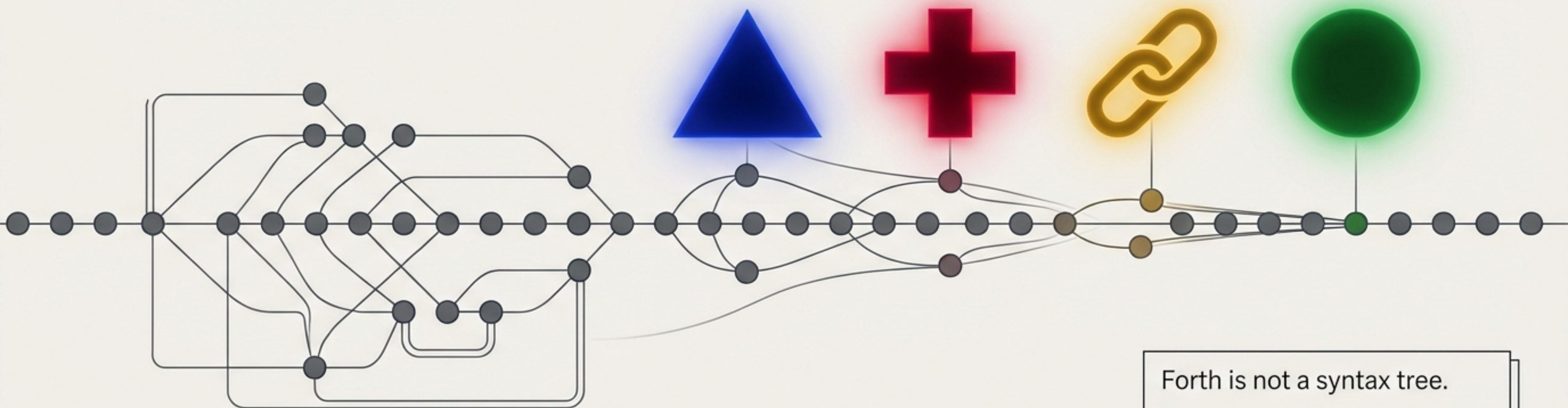


Building Forth from Spherepop Primitives

Stacks, Continuations, and the
Geometry of Recursive Control.

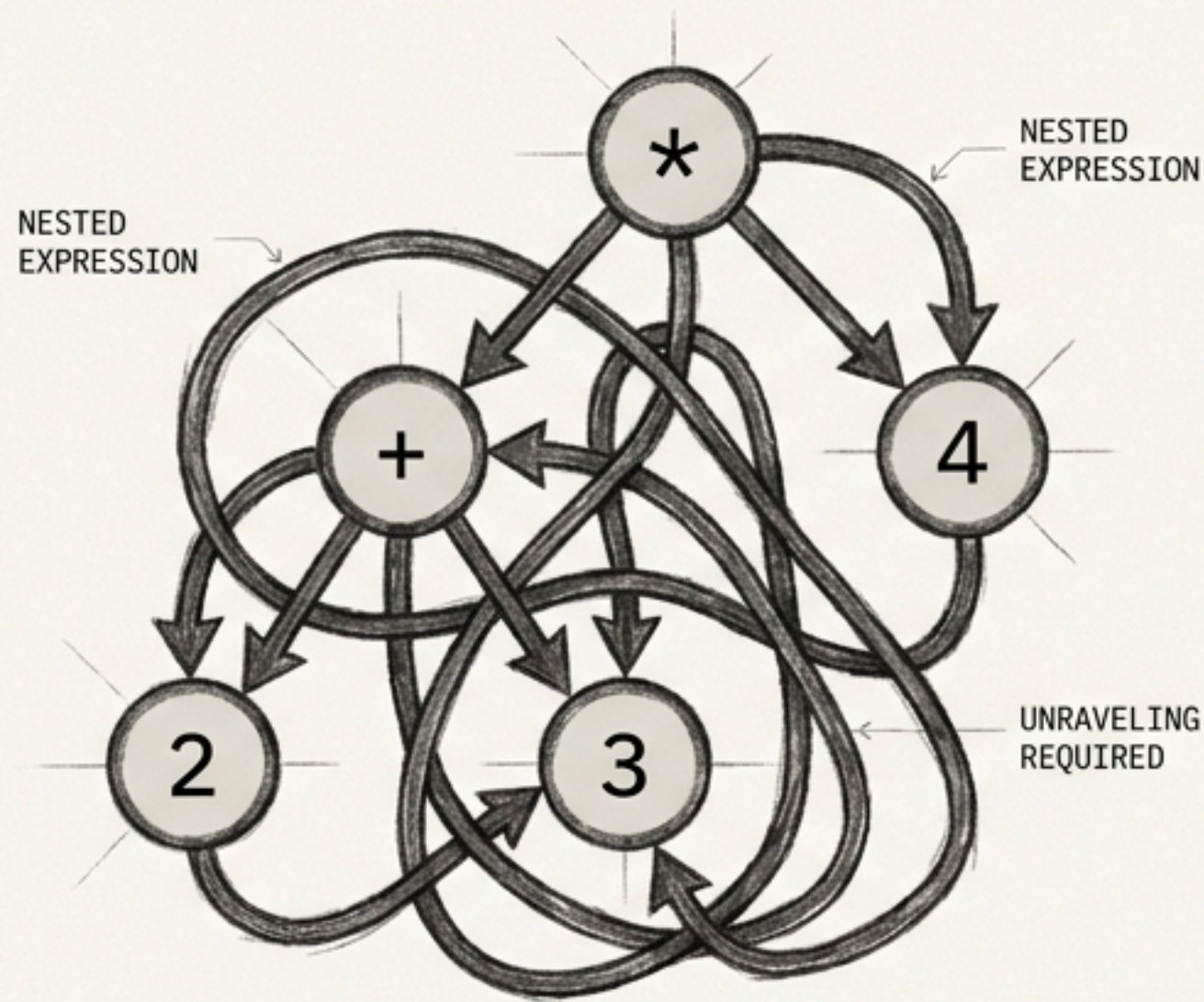


Forth is not a syntax tree.
It is an explicitly structured
field of state transitions
where nothing is truly erased.

Forth Rejects the Syntax Tree for a Geometry of Reachability

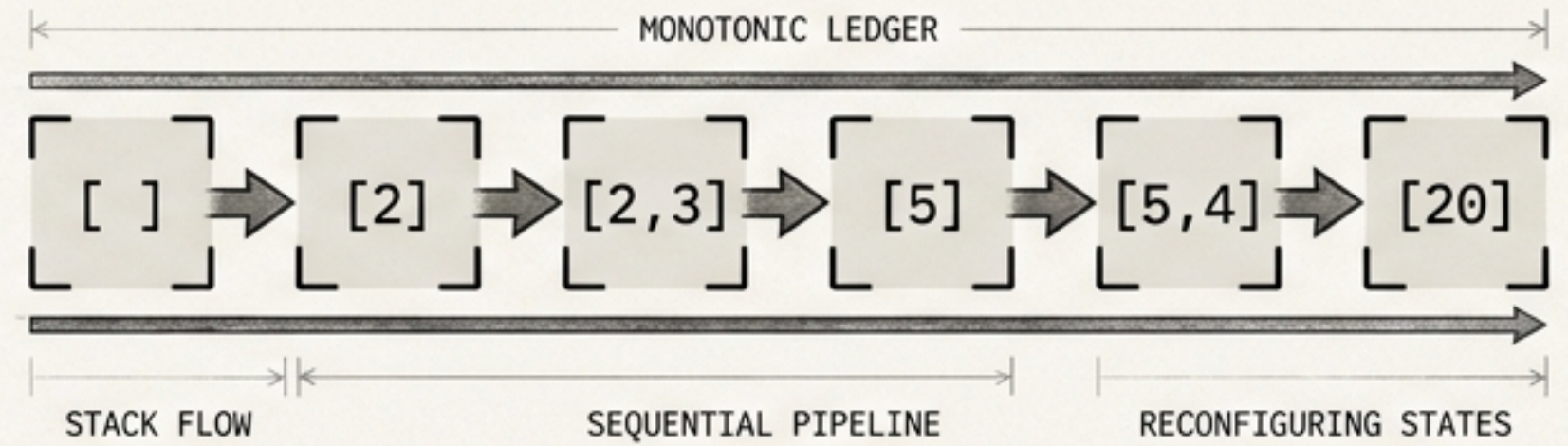
Traditional Expression

(2 + 3) * 4



Forth / Spherepop

2 3 + 4 *



The Shift: In Spherepop, words do not primarily denote values.

