Tehnici de Ingineria Limbajului Natural

Curs 8
Nivelul discursului: Teoria Nervurilor (coerență) și rezumare automată

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The account of VT on coherence

- ***Veins give a natural way to generalize Centering from local to global***

Centering Rule 2: transitions

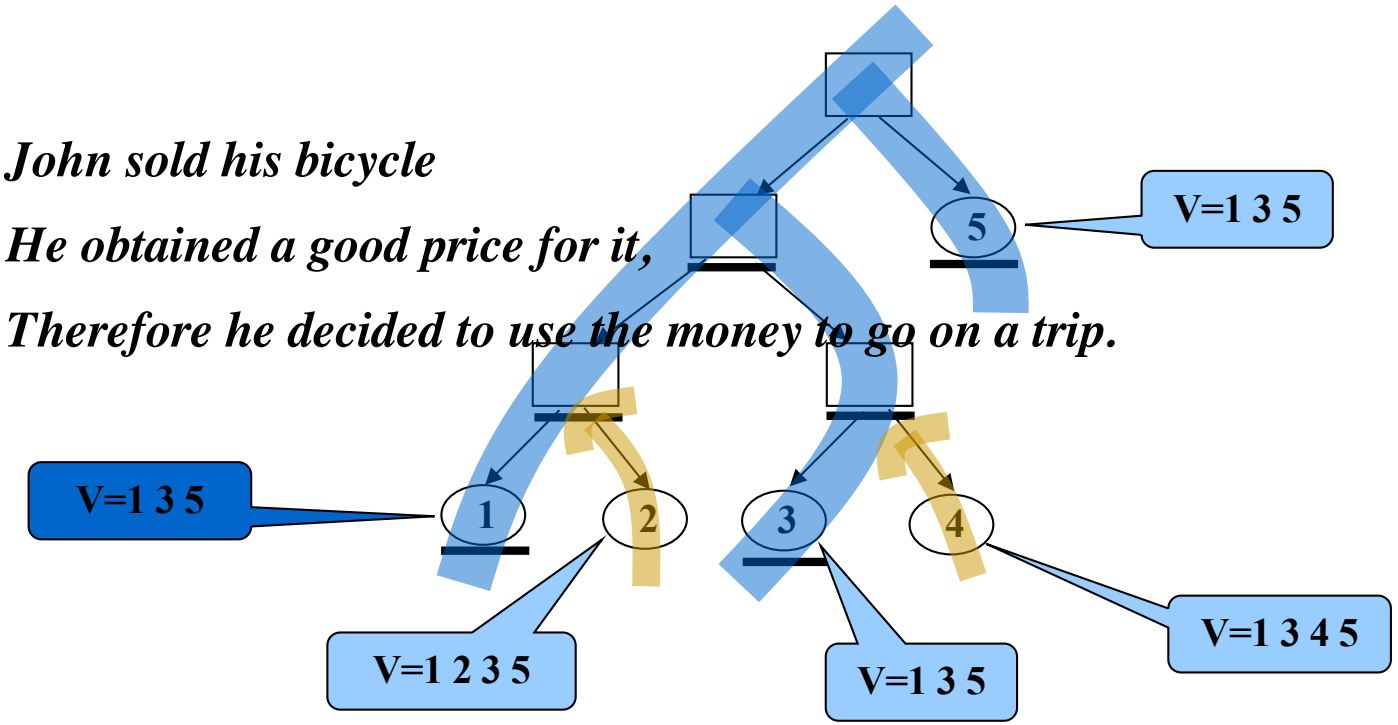
	$C_b(u) = C_b(u\text{-}1)$	$C_b(u) \neq C_b(u\text{-}1)$
$C_b(u) = C_p(u)$	***CONTINUING***	***SMOOTH SHIFT***
$C_b(u) \neq C_p(u)$	***RETAINING***	***ABRUPT SHIFT***

CON > RET > SSH > ASH

Vein expressions give „lines of argumentation“

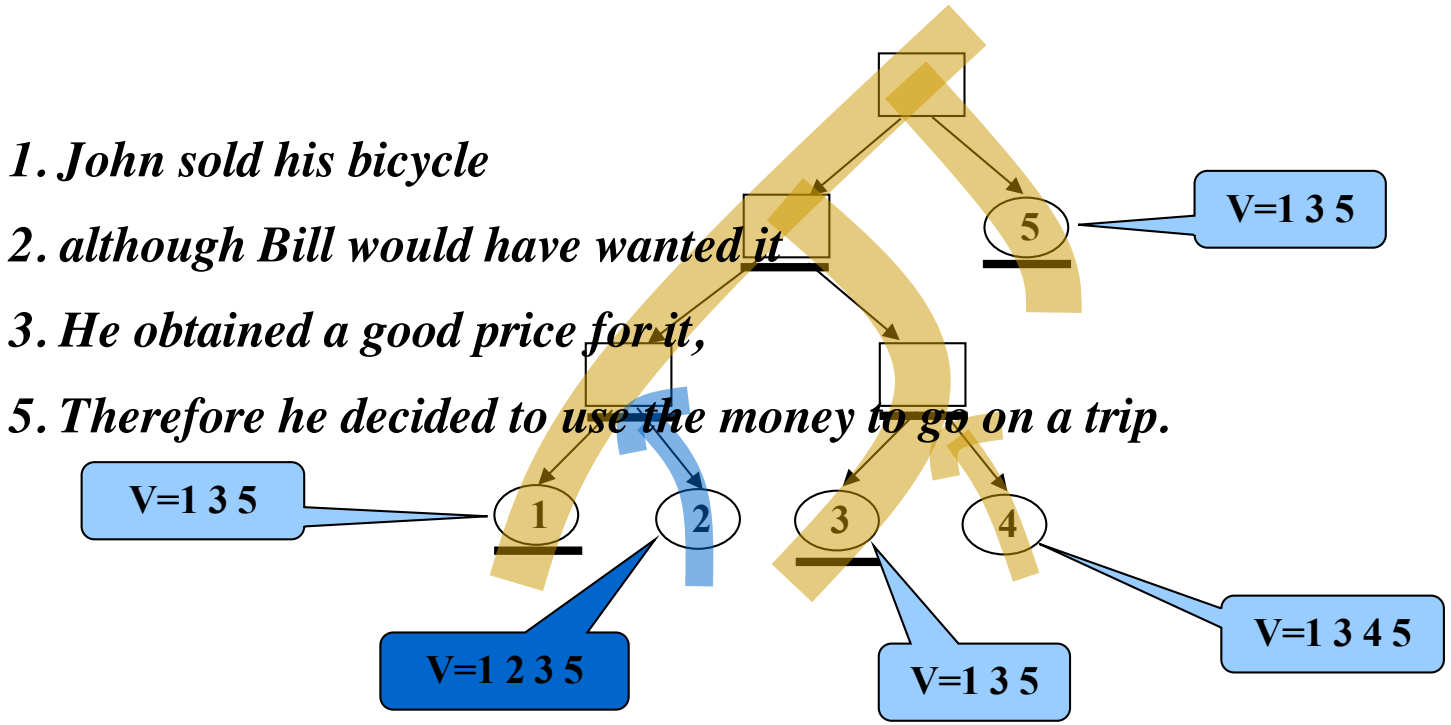
1. John sold his bicycle

1. John sold his bicycle
2. although Bill would have wanted it
3. He obtained a good price for it,
4. which Bill could not have afforded
5. Therefore he decided to use the money to go on a trip.



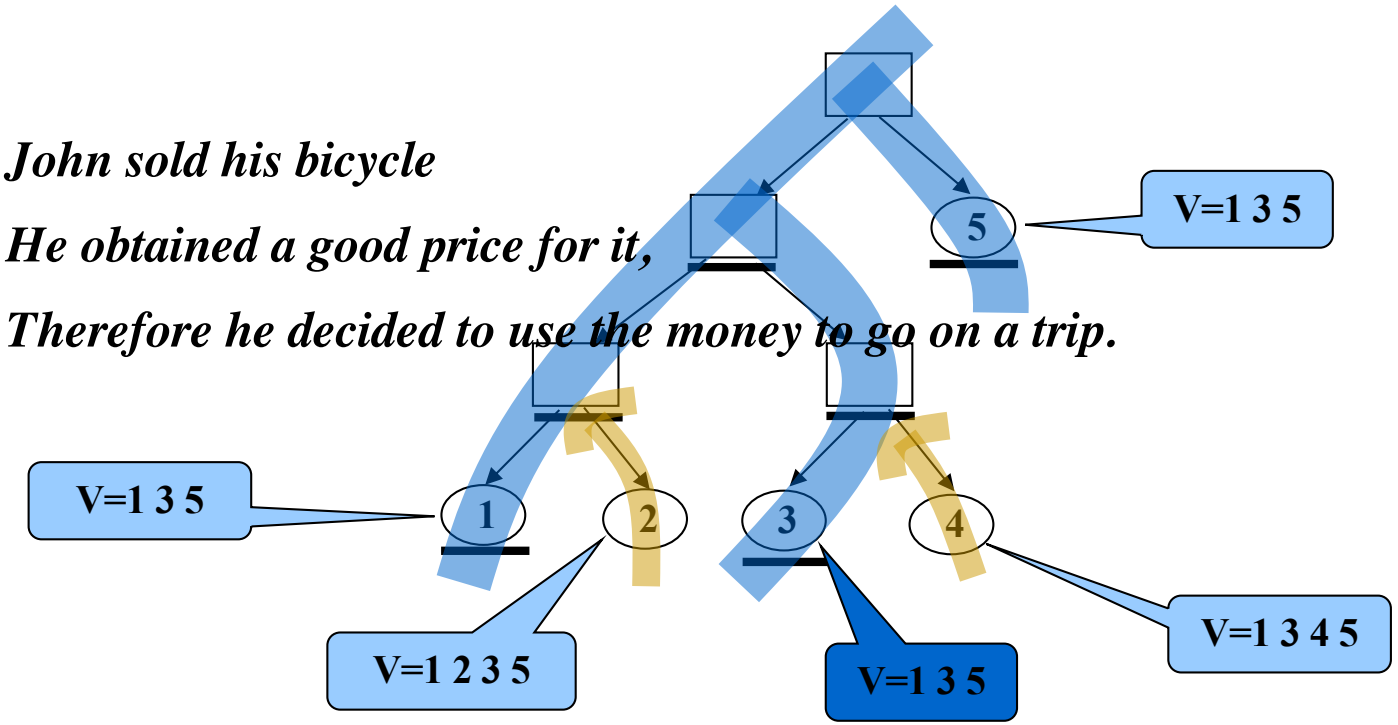
Lines of argumentation

2. although Bill would have wanted it.



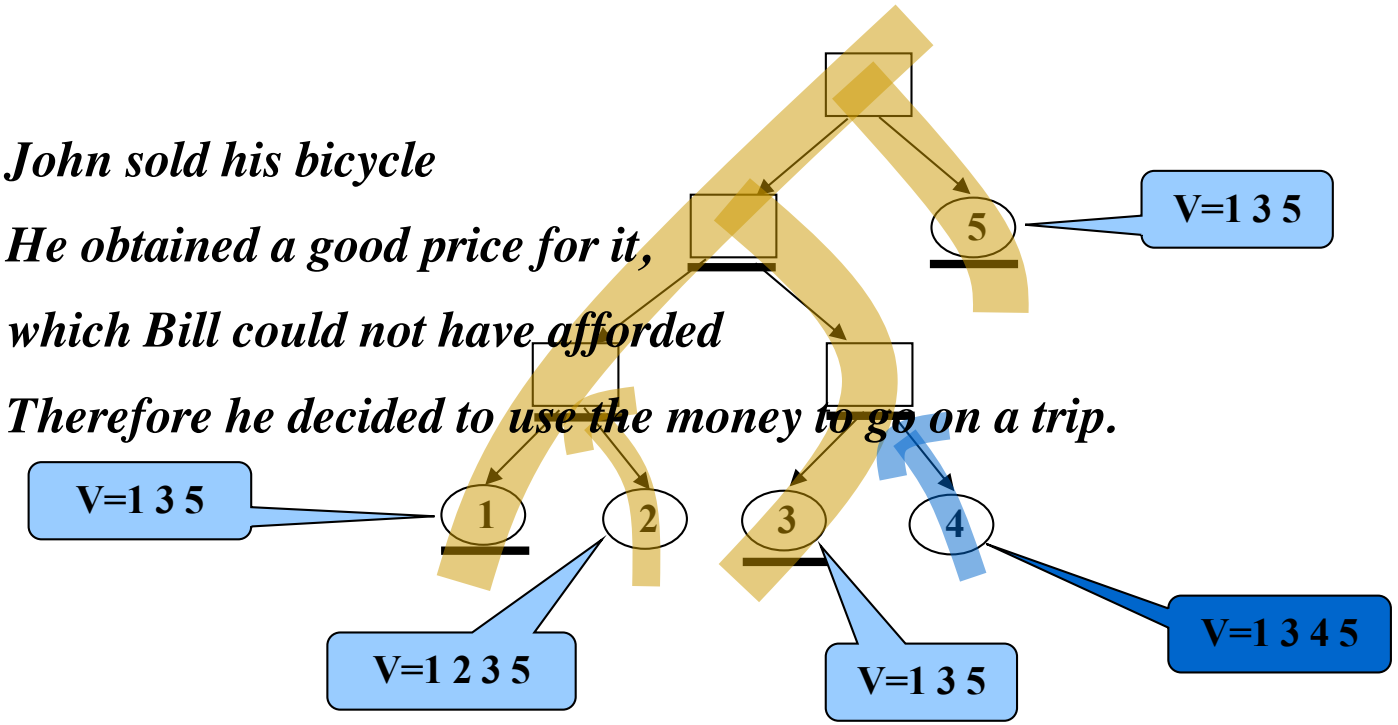
Lines of argumentation

3. He obtained a good price for it,



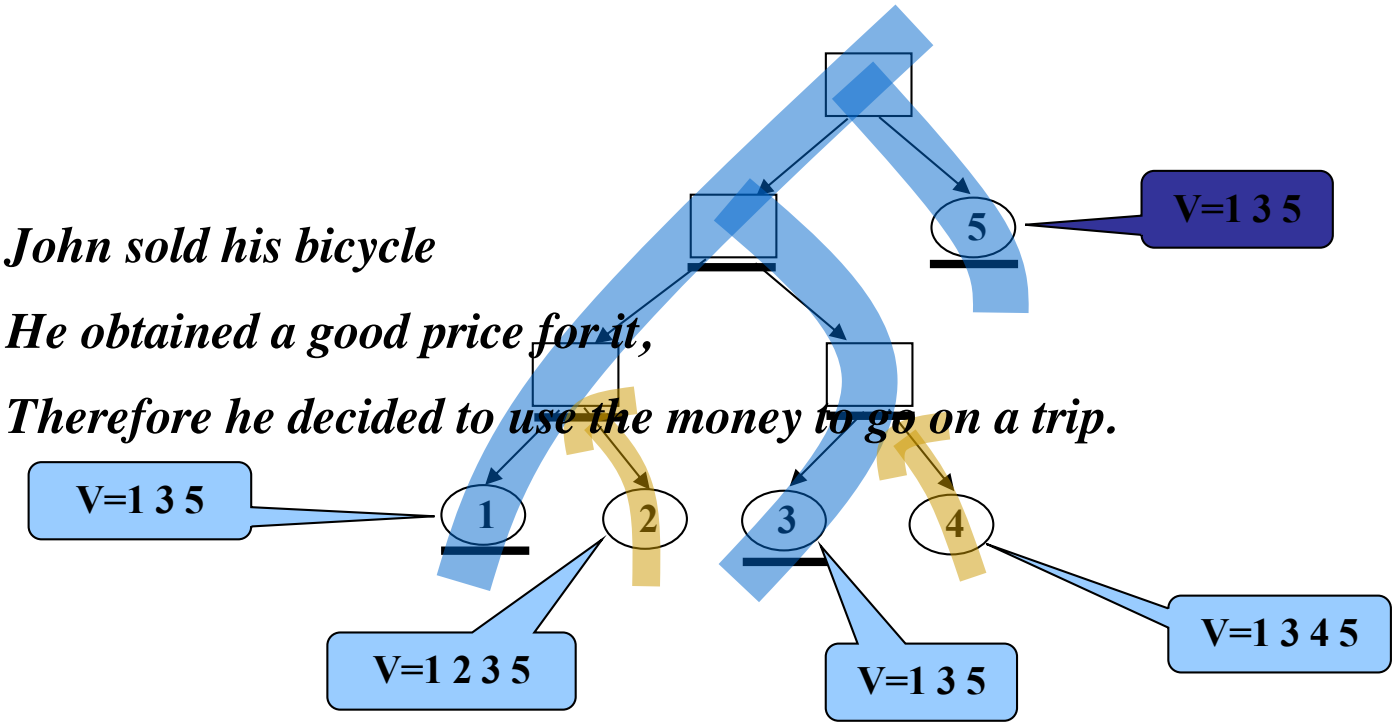
Lines of argumentation

4. which Bill could not have afforded.



Lines of argumentation

5. Therefore he decided to use the money to go on a trip.



Computation of longest argumentation lines (*al*)

u	$V(u)$	$dea(u)$	al
1	1 3 5	1	
2	1 2 3 5	**1 2**	**1 2**
3	1 3 5	1 3	
4	1 3 4 5	**1 3 4**	**1 3 4**
5	1 3 5	**1 3 5**	**1 3 5**

Evaluating the coherence of a discourse

- ***A smoothness score:***
  - ***CONTINUING = 4***
  - ***RETAINING = 3***
  - ***SMOOTH SHIFT =2***
  - ***ABRUPT SHIFT = 1***
  - ***NO Cb = 0***
- ***A global smoothness score: summing up the score of all units***

The second conjecture (on coherence)

- ***The global smoothness score of a discourse when computed following VT is at least as high as the score computed following CT.***
- But segments, as considered by Centering, typically are developed along veins.
- When passing segments frontiers, in a linear reading, transitions are usually abrupt.
- Therefore, what we claim here is that long-distance transitions, as computed along veins, are systematically smoother than accidental transitions at segment boundaries.

Transitions and scores on a linear adjacency metric

J = [**John**], b = [**John's bicycle**], B = [**Bill**], p = [**price**], m = [**the money**], t = [**a trip**])

	1	**2**	**3**	**4**	**5**
Cf	J, b	B, b	J, p, b	p, B	J, m, t
Cb	J	b	b	p	**-**
Trans		**ASH**	**RET**	**SSH**	**No Cb**
Score		**1**	**3**	**2**	**0**
Global					**6/4 = 1.5**

Transitions and scores on a hierarchical adjacency metric

	1	2
Cf	J, b	B, b
Cb	J	b
Trans		**ASH**
Score		**1**
Global		

1	3	4
J, b	J, p, b	p, B
J	J	p
	CON	**SSH**
	4	**2**

1	3	5
J, b	J, p, b	J, m, t
J	J	J
		CON
		4
		11/4=2.75

Verifying the second conjecture

Source	No. of transitions	CT score	Average CT score per transition	VT score	Average VT score per transition
English	59	76	1.25	84	1.38
French	47	109	2.35	116	2.47
Romanian	65	142	2.18	152	2.34
Total	173	327	**1.89**	352	**2.03**

Incremental discourse parsing using VT

The account of VT on cohesion and coherence

- According to VT, a discourse tree correctly characterizes a text if two constraints are satisfied with respect to the corresponding set of veins:
  - a cohesion criterion – a score associated to the resolution of anaphors on antecedents placed on veins is maximized;
  - a coherence criterion – along veins (i.e. not linearly) a global smoothness score of the discourse, which sums up Centering transitions scores, is maximized.

Put VT at the base of a process of parsing the discourse

- VT revealed a hidden structure associated to a text and formulated two constraints
- Now, for parsing a text, reverse the process: use criteria evidenced by VT to guide the parsing process
  - HOW?: among all possible structures a text can have, the correct ones simultaneously observe both cohesion and coherence criteria.

In incremental discourse parsing two principles are of help

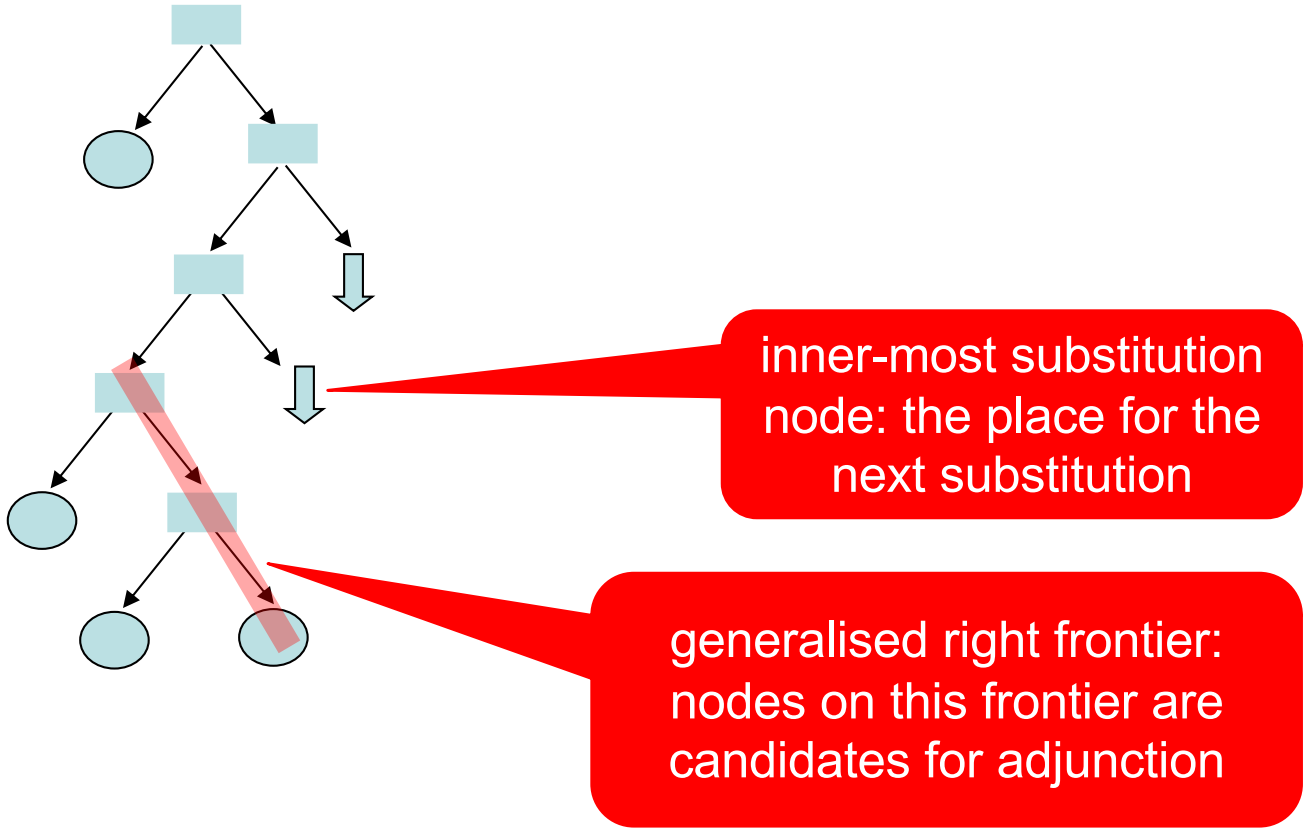
The principle of sequenciality

- *A left to right reading of the terminal frontier of the tree associated with a discourse must correspond to the span of text it analyses in the same left-to-right order.*

The right frontier constraint

- *A discourse constituent must be attached on the (generalised) right frontier of the ongoing discourse*

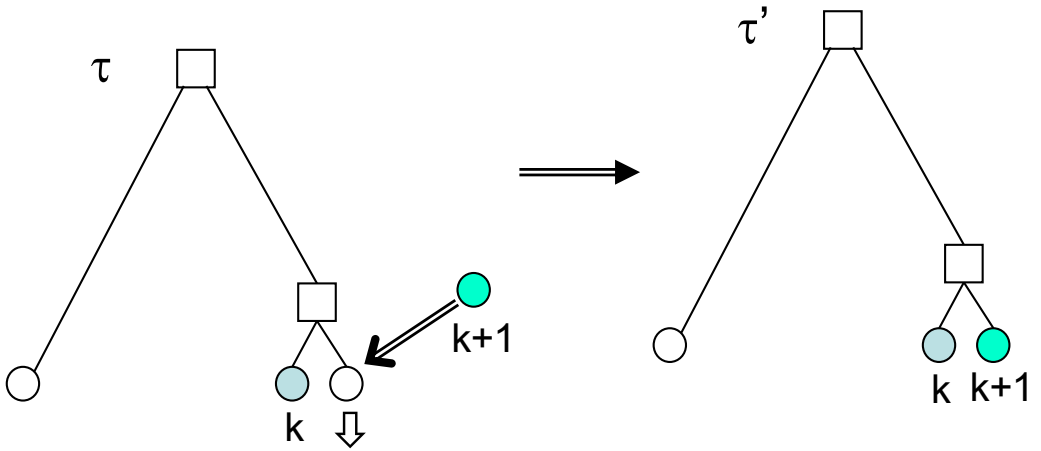
Generalised right frontier and inner-most substitution node



Apply TAG inspired operations: substitution

k. *Although Bill would have wanted it,*

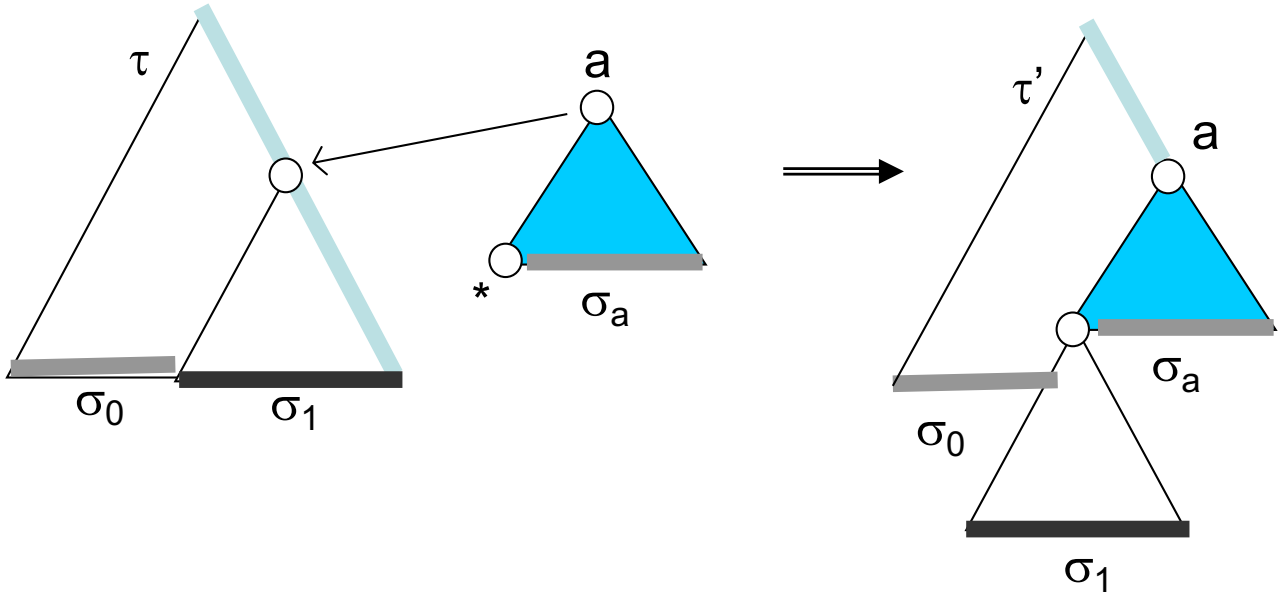
k+1. *John sold his bicycle to somebody else.*



Apply TAG inspired operations: adjoining

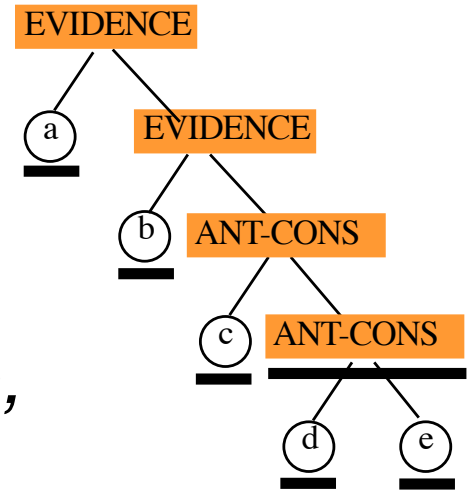
On the right frontier

(Polanyi, 1988)



Expectations-driven incremental parsing

(Cristea and Webber, 1997)



a. *Clinton is bound to win the elections.*
b. *He is a natural born campaigner.*
c. *If you hold some position on an issue,*
d. *then if Clinton wants to get your vote,*
e. *he will assure you with great sincerity that he holds that position too.*

Expectations-driven incremental parsing: variant 1

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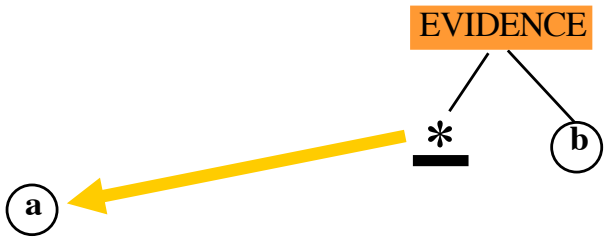

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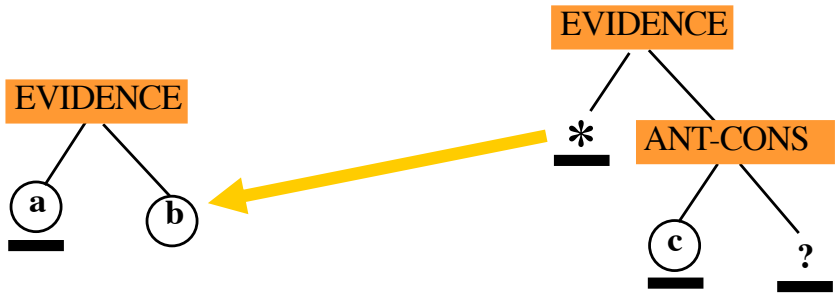

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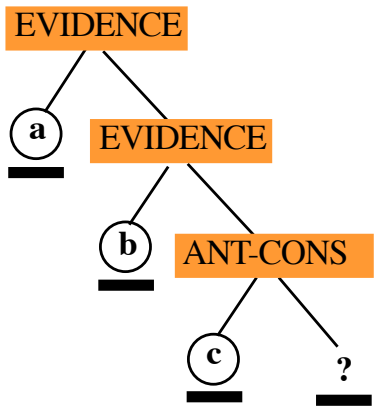

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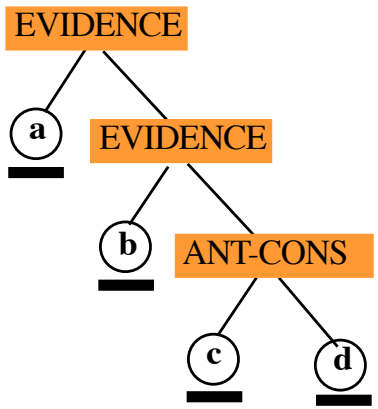


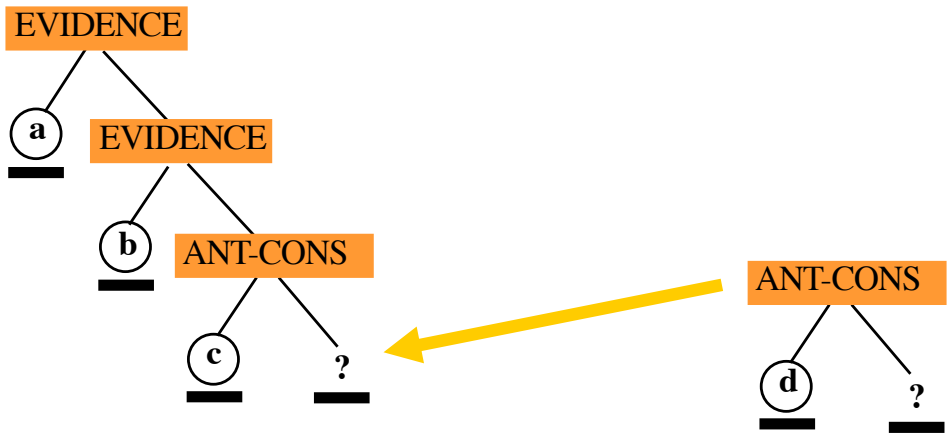
Expectations-driven incremental parsing: variant 2

a. *Clinton is bound to win the elections.*

b. *He is a natural born campaigner.*

c. *If you hold some position on an issue,*

d. *then if Clinton wants to get your vote,*



Expectations-driven incremental parsing: variant 2

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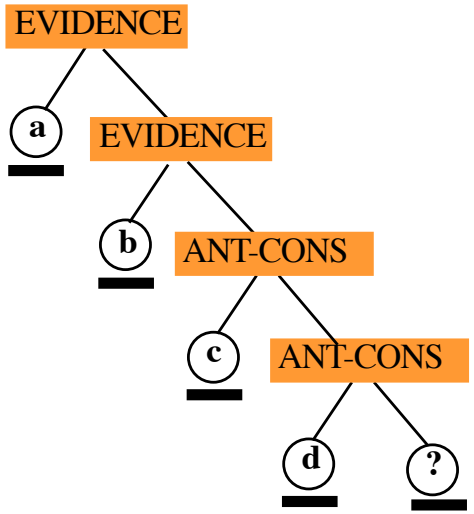

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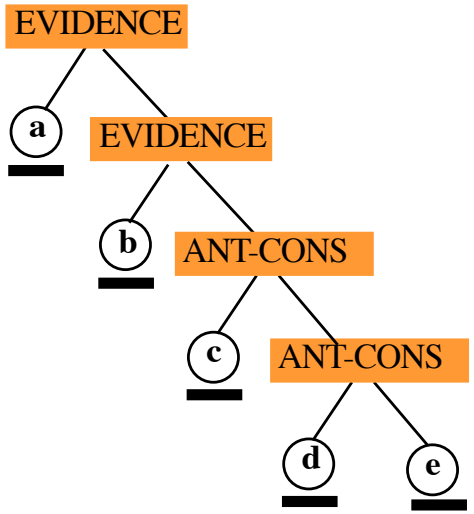


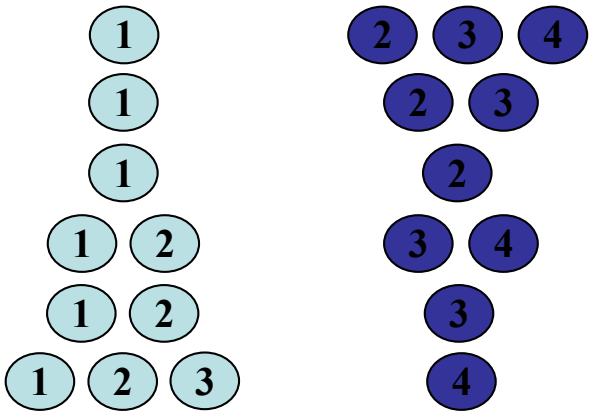
Discourse markers tell a lot about structure

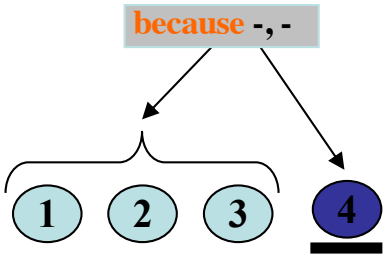
(Marcu, 1997, 2000; Cristea *et al*., 2003, 2005)

[*Because John is such a generous man* [1]] [*– whenever he is asked for money,* [2]] [*he will give whatever he has, for example* [3]] [*– he deserves the "Citizen of the year" award.* [4]]

Reproduced from (Cristea and Webber,1998)

because <something>, <something>





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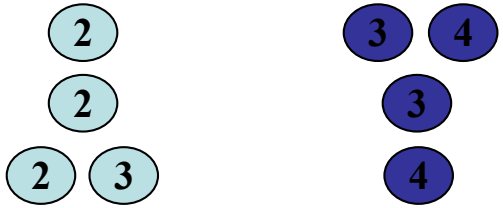
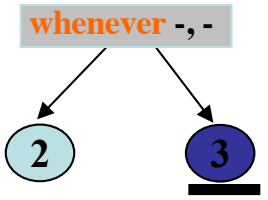
whenever <something>, <something>





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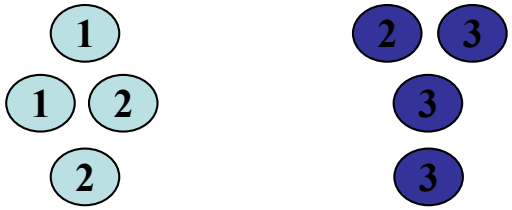

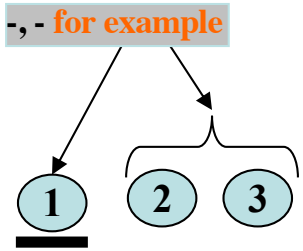

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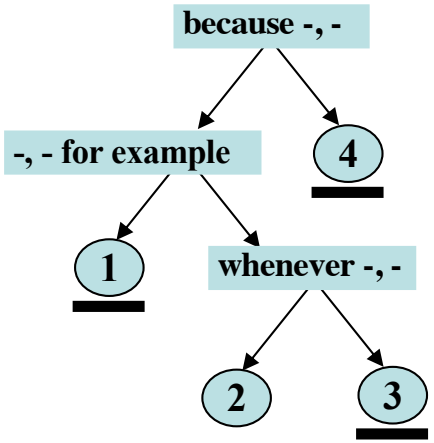
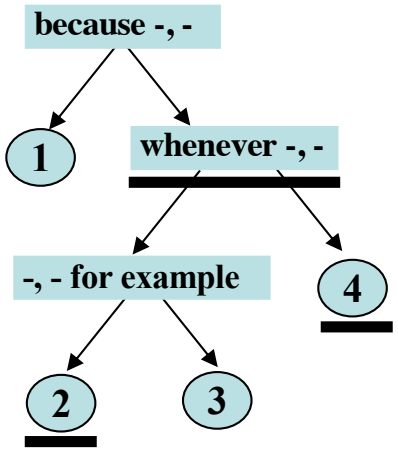
There are only two trees that can be obtained after considering all constraints:



because <1 2 3>, <4>
whenever <2>, <3>
<1>, <2 3> for example



because <1>, <2 3 4>
whenever <2 3>, <4>
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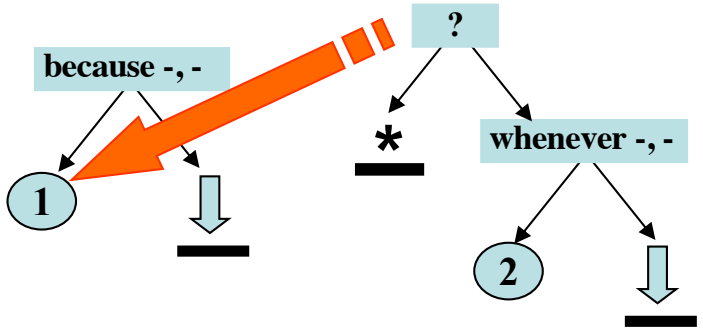
The incremental generation of the first interpretation

[*Because John is such a generous man* [1]]
[– *whenever he is asked for money,* [2]]



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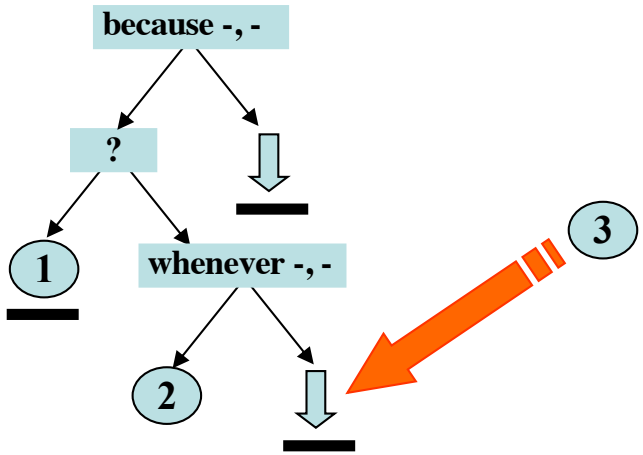

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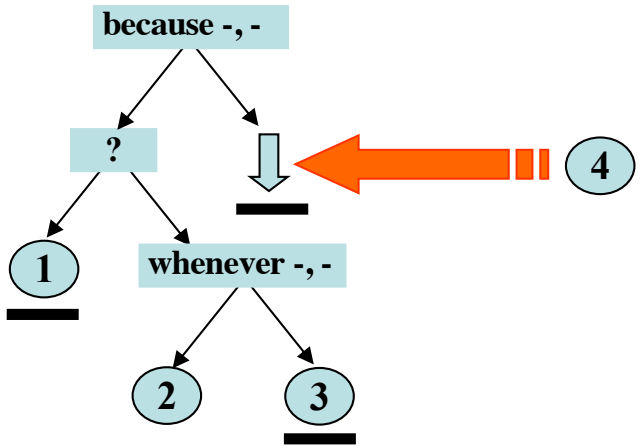

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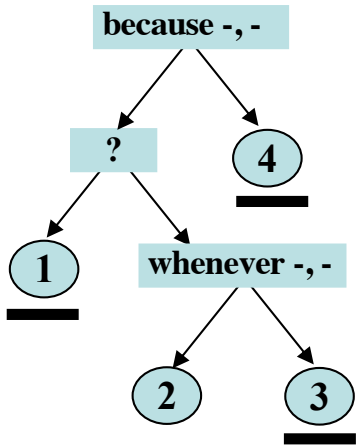

The incremental generation of the second interpretation

[*Because John is such a generous man* [1]]
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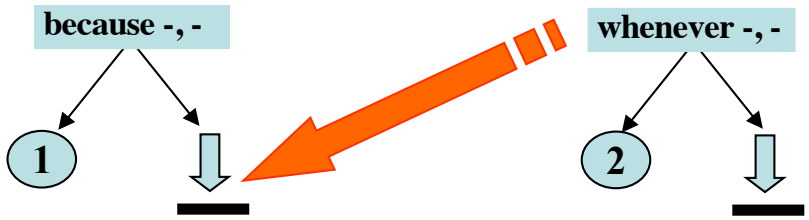

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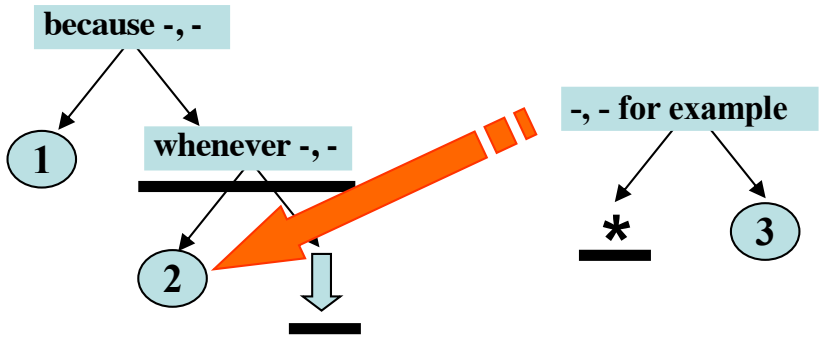

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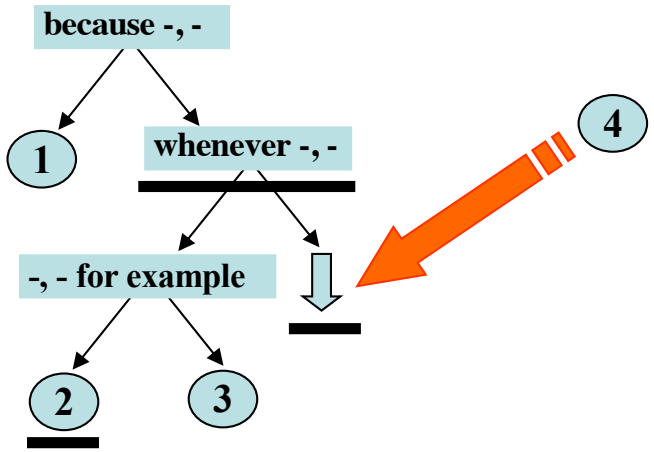

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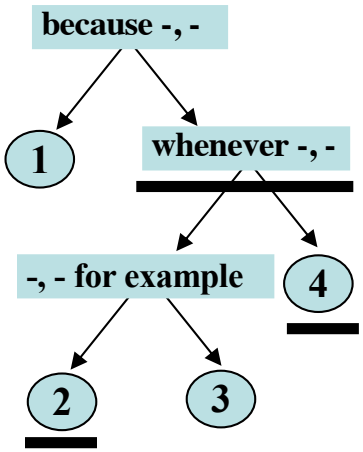
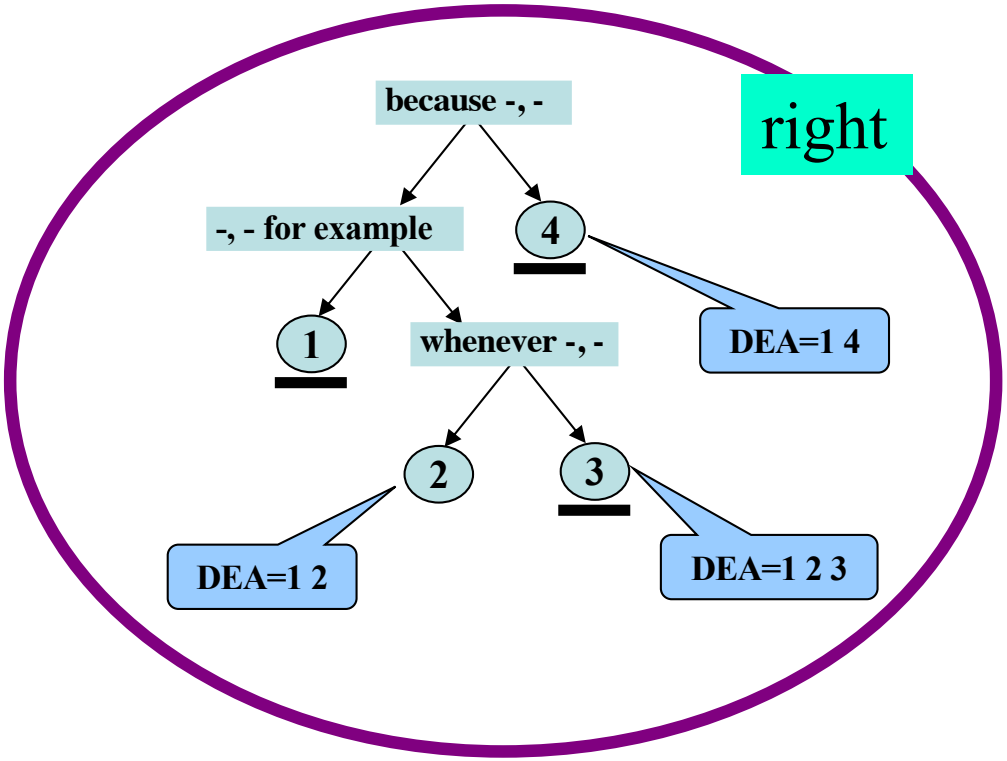
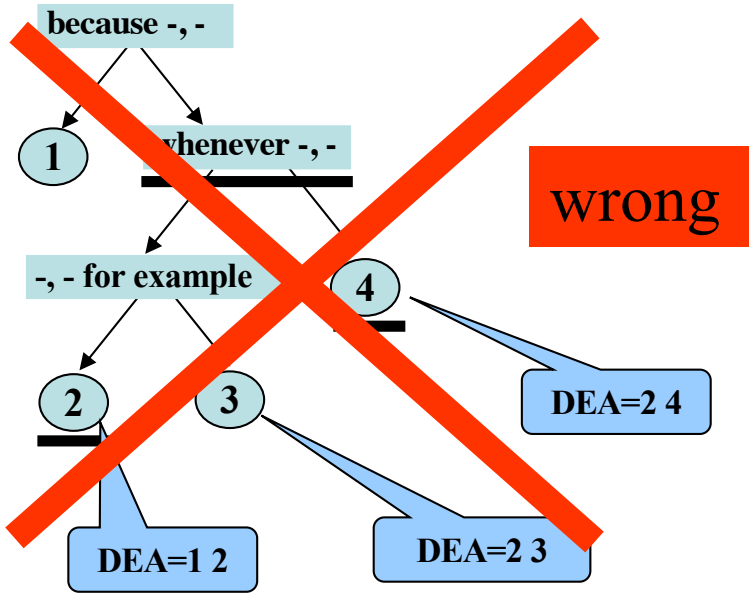


How can references help in discovering the structure?

[*Because John is such a generous man* [1]] [– *whenever <u>he</u> is asked for money,* [2]] [*<u>he</u> will give whatever he has, for example* [3]] [– *<u>he</u> deserves the "Citizen of the year" award.* [4]]



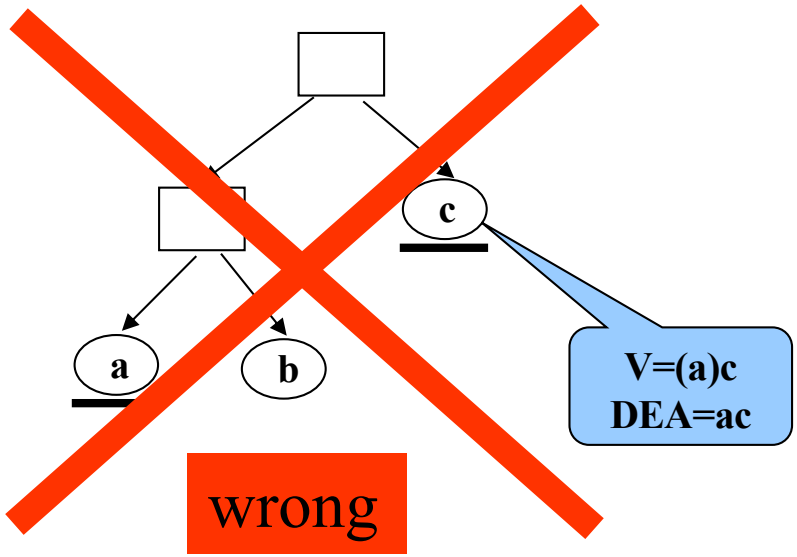


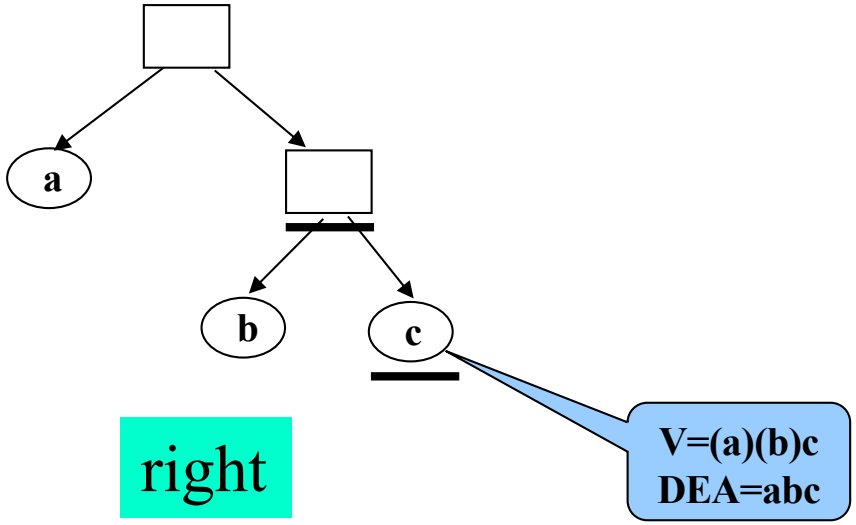
Anaphoric links can indicate the right structure

a. Because Mary was upset,

b. even if John agreed,

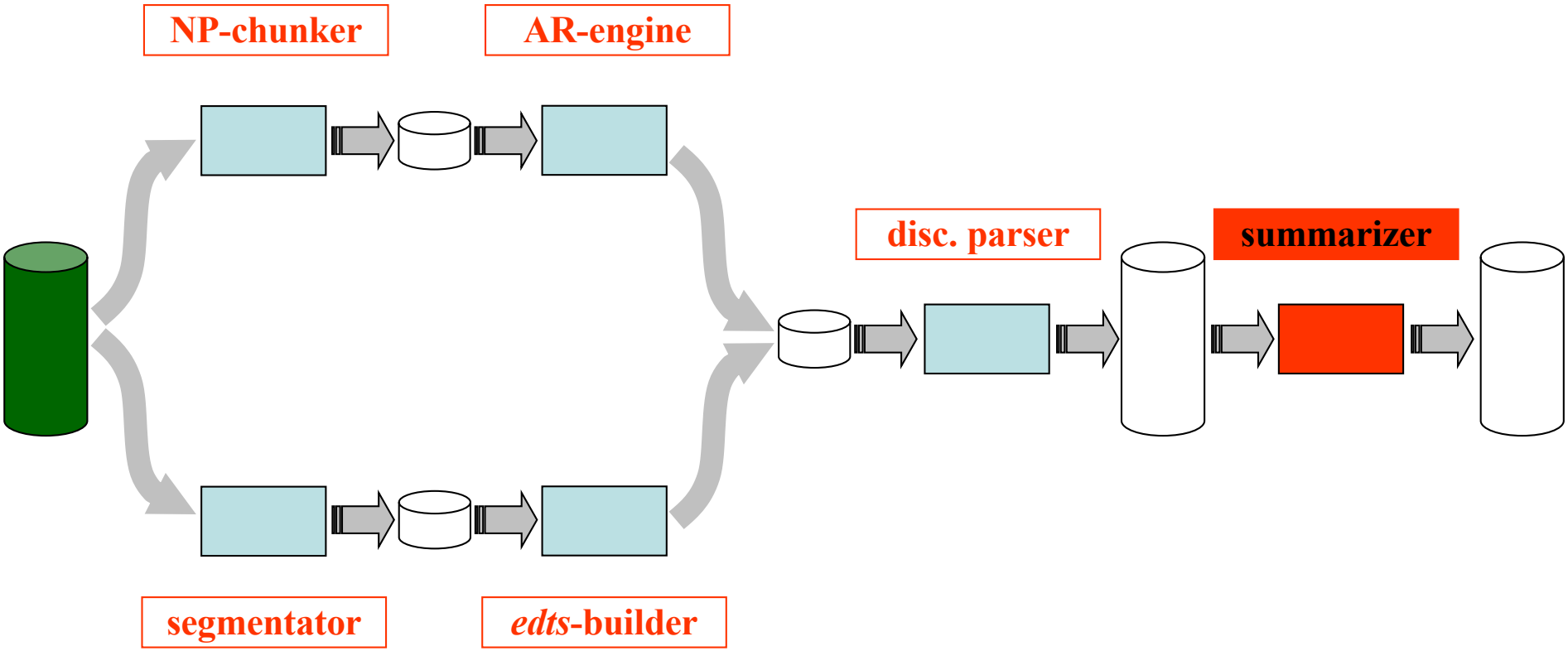
c. <u>they</u> didn't speak to one another for several days.





