Towards a Visual Editor for Lens Combinators

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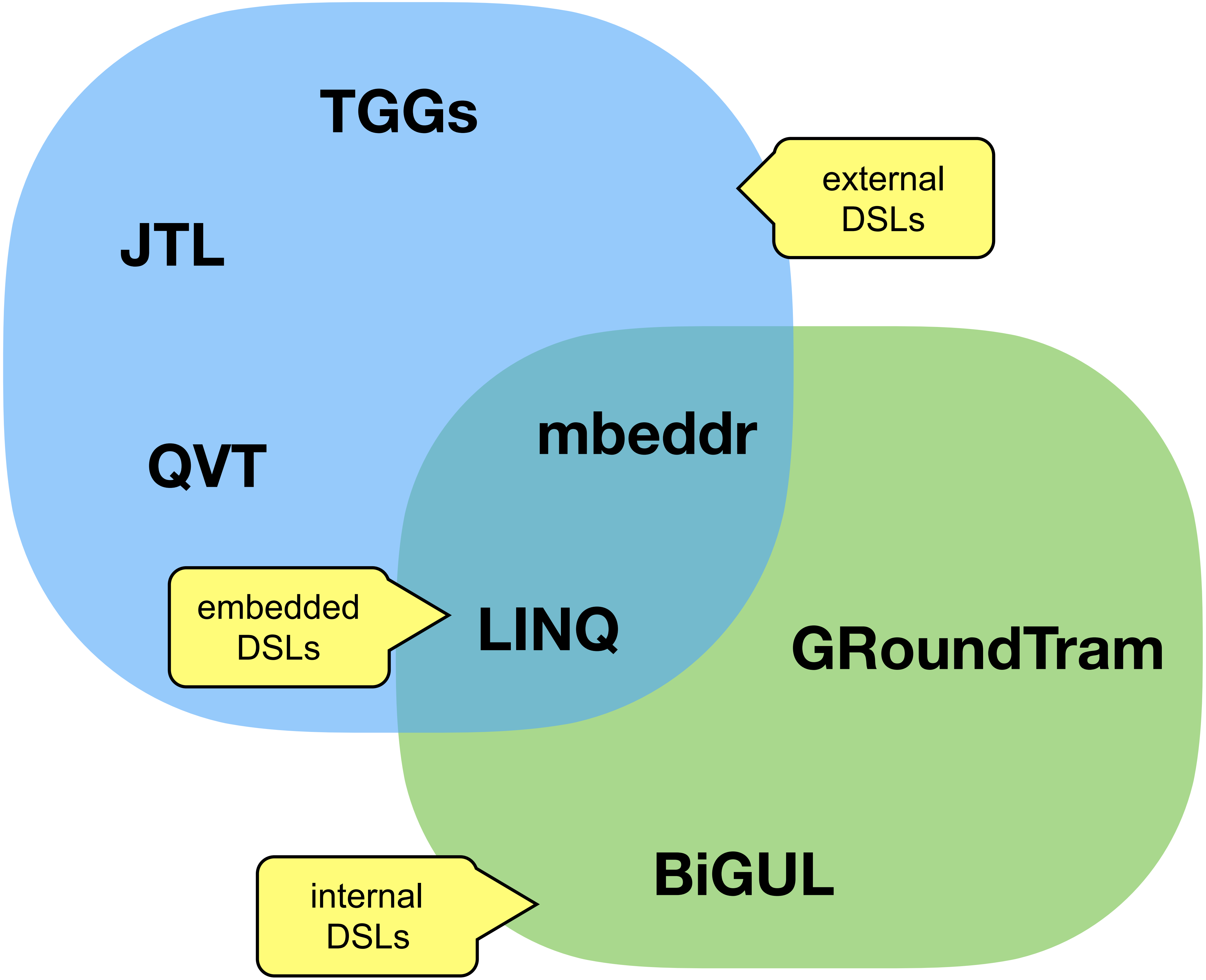
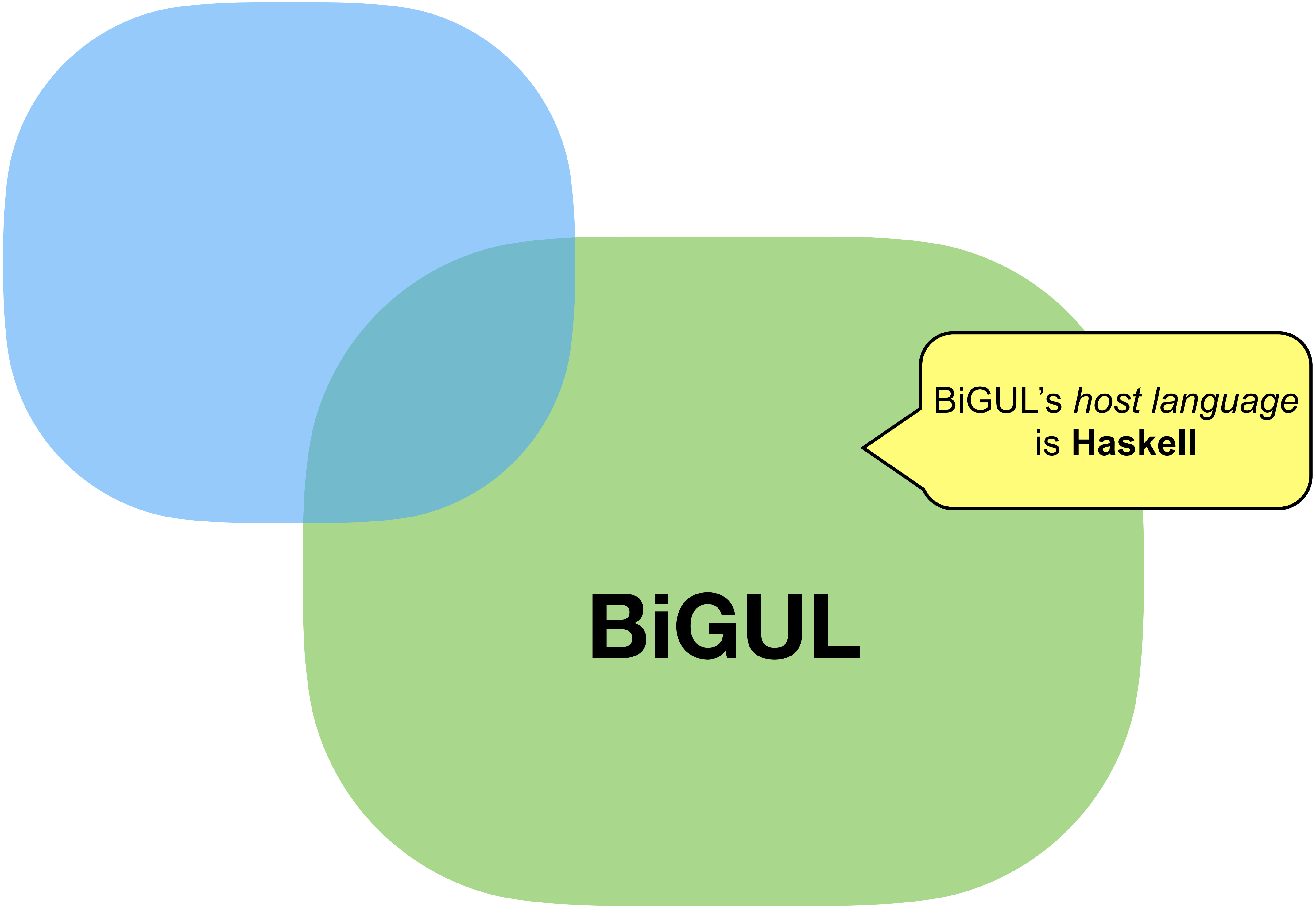
10 April 2018, Nice, France


TGGs
external DSLs
JTL
mbeddr
QVT
embedded DSLs
LINQ
GRoundTram
internal DSLs
BiGUL

