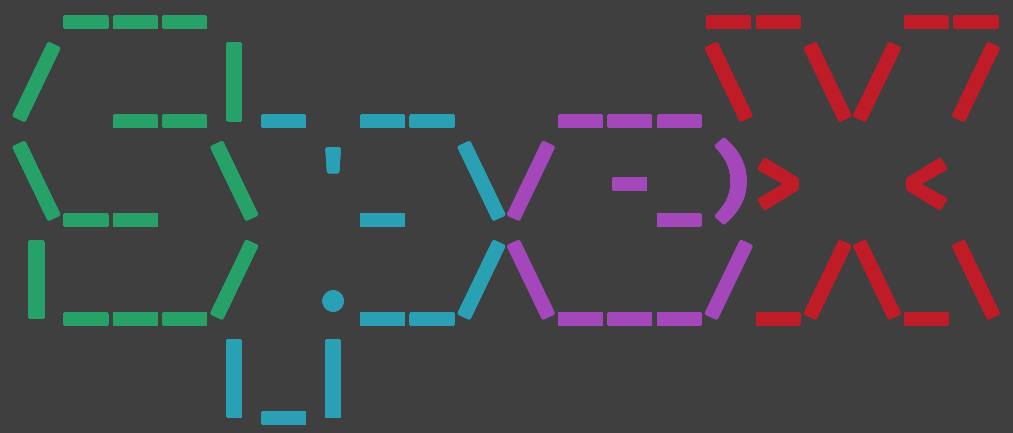


Ionuț Țuțu

IMAR, Romania

26th International Workshop on
Algebraic Development Techniques

In this talk

* interpreters (for free) via term rewriting
  ↳ of specification languages

* based on formal-specification technologies

  - sorts `sort Nat .`
  - subsorts `subsort Nat < Int .`
  - operations `op _+_ : Nat Nat → Nat .`
  - equations `eq X + 0 = X .`
  - rules `crl X, Y ⇒ Y, X if Y < X .`

Term rewriting as a substructure for specification-language interpreters

* solid mathematical foundation
* algebraic, close to standard notation used by working theoretical computer scientists
* great for rapid prototyping

but

* still somewhat rigid as a meta-language
* limited support for modularization

Object-based programming

* we rewrite configurations
  multisets of ↲

  1. objects `< Id : Class | Attributes >`
  2. messages `message(To, From, Arguments)`

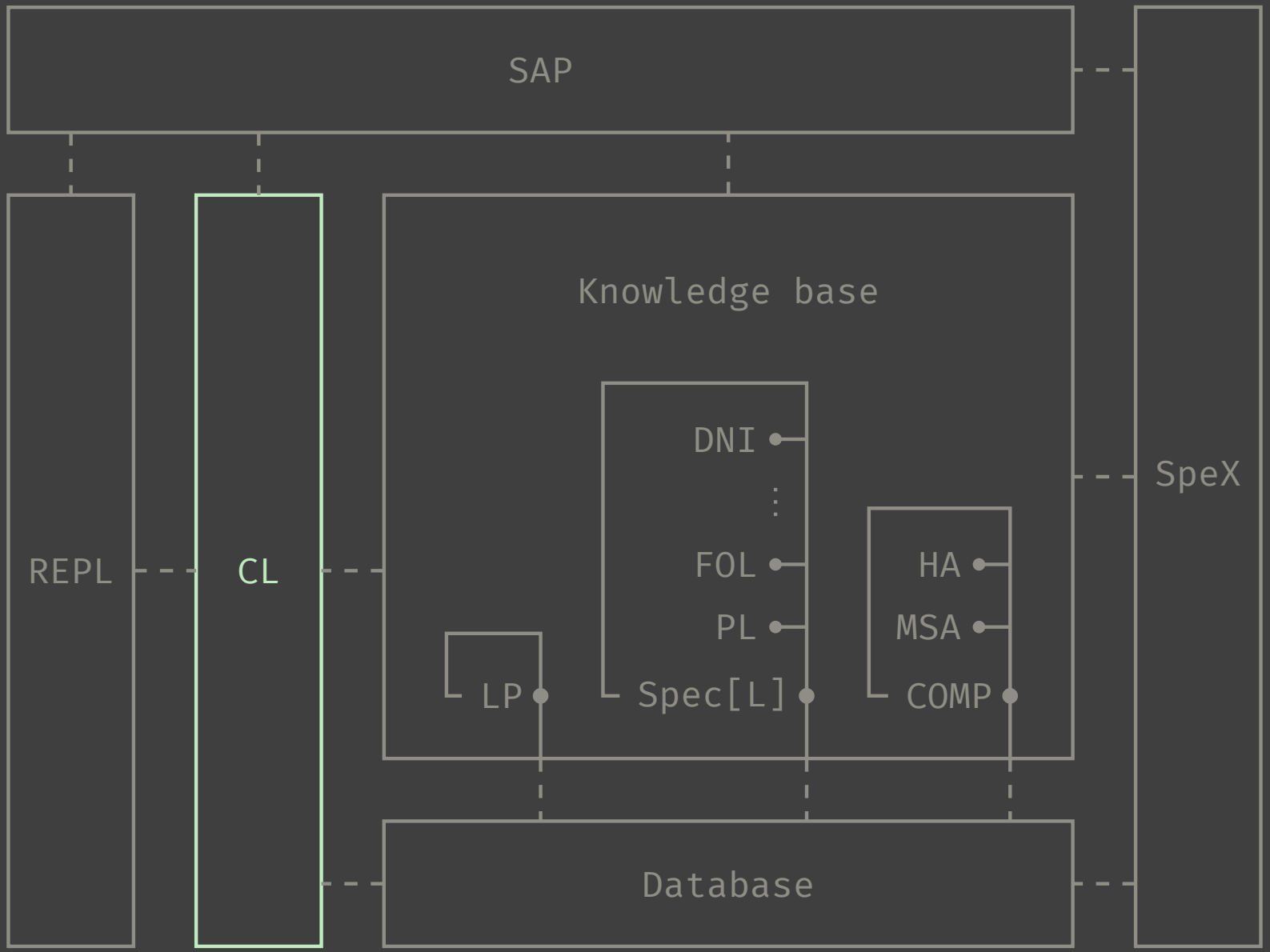
* using rules of the form

```
rl < Id : Class | ... >
   message(Id, ...)
  ⇒ ...
```

