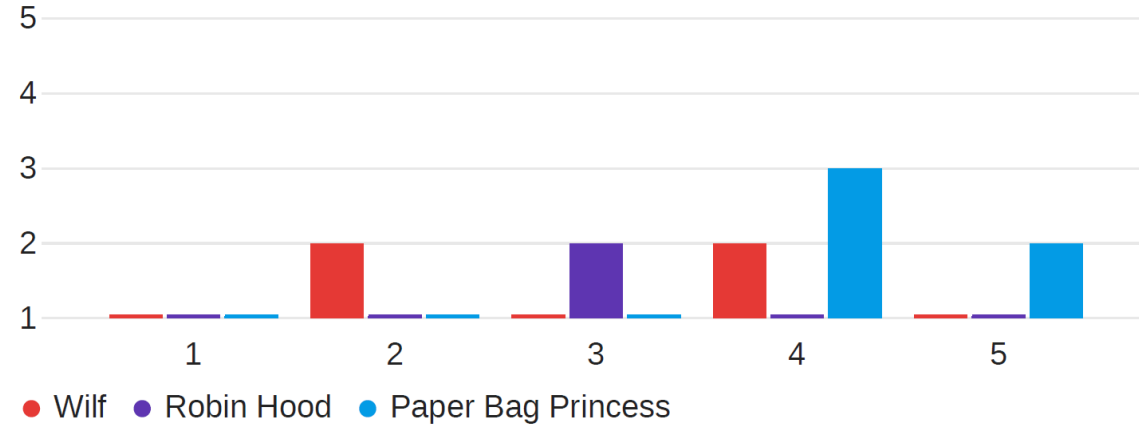
1. Story A is more believable than Story B.
2. Story A uses language that is more fluent and coherent (flows better grammatically) than Story B.
3. Story A is more enjoyable than Story B.
4. Variation #1 on Story A seems consistent (stems logically from the original story).
5. Variation #2 on Story A 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....

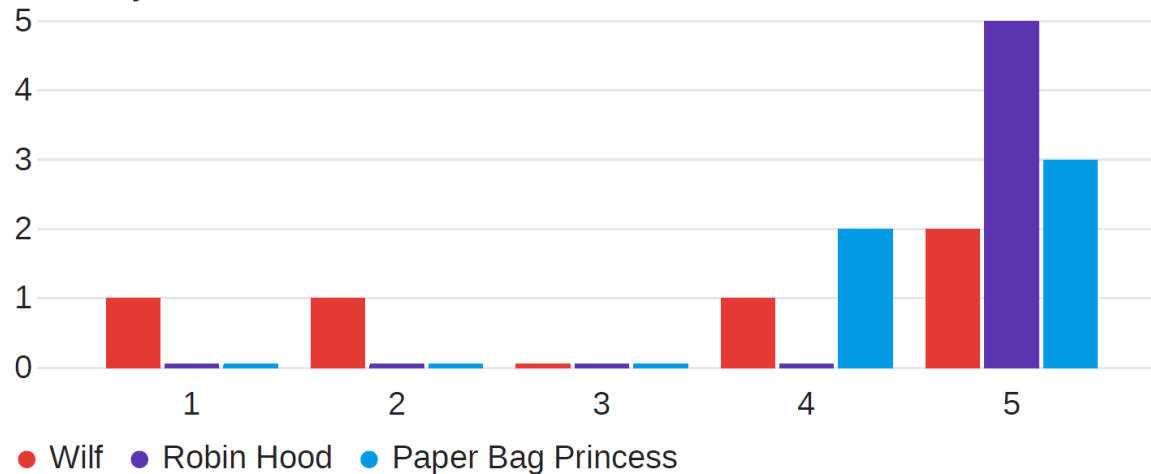


The proof of the pudding....

