Applying Generative Communication to Symbolic Computation in Common Lisp

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5. Conclusions and Further Work

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1 Introduction

2 Architecture of the system

3 Communication among modules

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5 Conclusions and Further Work

Introduction

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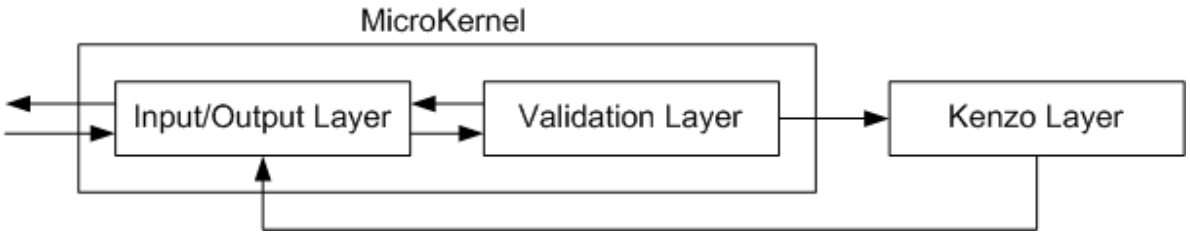

Figure: Simplified diagram of the previous architecture.

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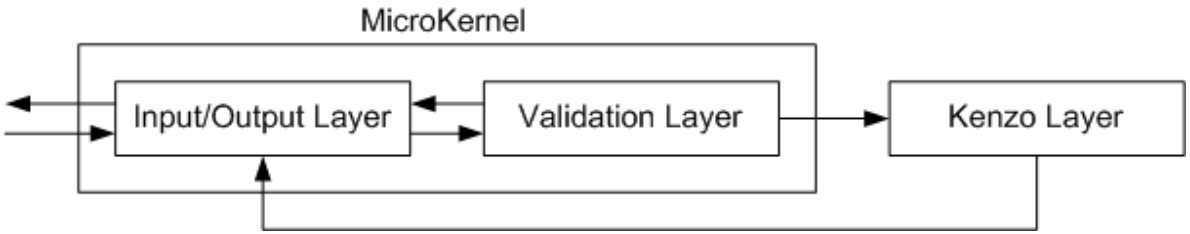

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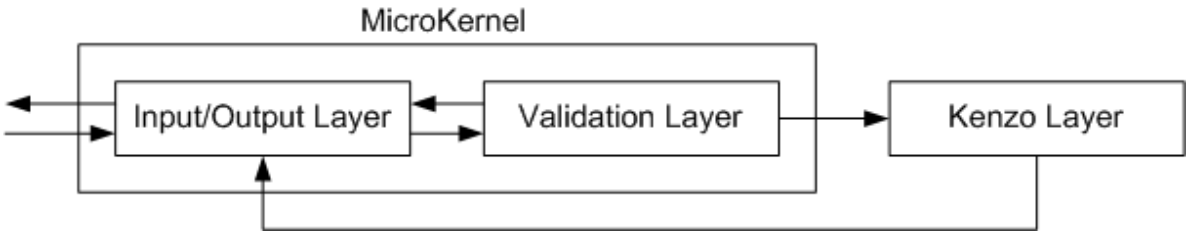

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Drawbacks:

- Message passing style
- Recalculations

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- Linda Model and Shared Repository
- An adapted implementation of the Linda Model
- An example of complete computation

3 Communication among modules

4 Clients of our system

5 Conclusions and Further Work

Linda Model and Shared Repository

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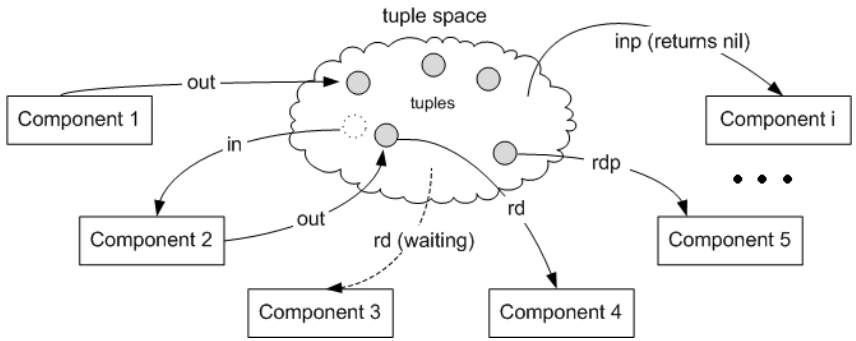

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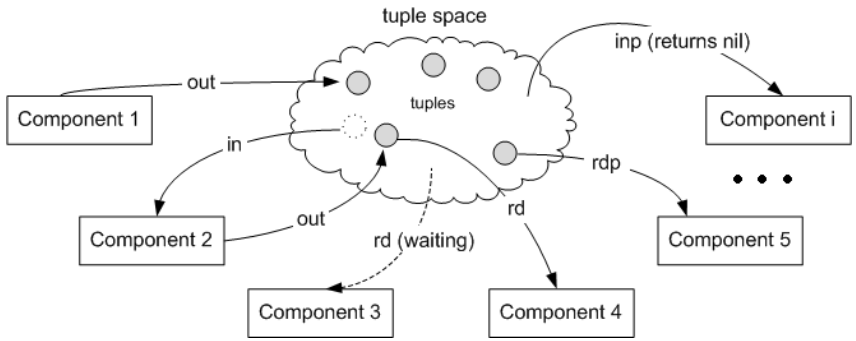

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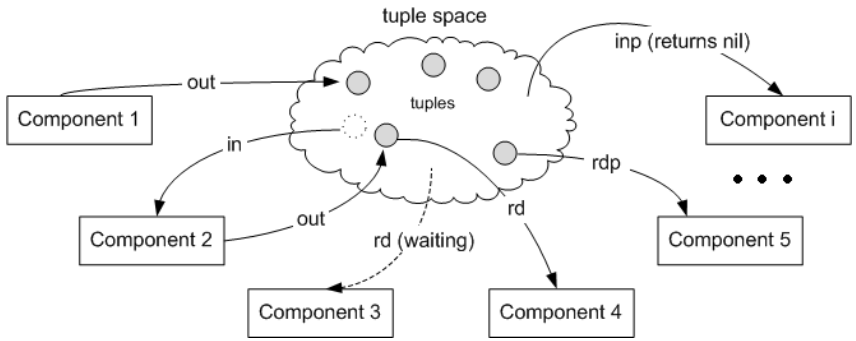

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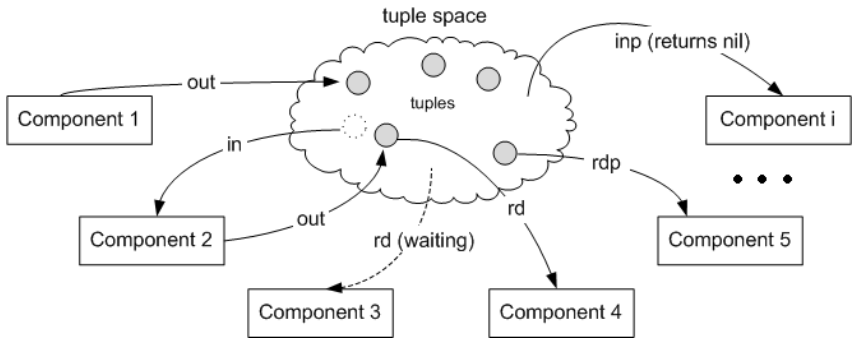

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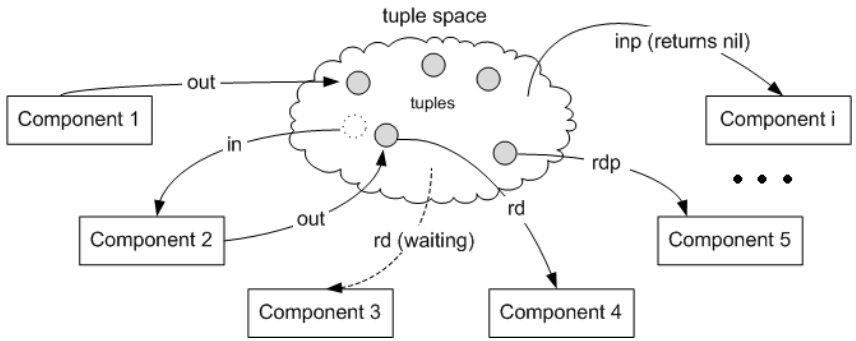
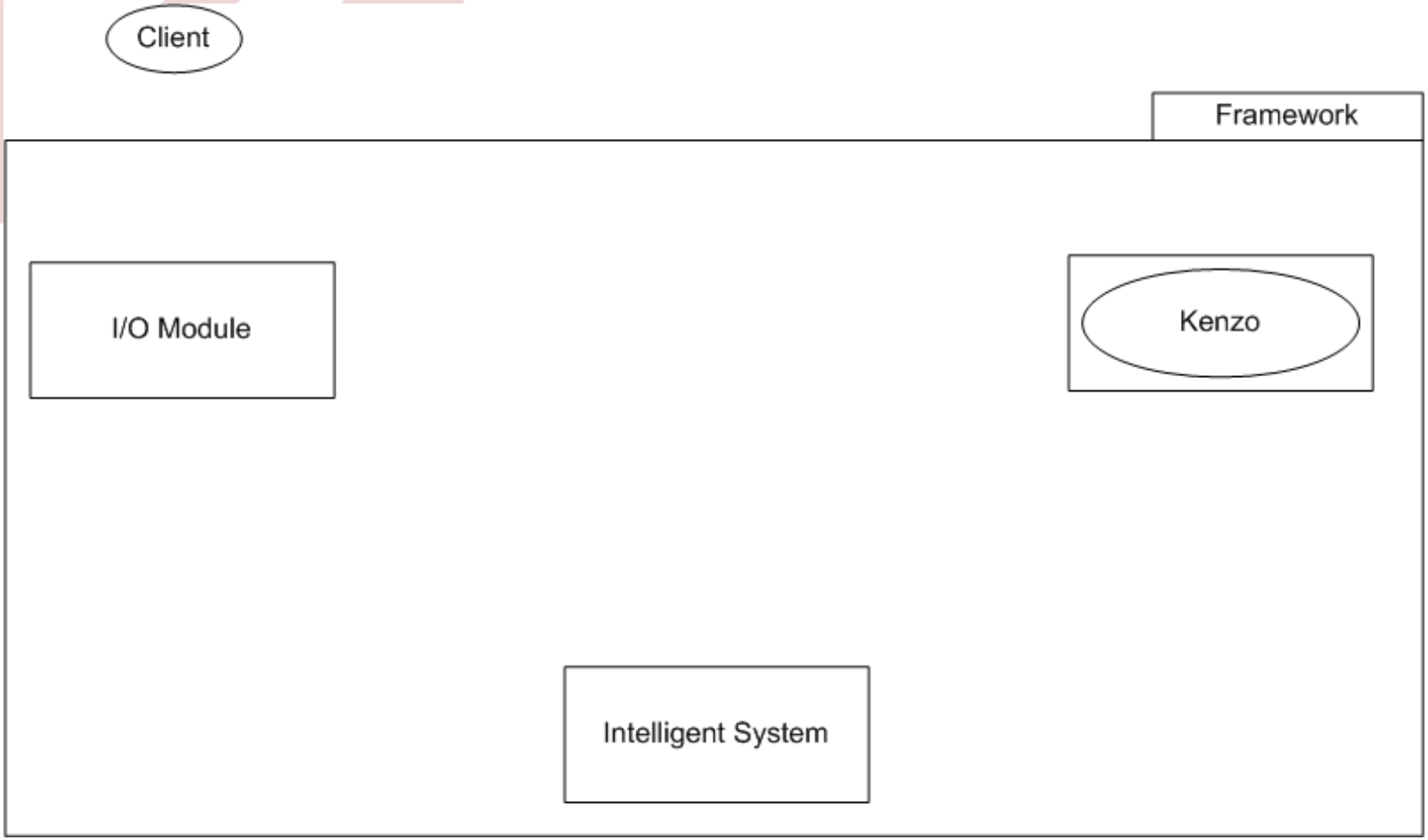


Shared repository pattern:

- Add the nuance that a component has no knowledge of:
  - what components have produced the data it uses,
  - what components will use its outputs