Introducing SpeX

* not a plain interpreter, but an ‘environment’
* integrates specification-language processors
* language agnostic
* offers a basic system UI ‘for free’
* based on Maude 3 (OBP with external rewrites)

An overview of SpeX (overly simplified)



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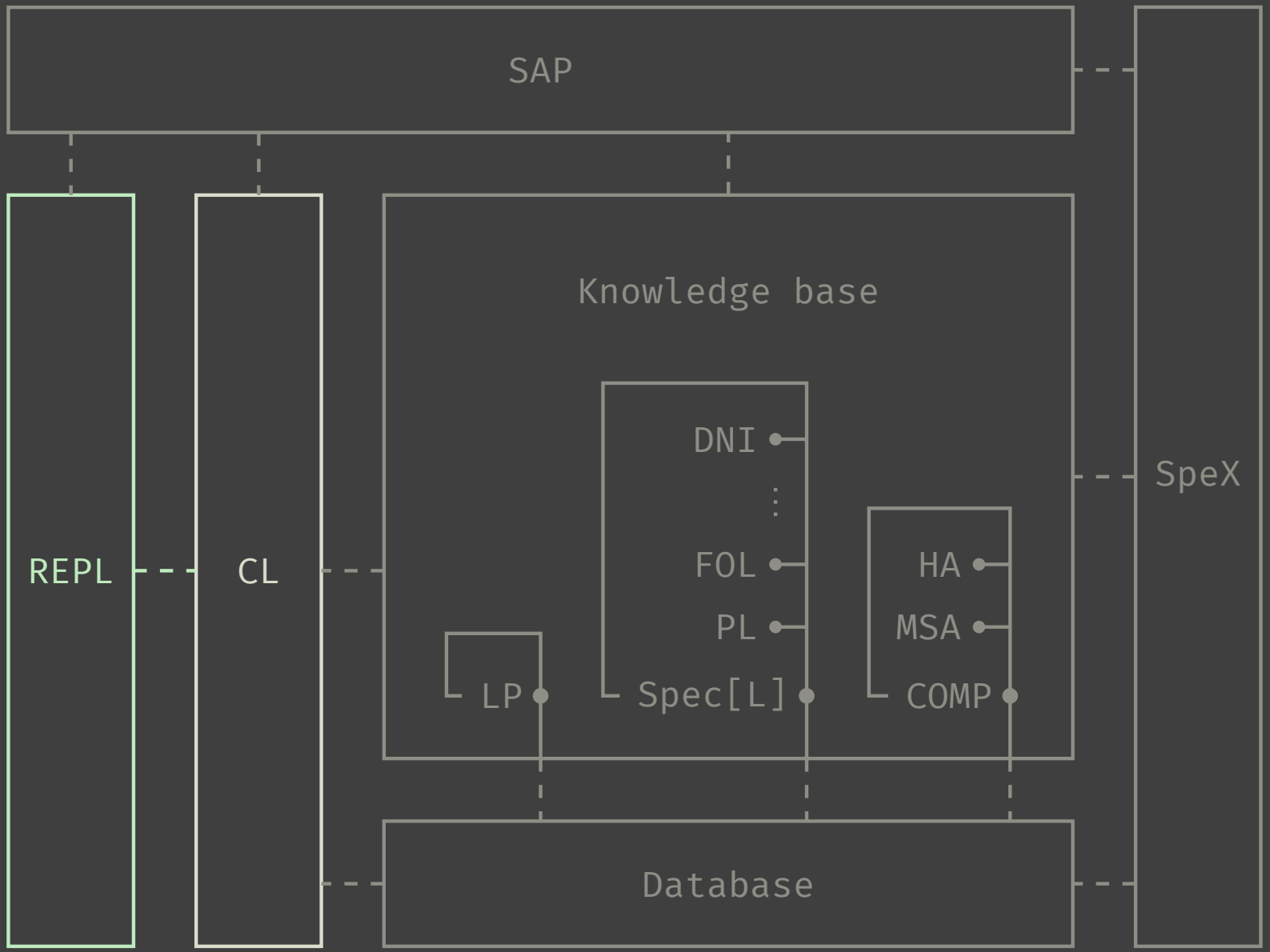