Incremental parallel processing

(Cristea et al., 2005)



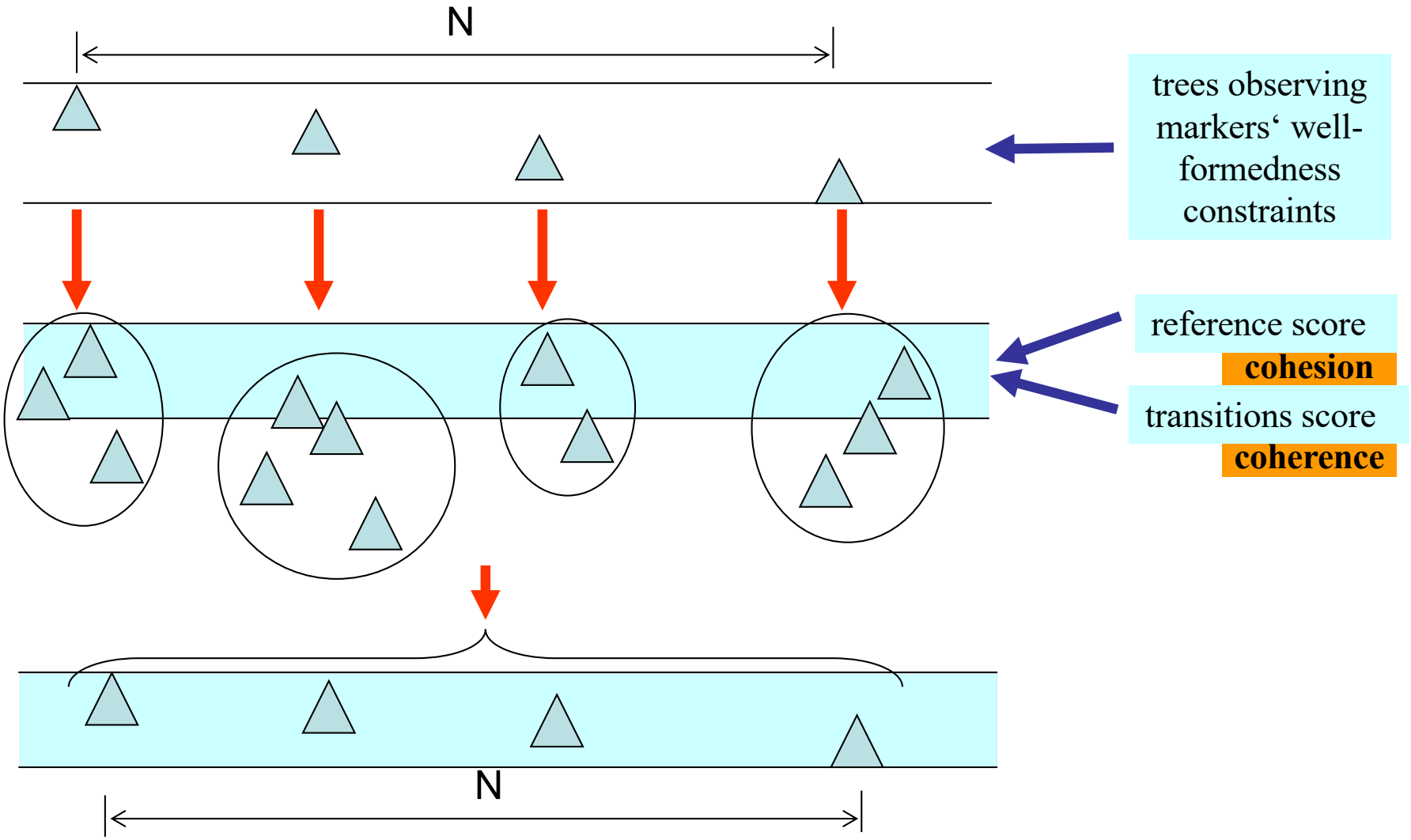
VT guides an incremental discourse parsing

(Cristea, 2000; Cristea et al., 2003, 2005)

The tree resulted after parsing is the one which manifests:

- the more natural overall references over the discourse structure
- the smoothest overall CT transitions on veins

The discourse parser implements a „beam search“

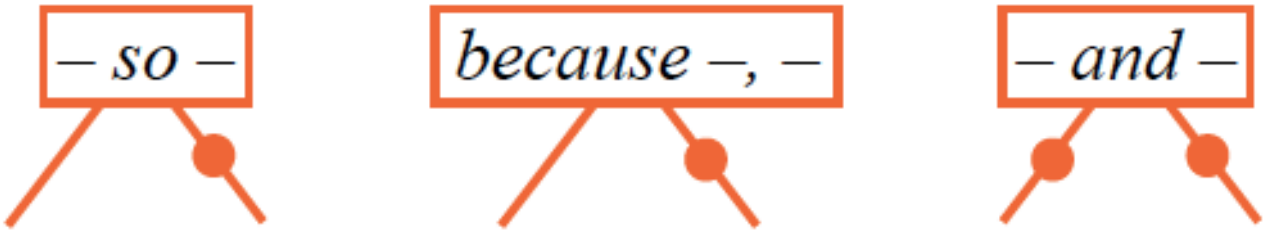


Exercise

For the sentence:

> [John is determined to pass the NLP exam [1]] so, because [he has missed many courses [2]] and [was only vaguely implicated at the working sessions [3]] , [he will have a hard time until summer. [4]]

knowing the involved markers have the argument patterns:



find the possible parsing trees.

Deciding the structure

1 *so, because* 2 *and* 3, 4

Have the following domains of arguments:

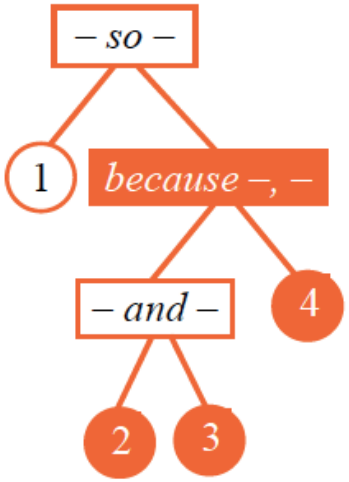
[1] *so* [2, 3, 4]

because [2, 3, 4] [2, 3, 4]

[1, 2] *and* [3, 4]

Then, out of all possible combinations, filter out: empty lists, non-adjacent lists and those placed at distance from their markers. The following combinations of arguments remain:

[1] so [2, 3, 4]	because [2] [3, 4]	[1, 2] and [3, 4]
[1] so [2, 3]	because [2] [3]	[1, 2] and [3]
[1] so [2]	because [2, 3] [4]	[2] and [3, 4]
		[2] and [3]

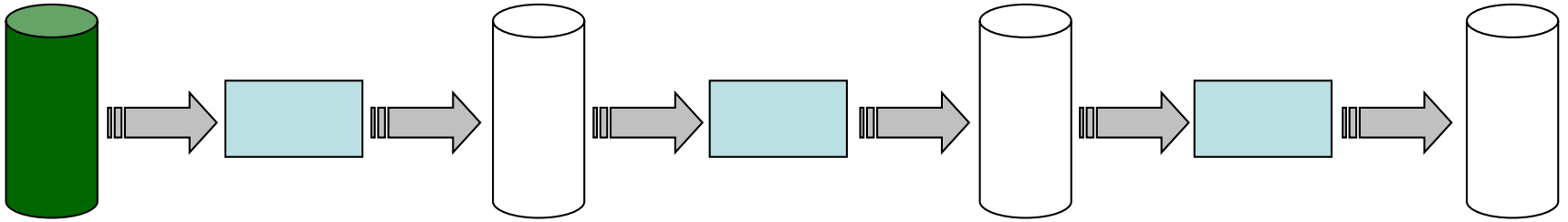


In (Cristea et al., 2003) there are expressed a number of rules that can constrain well-formedness of tree structures: “nesting-arguments”, “balanced-displacement”, “unique-root” and “one-parent”. Only one observe all constraints.

VT’s account on Summarisation

Pipe-line versus incremental processing

pipe-line



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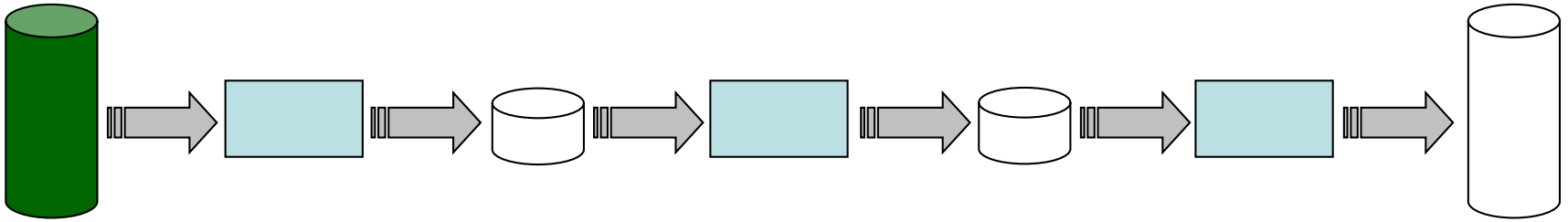

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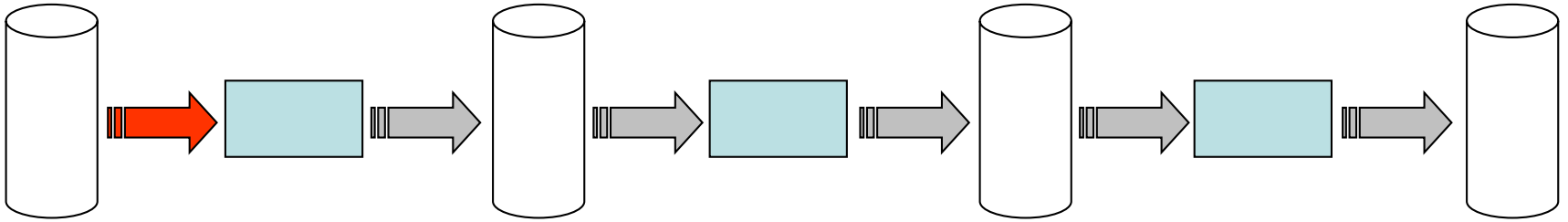

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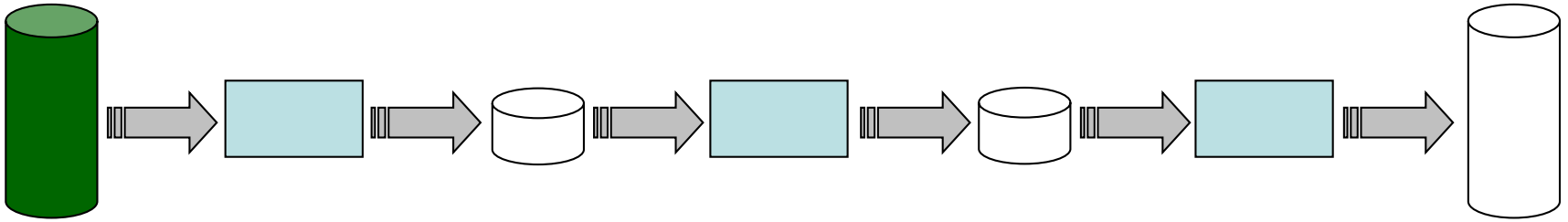

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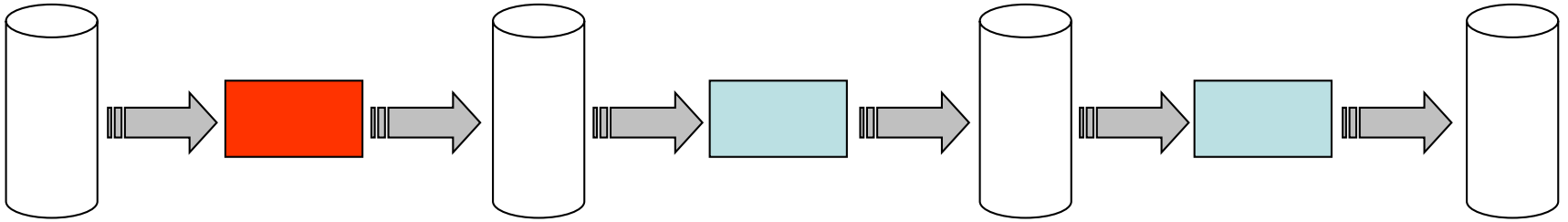

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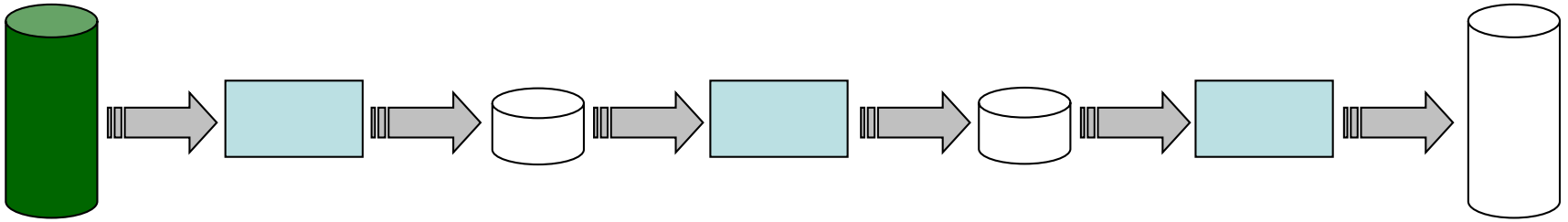

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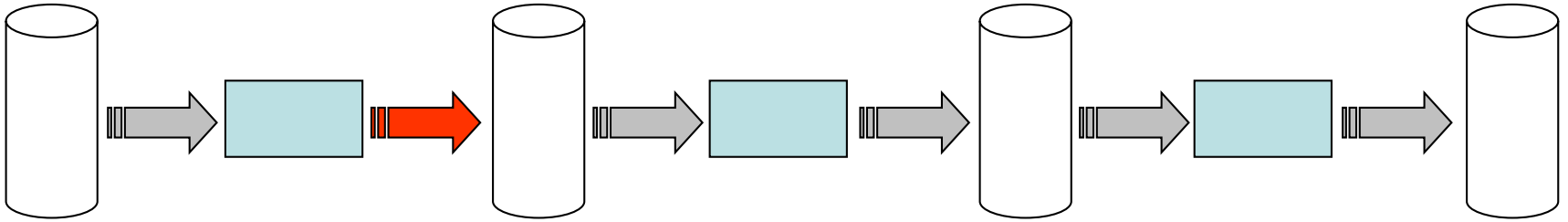

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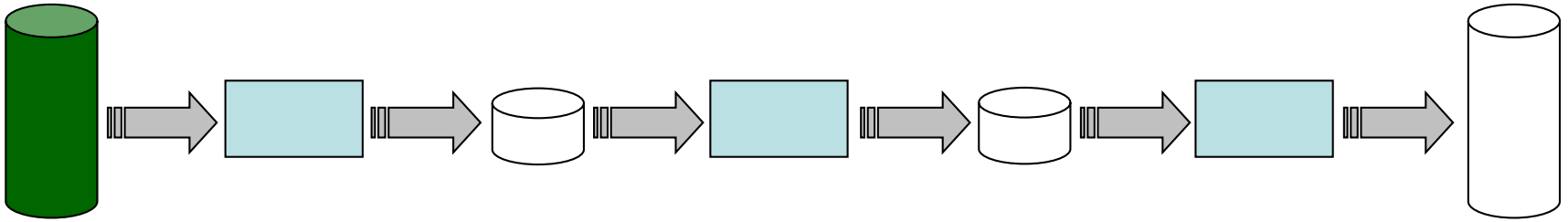

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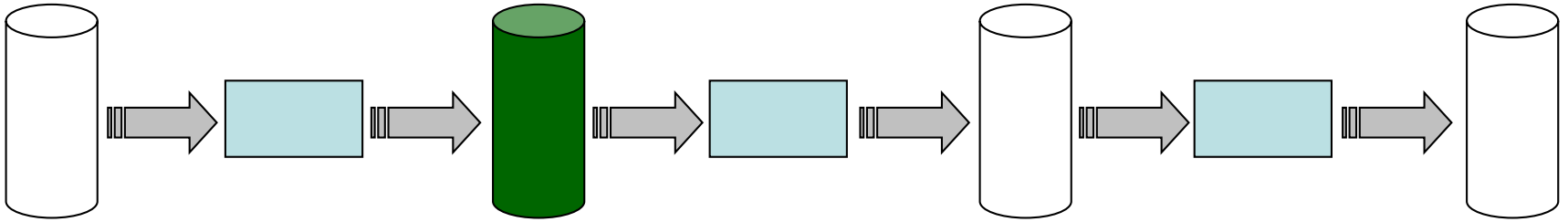

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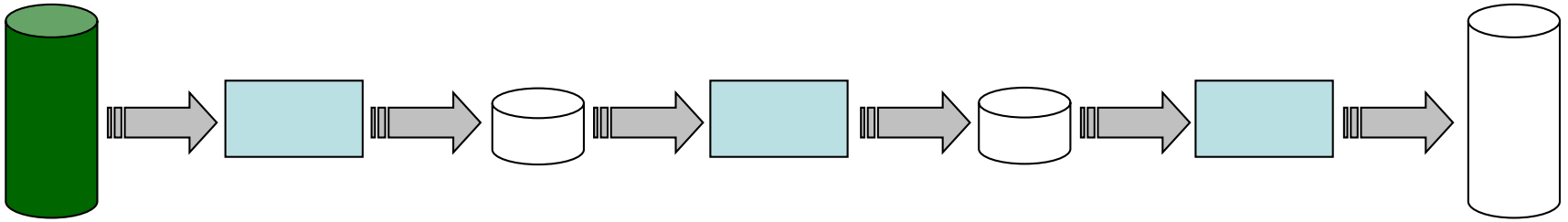

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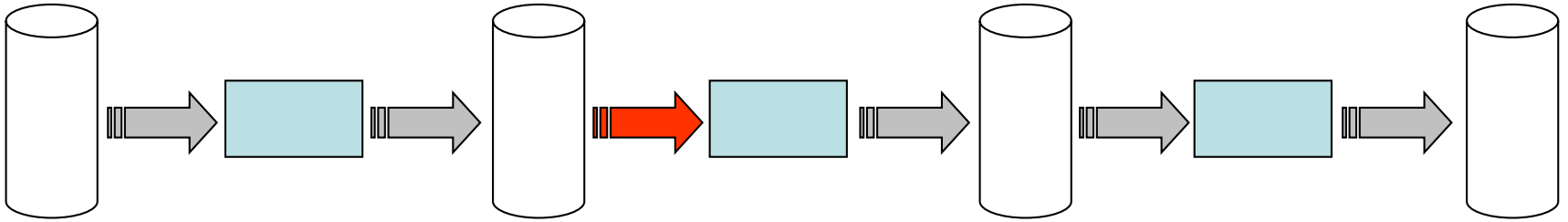

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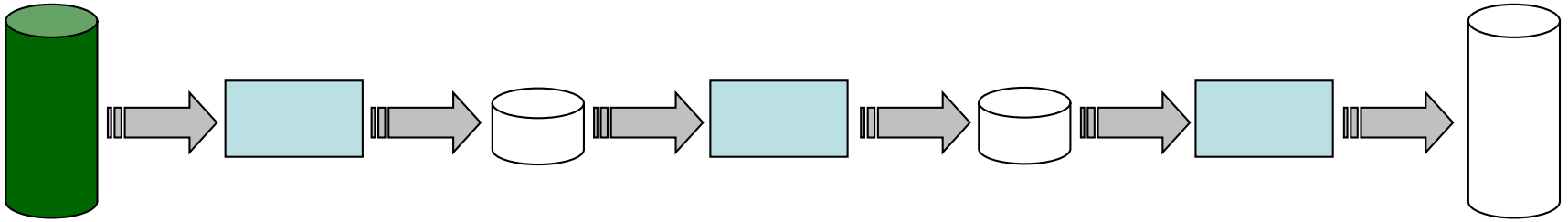

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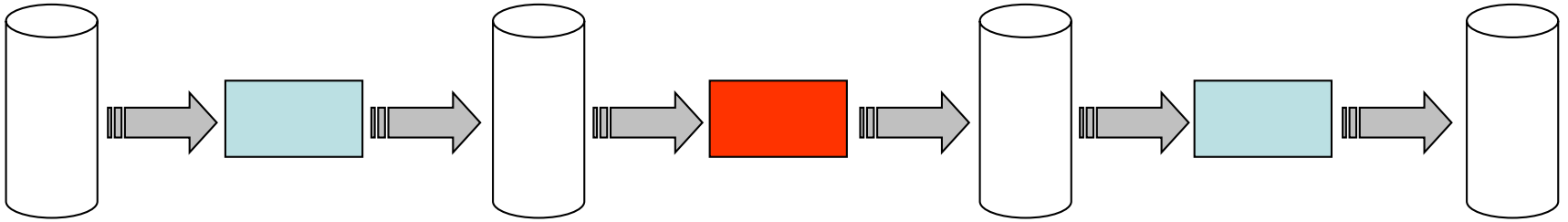

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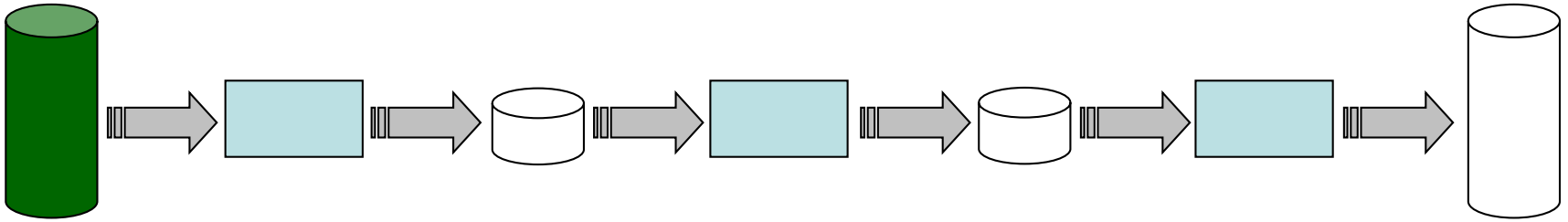

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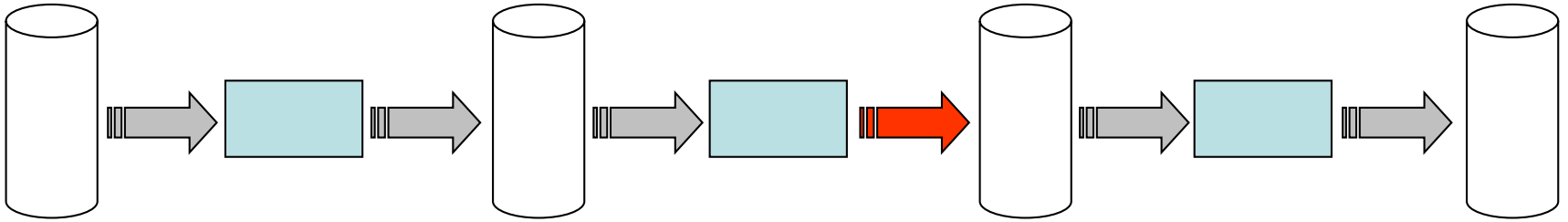

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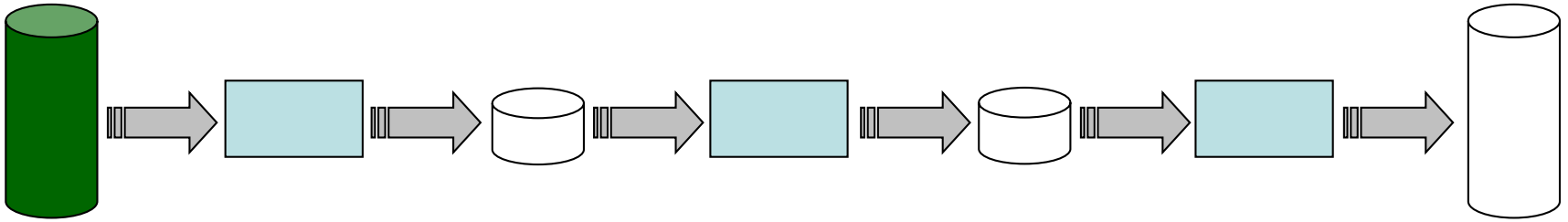

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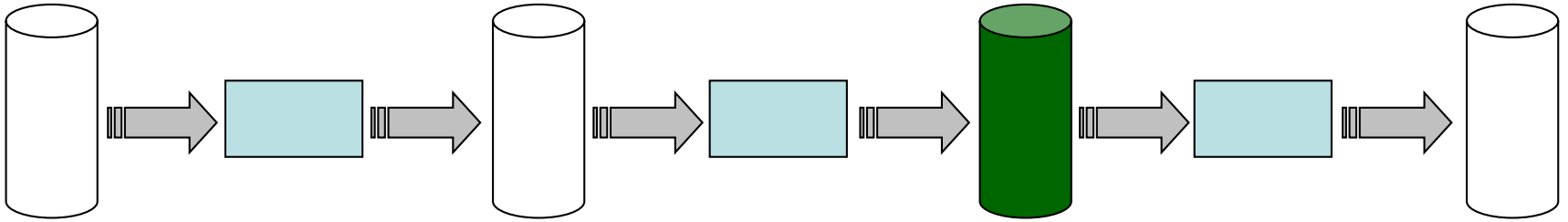

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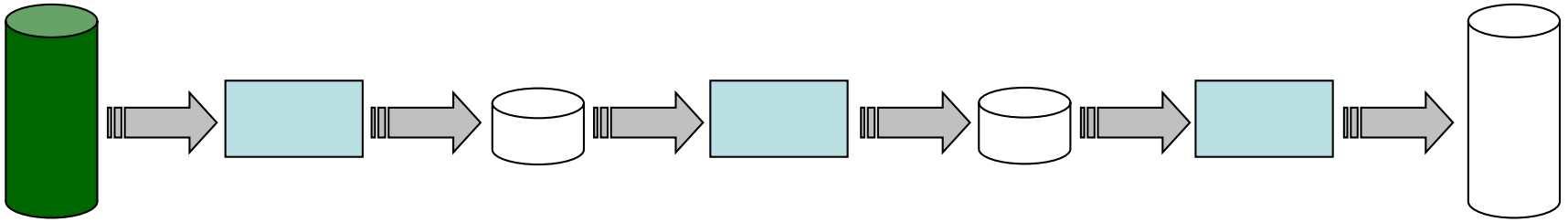

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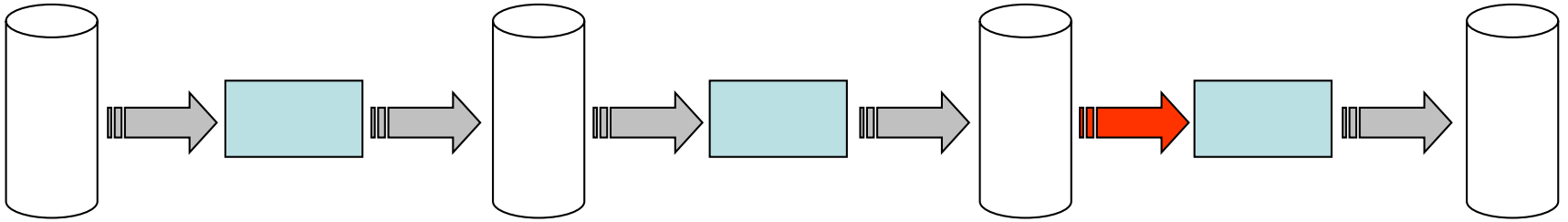

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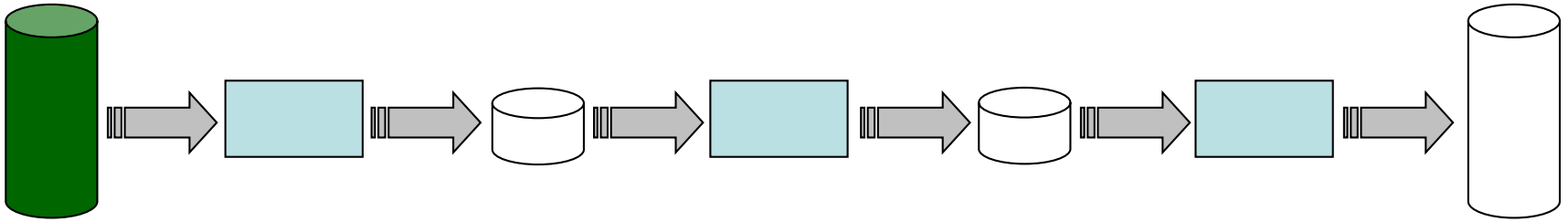

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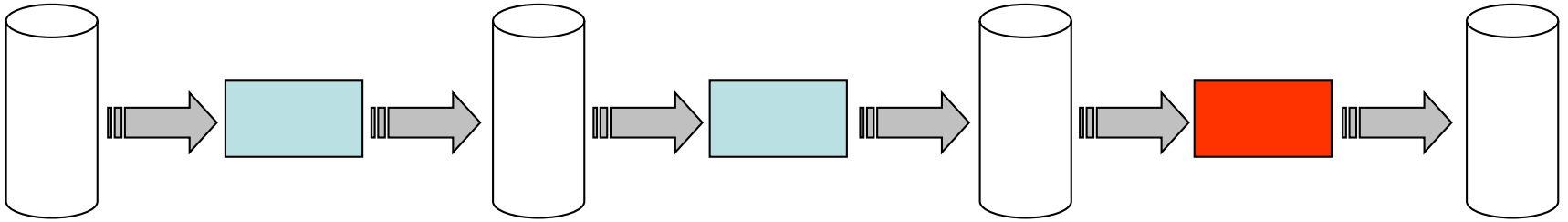

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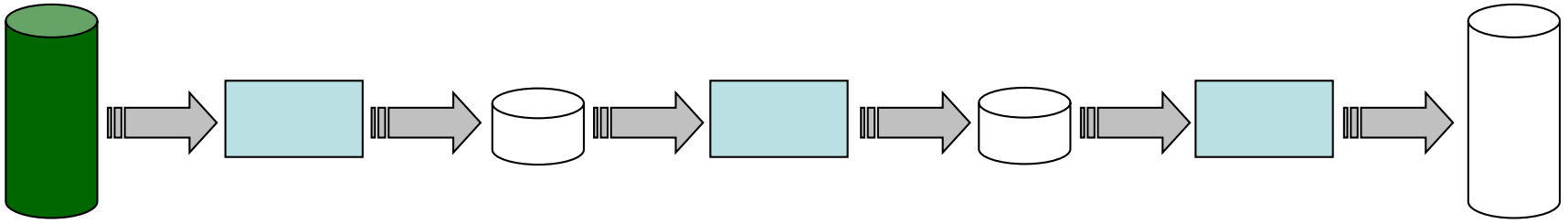

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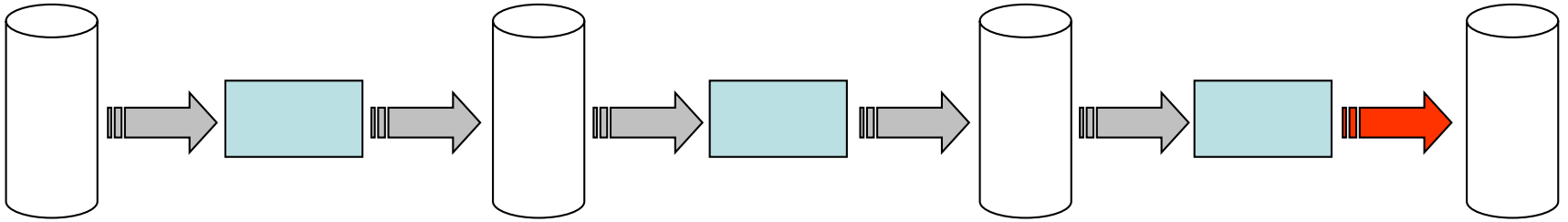

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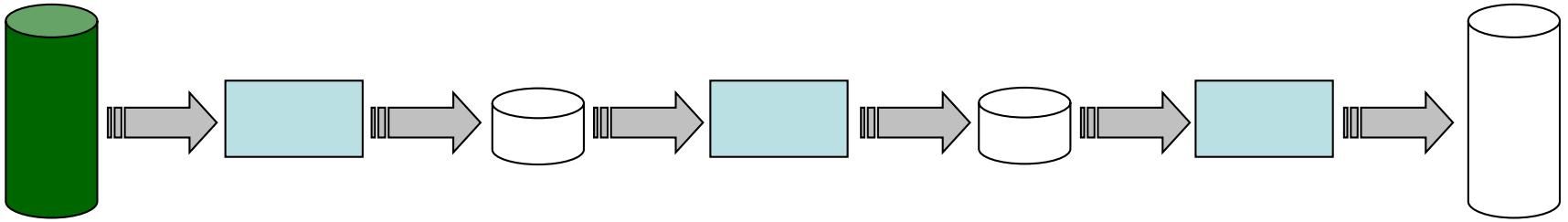

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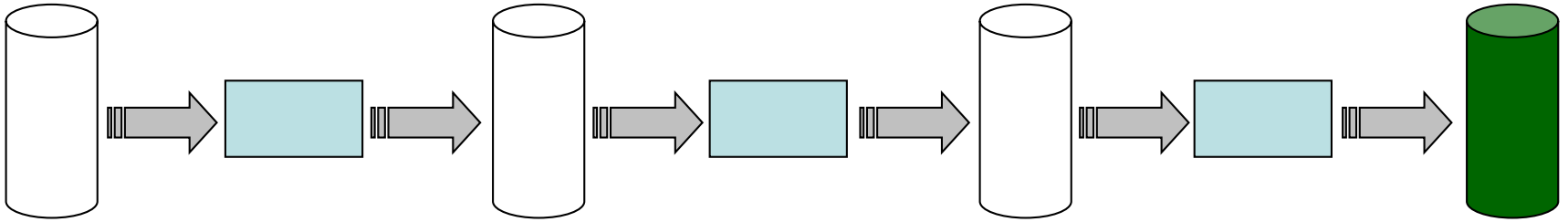

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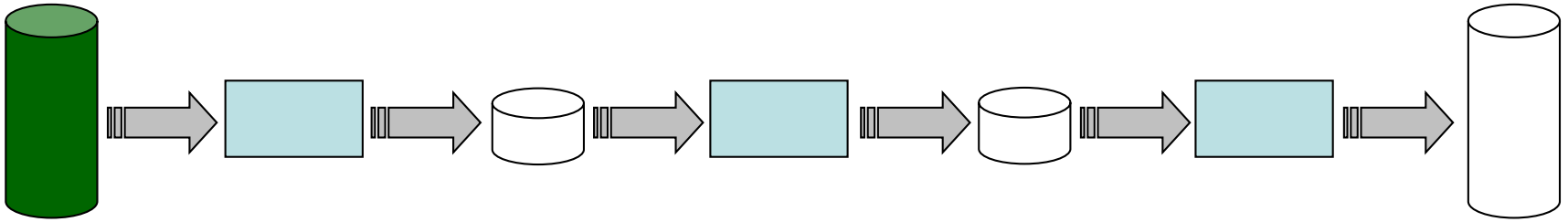

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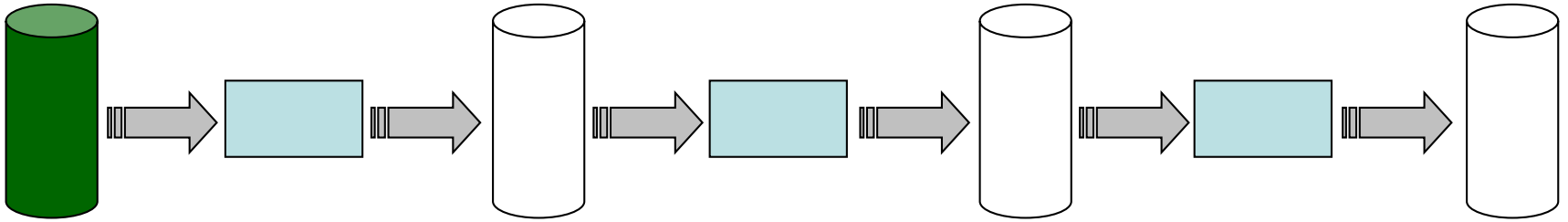

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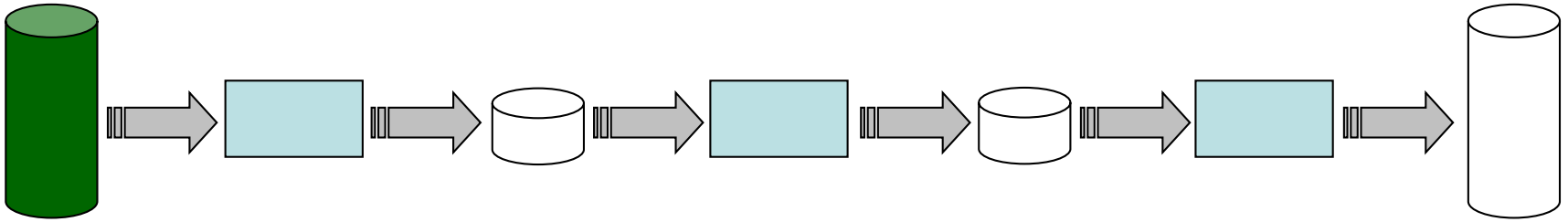

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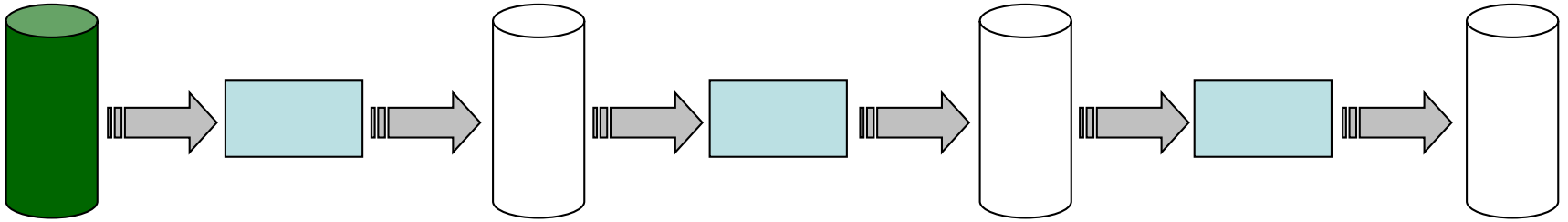

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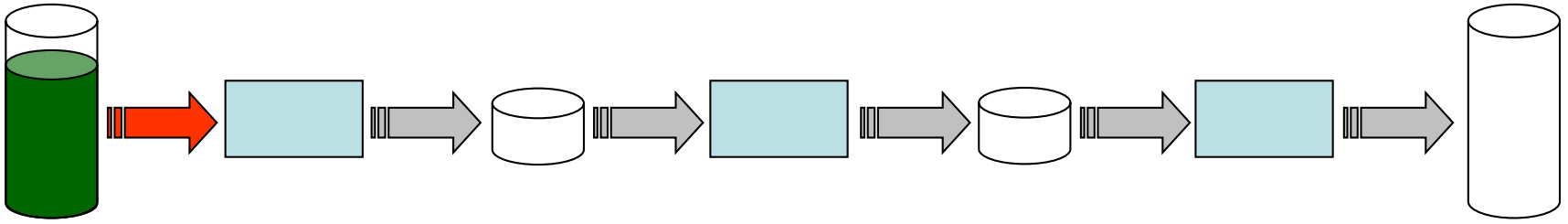

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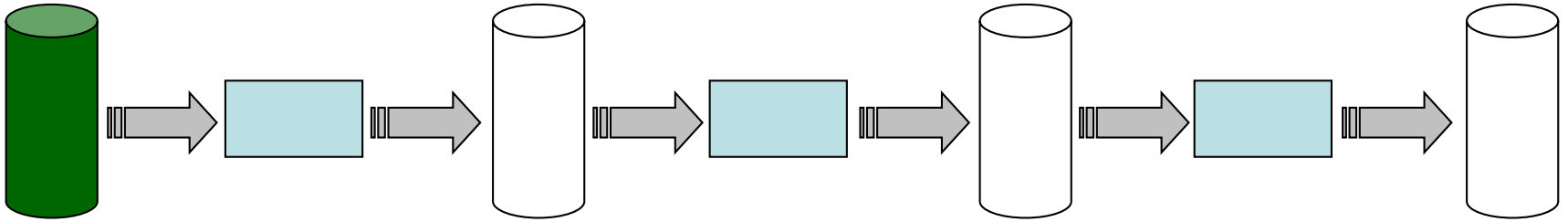

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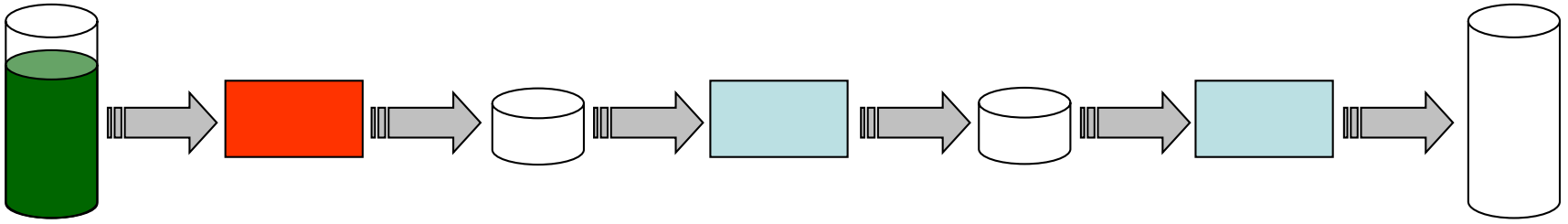

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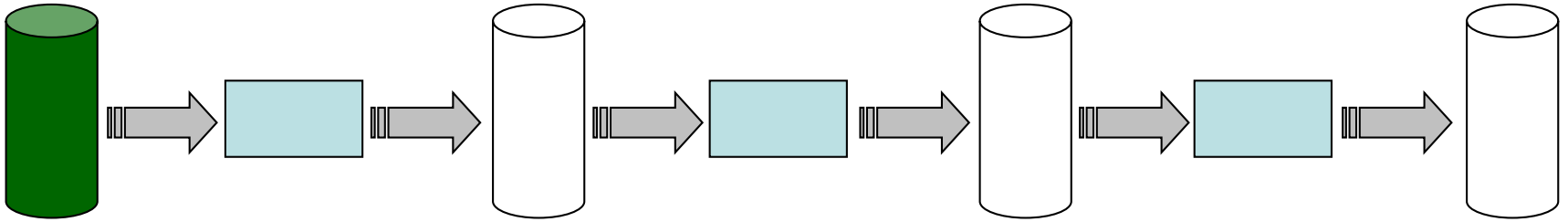

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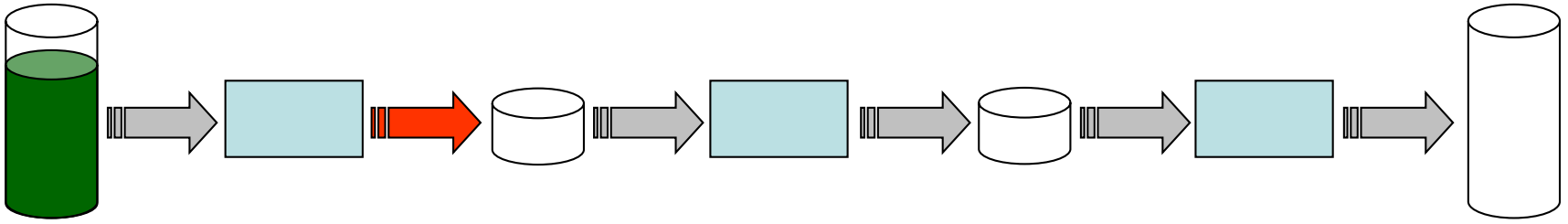

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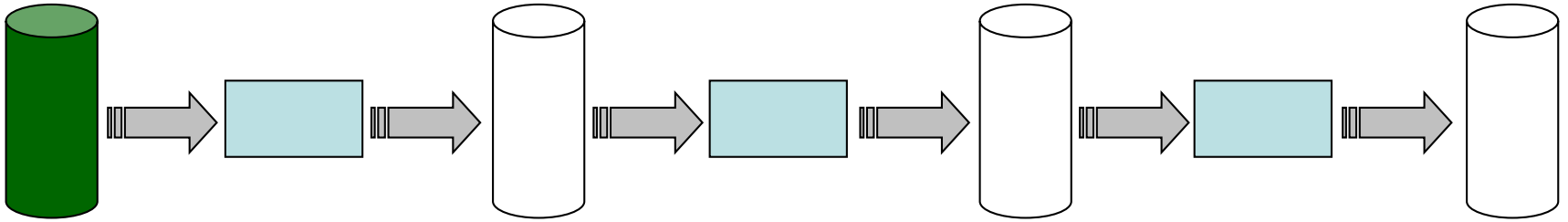

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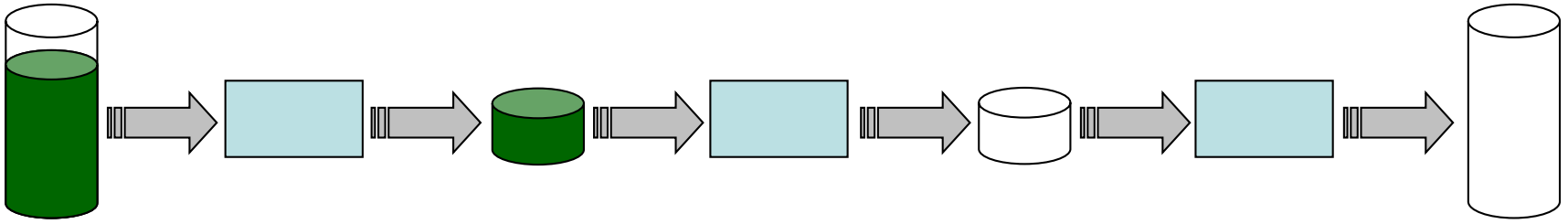

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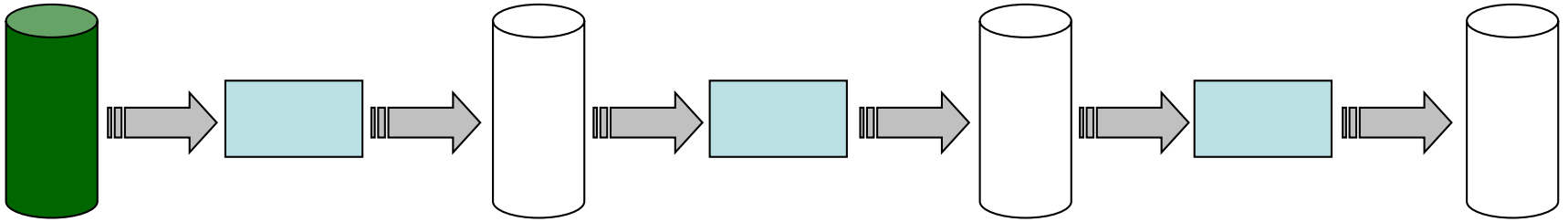

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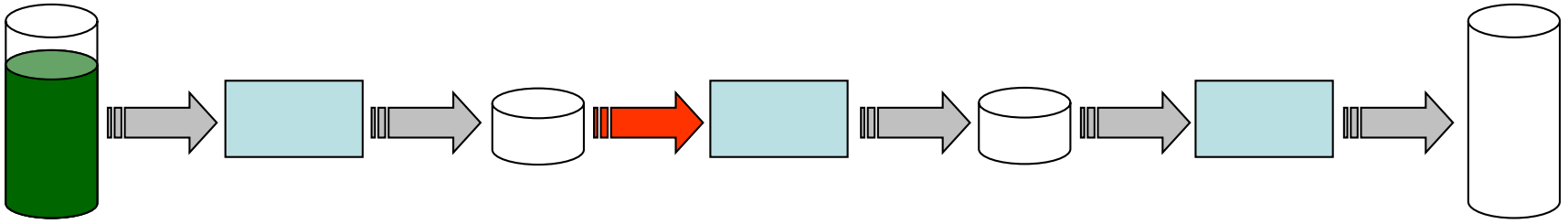

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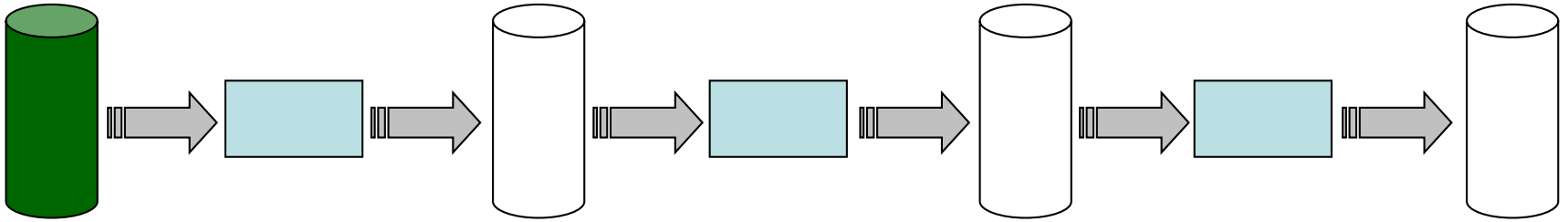

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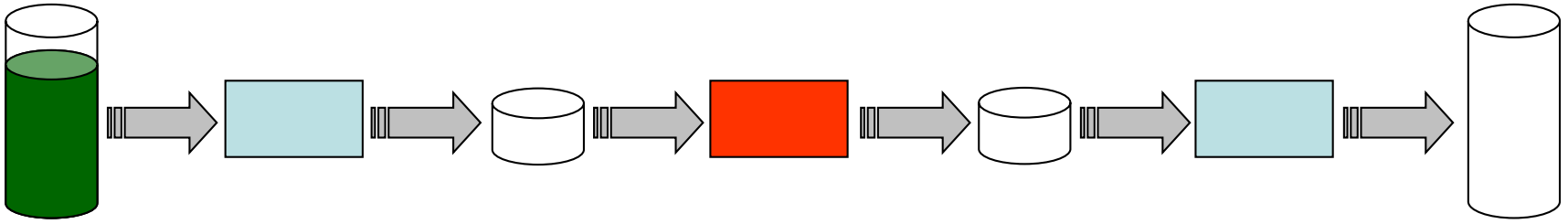

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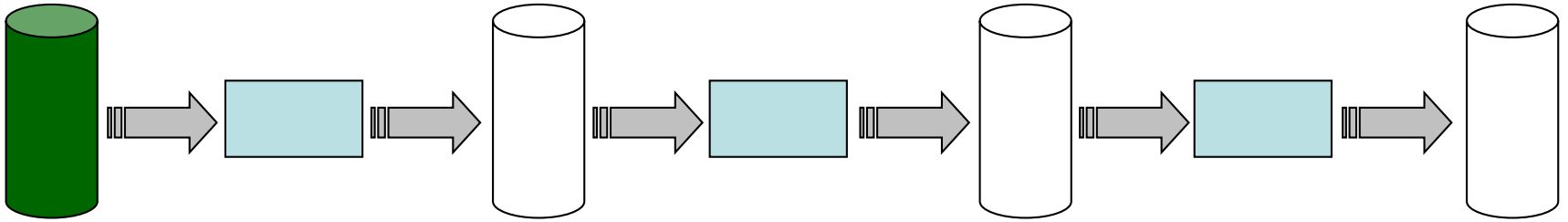

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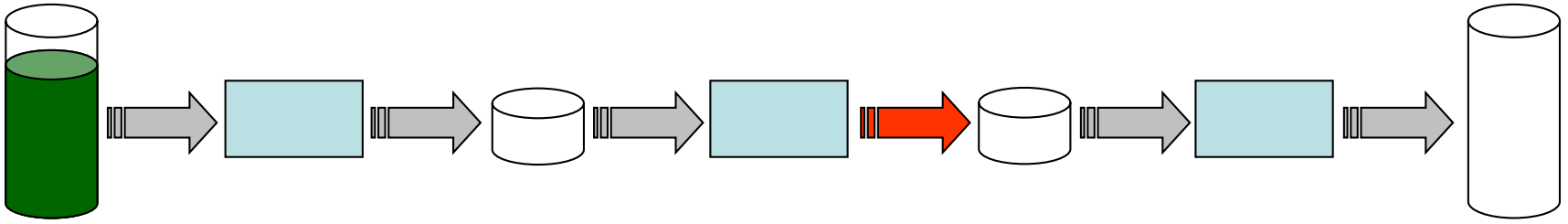

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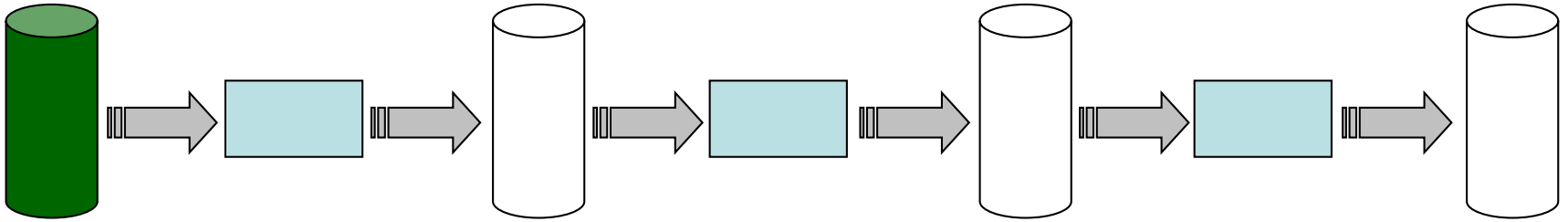

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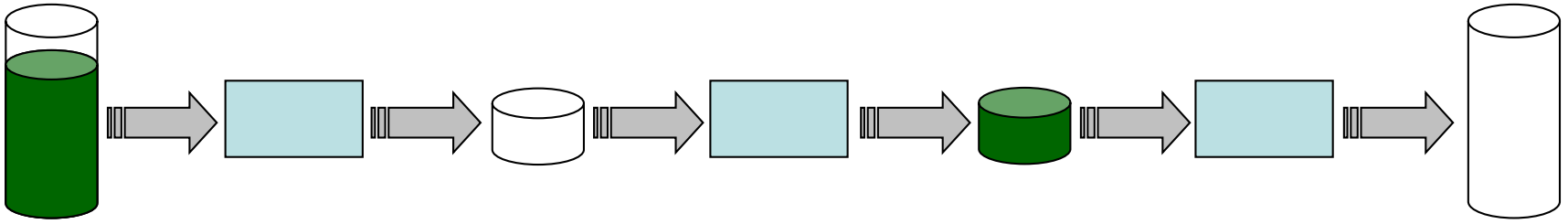

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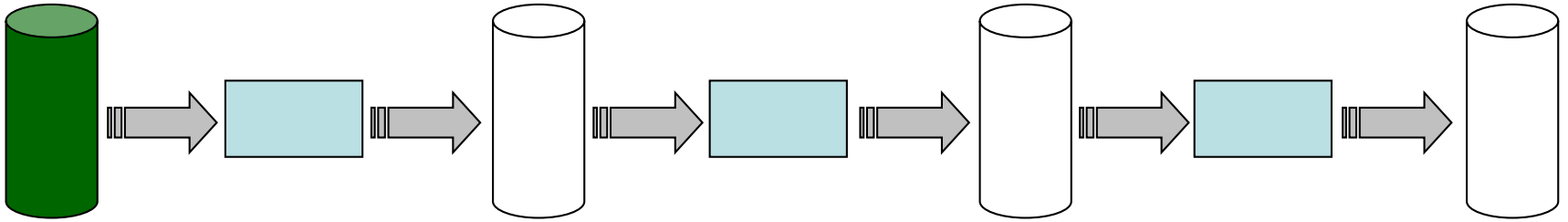

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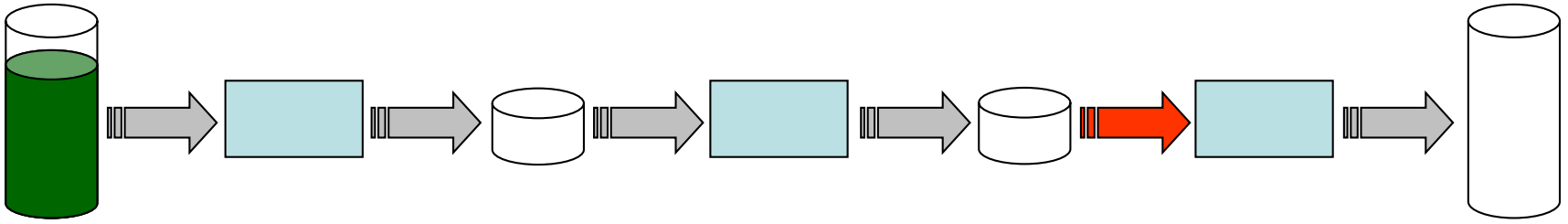

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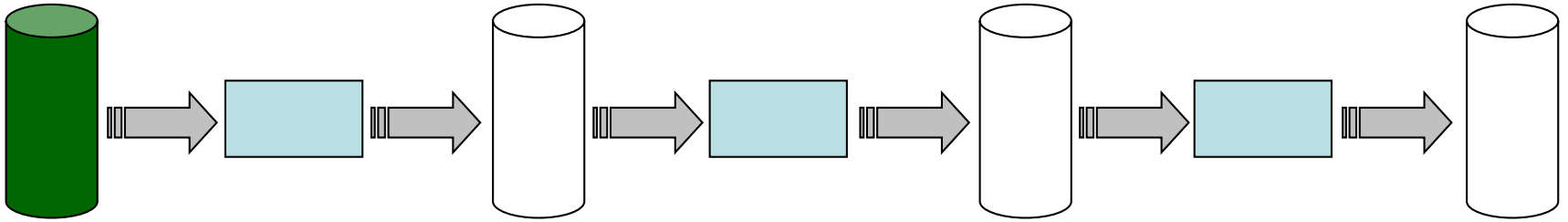

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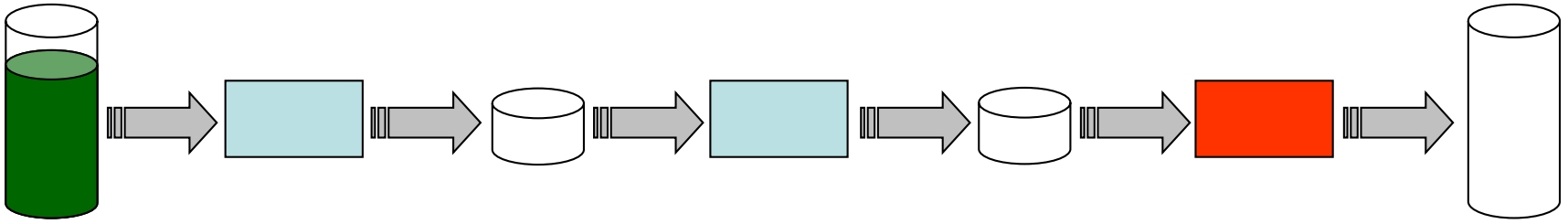
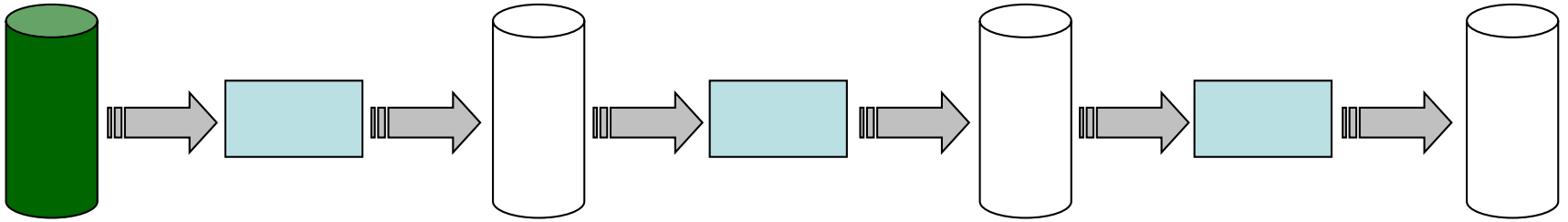