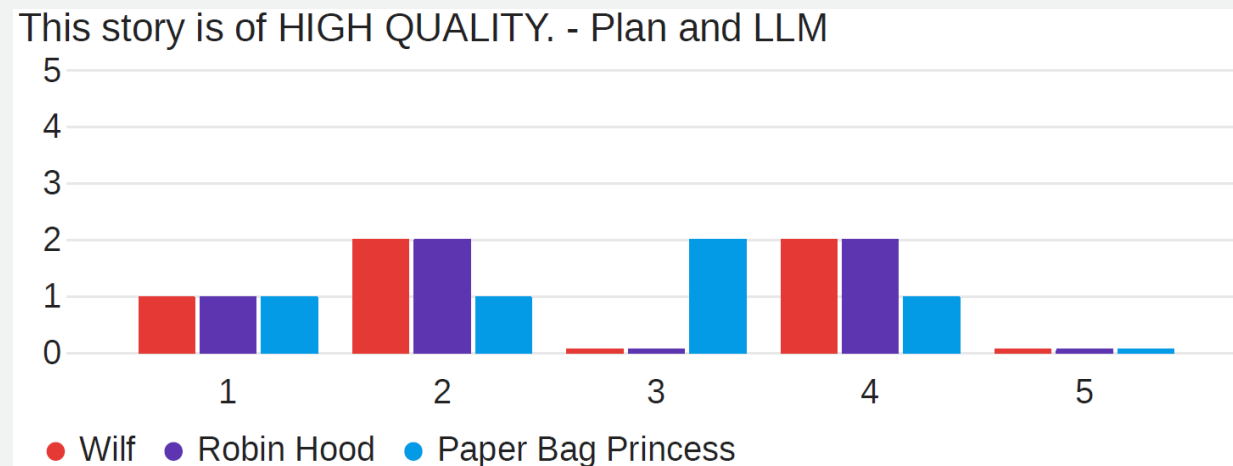
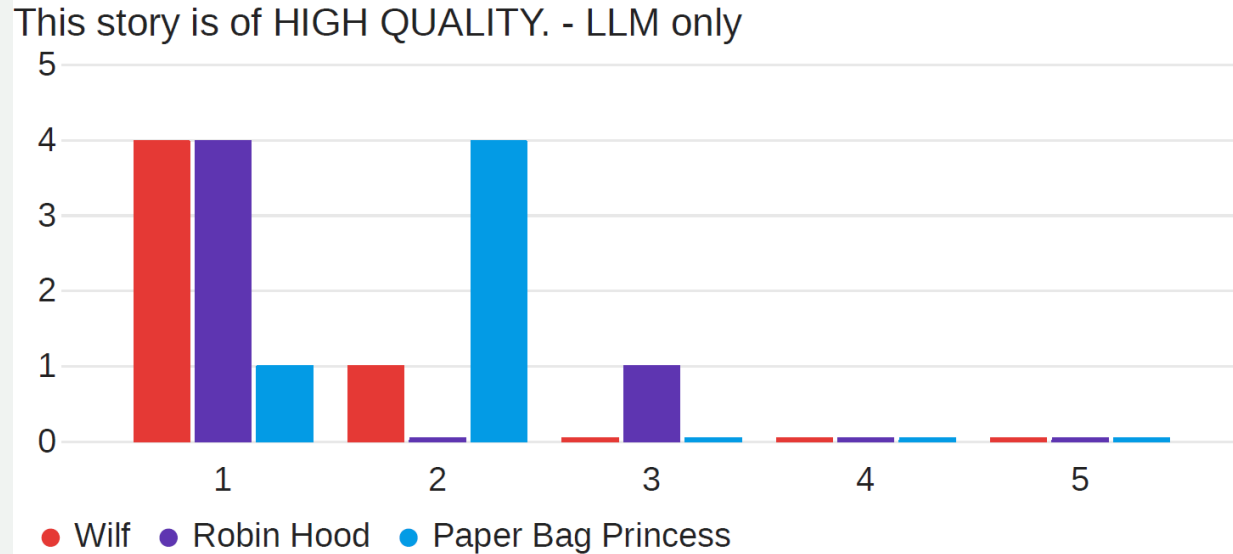
This story's events occur in a PLAUSIBLE ORDER. - LLM only