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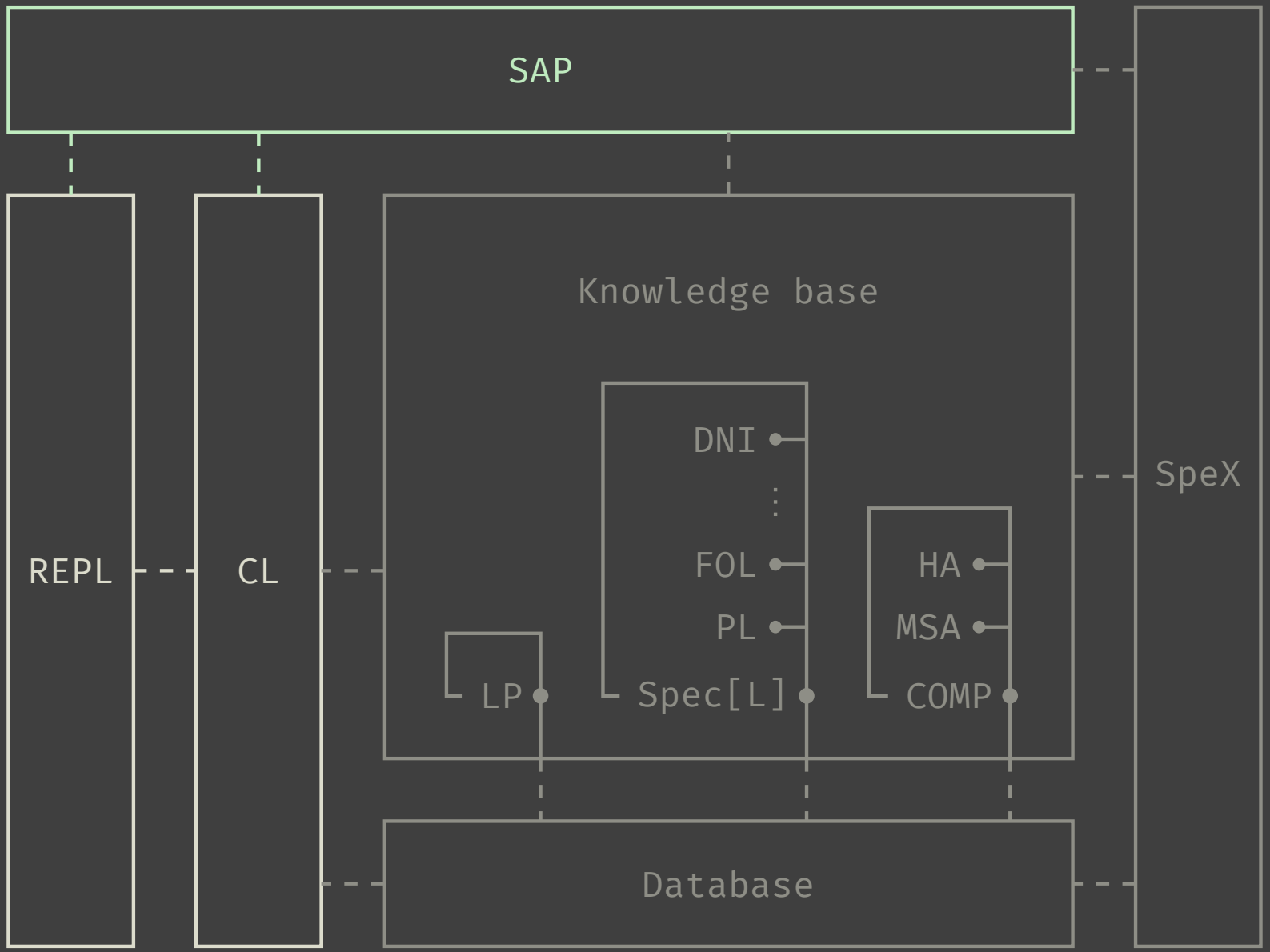