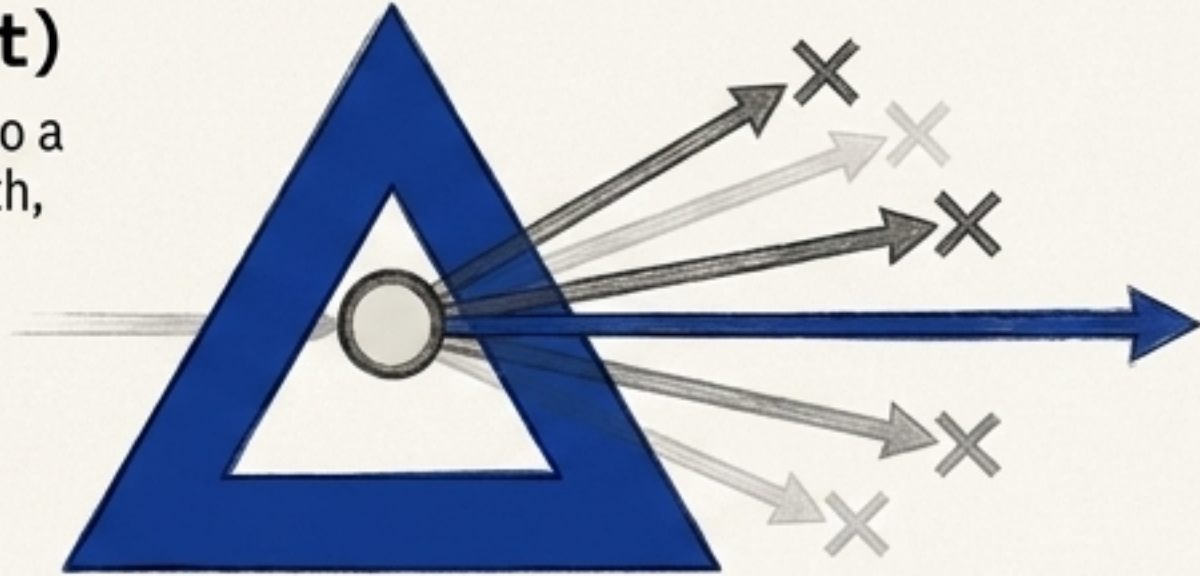
The Reality: A word denotes an admissible reconfiguration of reachable positions.

$\Sigma \rightarrow \Sigma$

The Spherepop Ontology Reduces Computation to Four Structural Actions

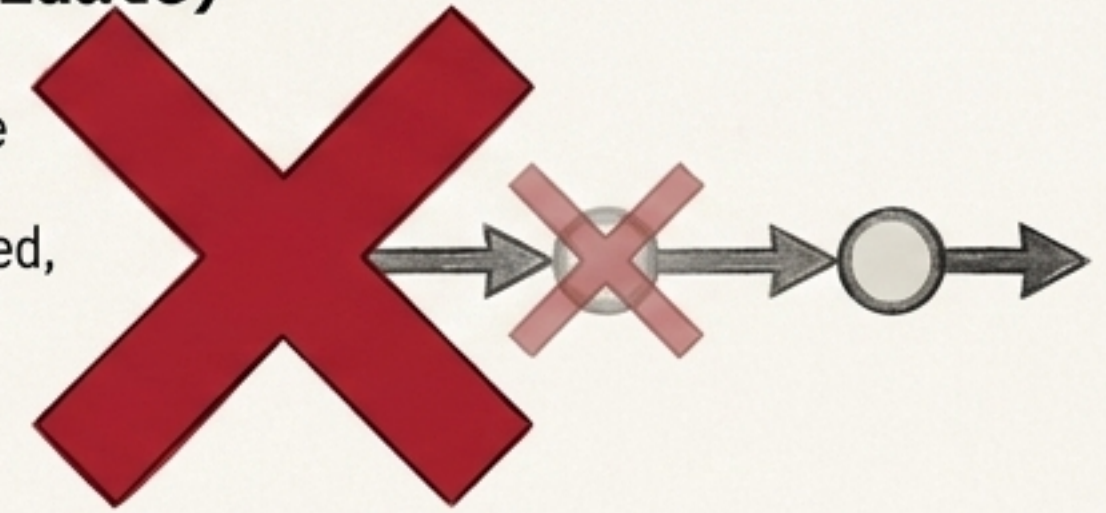
Pop (Commit)

A node locking into a single forward path, foreclosing other branches.



Refuse (Invalidate)

Marking a state as inadmissible. The node remains on the timeline—it is not erased, just bypassed.



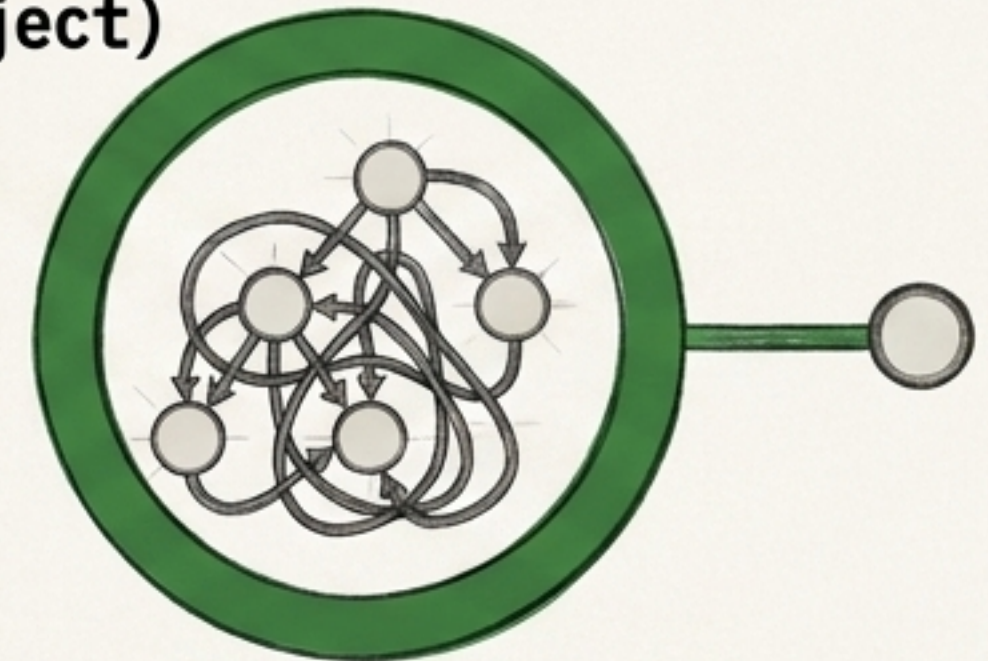
Bind (Couple)

Coupling two dependent elements together without identifying them as the exact same entity.