This story's events occur in a PLAUSIBLE ORDER.- Plan and LLM

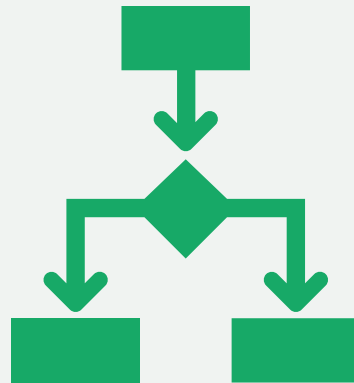


The proof of the pudding....

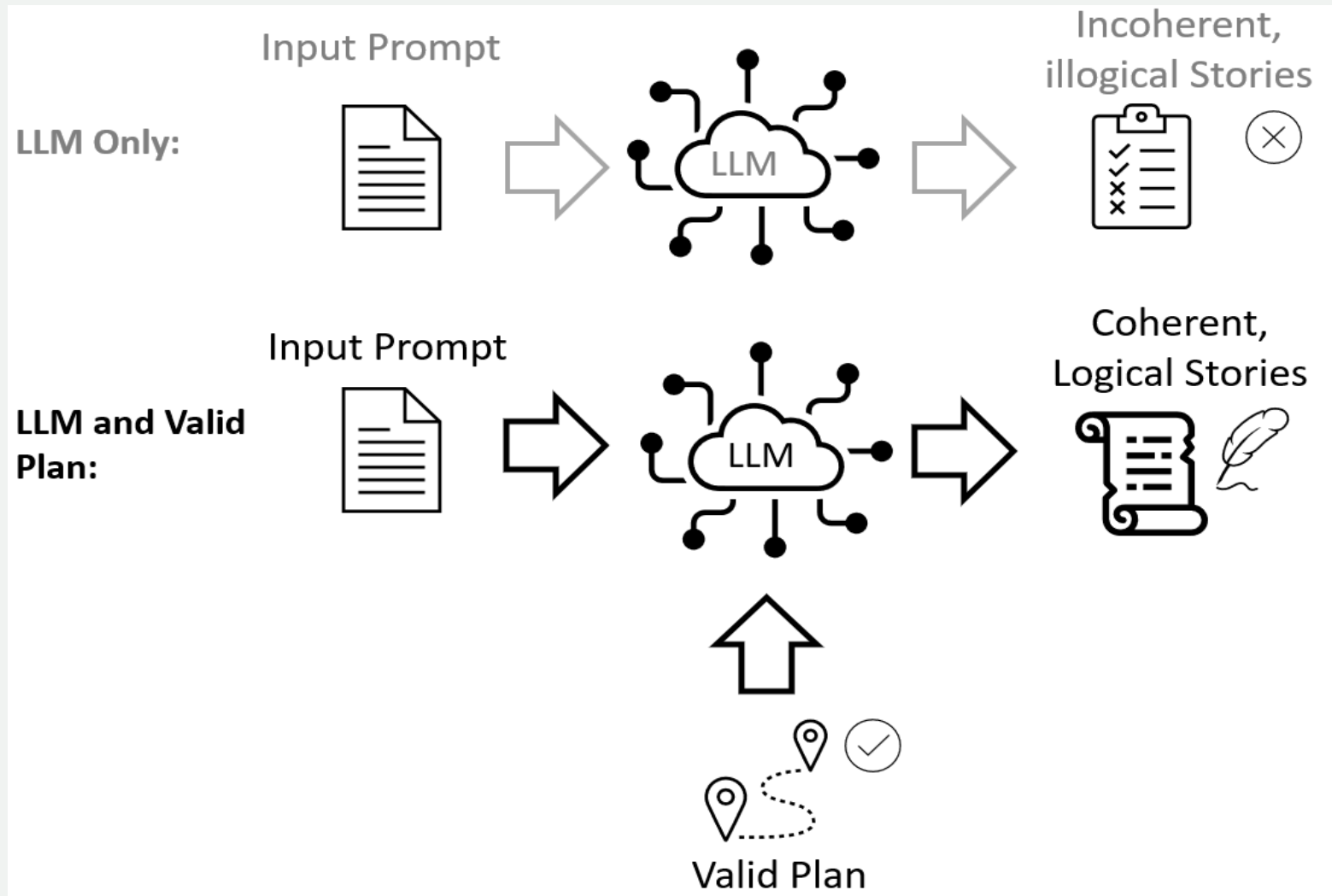


Let's Play!