Architecture



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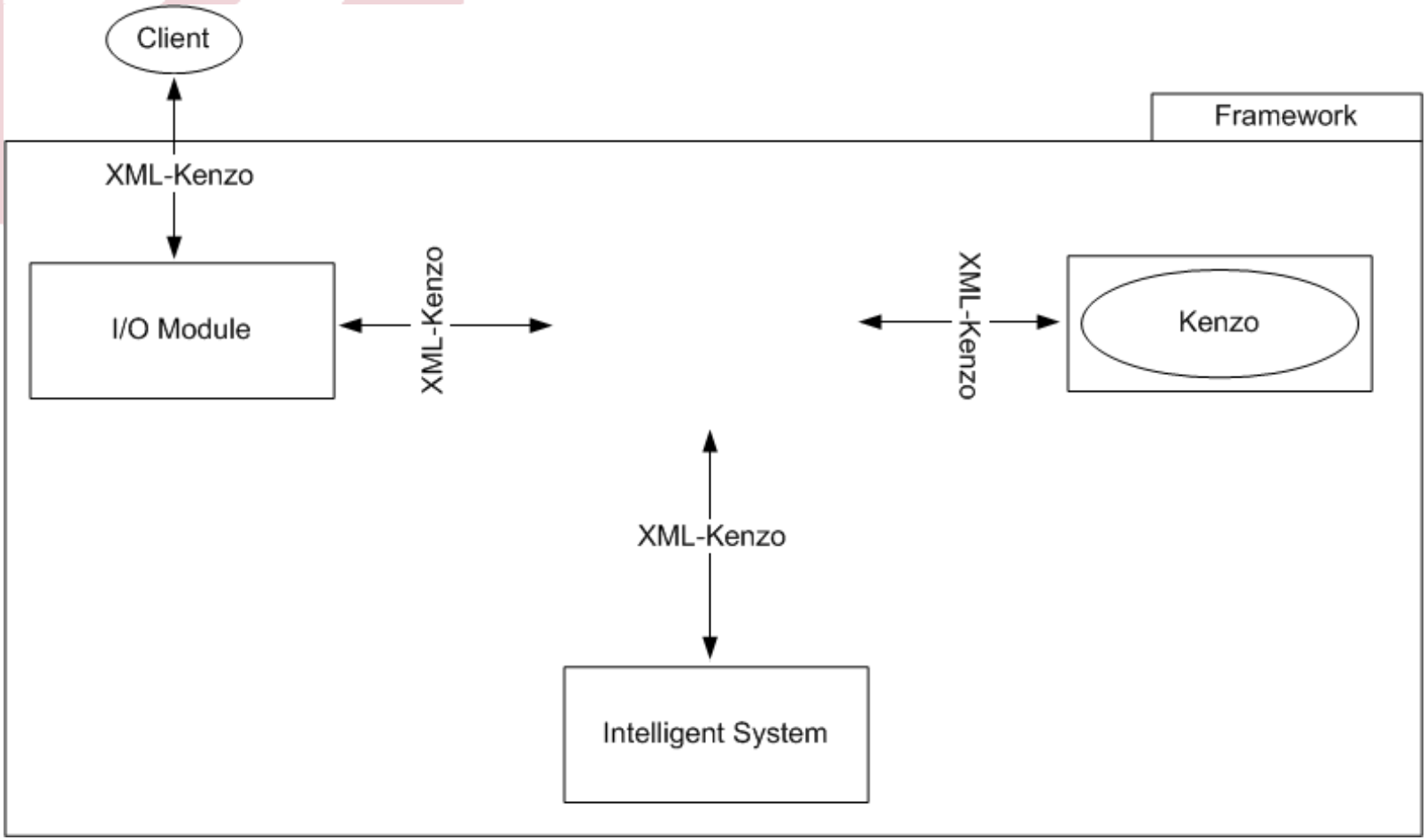

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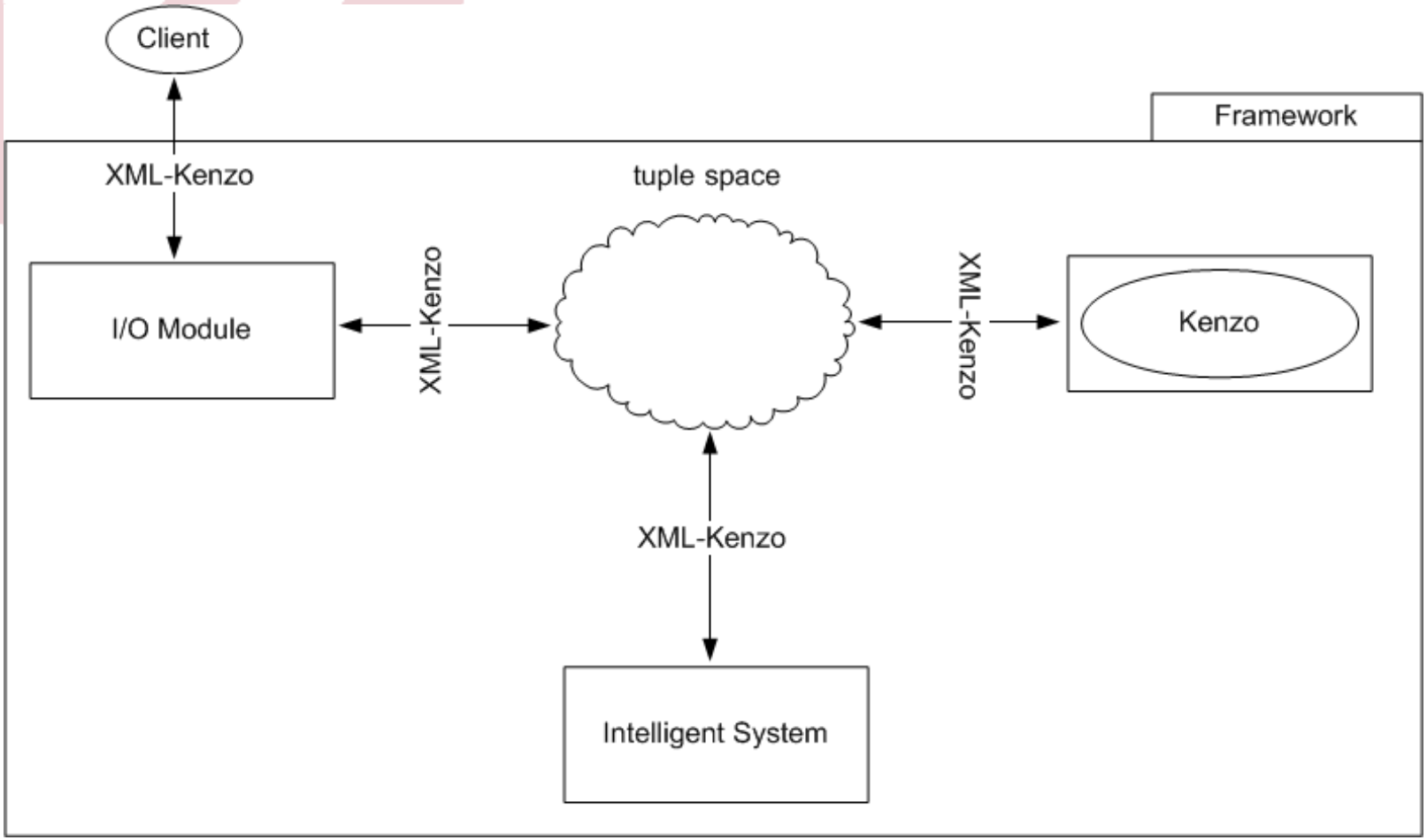

- Recalculations solved
- No longer message passing style

About our Linda Model implementation

Desirable properties of any implementation of the Linda Model

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- Implement the Linda Model from scratch.
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  - An XML enabled database is built on top of relational or object oriented databases.

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- Shared
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Two possibilities

- Implement the Linda Model from scratch.
- Use an XML enabled database
  - An XML enabled database is built on top of relational or object oriented databases.
  - Include two kind of processes:
    XML data $\longrightarrow$ database elements
    database elements $\longrightarrow$ XML data

Our Linda Model implementation

Implementation of a Linda Model

In our implementation

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Implementation of a Linda Model

tuple space

In our implementation

AllegroCache

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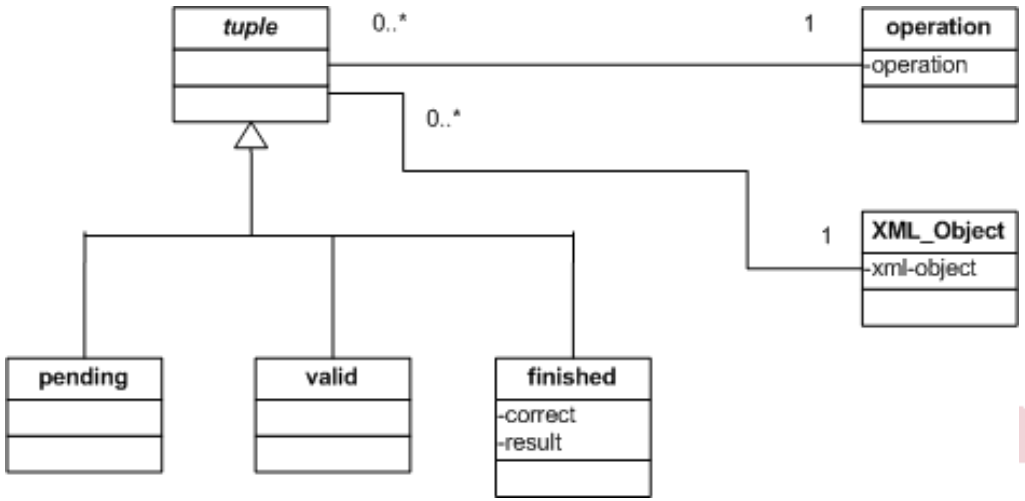
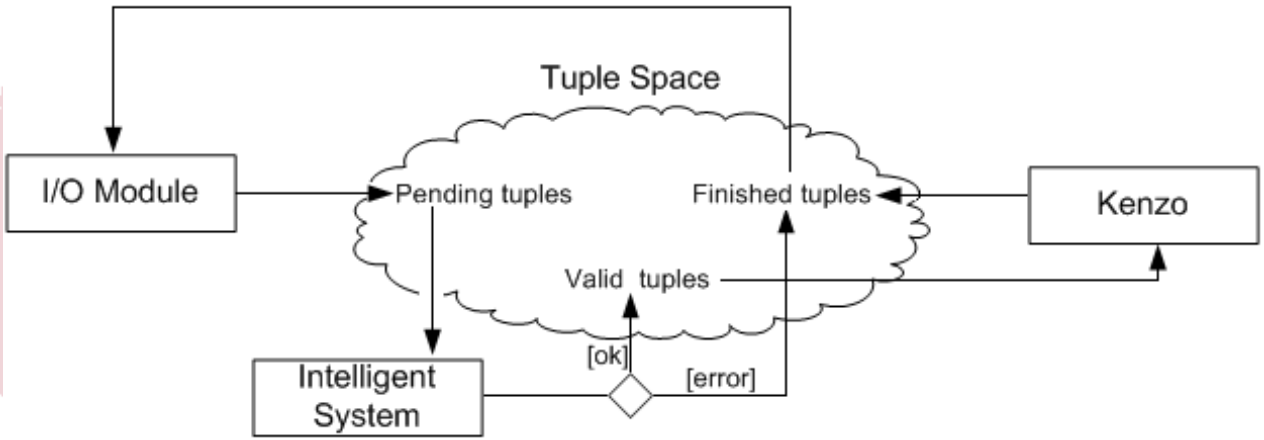


Implementation of the operations

`writetuple:`	`tuple` $\longrightarrow$ *Boolean*
`taketuple:`	`tuple` $\longrightarrow$ `tuple`
`readtuple:`	`tuple` $\longrightarrow$ `tuple-persistent`
`taketuplep:`	`tuple` $\longrightarrow$ `tuple` $\vee$ `nil`
`readtuplep:`	`tuple` $\longrightarrow$ `tuple-persistent` $\vee$ `nil`