Pipe-line versus incremental processing

pipe-line



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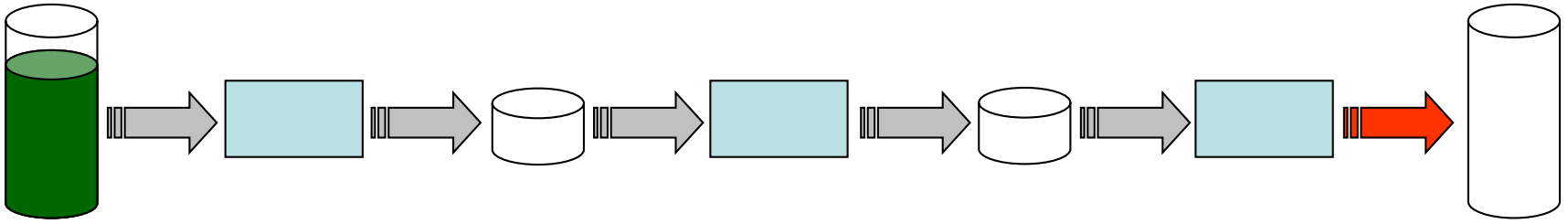

Pipe-line versus incremental processing

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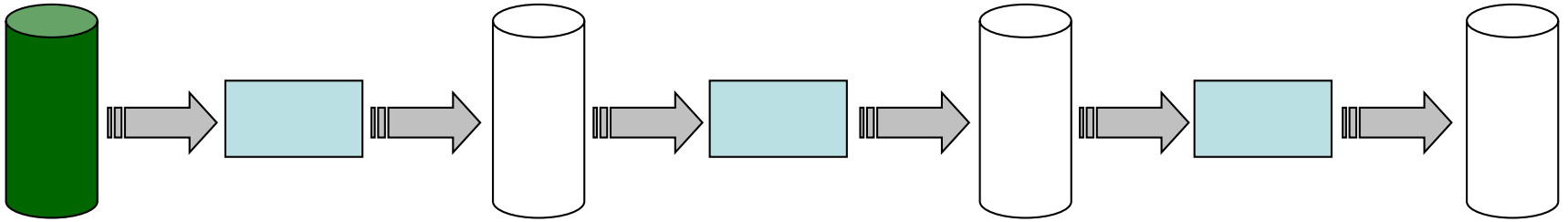

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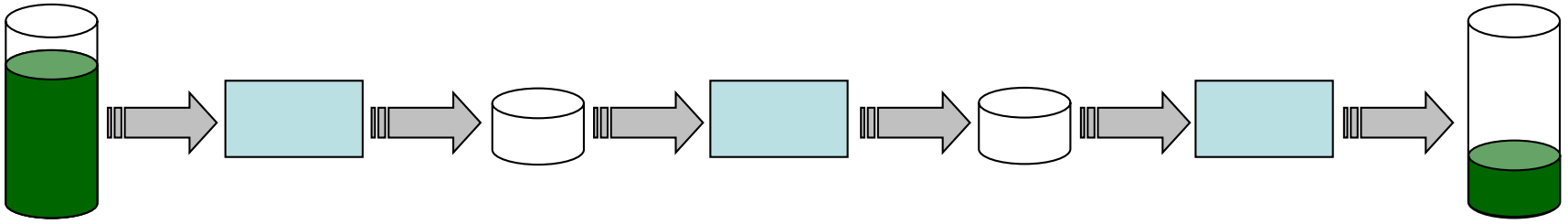

Pipe-line versus incremental processing

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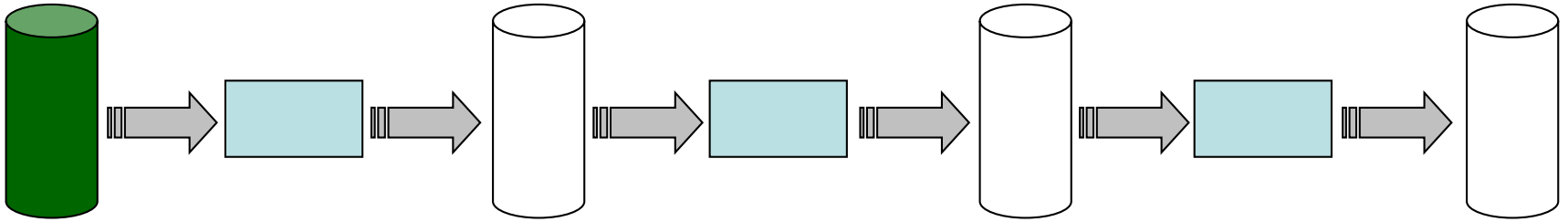

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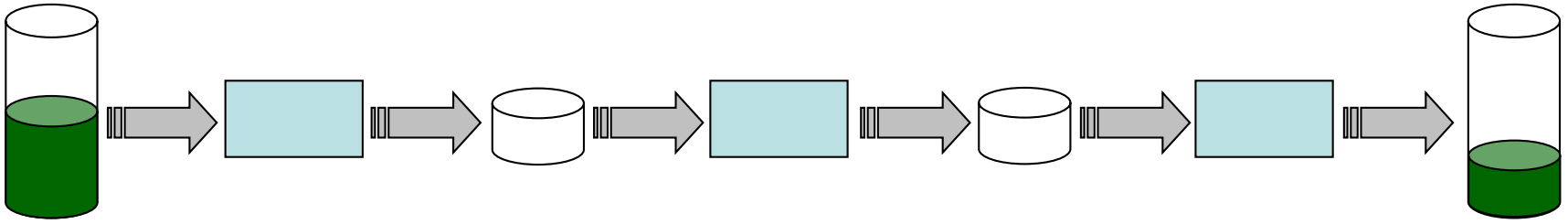

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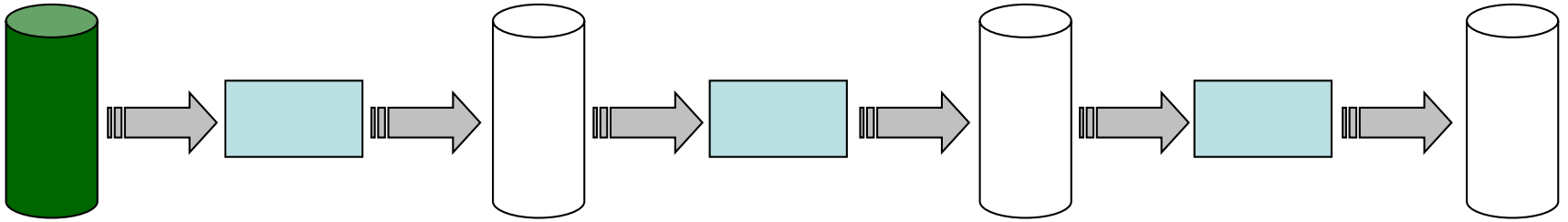

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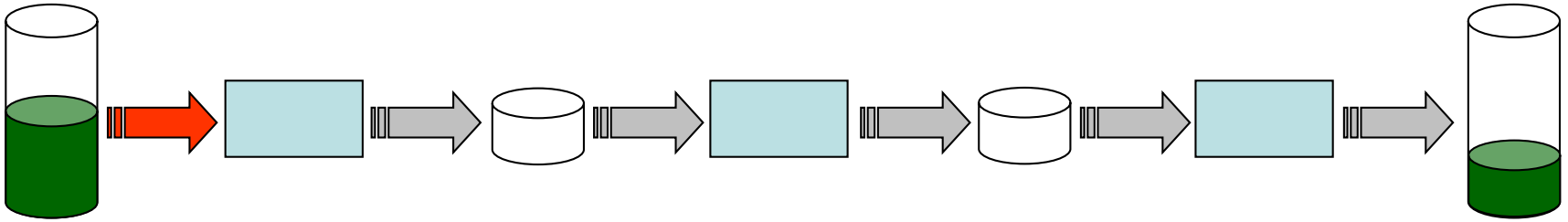

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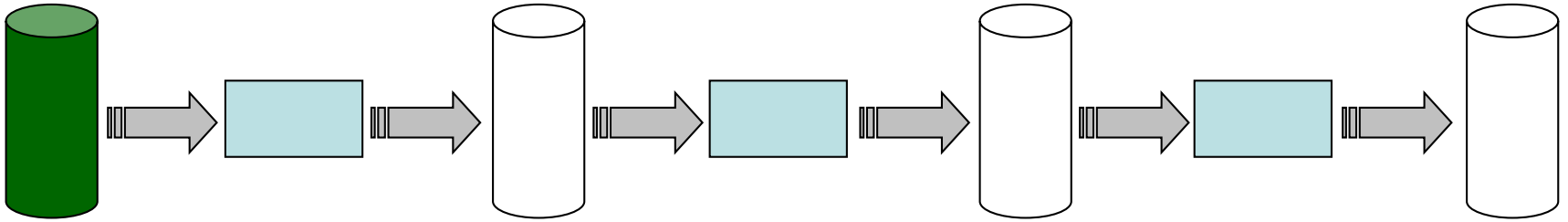

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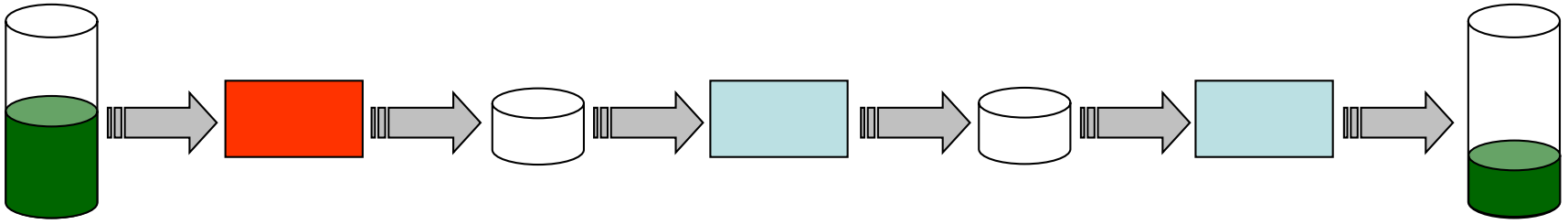

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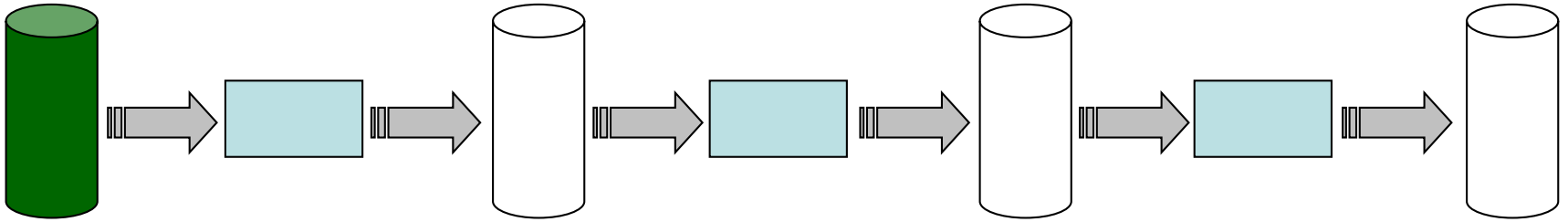

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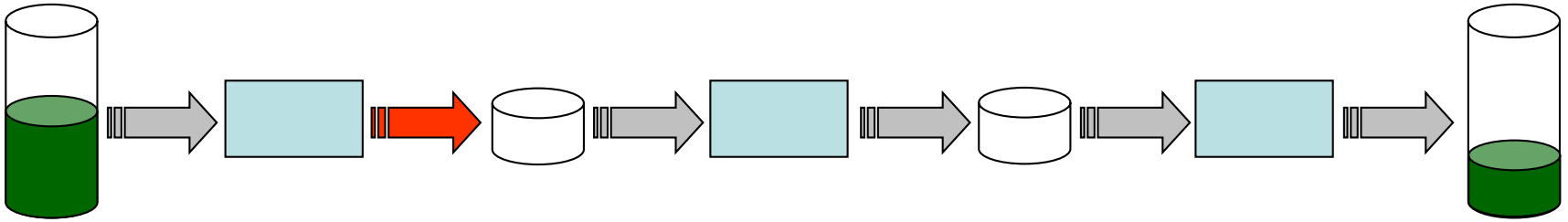

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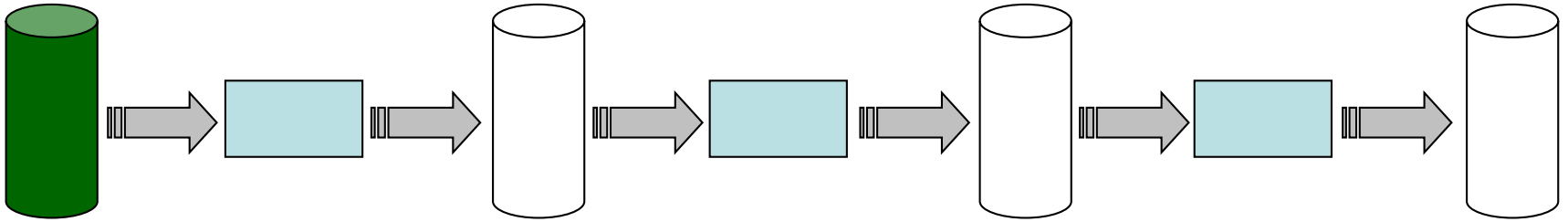

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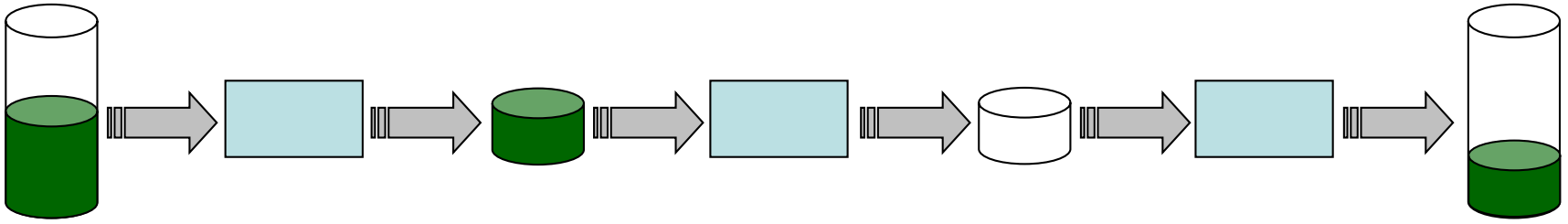

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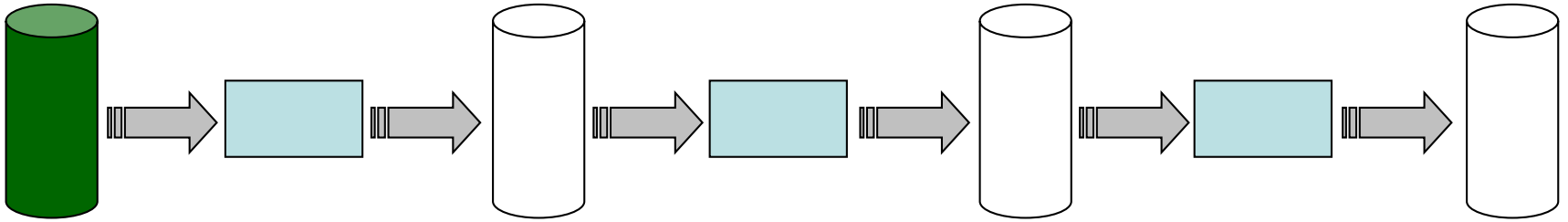

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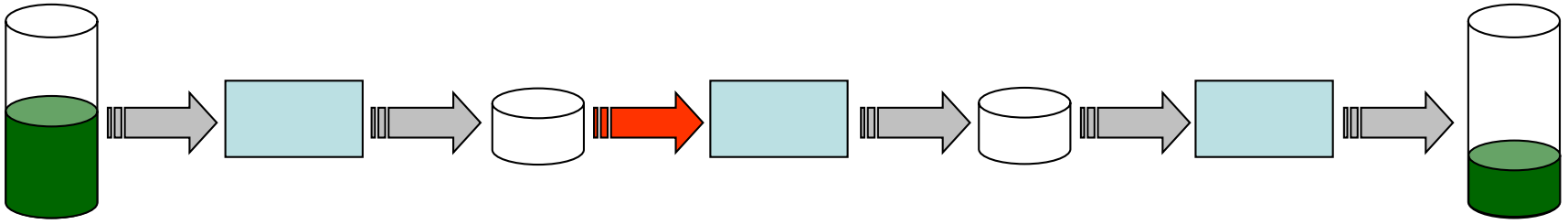

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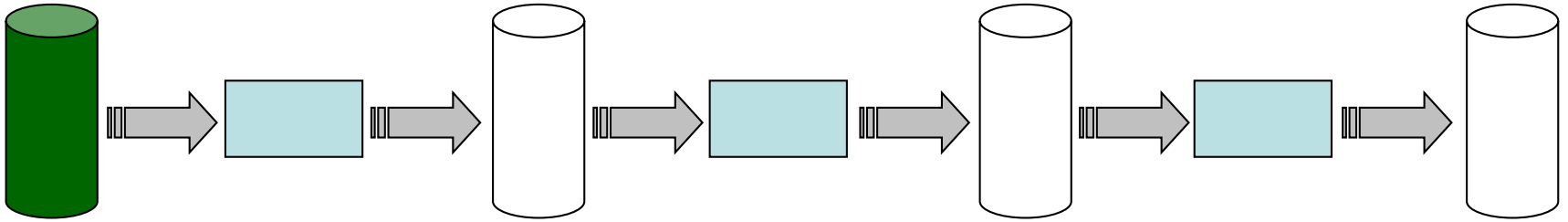

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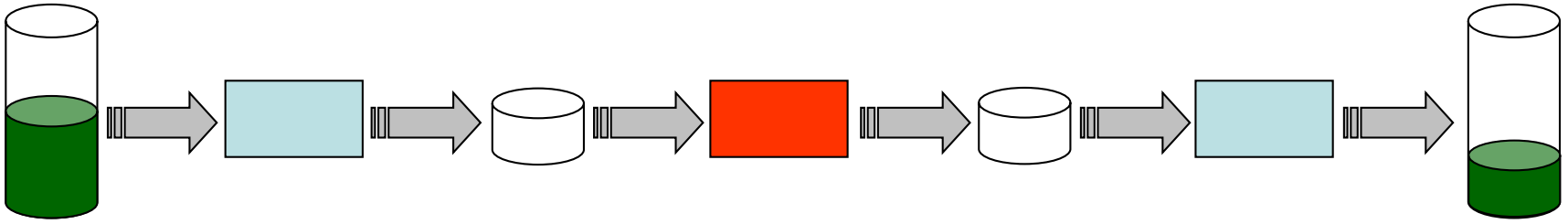

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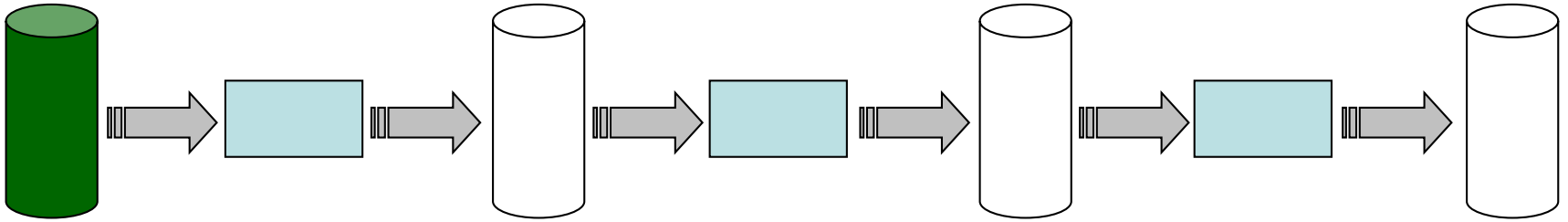

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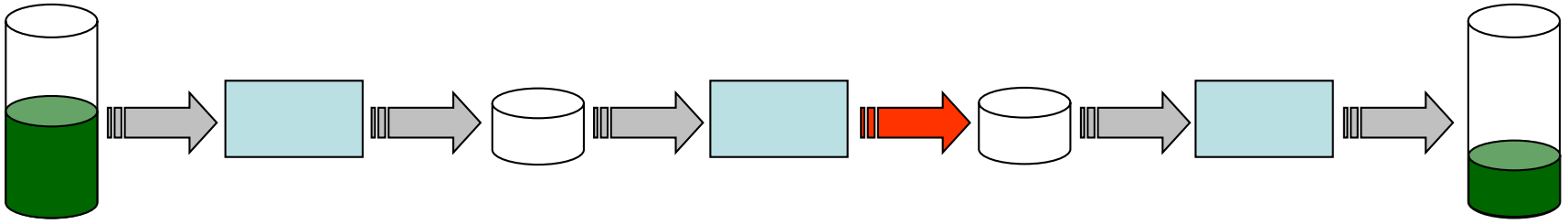

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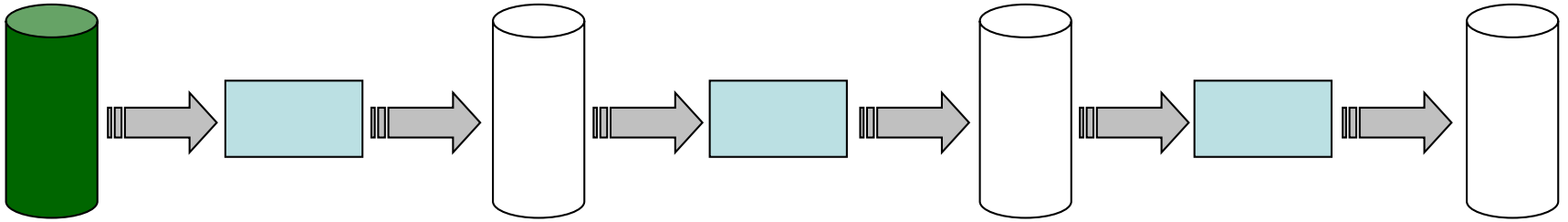

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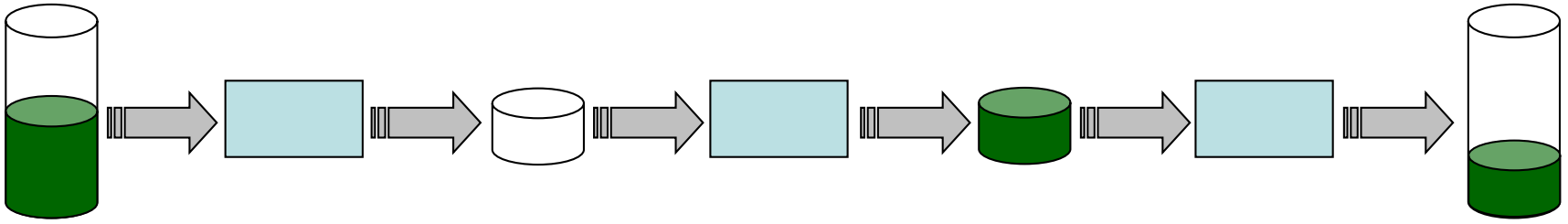

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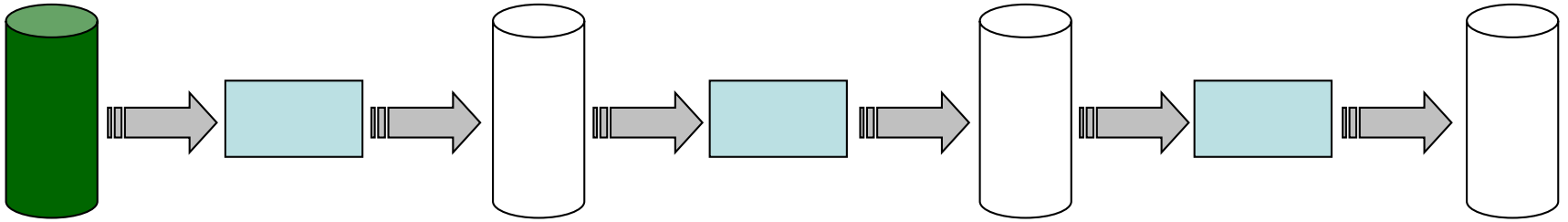

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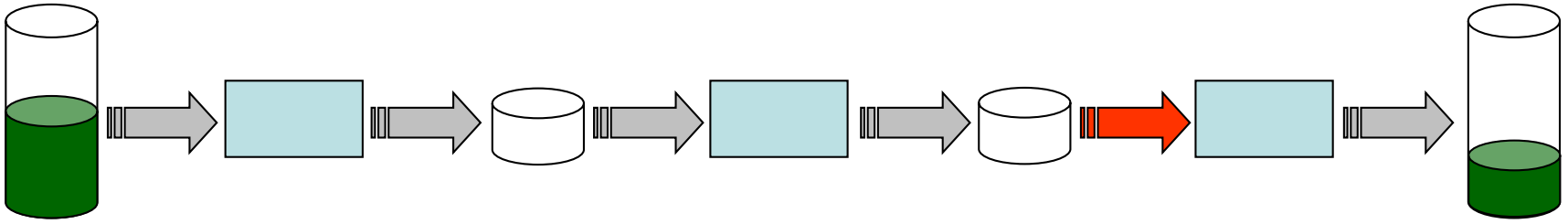

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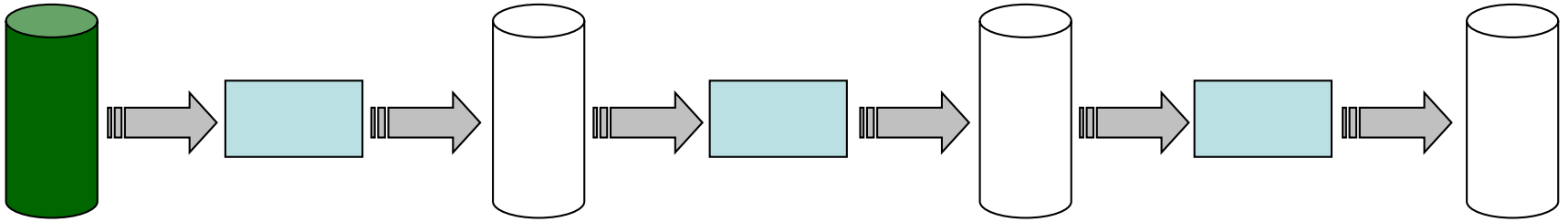

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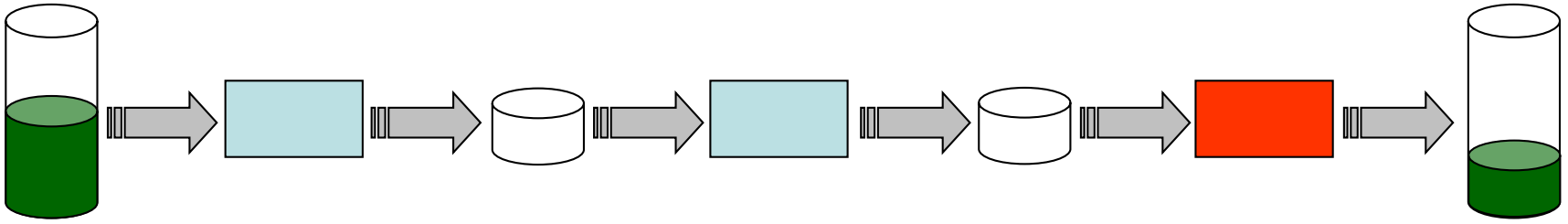

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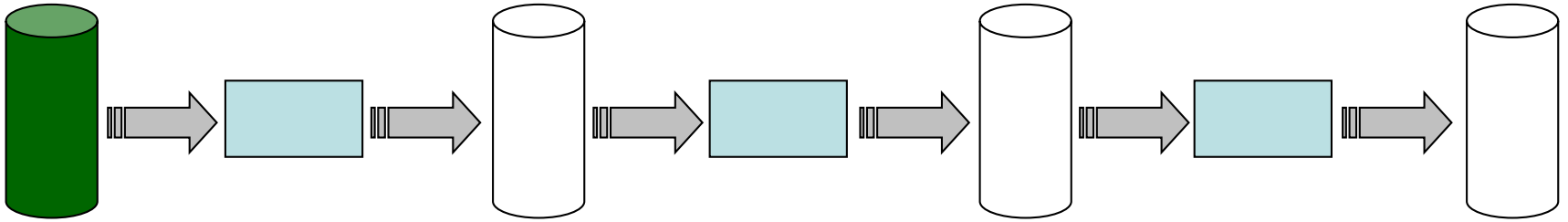

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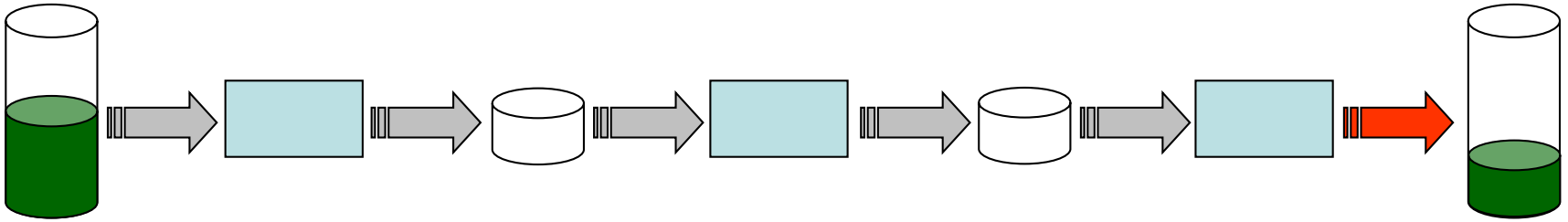

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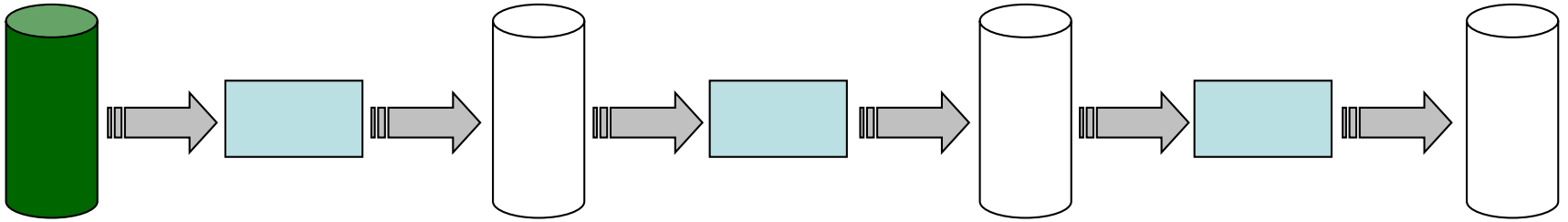

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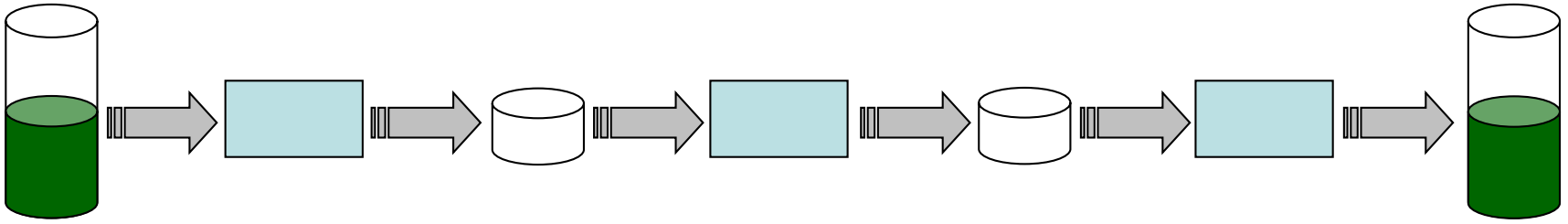

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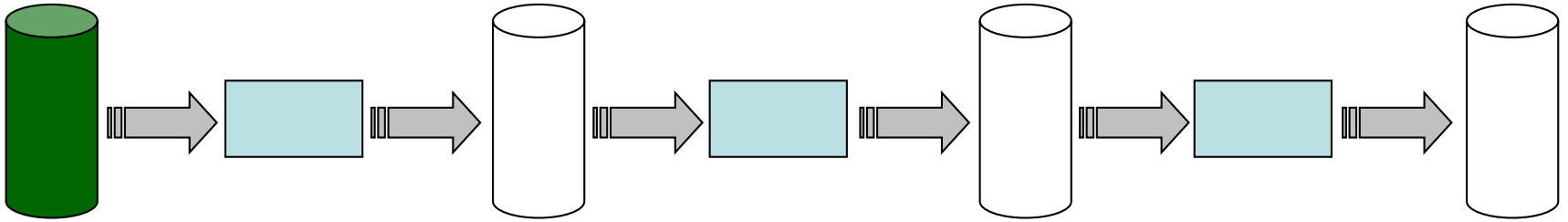

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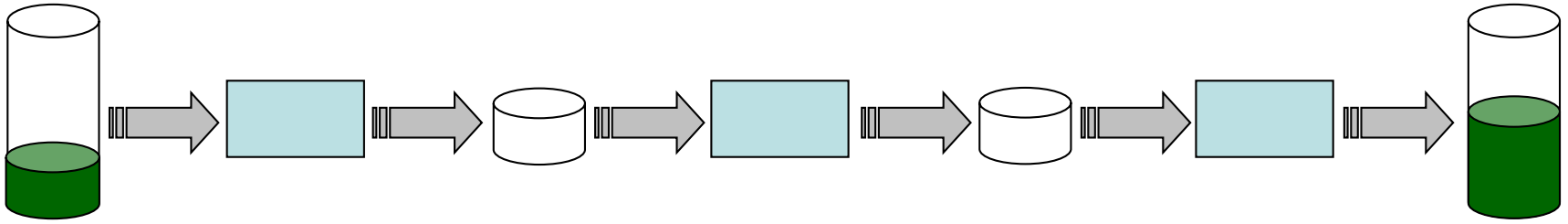

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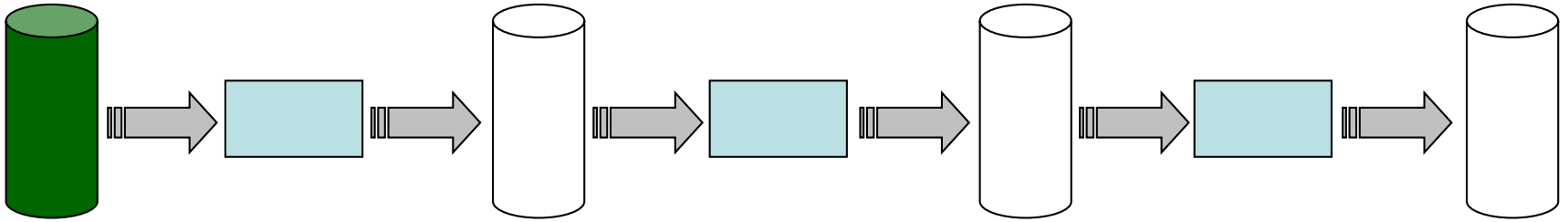

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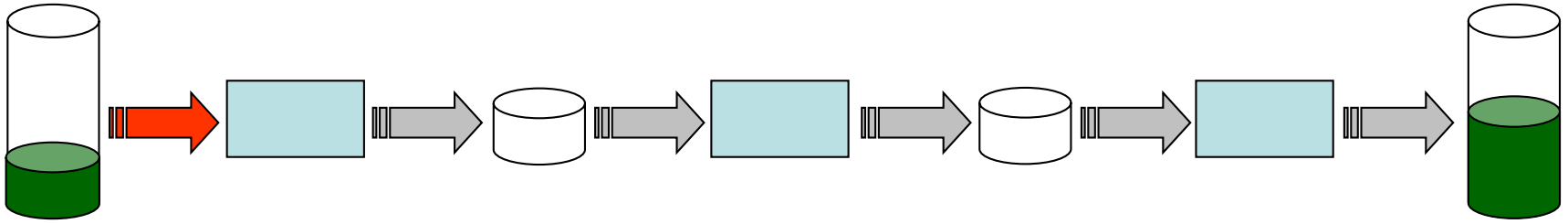

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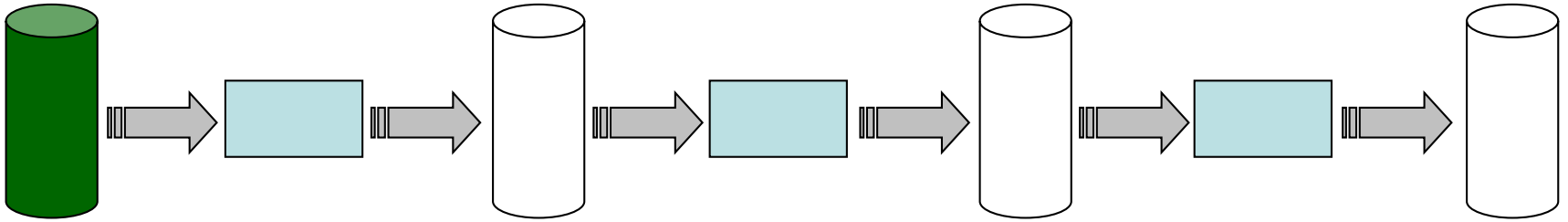

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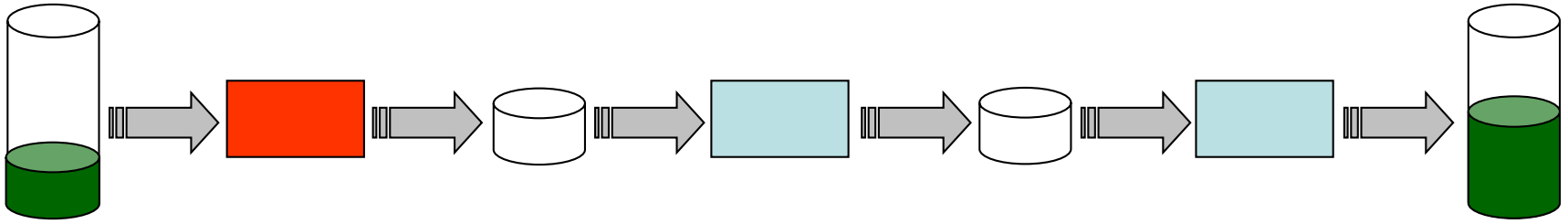

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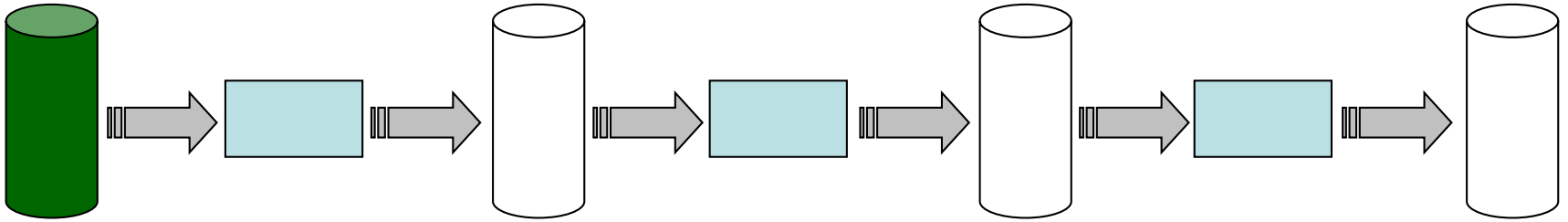

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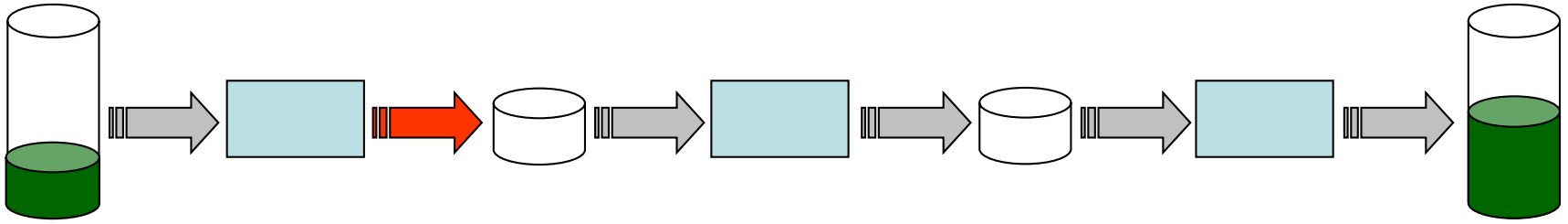

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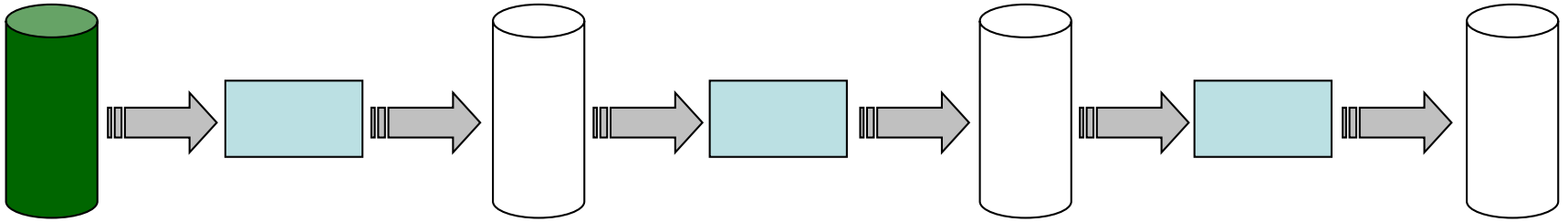

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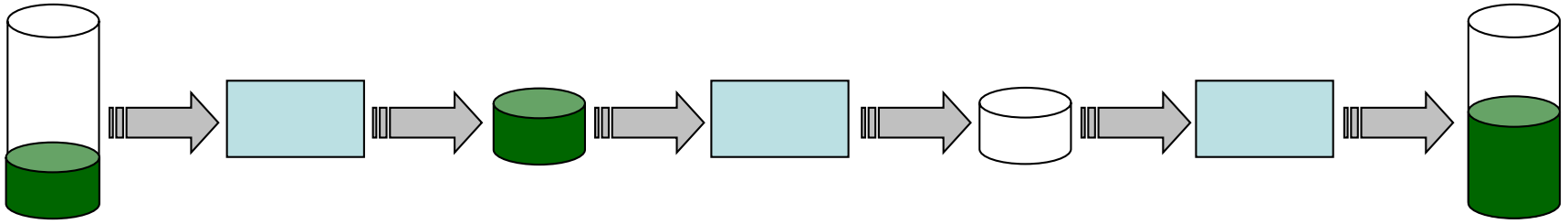

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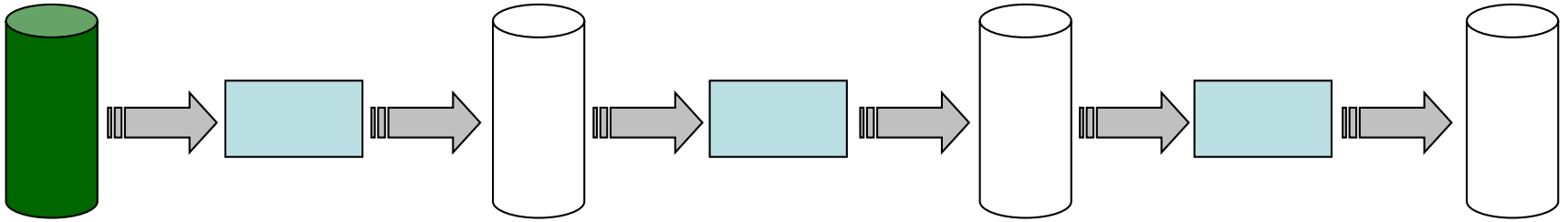

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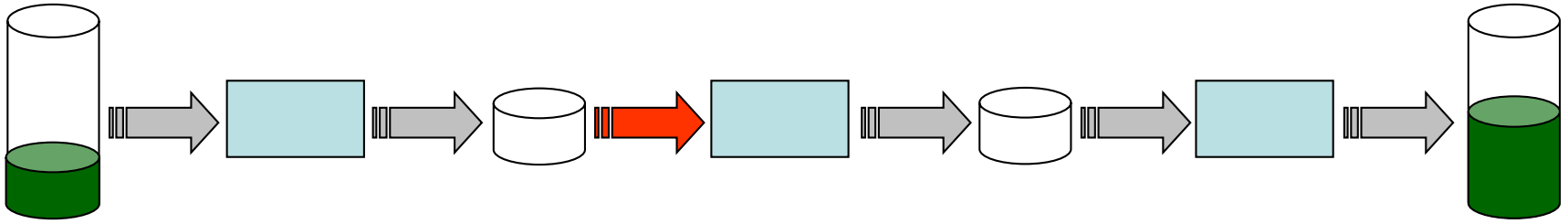

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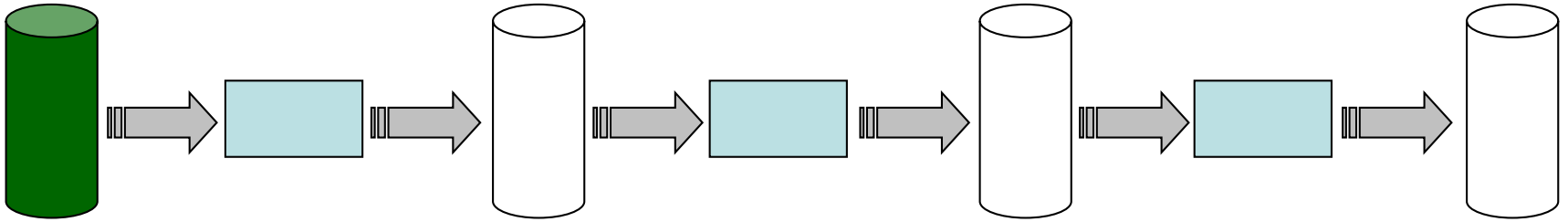

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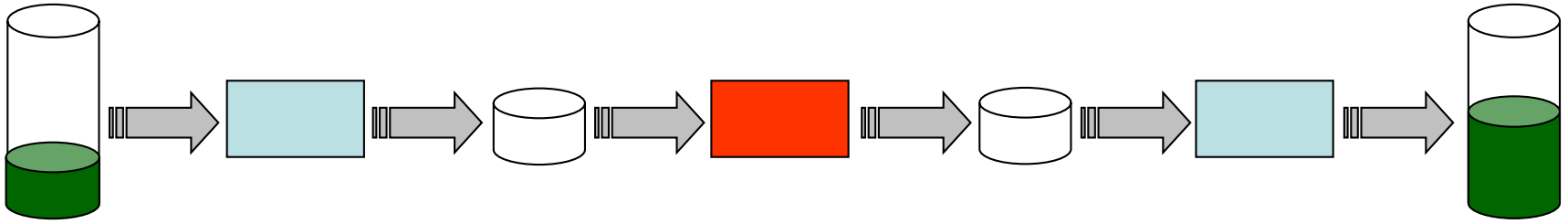

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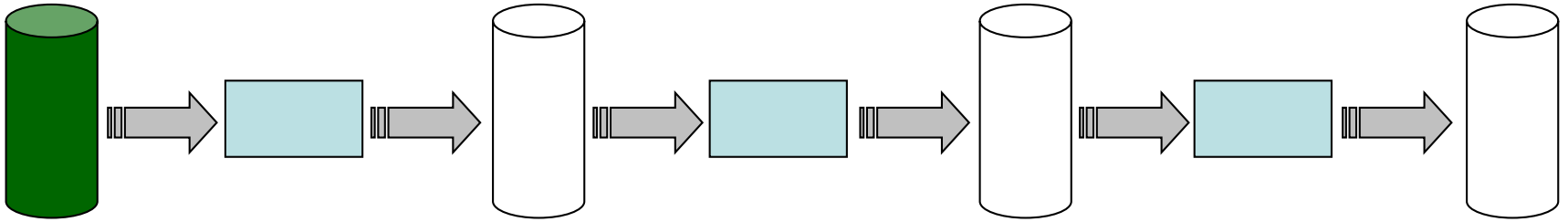

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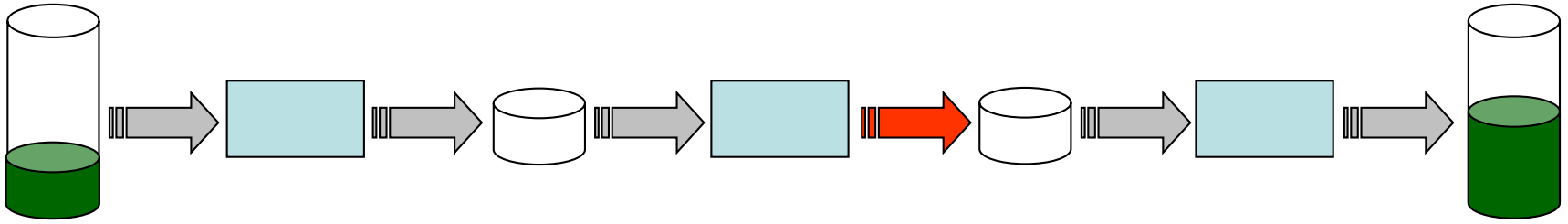

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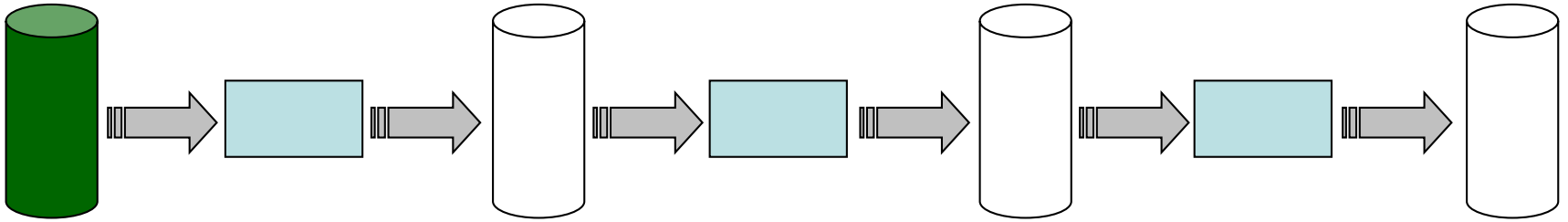

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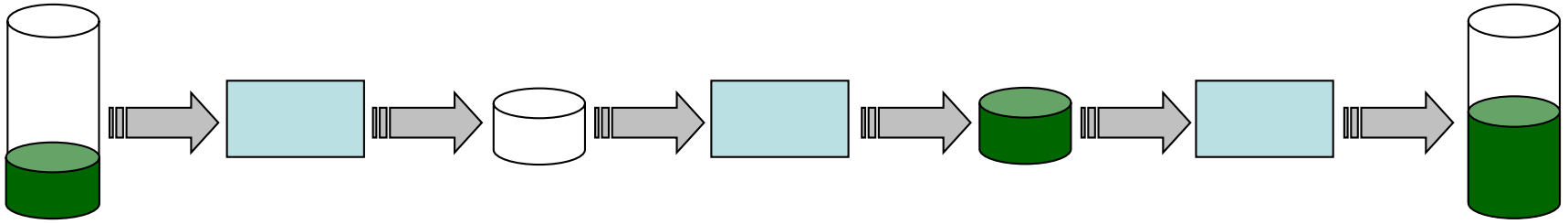

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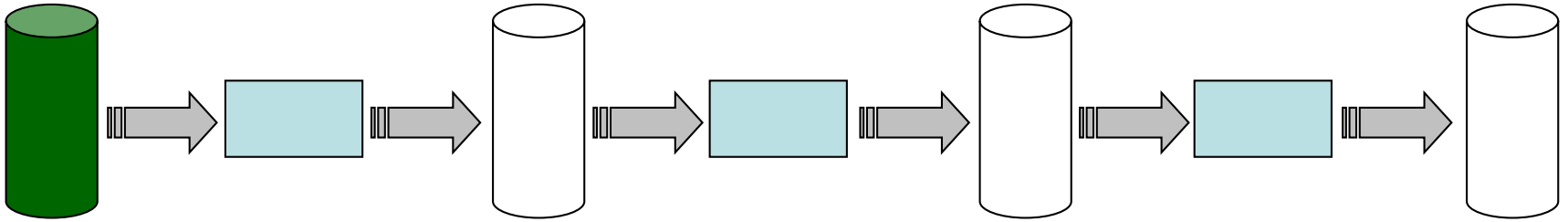

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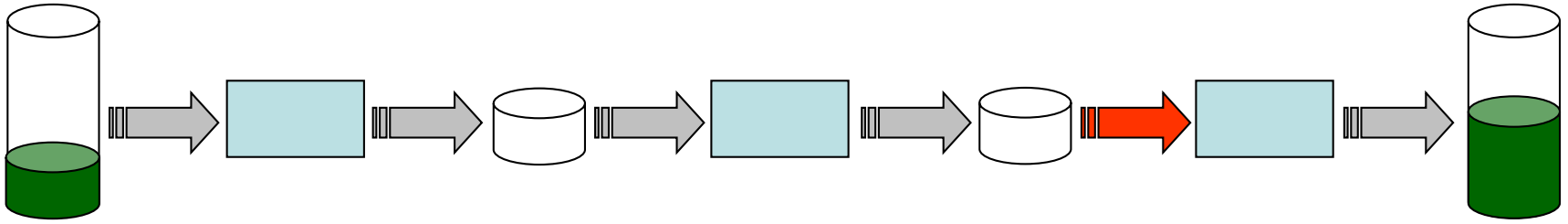

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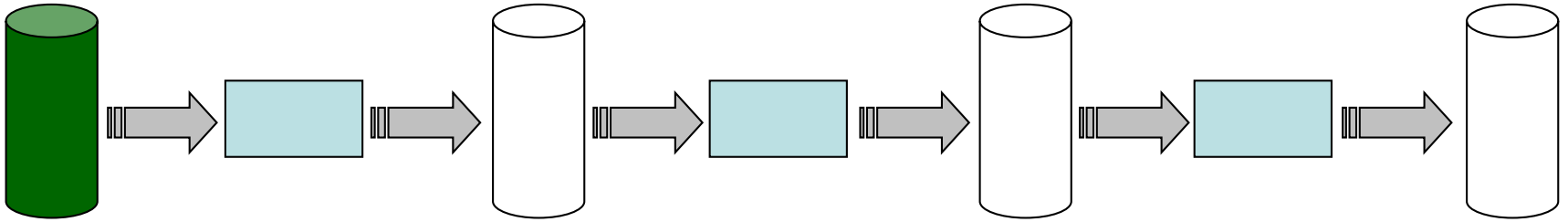

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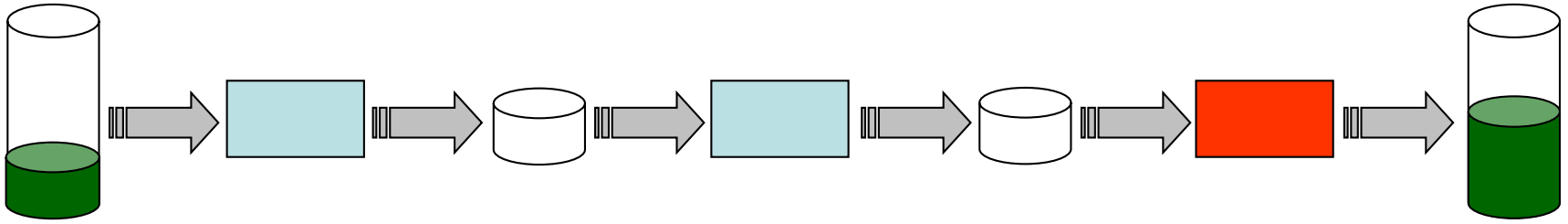

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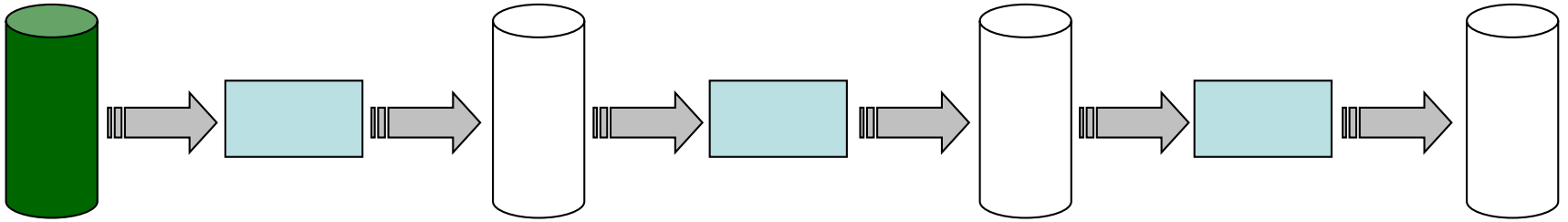