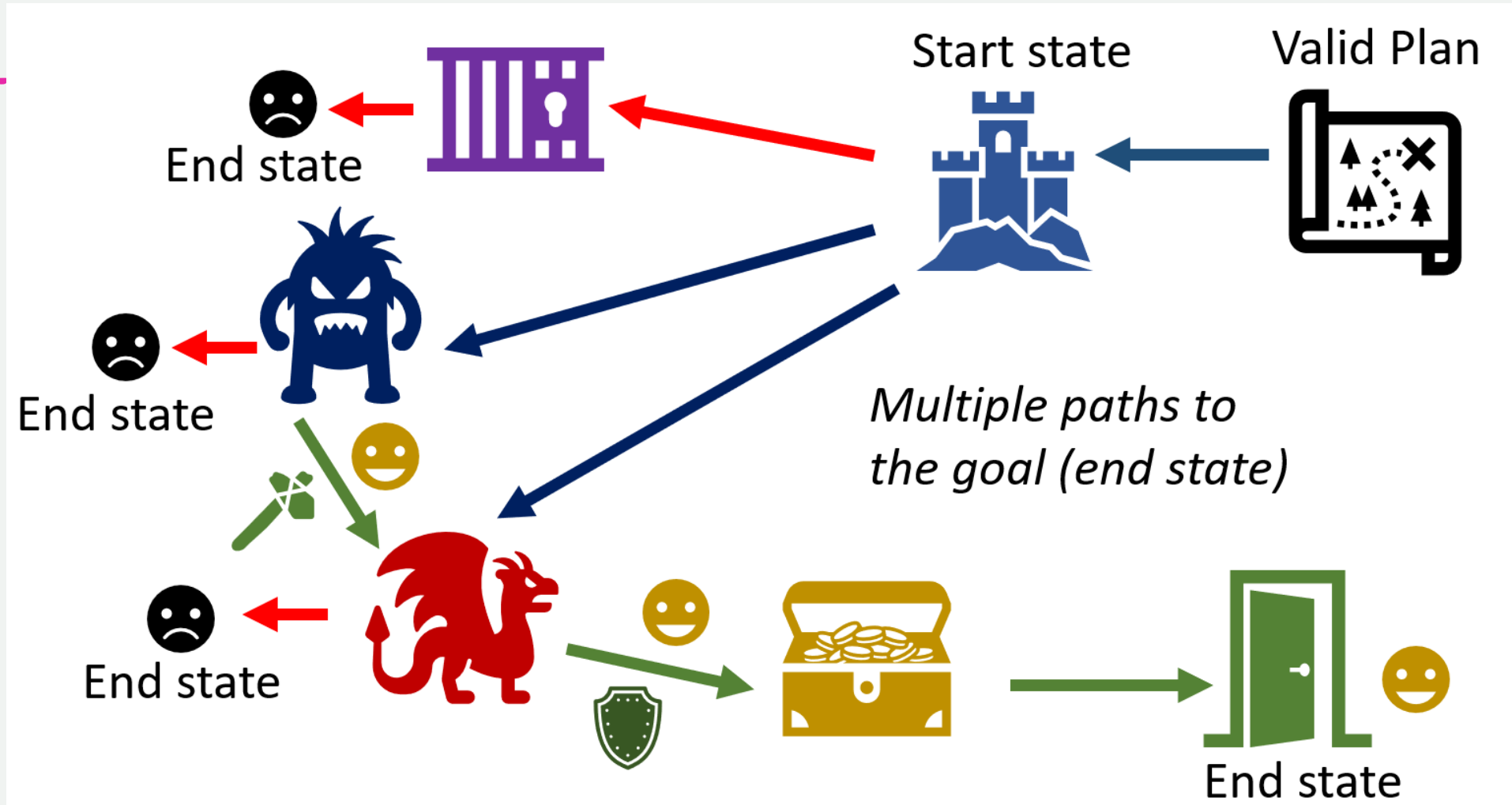
Choose-Your-Own-Adventure (CYOA) stories are interactive narratives where the reader assumes a fictional persona and then chooses various paths in order to reach the ending of a story.



