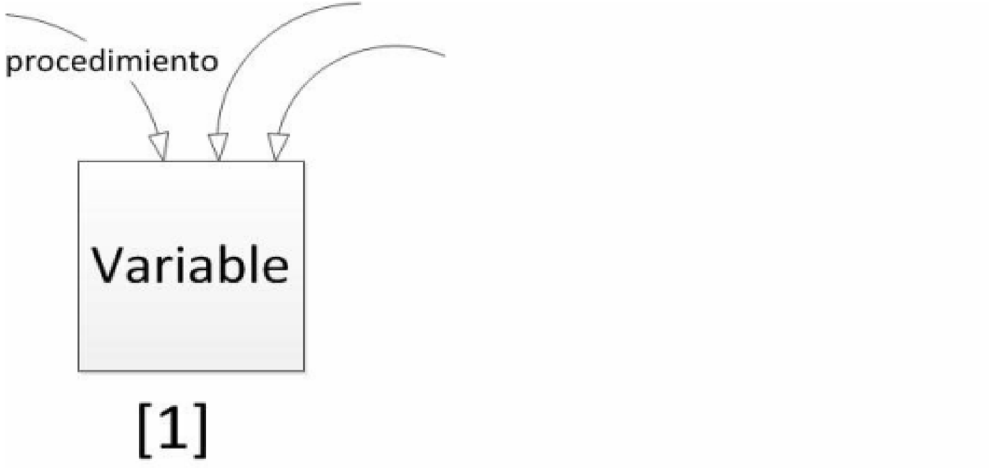
Concurrencia sin dolor

- Ignacio Blasco López
- Sebastián Ortega Torres

512

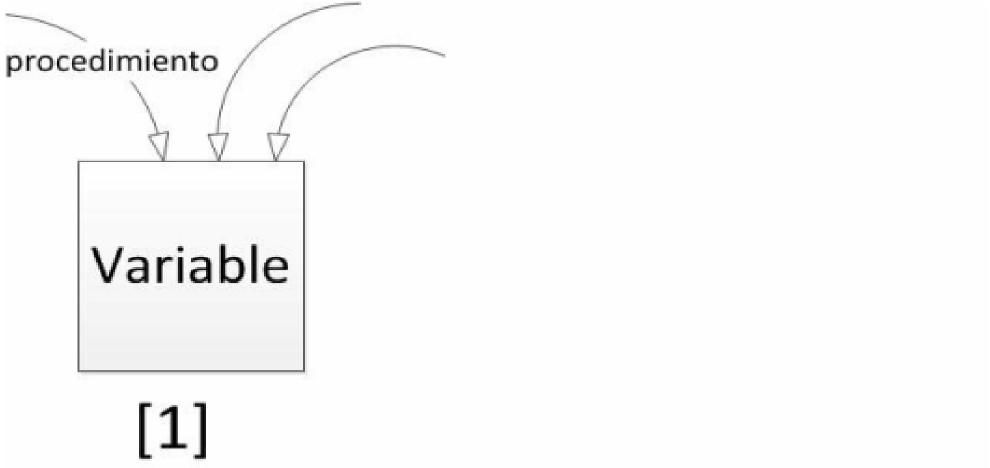
Imperativo vs Funcional

Imperativo vs Funcional



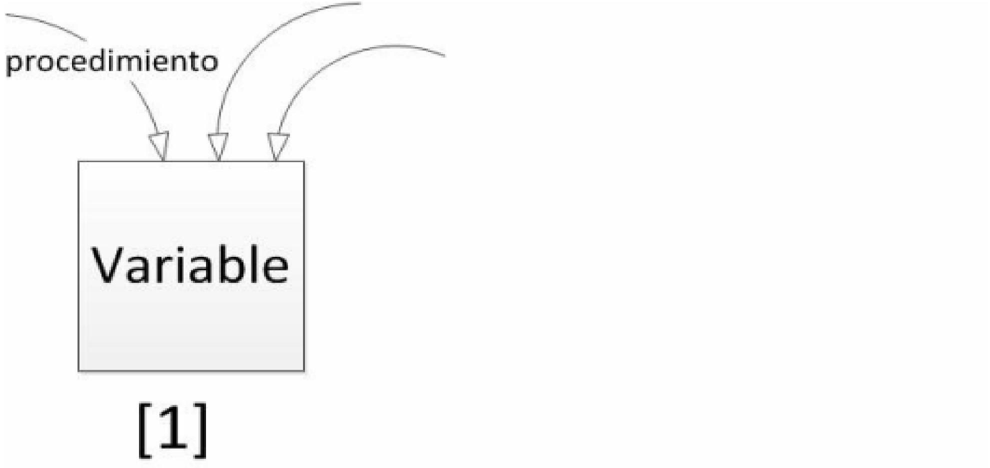
Imperativo vs Funcional

- Modelo Imperativo