Collapse (Project)

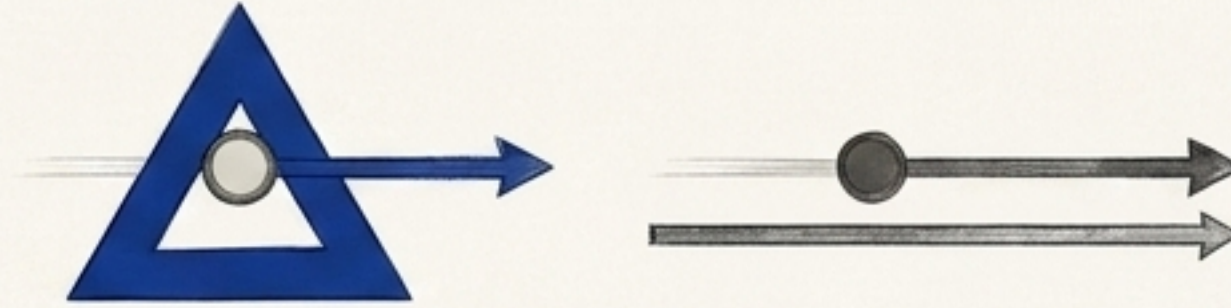
Observing accumulated history under a specific rule to project a single visible state.



Terminological Note: Spherepop "Pop" (commitment) $\neq$ Forth "pop" (removal).

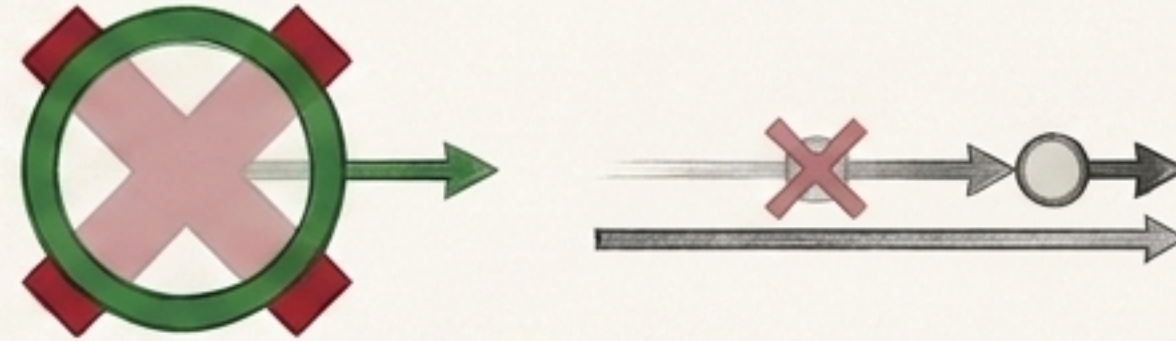
Familiar Stack Words Are Fixed Compositions of the Four Primitives

push(x)



A new state is committed to the ledger.

pop(x)



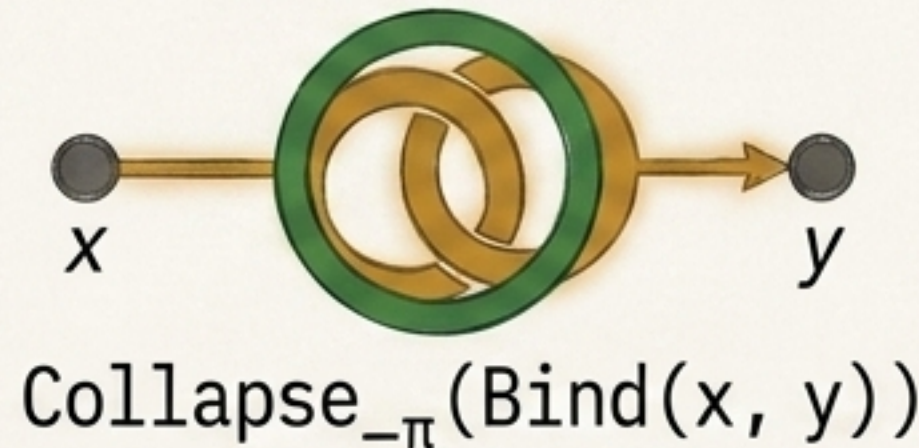
Consumption is not deletion, just a collapsed refusal.

dup(x)



Committing to a new dependent copy.

swap(x, y)

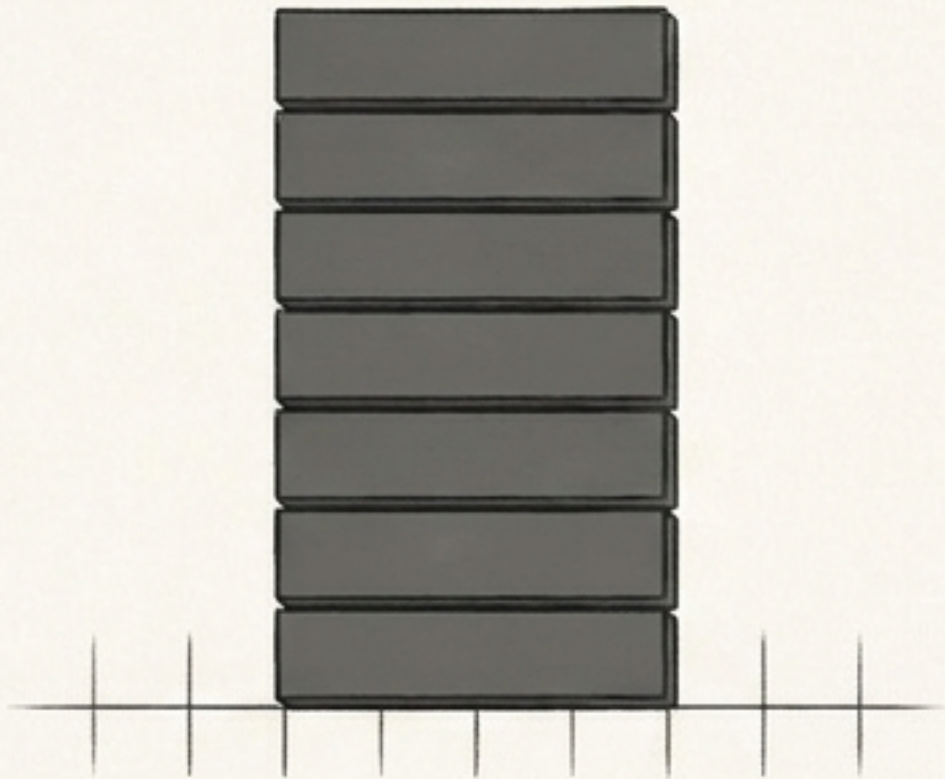


$\text{Collapse}_{\pi}(\text{Bind}(x, y))$

Collapsing a coupled pair under a transposition rule.