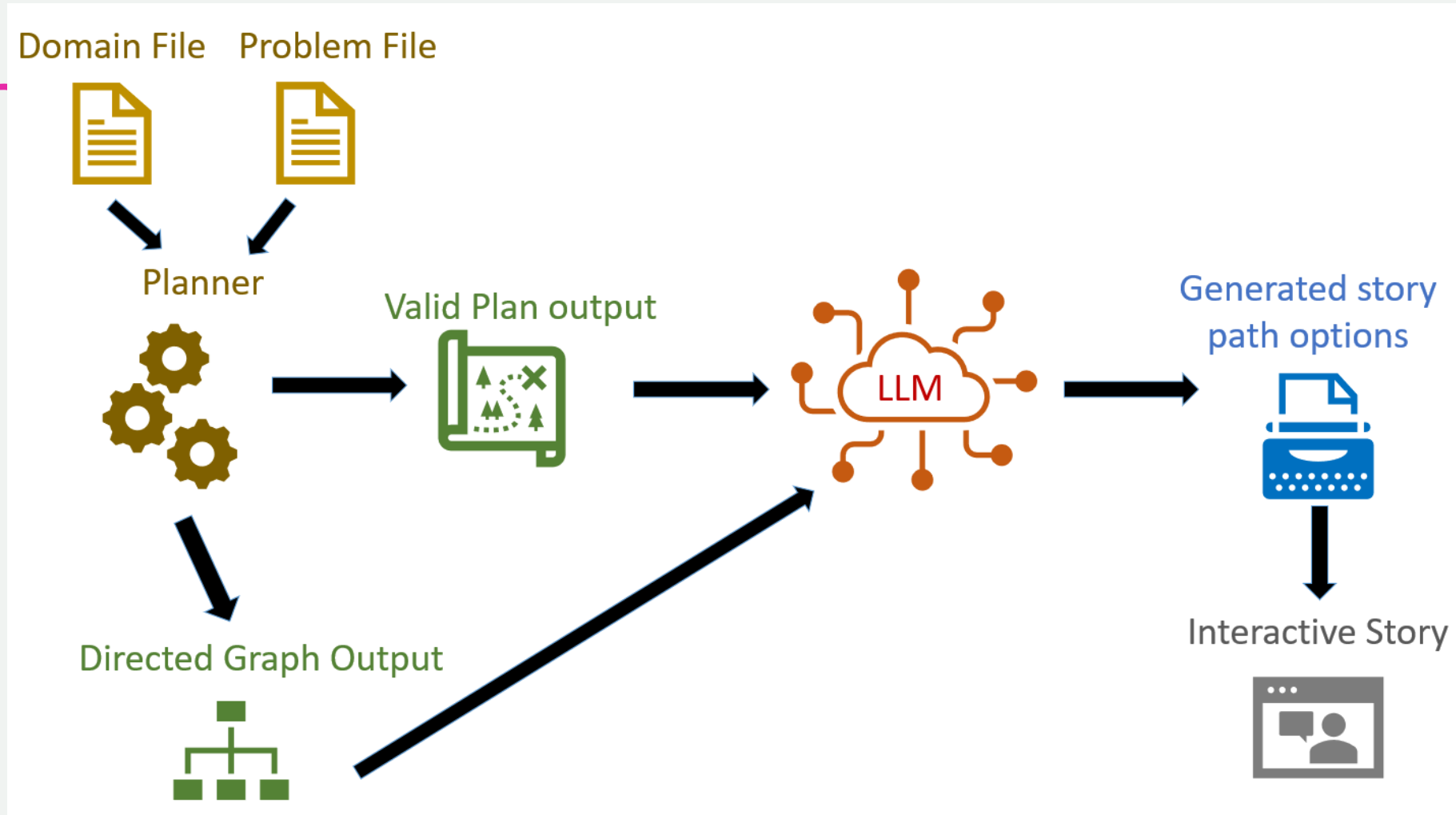
Why Automated Planning?