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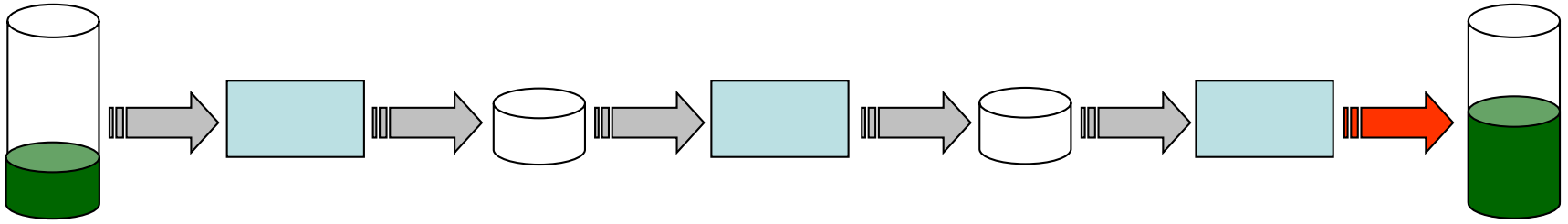

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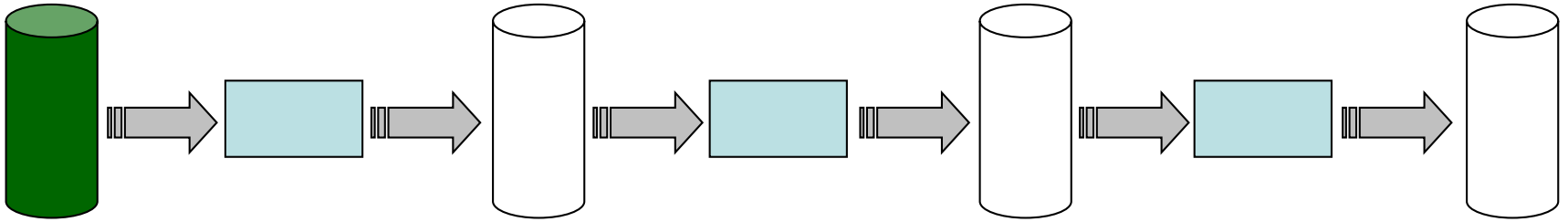

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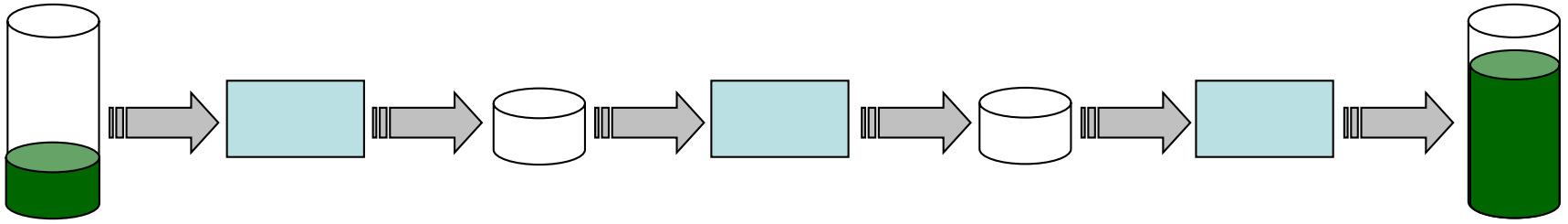

Pipe-line versus incremental processing

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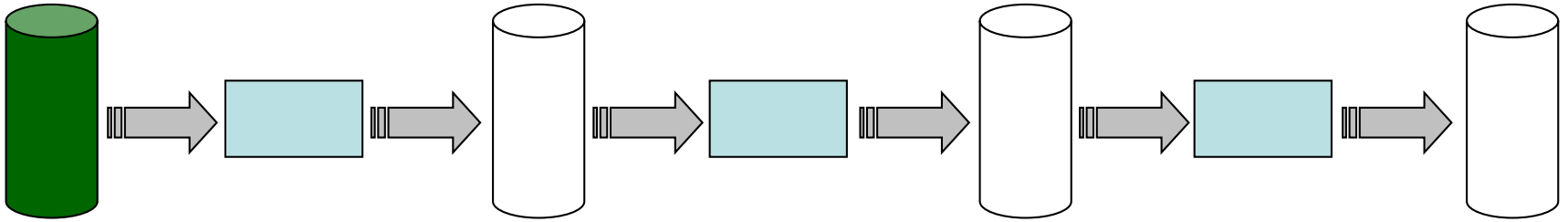

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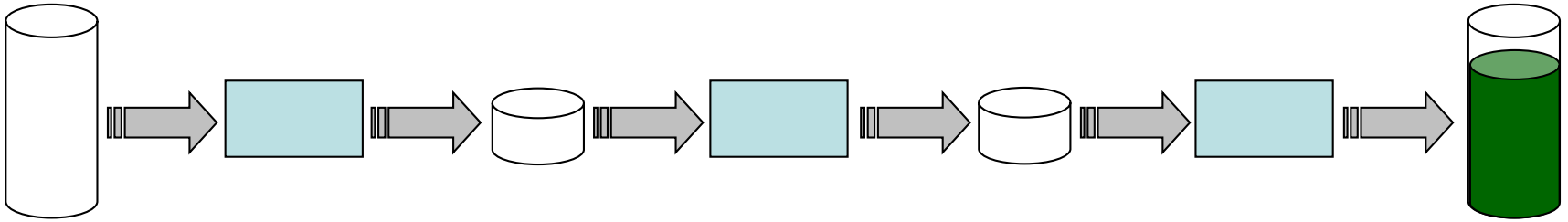

Pipe-line versus incremental processing

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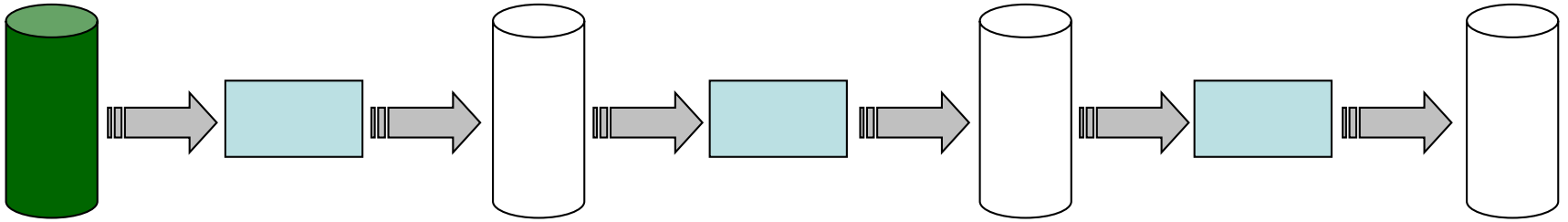

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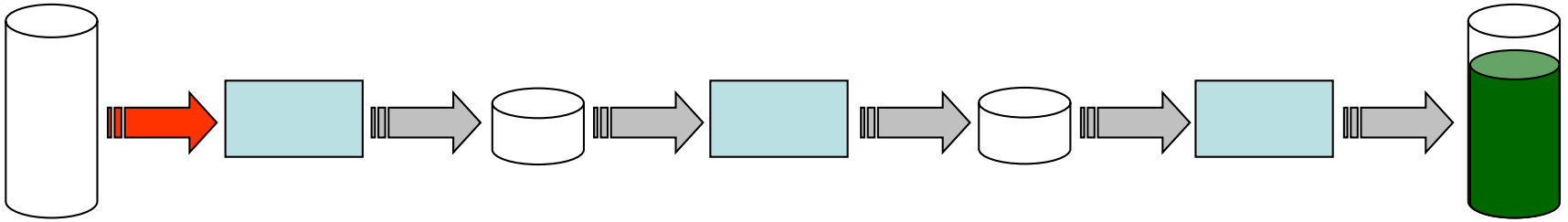

Pipe-line versus incremental processing

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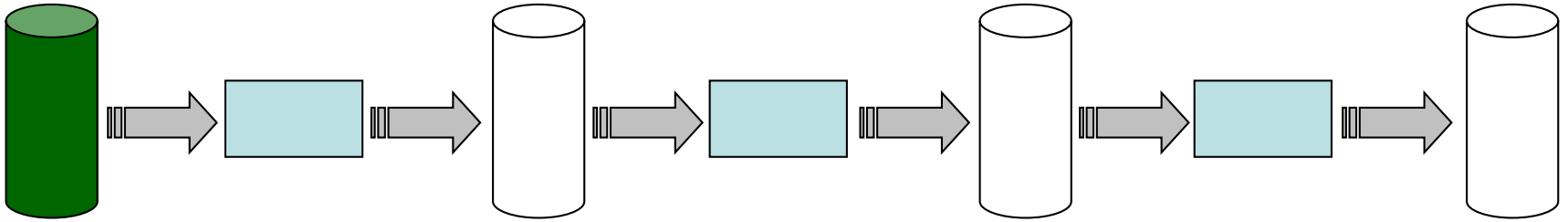

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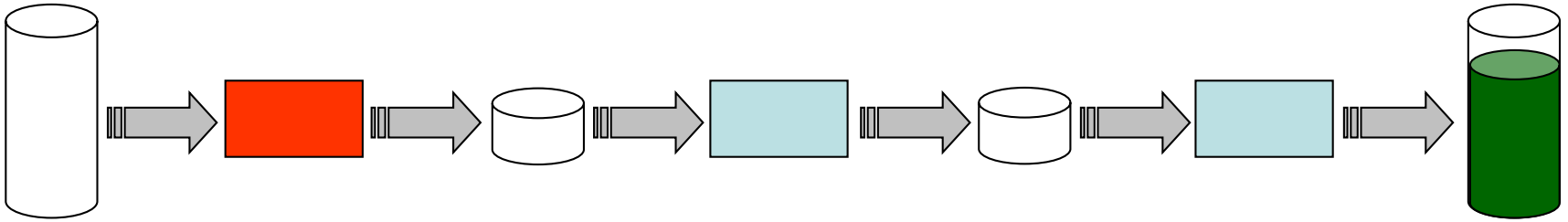

Pipe-line versus incremental processing

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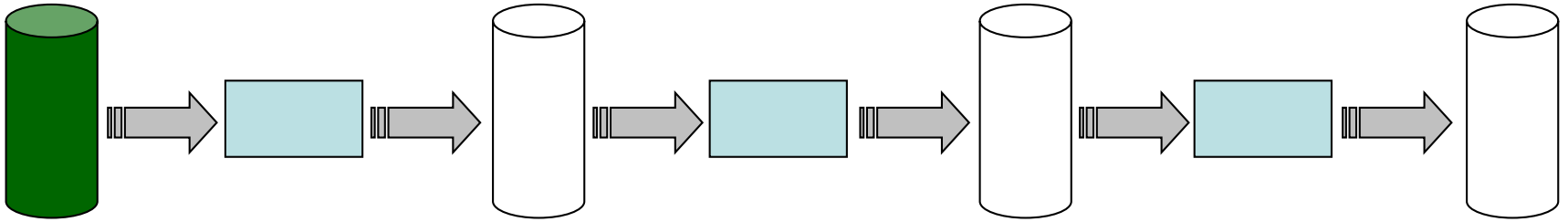

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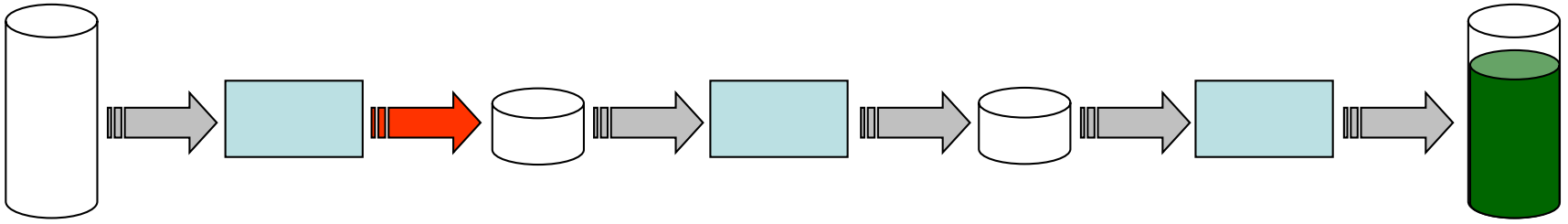

Pipe-line versus incremental processing

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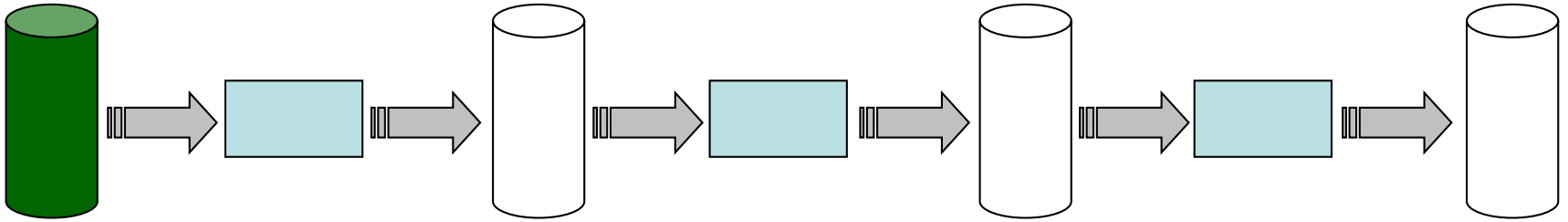

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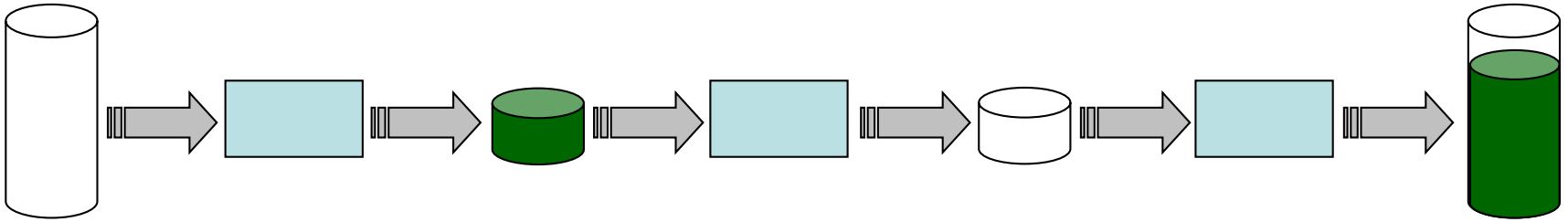

Pipe-line versus incremental processing

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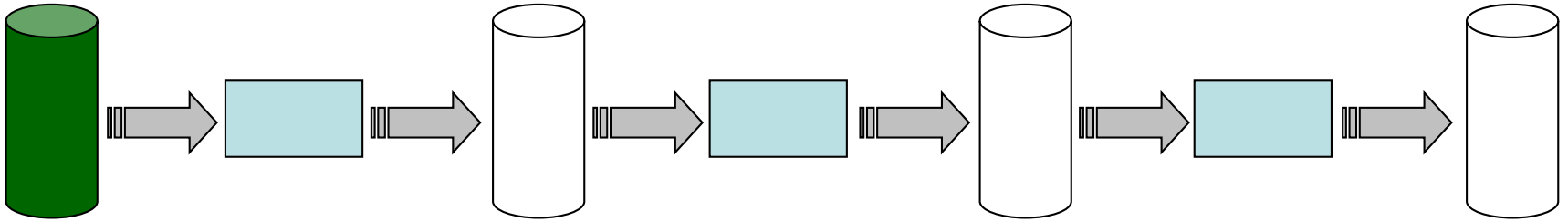

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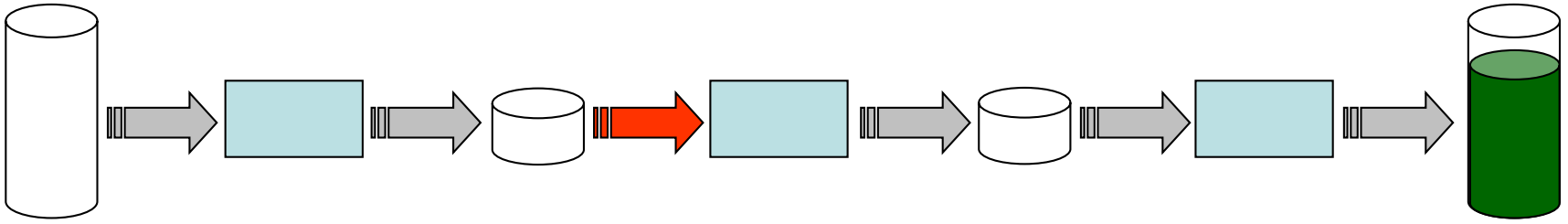

Pipe-line versus incremental processing

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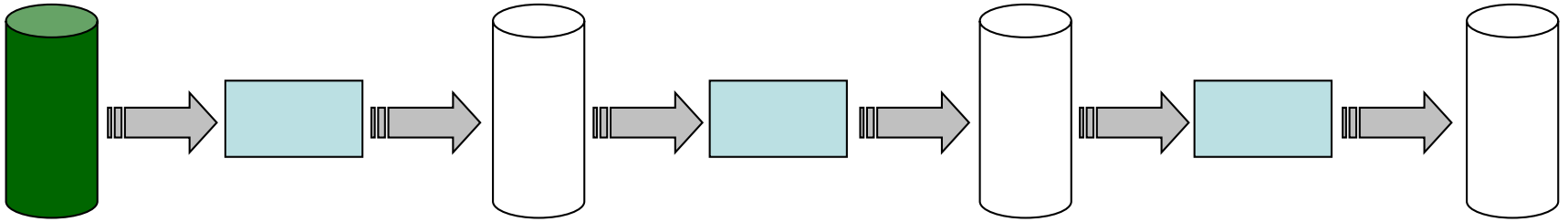

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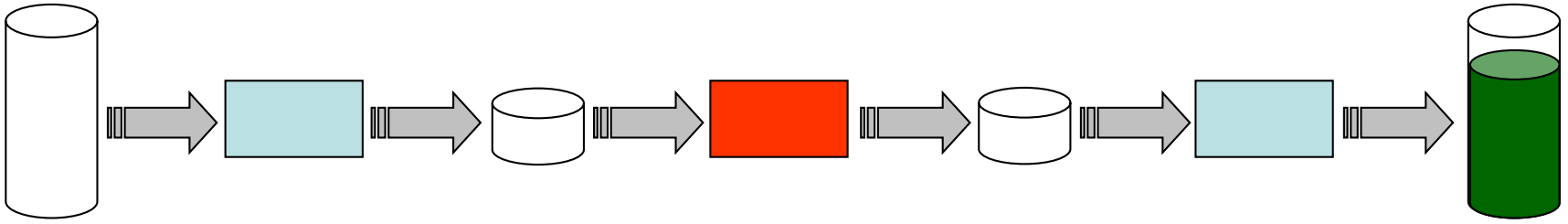

Pipe-line versus incremental processing

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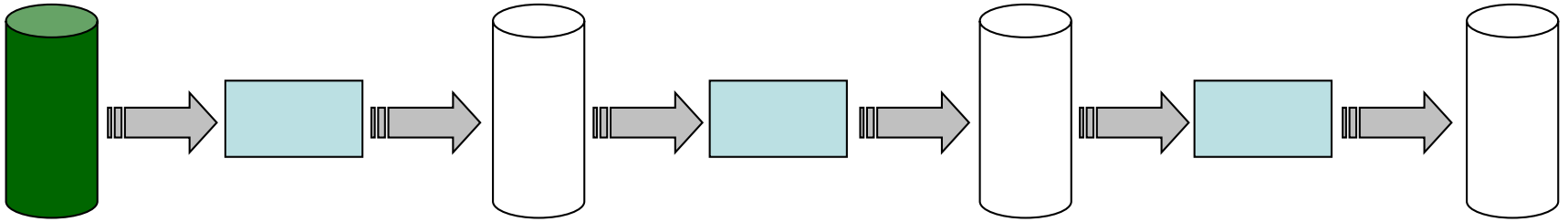

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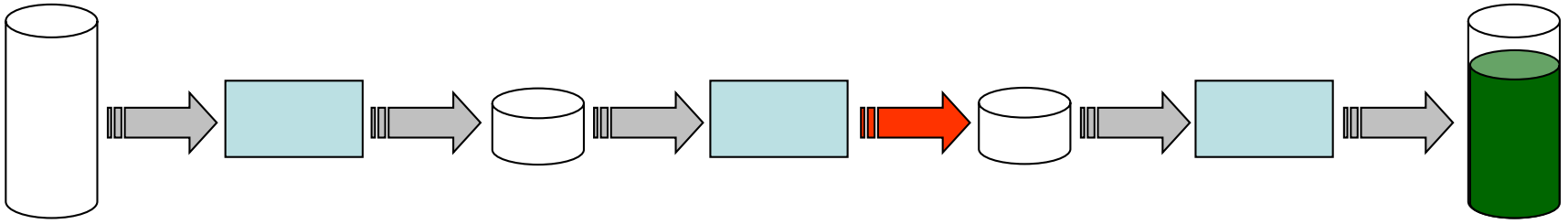
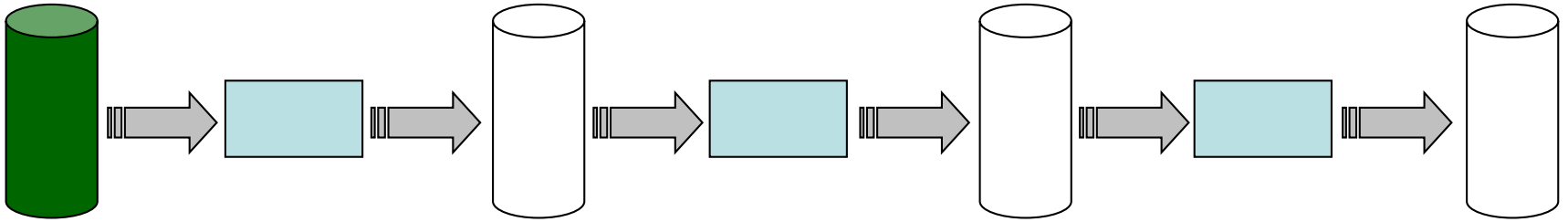


Pipe-line versus incremental processing

pipe-line



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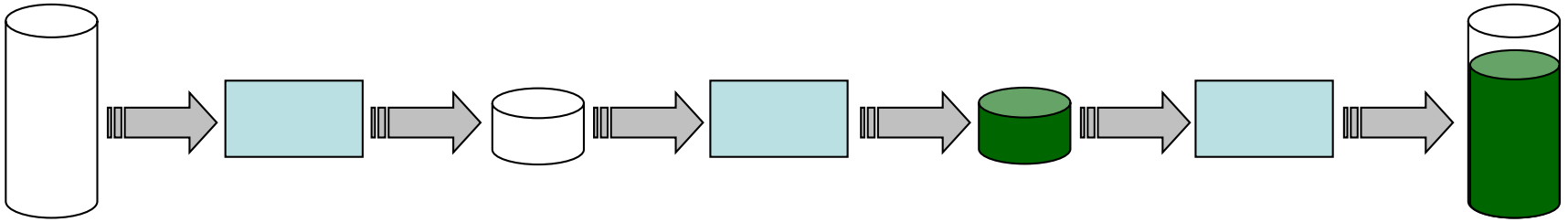

Pipe-line versus incremental processing

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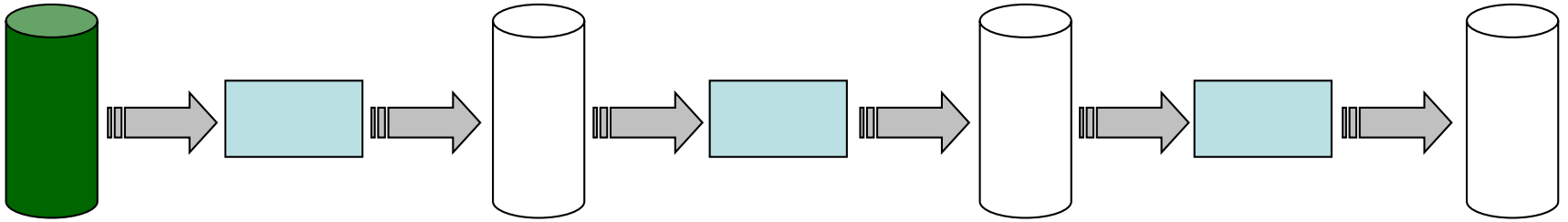

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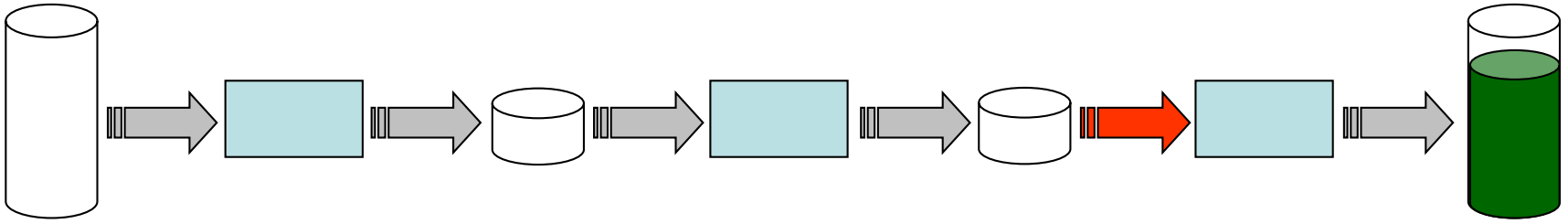

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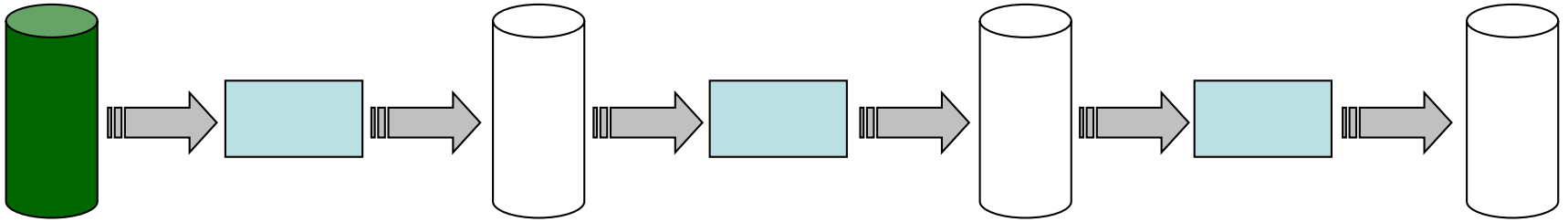

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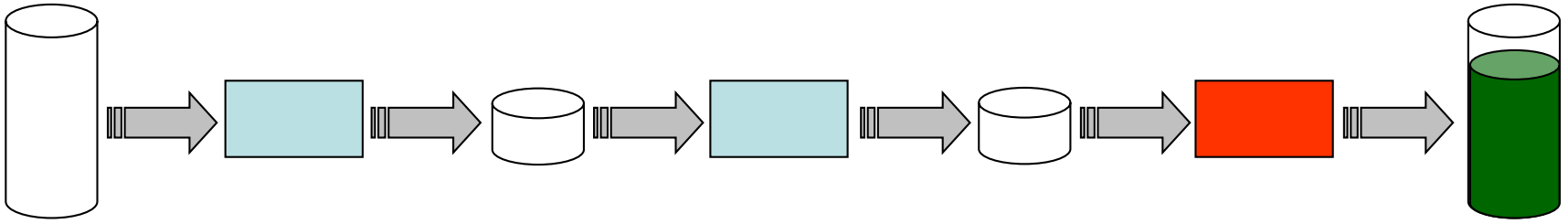

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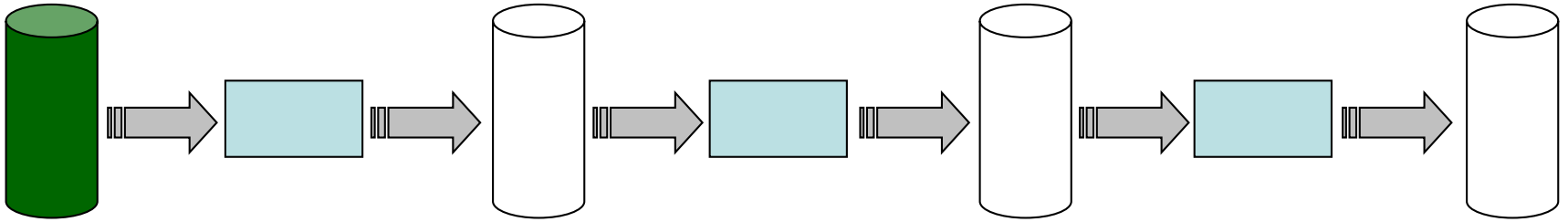

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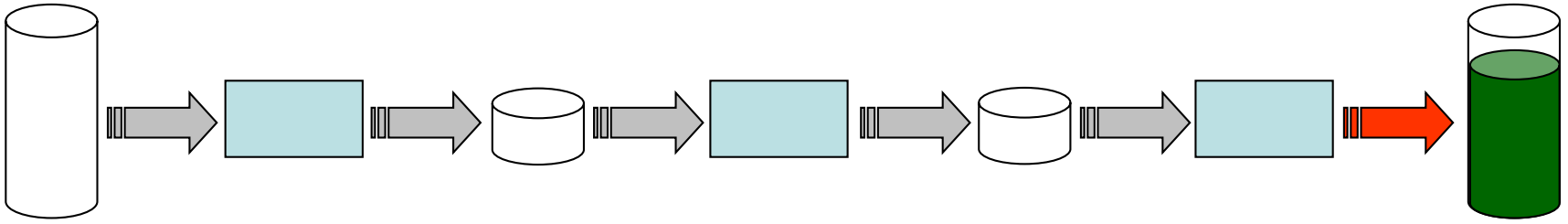

Pipe-line versus incremental processing

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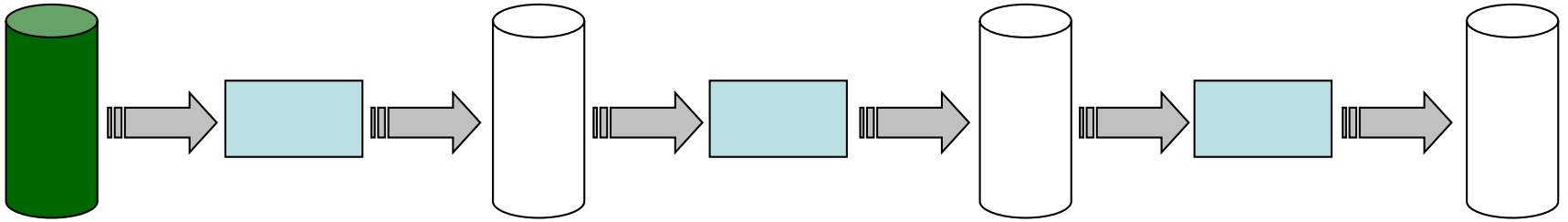

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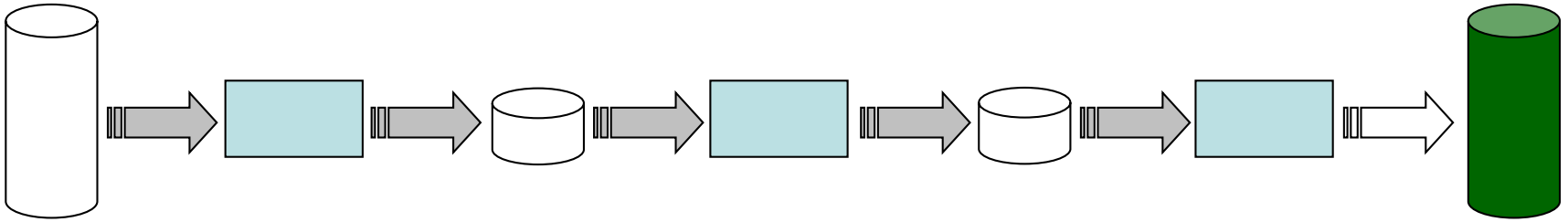

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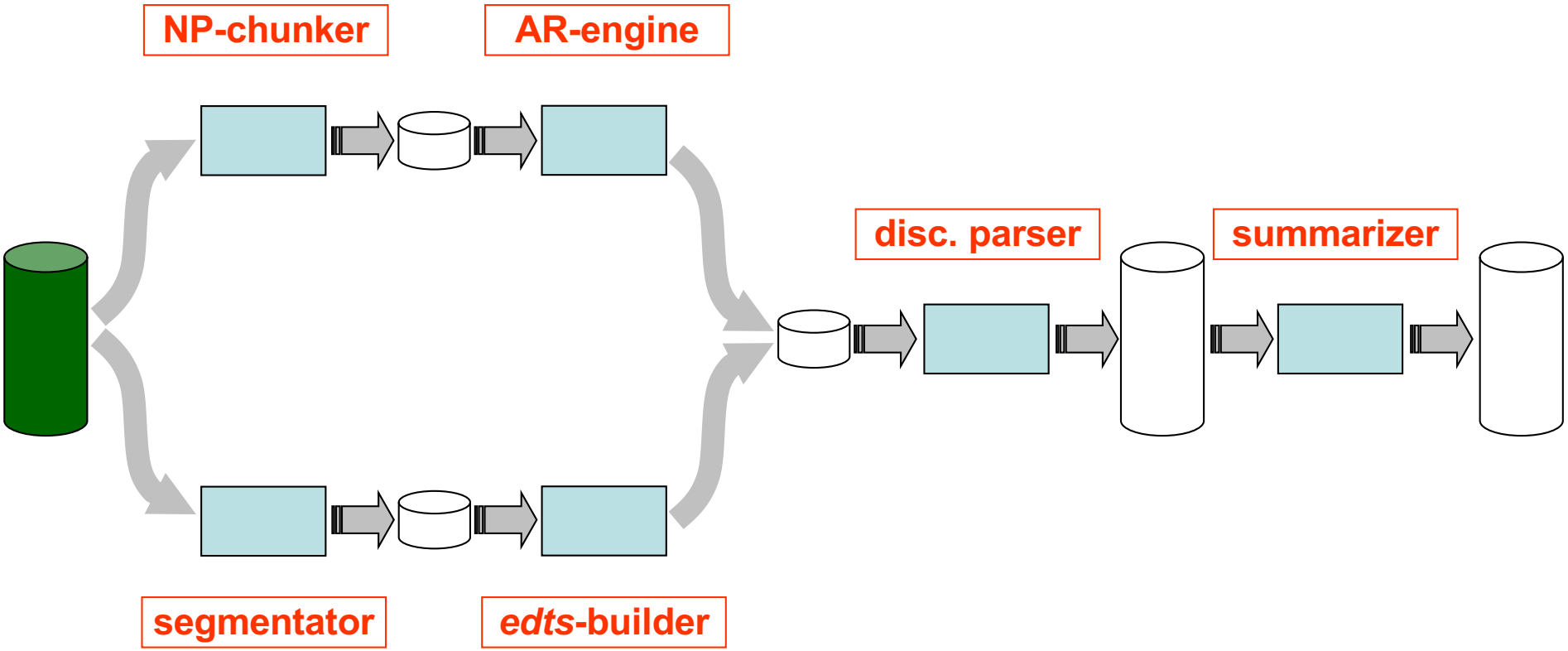
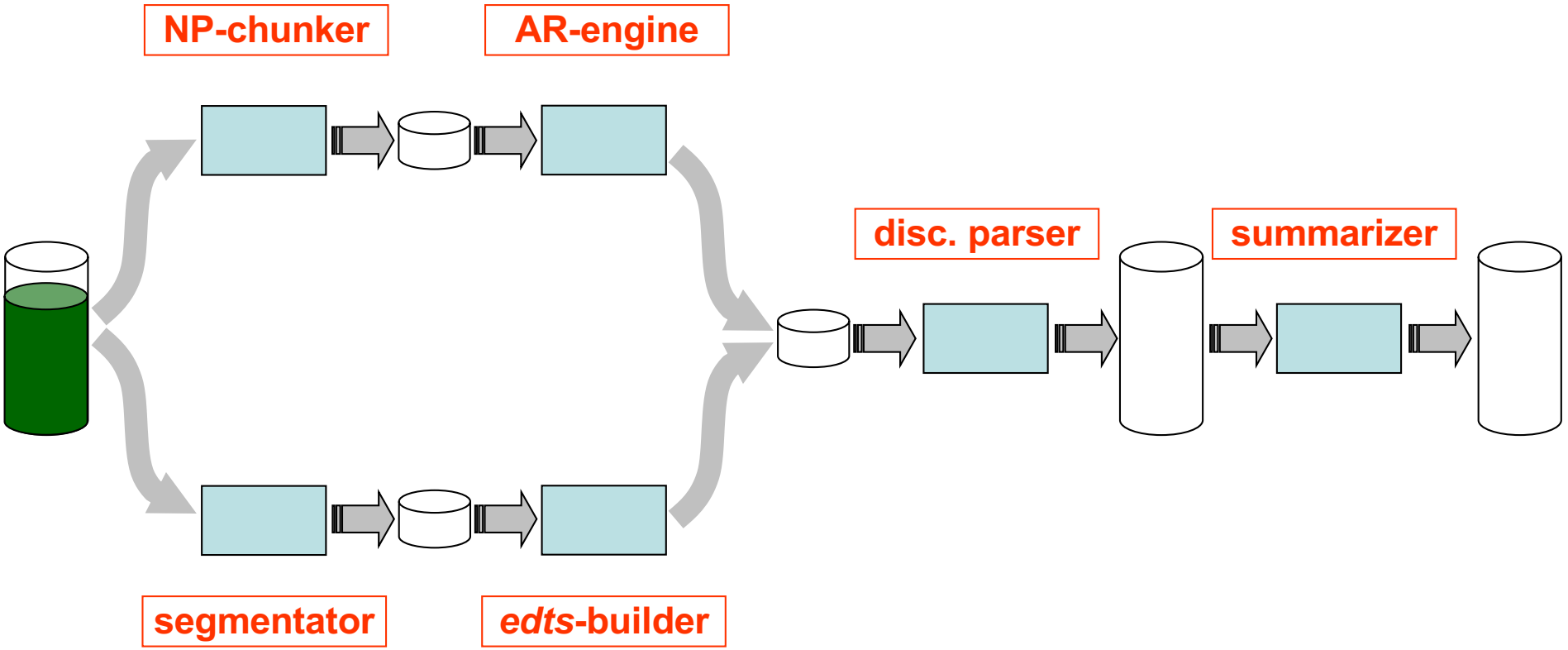


Processing: incremental parallel combined with pipe-line



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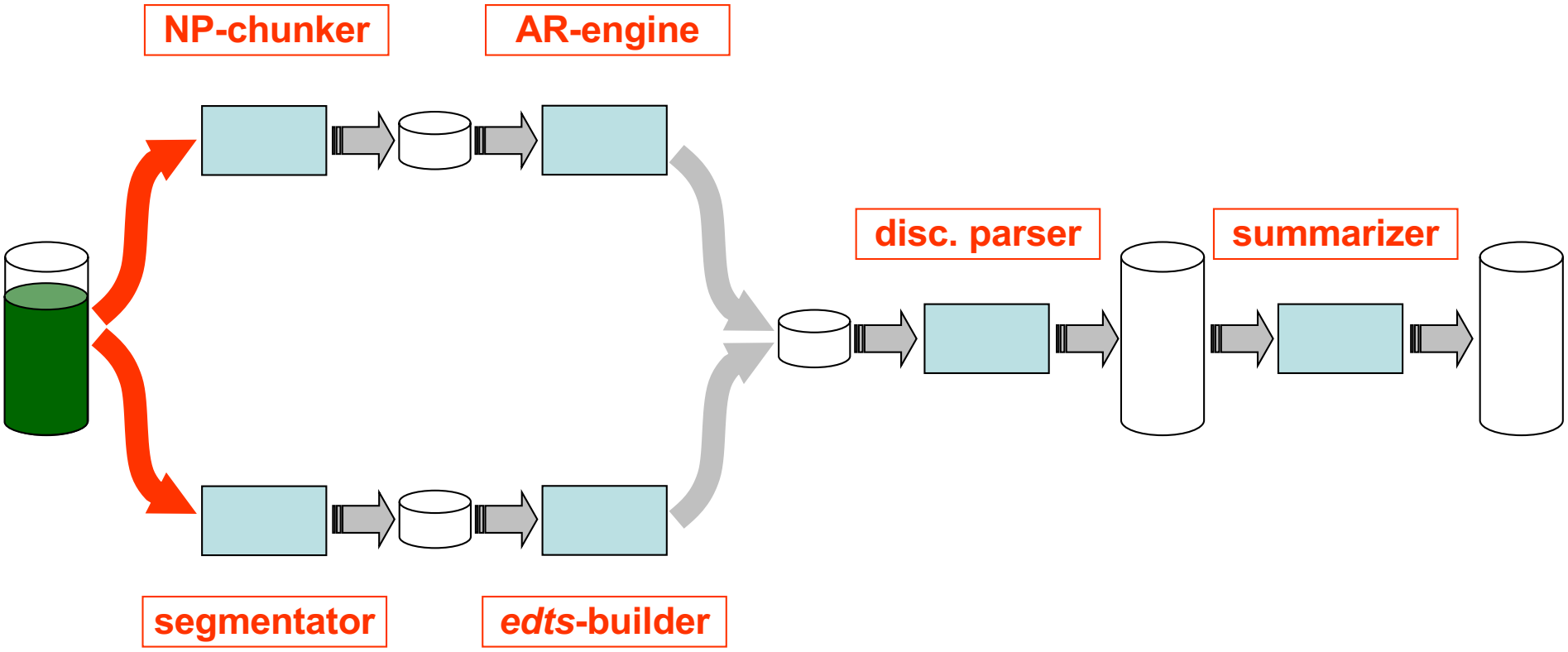

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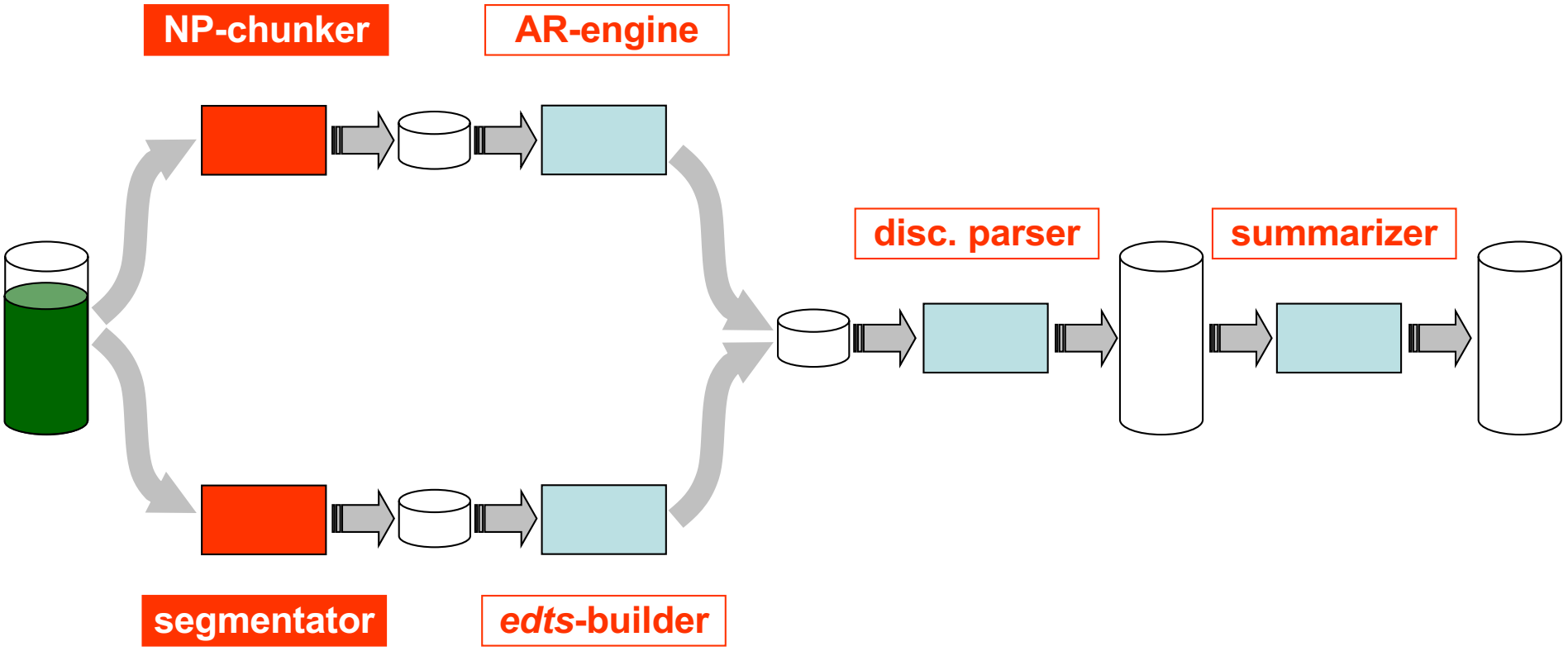

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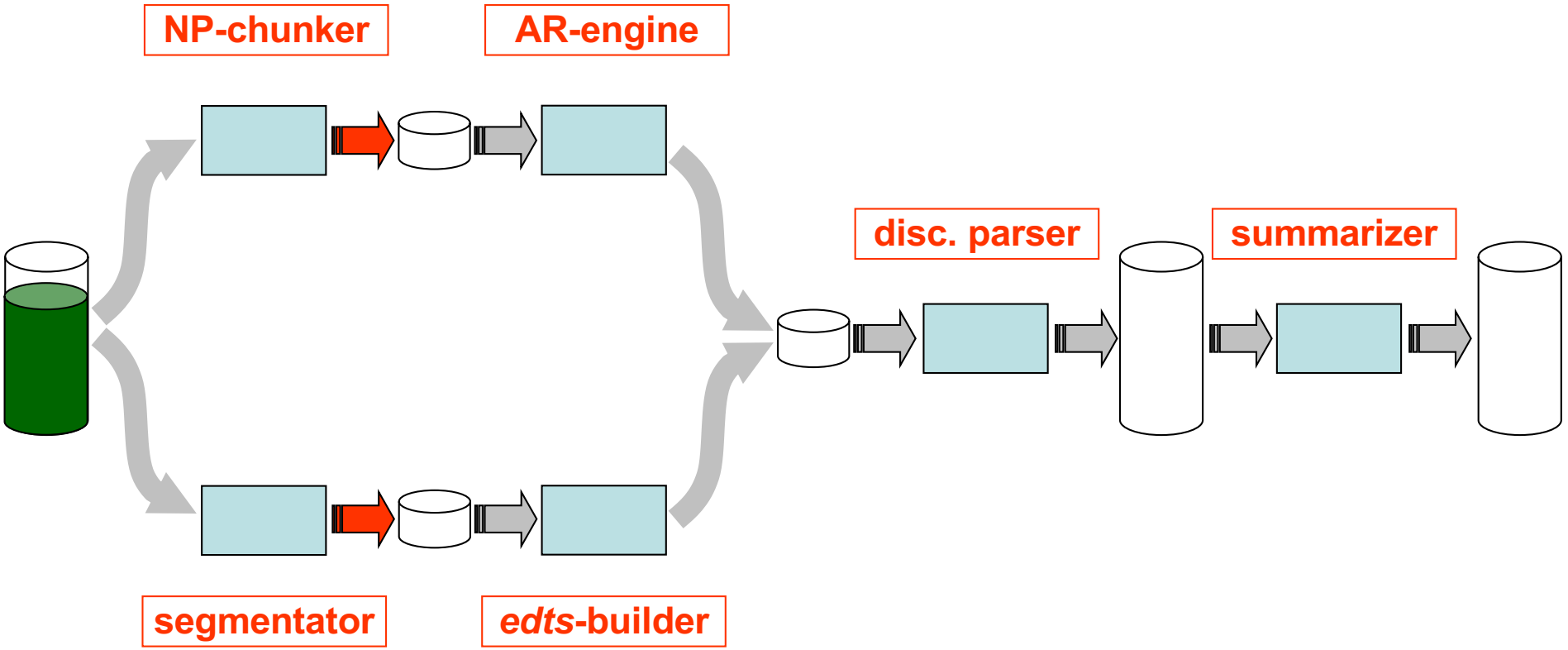

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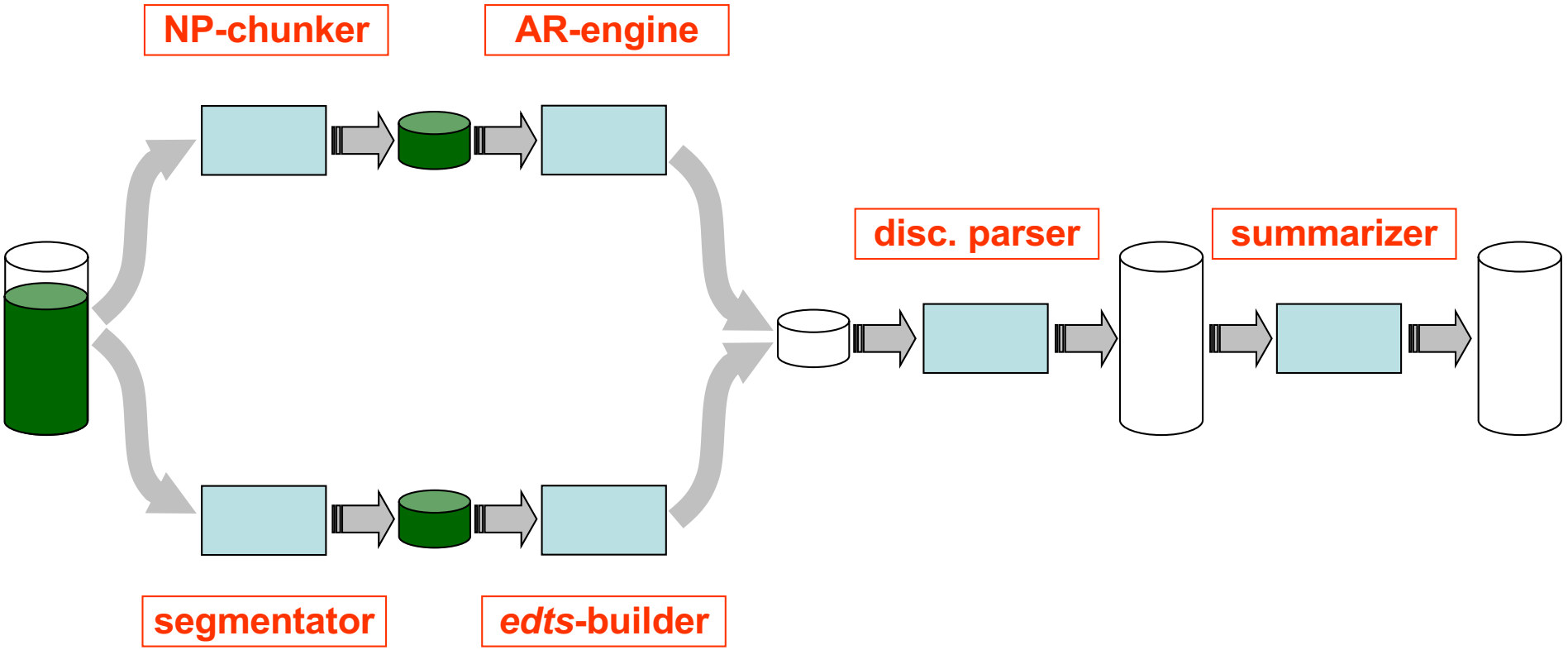

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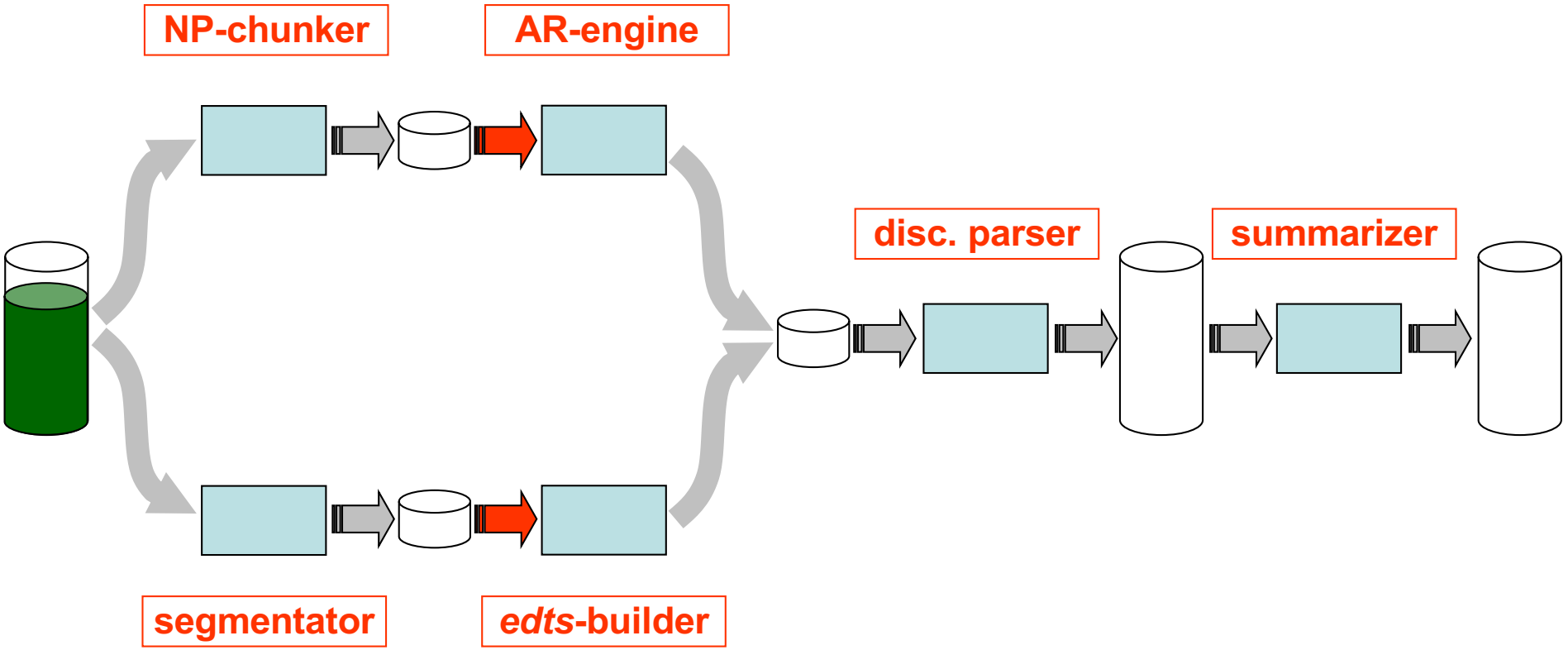

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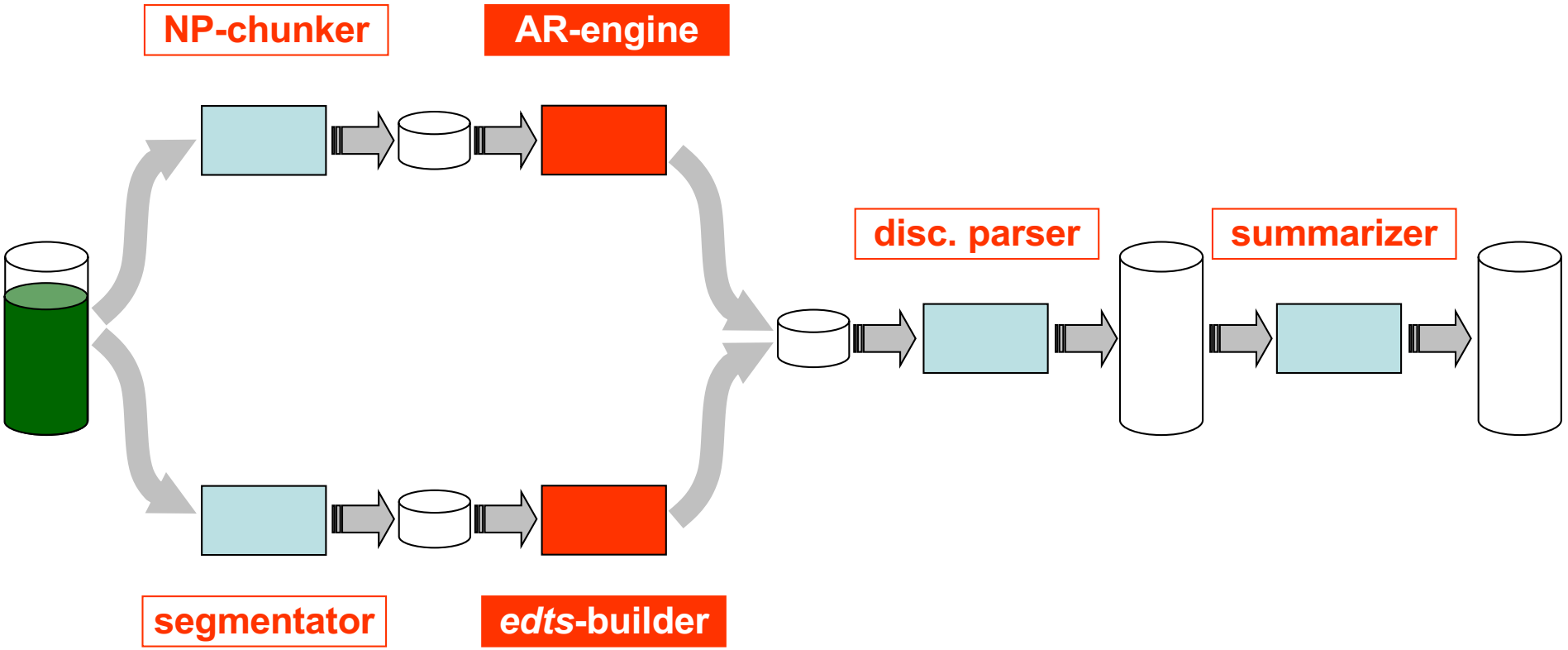