Implemented using the `select`, `insert` and `delete-instance` of AllegroCache

Relations between the tuple space and the modules



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  - writes `pending` tuples
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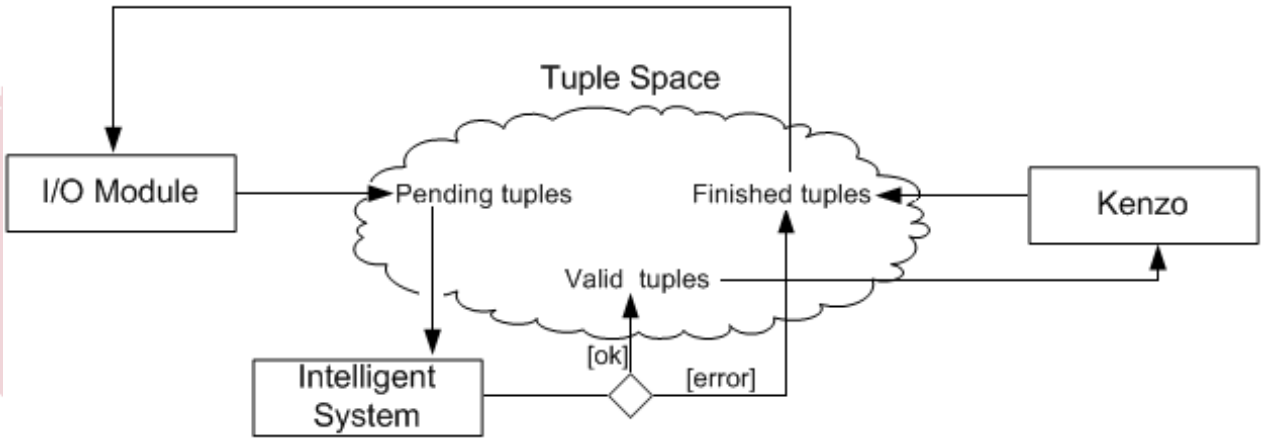

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  - writes `valid` tuples
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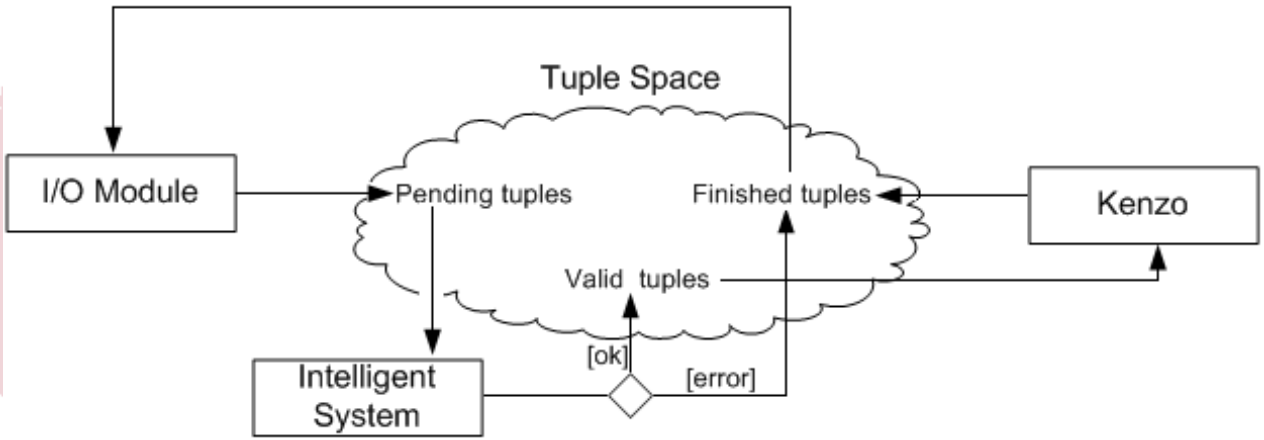

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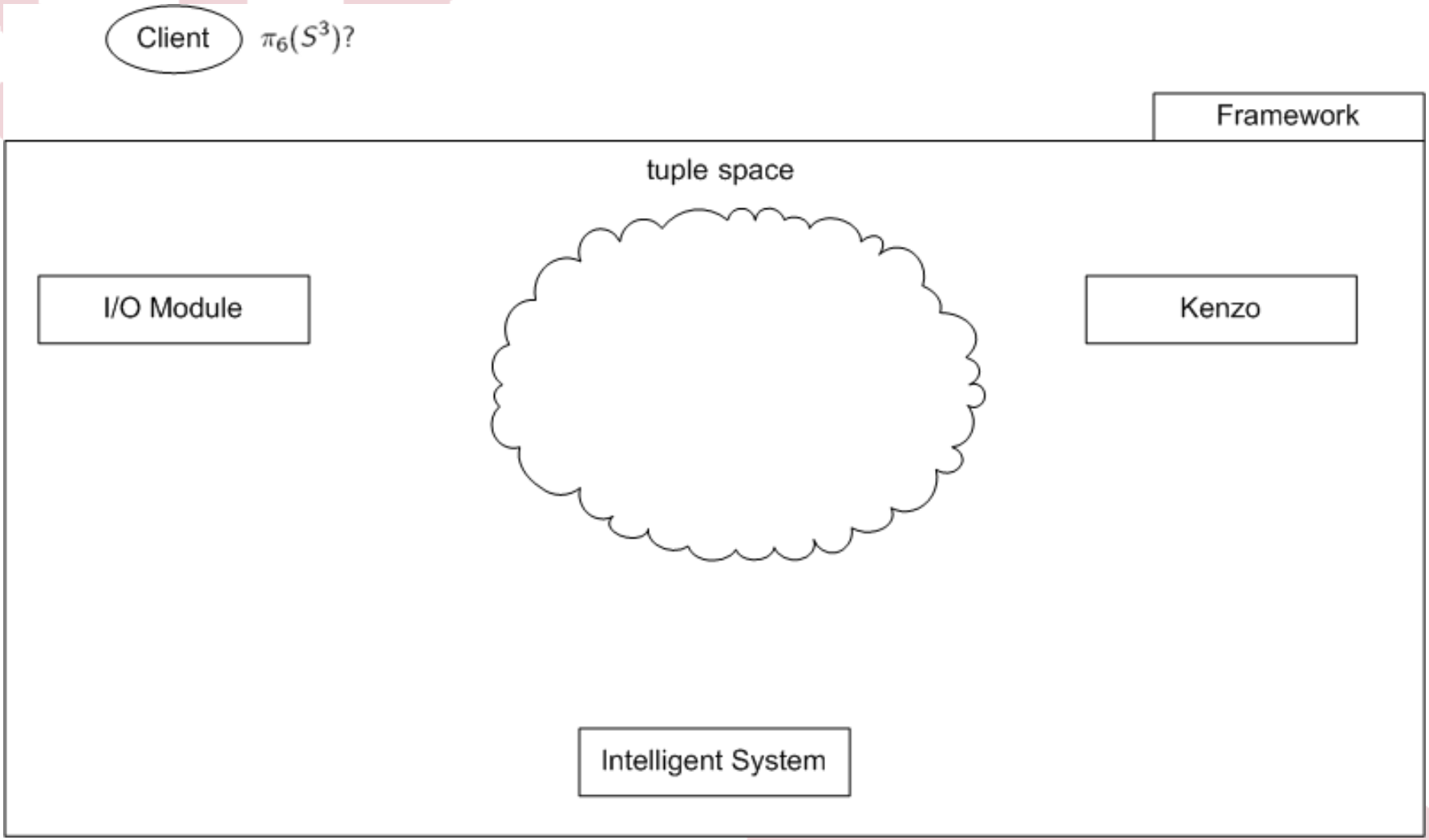
Computing $\pi_6(S^3)$



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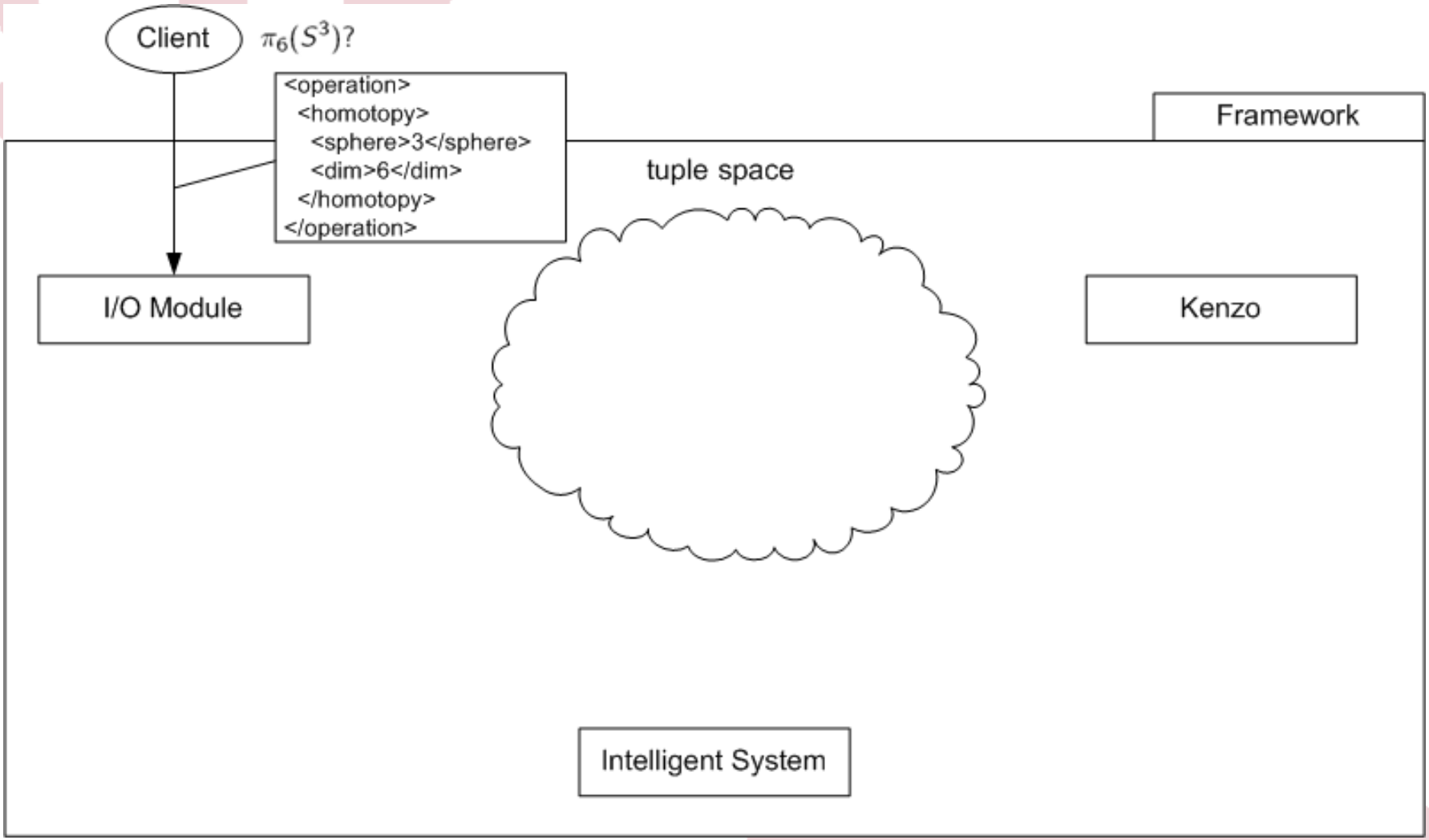

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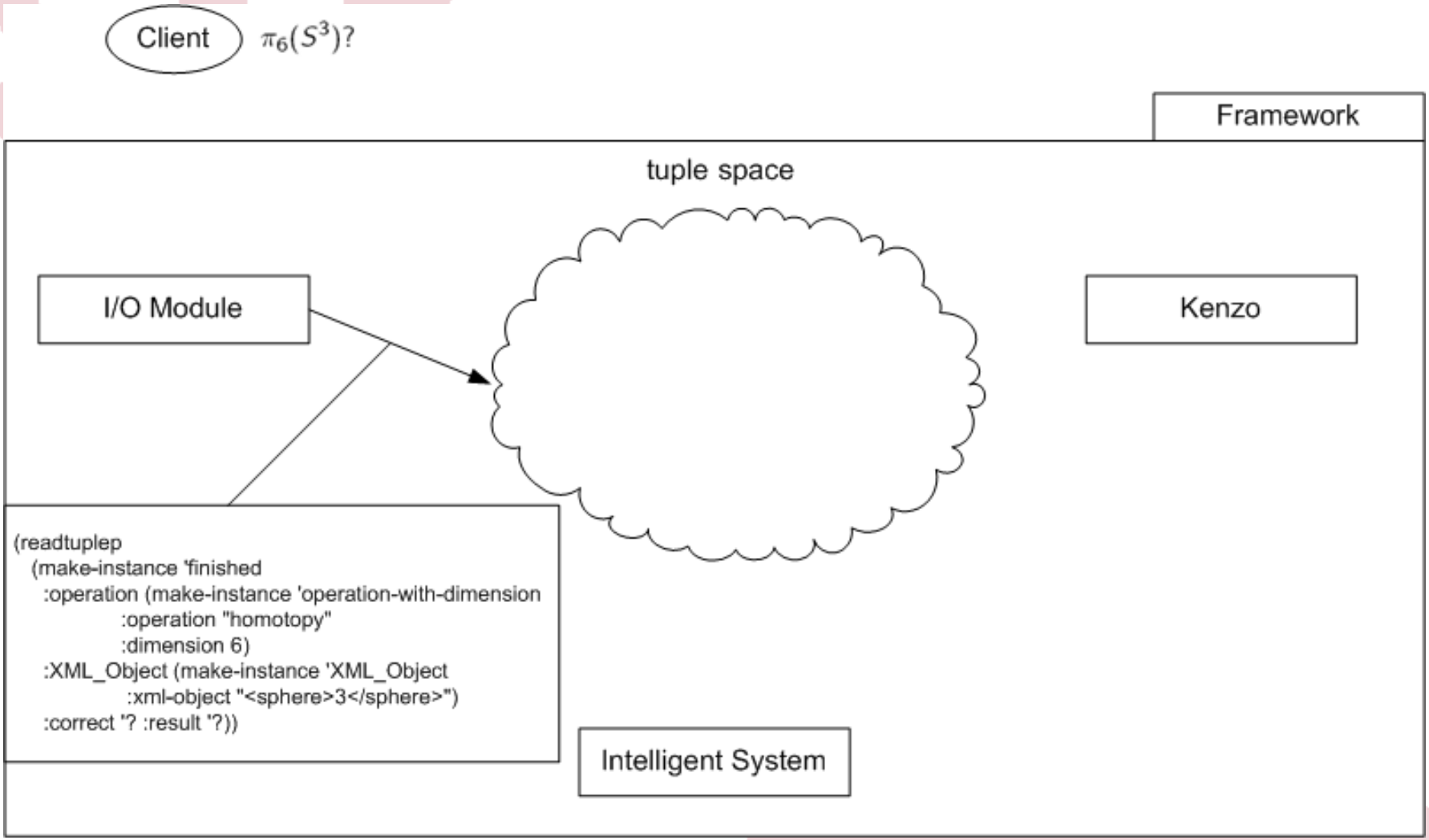