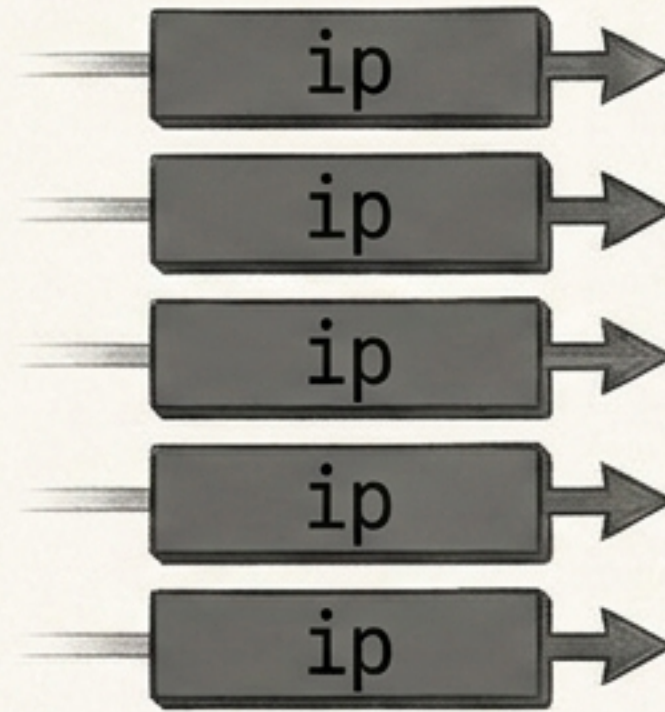
Three Distinct Architectures of Reachability

Data Stack (D)



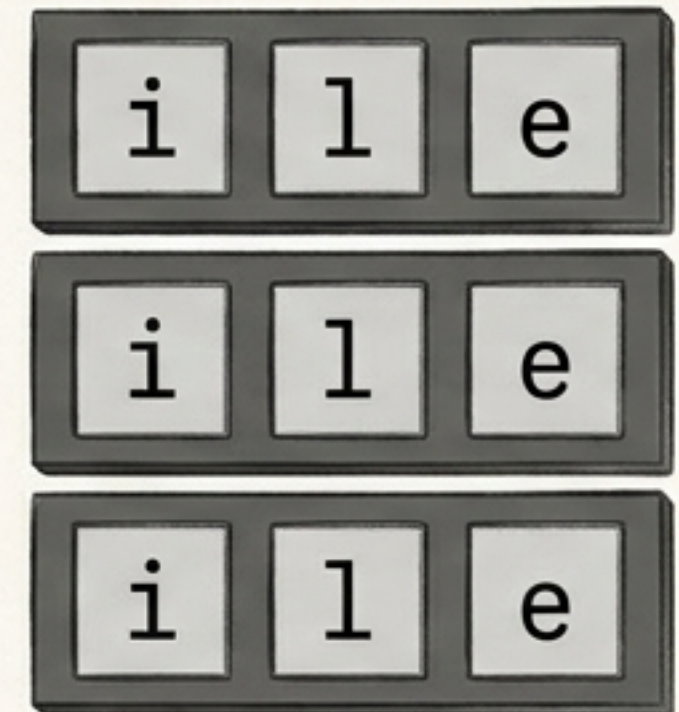
Rule: Values available to current computation.

Return Stack (R)



Rule: Discharged by a single Collapse under a substitution rule (c_subst).

Control Stack (C)



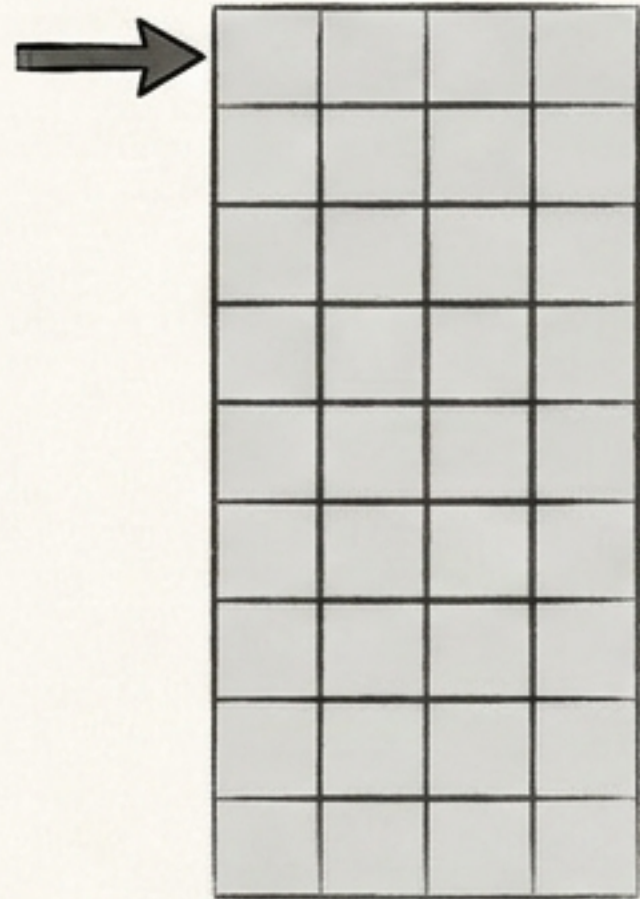
Rule: Discharged by repeated Collapse under an advancing index.

Synthesis Insight: A practical implementation may multiplex **C** onto **R** (sharing a physical array), but they answer to completely different mathematical admissibility rules.

The Persistent Stack is the Truest Physical Model of Spherepop

Fixed Contiguous

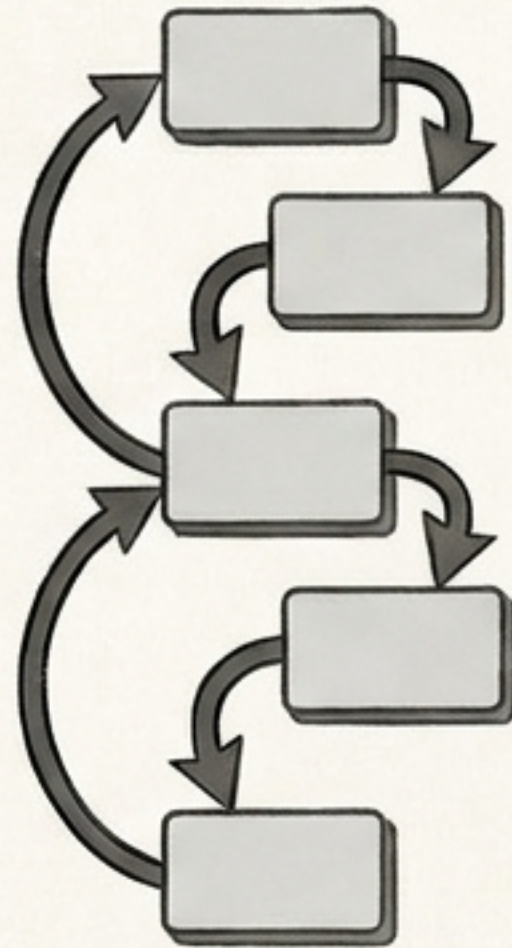
Array + Pointer.



Fast, rigid.

Linked

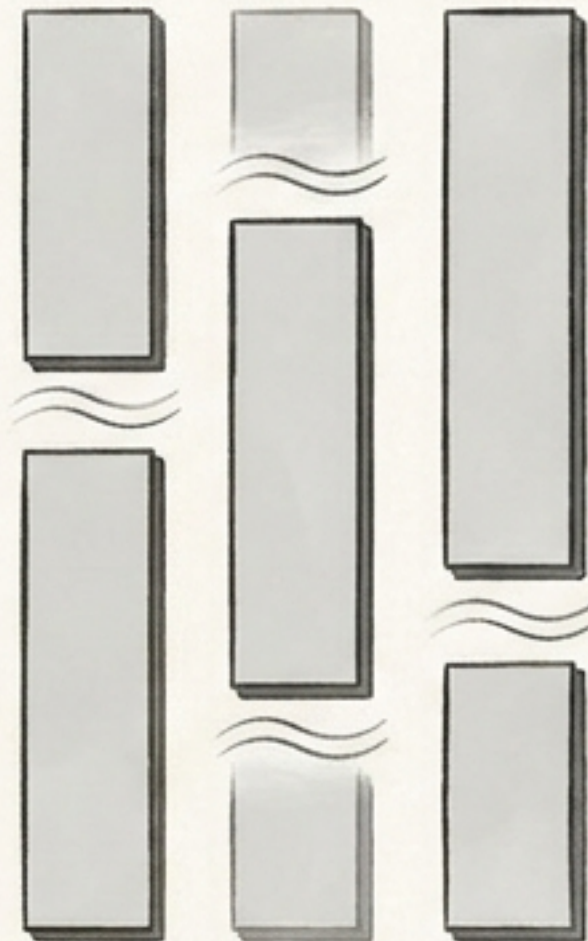
Node pointers.