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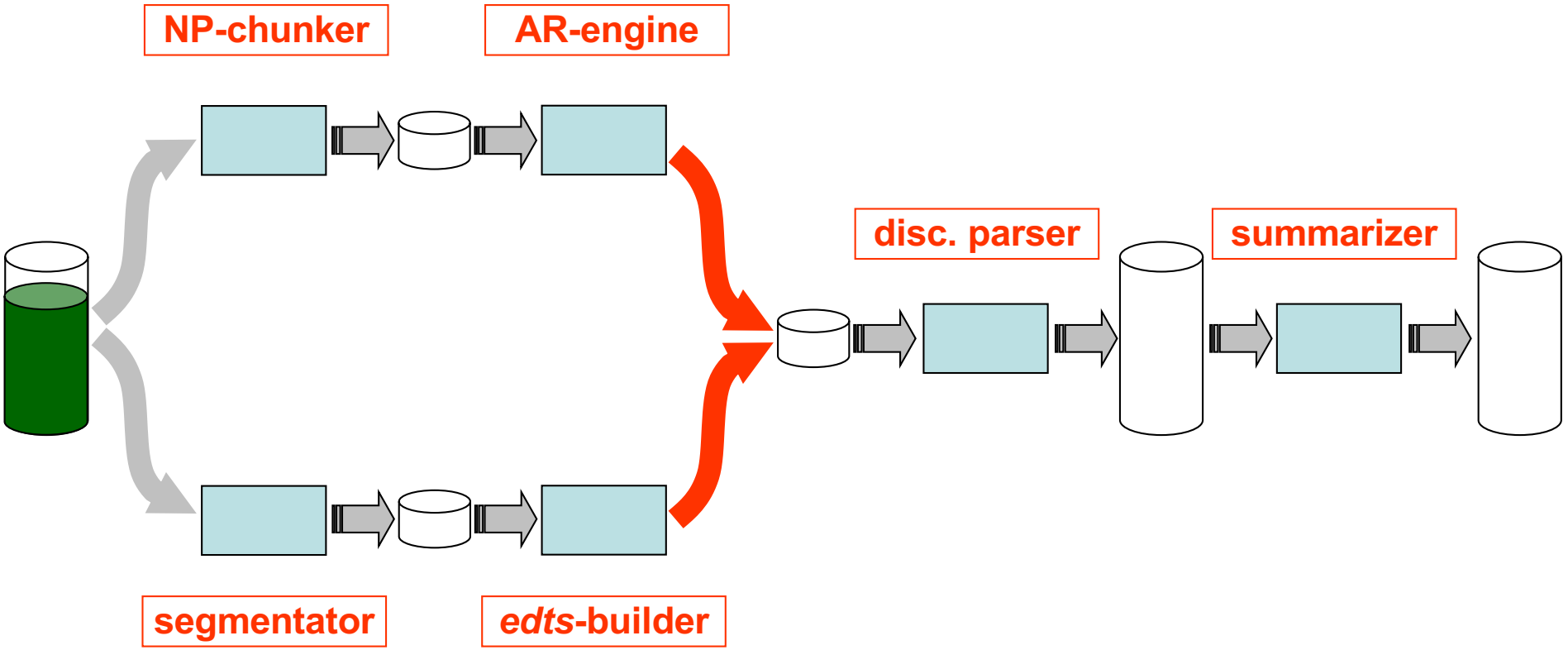

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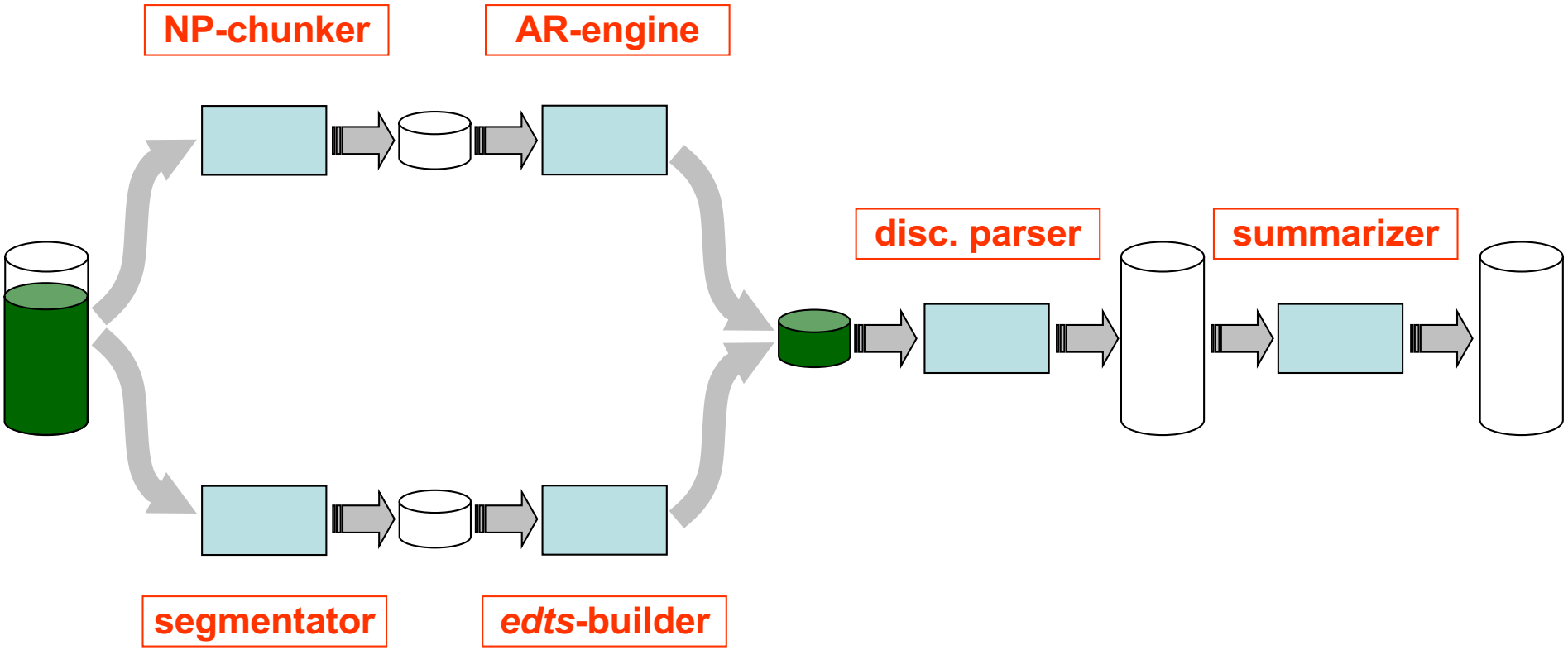

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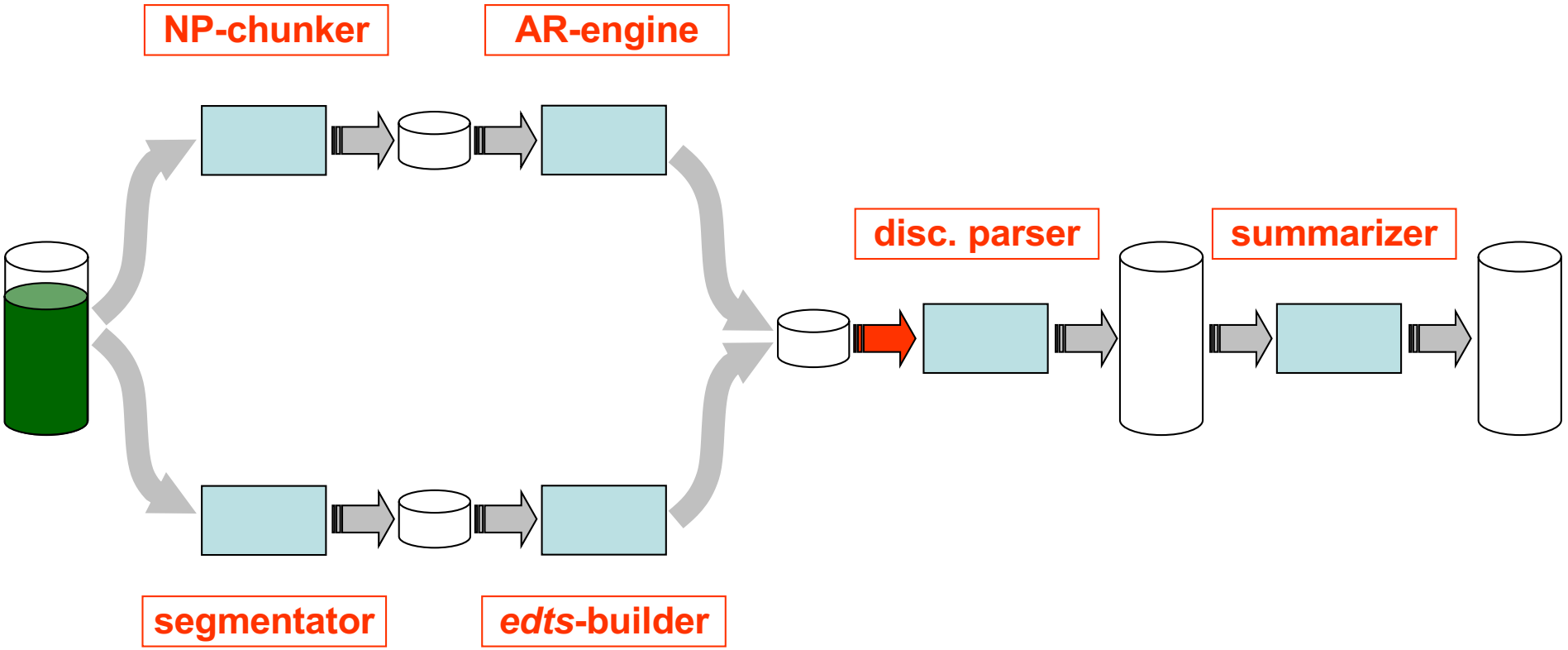

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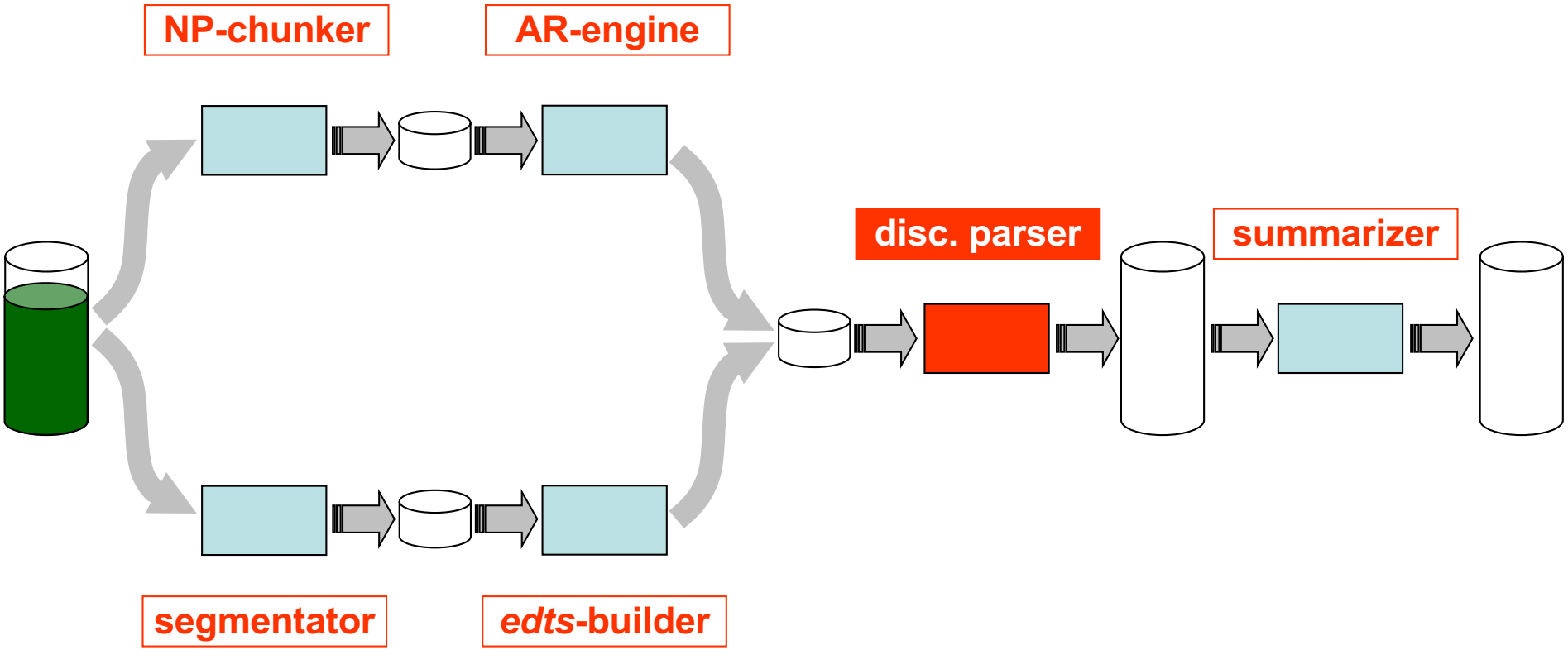

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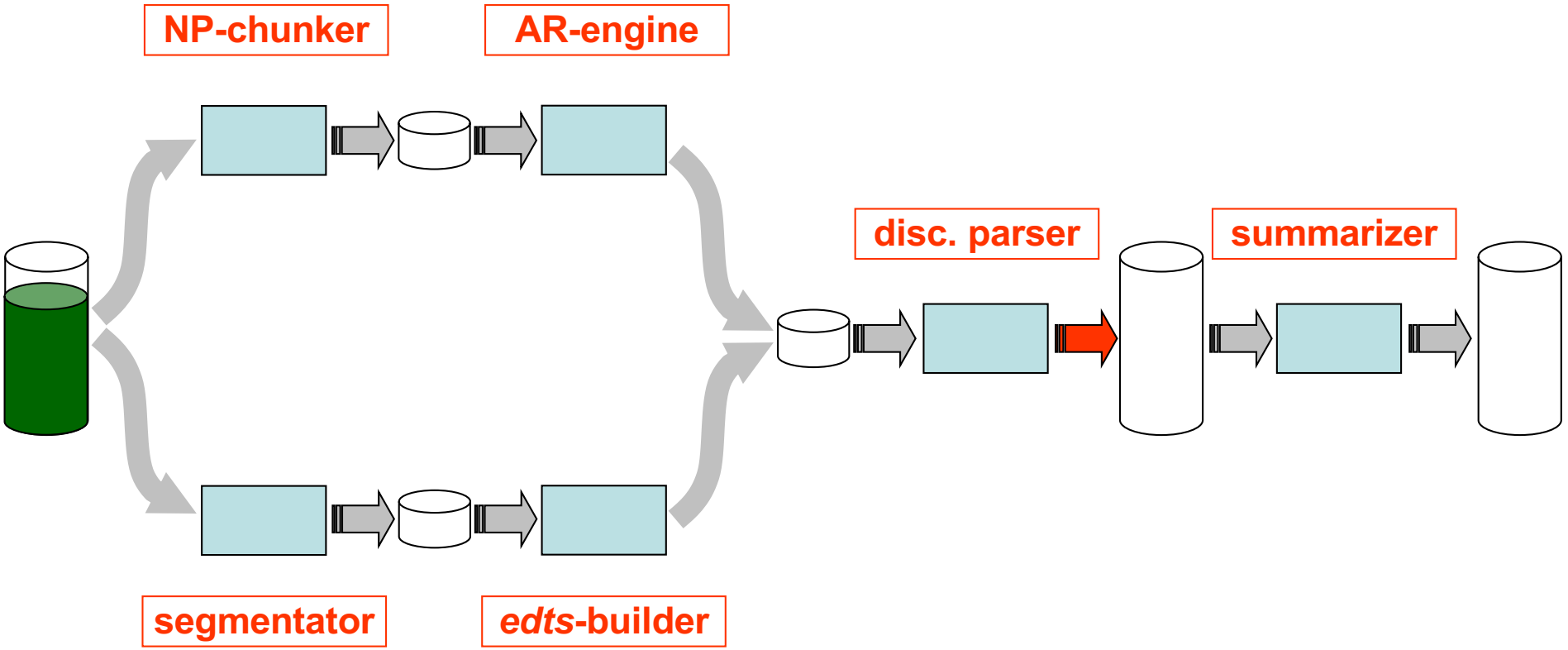

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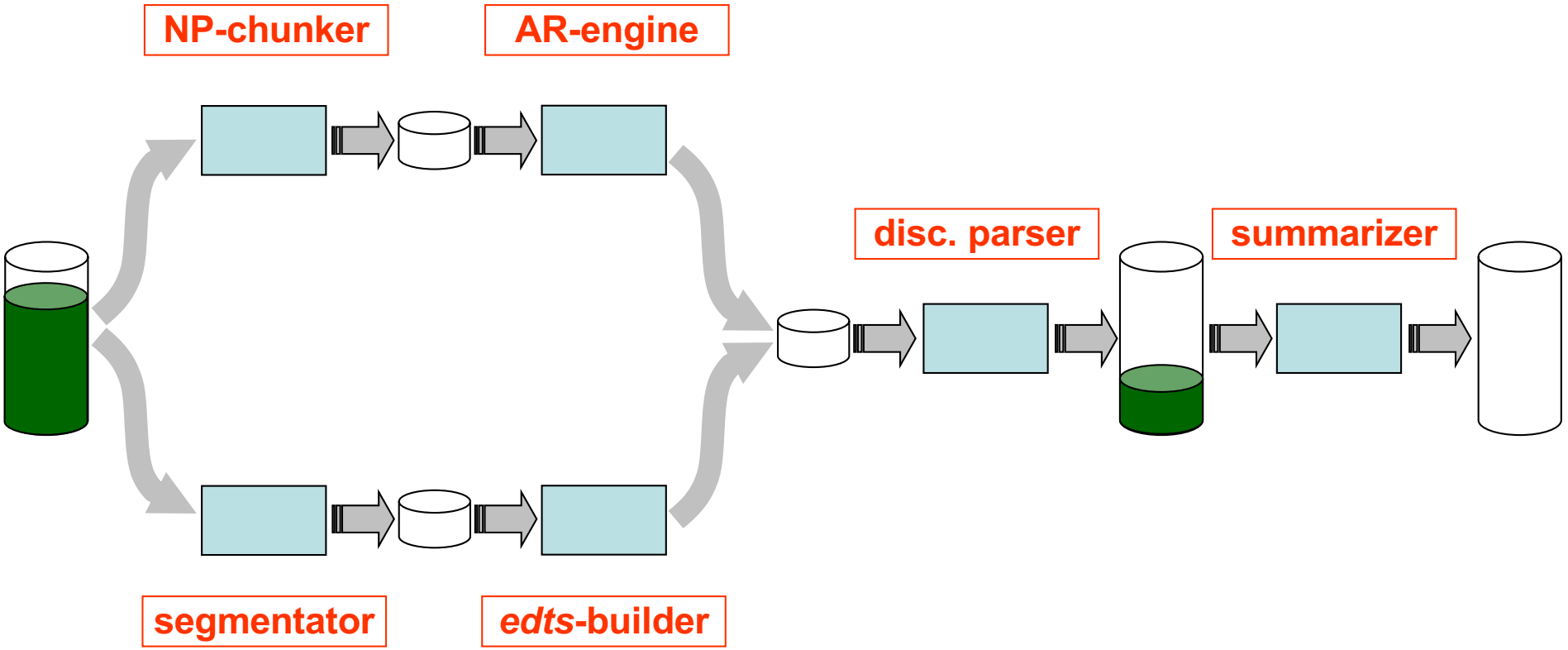

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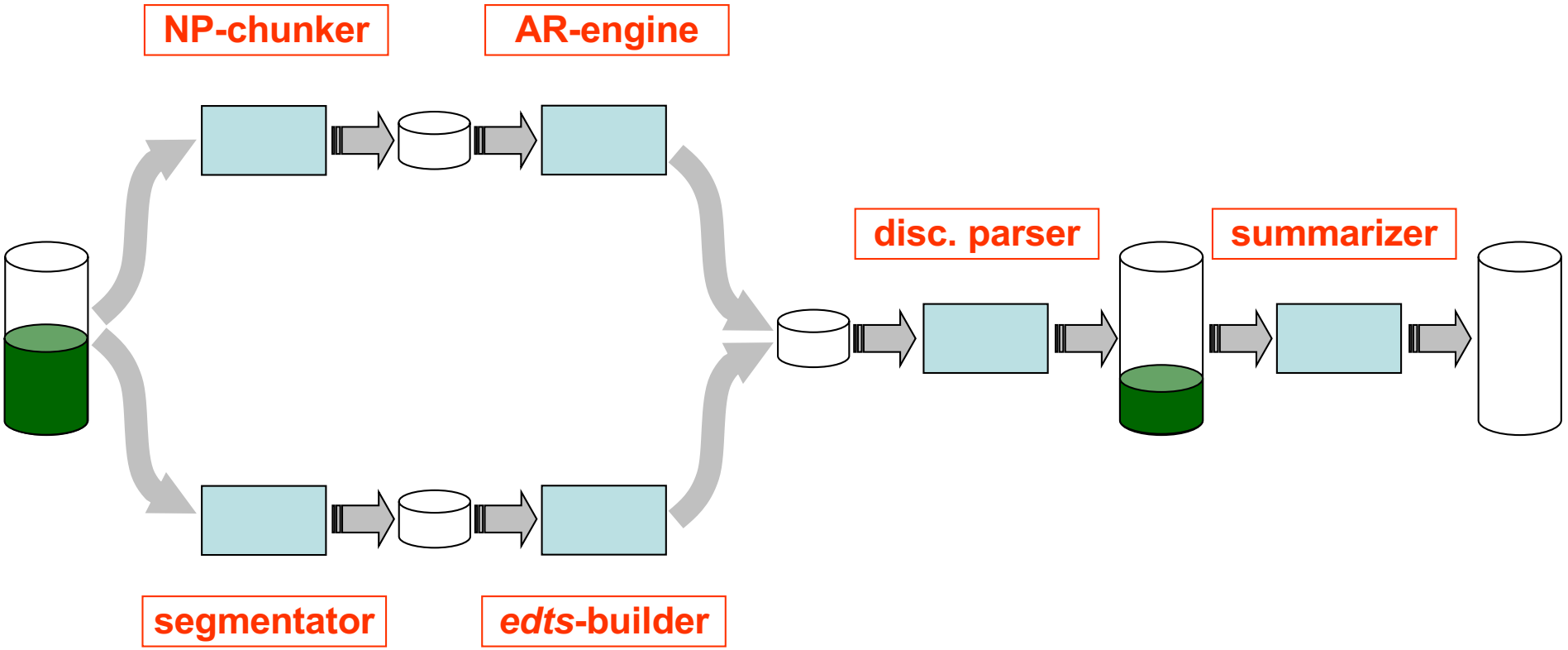

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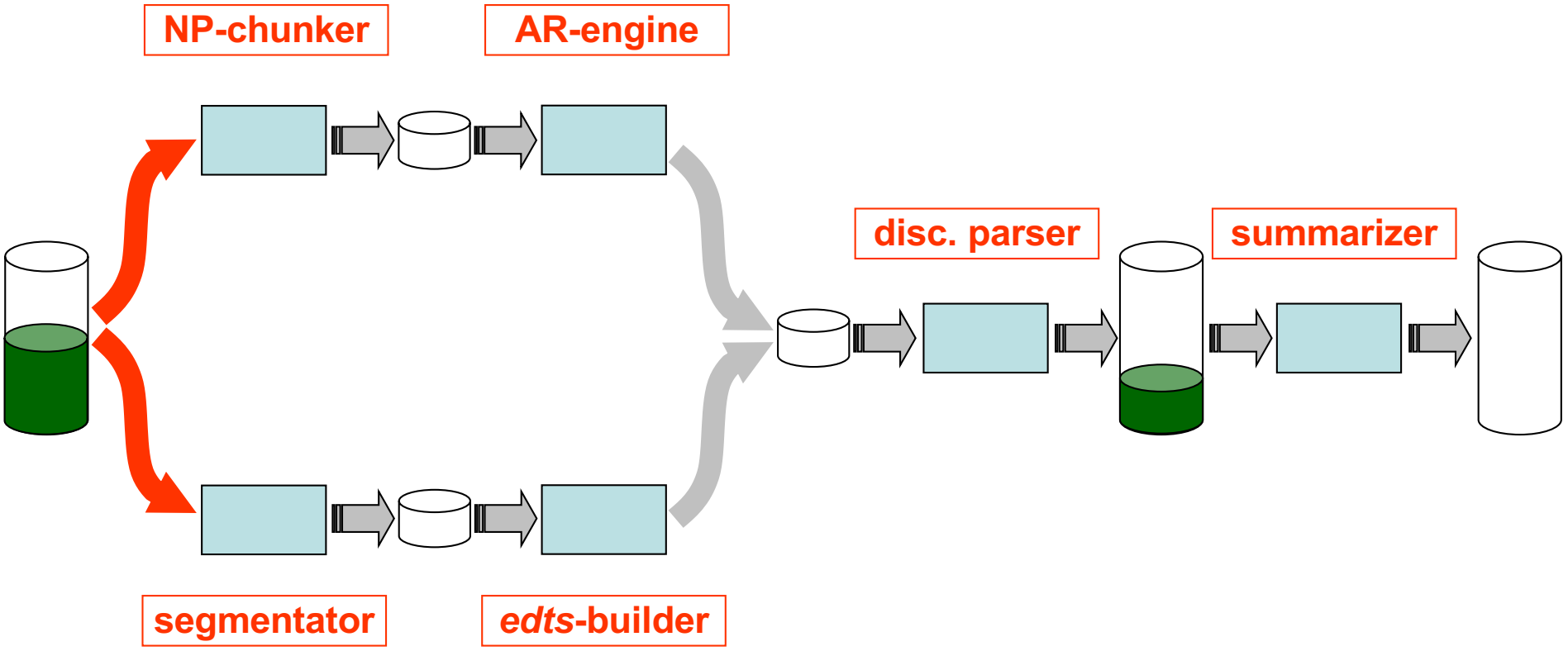

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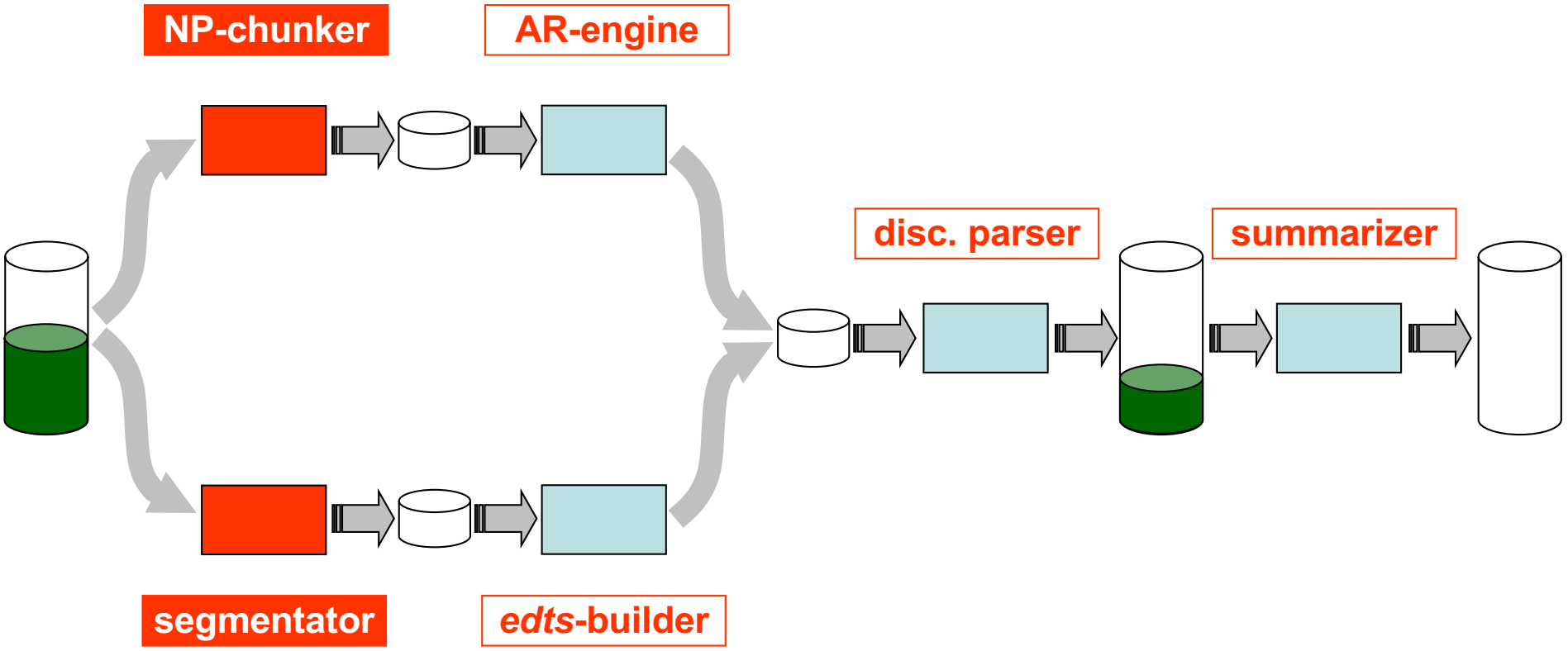

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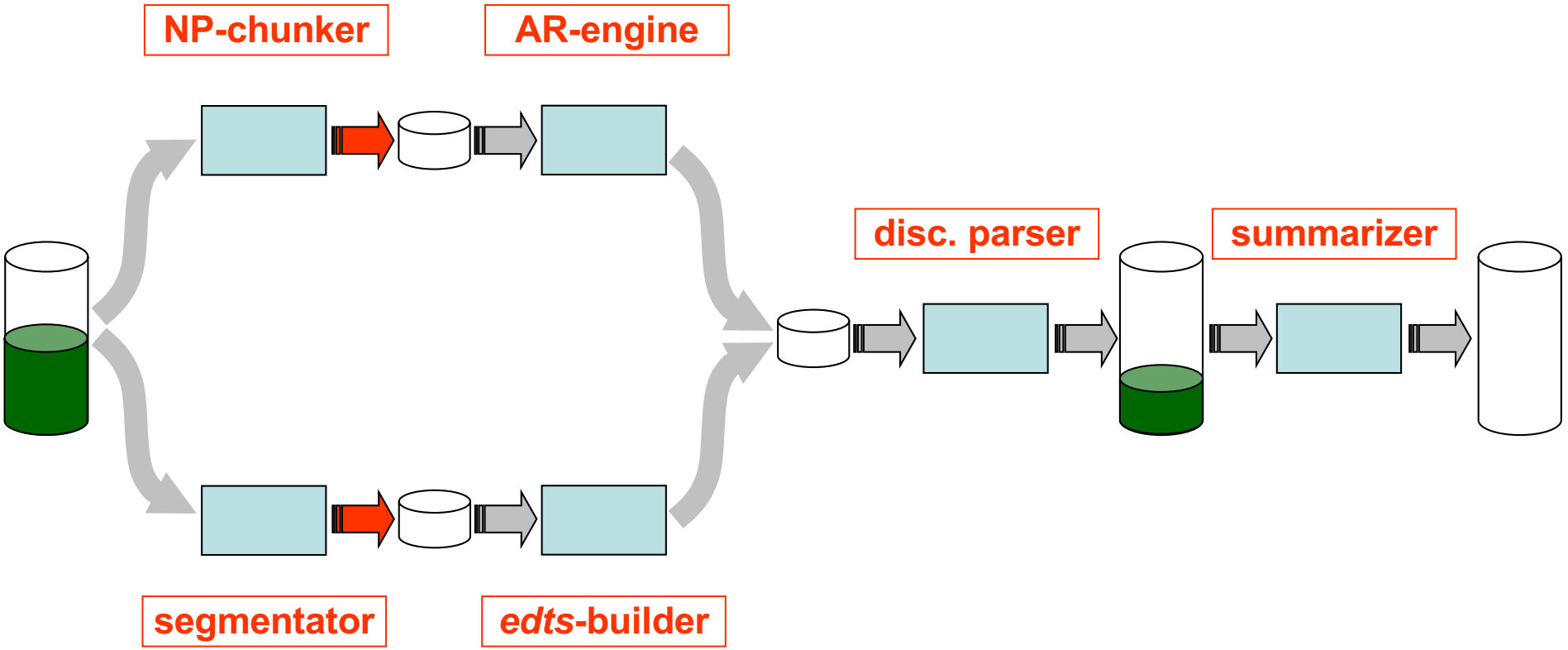

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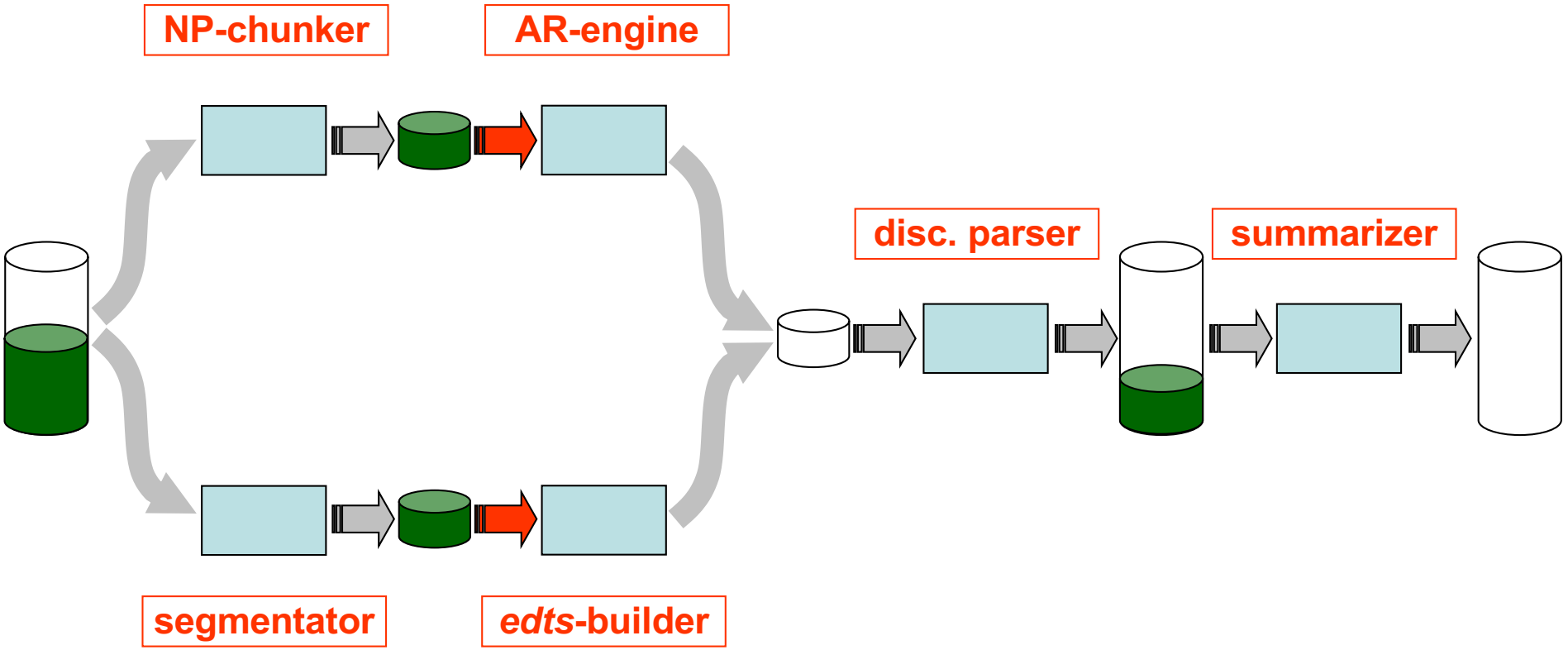

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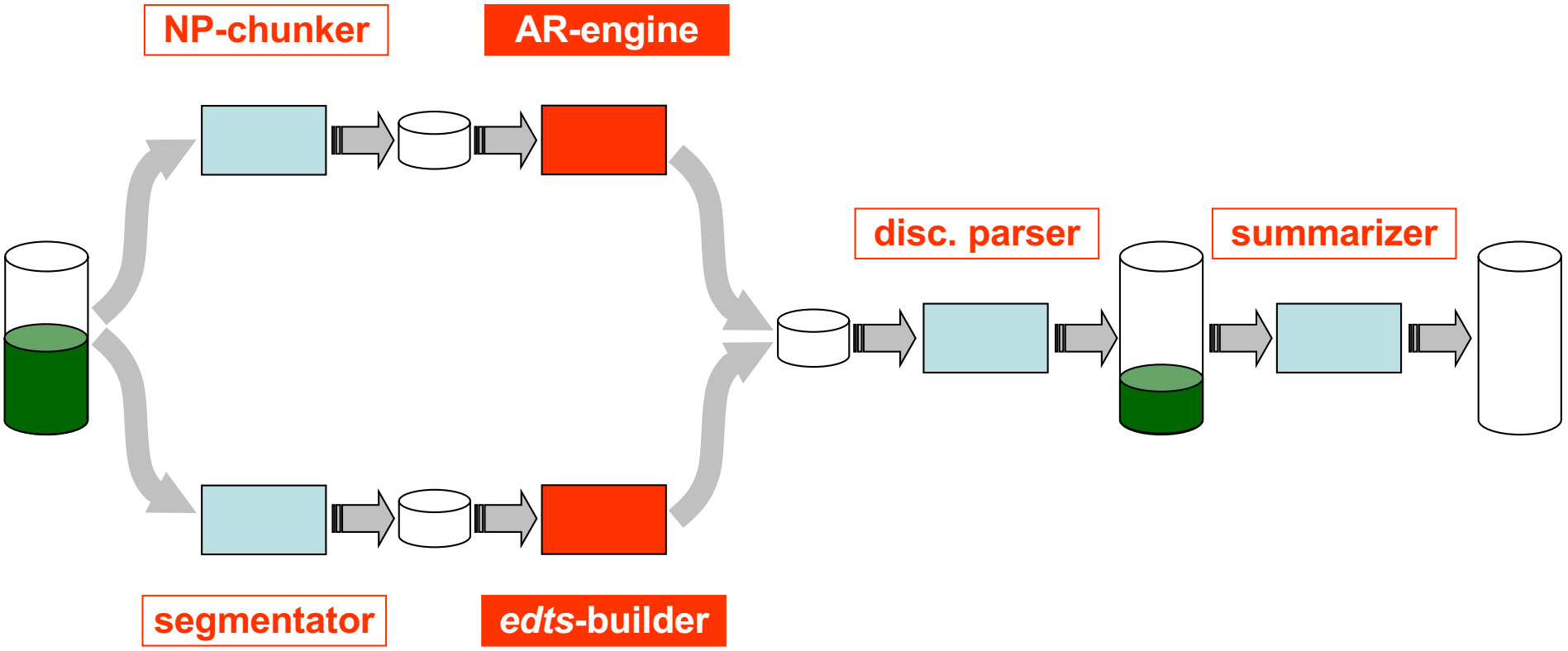

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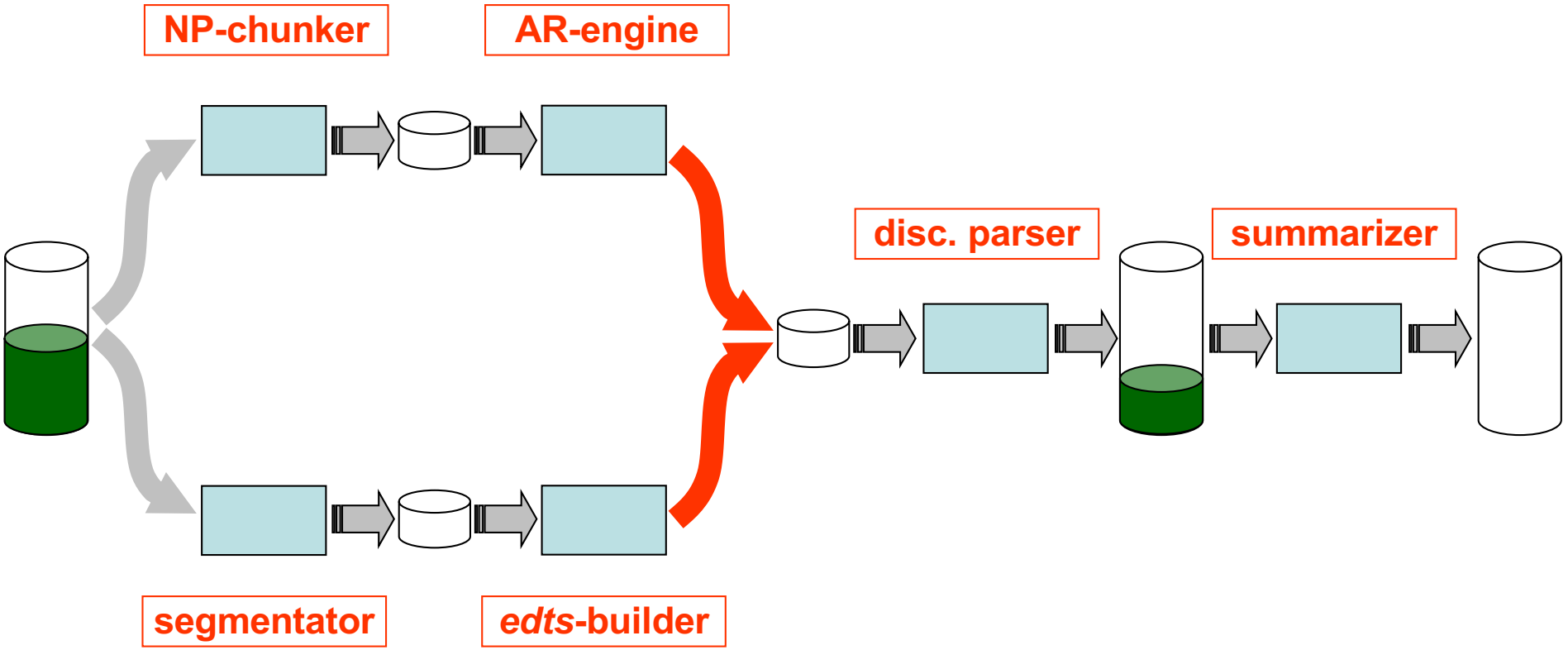

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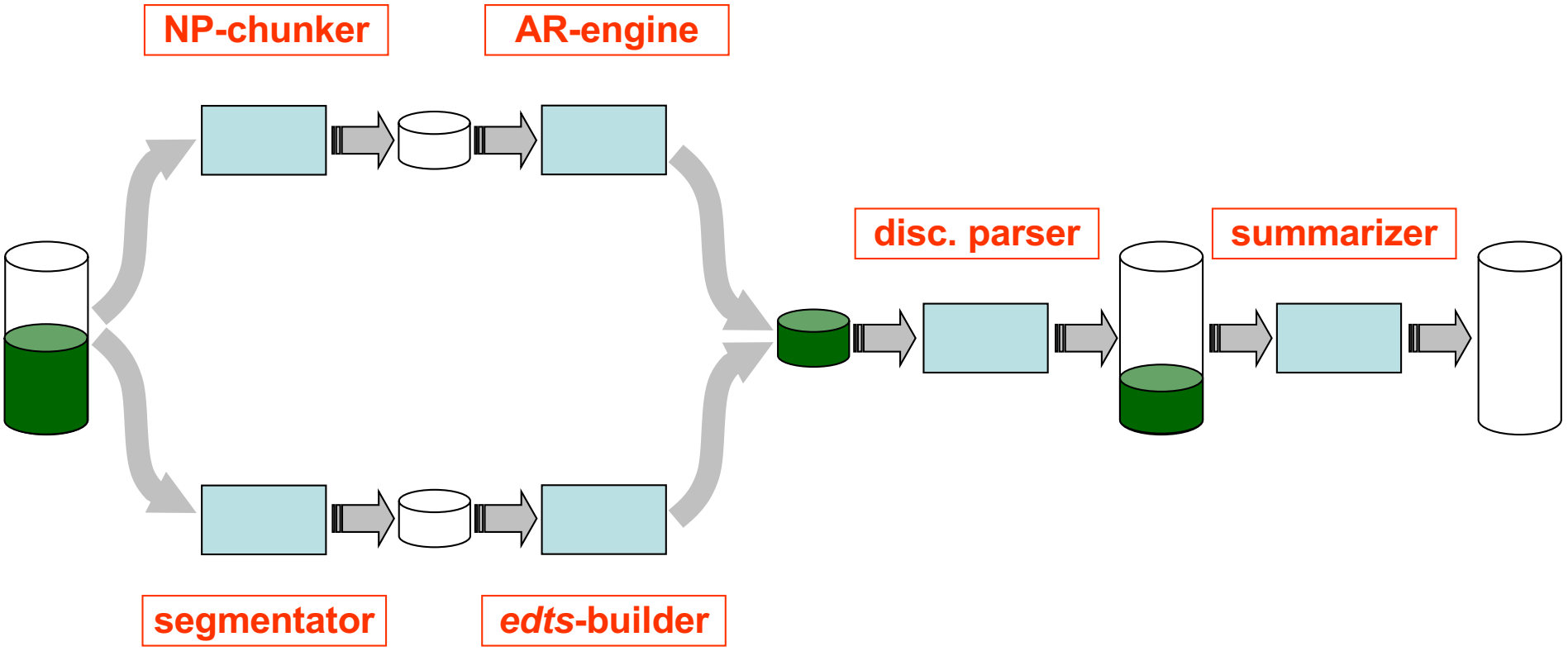

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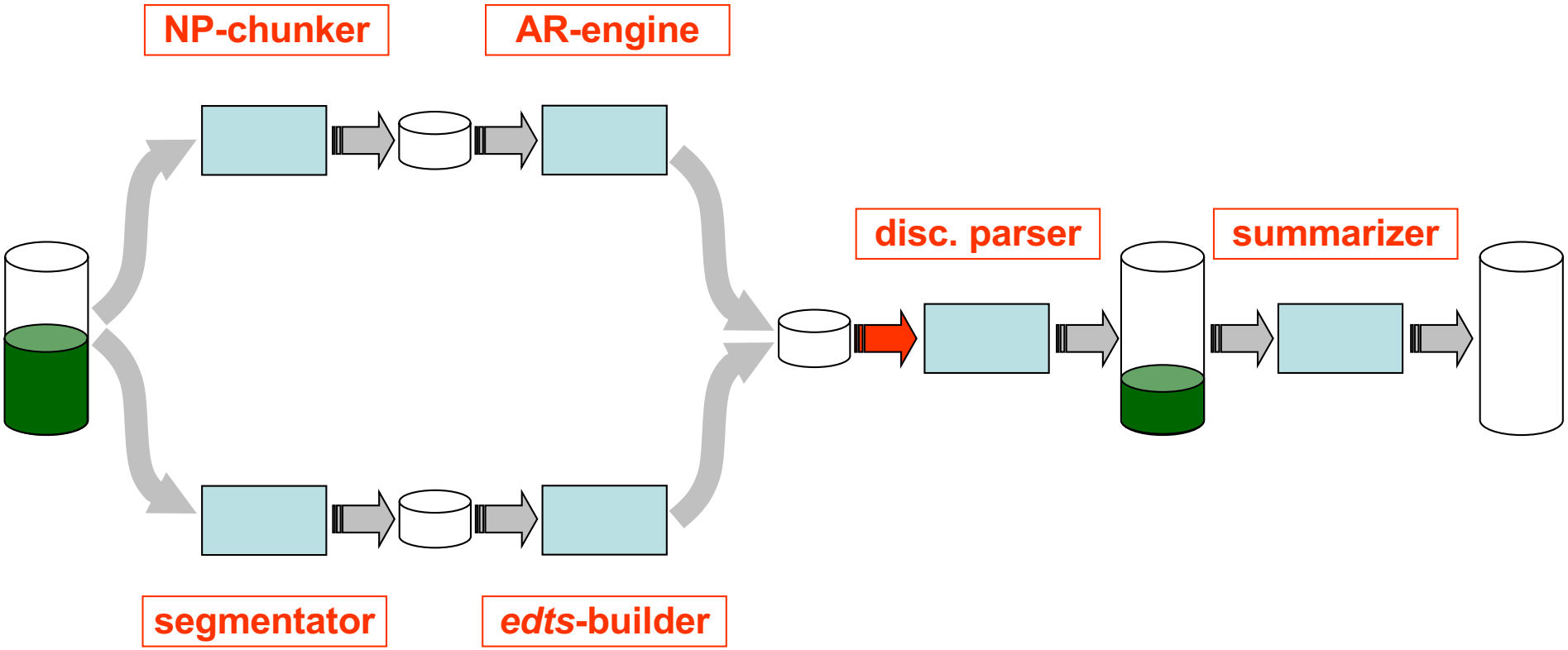

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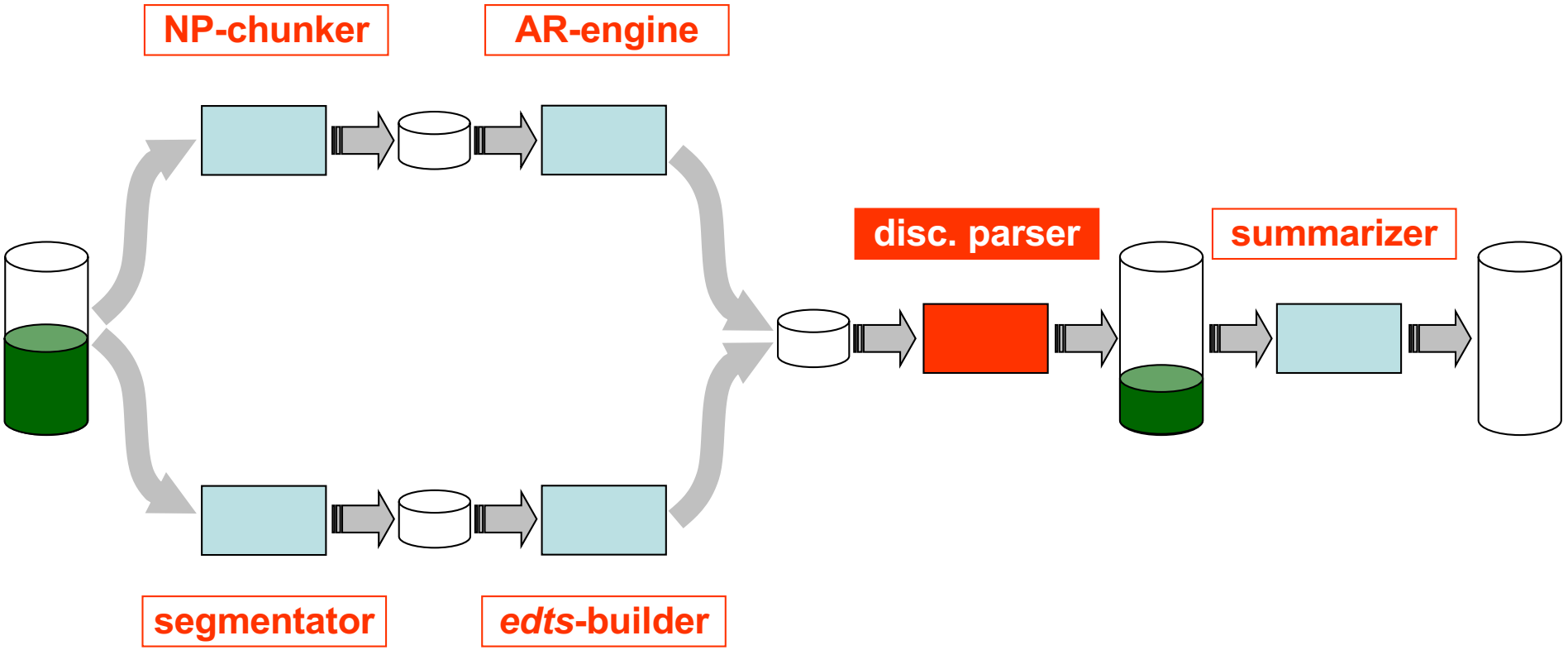

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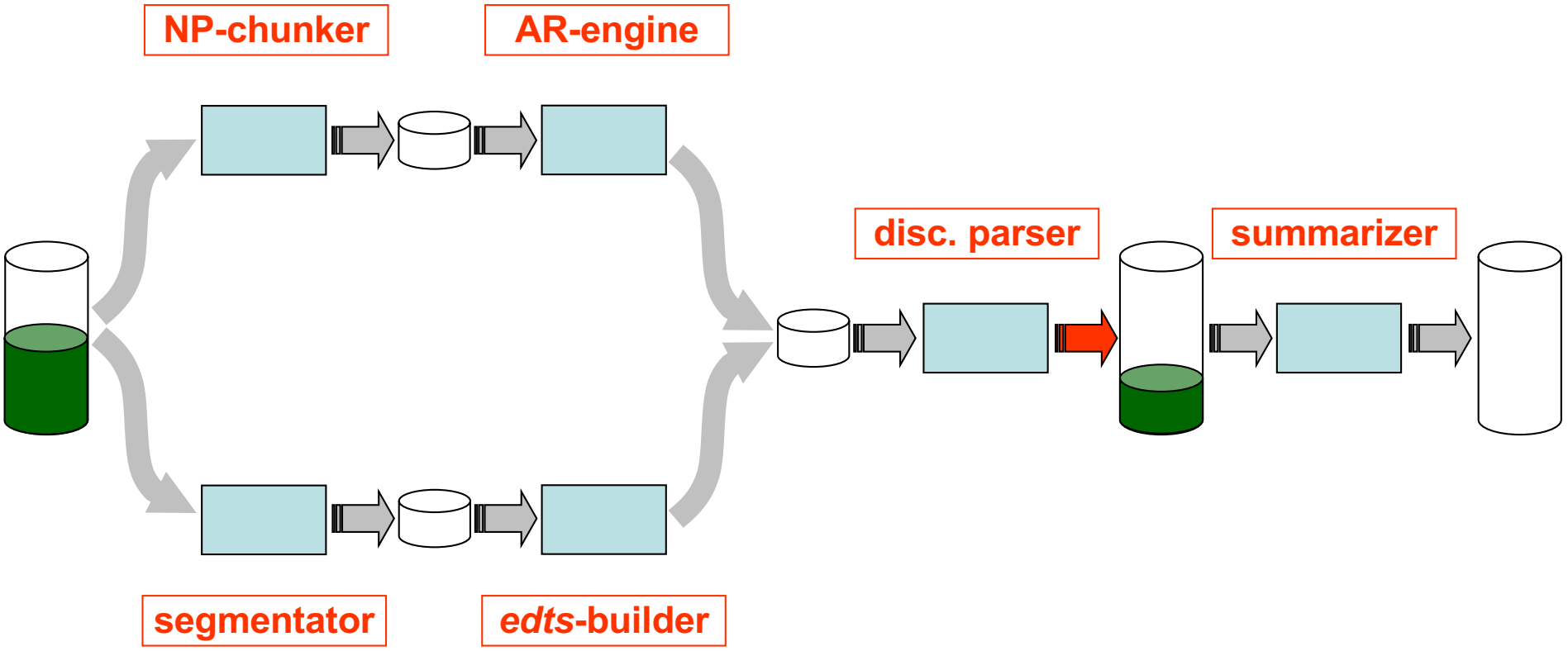