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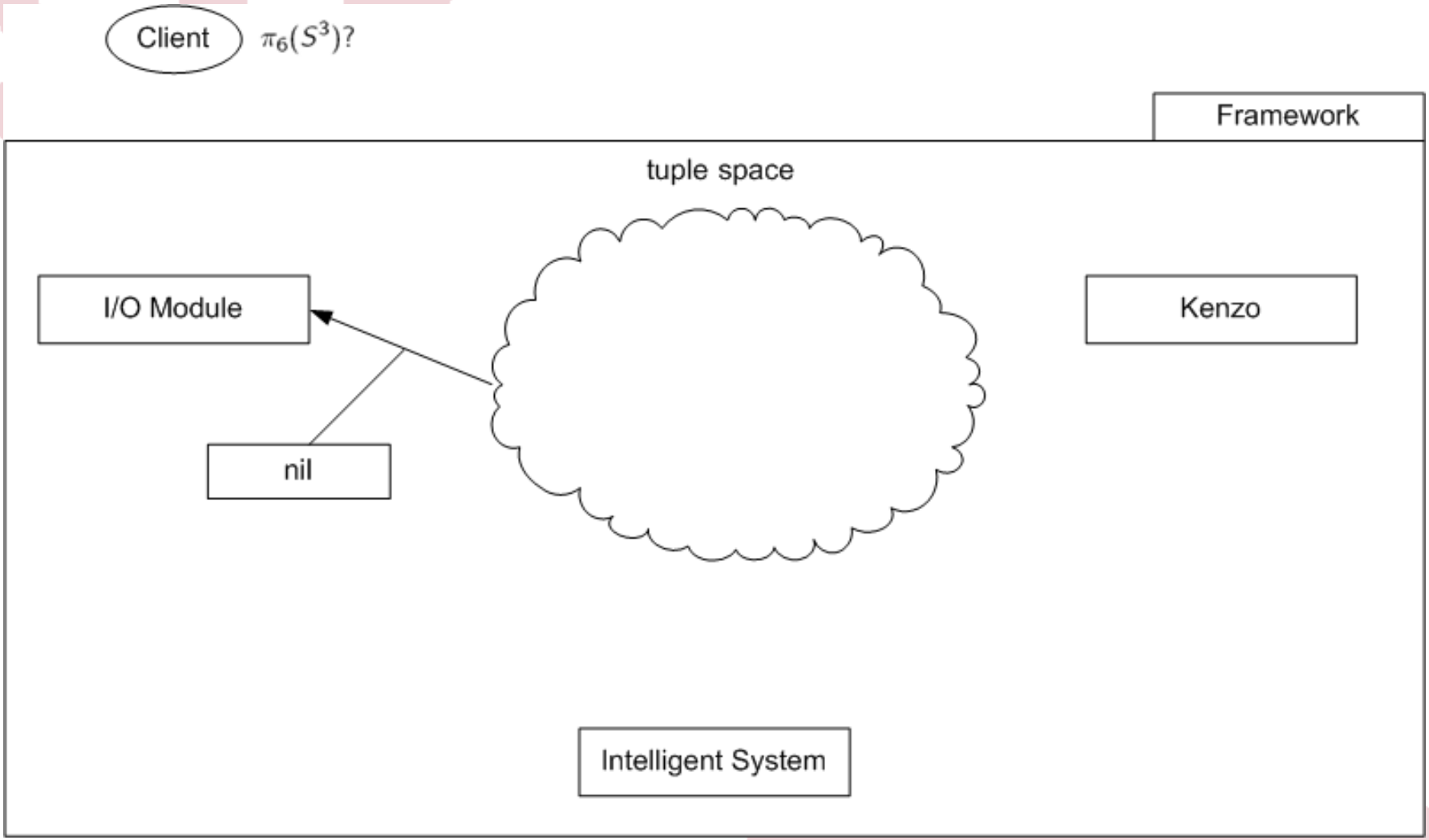

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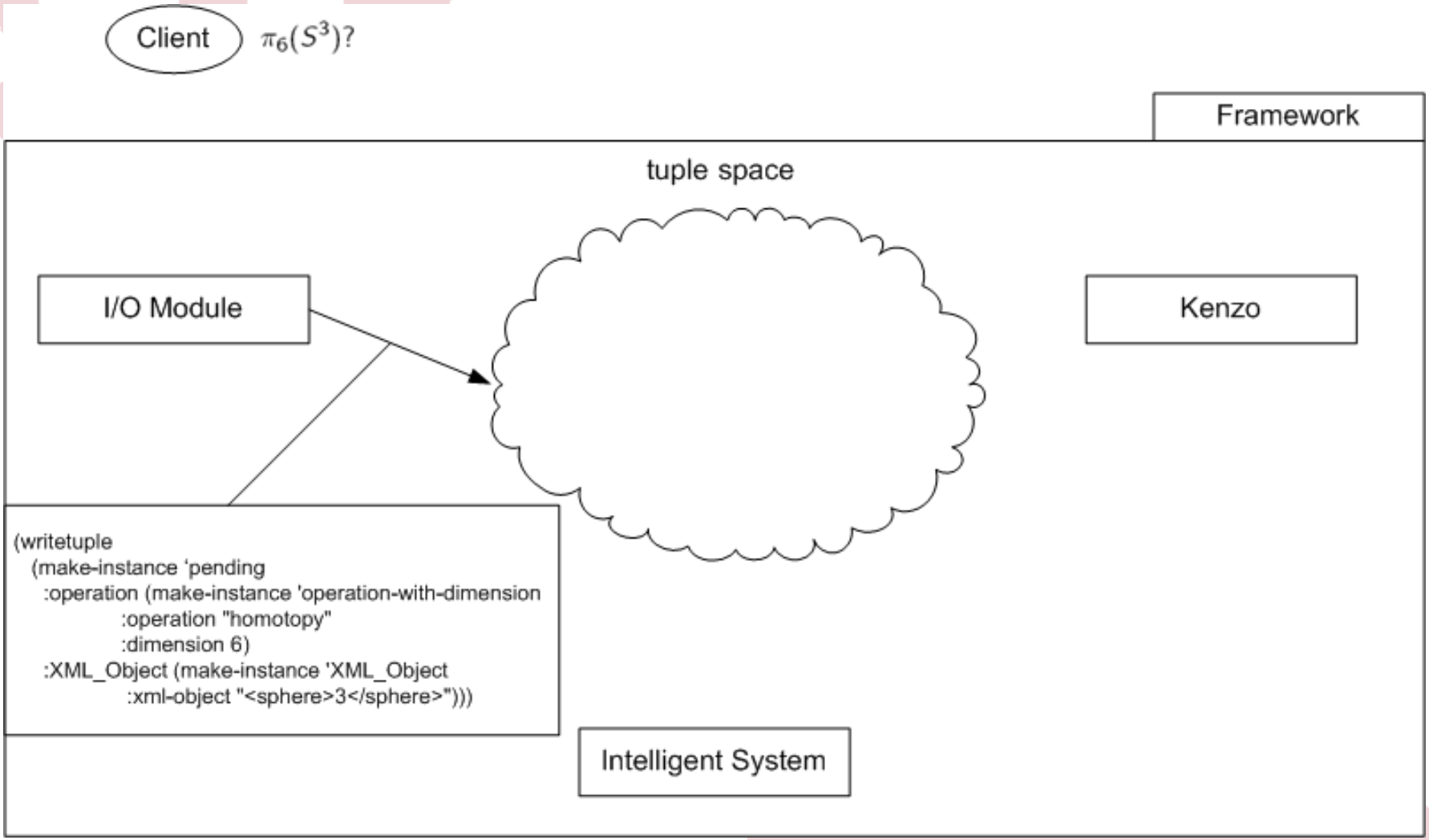

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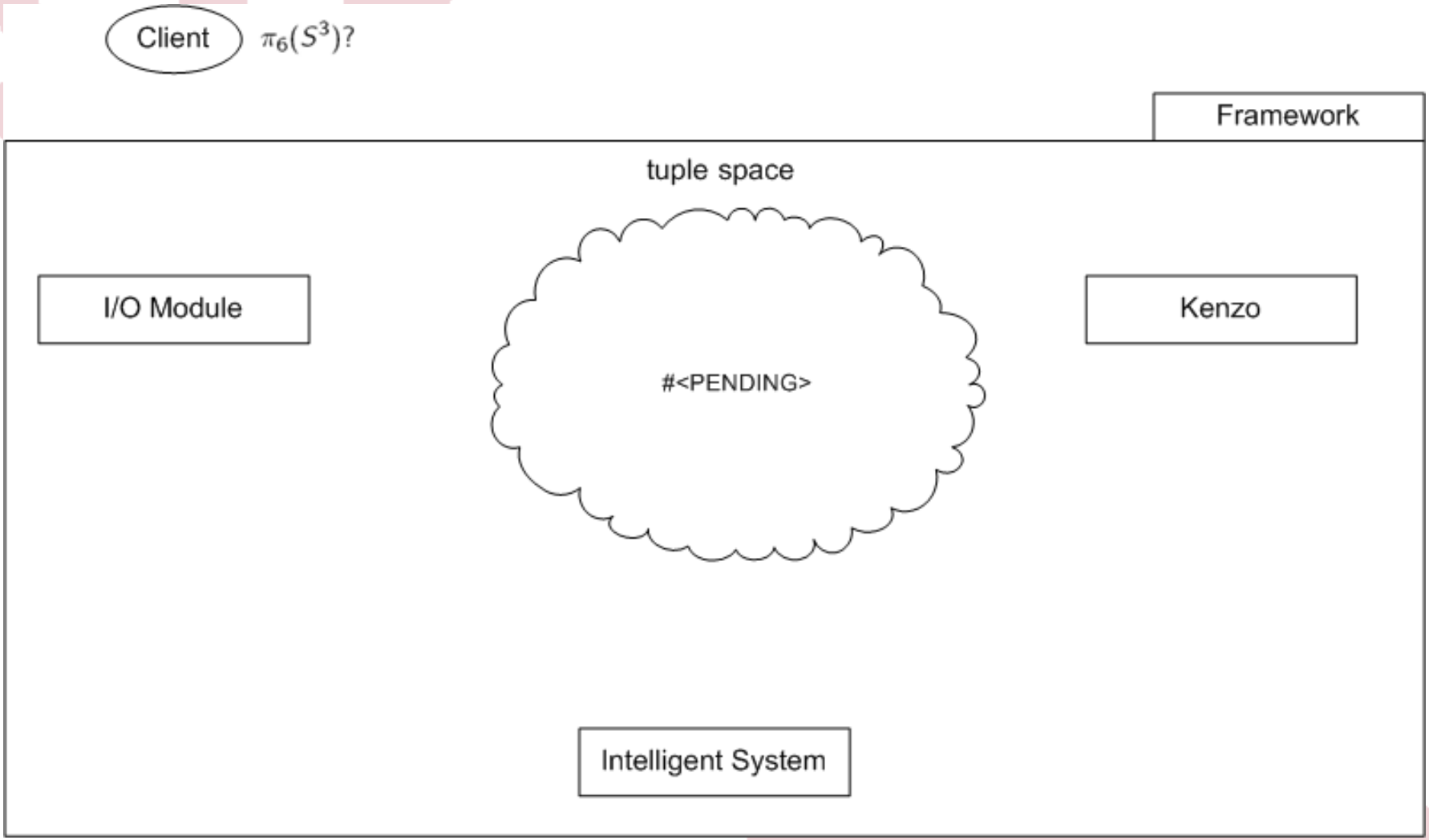