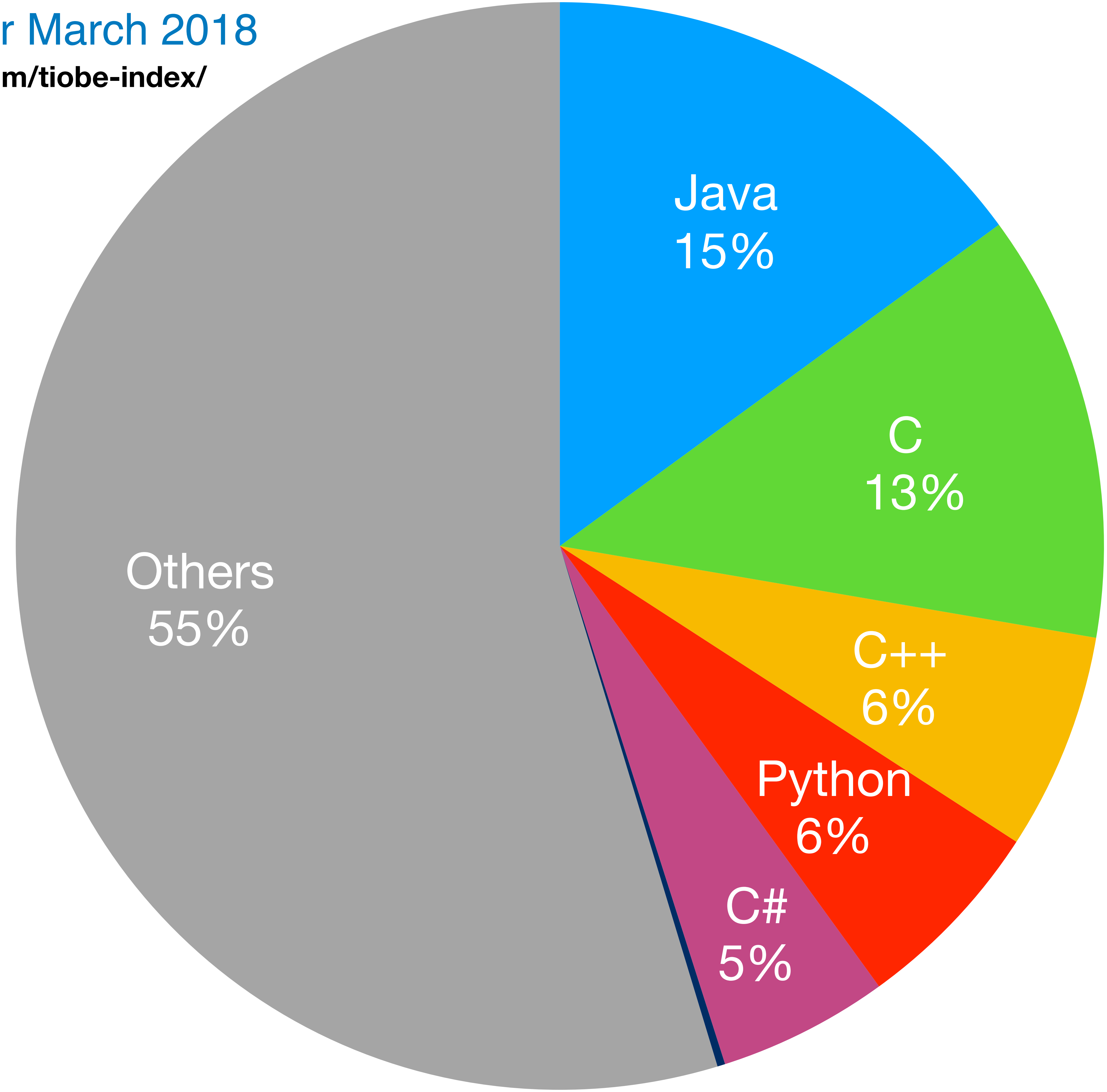


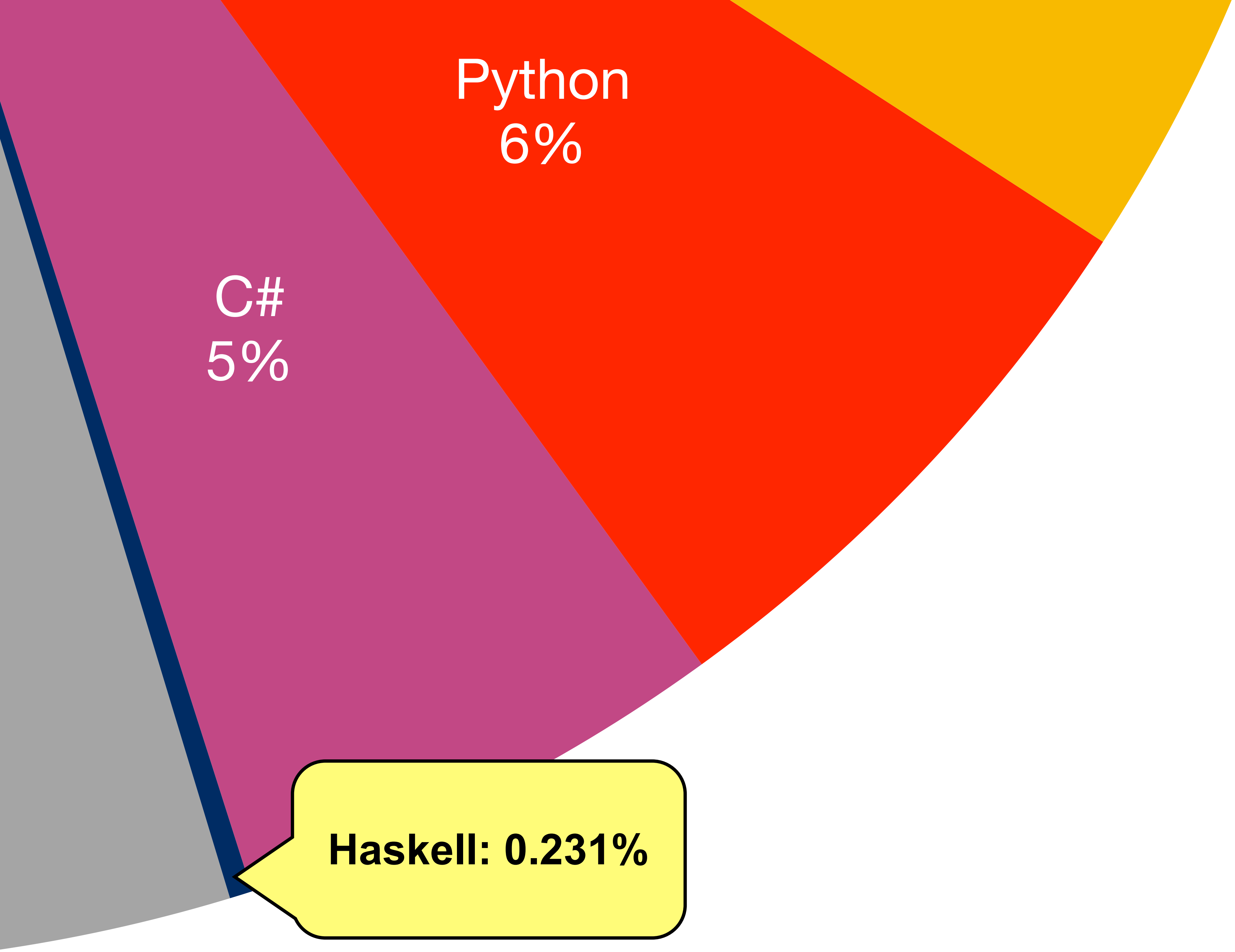
BiGUL

BiGUL's *host language*
is **Haskell**

TIOBE Index for March 2018

https://www.tiobe.com/tiobe-index/



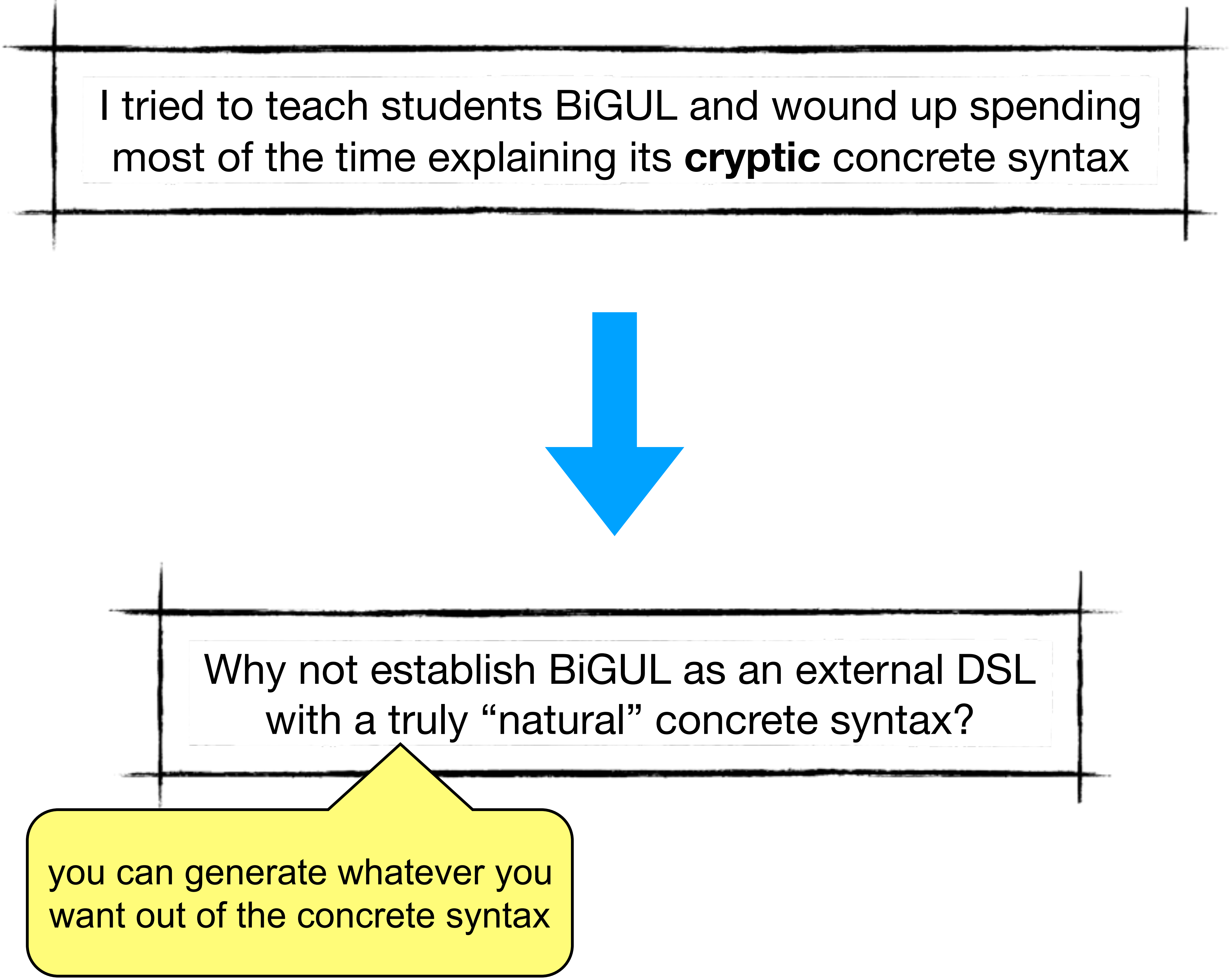

Python
6%
C#
5%
Haskell: 0.231%

My Conjecture

Haskell is a great language with a concise,
elegant concrete syntax, but …

… it is unfamiliar to **most** programmers
and is thus hard to learn and read

I tried to teach students BiGUL and wound up spending
most of the time explaining its **cryptic** concrete syntax



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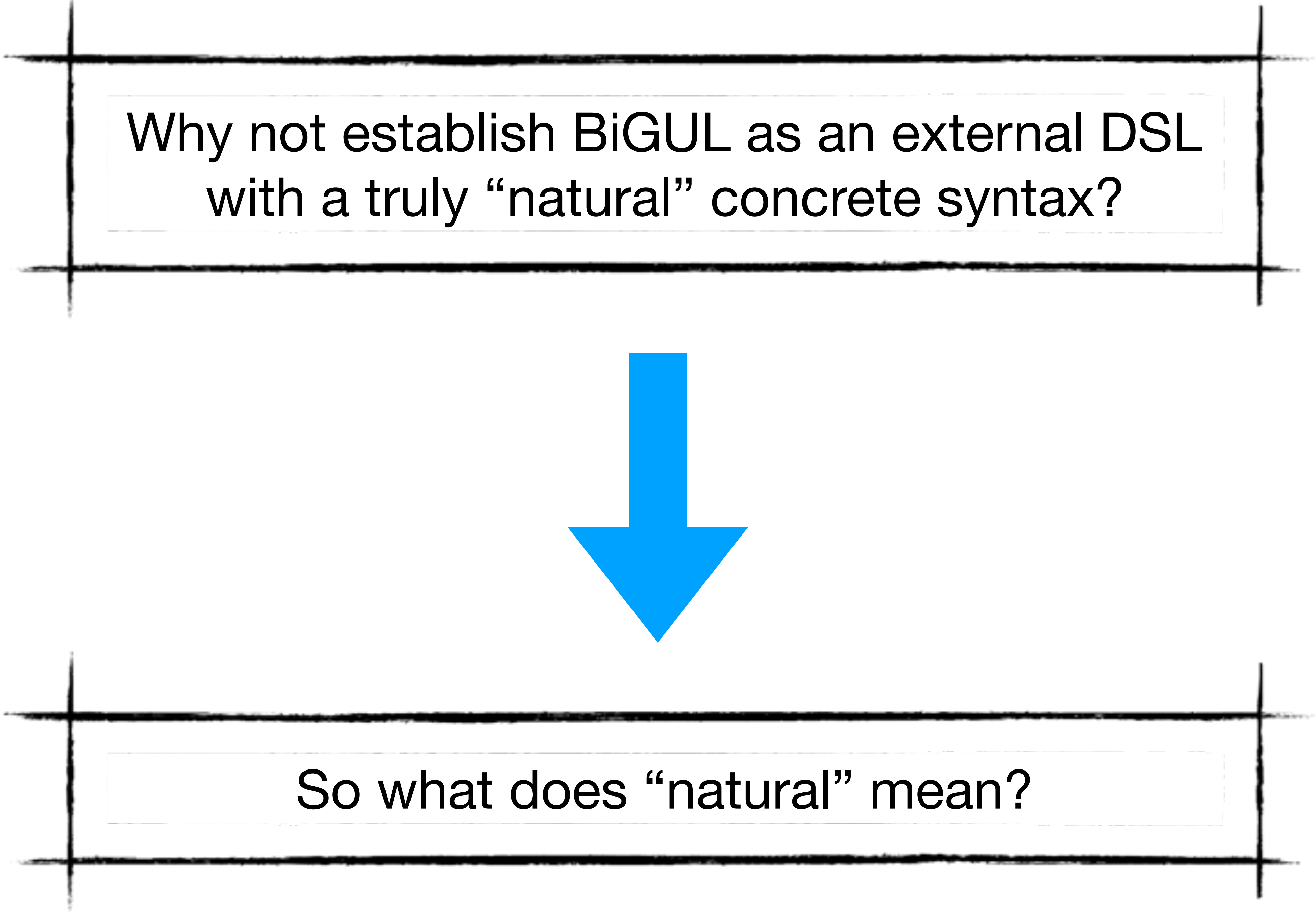
Why not establish BiGUL as an external DSL with a truly “natural” concrete syntax?

you can generate whatever you want out of the concrete syntax



Why not establish BiGUL as an external DSL with a truly “natural” concrete syntax?

So what does “natural” mean?

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My students (and I tend to agree) say:

VISUAL

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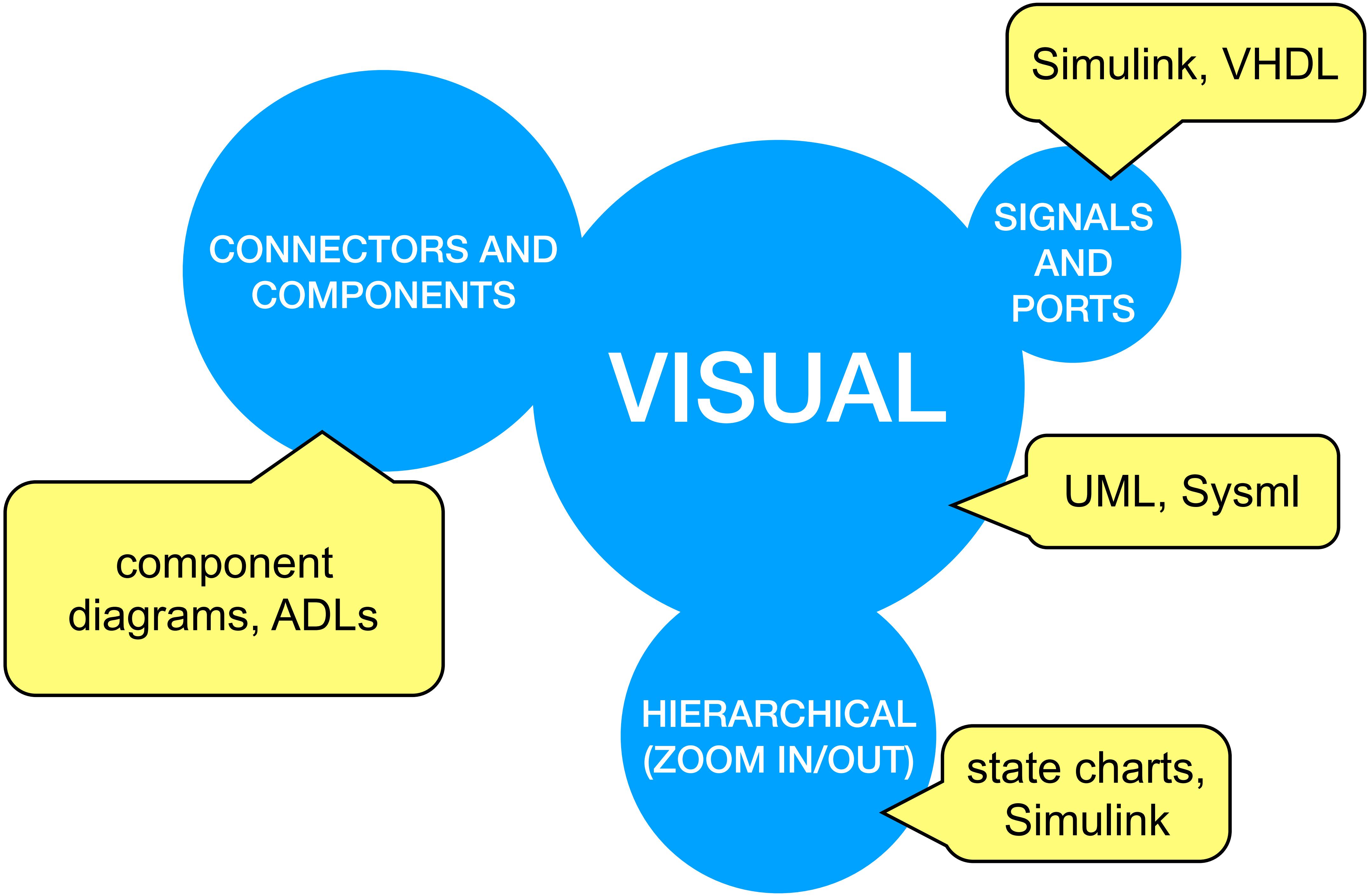


VISUAL

CONNECTORS AND COMPONENTS

component diagrams, ADLs

SIGNALS AND PORTS

Simulink, VHDL

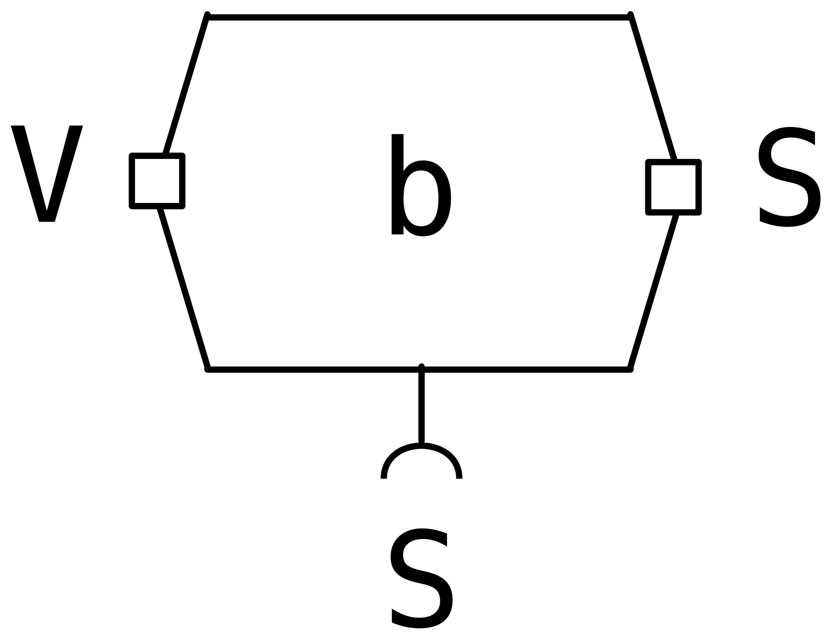
UML, Sysml

HIERARCHICAL (ZOOM IN/OUT)