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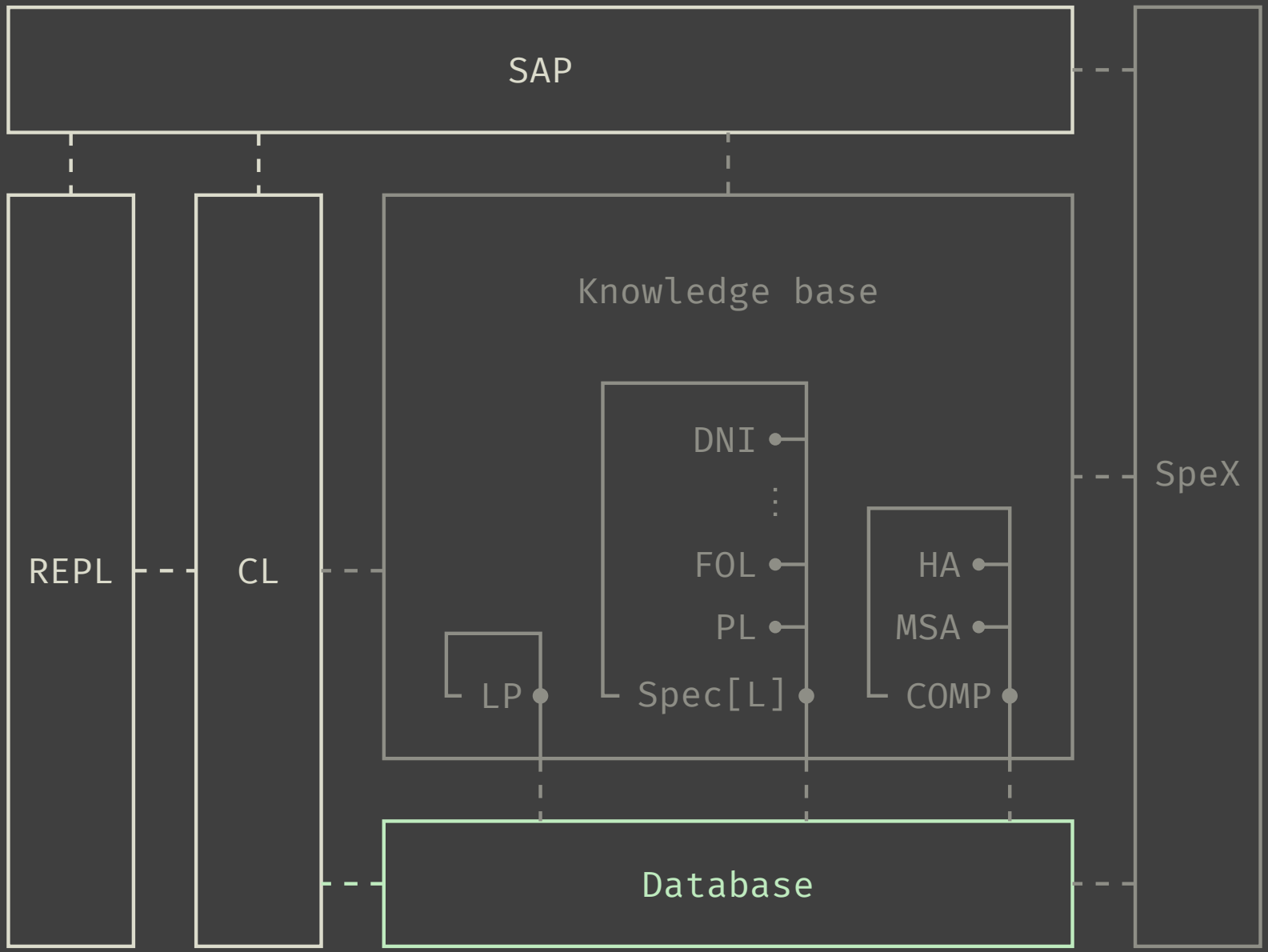