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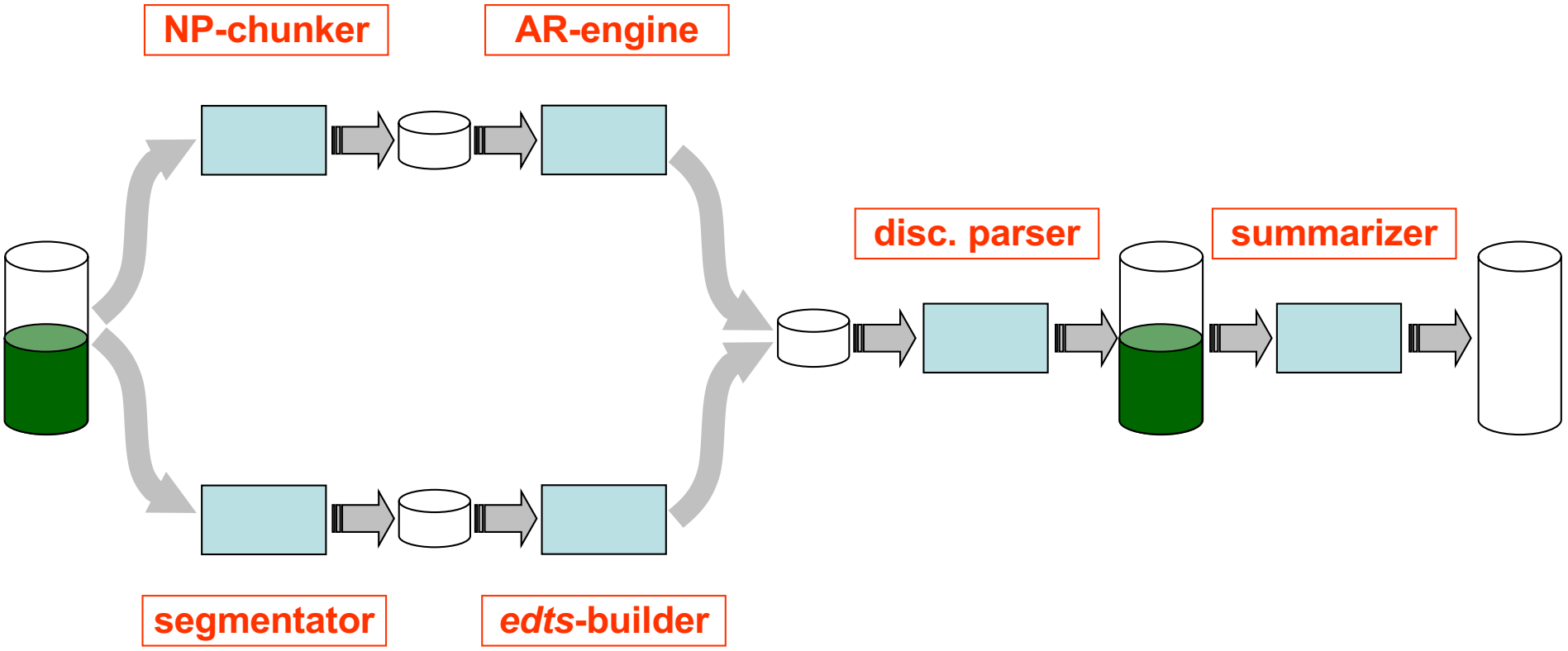
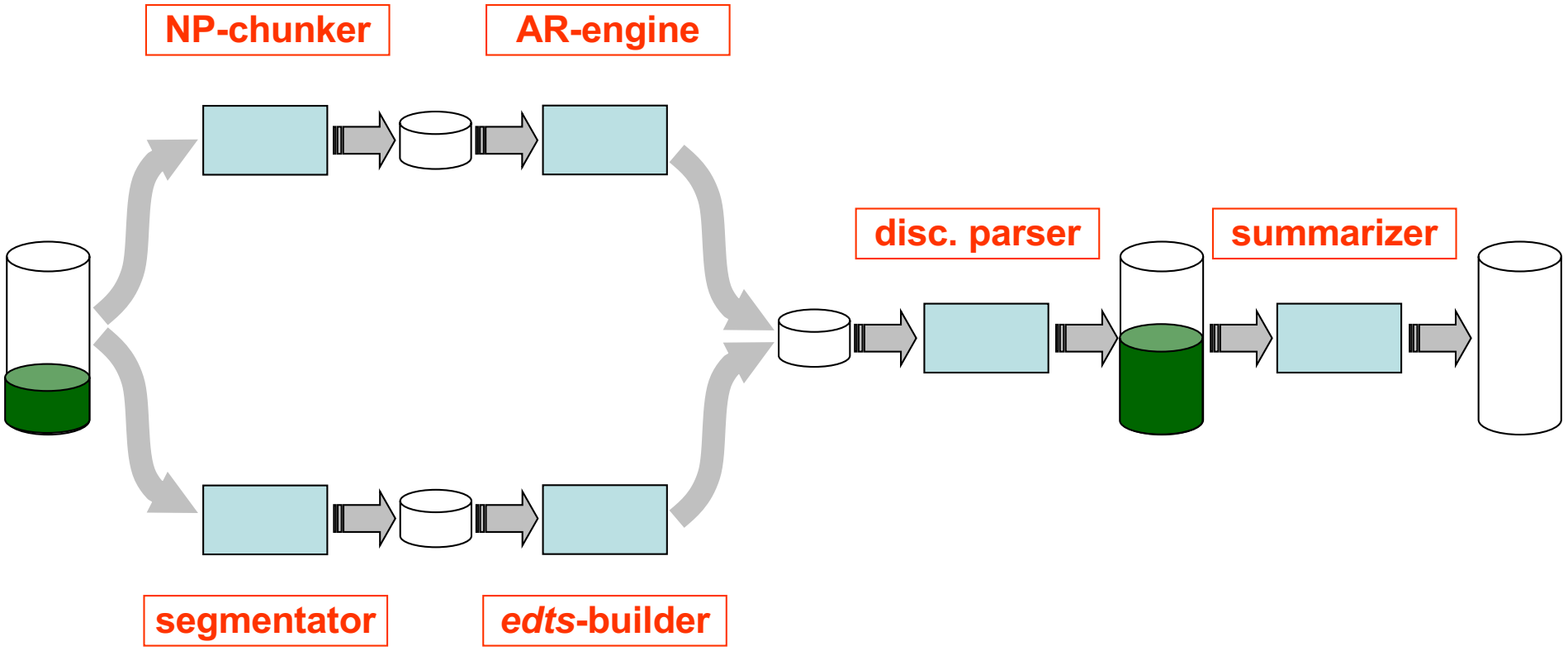


Processing: incremental parallel combined with pipe-line



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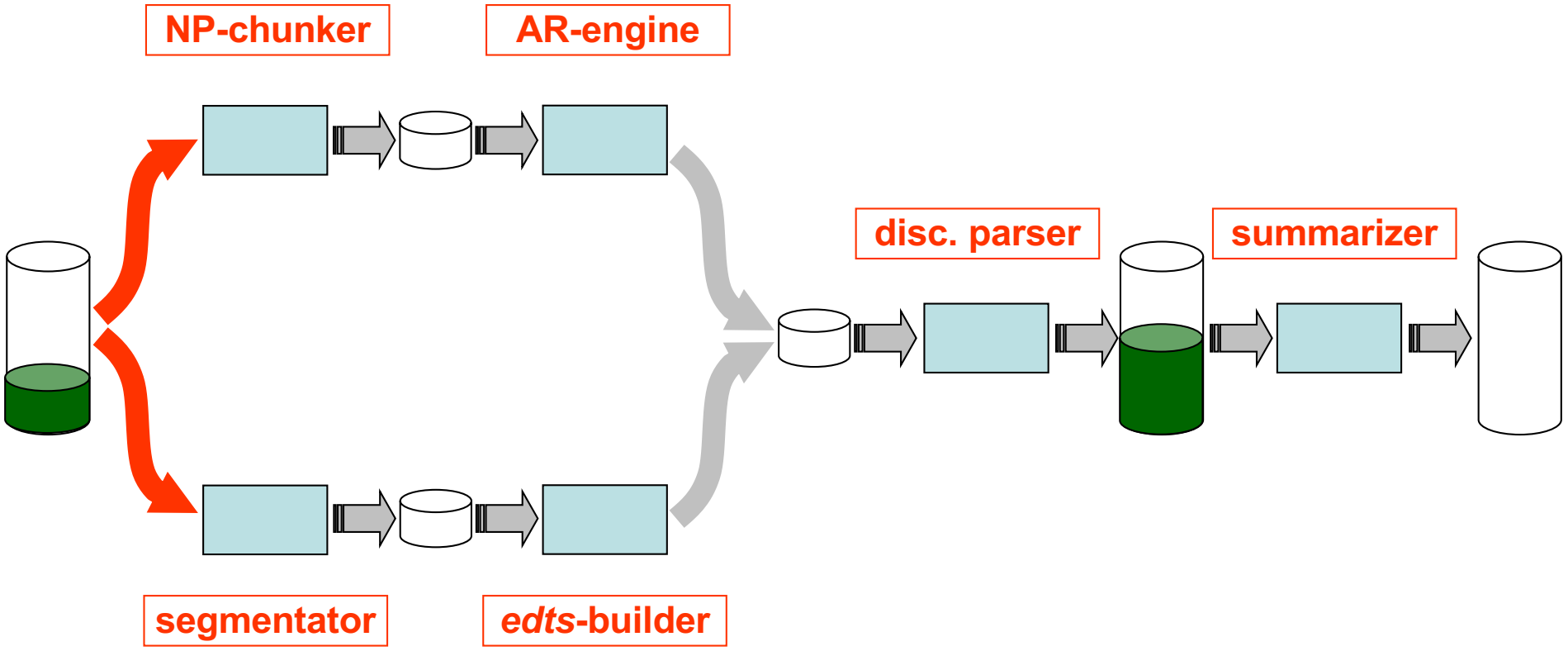

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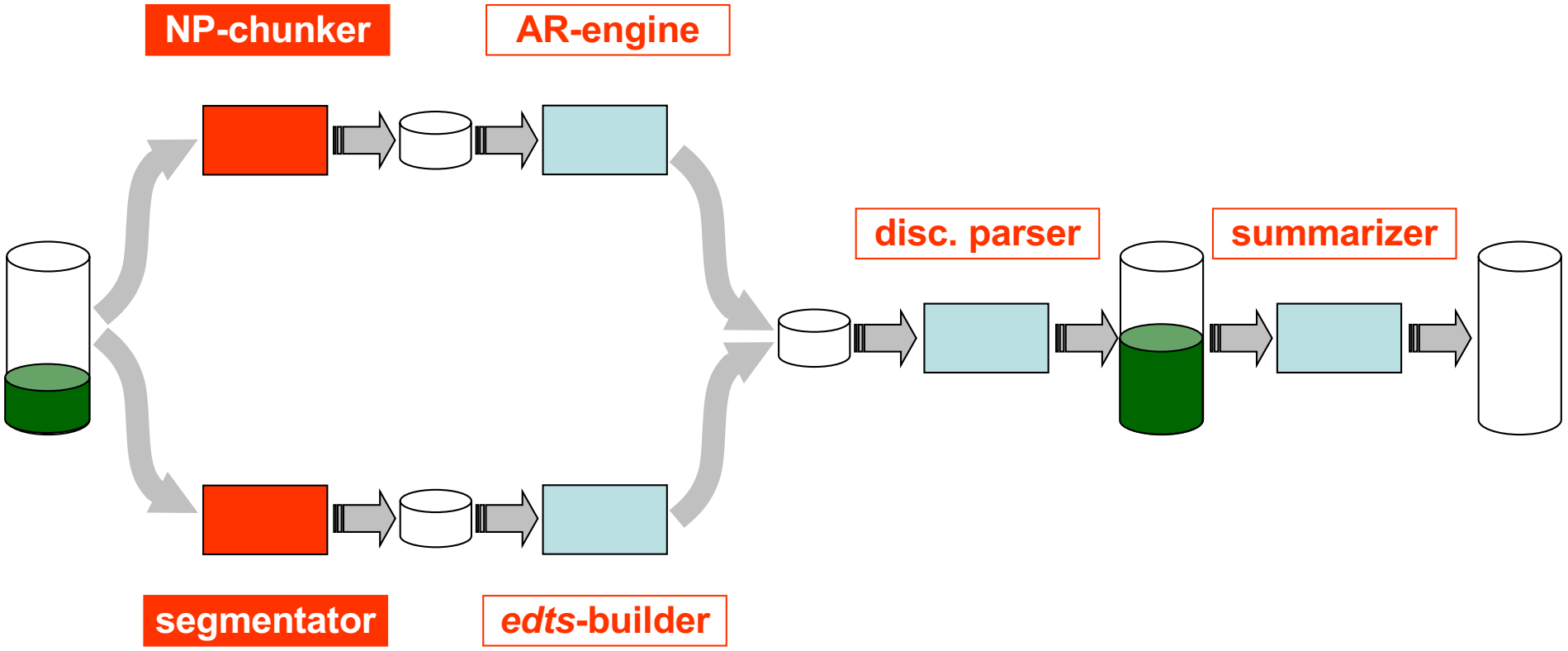

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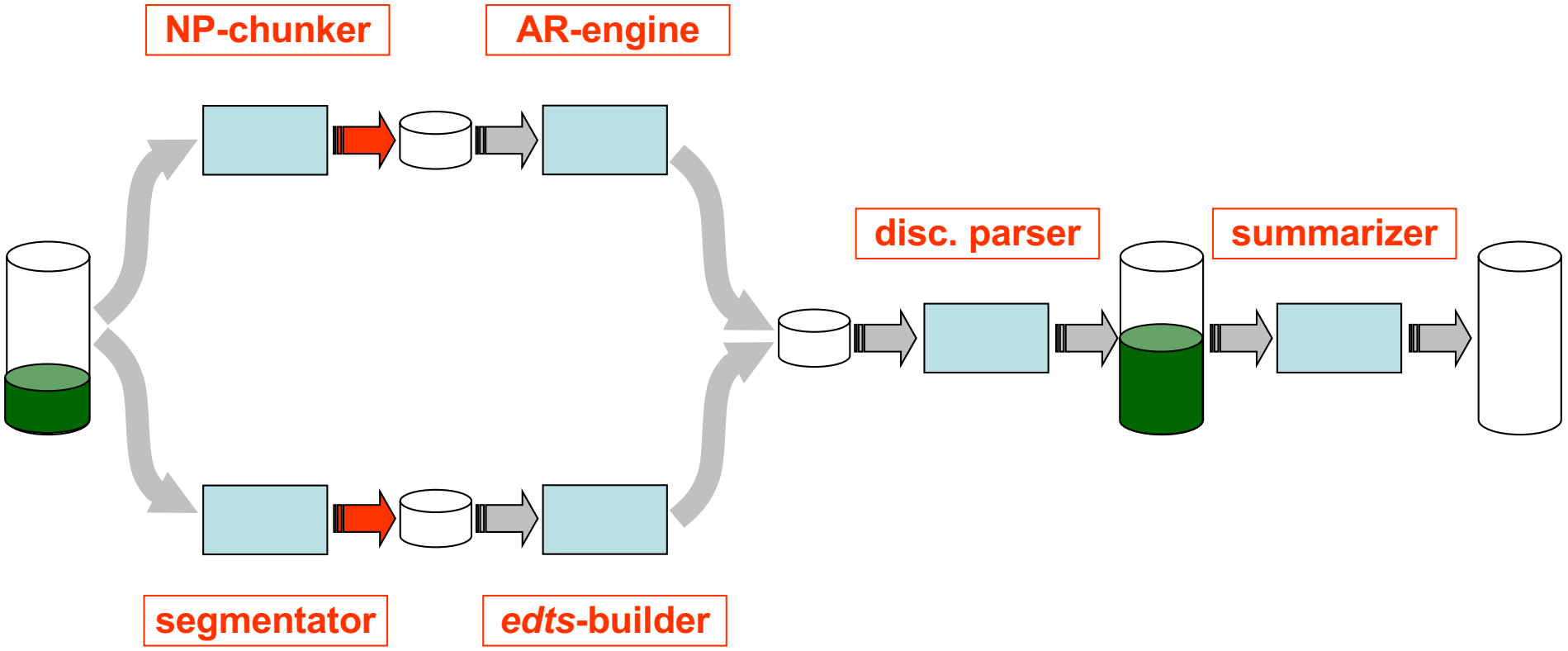

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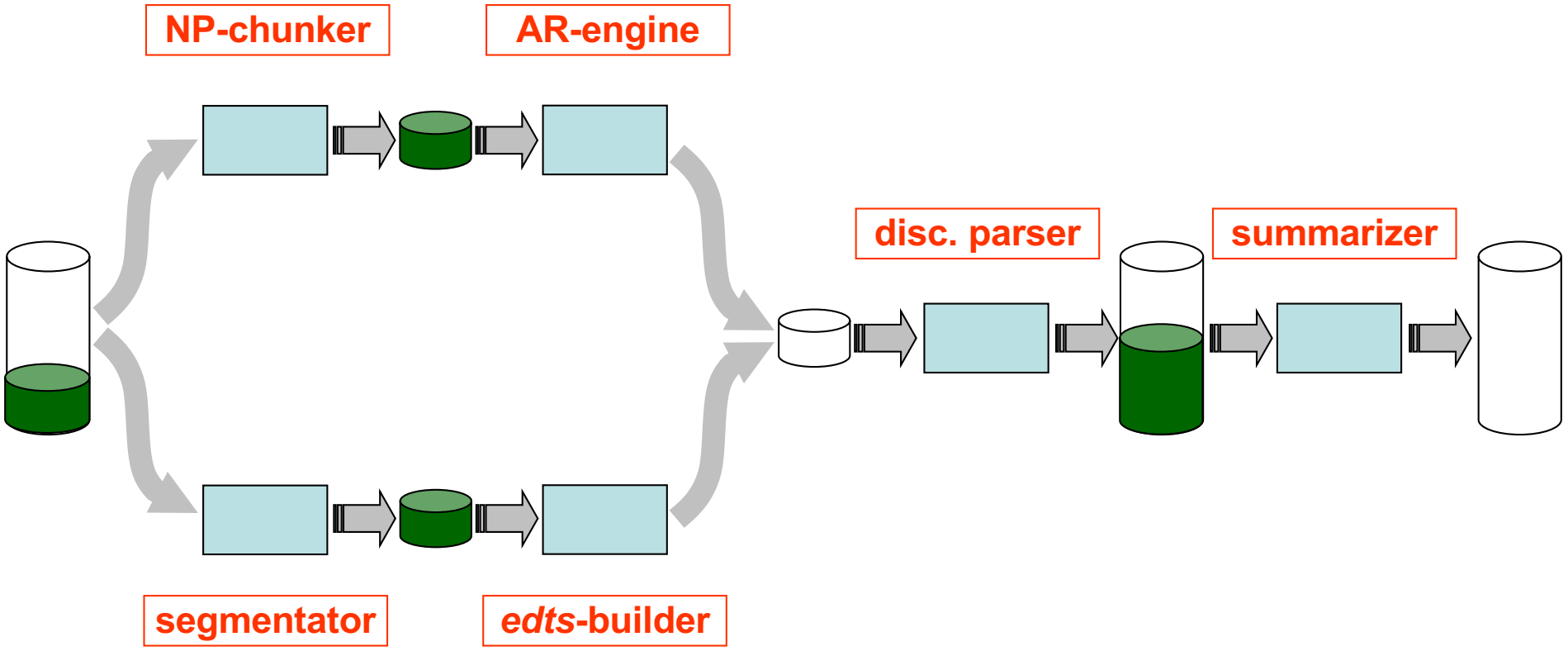

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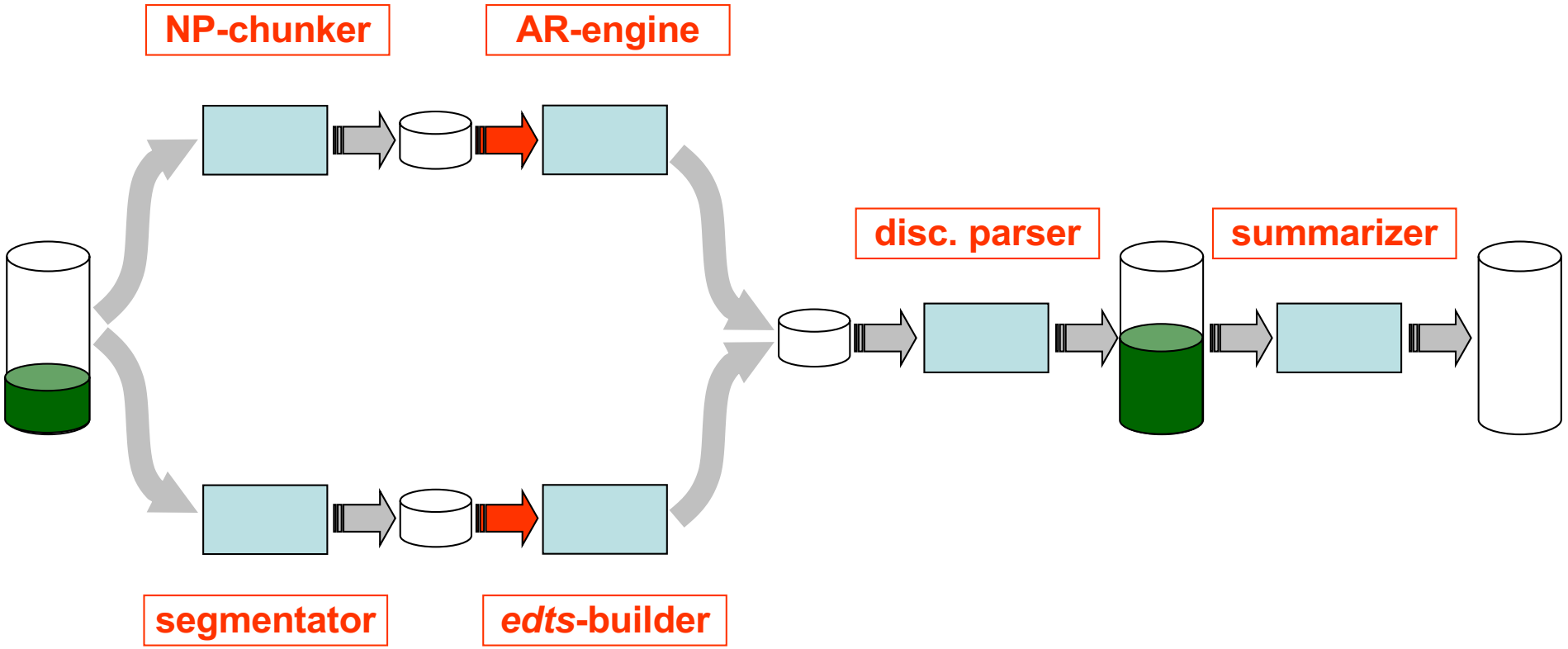

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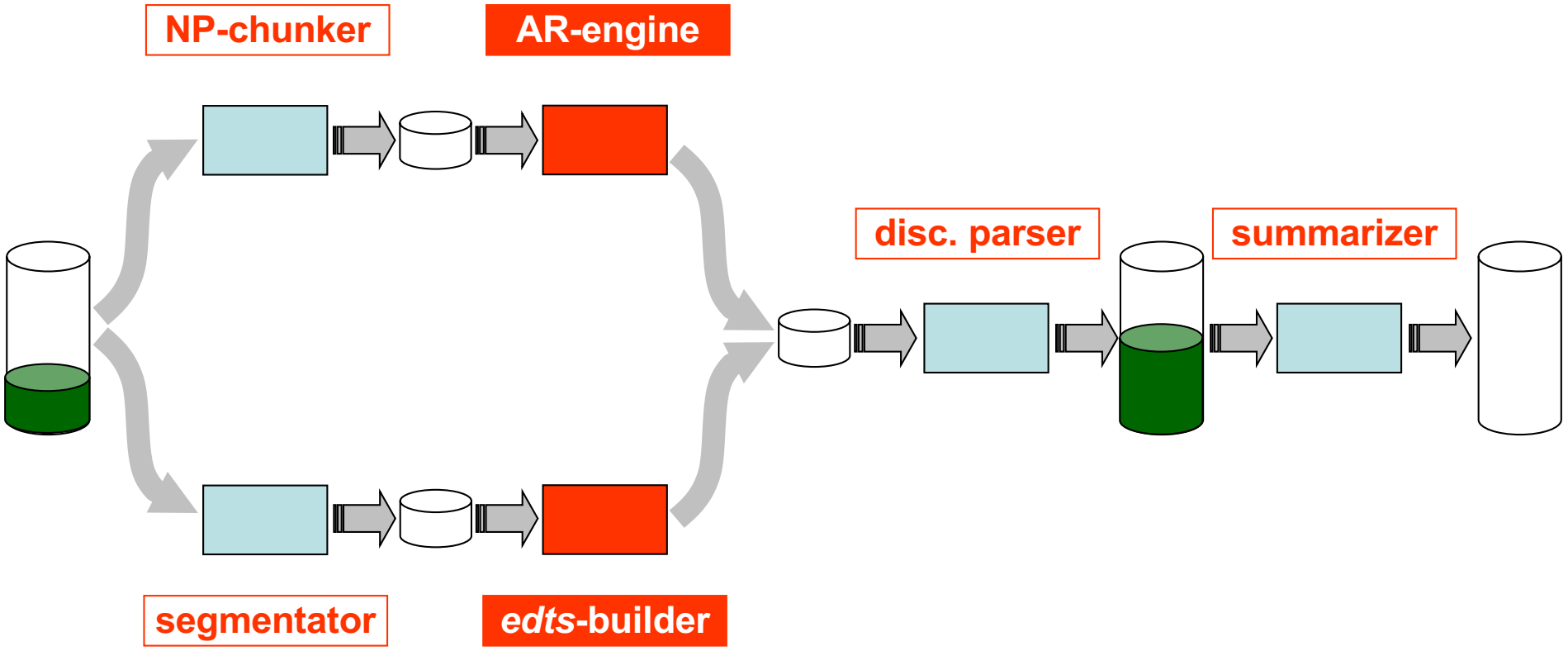

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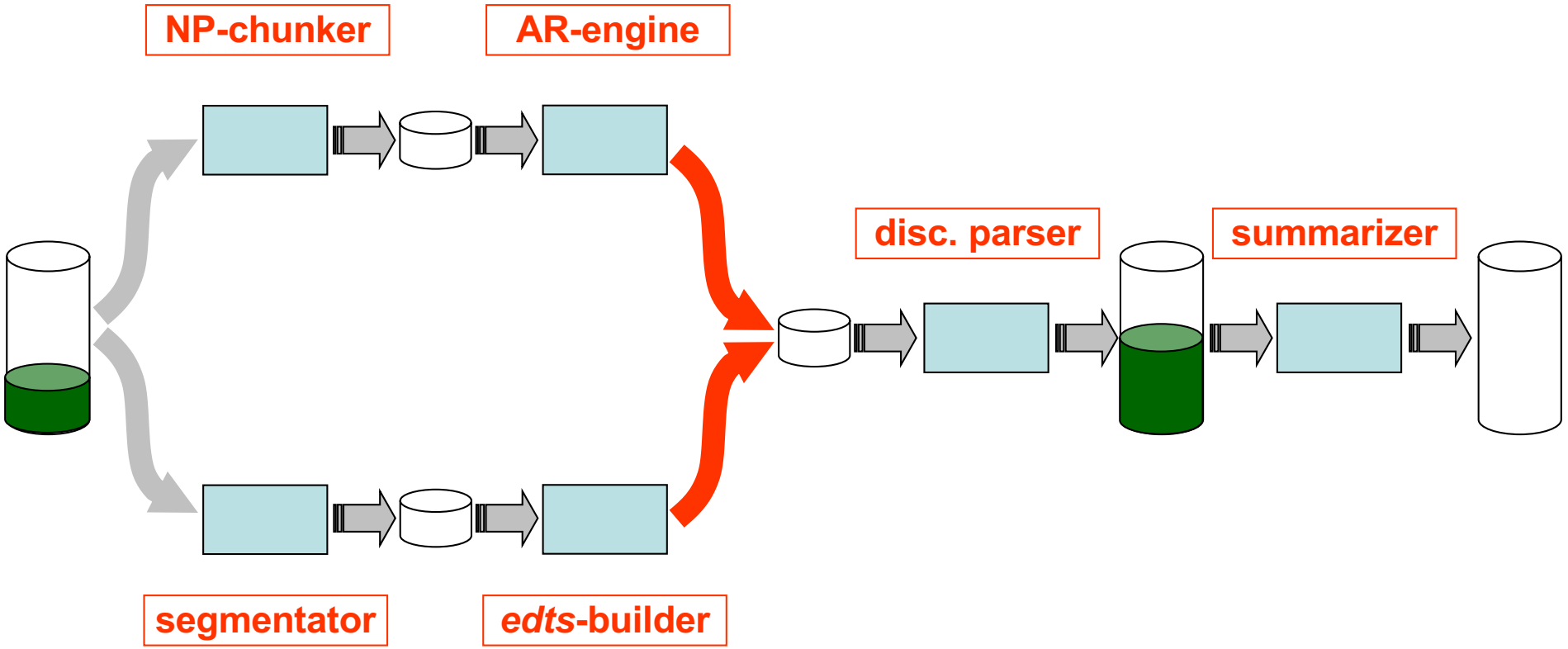

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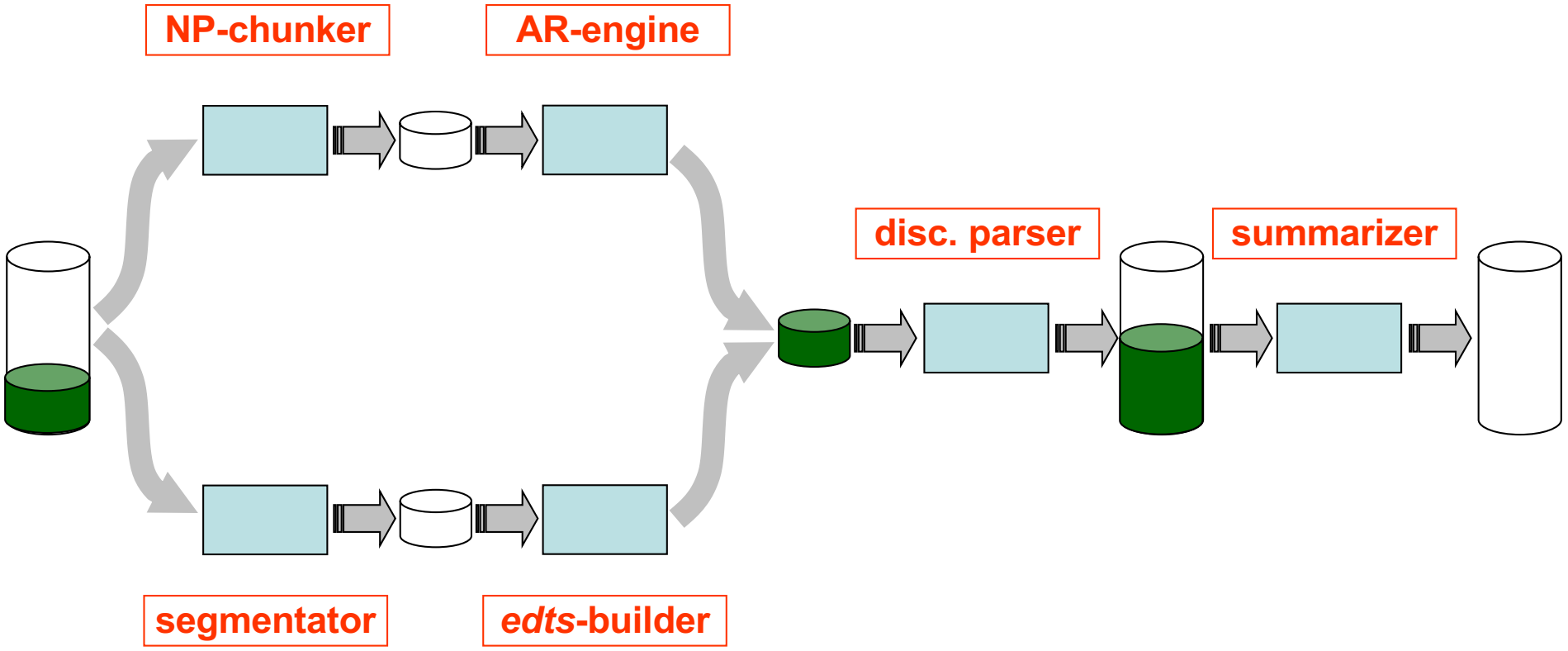

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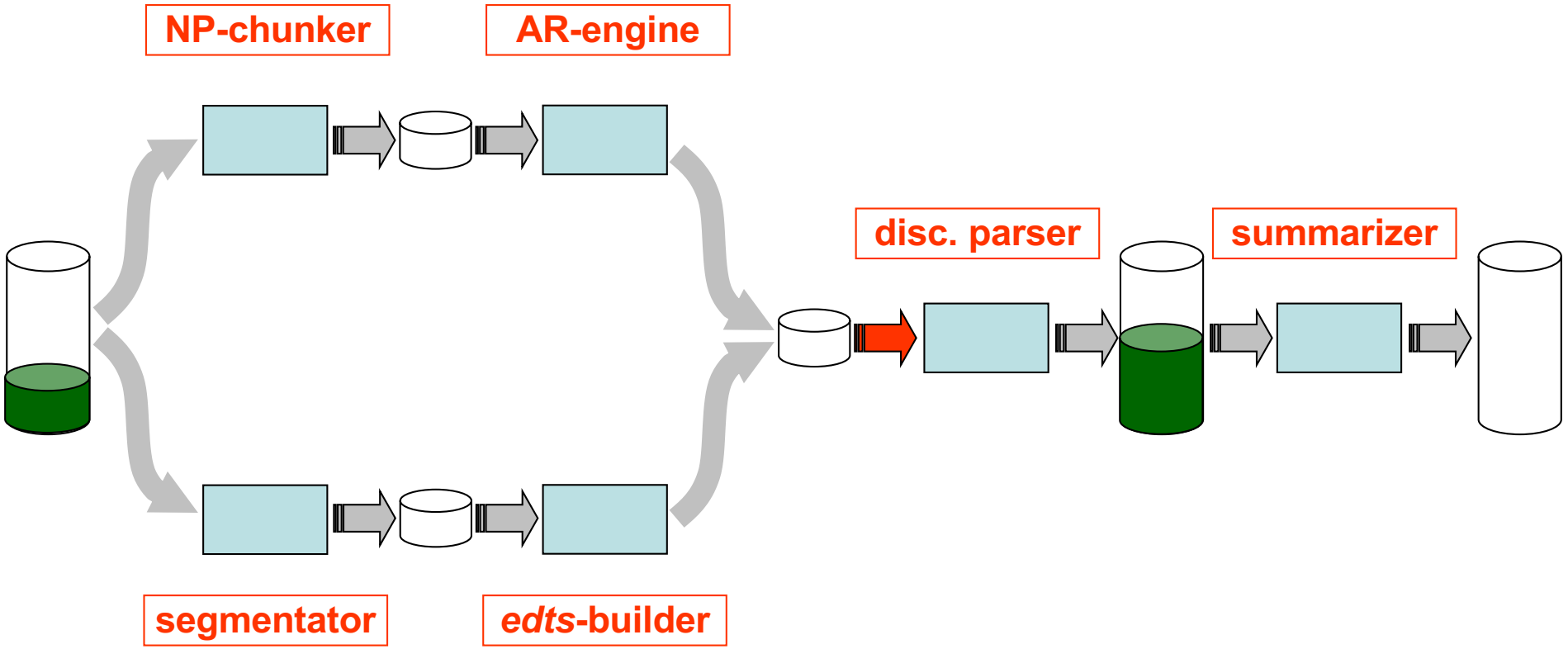

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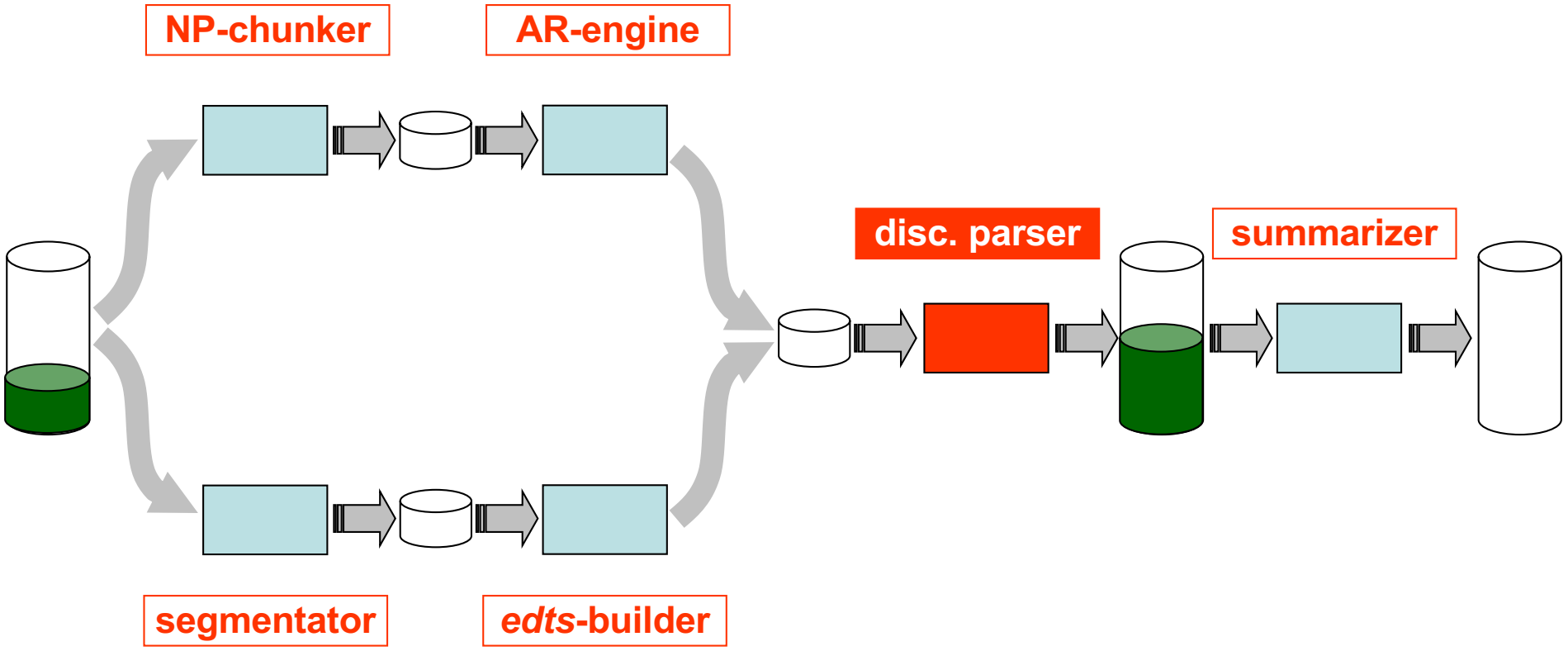

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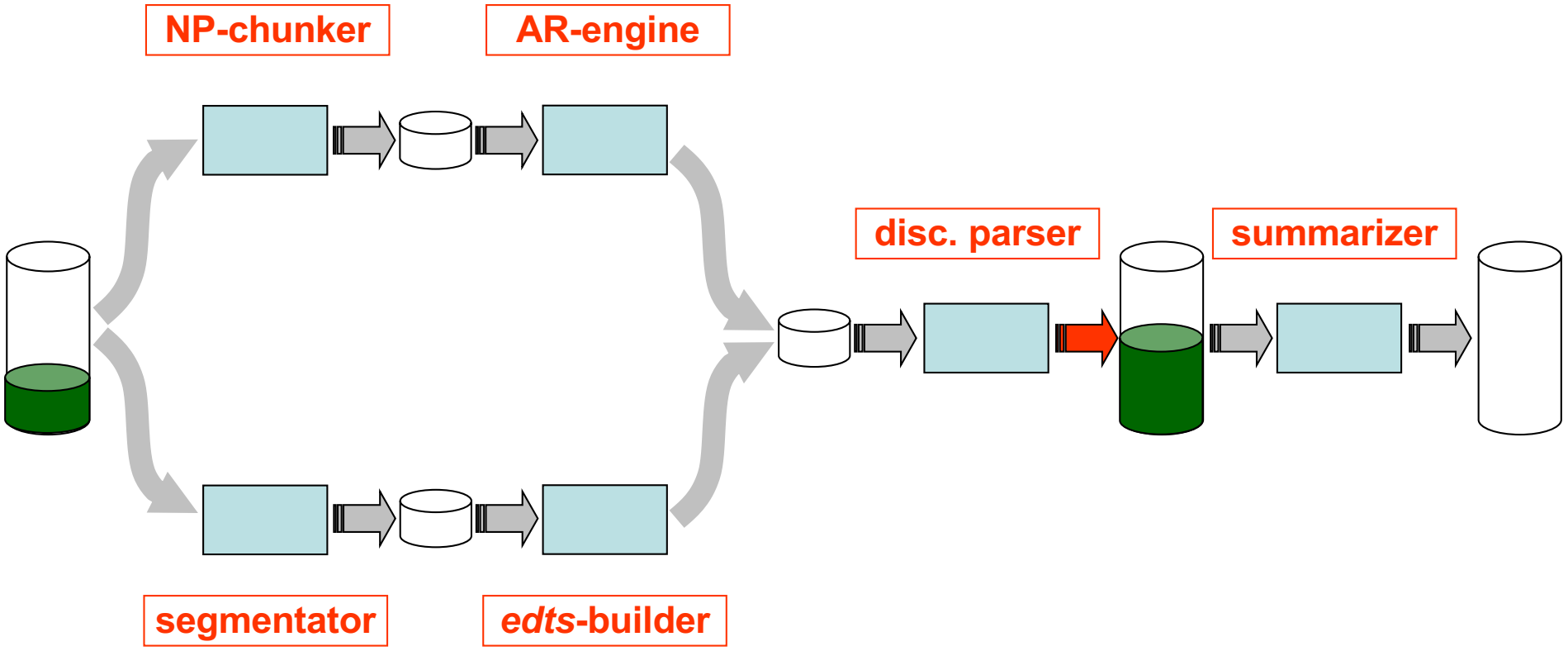

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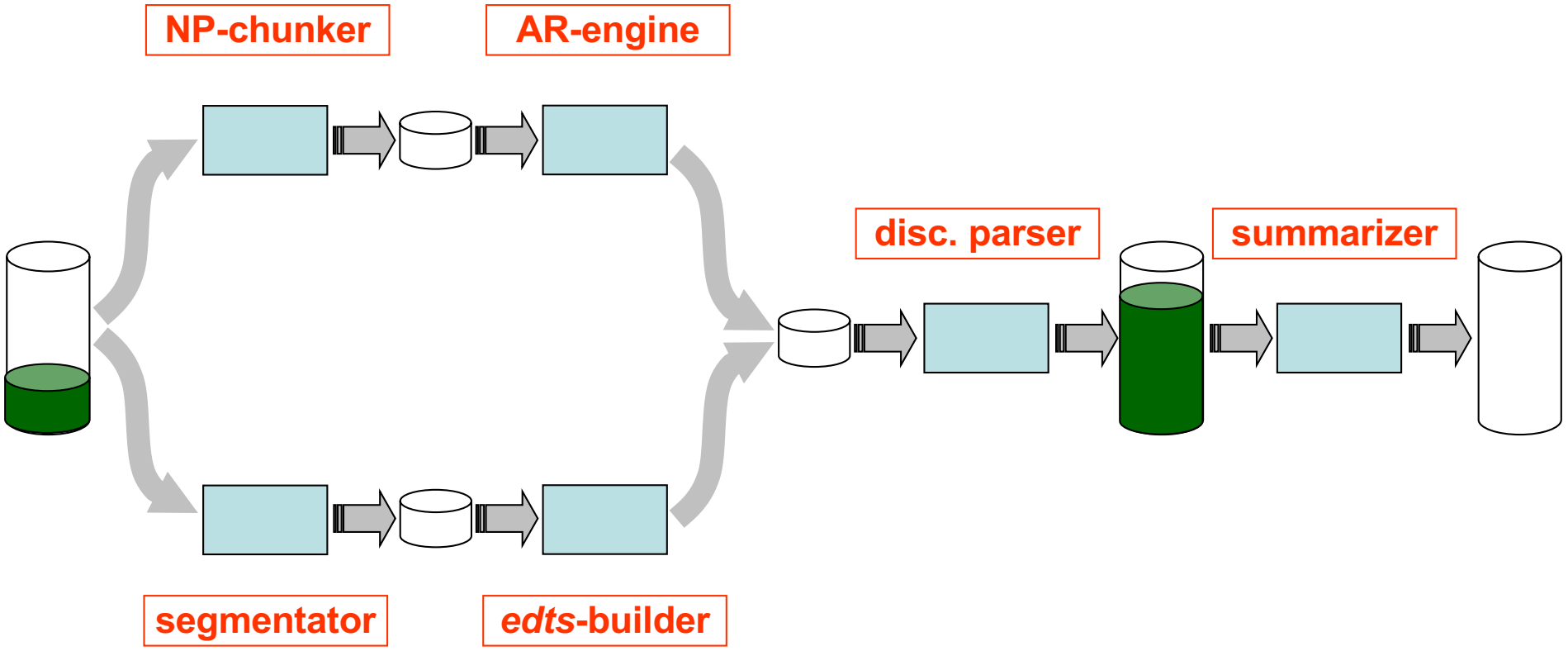

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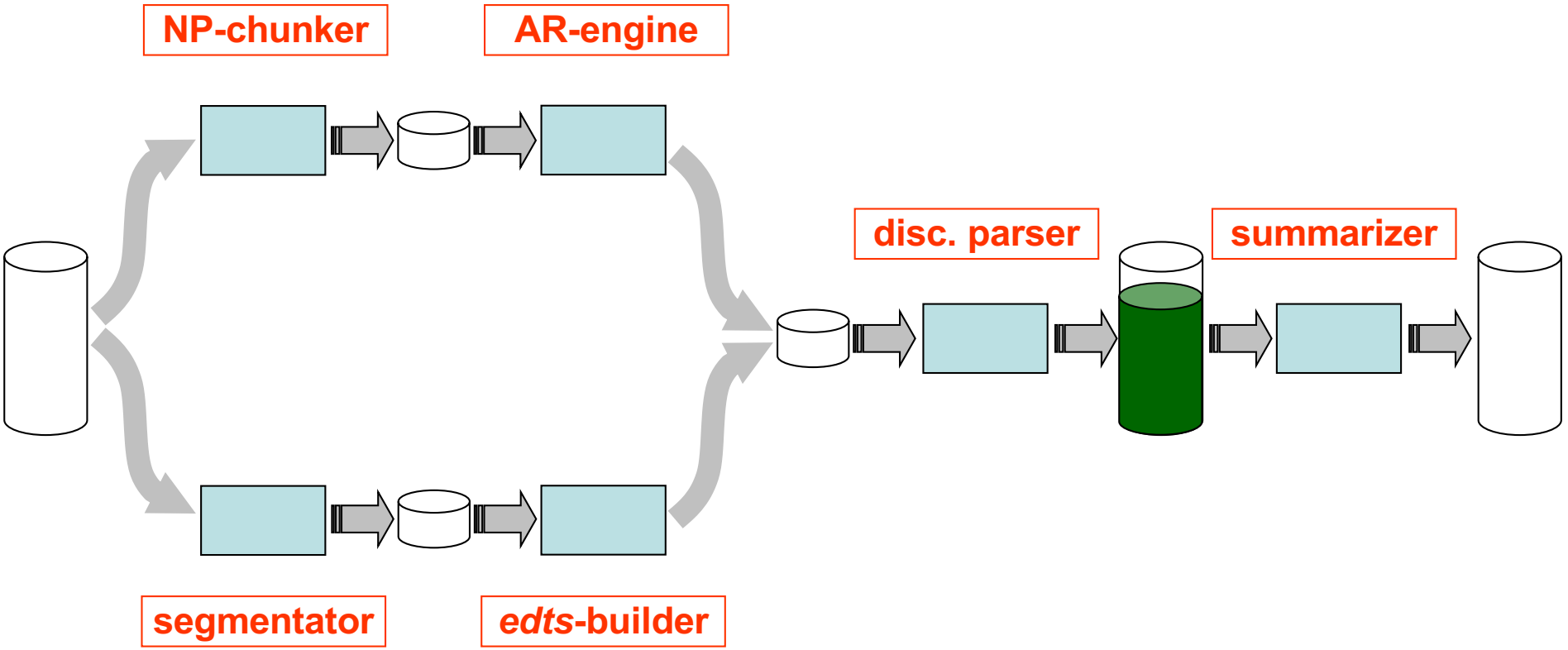

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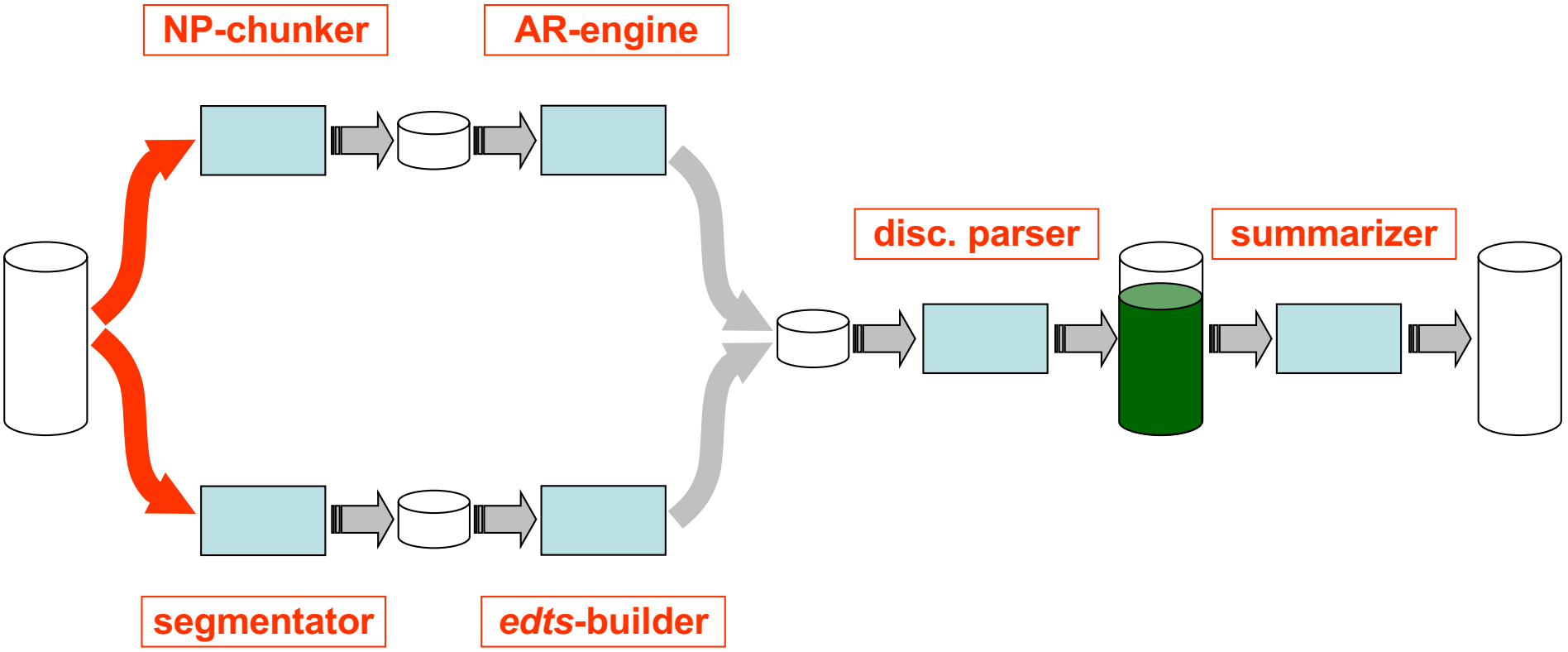
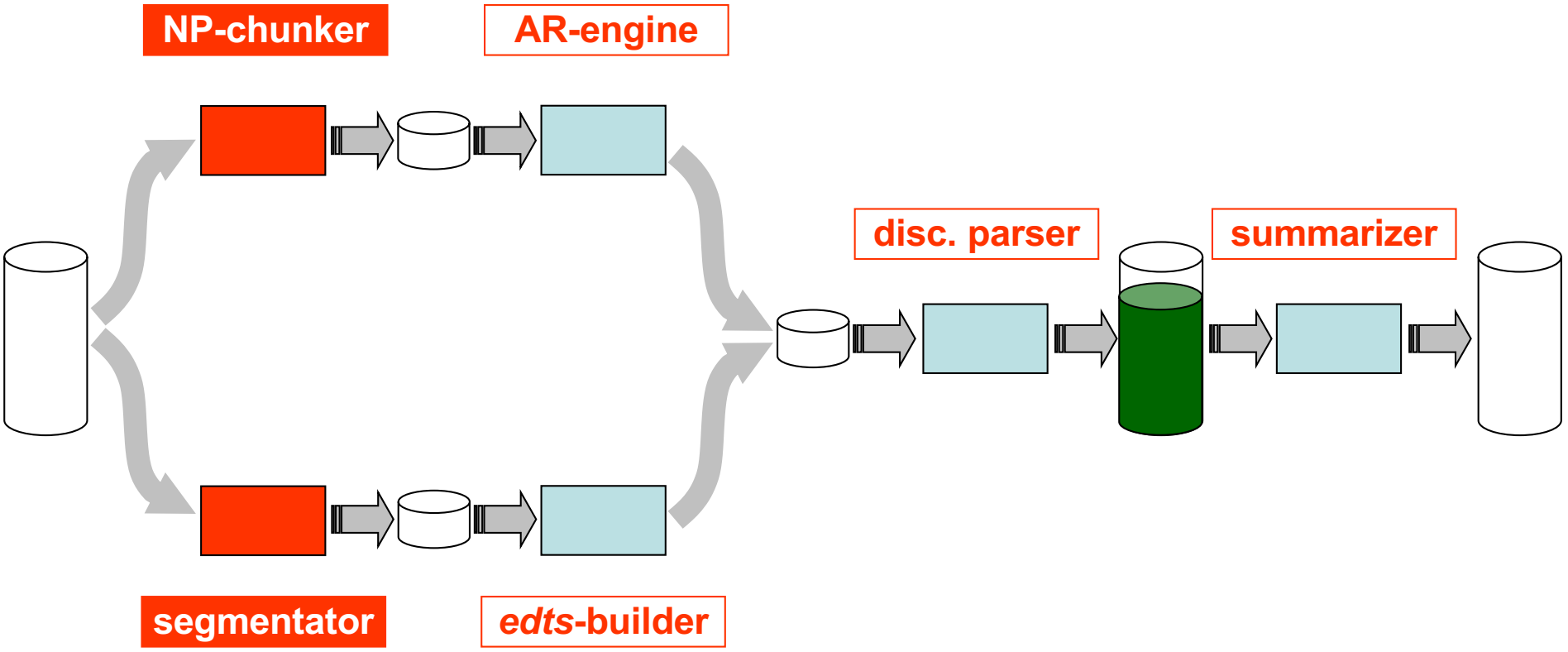


Processing: incremental parallel combined with pipe-line



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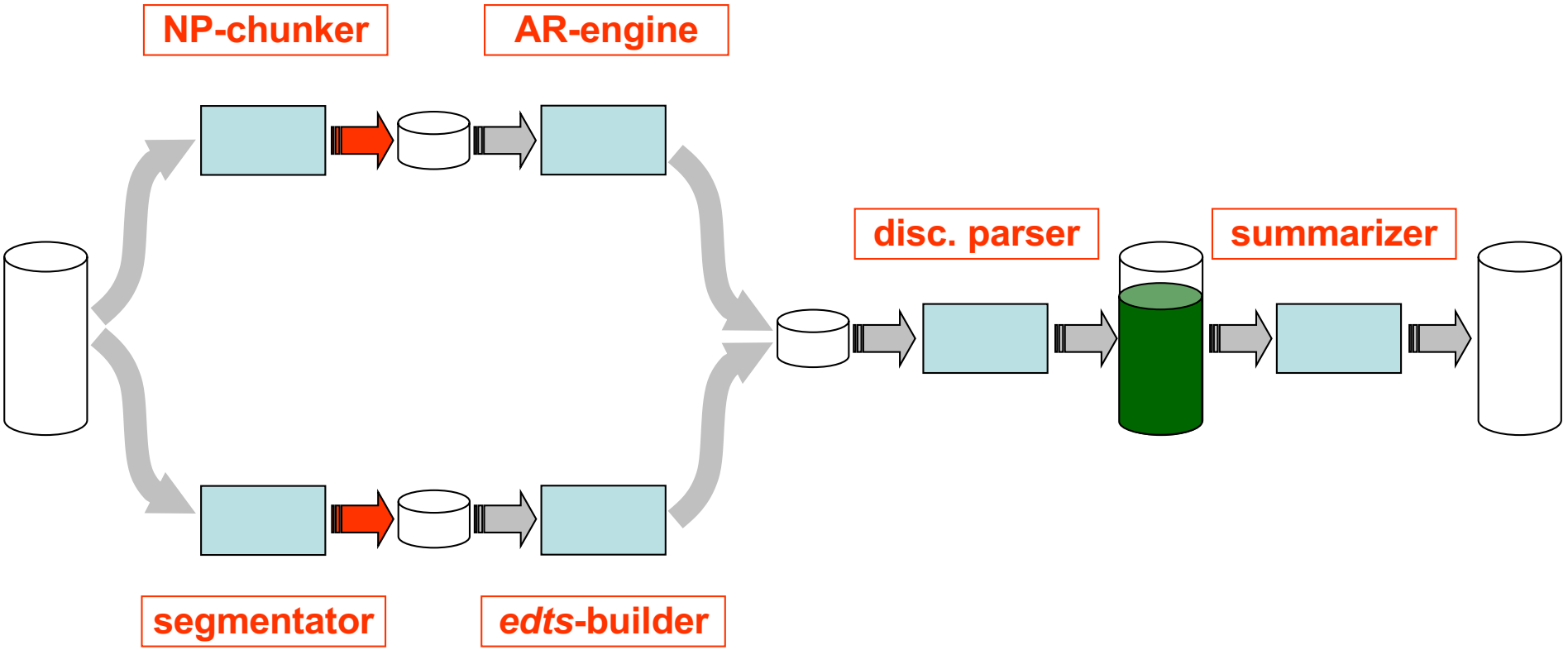