CYOA Story Paths



System Architecture



Let's Play!

The hero of the tale is a brave adventurer named Jack, who is navigating the intricacies of an ancient castle.



The user (**that's you!**) takes on the persona of Jack and makes decisions about what action to take at each stage of the story

If the user chooses a `good` path, Jack escapes from the castle. If the user makes the `wrong` choices, Jack could meet with an untimely demise.

Let's Play!

Note that the 'good' and 'wrong' choices are based only on the perspective of the main character.

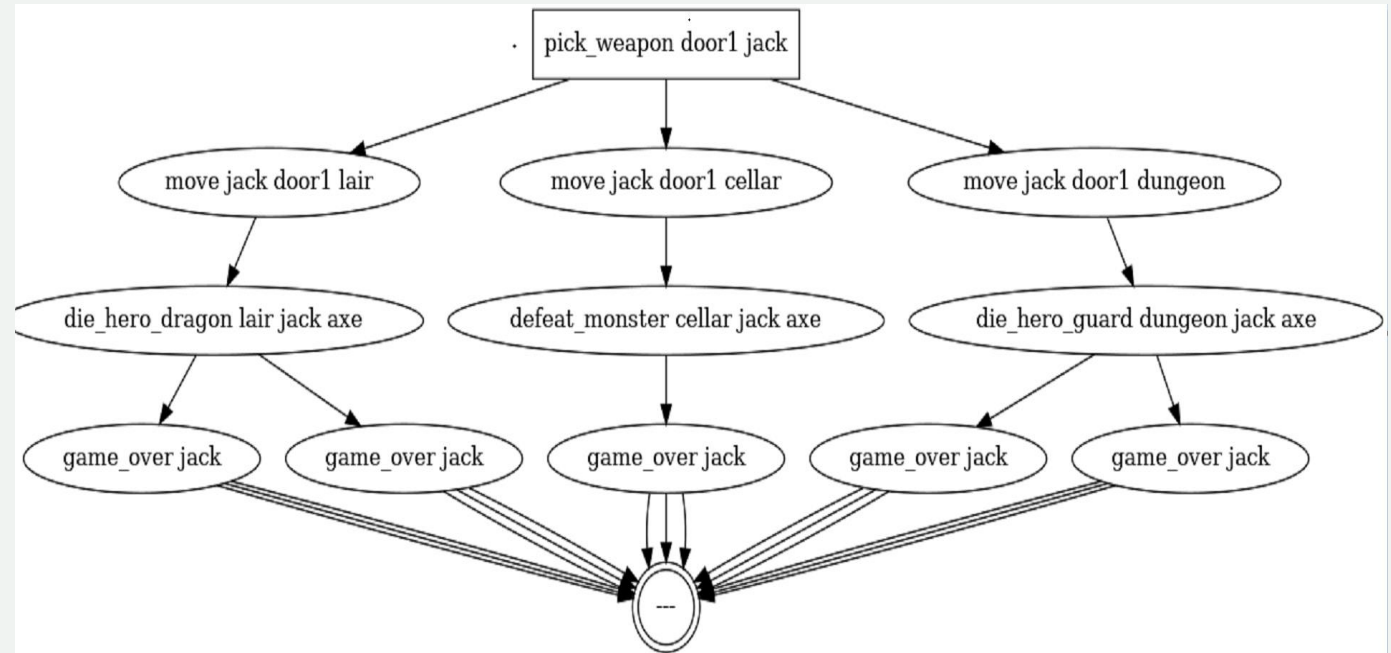
The valid plan that the automated planner generates is simply concerned with reaching the goal state from the starting state, within the confines of the given environment, and therefore it makes no distinction as to whether the 'game over' state is reached in a 'positive' or 'negative' way for the main character.