state charts, Simulink

VISUAL BiGUL

Put Block



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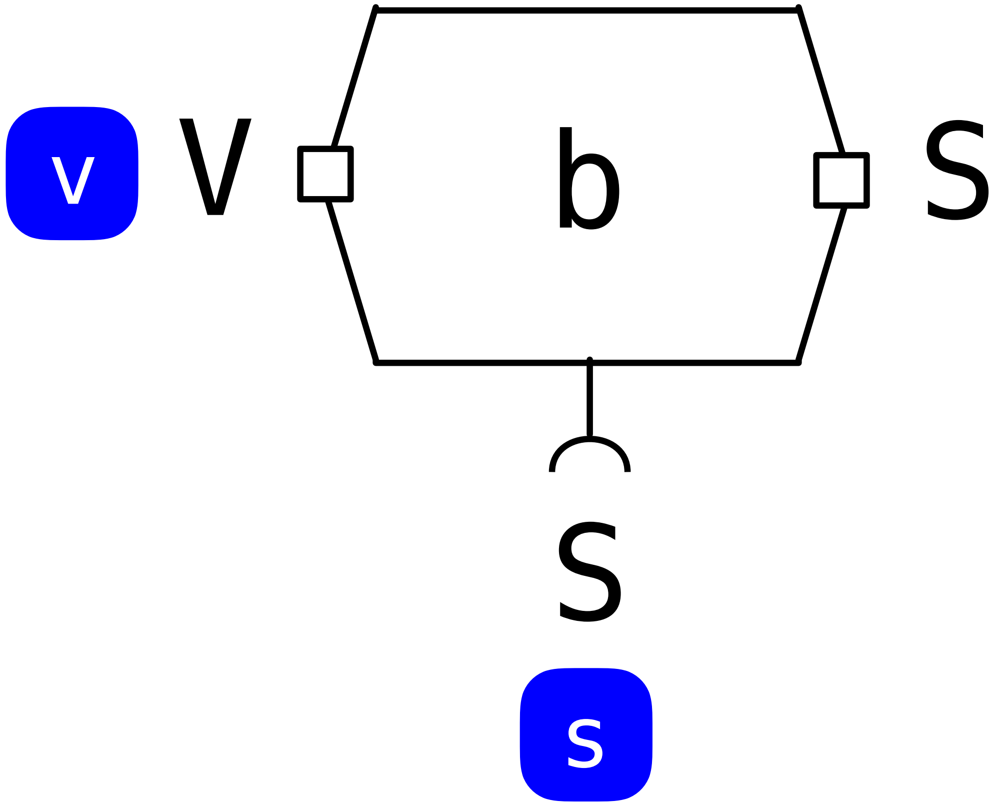
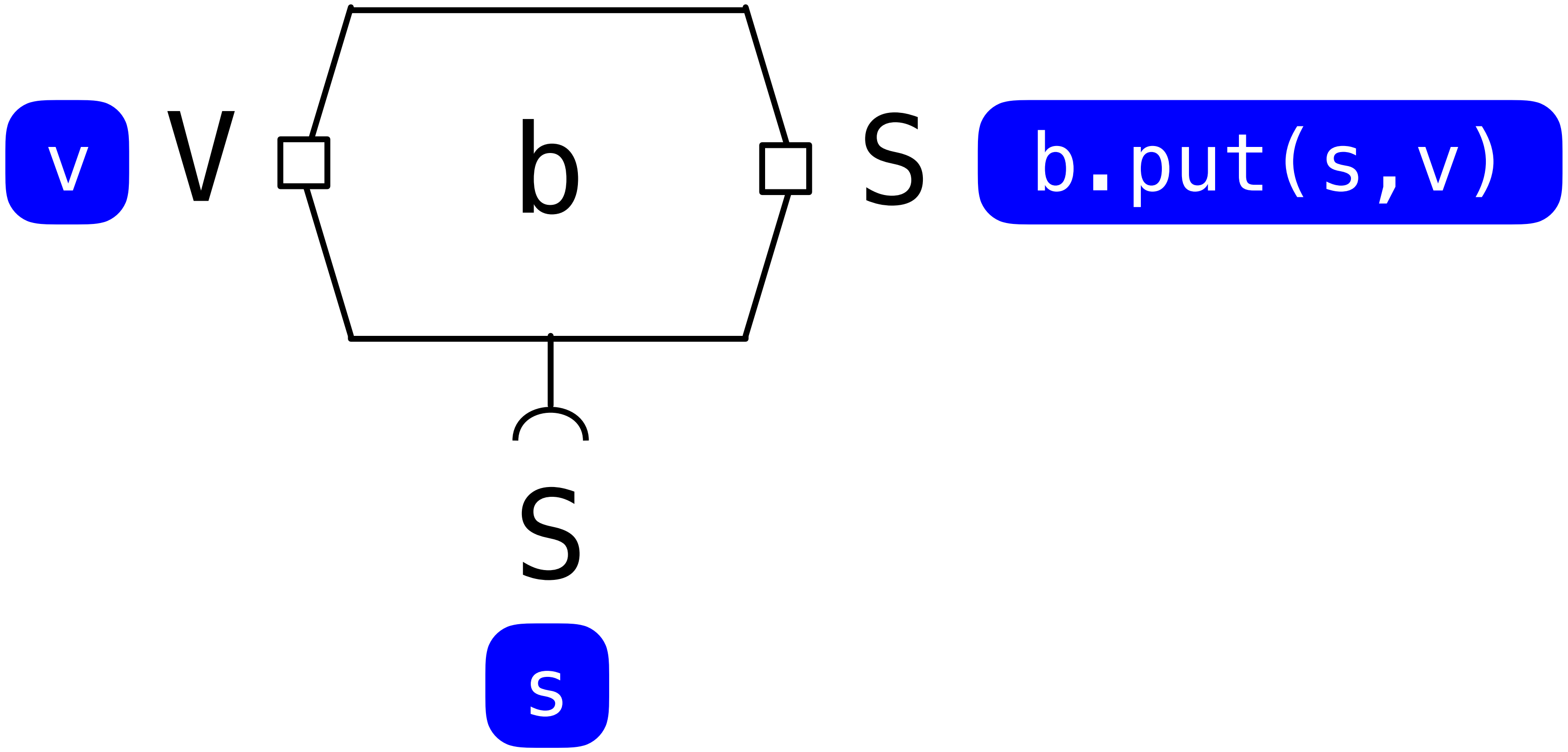
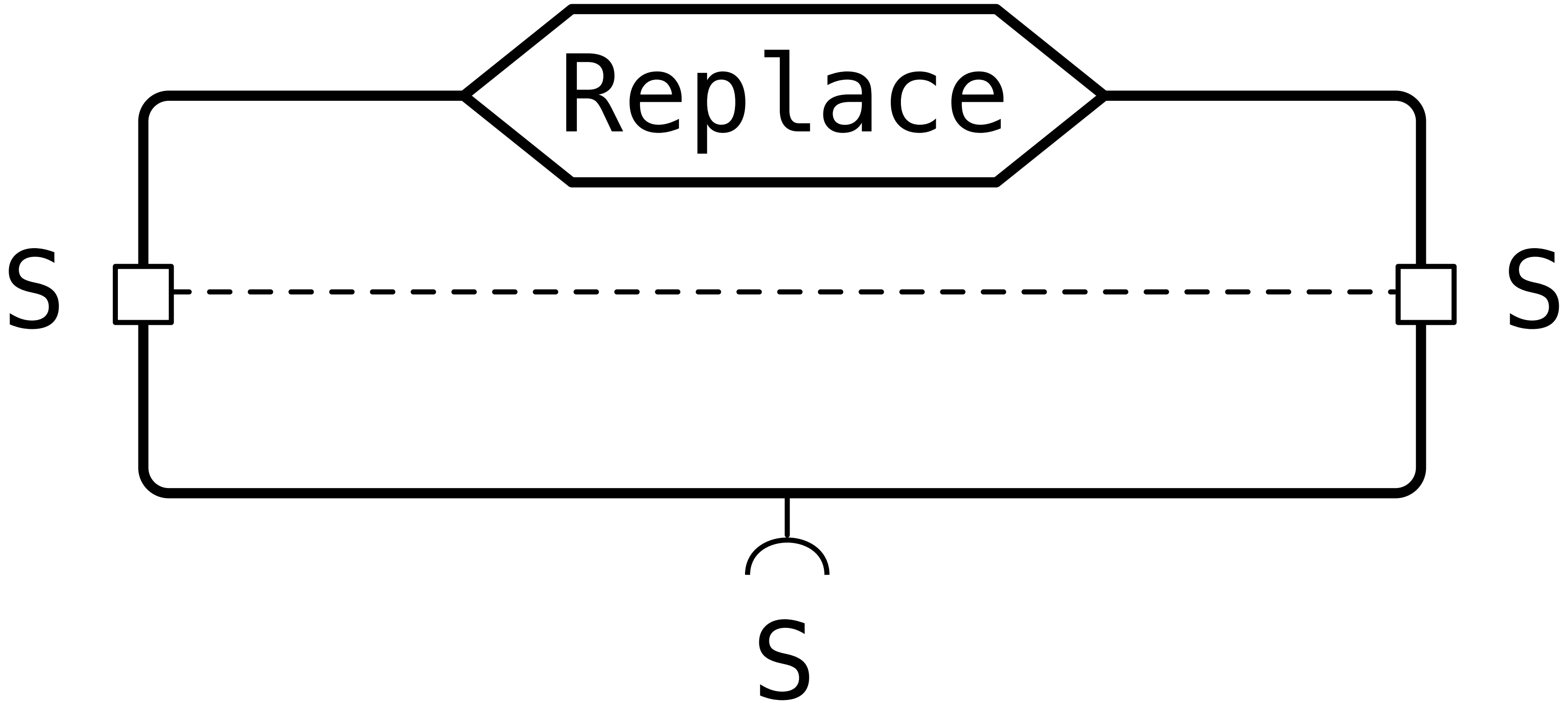


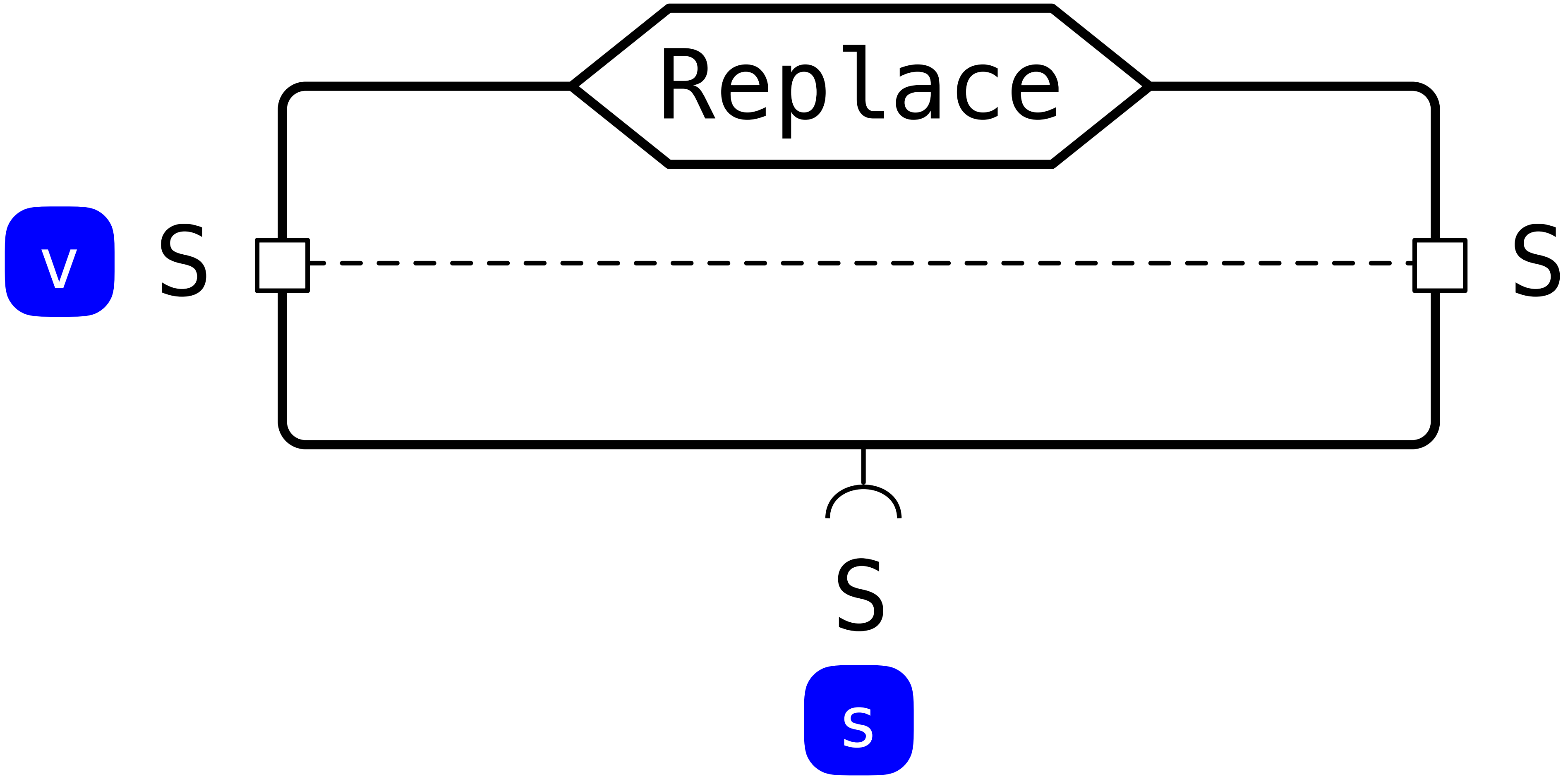
Put Block



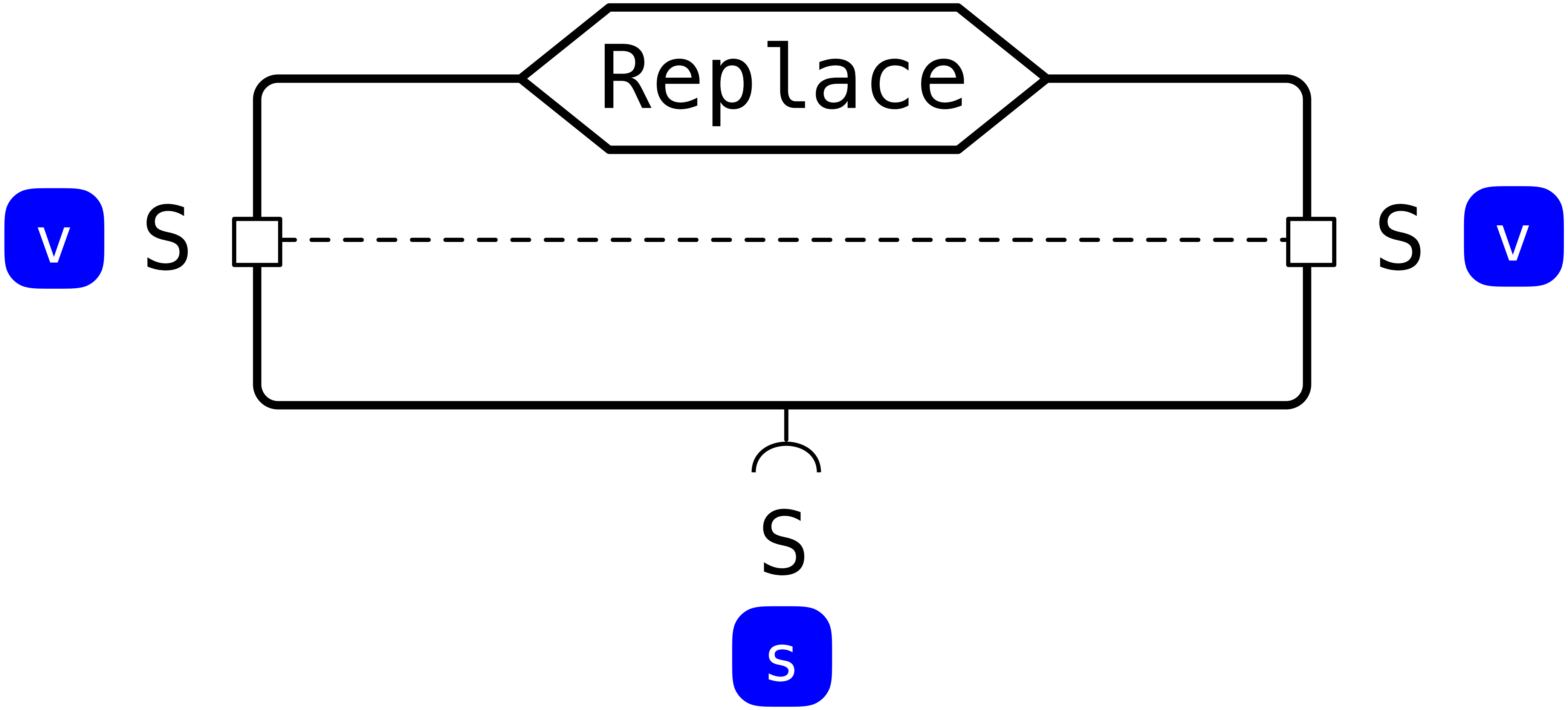
Replace



Replace



Replace



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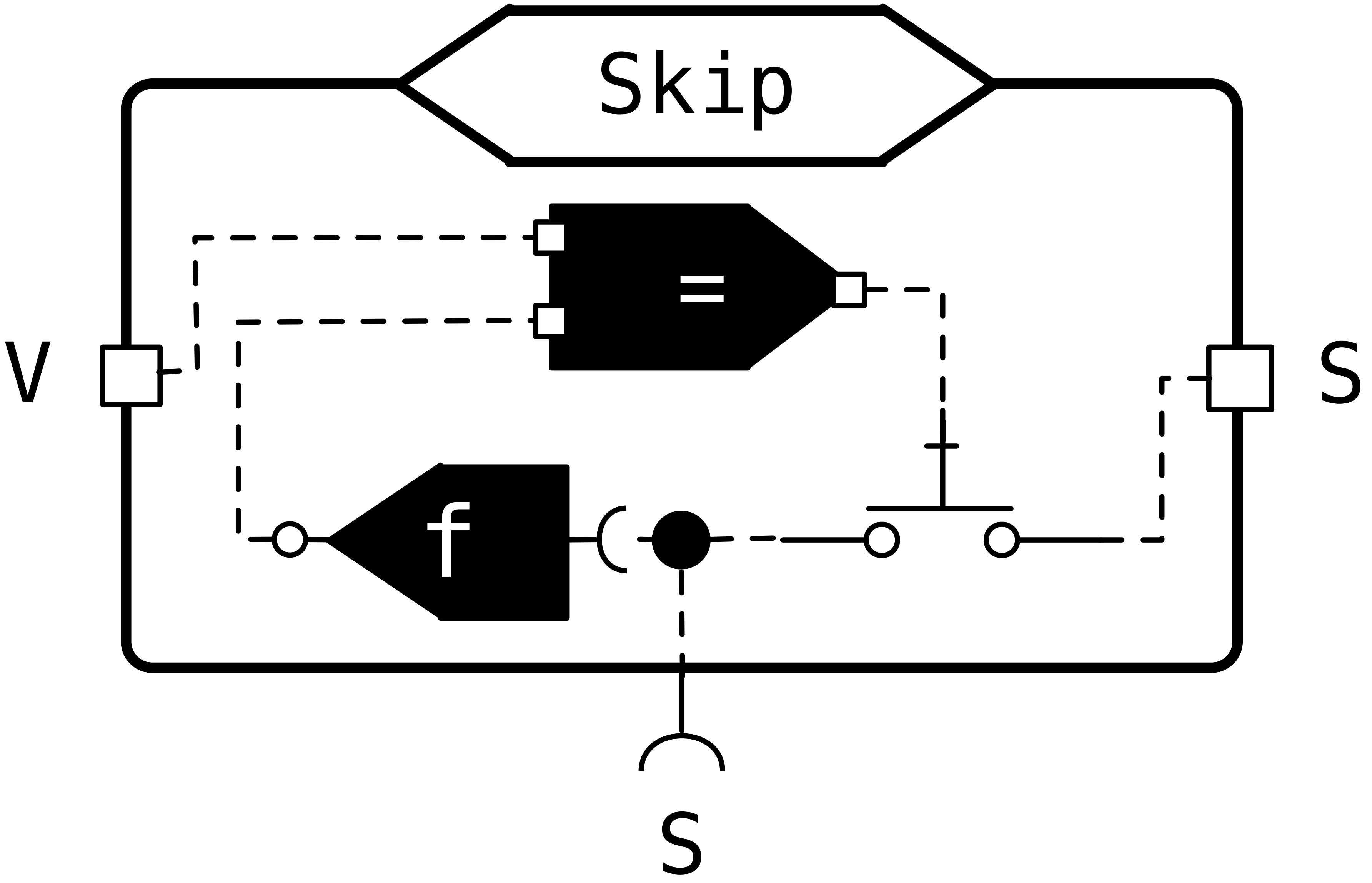