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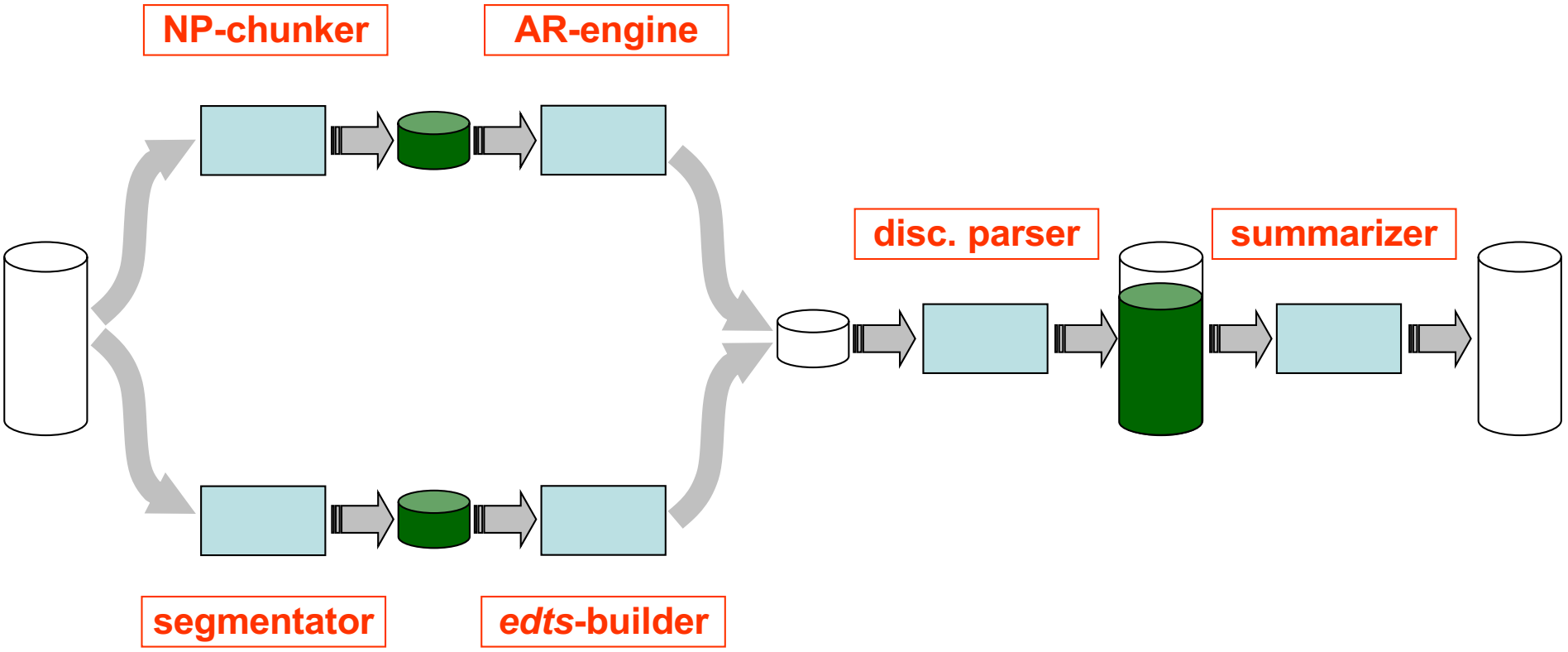

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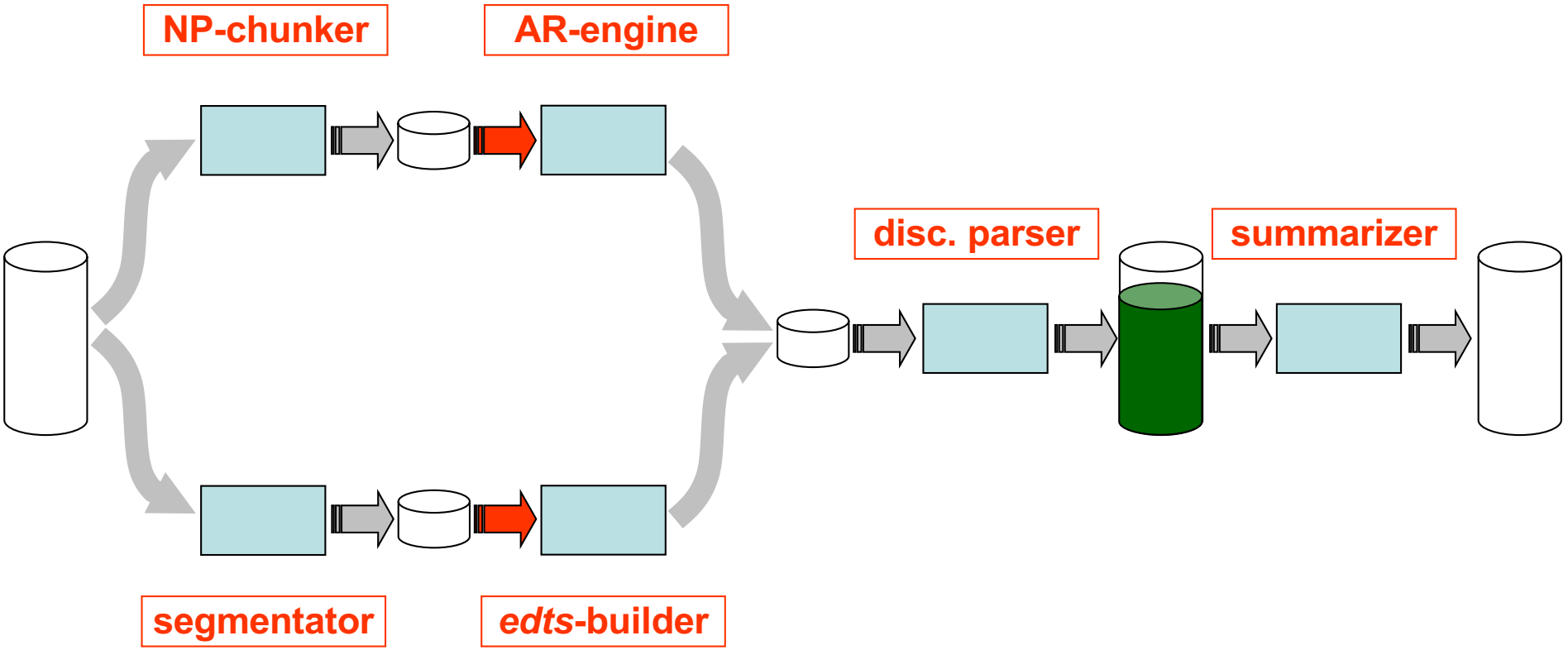

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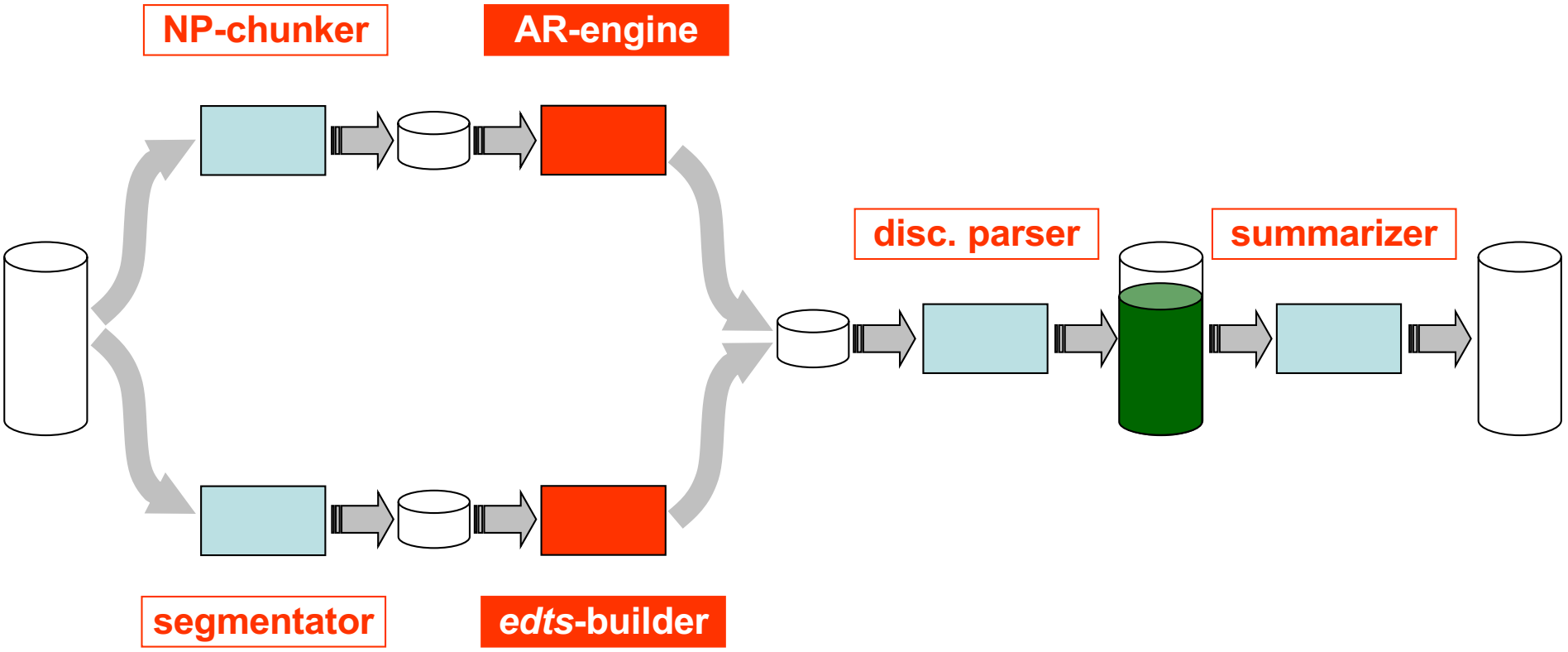

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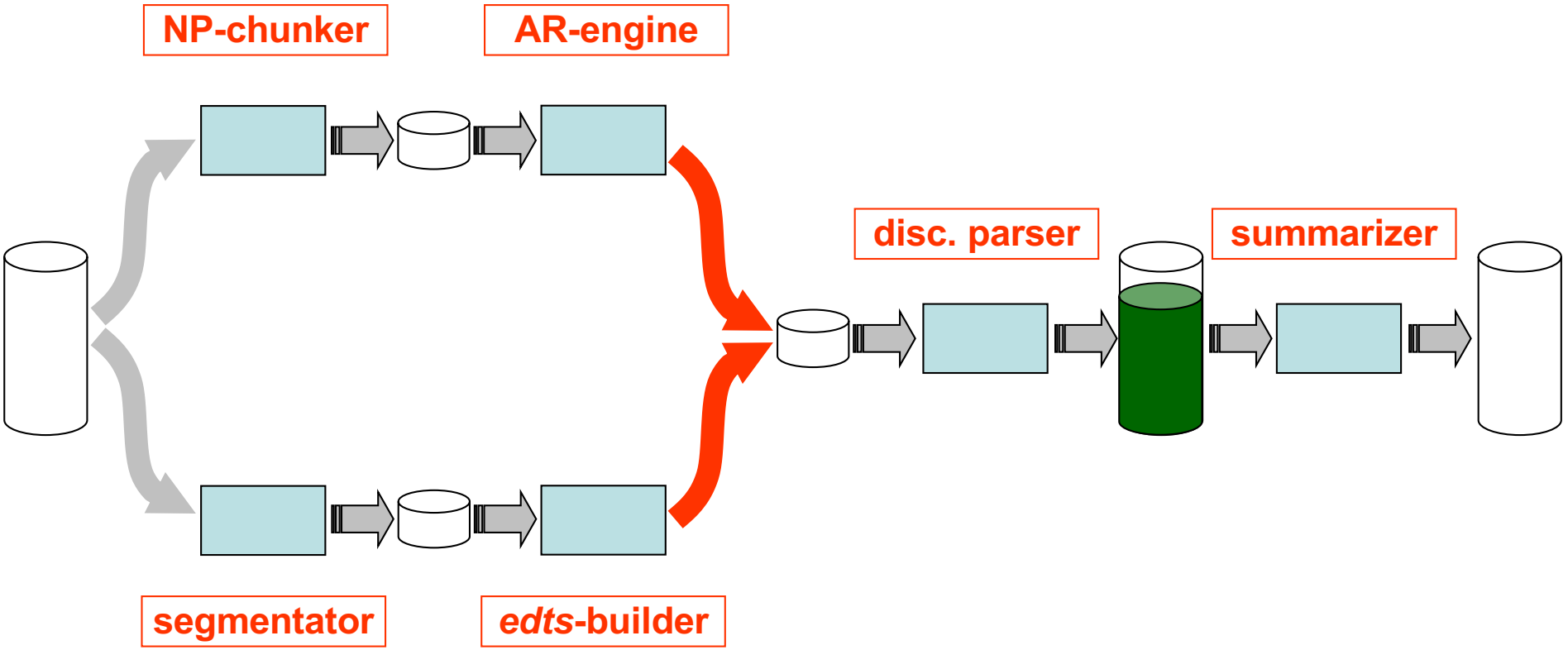

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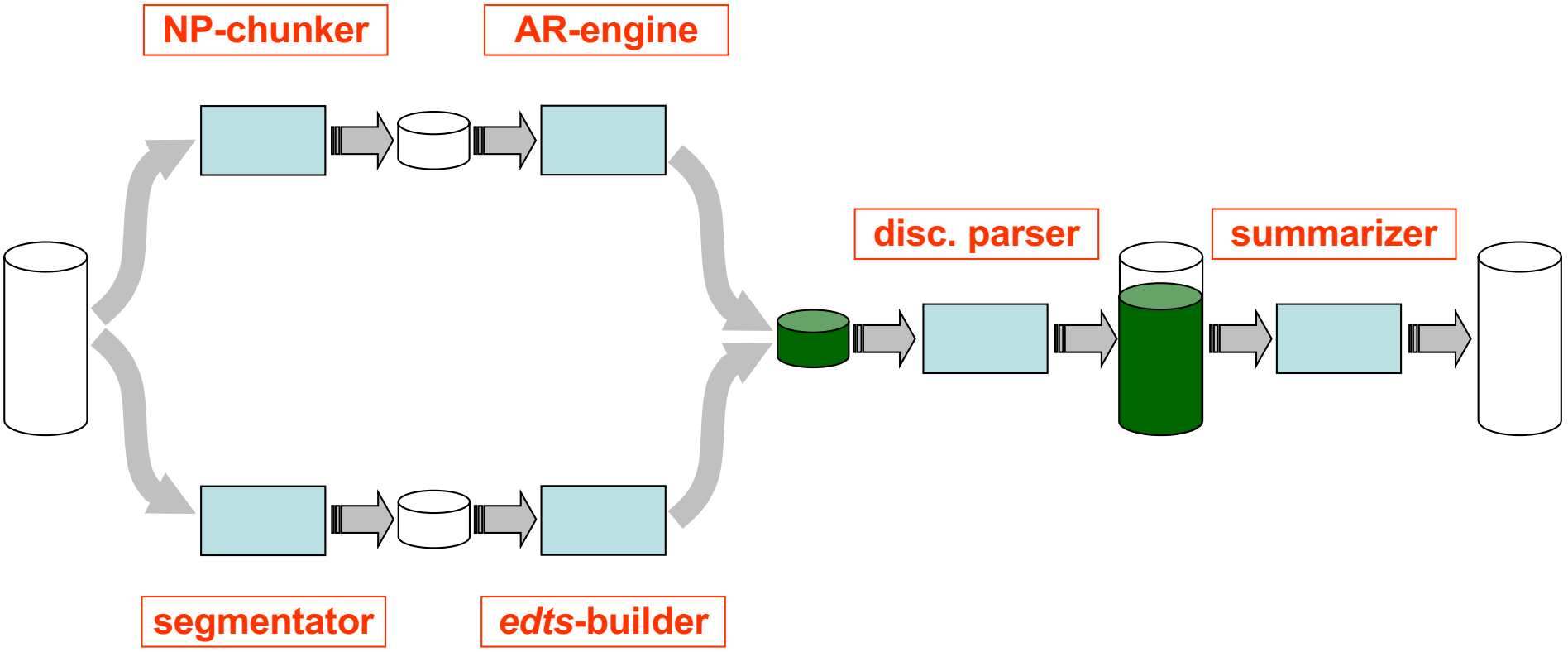

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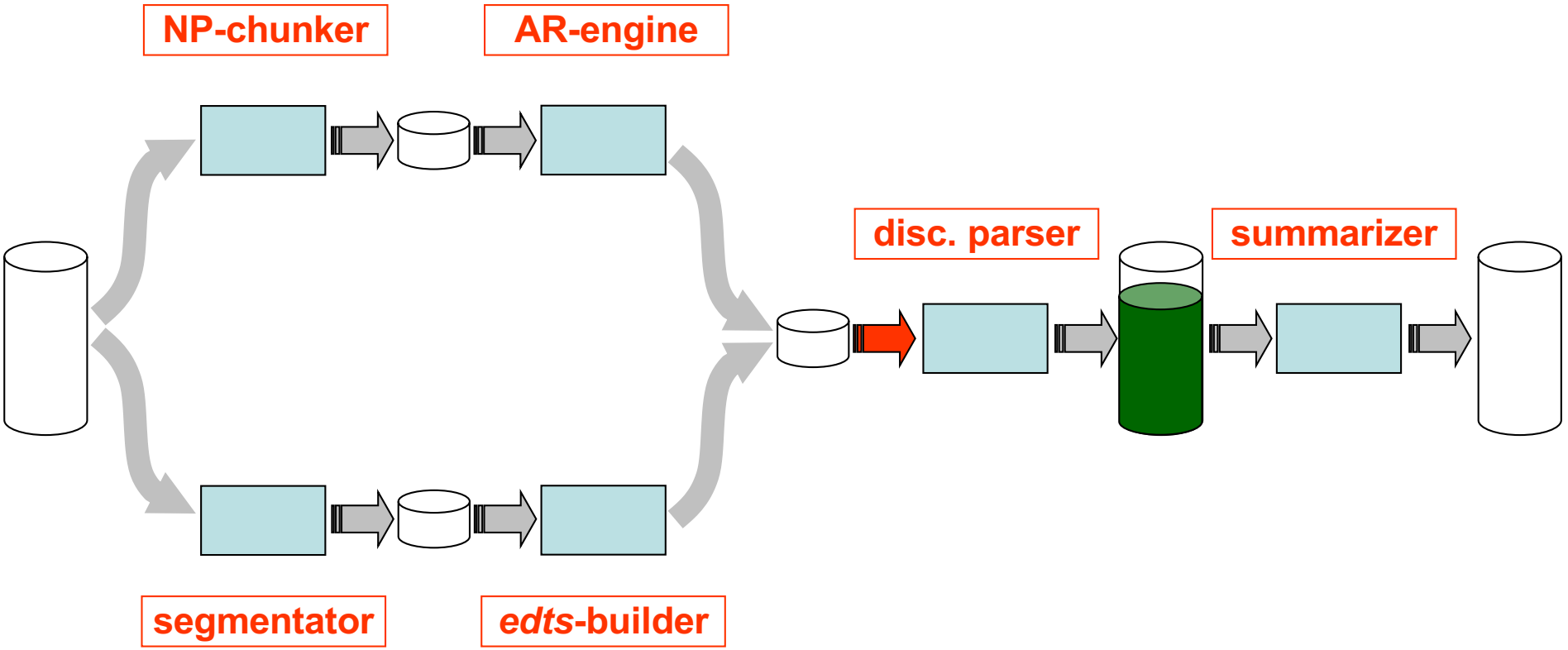

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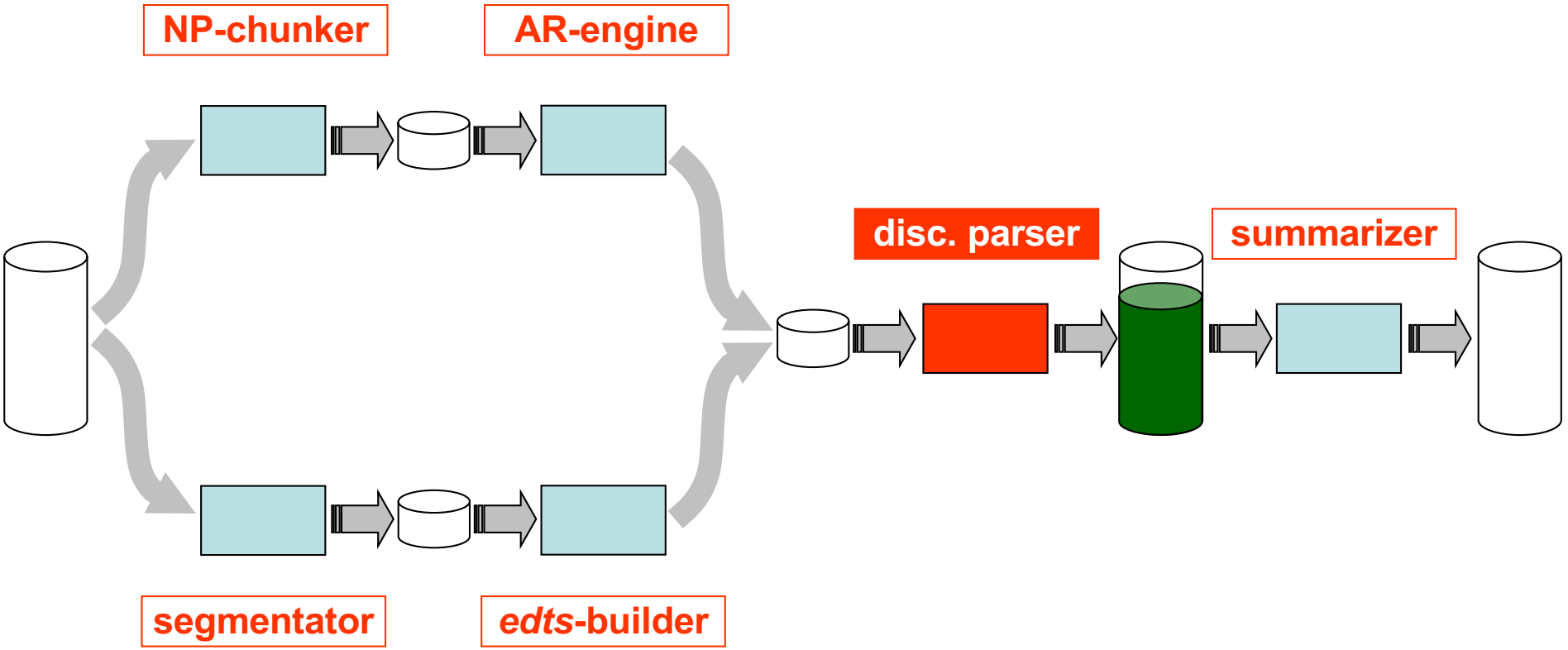

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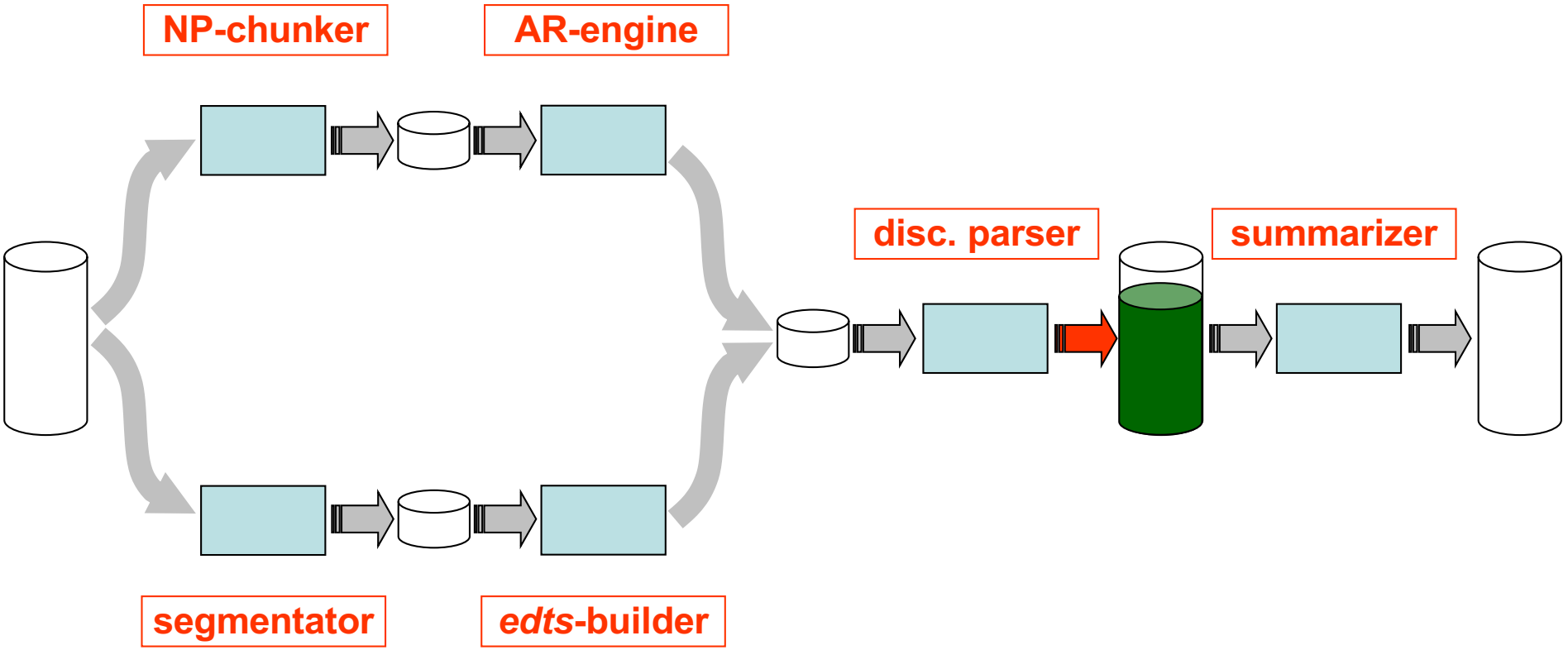

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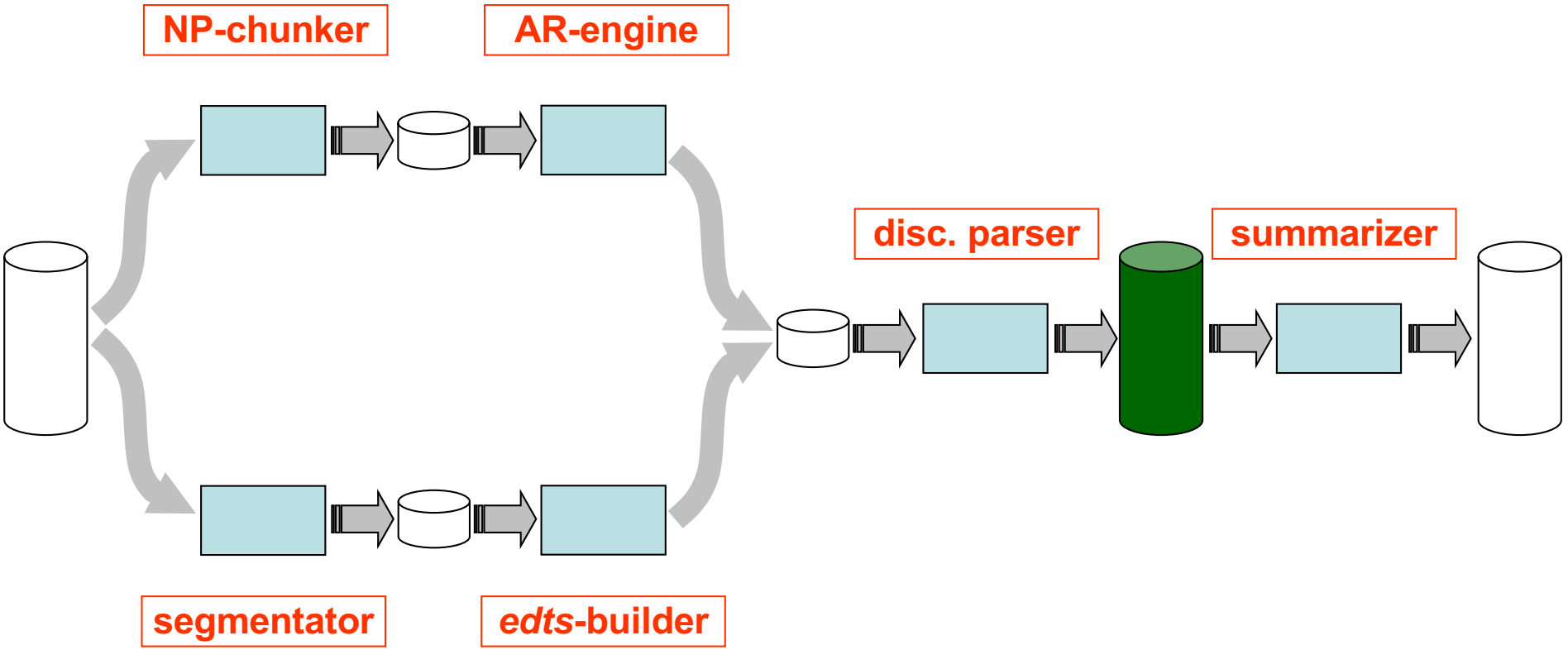

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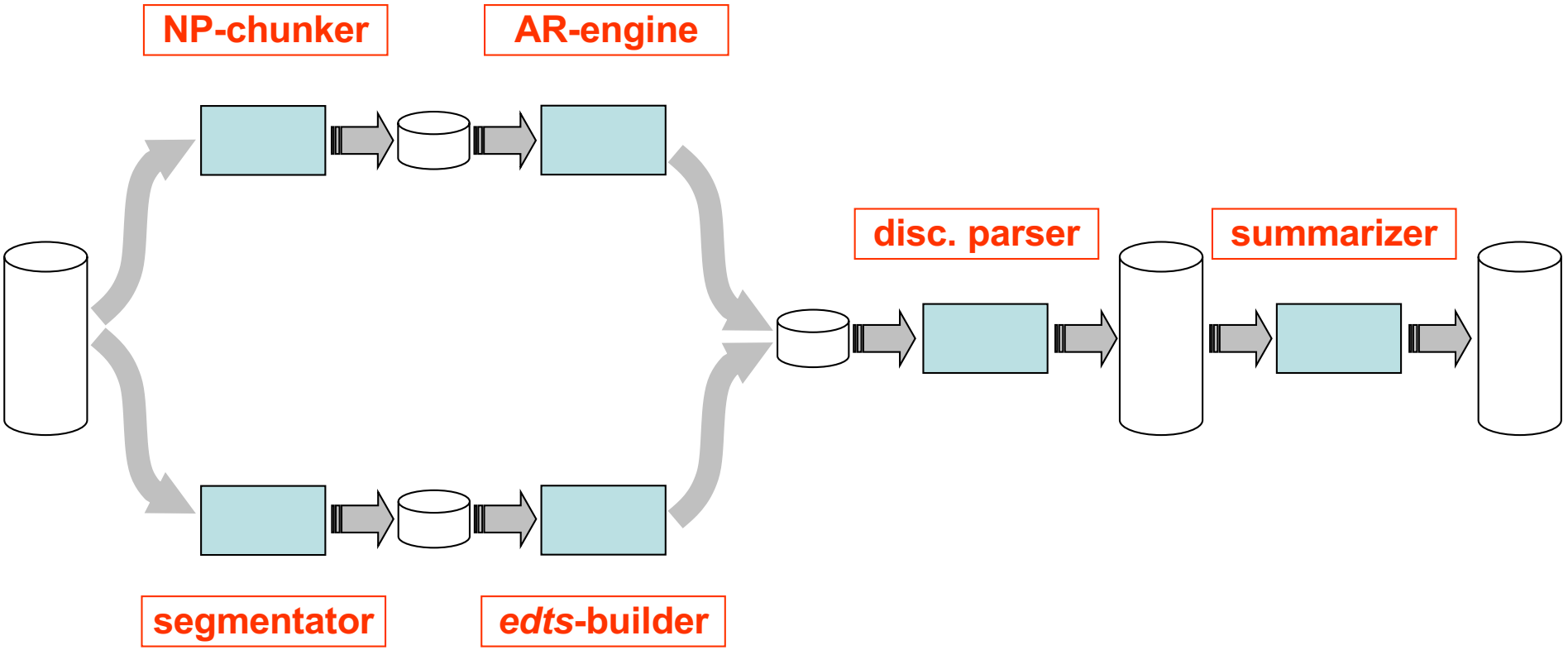

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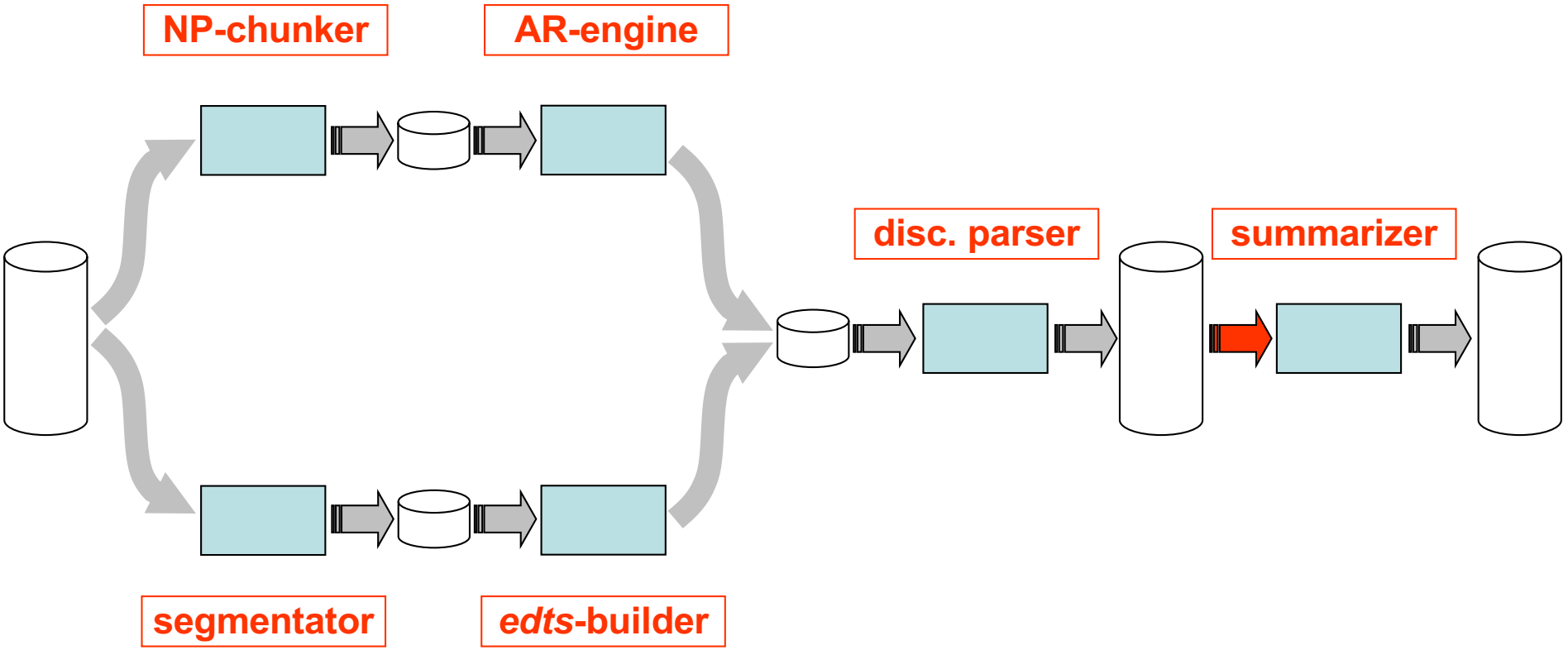

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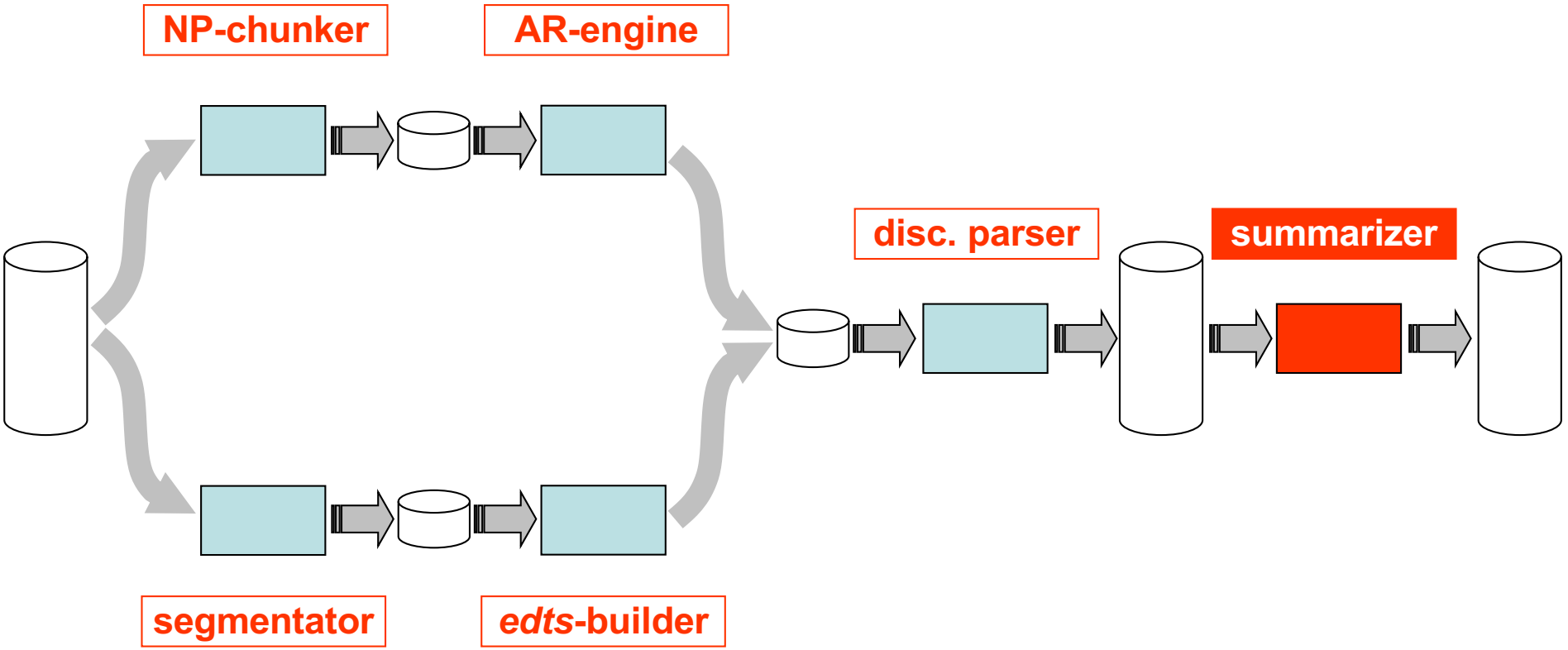

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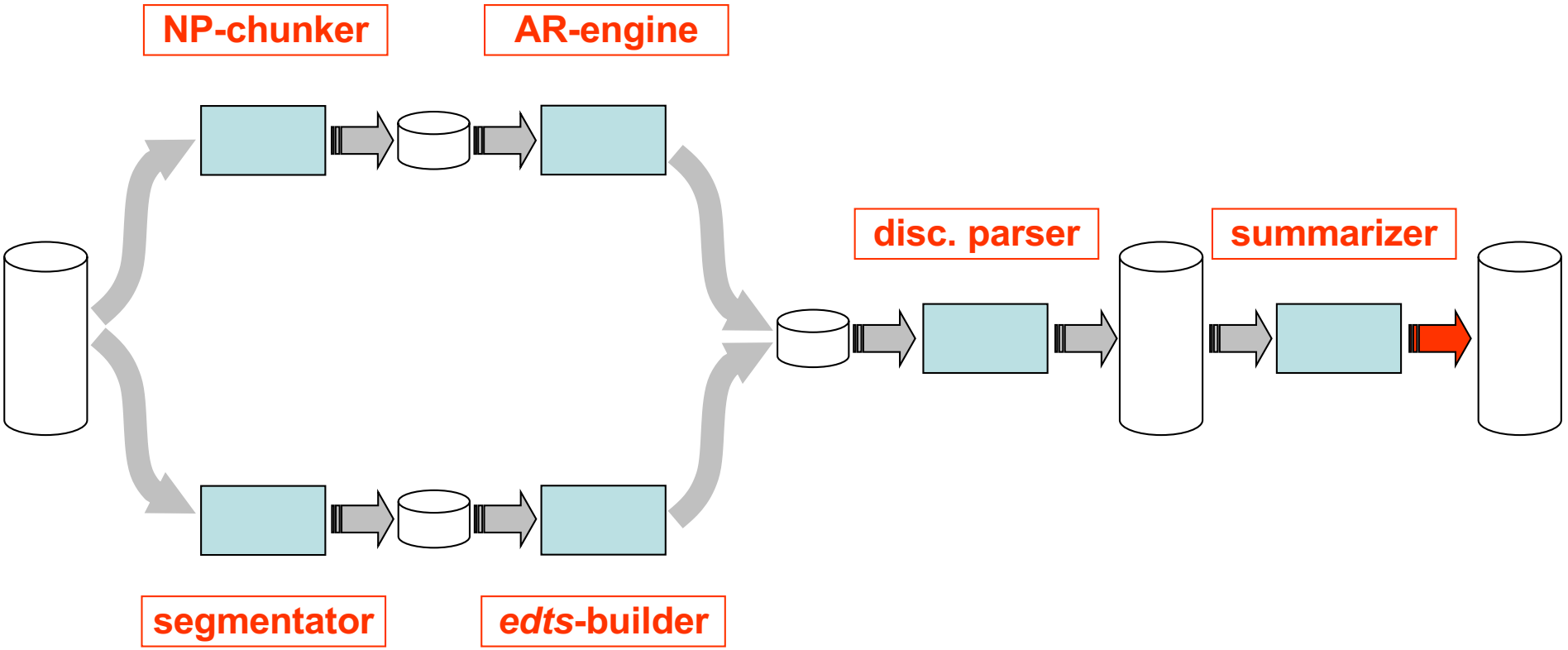

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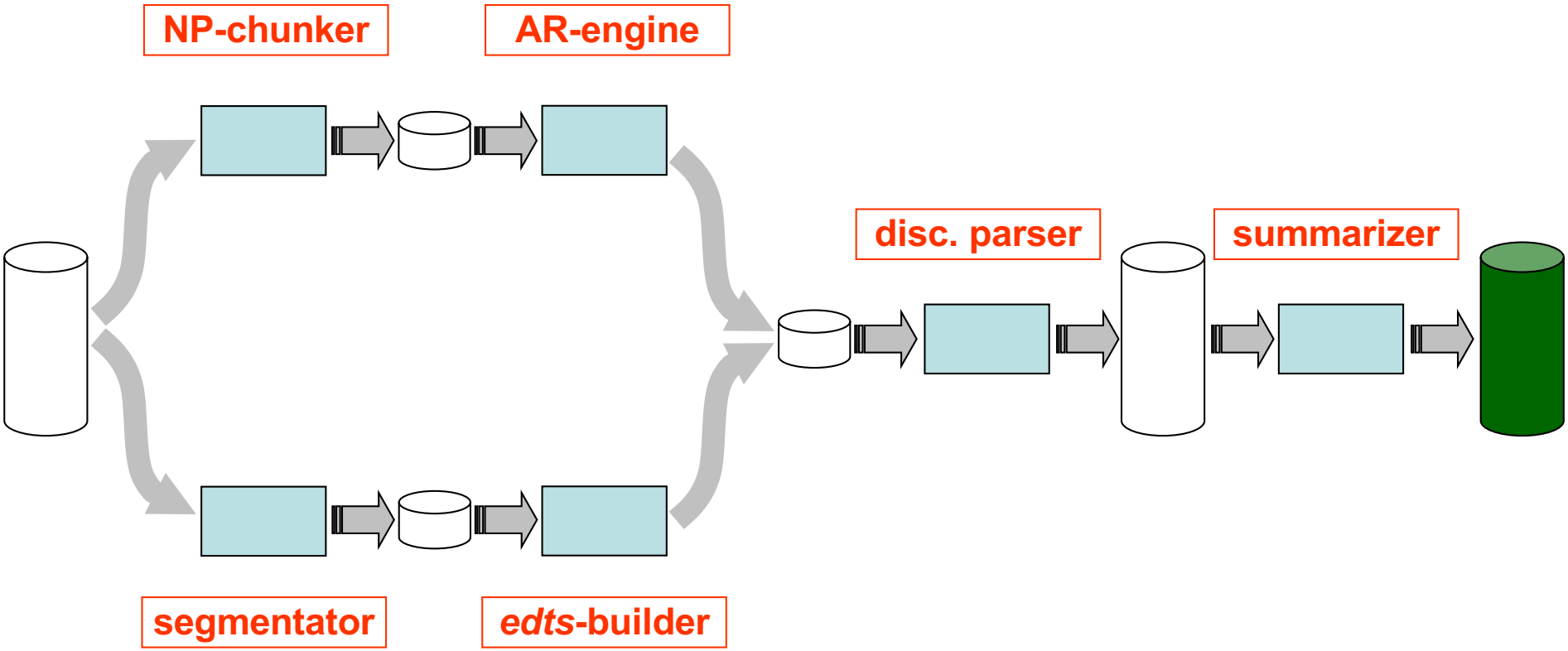
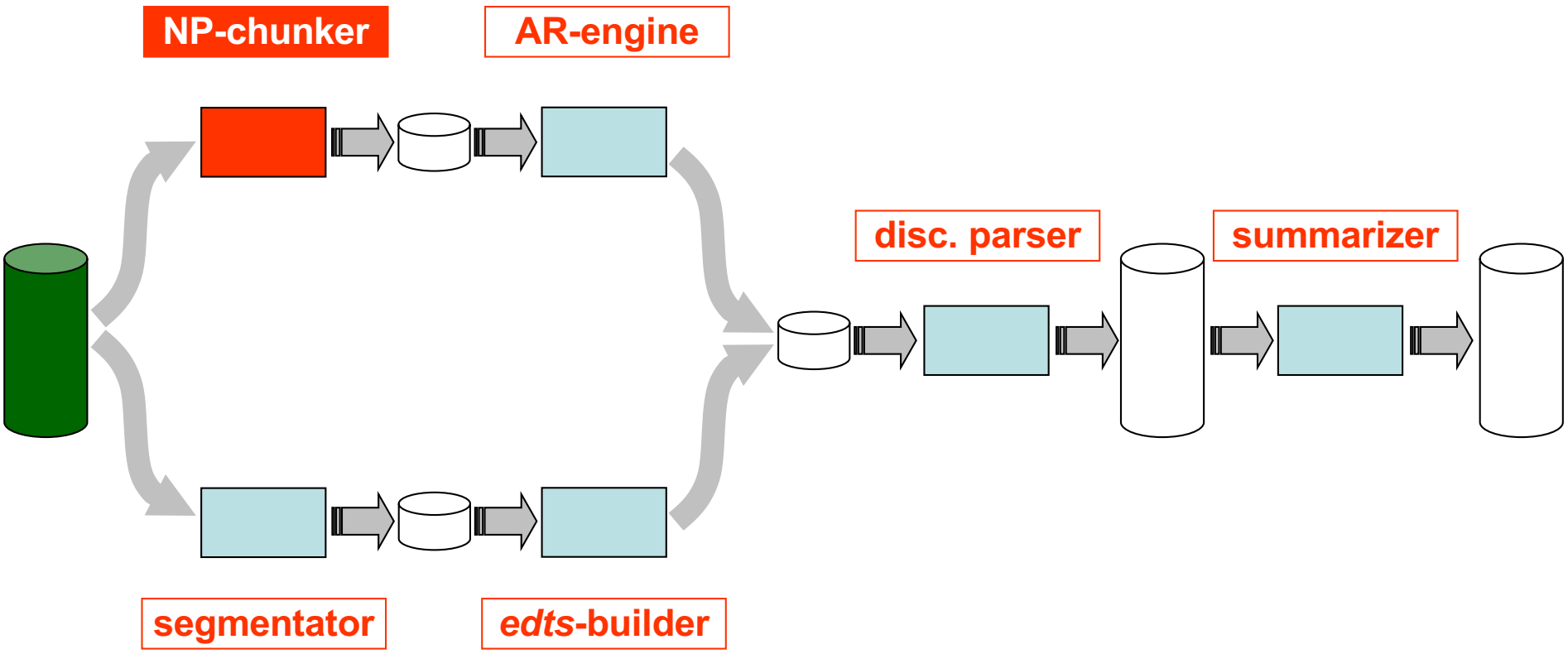


NP chunker


NP-chunker
AR-engine
disc. parser
summarizer
segmentator
edts-builder

NP chunker

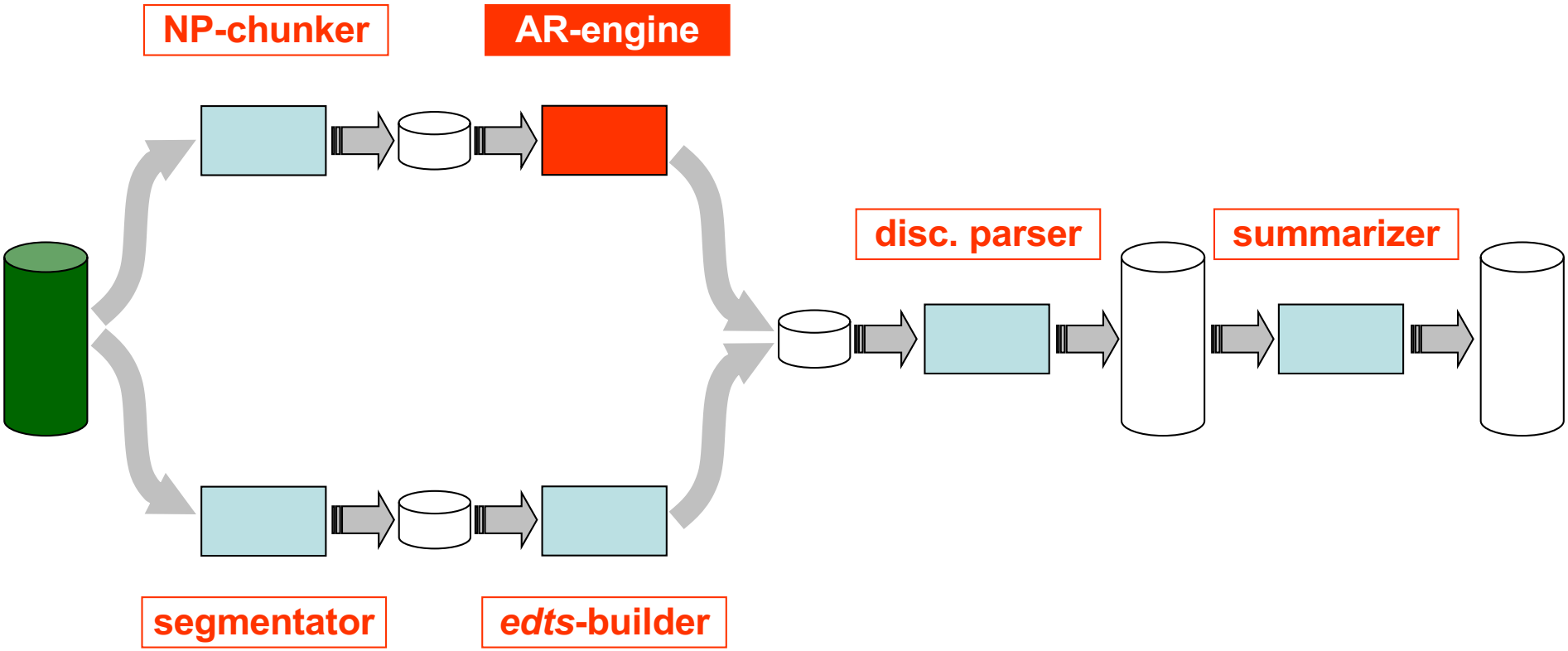
SEROQUEL

…

The pharmacokinetics of quetiapine were not significantly altered following co-administration with the antipsychotics risperidone or haloperidol. However, co-administration of Seroquel and thioridazine caused increases in clearance of quetiapine.