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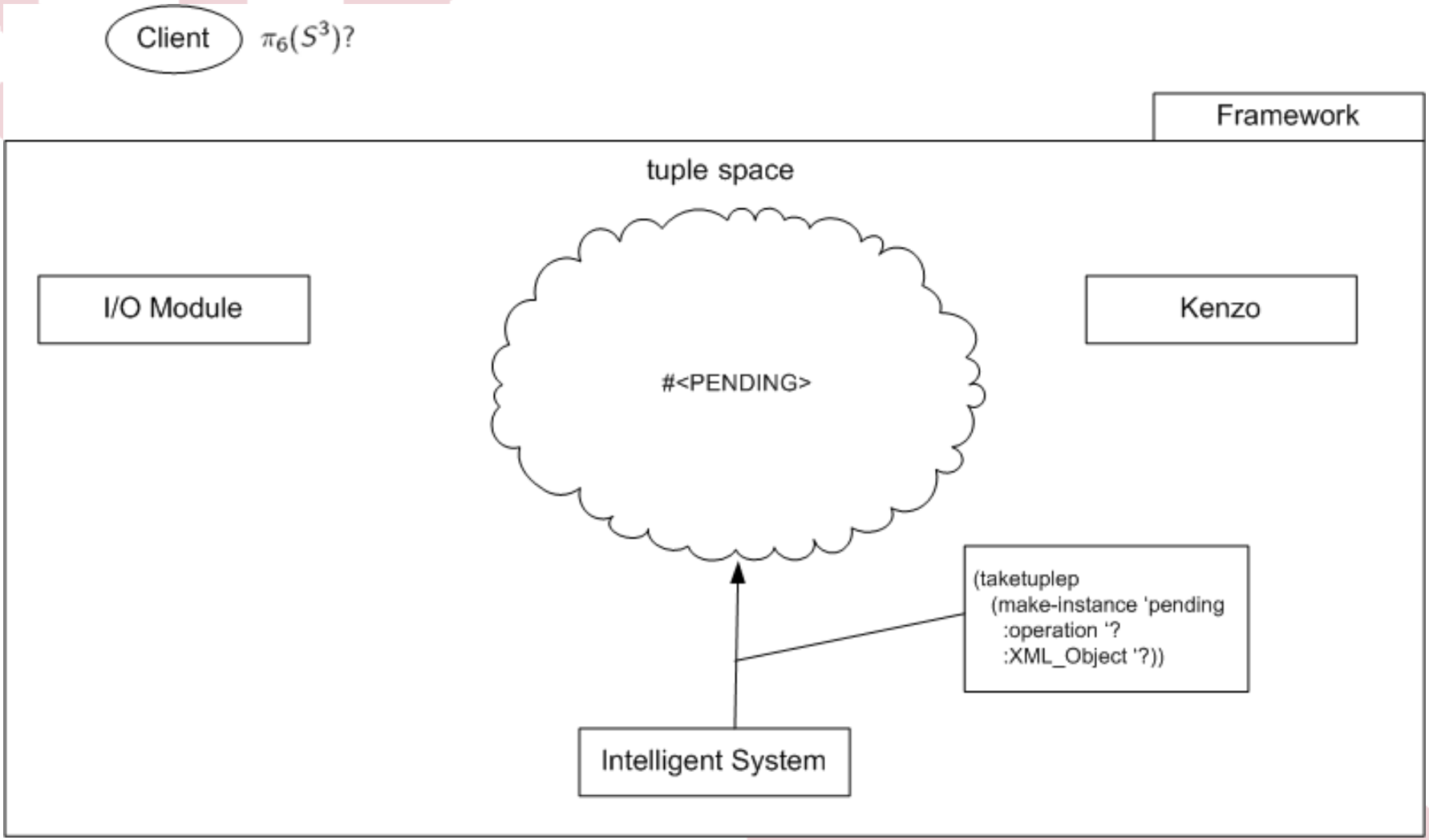

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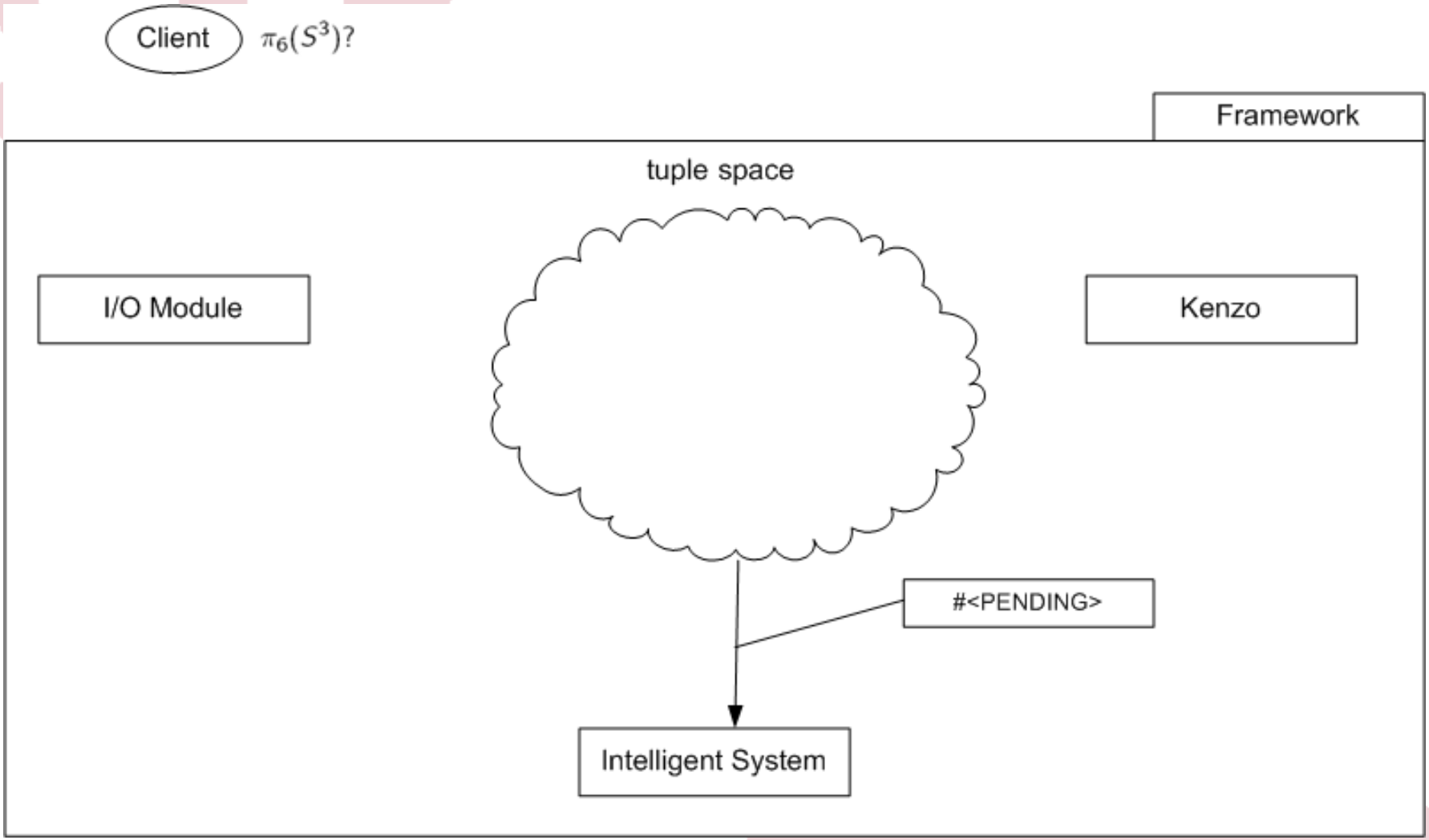

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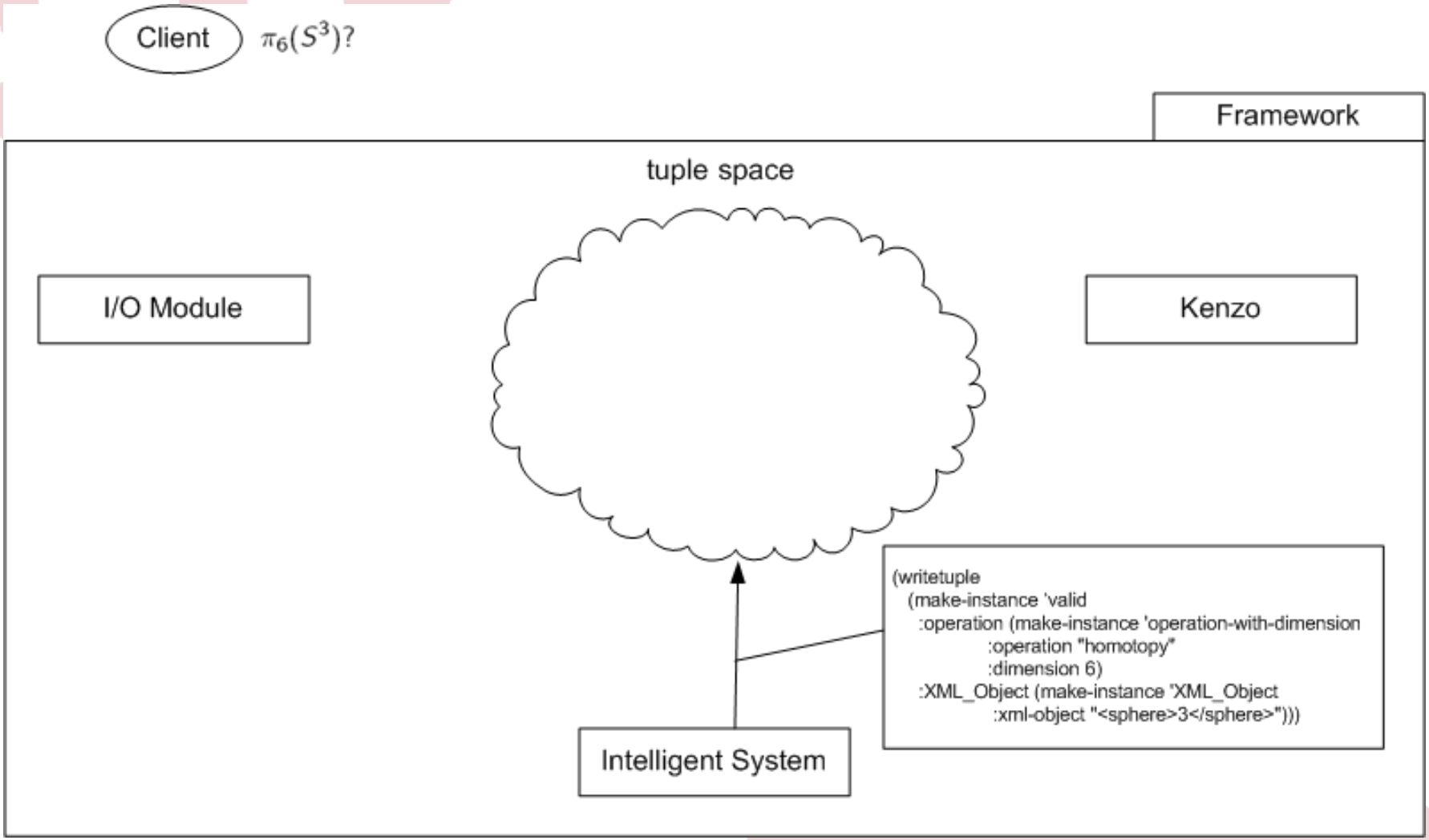