Therefore, the automated planner and the LLM do not care what happens to Jack.

You are Jack's only hope!

Selected Inputs and Outputs

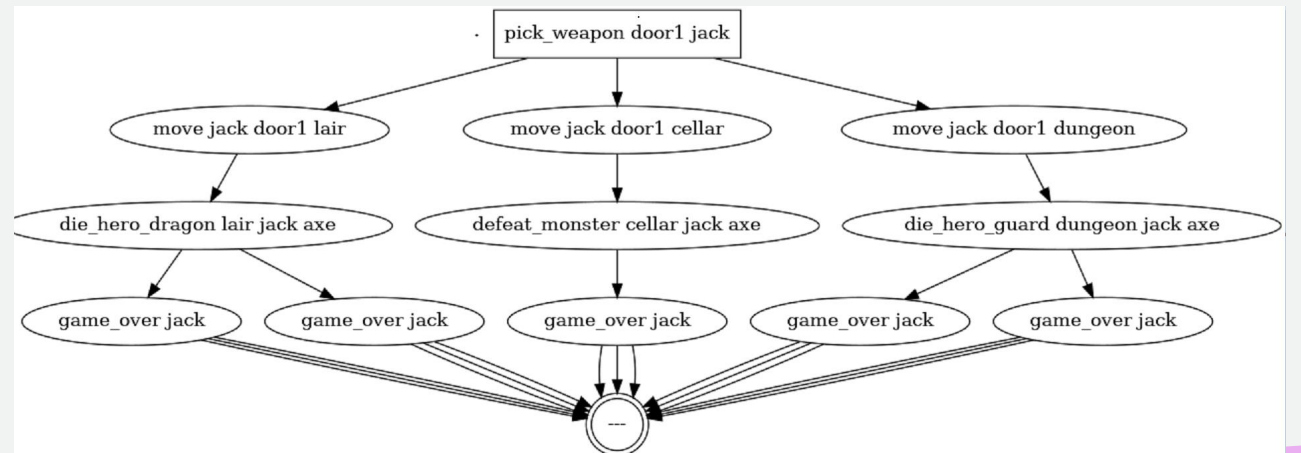
```
(:action pick_weapon
:parameters(?l1 - location
            ?b1 - hero)
:precondition (and (at ?b1 ?l1)
                  (not(have_weapon))
                  (not(is_dead ?b1)))
:effect
  (and (at ?b1 ?l1)(have_weapon)
        (labeled-oneof get_weapon
                        (outcome shield
                          (and
                            (have_shield)(picked_weapon
                              shield)
                            (not (have_mace))
                            (not (have_axe))
                          )
                        )
        (outcome mace
          ...
        ))
```



Let's Play!

The plan is generated by the automated planner from hand-crafted PDDL domain and problem files. Planner outputs are extracted in the form of a text file and a directed graph.

move jack door1 lair
pick_weapon door1 jack
die_hero_dragon lair jack axe
defeat_monster cellar jack axe
die_hero_guard dungeon jack axe
game_over jack



Let's Play!