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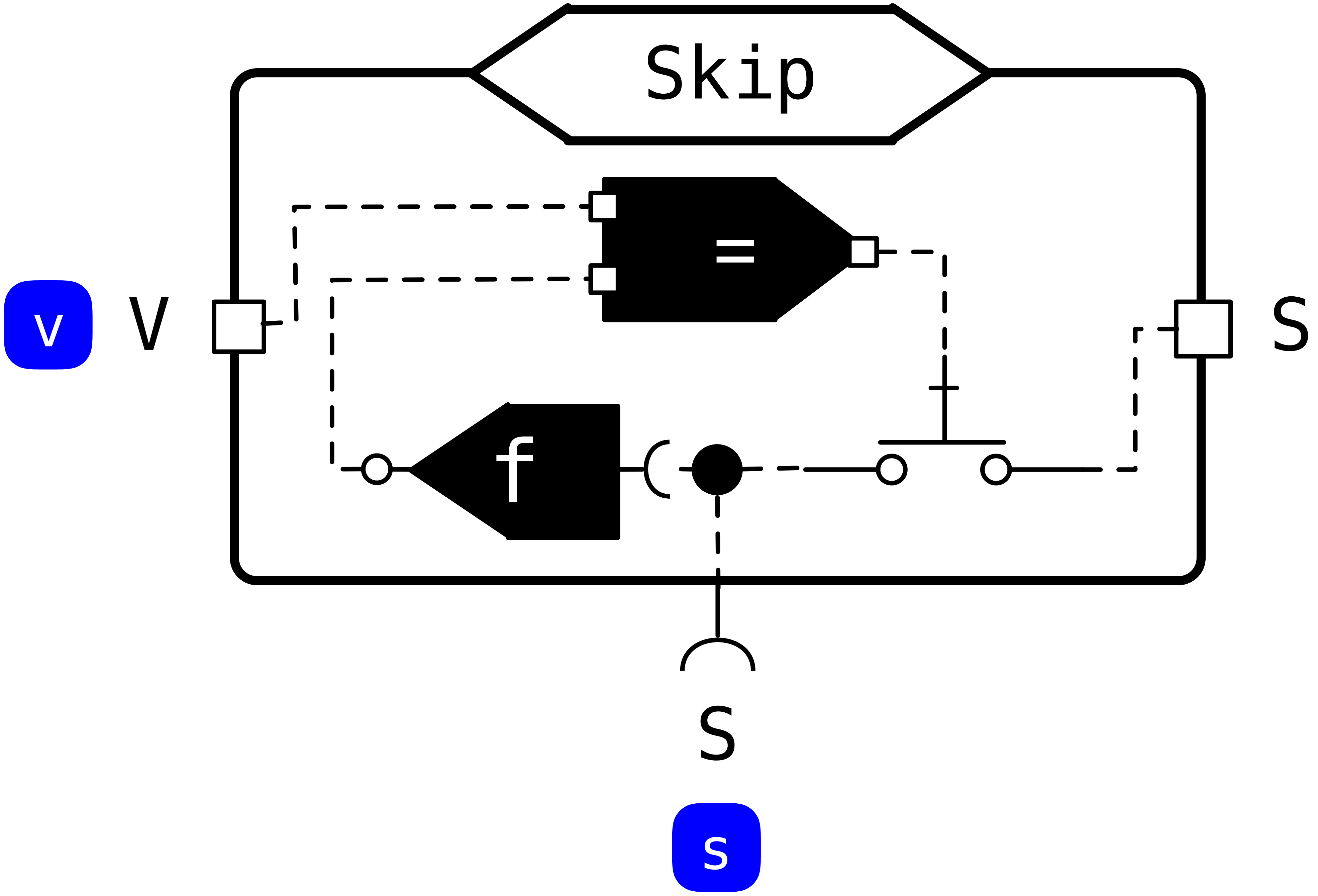

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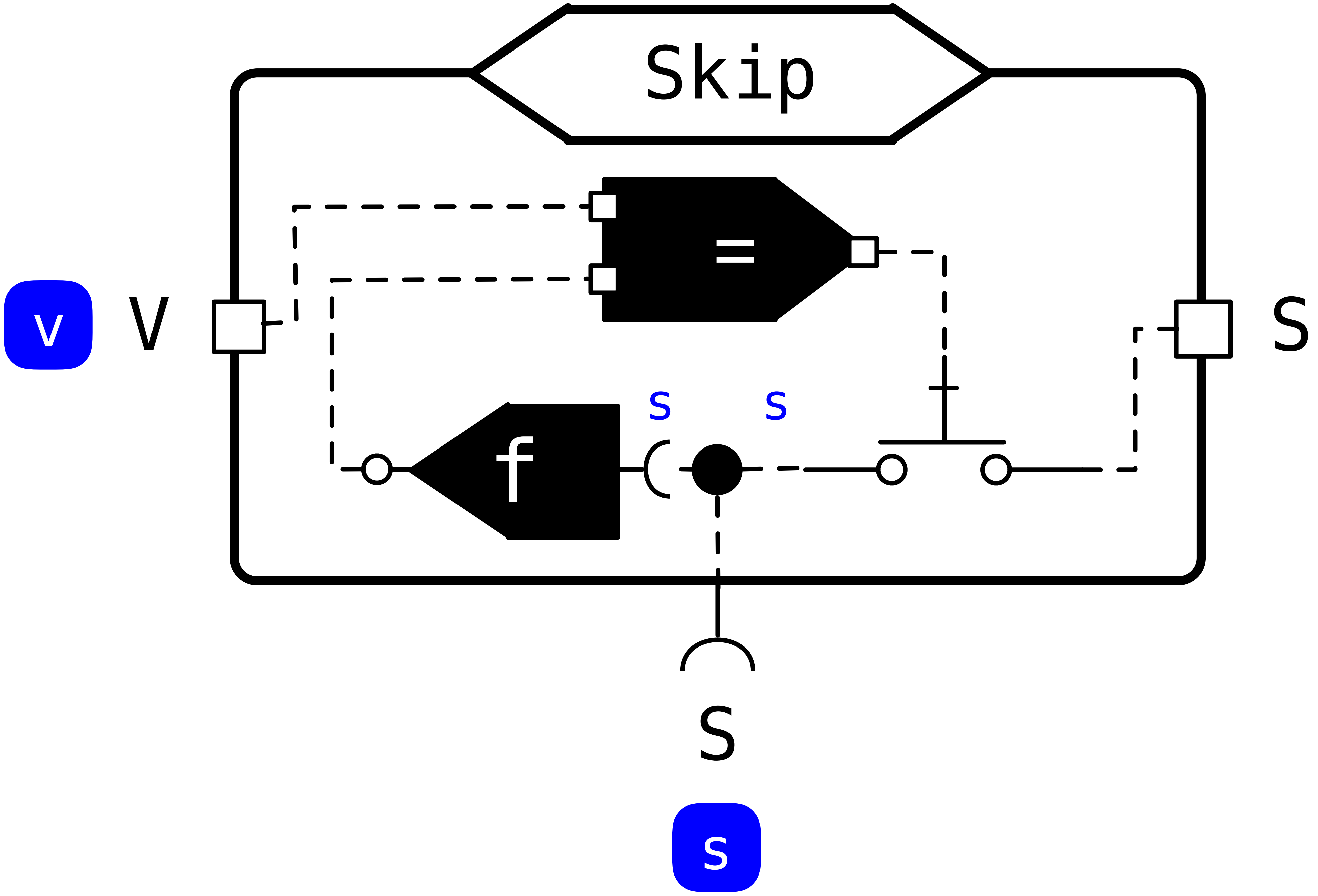

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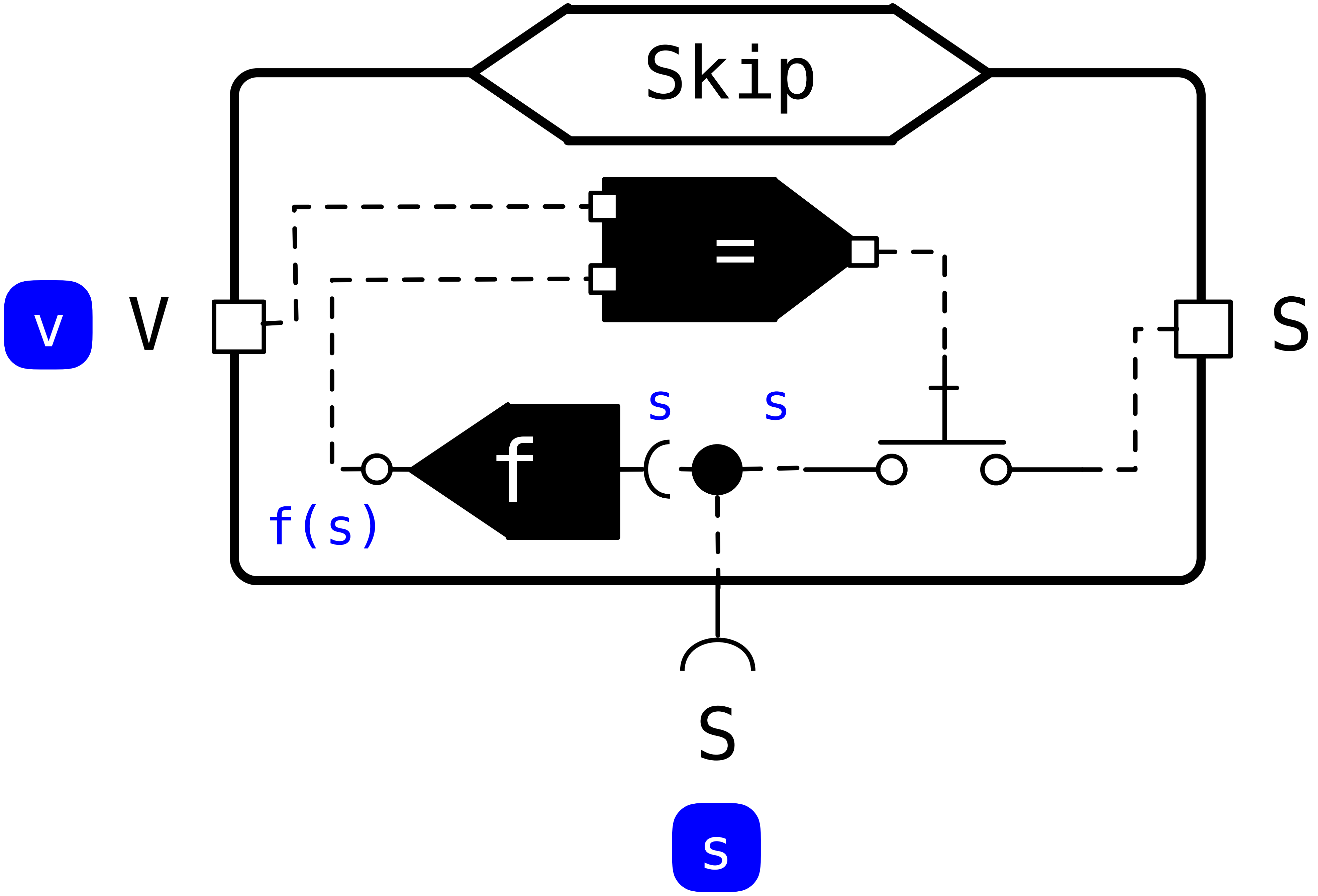

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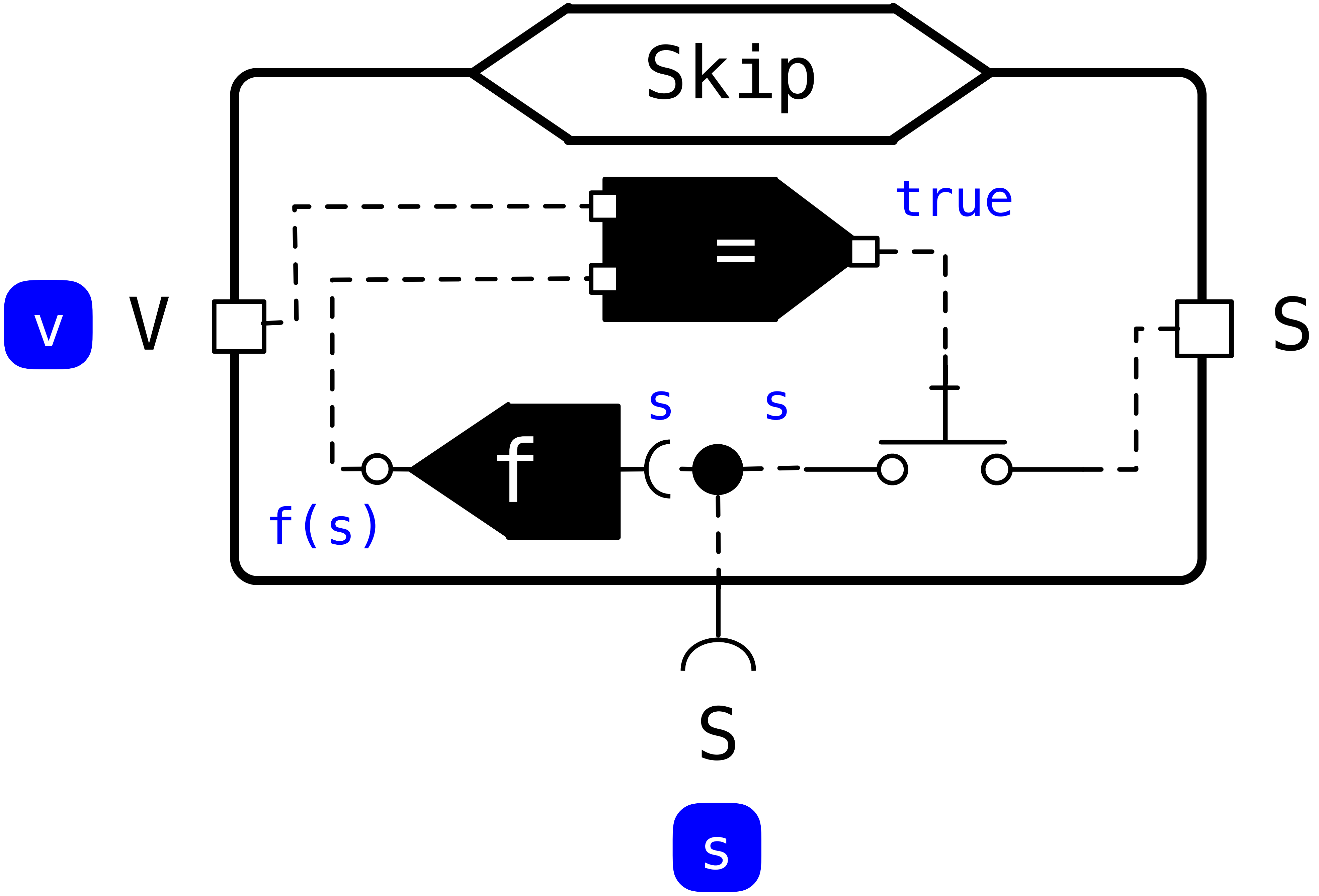