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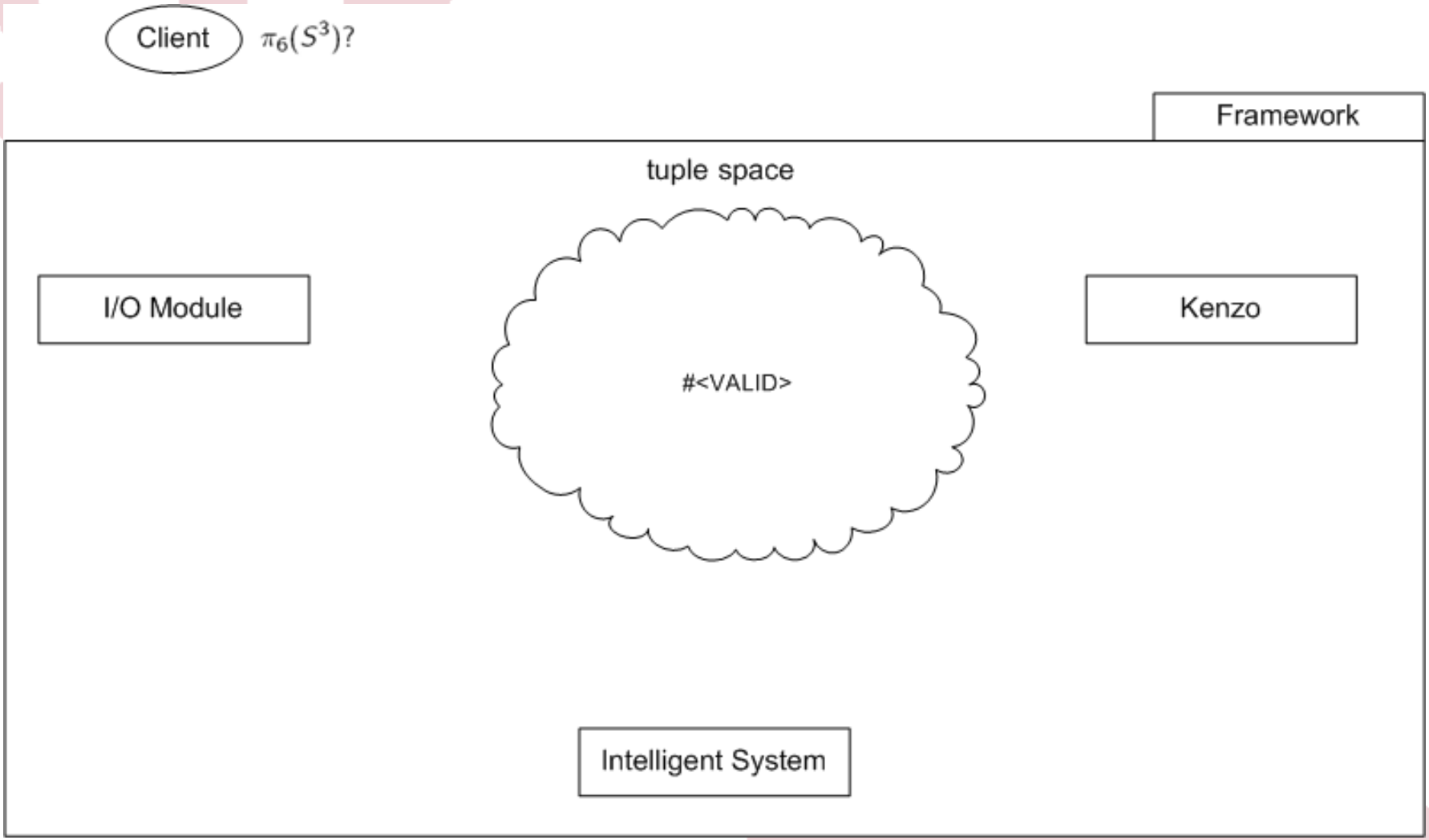

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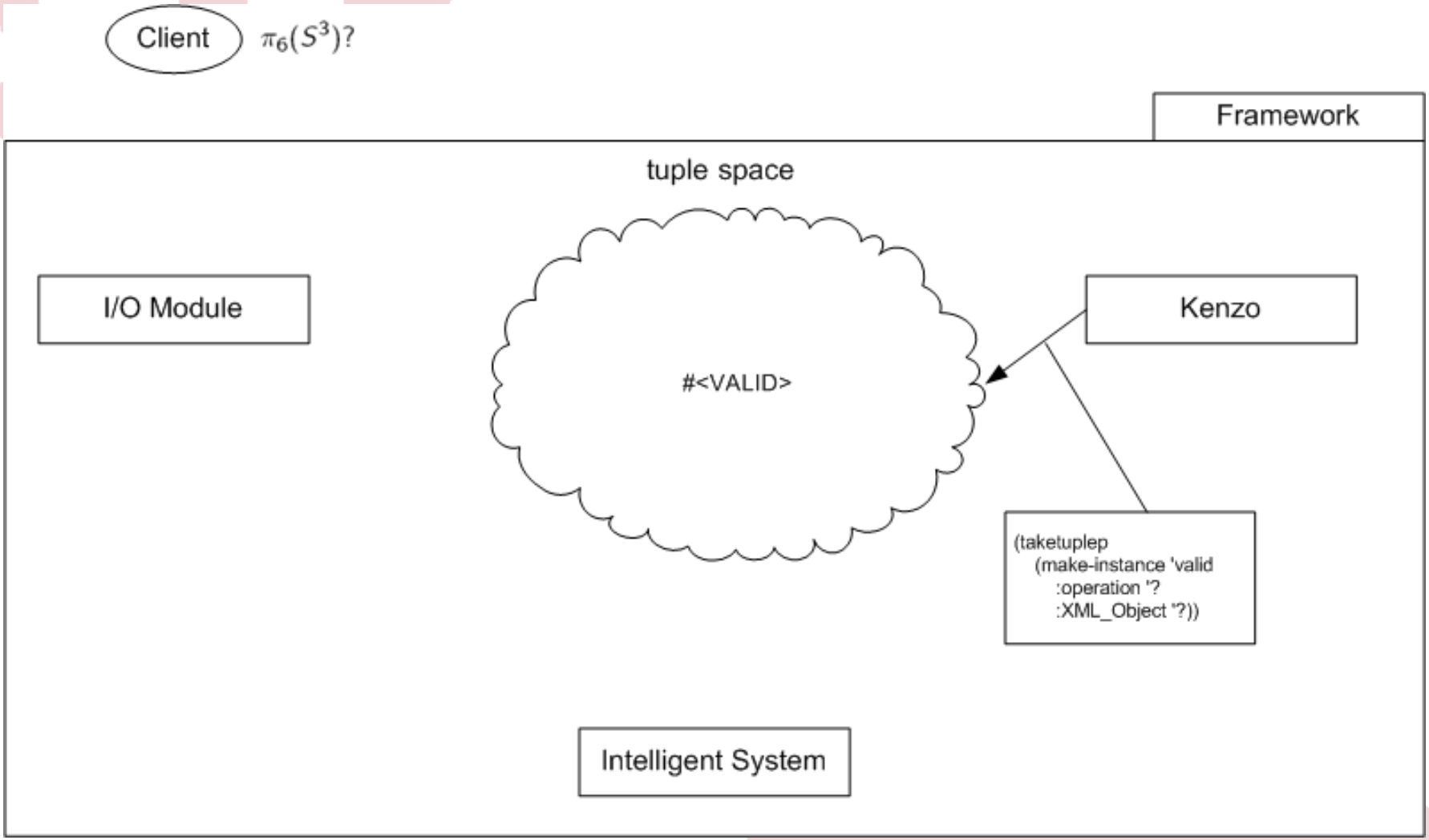

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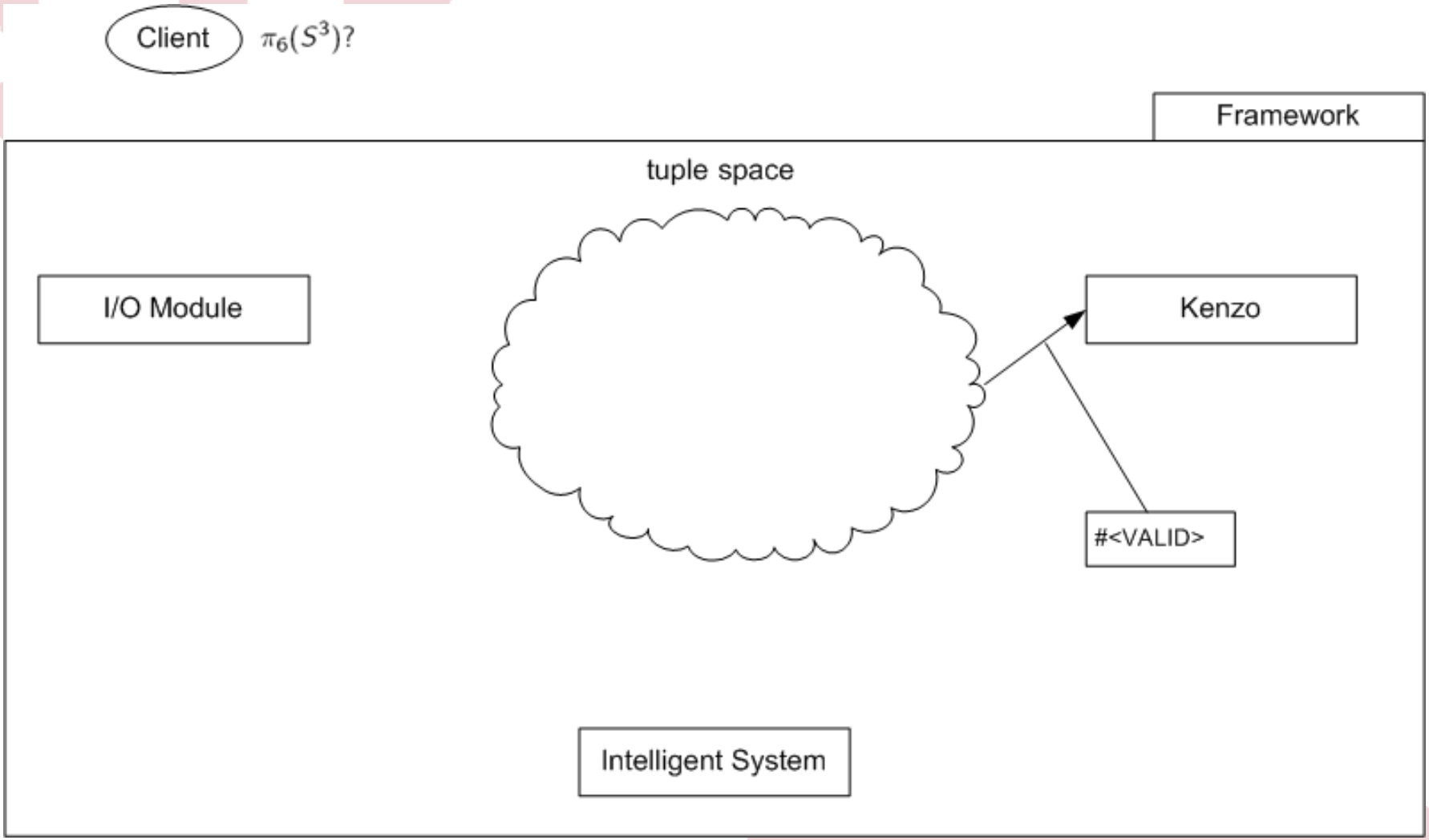