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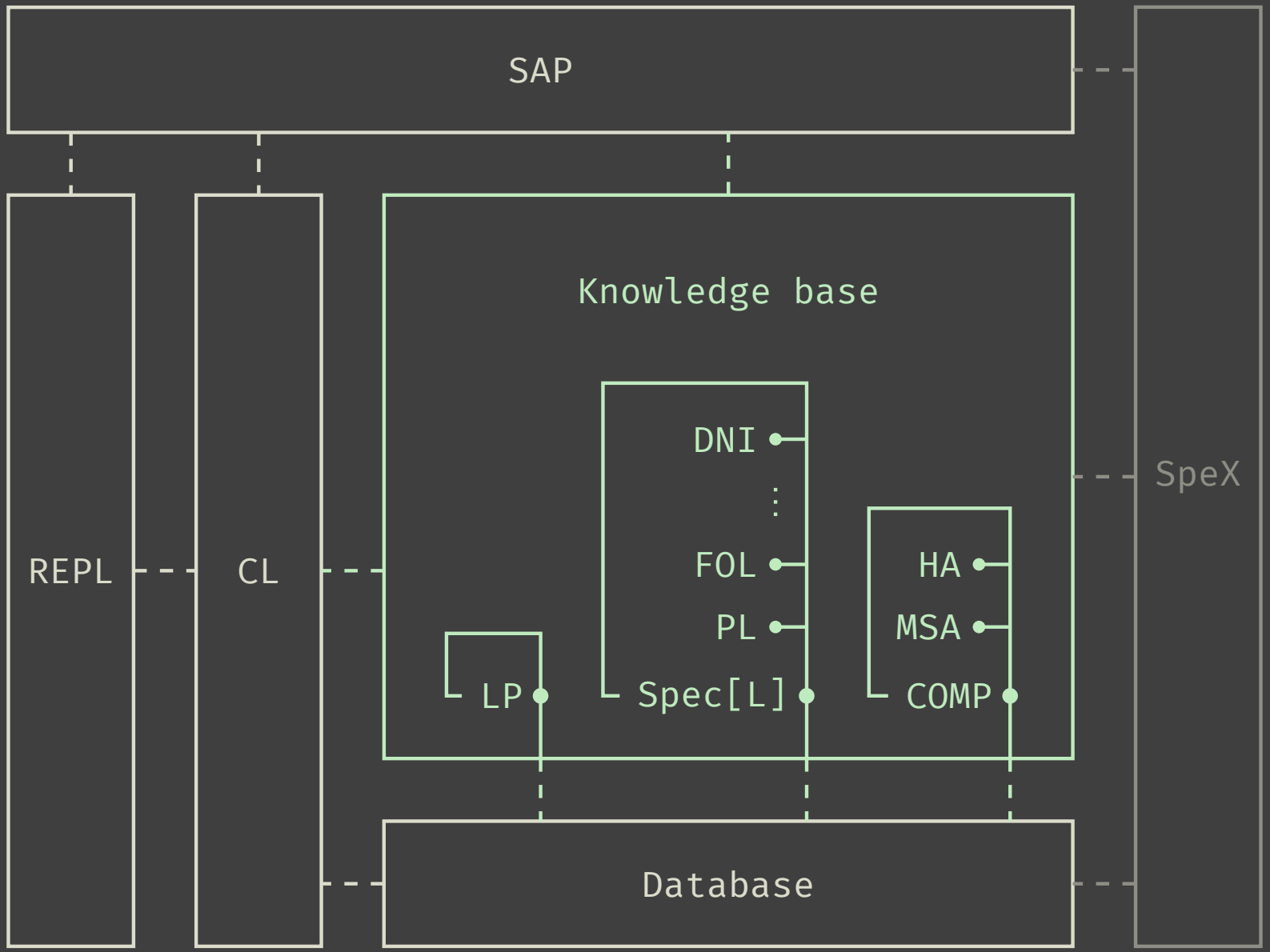