…

AR-engine


NP-chunker
AR-engine
disc. parser
summarizer
segmentator
edts-builder

AR-engine: referential links

SEROQUEL

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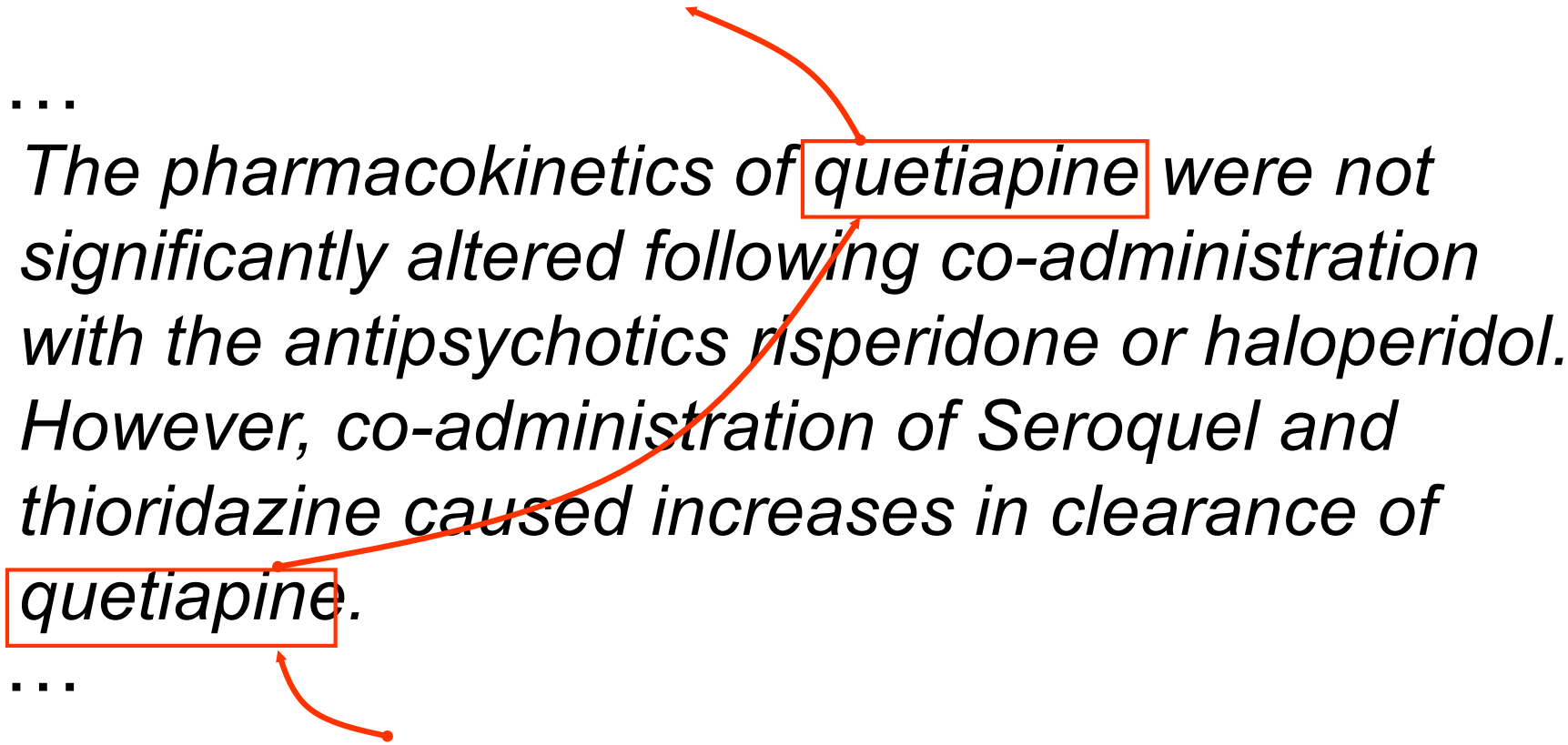
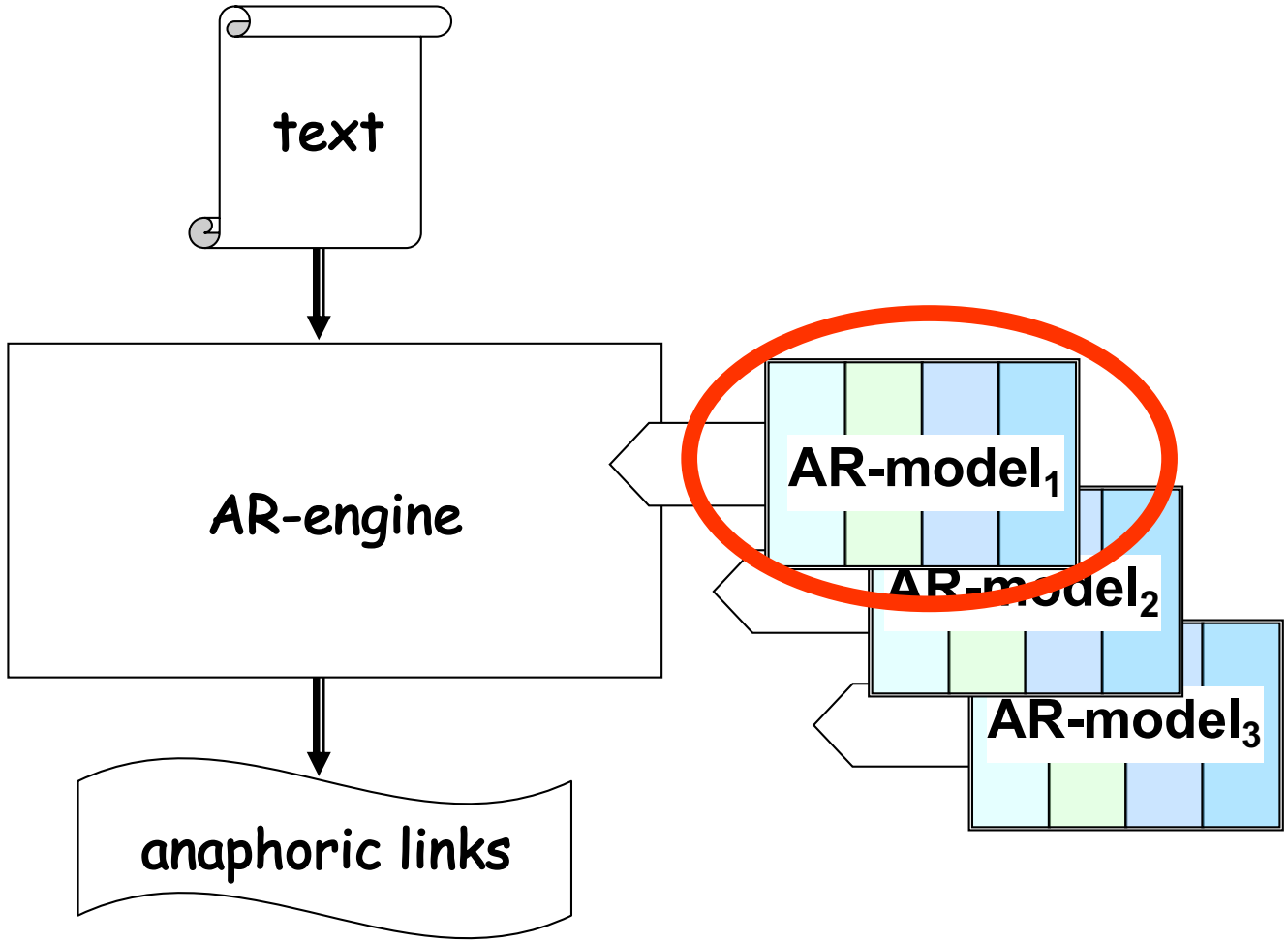
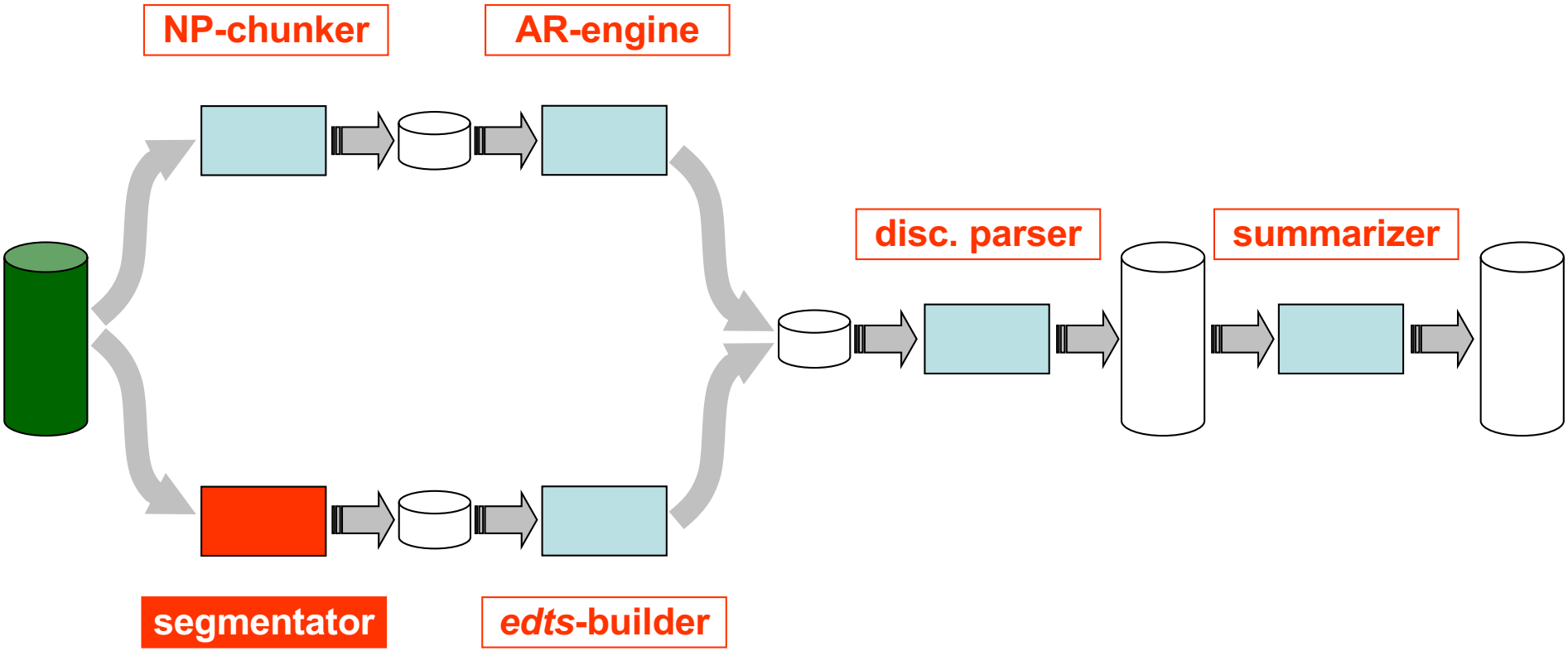
…



AR-engine: the architecture



Segmentator



Segmentator

SEROQUEL

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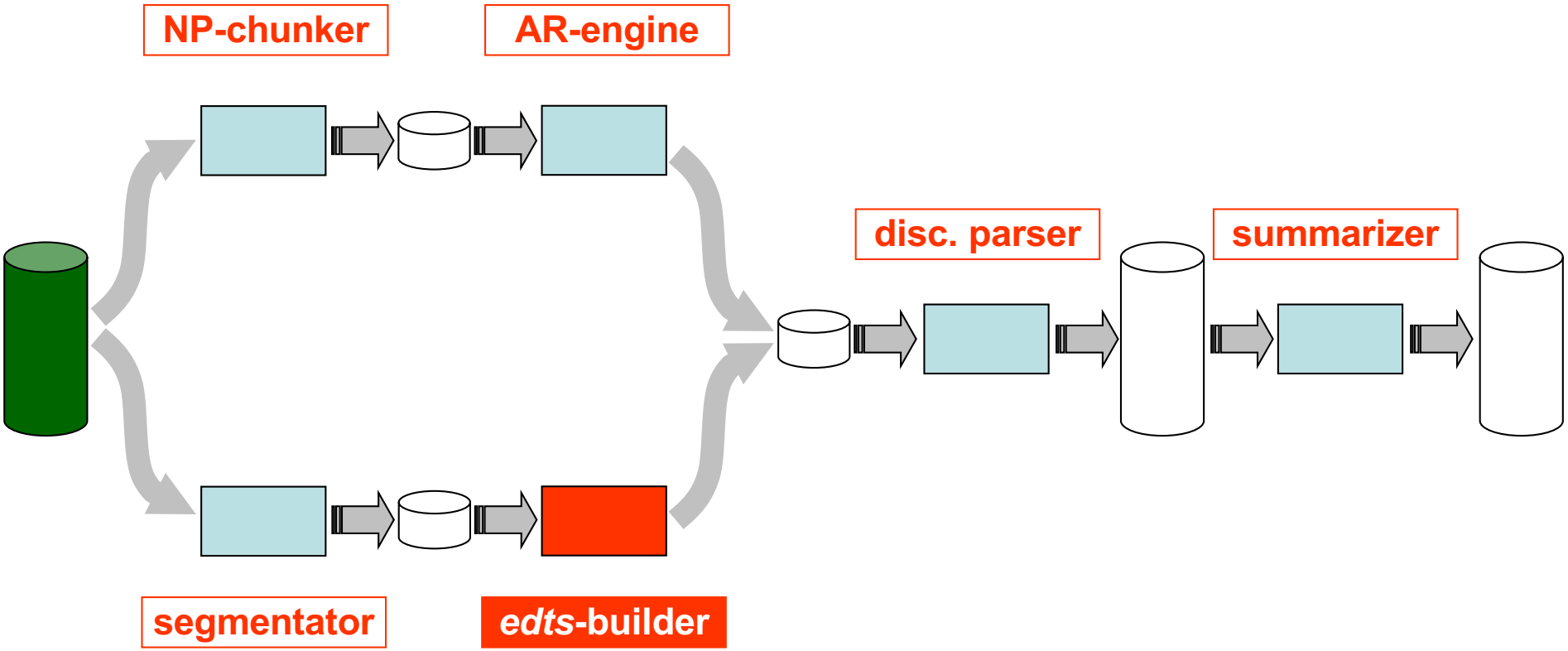
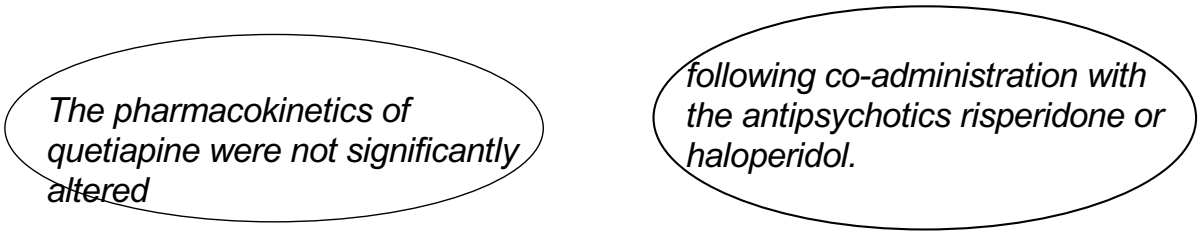
…

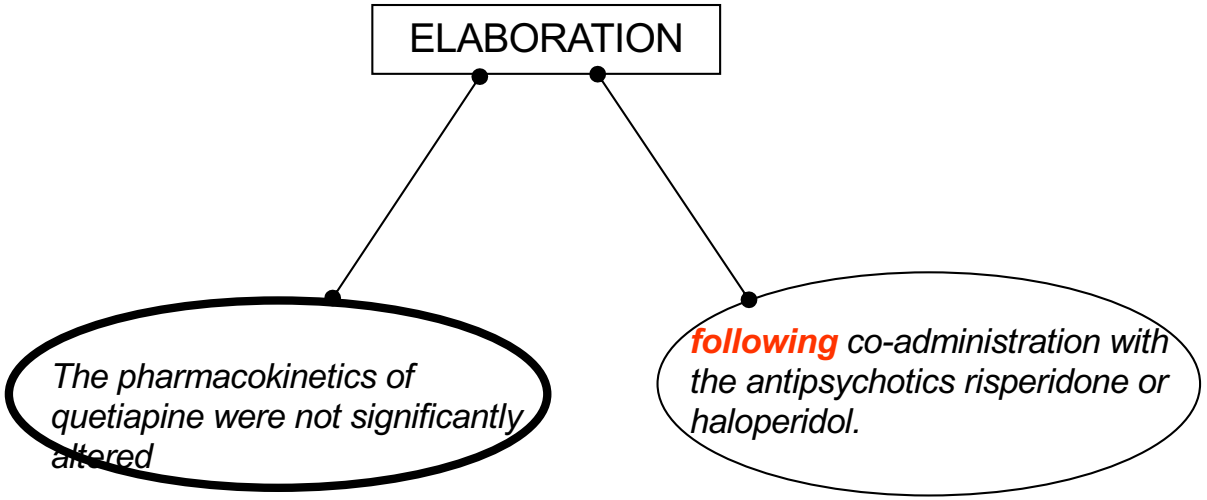
Elementary Discourse trees (*edts*)-builder



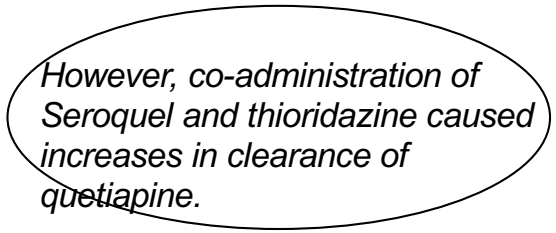
edts-builder



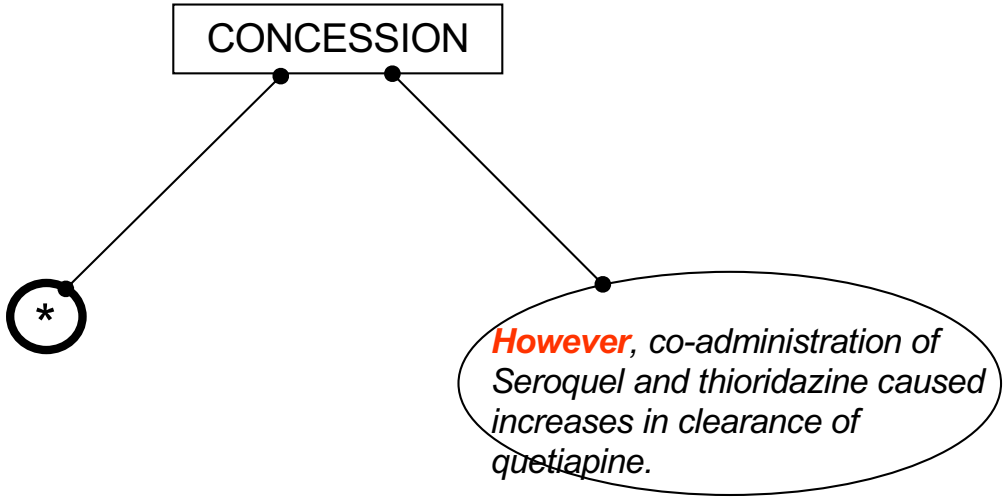
edts-builder



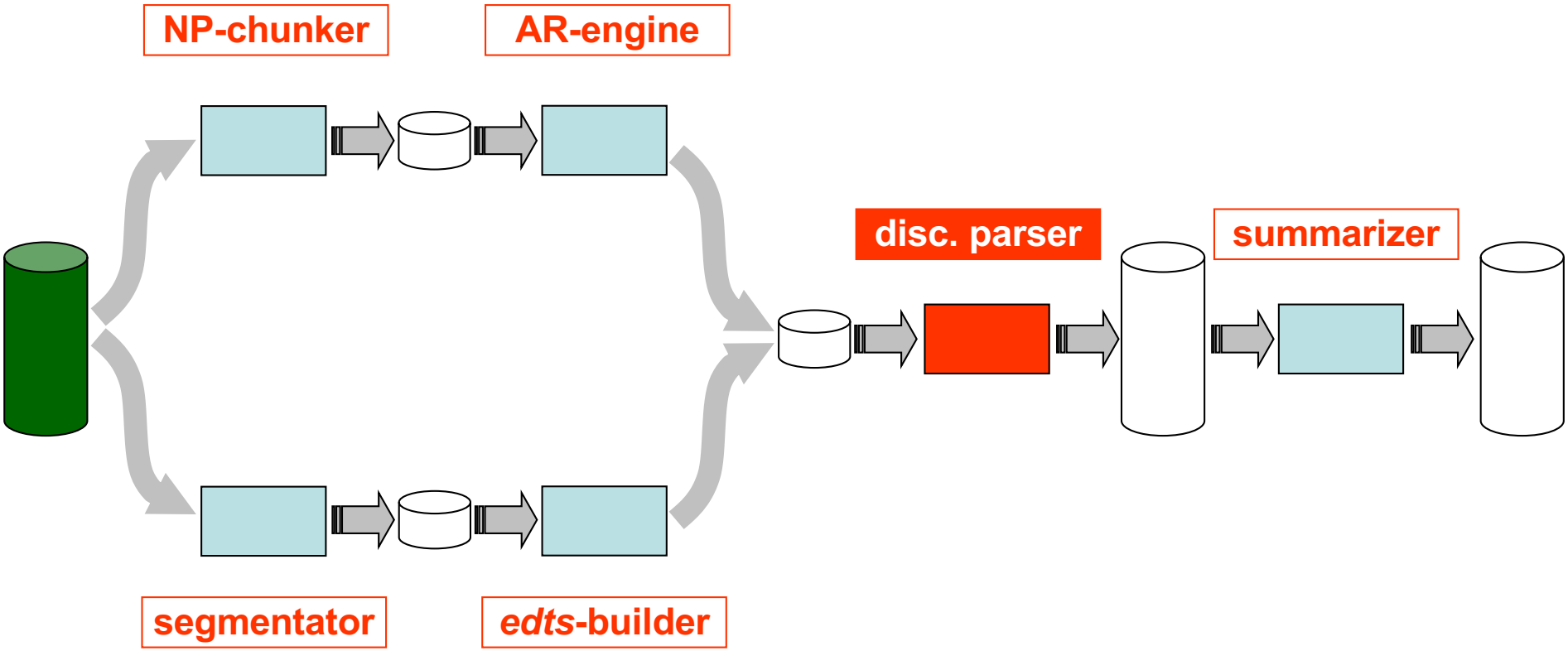
edts-builder



edts-builder



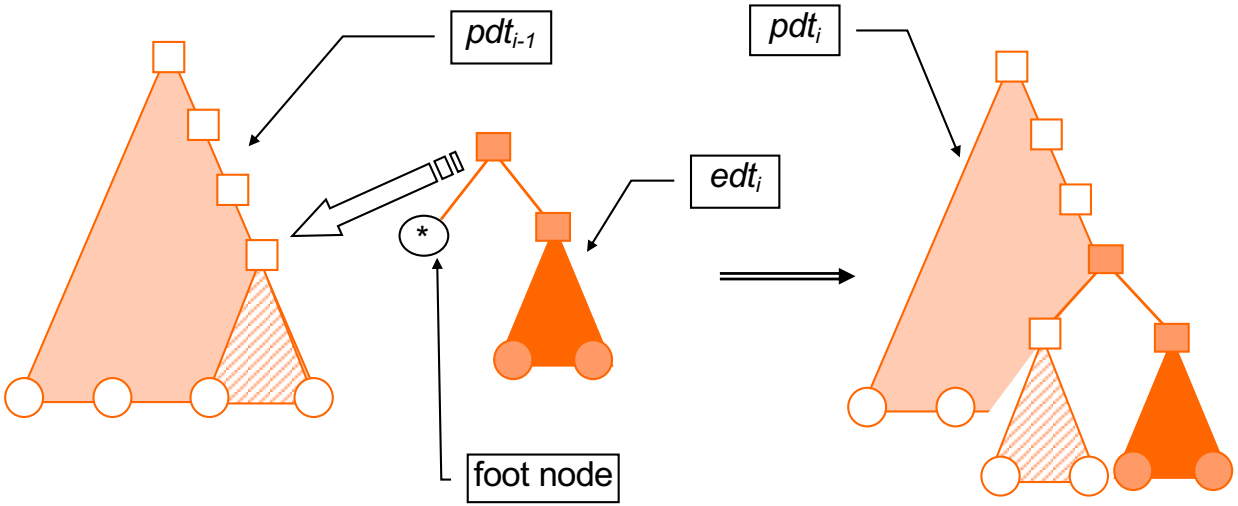
Discourse parser



Operations

Adjoining: always on the (generalised) right frontier of the developing tree

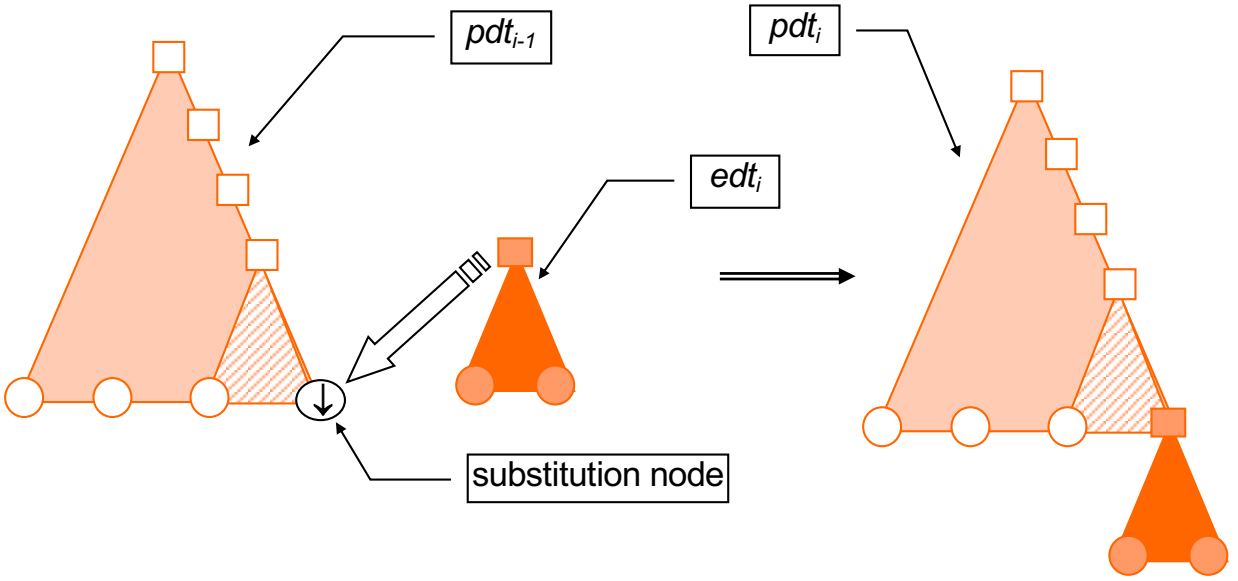
(Cristea & Webber, 1997)



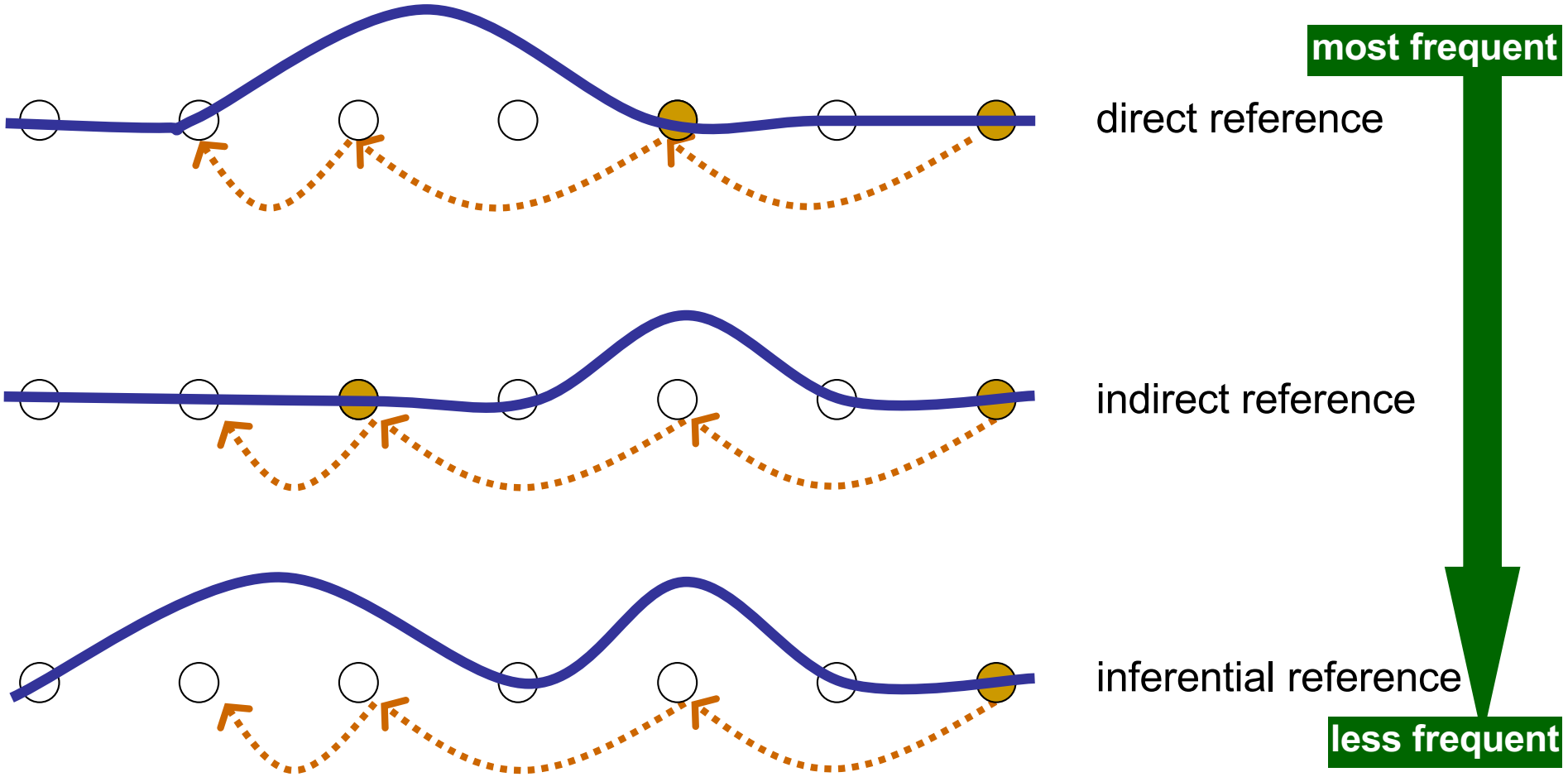
Operations

Substitution: on the most inner substitution node of the developing tree

(Cristea & Webber, 1997)



Evocative and post-evocative references

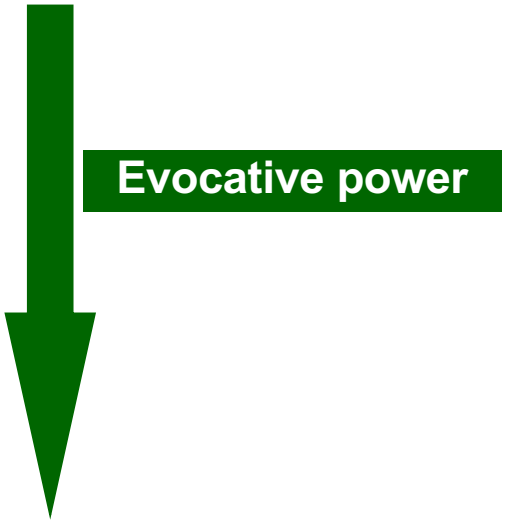


Inferential references, by type of anaphor

Remember the 4.4% inferential references!

(Gundel et al., 1993; Ide and Cristea, 2001)

type of anaphor	**disobeying VT**
pragmatic	56.3%
proper nouns	22.7%
common nouns	16.0%
pronouns	5.0%



Reference score

- To score *references in relation with veins* we have given the values **2**, **1** and **0** for the values **direct**, **indirect** and **inferential**, respectively.
- Then, to score the *anaphor type* we have given the values **3**, **2** and **1** for the following categories of anaphors: **pronoun**, **common noun** and **proper noun**, respectively.
- Then we have multiplied these scores for each anaphor, allowing each anaphor to contribute to the general score of the tree with a value between 0 and 6:
  - 0 = any of its antecedents are outside the *DEA* of anaphor's unit
  - …
  - 6 = pronoun whose most recent antecedent is included in the *DEA* of the unit the anaphor belongs to.

Transitions score

- *A local smoothness score:*
  - *CONTINUING = 4*
  - *RETAINING = 3*
  - *SMOOTH SHIFT =2*
  - *ABRUPT SHIFT = 1*
  - *NO Cb = 0*
- *A global smoothness score: summing up the transition scores of all units*

The Discourse Parser combines the two scores

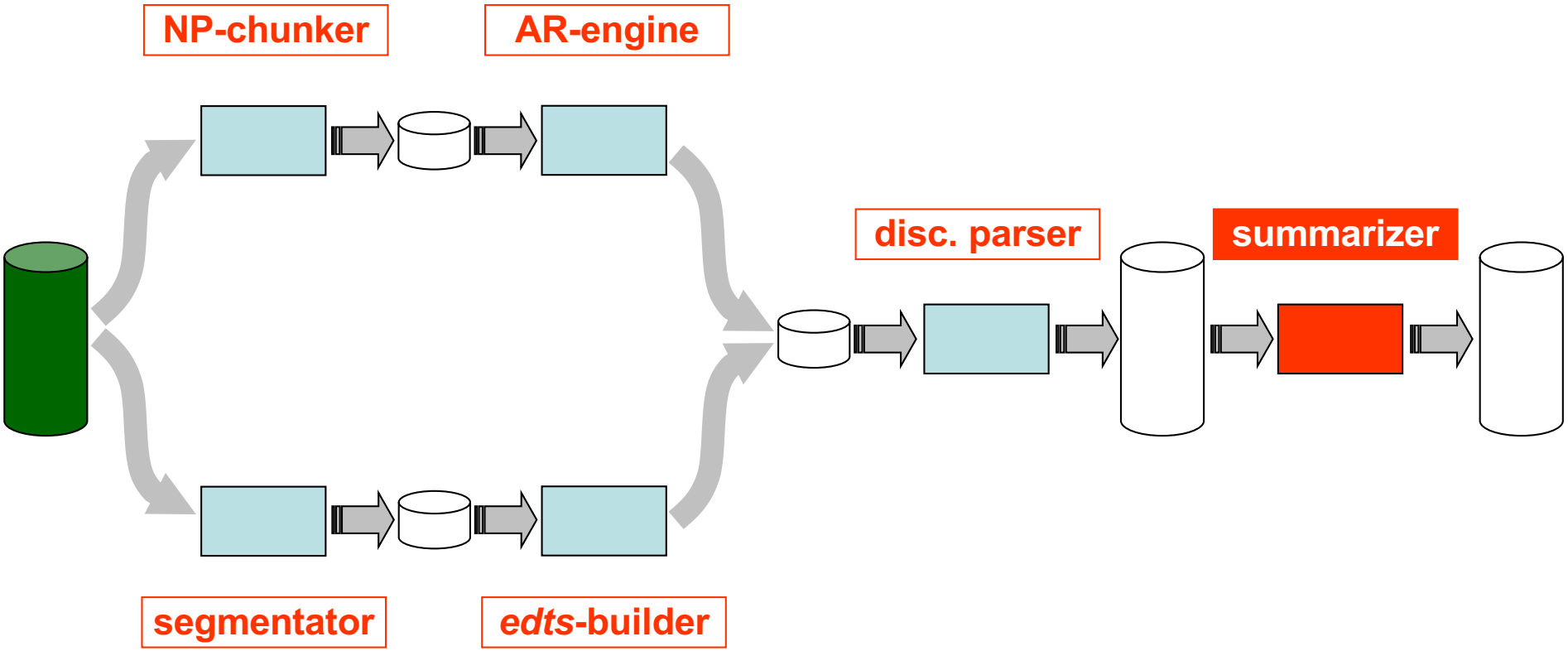
(Cristea, 2000)

Veins Theory guides an incremental discourse parsing process

The tree resulted after parsing is the one which manifests:

- the more natural overall references over the discourse structure (cohesion)
- the smoothest overall Centering transitions on veins (coherence)

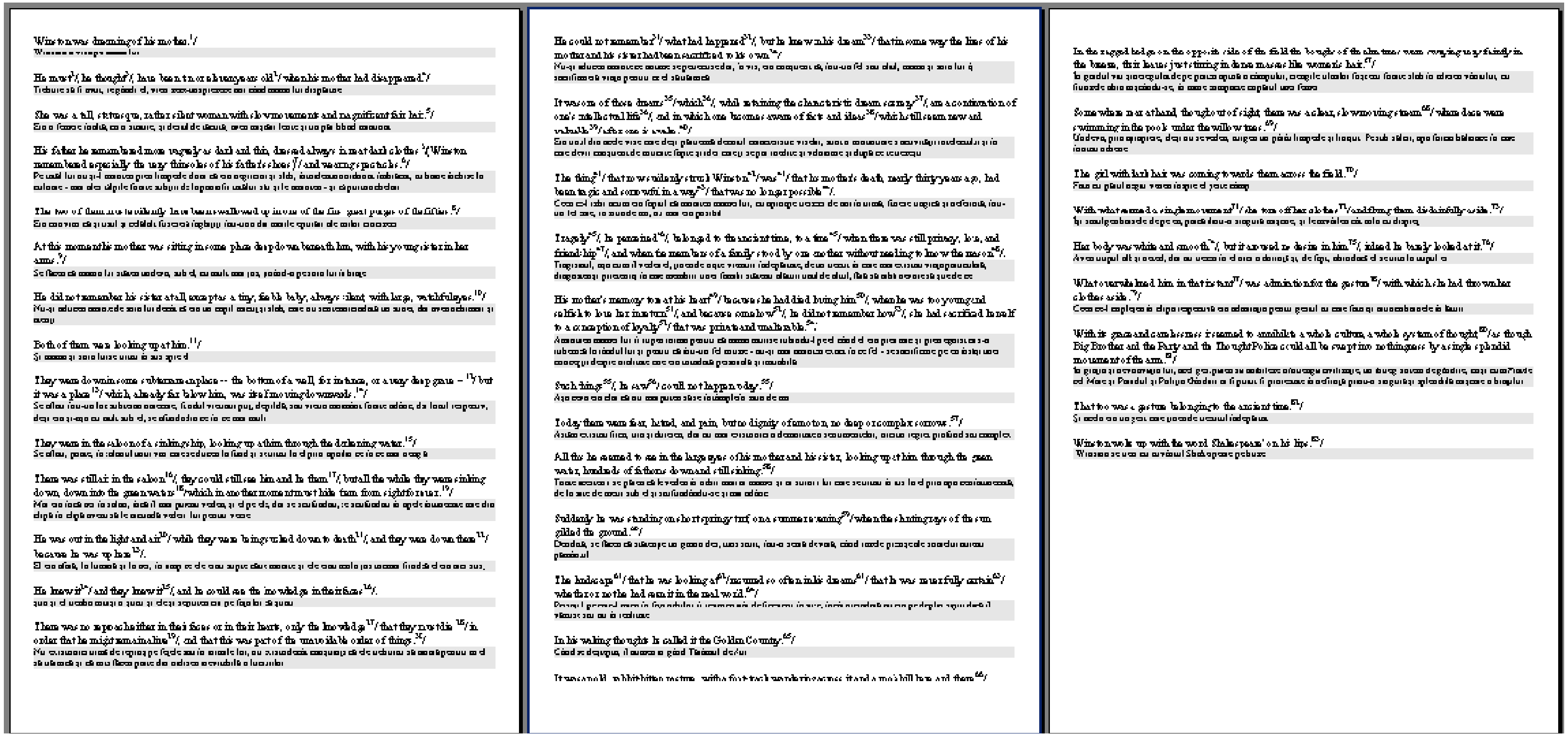
Incremental parallel processing



Focused summaries can easily be obtained by VT

Since the **vein expression** of a discourse unit is meant to give the minimal sequence of units that are required to understand just that unit in the context of the whole discourse ➔ the vein expression of a unit gives also a summary of the discourse focused on that unit.

The text



George Orwell: “1984”

Annotation: *edu*s are numbered

Winston was dreaming of his mother.[1]/

Winston o visa pe mama lui.

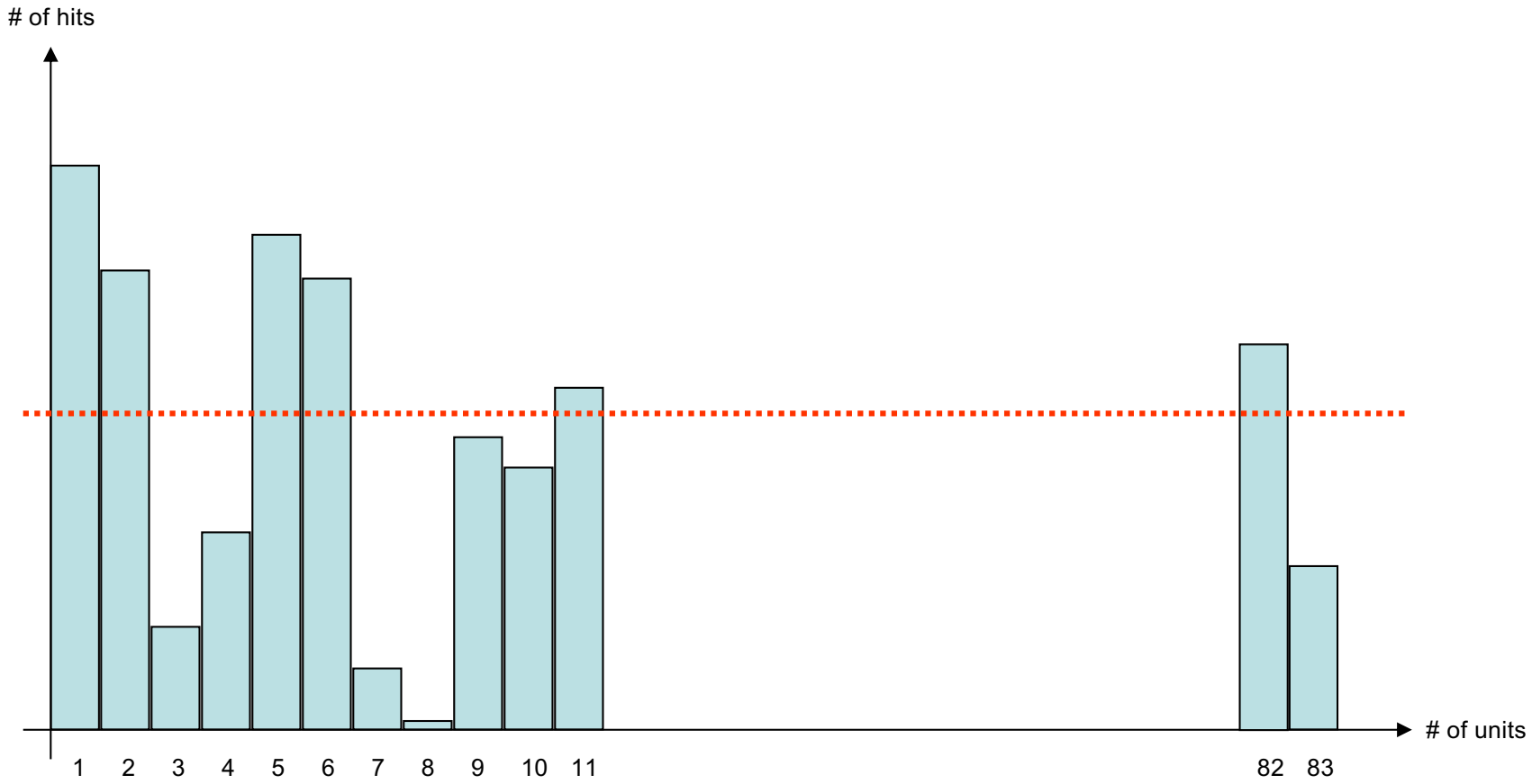
He must[2]/, he thought[3]/, have been ten or eleven years old[2]/ when his mother had disappeared.[4]/

Trebuie să fi avut, se gândi el, vreo zece-unsprezece ani când mama lui dispăruse.

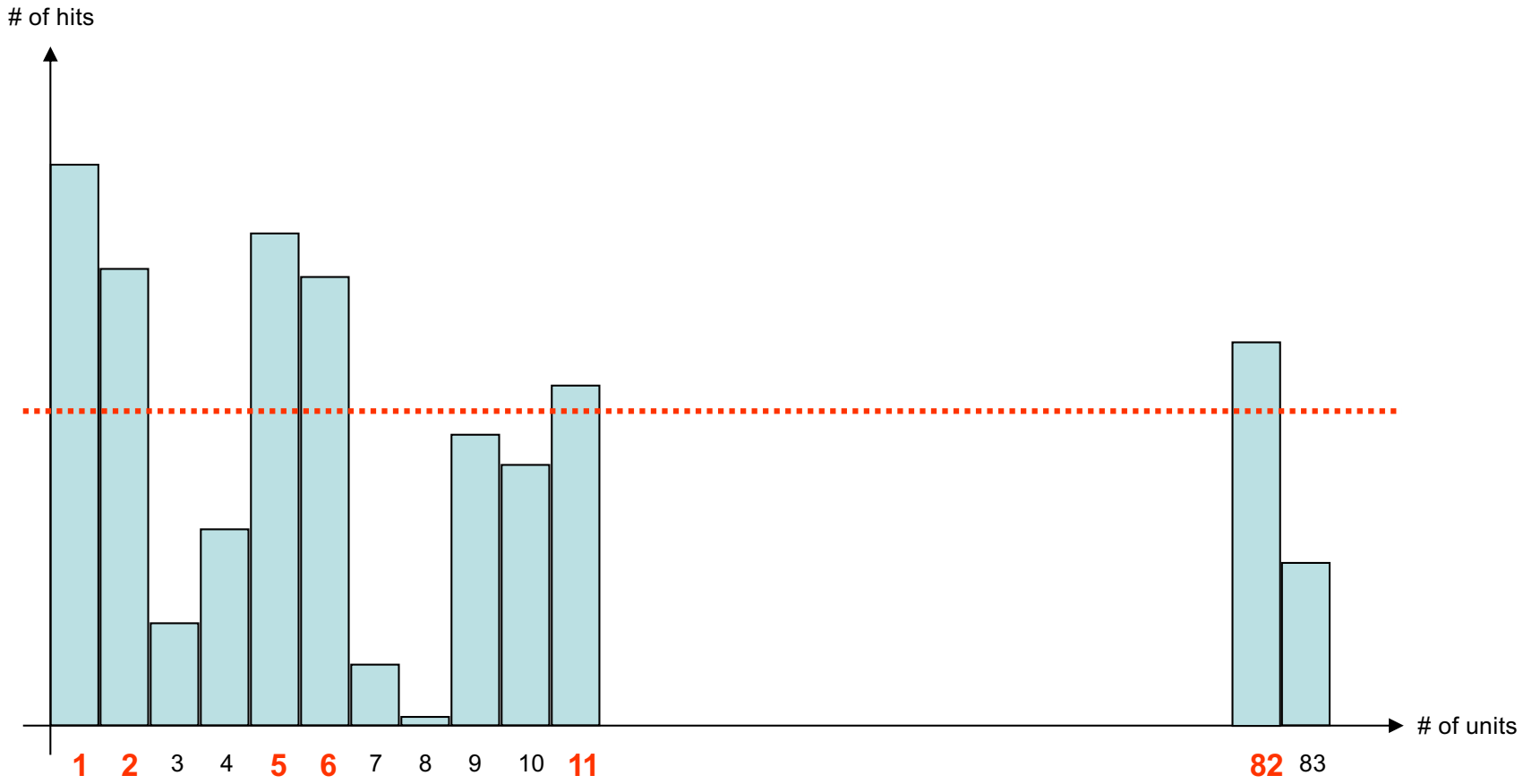
She was a tall, statuesque, rather silent woman with slow movements and magnificent fair hair.[5]/

Era o femeie înaltă, ca o statuie, şi destul de tăcută; avea mişcări lente şi un păr blond minunat.

The summary gold



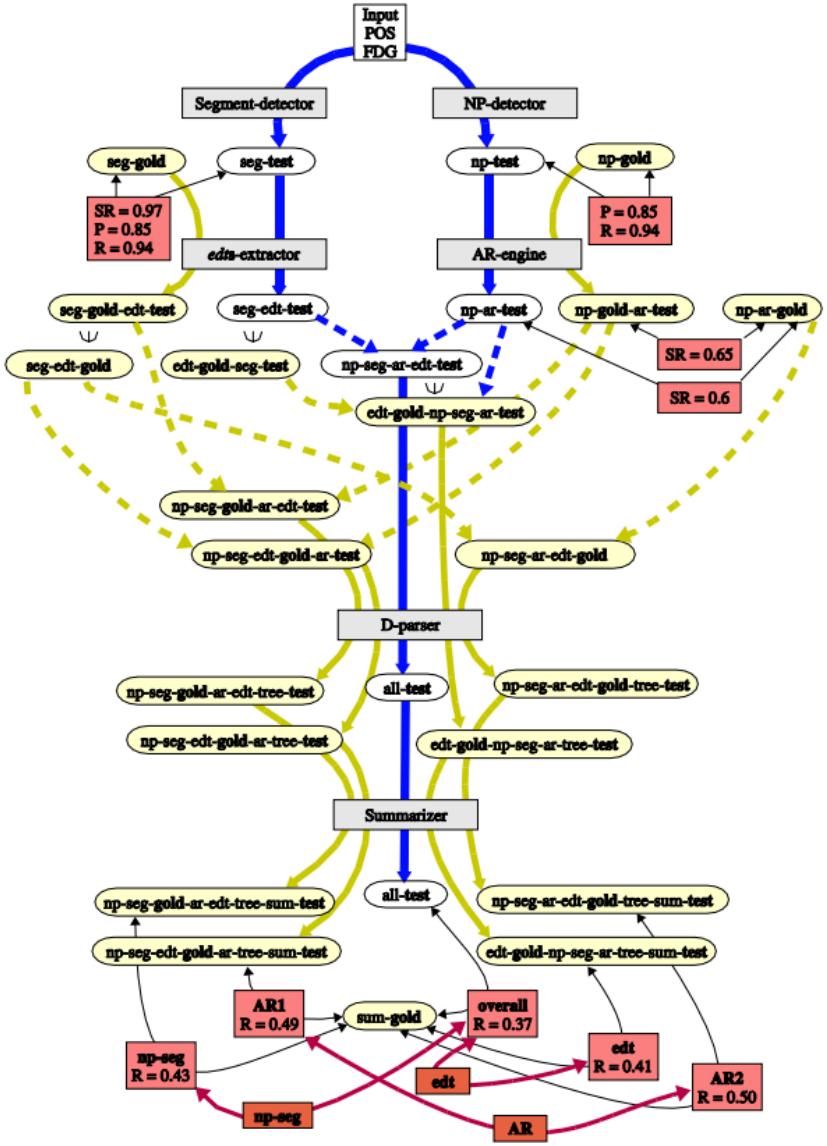
The summary gold



No of *edt*s

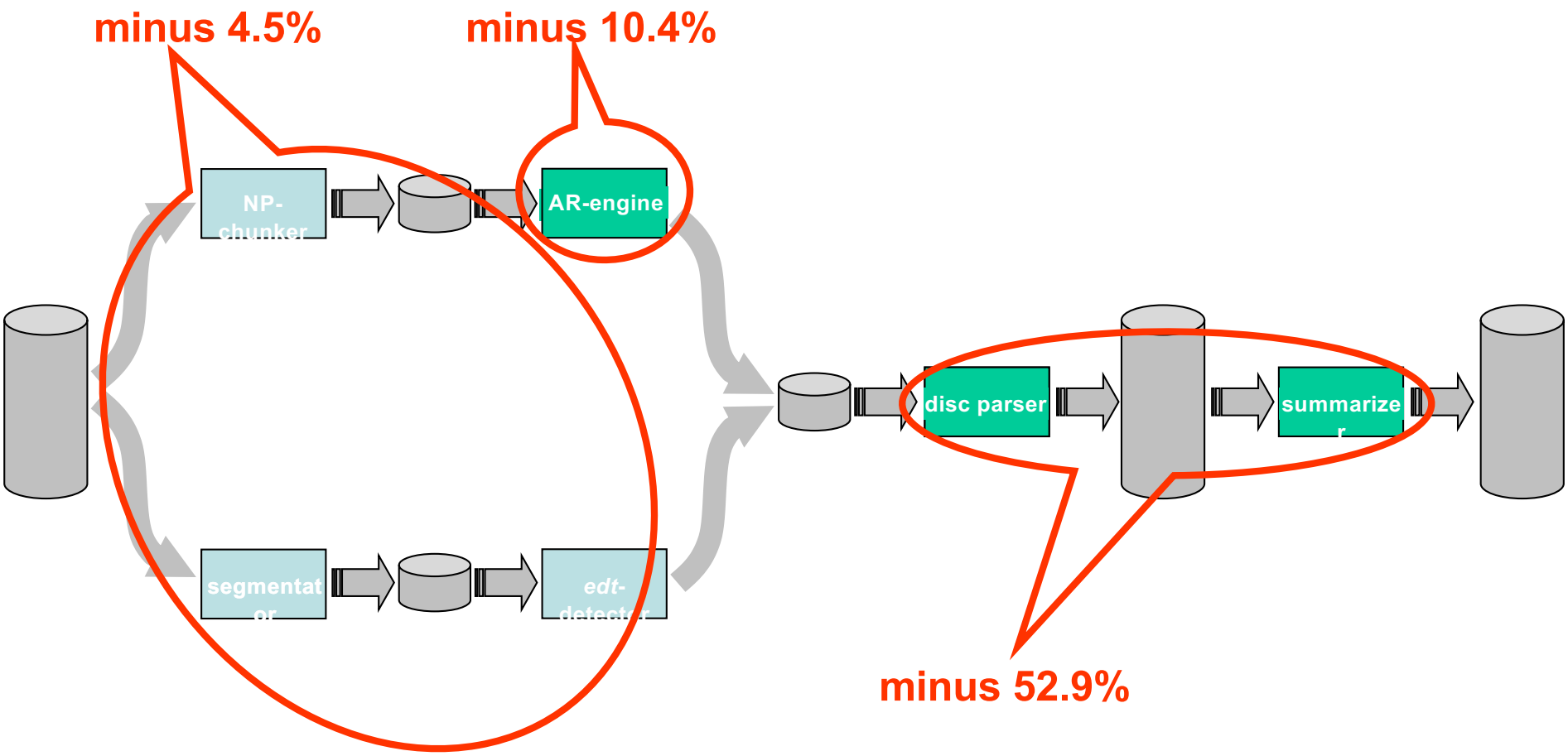
No of *edu*s	**No of sentences of this length**	**No of generated *edt*s per sentence**
1÷3	**25**	**1÷4**
4÷5	**9**	**5÷28**
6	**1**	**42**

VT guides the summarisation process



Evaluation in different points

Impact of different modules



Rezumare: un extras din “Legendele Olimpului”

Zeul - după aceea - a coborît în lume şi a cutreierat prin ţări nenumărate, căutîndu-şi loc de templu. Şi, tot umblînd pe drumuri, Apolo a ajuns în nişte locuri stranii, stîncoase, mohorîte. Pasămite sosise în muntele Parnas. Aici sînt nişte vîrfuri de piatră cenuşie, ce parcă stau să cadă într-un abis de smoală clocotitor de vuiet. Şuvoaiele de aer - un aer cald si umed - ţîşnesc necontenit şi vorbele rostite se-ntorc iute-n ecouri, sunînd din stîncă-n stîncă.

Pădurea-i misterioasă. Frunzişul ei şopteşte. Un izvor îşi prăvale apa sa cristalină spre valea-nnegurată sărind peste pripoare.

Şi-n munte-i o strîmtoare afundă, mocirloasă, unde traia atuncea - precum spunea legenda - un şarpe numit Piton. Trupul acestui monstru era lung cît un munte, cu-o sută de grumazuri şi o sută de guri, care azvîrleau flăcări, duhori înecăcioase.

Duhorile acestea înţesau tot văzduhul şi oameni, fiare, gîze, păsări sau alte fiinţe, dacă treceau pe acolo, se stingeau otrăvite.

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Chinuit de dureri, Piton s-a zvîrcolit prin verzile mocirle în care vieţuia. A sărit în nisipul cel galben de pe maluri şi a lunecat iară, cu şuiere cumplite, în putreda baltoacă, în vreme ce veninul i se scurgea din boturi.

Monstrul s-a zvîrcolit tot mai încet în apă. Ochii i s-au lăsat. S-au cufundat pe încetul, de tot, în întuneric. Aşa s-a prăpădit. Iar trupul său lungit pe zeci şi zeci de stînjeni, i s-a uscat cu timpul, sub razele de soare...

Şi locurile acestea unde-a răpus Apolo pe fiorosul monstru au fost numite Delfi.

În Delfi se vor pune temelii unui templu şi-unui vestit oracol, a hotărît Apolo. Oamenii vor putea să-ntrebe şi să afle răspuns la întrebări, prin preuteasa mea, Pitia, înţeleapta. Ea se va aşeza pe un trepied de aur, învăluit în pielea lui Piton cel răpus, deasupra unei grote adînci si fumegînde, ce duce pînă-n ţara lui Hades, mohorîtul... Prin ea voi da răspunsuri. Dar oamenii datori sînt să-mi dăruiască aur şi scule preţioase şi zeci de bogăţii, răsplată pentru mine şi preoţii din templu... Mai poruncesc, de-asemeni, să aibă loc, în cinstea luptei mele cu monstrul, jocuri, serbări, concursuri, şi cîntece, şi danţuri... Să fie veselie, iar eu să fiu slăvit...

După aceea zeul, pătat încă de sînge - de sîngele lui Piton - a pornit să se spele, să-şi purifice trupul, în micul rîu Tempe.

Rezumare: un extras din “Legendele Olimpului”

Prima mențiune a lui Hefaistos

Zeul - după aceea - a coborît în lume şi a cutreierat prin ţări nenumărate, căutîndu-şi loc de templu. Şi, tot umblînd pe drumuri, Apolo a ajuns în nişte locuri stranii, stîncoase, mohorîte. Pasămite sosise în muntele Parnas. Aici sînt nişte vîrfuri de piatră cenuşie, ce parcă stau să cadă într-un abis de smoală clocotitor de vuiet. Şuvoaiele de aer - un aer cald si umed - ţîşnesc necontenit şi vorbele rostite se-ntorc iute-n ecouri, sunînd din stîncă-n stîncă.

Pădurea-i misterioasă. Frunzişul ei şopteşte. Un izvor îşi prăvale apa sa cristalină spre valea-nnegurată sărind peste pripoare.

Şi-n munte-i o strîmtoare afundă, mocirloasă, unde traia atuncea - precum spunea legenda - un şarpe numit Piton. Trupul acestui monstru era lung cît un munte, cu-o sută de grumazuri şi o sută de guri, care azvîrleau flăcări, duhori înecăcioase.

Duhorile acestea înţesau tot văzduhul şi oameni, fiare, gîze, păsări sau alte fiinţe, dacă treceau pe acolo, se stingeau otrăvite.

Şarpele se născuse dintr-o mocirlă verde. Mocirla rămăsese din apele vărsate acolo, prin potopul orînduit de Zeus.

Piton primise-n taină poruncă de la Hera să-l pîndească pe Apolo, cînd va trece prin munte, şi să-i răpună viaţa. Hera-l ura pe fiul cel nou născut al Letei, pentru că soţul său, prea puternicul Zeus, ţinea mai mult la dînsul decit la fiii ei: Hefaistos şi Ares.

Cînd a ajuns Apolo în muntele Parnas, dihania uriaşă s-a avîntat spre dînsul, dornică să-l ucidă. Dar zeul şi-a întins arcul. A tras prima săgeată. Erau doar patru zile de cînd văzuse lumea, şi întiia lui săgeată a şi nimerit monstrul.

E drept că şi săgeata fusese făurită de fierarul din Lemnos, Hefaistos, schilodul, cu mare meşteşug. Cum i-a pătruns săgeata în carnea mucedă, şarpele a simţit că i-a venit sfîrşitul. A încercat să scape şi să se furişeze într-o pesteră adîncă. Dar n-a mai izbutit...

Chinuit de dureri, Piton s-a zvîrcolit prin verzile mocirle în care vieţuia. A sărit în nisipul cel galben de pe maluri şi a lunecat iară, cu şuiere cumplite, în putreda baltoacă, în vreme ce veninul i se scurgea din boturi.

Monstrul s-a zvîrcolit tot mai încet în apă. Ochii i s-au lăsat. S-au cufundat pe încetul, de tot, în întuneric. Aşa s-a prăpădit. Iar trupul său lungit pe zeci şi zeci de stînjeni, i s-a uscat cu timpul, sub razele de soare...

Şi locurile acestea unde-a răpus Apolo pe fiorosul monstru au fost numite Delfi.

În Delfi se vor pune temelii unui templu şi-unui vestit oracol, a hotărît Apolo. Oamenii vor putea să-ntrebe şi să afle răspuns la întrebări, prin preuteasa mea, Pitia, înţeleapta. Ea se va aşeza pe un trepied de aur, învăluit în pielea lui Piton cel răpus, deasupra unei grote adînci si fumegînde, ce duce pînă-n ţara lui Hades, mohorîtul... Prin ea voi da răspunsuri. Dar oamenii datori sînt să-mi dăruiască aur şi scule preţioase şi zeci de bogăţii, răsplată pentru mine şi preoţii din templu... Mai poruncesc, de-asemeni, să aibă loc, în cinstea luptei mele cu monstrul, jocuri, serbări, concursuri, şi cîntece, şi danţuri... Să fie veselie, iar eu să fiu slăvit...

După aceea zeul, pătat încă de sînge - de sîngele lui Piton - a pornit să se spele, să-şi purifice trupul, în micul rîu Tempe.

Rezumare: un extras din “Legendele Olimpului”

A doua mențiune a lui Hefaistos

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Un rezumat obişnuit

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Un rezumat focalizat pe prima apariţie a lui Hefaistos

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Şi-n munte-i o strîmtoare afundă, mocirloasă, unde traia atuncea un şarpe numit Piton.

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Un rezumat focalizat pe a doua apariţie a lui Hefaistos

Zeul - după aceea - a coborît în lume şi a cutreierat prin ţări nenumărate. Apolo a ajuns în nişte locuri stranii, stîncoase, mohorîte. Pasămite sosise în muntele Parnas.

Şi-n munte-i o strîmtoare afundă, mocirloasă, unde traia atuncea un şarpe numit Piton.

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