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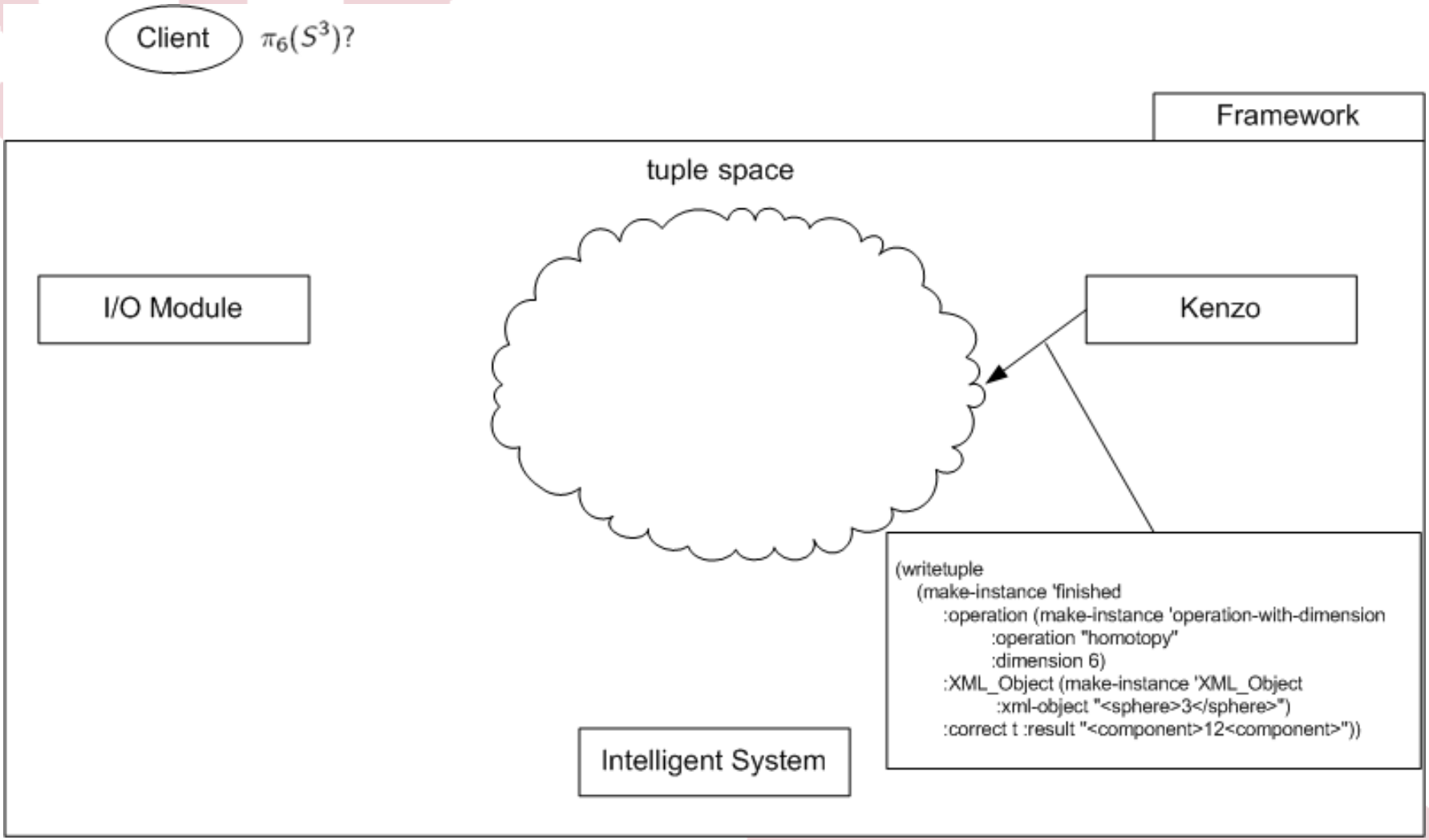

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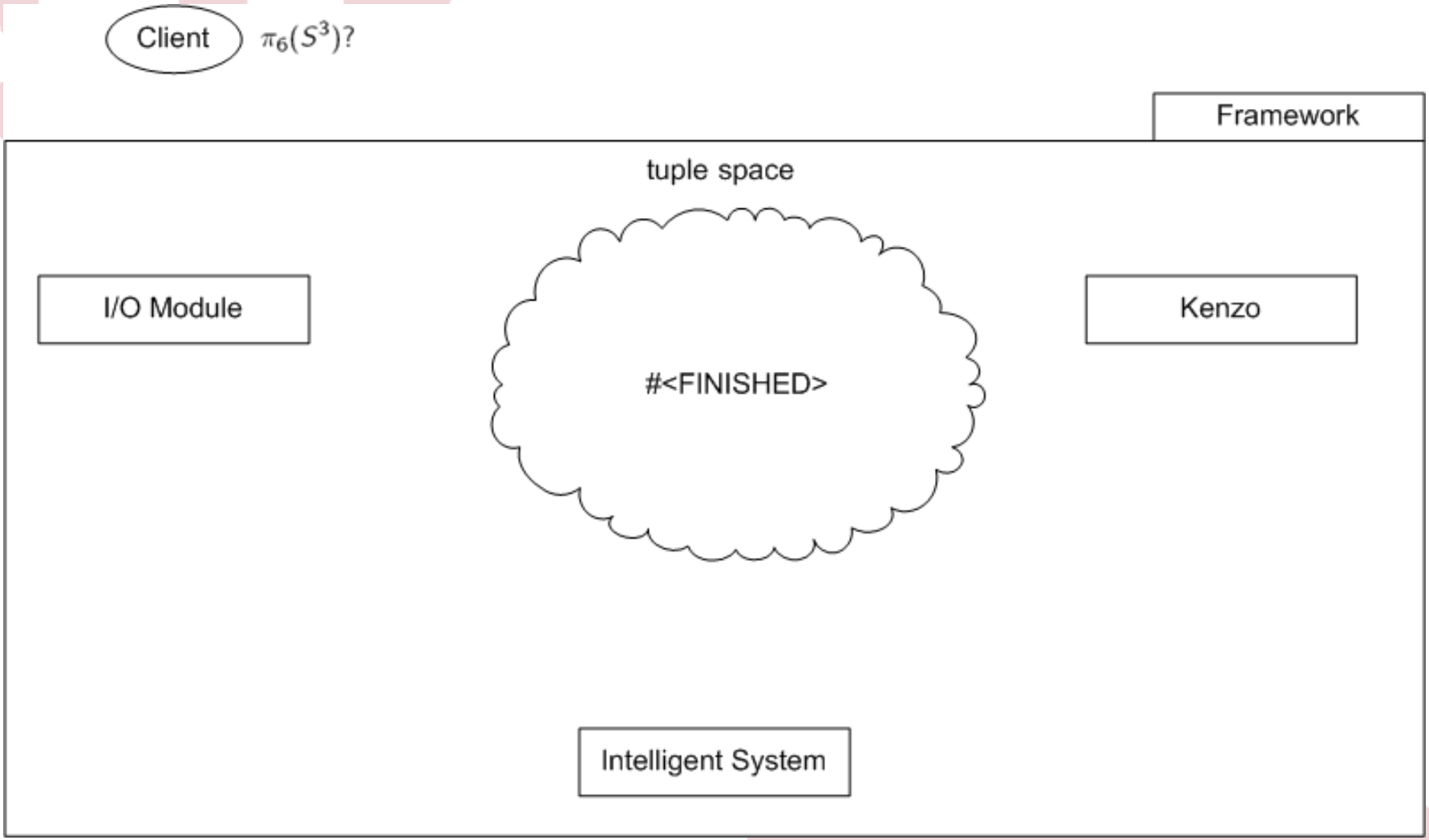

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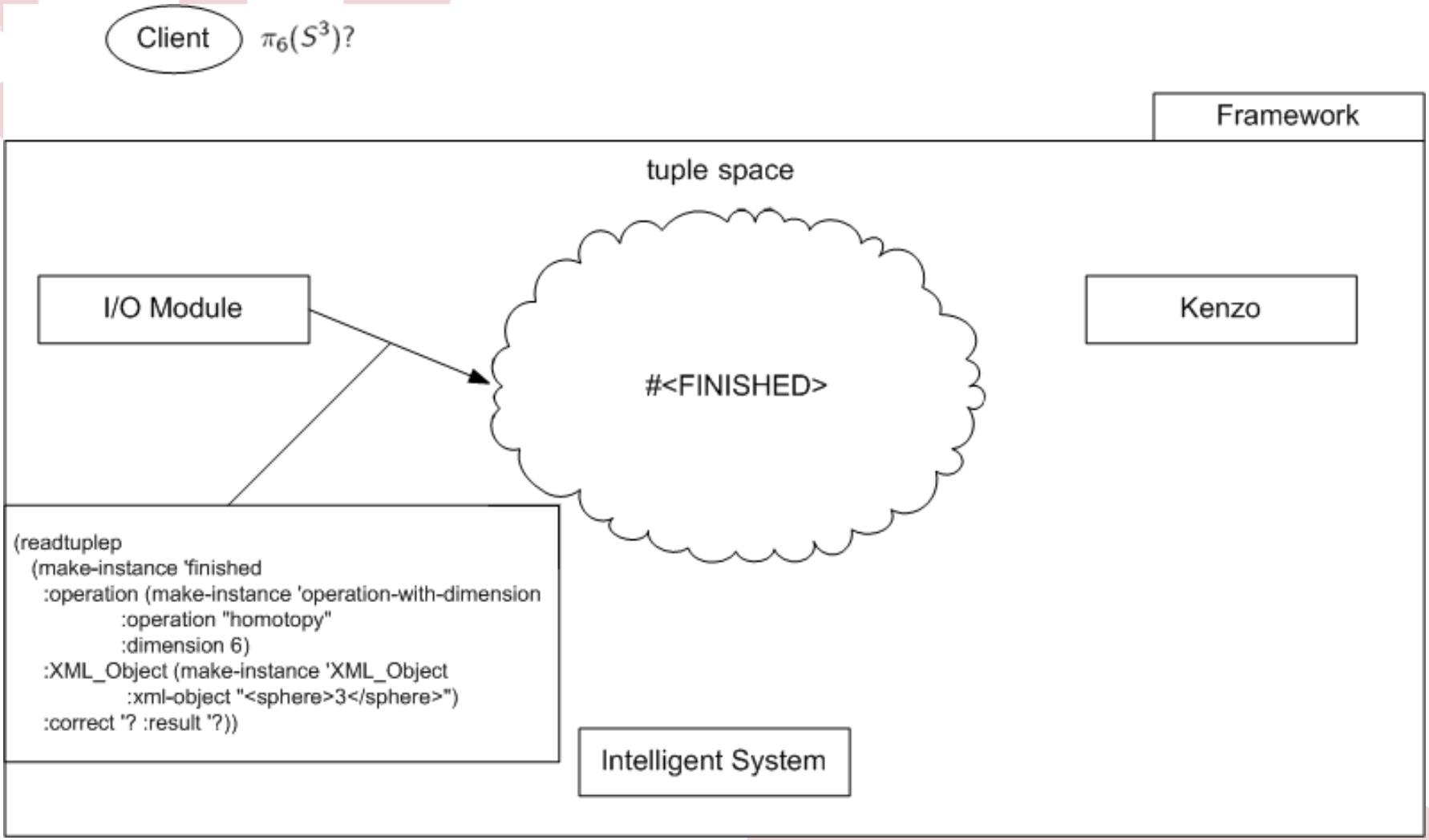

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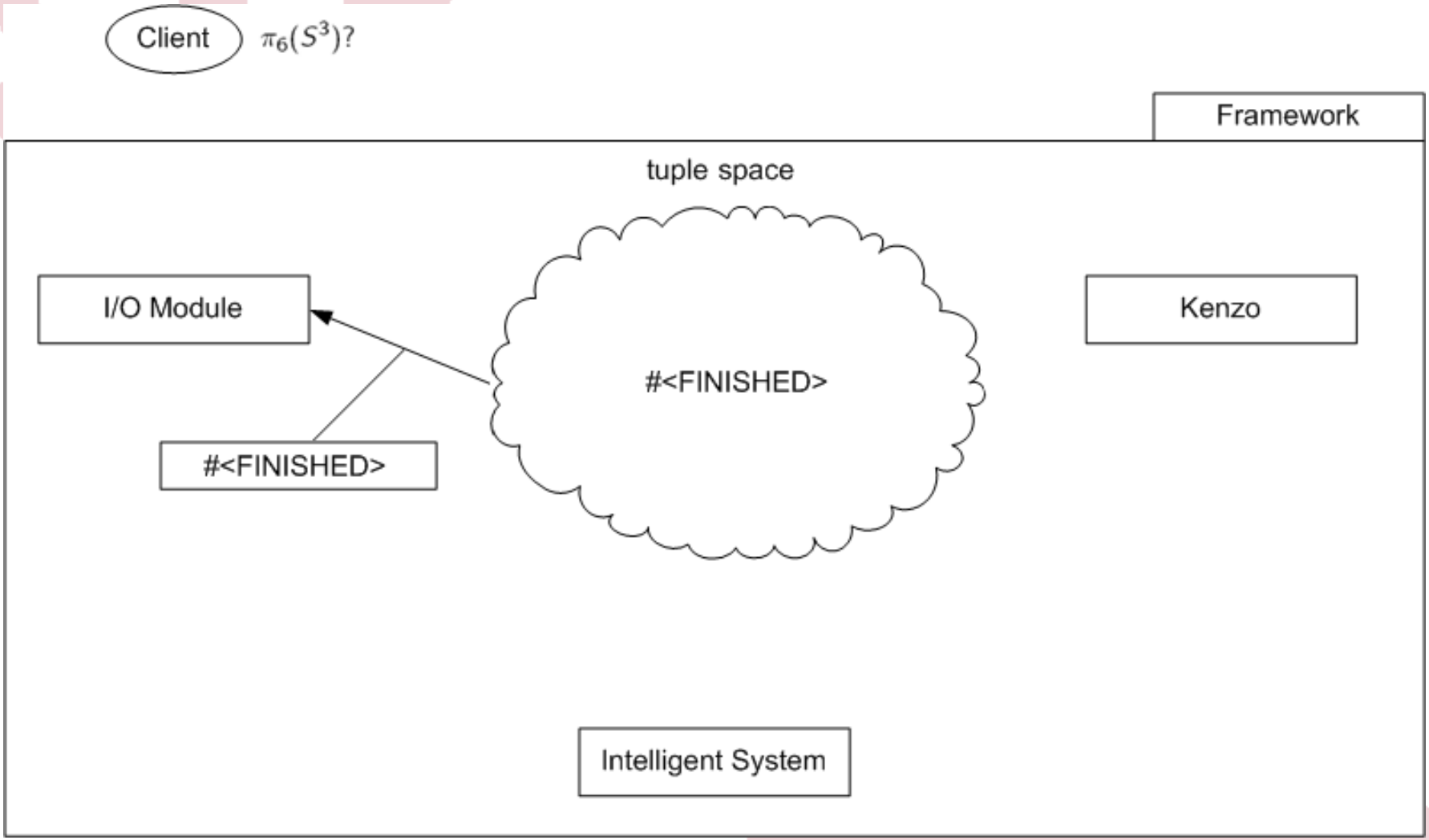