Imperativo vs Funcional

- Modelo Imperativo
  - Modificar variables



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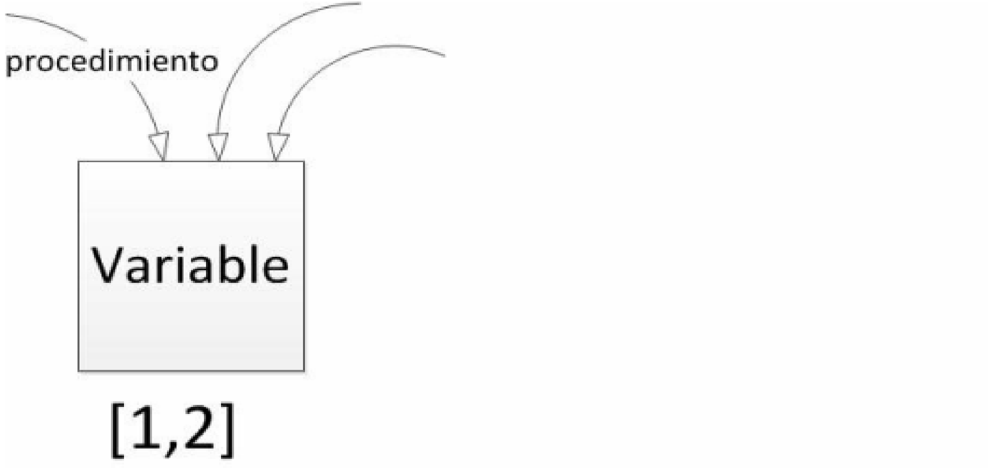

Imperativo vs Funcional

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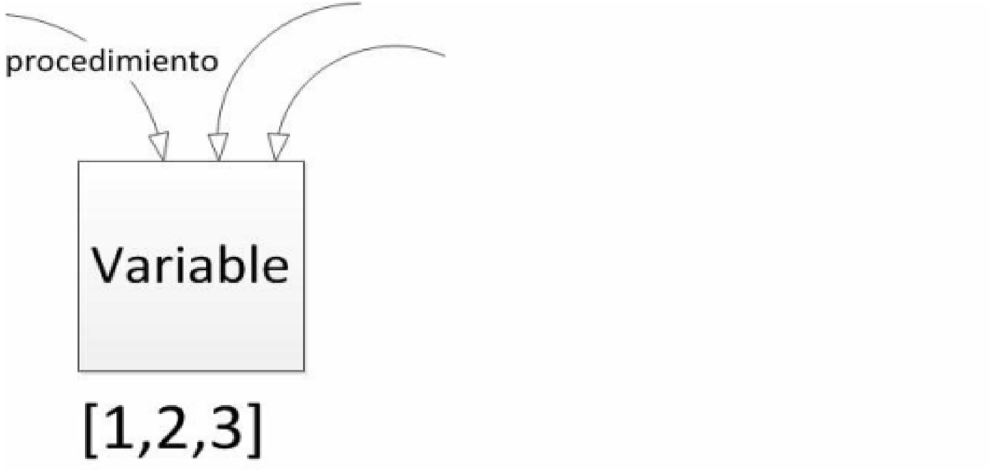