High overhead,
allows sharing.

Segmented

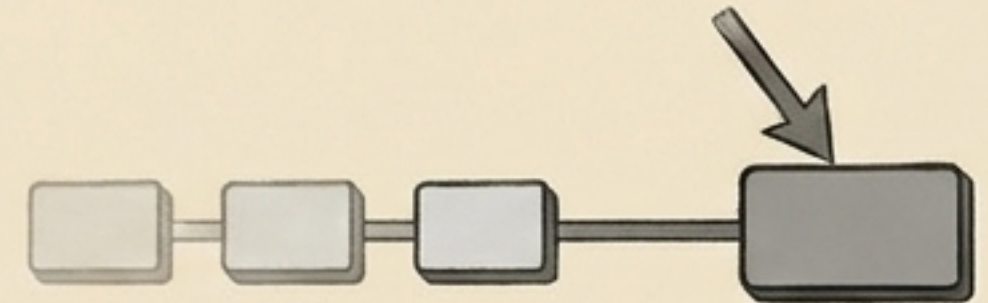
Bounded regions.



Explicit
continuation points.

Persistent

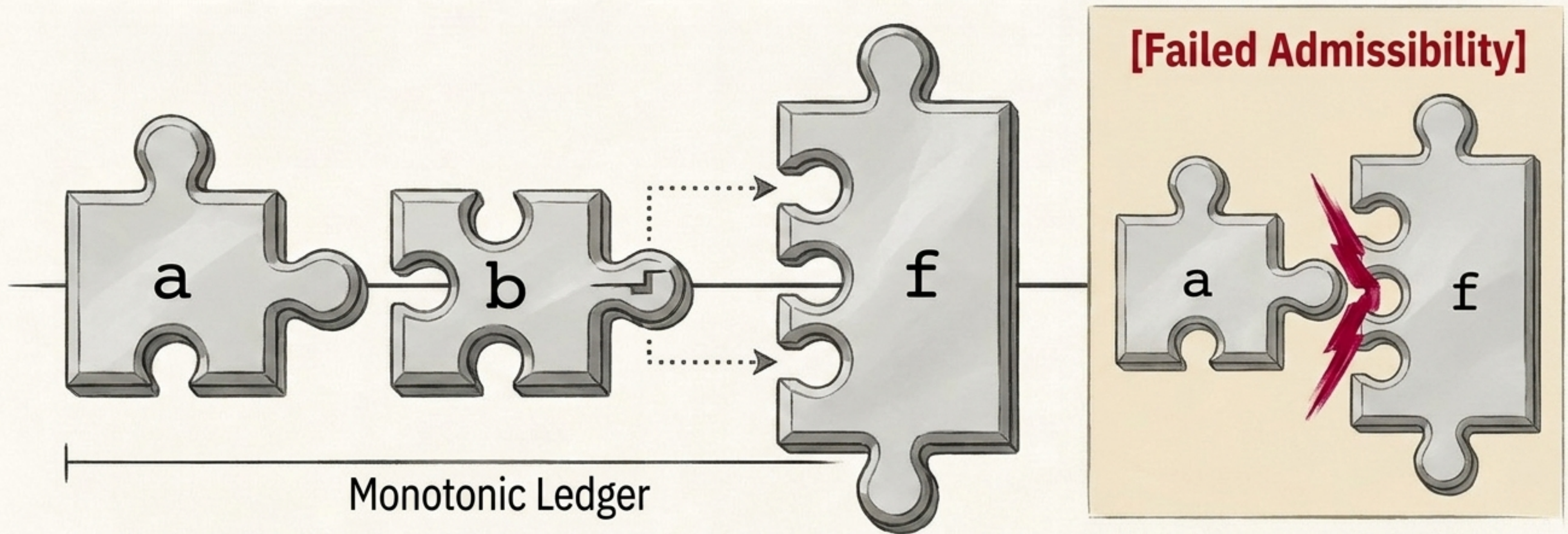
Append-only nodes.



$\text{push}(x, D) = \text{Node}(x, D)$

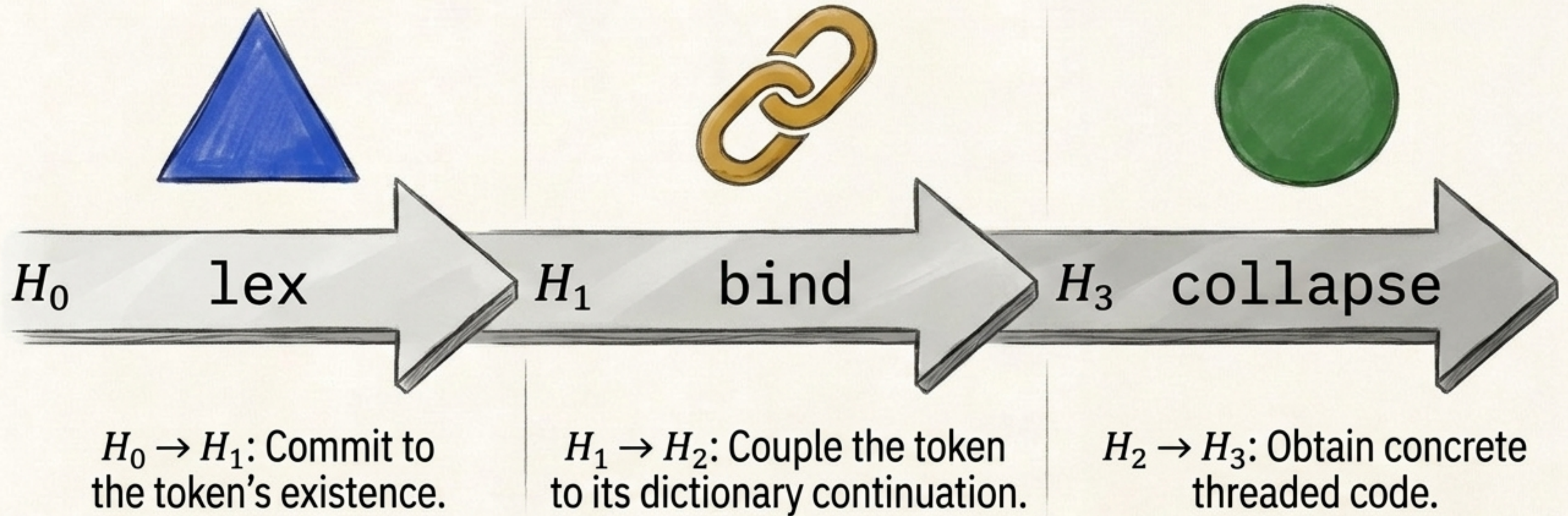
Older states remain
reachable for rollback.
A Forth "pop" is just a
Refuse layered over an
intact push, exactly mirroring
the Spherepop ontology.