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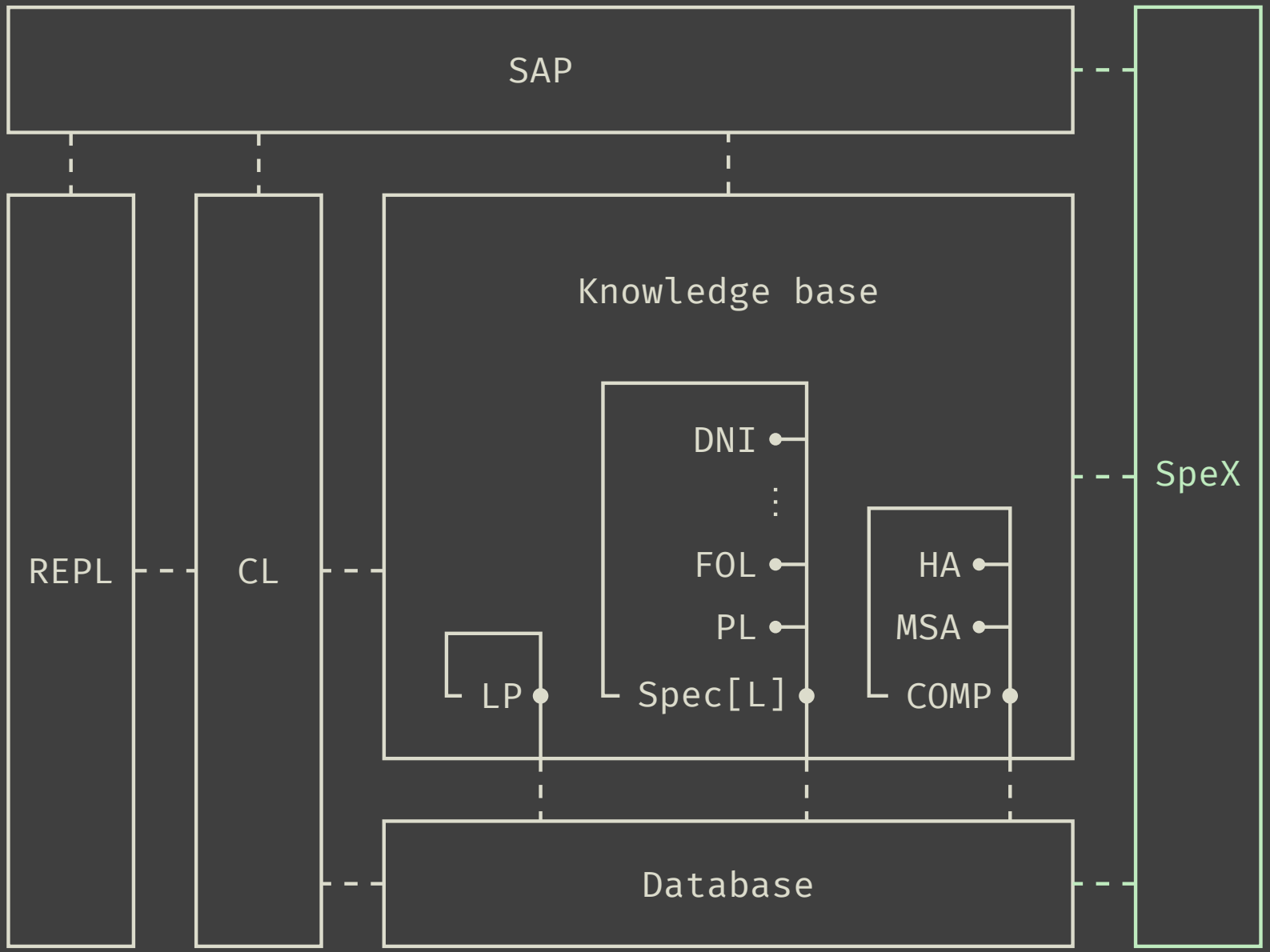


To understand how it works ...