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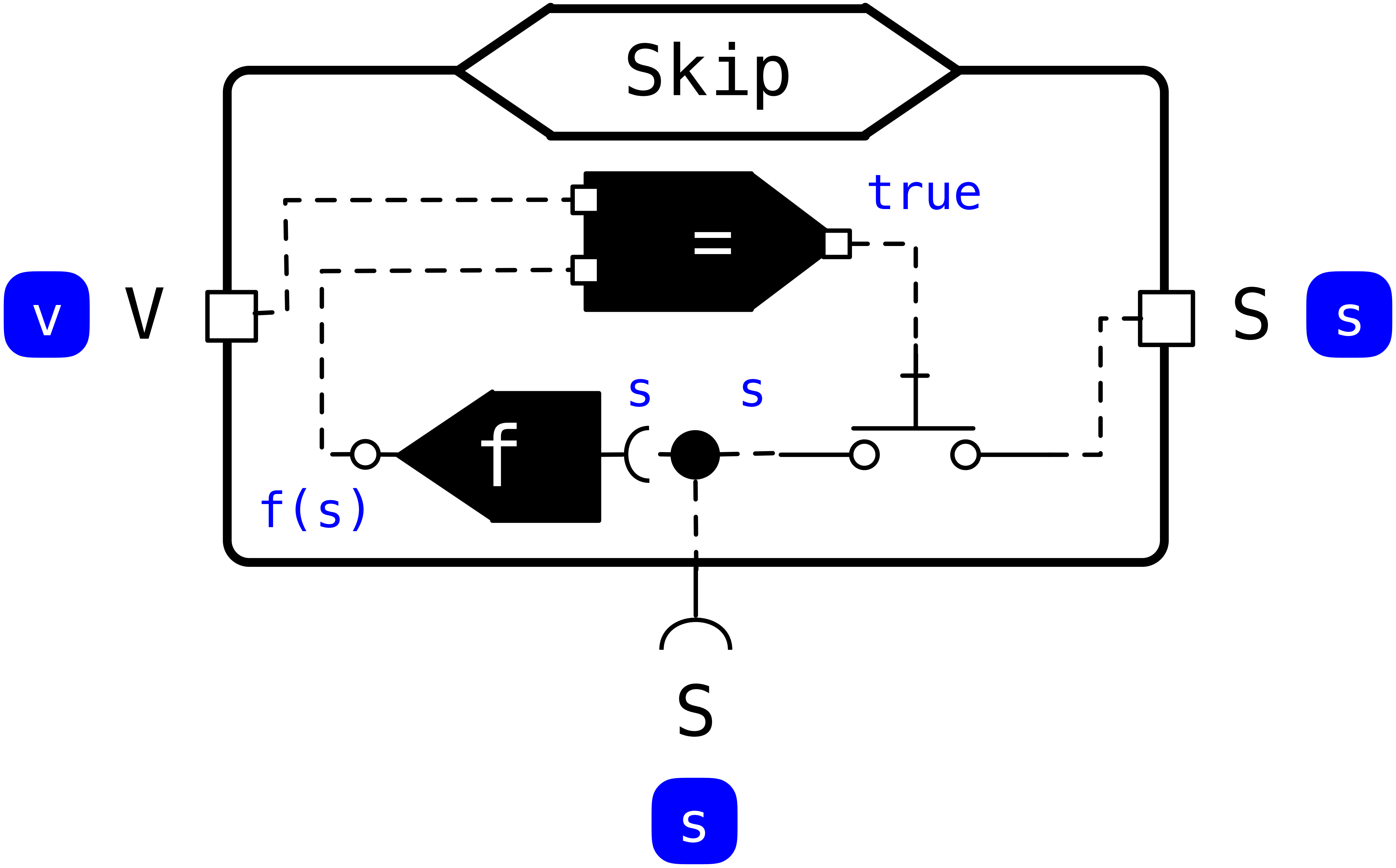
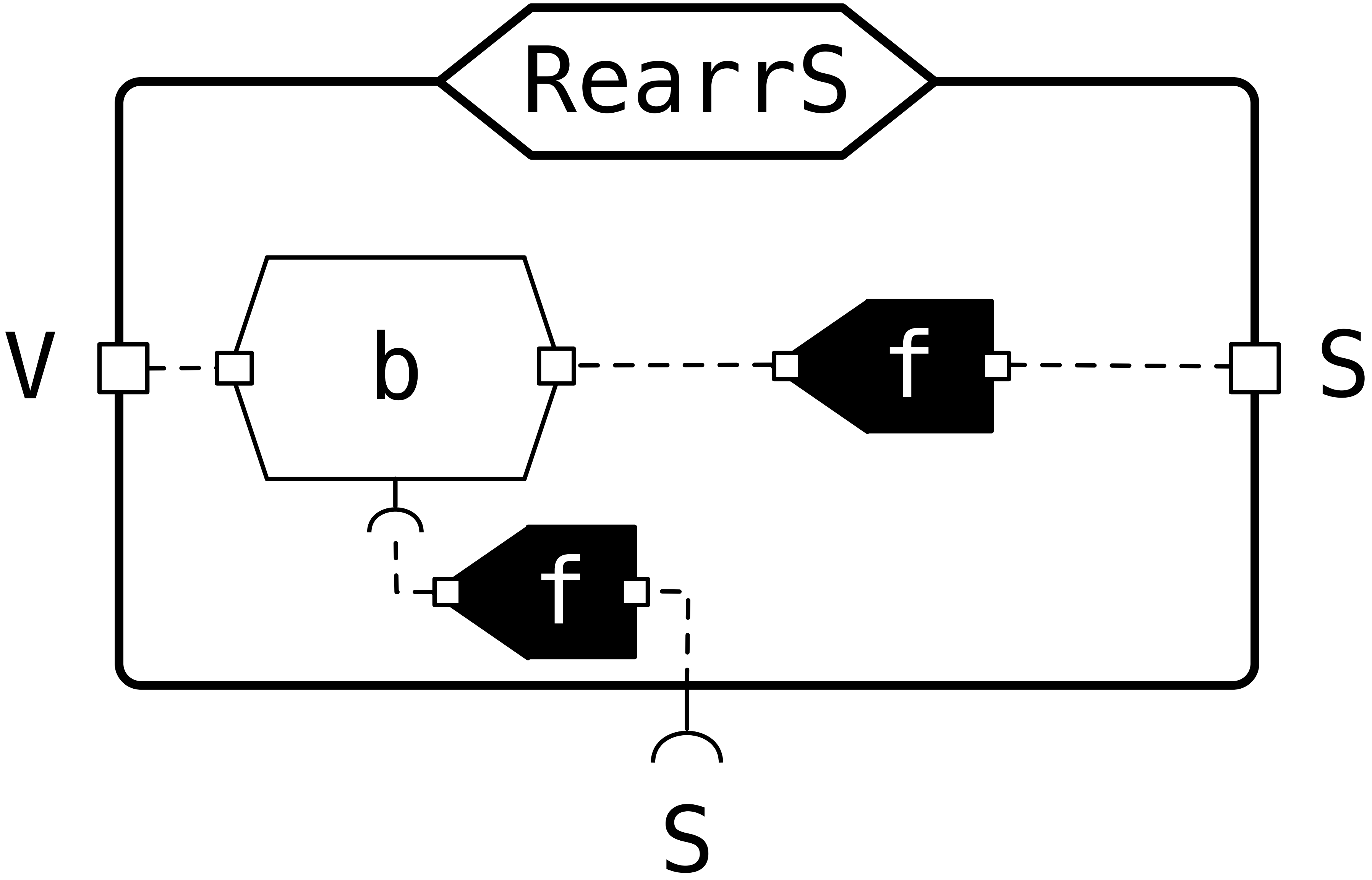
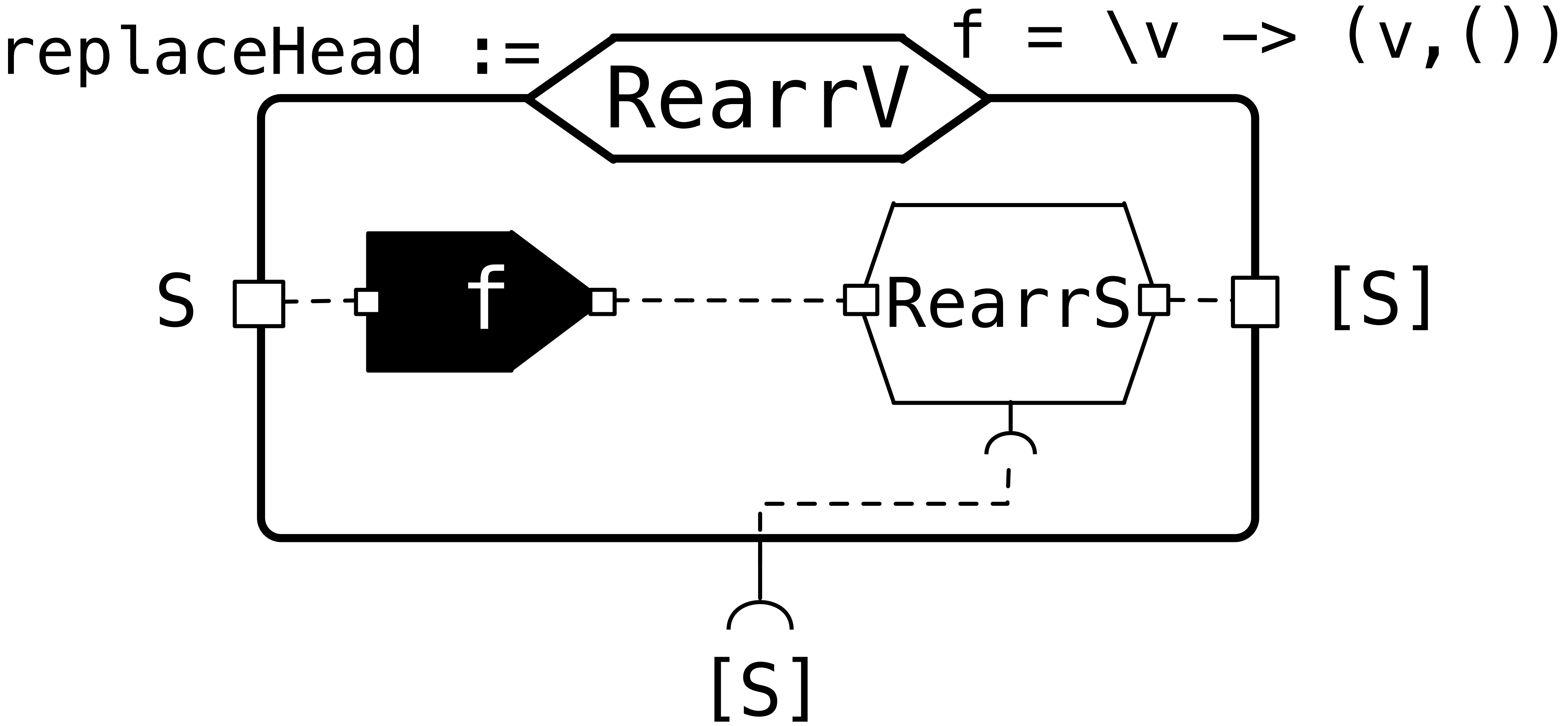