Reverse Polish Notation Serializes a Proof of Availability



- **RPN** is a **serialized proof** that operands become available before the consuming operation occurs.
- **Stack underflow** is simply a failed physical admissibility condition, not a syntactic error.

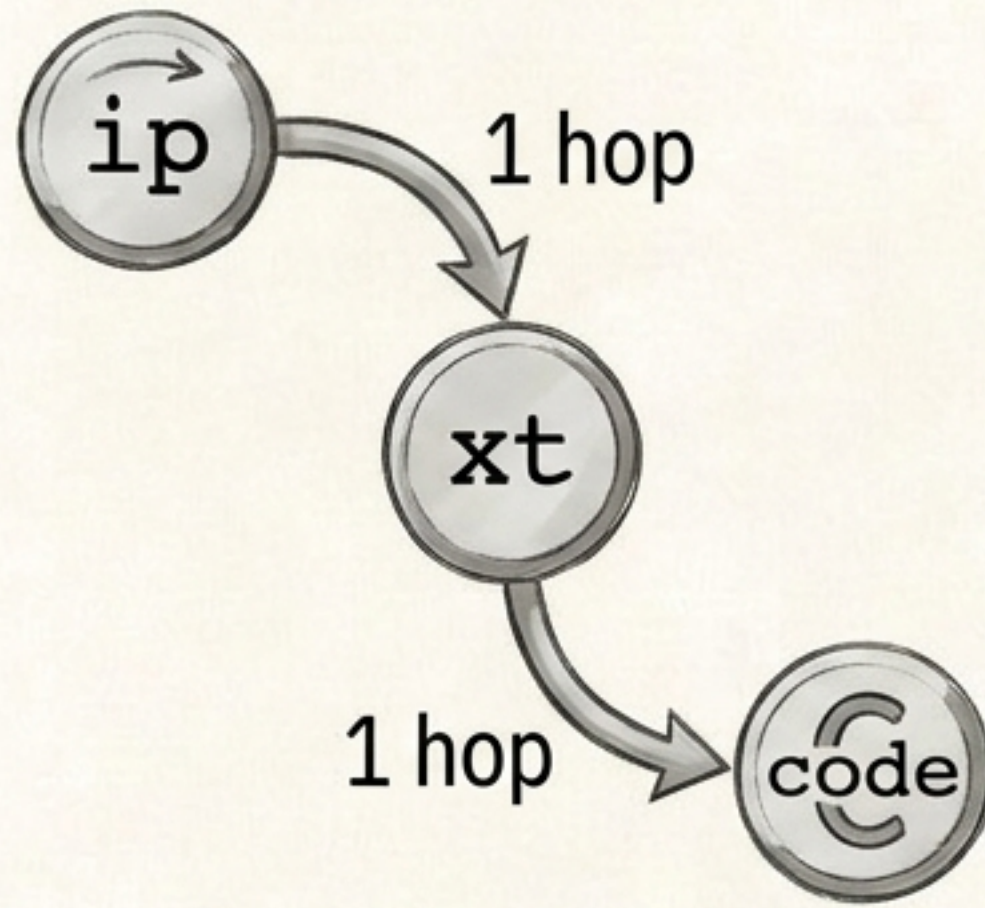
The Compiler Grows a History Through Lexing, Binding, and Collapsing



Synthesis Insight: Interpret vs. Compile modes are not different architectures. They simply dictate **when the Collapse** happens—either immediately upon reading, or deferred into a constructed body.

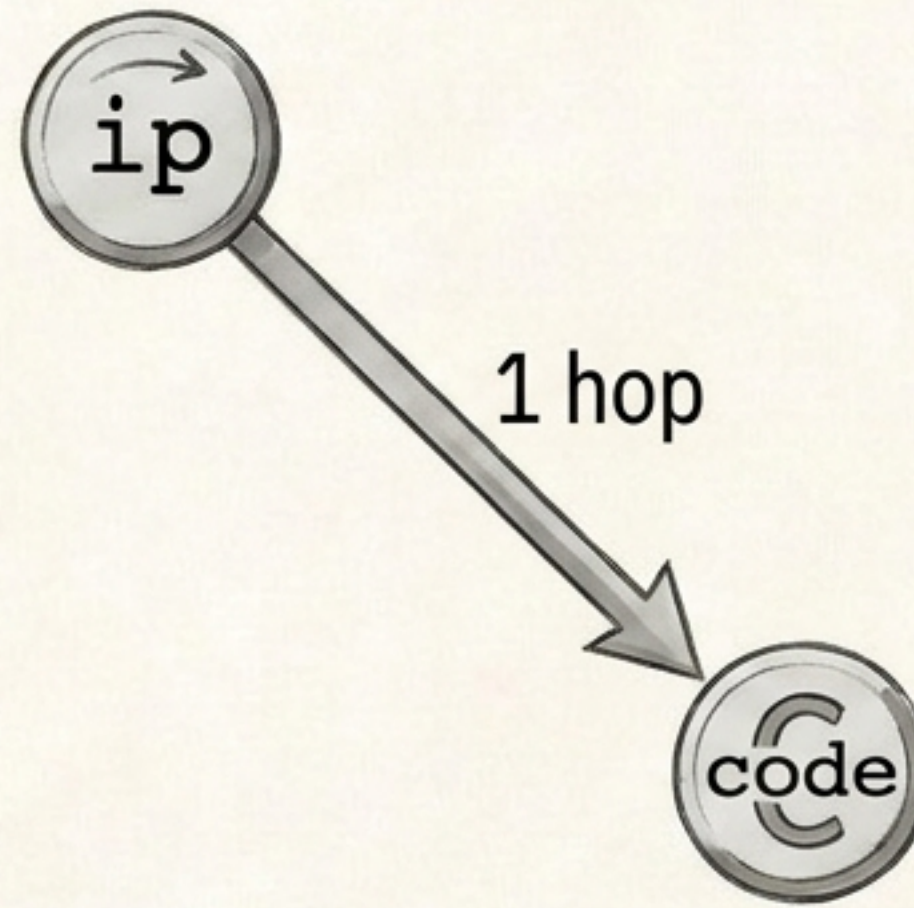
Threading Models Represent Different Distances of Reachability