* we take a look at REPL interpreters
  - objects of class INT
  - interact with REPL objects (streams)

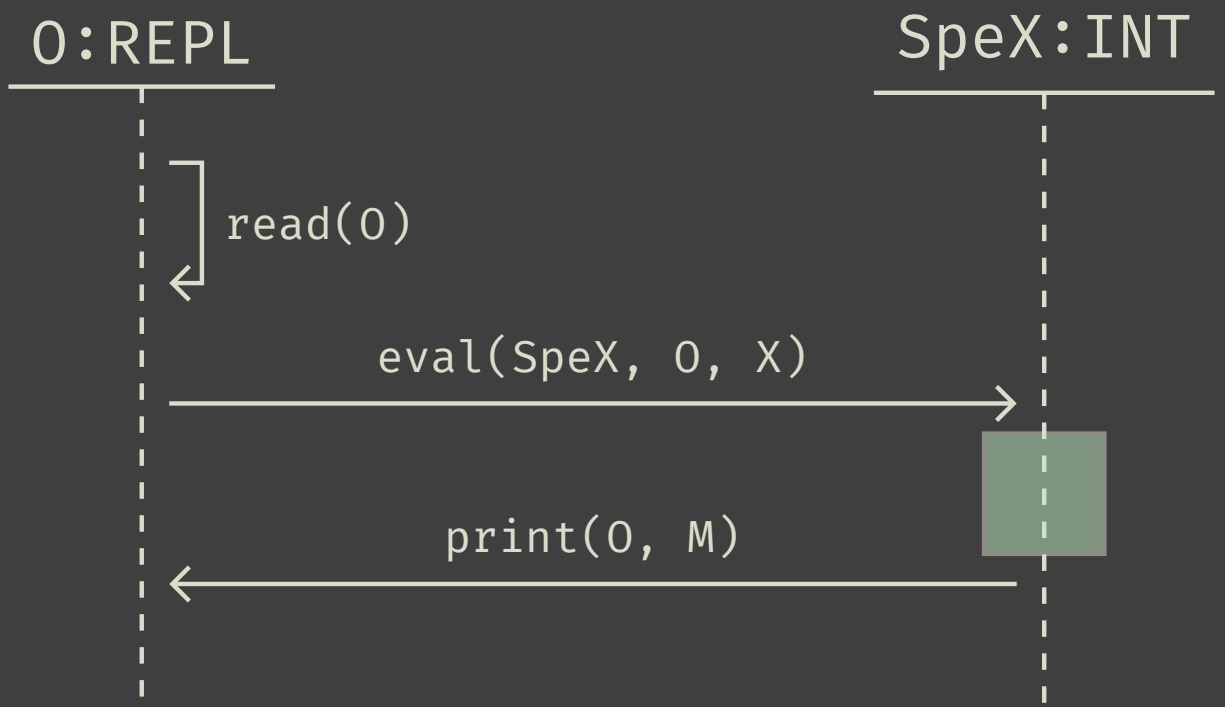
* they receive messages of the form

```
eval(I, O, X)
```

* reply with messages of the form

```
print(O, Text)
warn(O, Text, Arguments)
read-more(O) ...
```

A basic execution scenario



Integrating new languages into SpeX

* by means of processors
  - objects of class PROC
  - interact with SpeX (the object)