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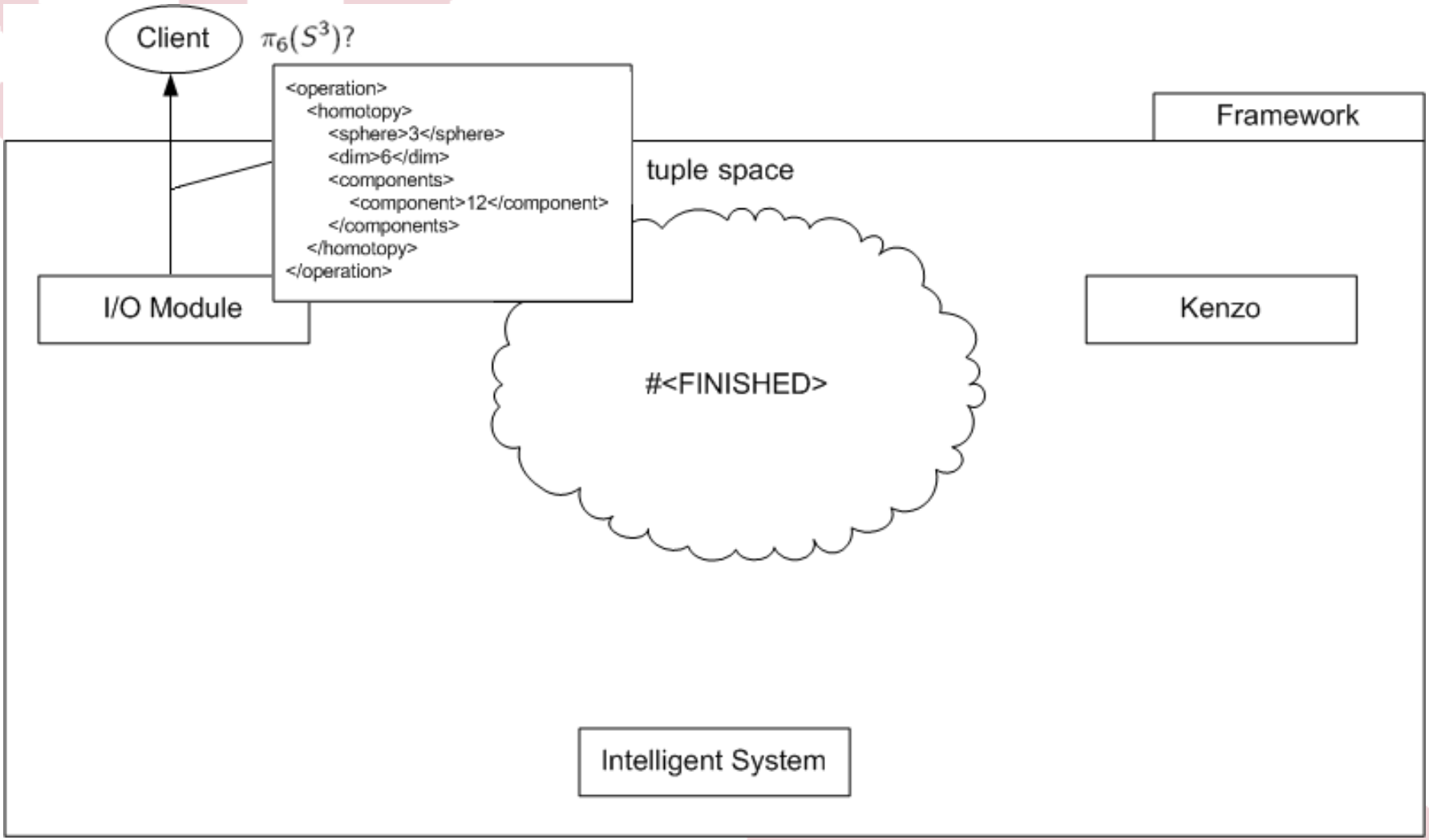

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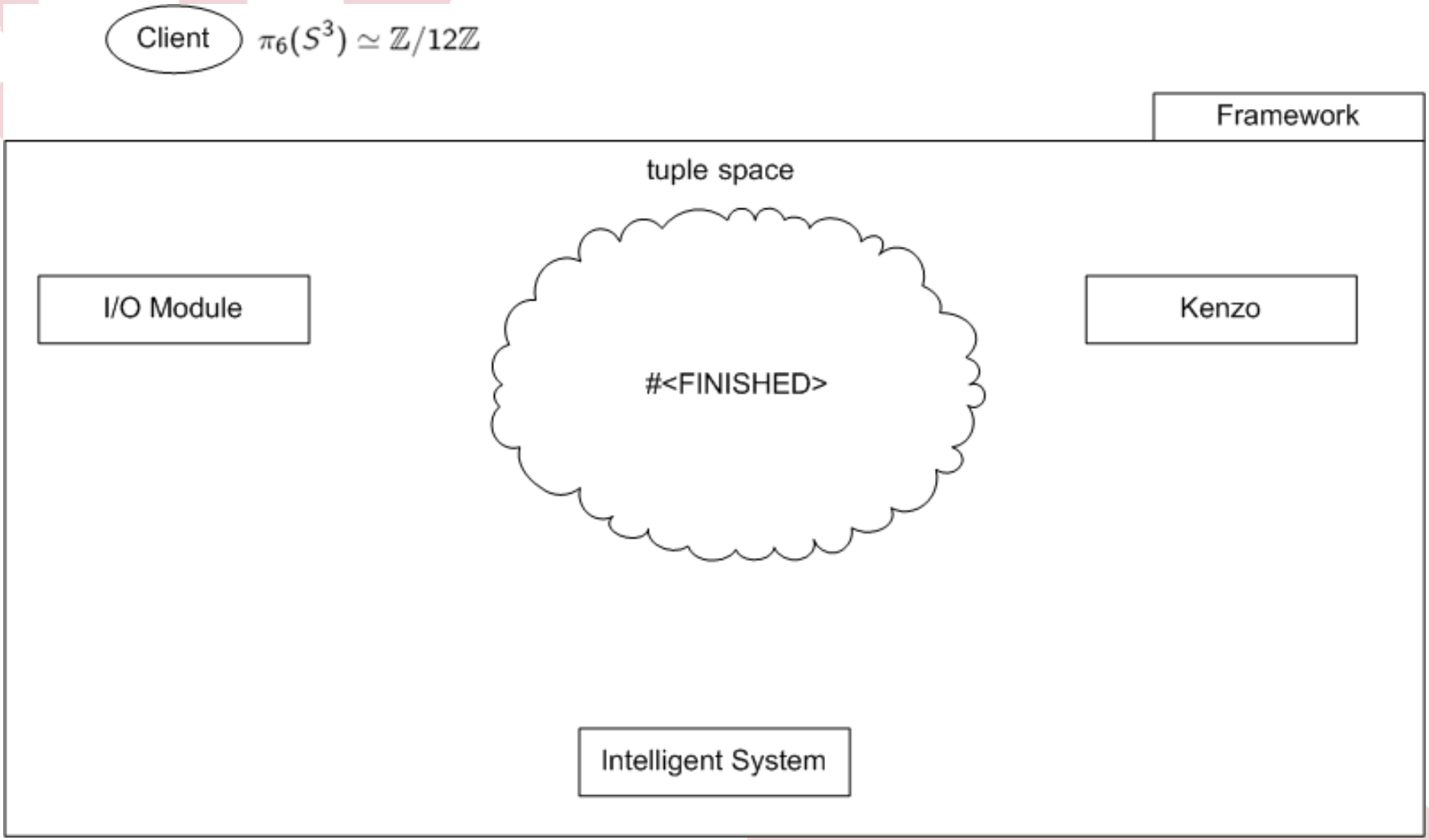

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- Communication
- Concurrency issues

4 Clients of our system

5 Conclusions and Further Work

Communication among modules

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- Subscriptions are stored in an AllegroCache database

```
(defclass subscription ()
  ((host :initarg :host :accessor host )
   (port :initarg :port :accessor port )
   (type-tuples :initarg :type :accessor type :index any))
  (:metaclass persistent-class))
```

Communication among modules

Module observer creates a passive socket

```
(defun observer ()
  (loop
    (let ((sock
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      (wait-for-input-available sock)
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Tuple space observer

- Consults the database of subscriptions
- Sends a notification to the subscribers

```
(defun notify (type-tuple)
  (open-network-database "localhost" 8010)
  (let ((subscrites
         (retrieve-from-index 'subscription
                              'type-tuple type-tuple :all t)))
    (dolist (temp subscrites)
      (let ((socket (make-socket :remote-host (host temp)
                                 :remote-port (port temp))))
        (close socket))))
  (close-database))
```

Concurrency issues

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Two situations can appear:

- Different modules working at the same time
  - Absence of deadlocks
  - Mutual exclusion
- Different processes working in a same module
  - No deadlocks
  - No race condition problems
  - No starvation

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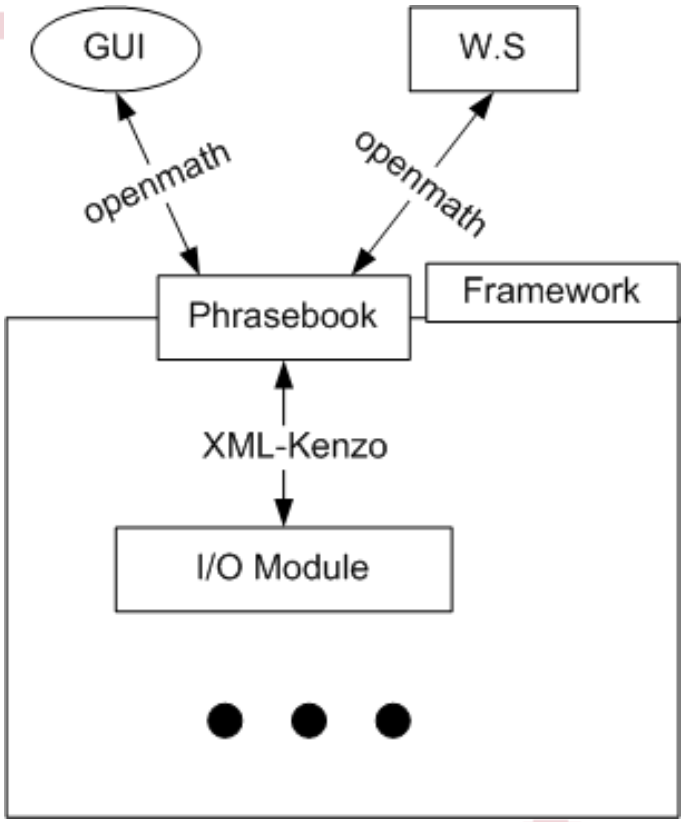
5 Conclusions and Further Work

A GUI and two web services

- A GUI
- Two web services



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- We have reported on a system to interact with the Kenzo Computer Algebra system
- We have obtained a system which can process queries *concurrently* and where *persistent* results are available thanks to an adapted implementation in Common Lisp of the Linda Model

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- We have reported on a system to interact with the Kenzo Computer Algebra system
- We have obtained a system which can process queries *concurrently* and where *persistent* results are available thanks to an adapted implementation in Common Lisp of the Linda Model

Future Work

- Liberate our system from the proprietary features of Allegro Common Lisp
- Decide when a computation is easy enough to solve it locally or whether it must be sent to a central server
- Devise good heuristics to decide what is the meaning of the predicate "to be an easy computation"
- Integration with other systems

Applying Generative Communication to Symbolic Computation in Common Lisp

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