Indirect Threading



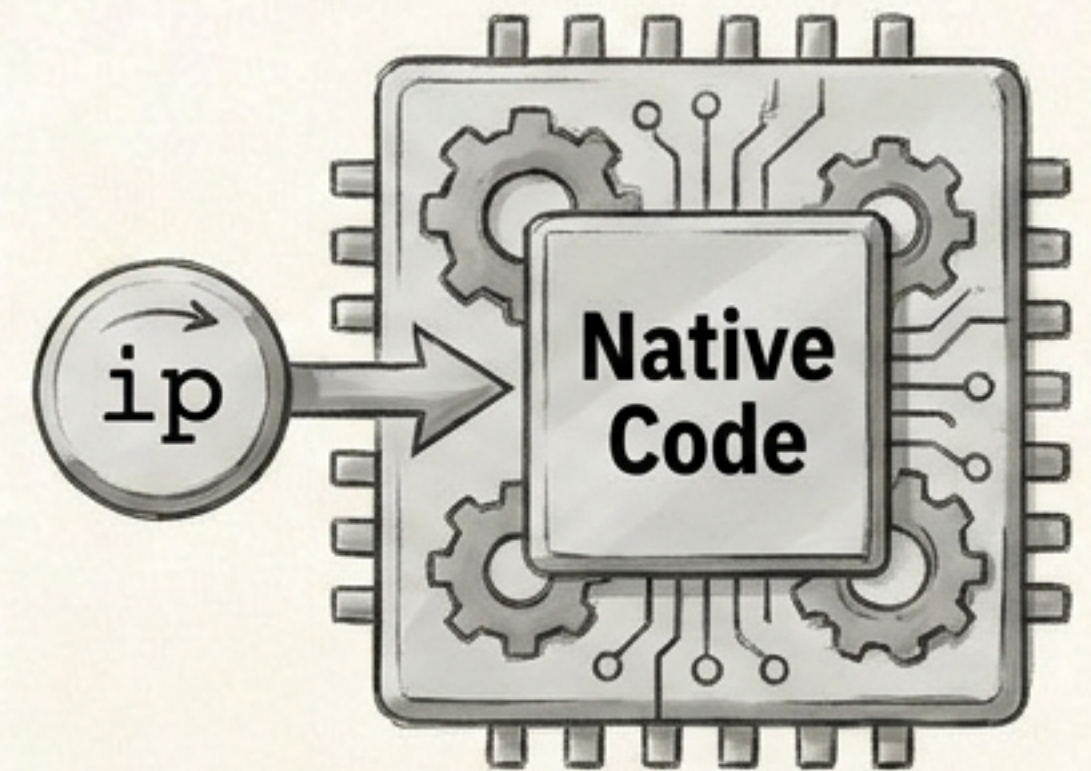
Adds a pop-like dereference.

Direct Threading



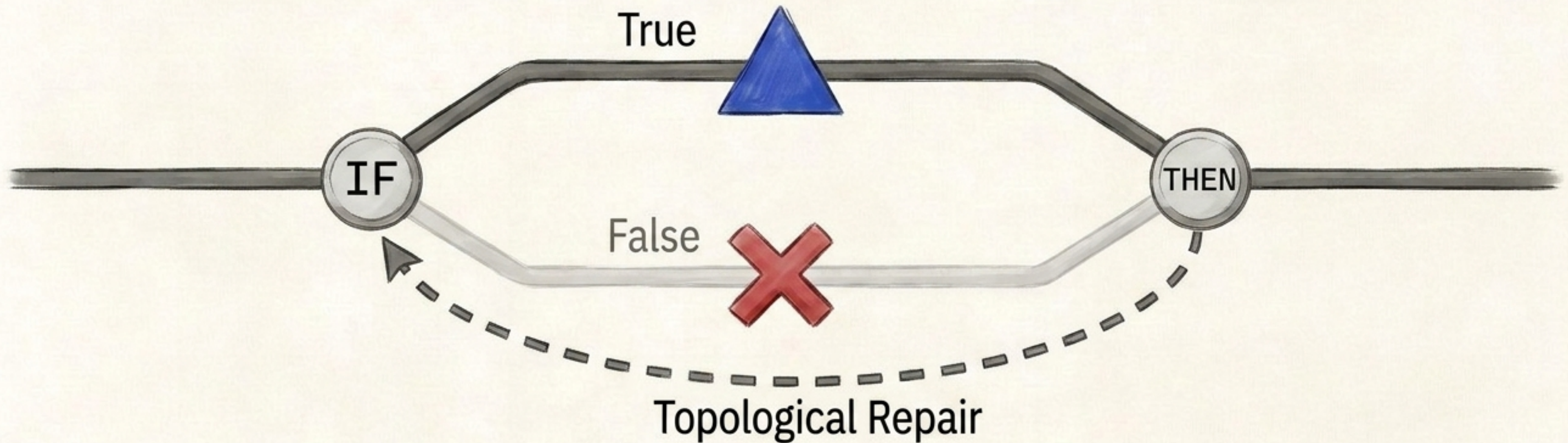
Contracted reachability layer.

Subroutine Threading



Delegates continuation entirely to the host processor.

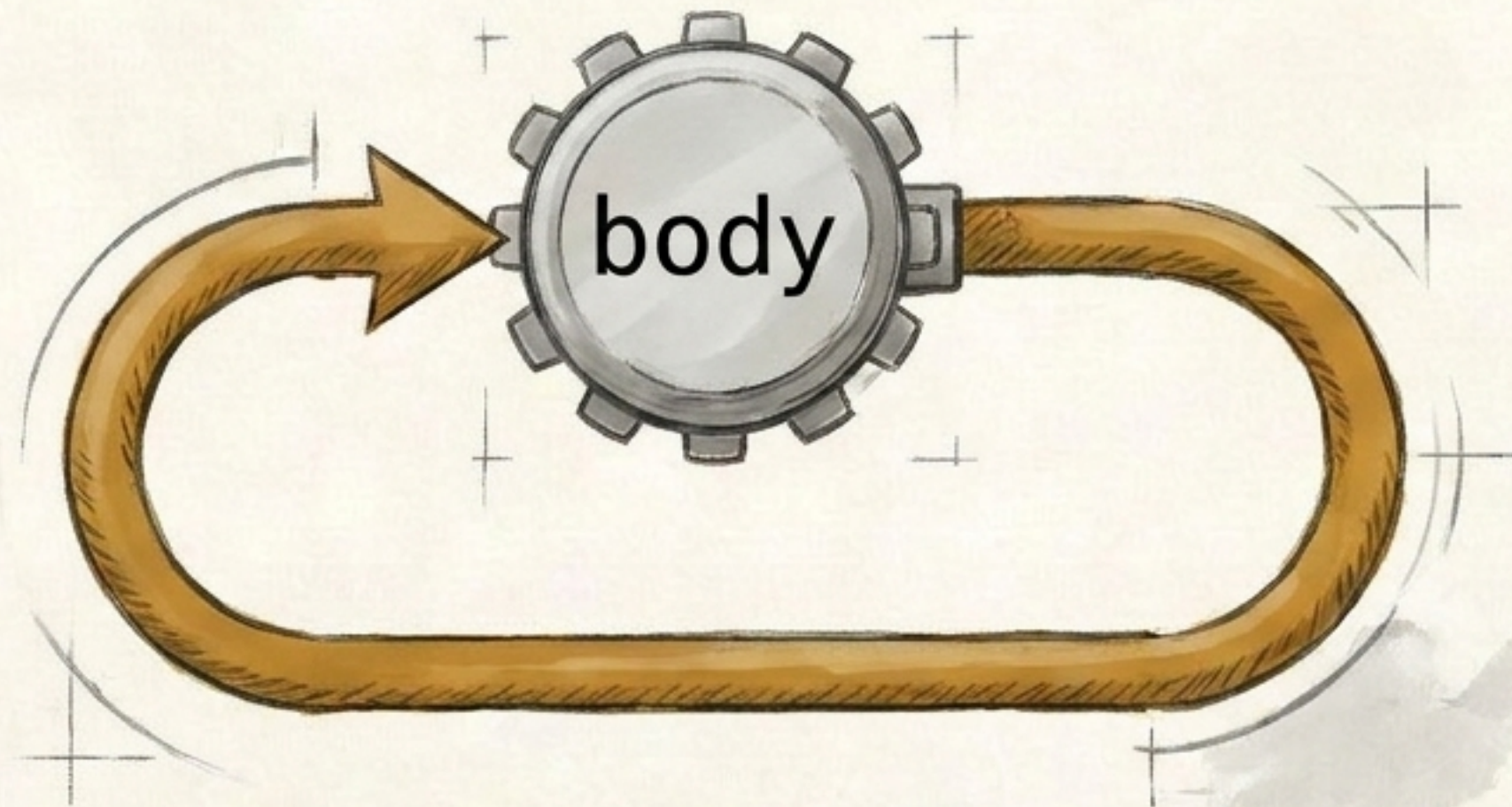
Conditionals Are Monotonic Constructions with Deferred Topological Repairs



Mechanism: At IF, a placeholder is pushed to the Control Stack. At THEN, the system reaches back into the accumulated history and patches the address. The untaken branch is retained as a Refused history, never erased.