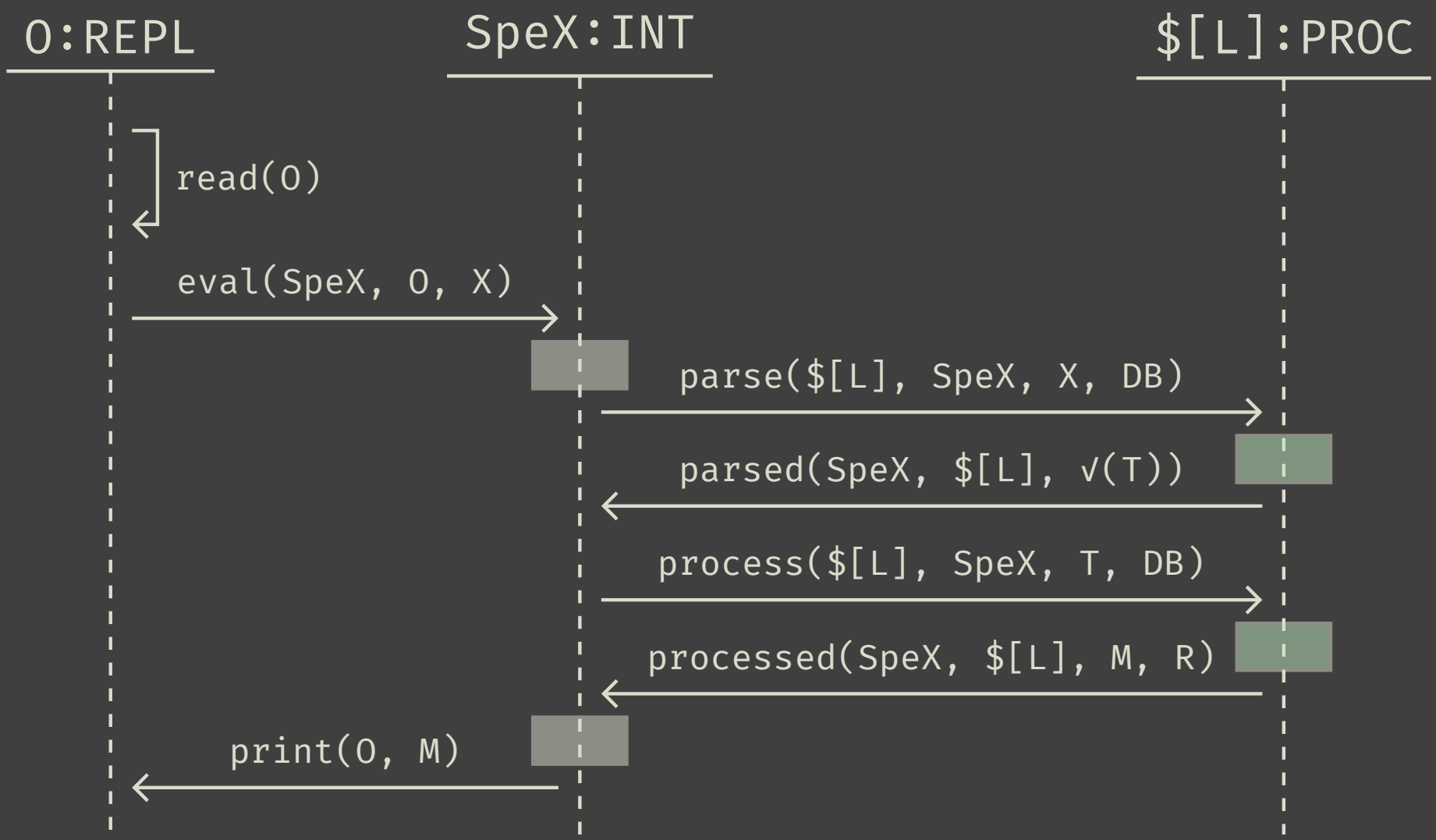
* receive messages of the form

```
parse($[L], SpeX, Input, DB)
process($[L], SpeX, AnnotatedTerm, DB)
```

* reply with messages of the form

```
parsed(SpeX, $[L], ParsingOutcome)
processed(SpeX, $[L], Text, Record)
```

A basic execution scenario (cont.)



Example: Spec[DNI]

```
spec Bind is
  including Base .
  mod __bind_ : Protein Organelle >< Coat .
  …
  sen store k:Nominal
      forall-local {p:Protein, o:Organelle}
      [ p o bind z:Coat ]
      (forall-local {o':Organelle}
        brane(o') = @(k) brane(o))
      and
      (forall-local {c':Coat}
        c' = z implies brane(c') = @(k) brane(o))
      [label: bind-effect] .
endspec
```

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endspec
```

Example: COMP

```
bobj WATCH is
  syncing (UP-TO-24-COUNTER as HOUR)
      and (UP-TO-60-COUNTER as MINUTE)
      and (UP-TO-60-COUNTER as SECOND) .
  op _:_:_ : Nat Nat Nat → State .
  act tick_ : State → State .
  act inc-min_ : State → State .
  ...
endbo
```

```
open WATCH
  check tick inc-min (H:Nat : M:Nat : S:Nat)
      ~ inc-min tick (H:Nat : M:Nat : S:Nat)
  forall M:Nat < 60 = true
     and S:Nat < 60 = true .
close
```

Example: COMP

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open WATCH
  check tick inc-min (H:Nat : M:Nat : S:Nat)
      ~ inc-min tick (H:Nat : M:Nat : S:Nat)
  forall M:Nat < 60 = true
     and S:Nat < 60 = true .
close
```

Obtaining SpeX

* from the GitLab repository:

  https://gitlab.com/ittutu/spex

* then, if Maude 3(.2) is installed:

```
./configure
make
[sudo] make install
```

Happy hacking!