ChatGPT ▾

Temporary Chat ⓘ

You are a creative interactive game designer. Generate Game Play user text for each of the following action sentences:

move jack door1 lair

pick_weapon door1 jack

die_hero_dragon lair jack axe

defeat_monster cellar jack axe

die_hero_guard dungeon jack axe

game_over jack

Let's Play!



Sure, here is the gameplay user text for each action sentence:

1. **move jack door1 lair**

- "Jack cautiously approached Door1, the ominous gateway to the Lair. With a deep breath, he stepped inside, the air growing colder and the shadows longer as he entered the foreboding domain."

2. **pick_weapon door1 jack**

- "As Jack entered the room just past Door1, his eyes caught the glint of steel. There, lying on an ancient pedestal, was a mighty axe. Jack picked up the weapon, feeling its weight and power course through him."

Let's Play!

3. `die_hero_dragon lair jack axe`

- "In the heart of the Lair, Jack faced the fearsome dragon. Despite his brave efforts and the powerful swings of his axe, the dragon's fiery breath overwhelmed him. Jack fell to the ground, his heroic journey ending in a blaze of glory."

4. `defeat_monster cellar jack axe`

- "Deep within the dark and musty Cellar, a monstrous creature lurked. Jack gripped his axe tightly and, with a series of swift and decisive blows, defeated the beast. The cellar fell silent as Jack emerged victorious."

Let's Play!

5. die_hero_guard dungeon jack axe

- "Within the Dungeon's grim corridors, Jack confronted a heavily armored guard. The battle was fierce, and though Jack fought valiantly with his axe, the guard's relentless strikes proved too much. Jack succumbed to his injuries, his heroic tale ending in the depths of the dungeon."

6. game_over jack

- "The screen fades to black as Jack's journey reaches its tragic conclusion. The words 'Game Over' appear, a somber reminder of the perils faced and the bravery shown. But every end is a new beginning. Will you try again?"

Let's Play!

Points to Note:

- A logical story within the given environment and restrictions will not be generated by the LLM if the LLM is not given a valid plan.
- The output of the LLM can be considered to be an `average`, as the text will change each time the LLM is queried. However, the main ideas of the story will be consistent.
- Different LLMs will produce results with varying accuracy, since the inputs on which the LLM has been trained will affect the generated outputs.
- Prompt engineering is a key part of generating text with LLMs.



Game Over.

Thank you for playing!

Selected Papers

Nisha Simon and Christian Muise, 2024, "*Want To Choose Your Own Adventure? Then First Make a Plan.*", Proceedings of The 37th Canadian Conference on Artificial Intelligence (Canadian AI 2024), pp 1-6. <https://caiac.pubpub.org/pub/d2ujhb4x>

Nisha Simon, 2024, "*Large Language Models are Incoherent Storytellers*", Proceedings of The 37th Canadian Conference on Artificial Intelligence (Canadian AI 2024) Graduate Student Symposium, pp 1-5. <https://caiac.pubpub.org/pub/3w466klp>

Nisha Simon, 2024, "*Does Robin Hood Use a Lightsaber?: Automated Planning for Storytelling*", Twenty-Seventh AAI/SIGAI Doctoral Consortium, Association for the Advancement of Artificial Intelligence (AAAI) 2024, pp 1-2.

<https://doi.org/10.1609/aaai.v38i21.30411>

Nisha Simon and Christian Muise, 2022, "*TattleTale: Storytelling with Planning and Large Language Models*", Proceedings of The International Conference on Automated Planning and Scheduling (ICAPS) 2022, SPARK Workshop, pp 1-8, https://icaps22.icaps-conference.org/workshops/SPARK/papers/spark2022_paper_2.pdf

Tell me a story, LLM

Nisha Simon



<https://nisimon48.github.io/>



@NishaSimon612