Loops Are Recursive Continuation Frames Bound to Themselves

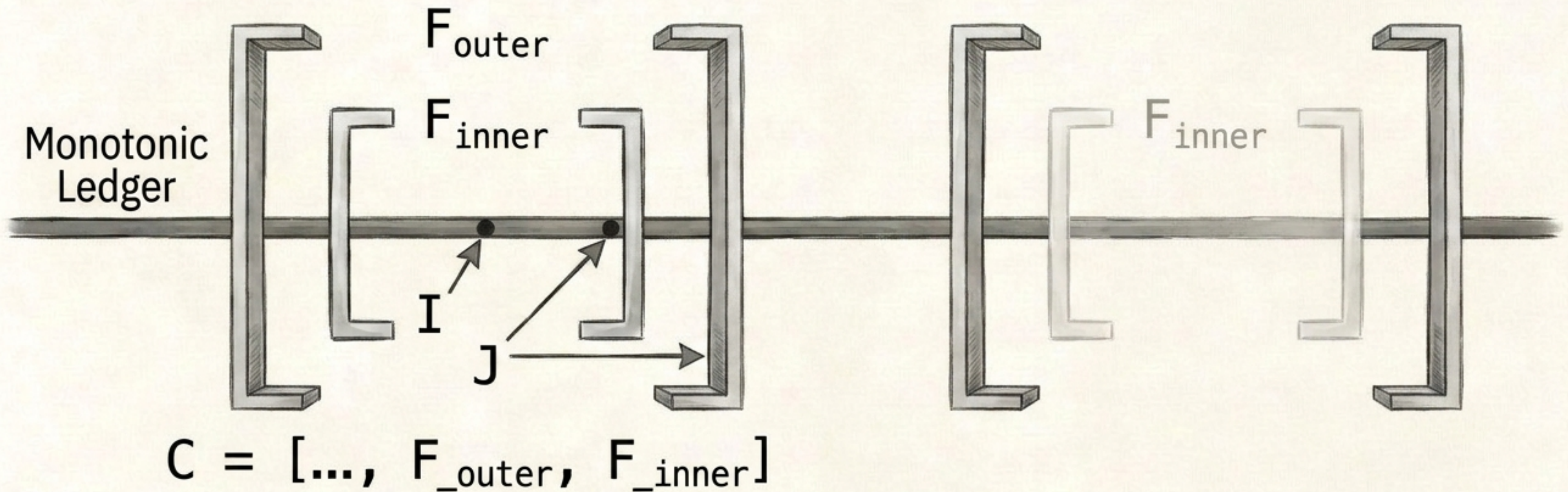
$K = \text{body}; K$



Loops require no separate primitive in Spherpap.

A loop frame is just a **Bind** of a body's continuation back to itself, repeatedly observed under an advancing index.

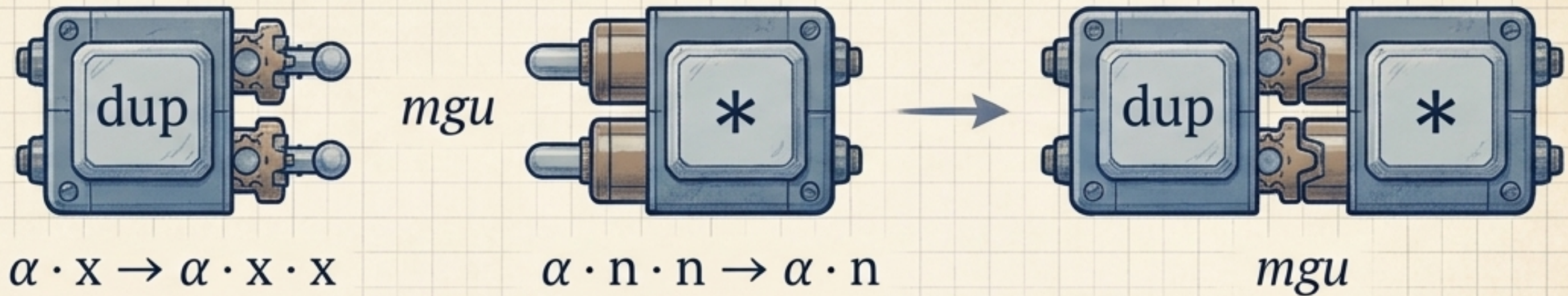
Nested Loops Behave as a Stack of Dynamically Maintained Futures



Synthesis Insight: Nested loops are nested fixed points. Recursion is a dynamically growing path of suspended resumptions, safely maintained on the control stack without collapsing the wrong history.

The Compiler Functions as an Admissibility Checker for Stack Trajectories

Valid Unification: **dup** *



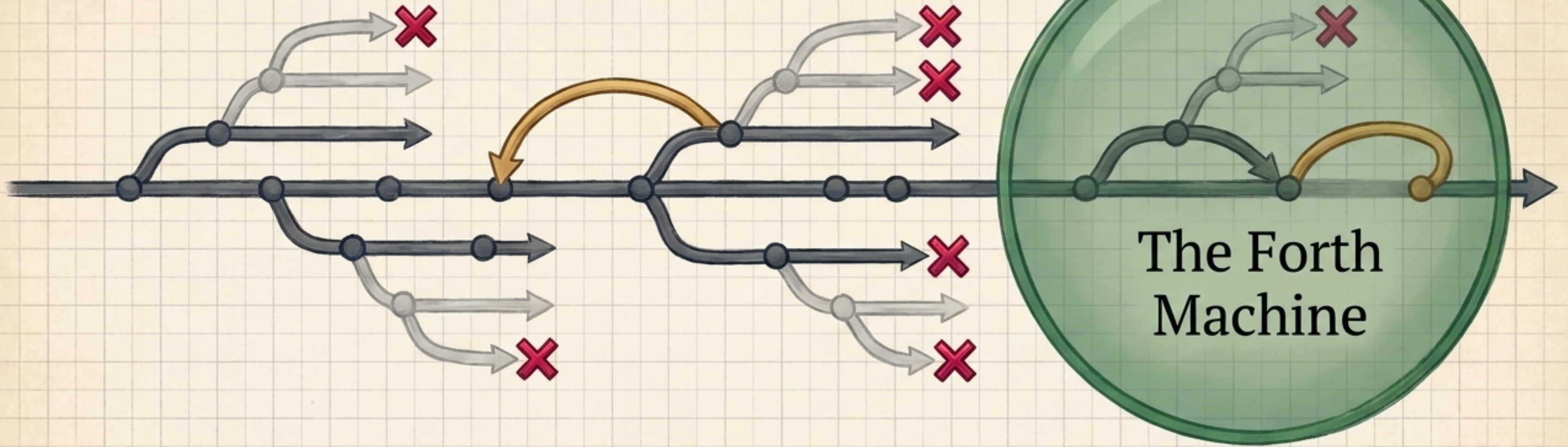
Invalid Sequence: **bad drop** +



A program is **well-formed** exactly when transitions preserve reachability without addressing un-Bound or Refused space. This geometry mathematically prevents stack underflow entirely.

Forth Compilation is the Construction of Executable Reachability

Spherepop History



- Nothing is truly erased. Values are simply occupied reachable positions.
- Words are local contracts over reachability.
- Loops are continuations repaired backward.
- Spherepop supplies the precise geometry; Forth supplies the executable language.