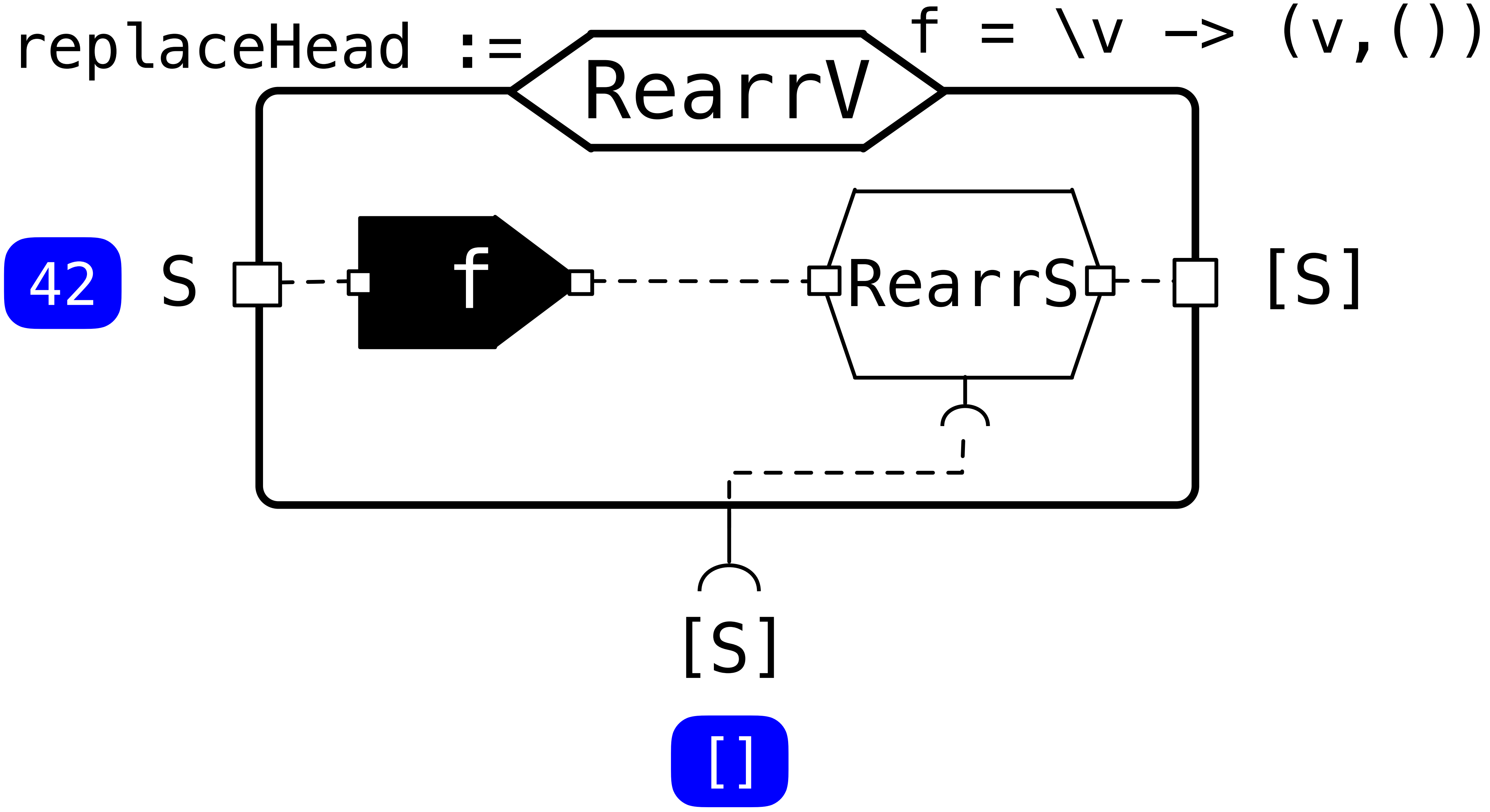
Source Rearrangement



Debugging



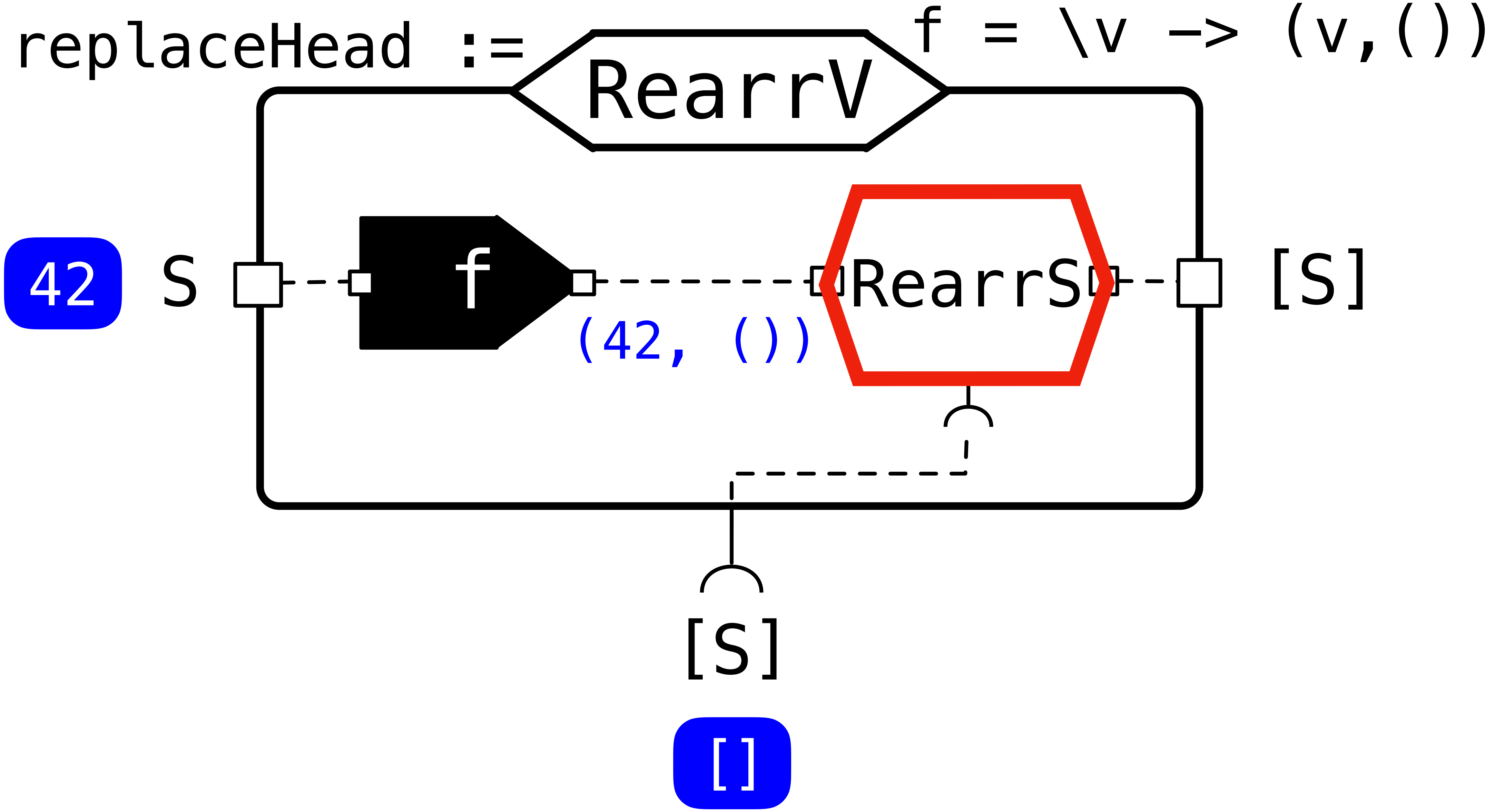
Debugging



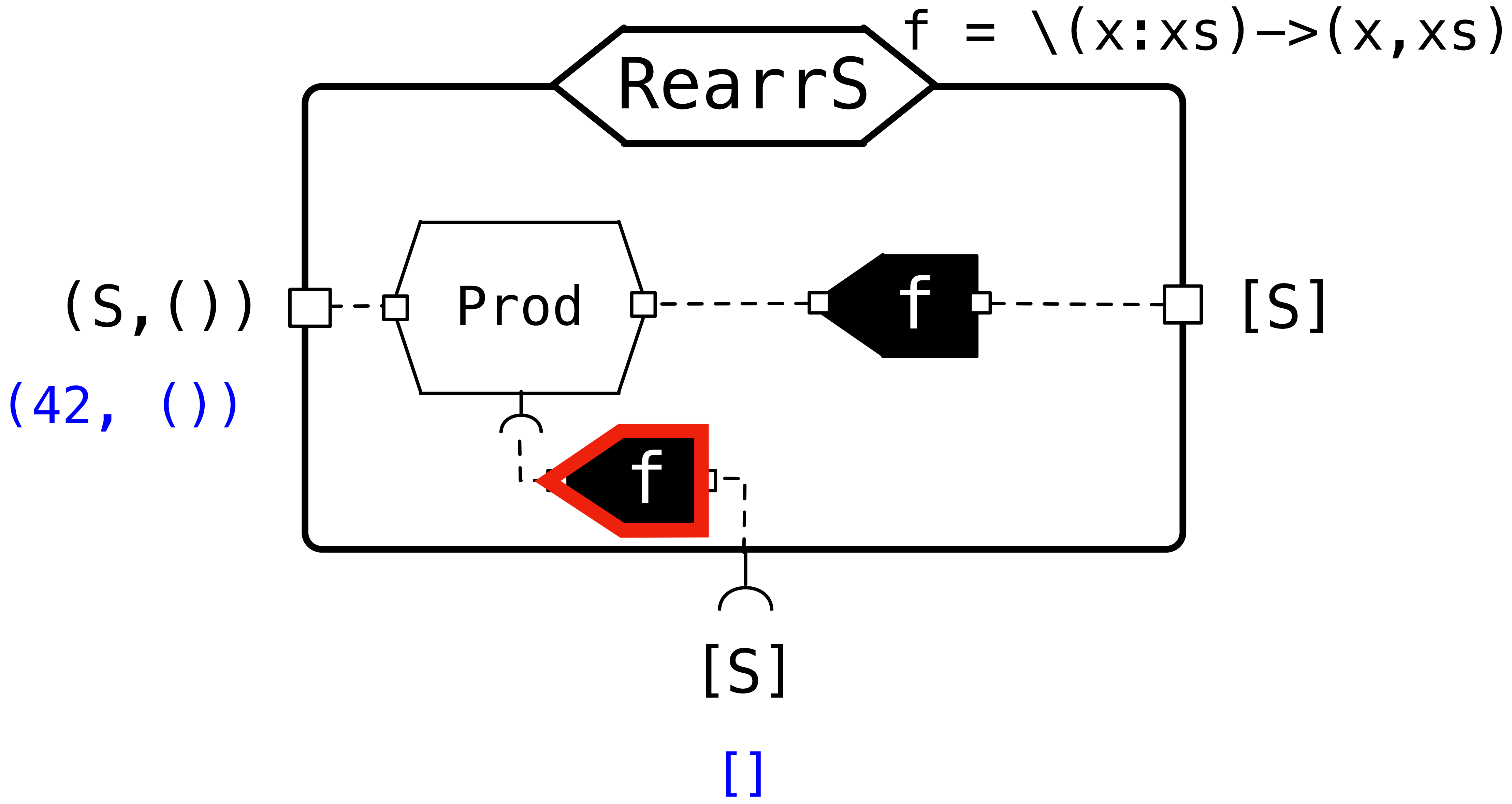
```
replaceHead :=
```

```
f = \v -> (v,())
```

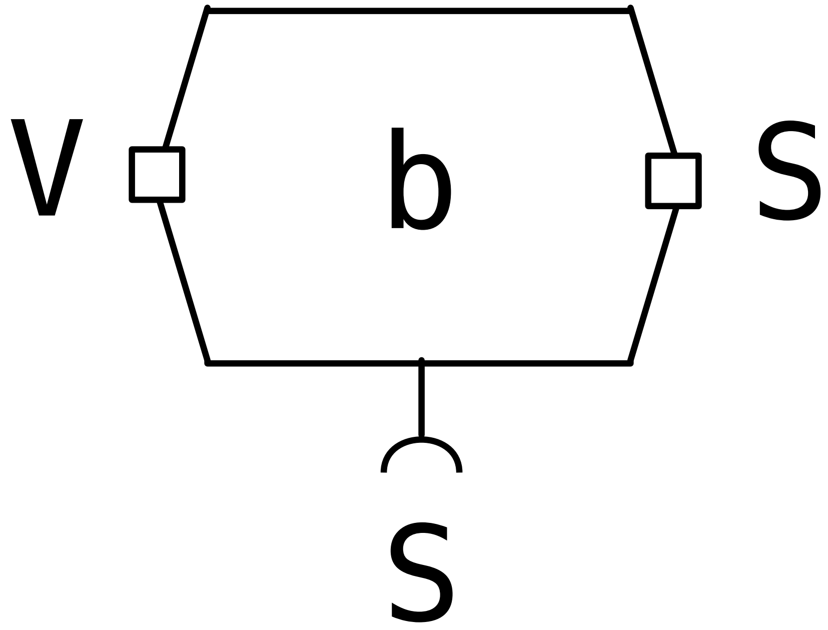
Debugging



Debugging



Get Semantics



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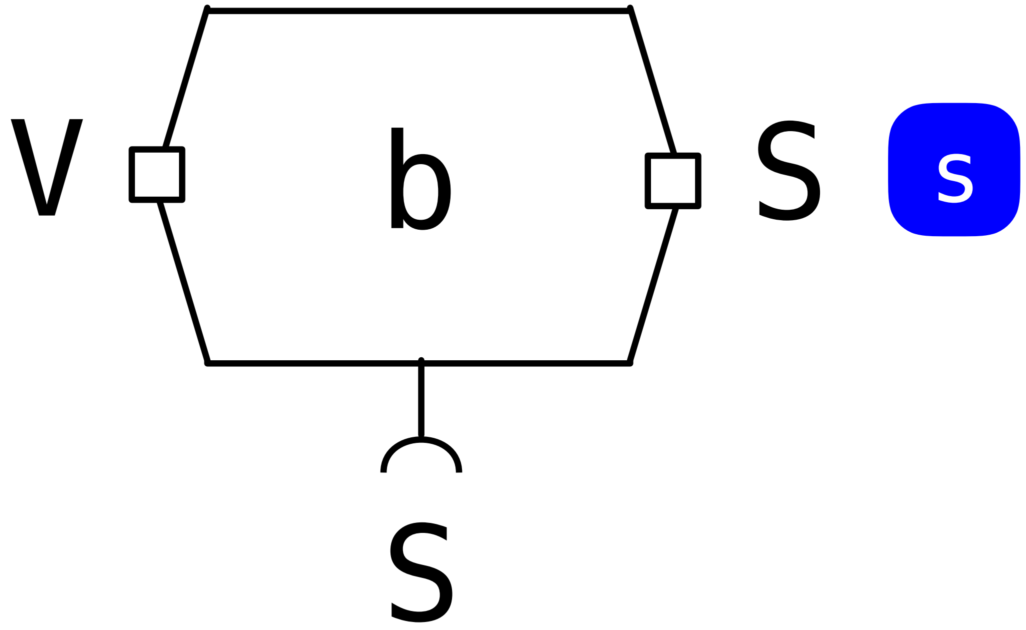
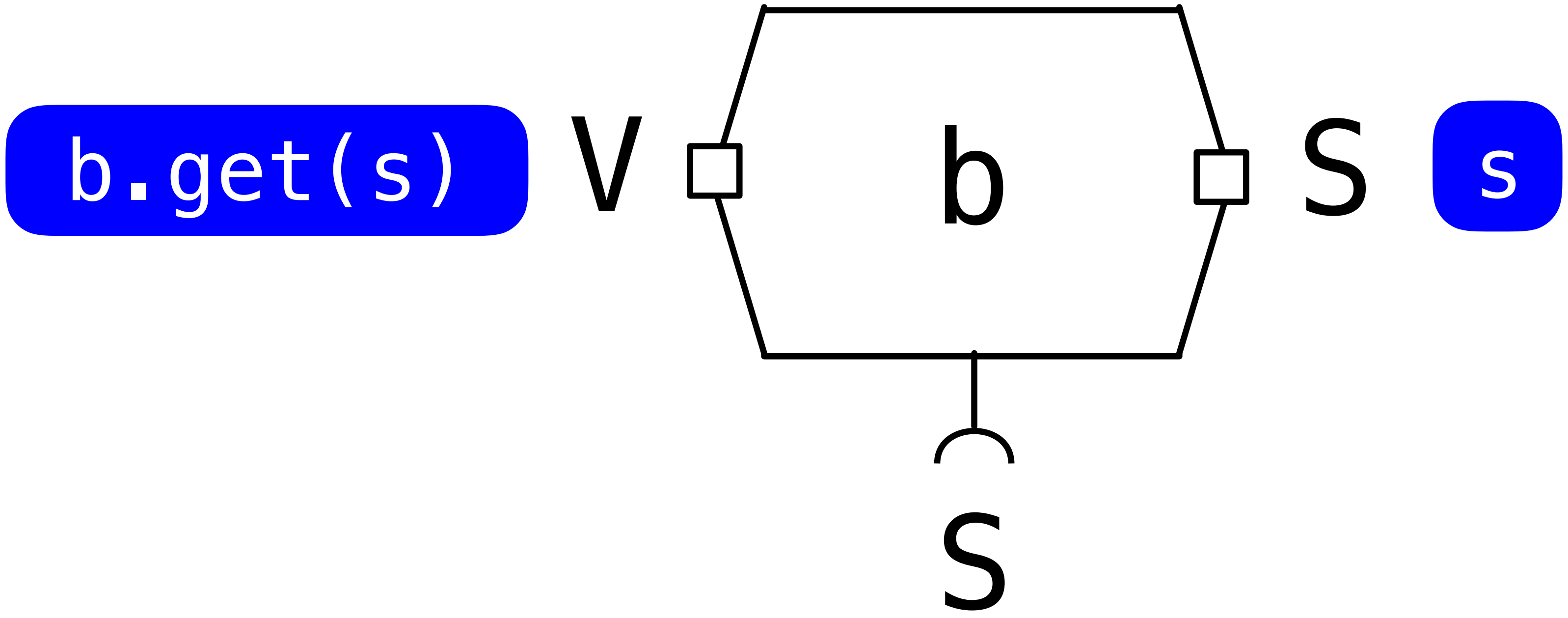


Get Semantics



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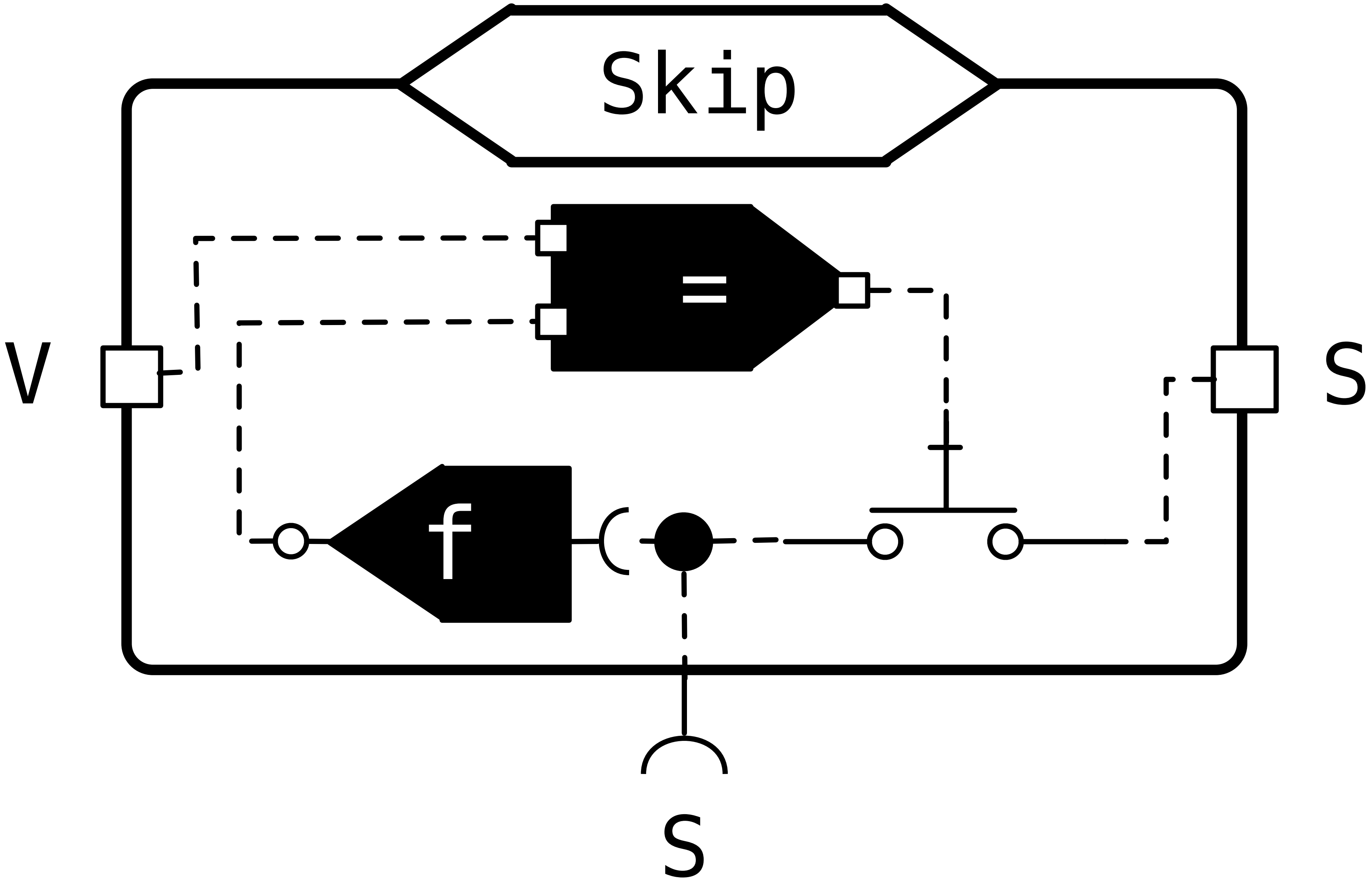

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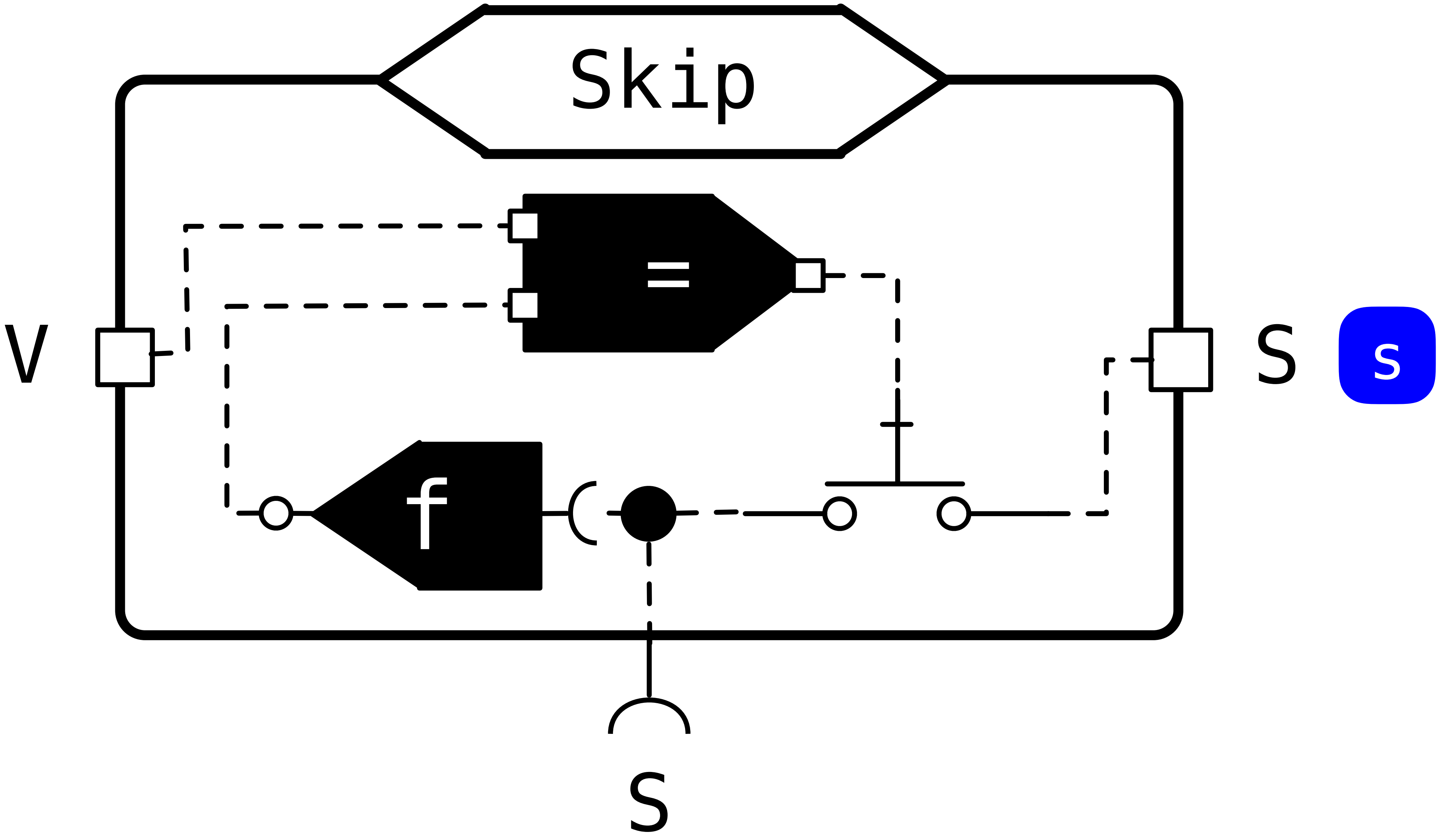

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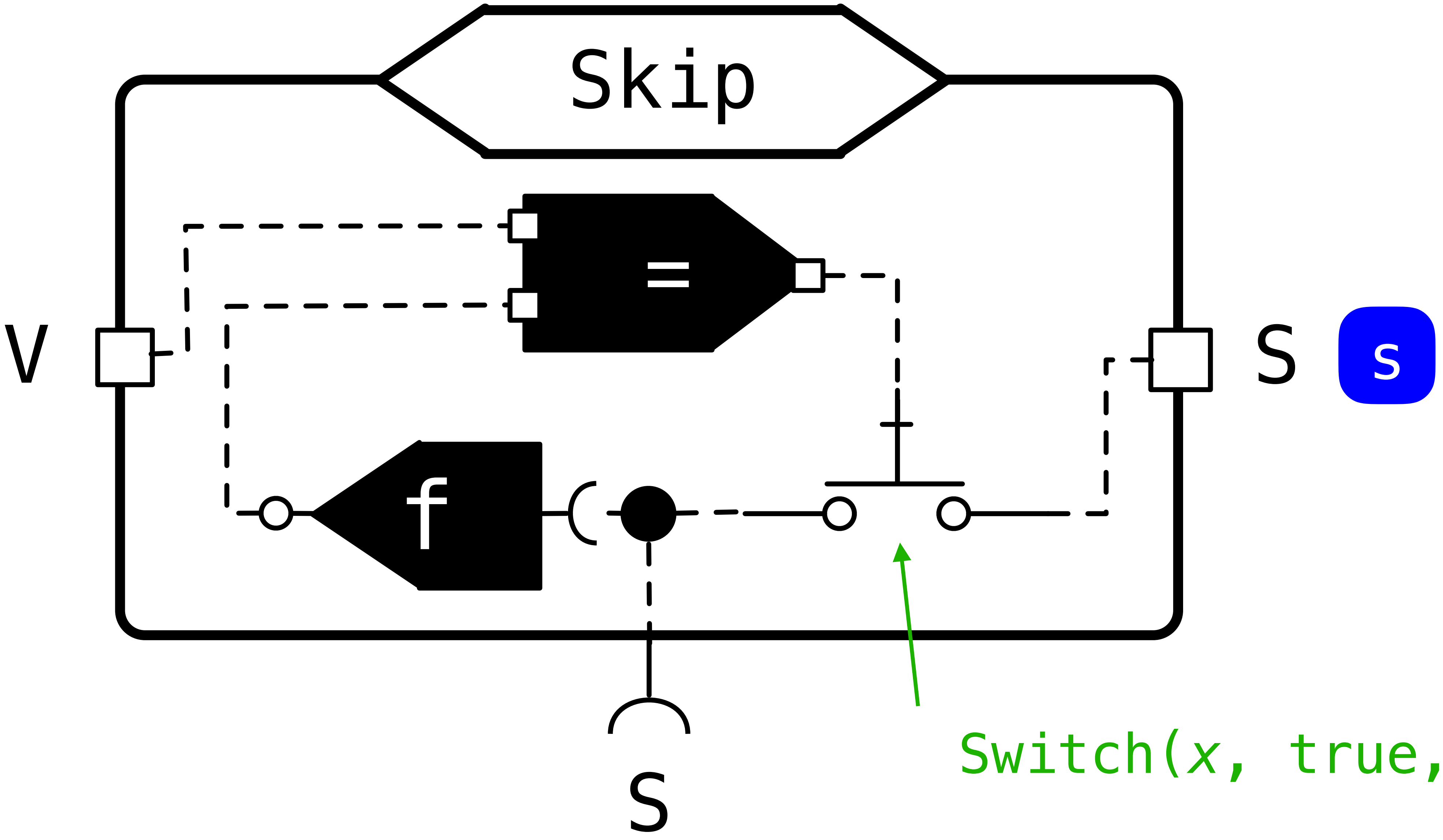
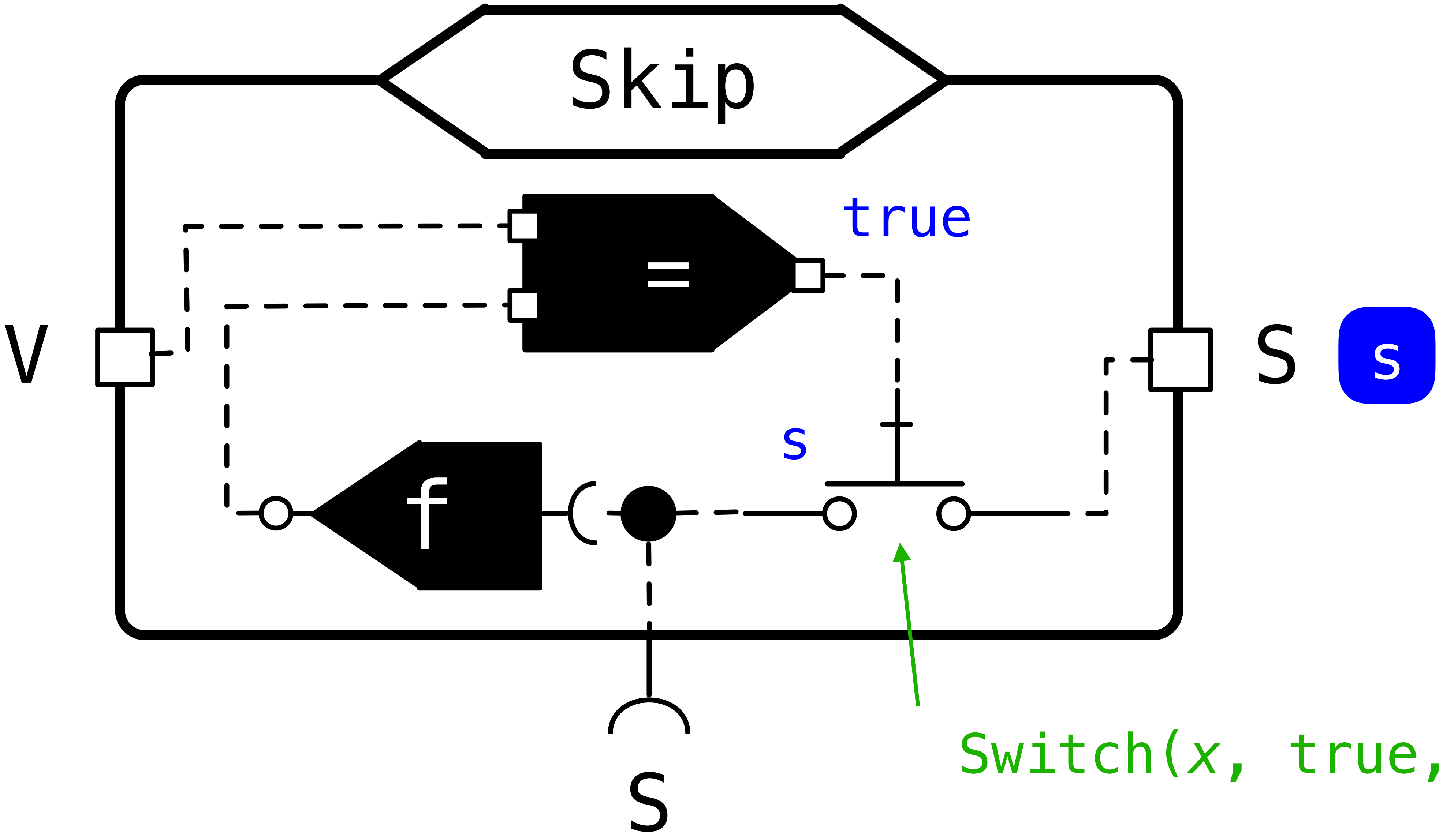


Switch(*x*, true, *x*)

Skip (Get Semantics)



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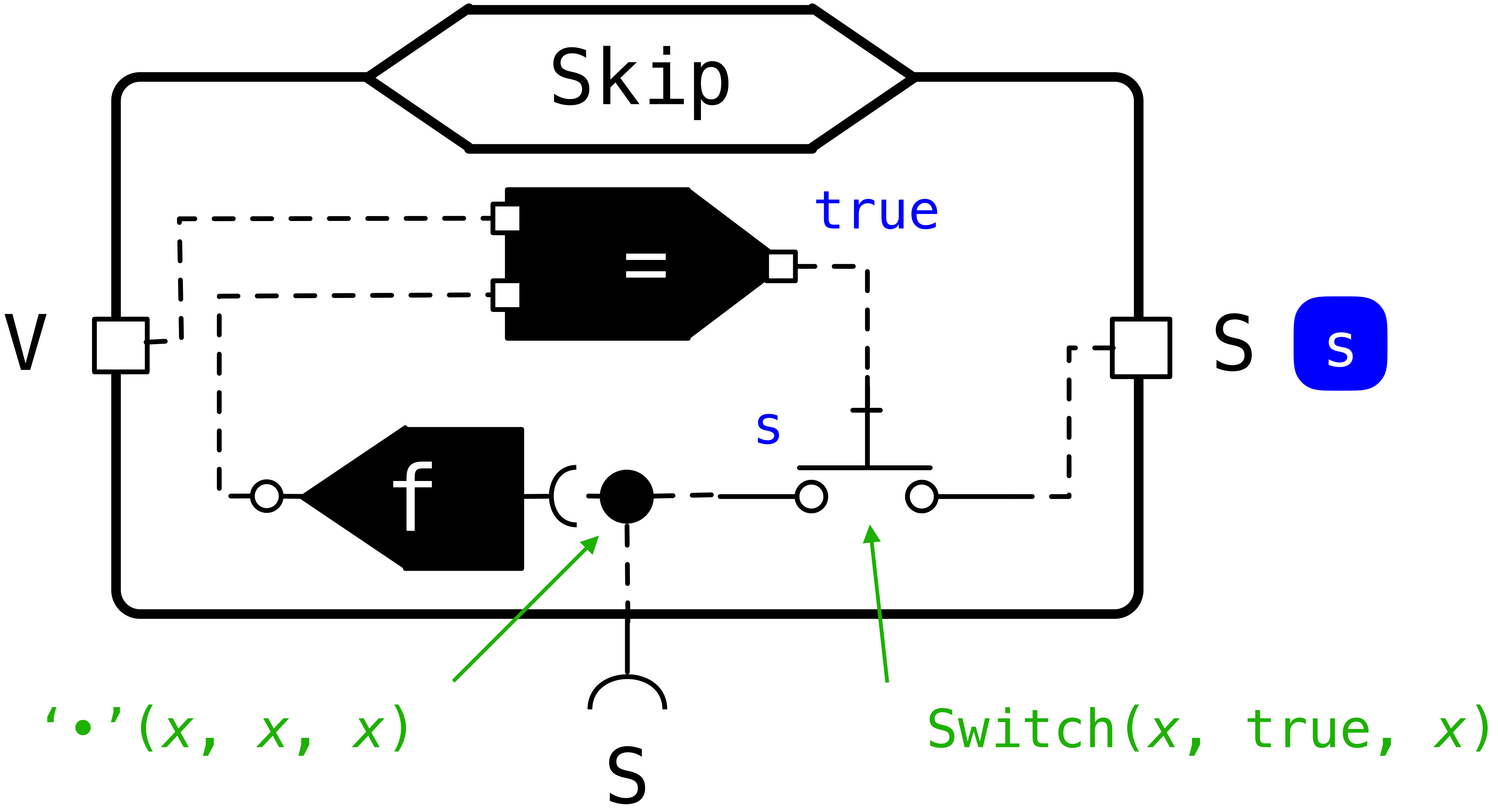

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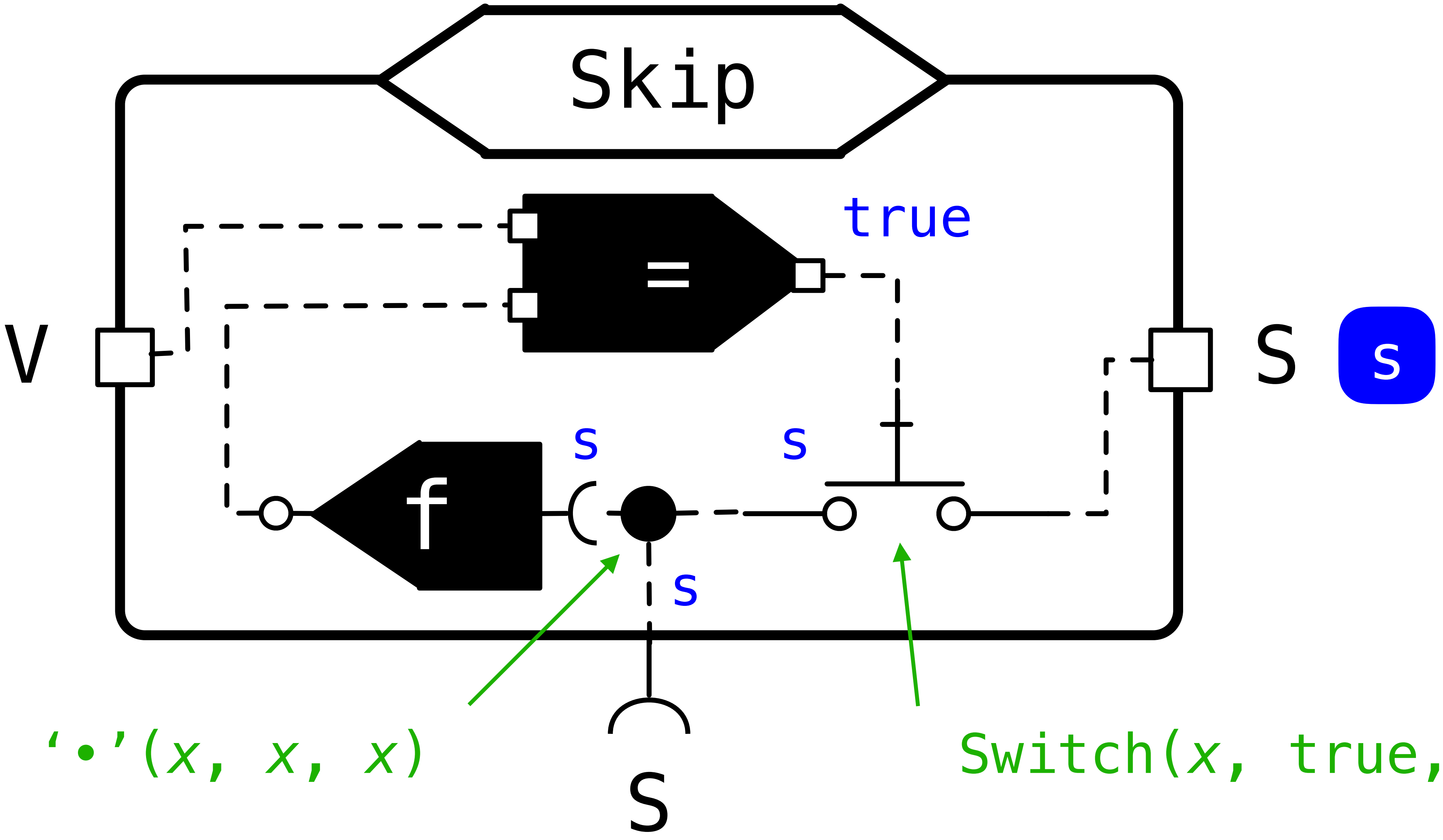
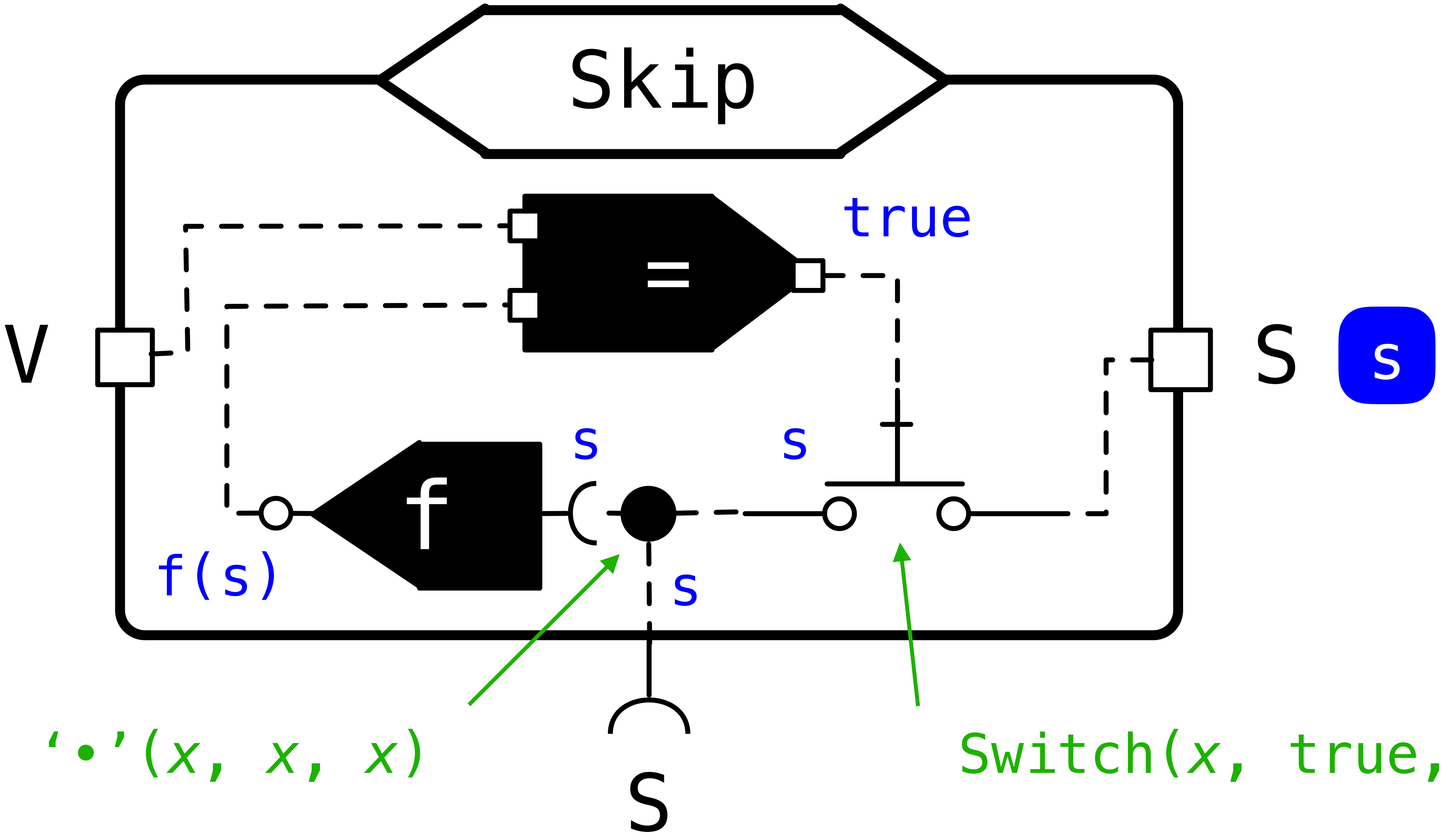


‘•’(*x*, *x*, *x*)

Switch(*x*, true, *x*)

Skip (Get Semantics)

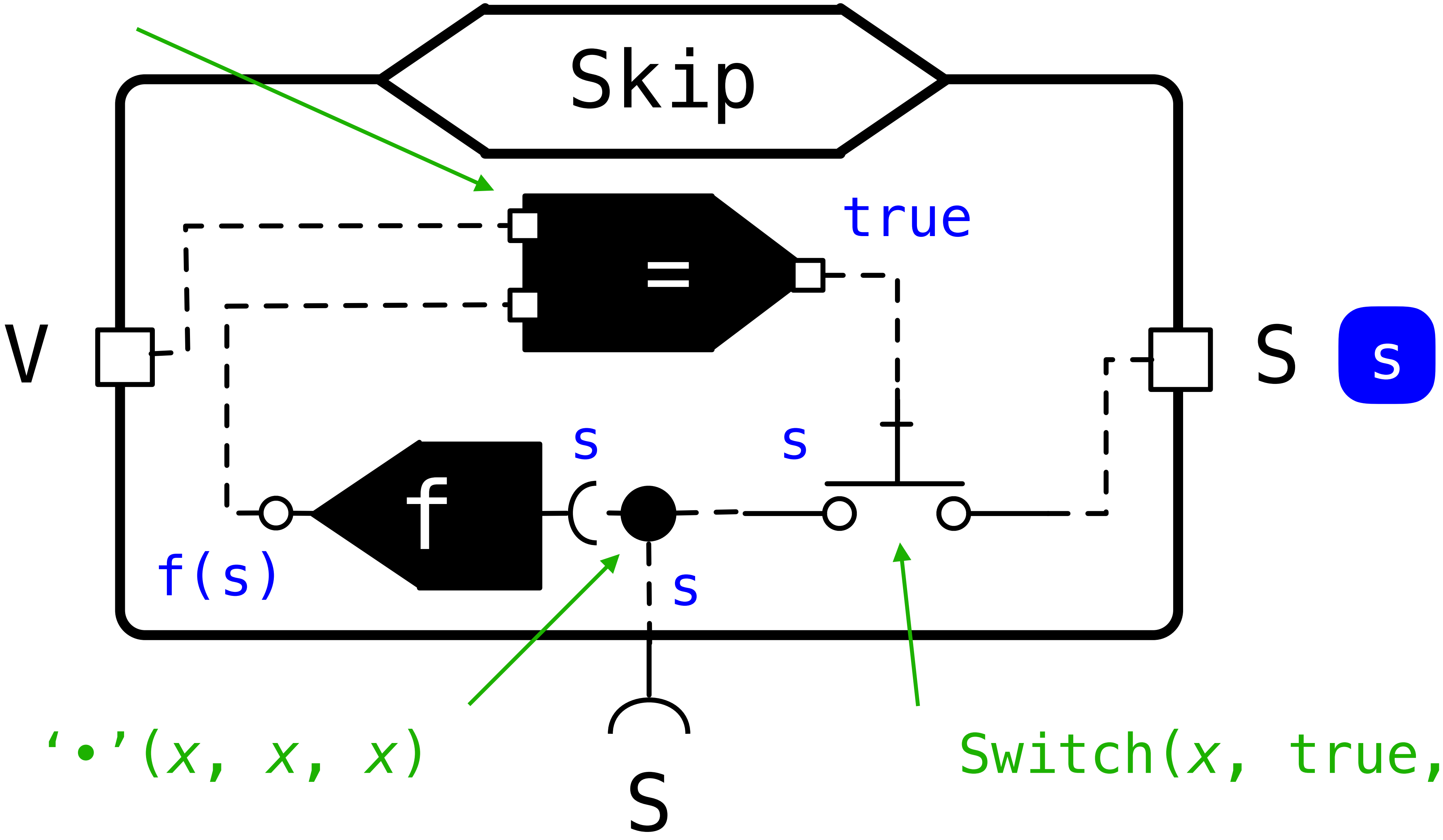


‘•’(*x*, *x*, *x*)

Switch(*x*, true, *x*)

Skip (Get Semantics)

‘=’(*x*, *x*, true)
‘=’(*x*, *y*, false) if *x* ≠ *y*



‘•’(*x*, *x*, *x*)

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Skip (Get Semantics)

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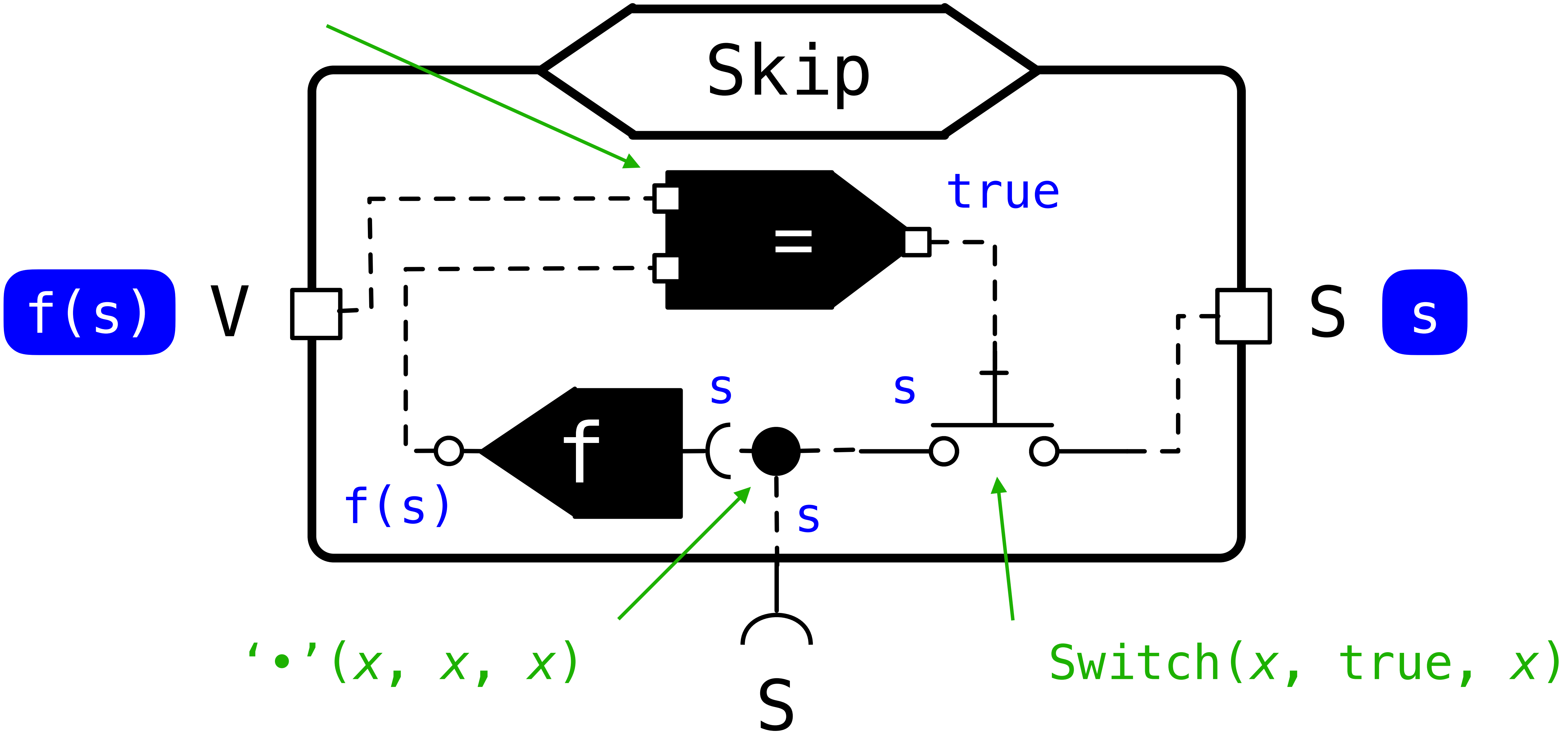

‘•’(*x*, *x*, *x*)

Switch(*x*, true, *x*)

How This Can Help

- A drag-and-drop visual editor, which is easier to use for programmers not familiar with Haskell
- Novice programmers often need to start from an operational understanding of the language.
- Proficient programmers sometimes also need to debug their program by tracing its execution.
  - BiGUL has an axiomatic semantics (to appear in the next session), which currently does not cover lens composition.

Beyond WB Combinators

- An instantiation of the relational/logic programming paradigm (?)
  - Lens combinators are deterministic in both directions.
- Well-behavedness has been regarded as an atomic property established and preserved by lens combinators, but the Skip circuit suggests that there is some “sub-atomic” structure to explore.
  - Prospect for “*deterministic relational programming*”?
    - Also subsuming reversible programming