Imperativo vs Funcional

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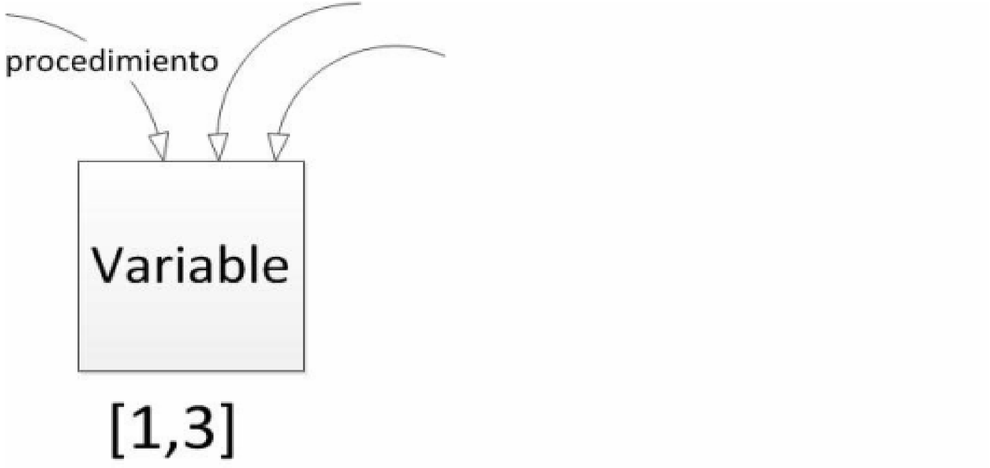
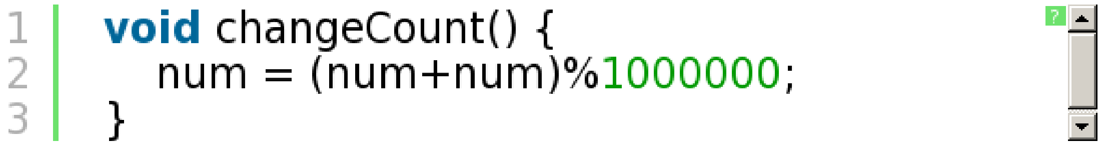
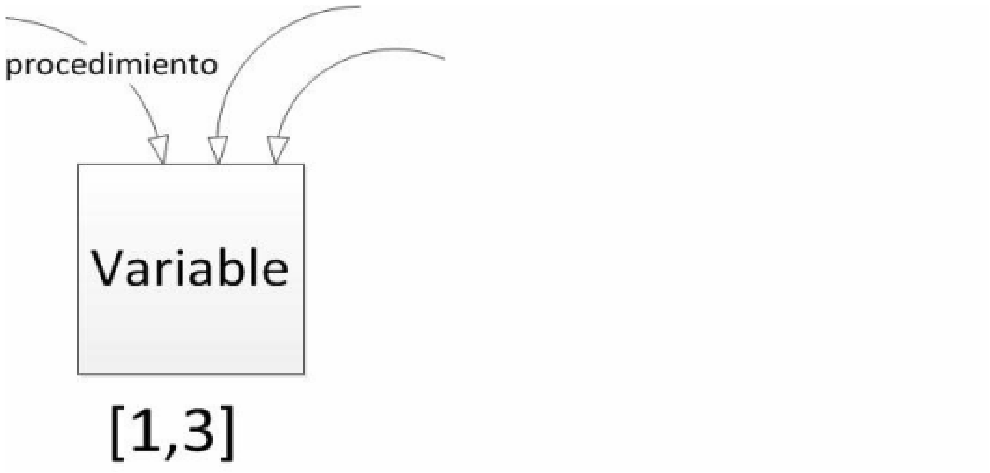


Imperativo vs Funcional

- Modelo Imperativo
  - Modificar variables

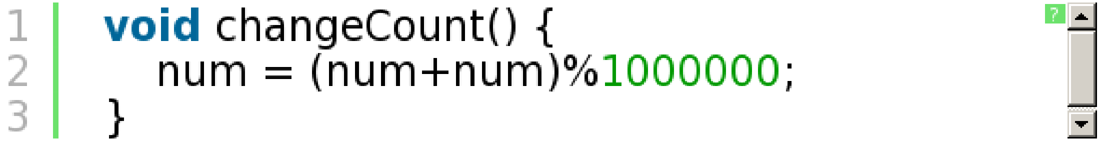


```
void changeCount() {
    num = (num+num)%1000000;
}
```



Imperativo vs Funcional

- Modelo Imperativo
  - Modificar variables



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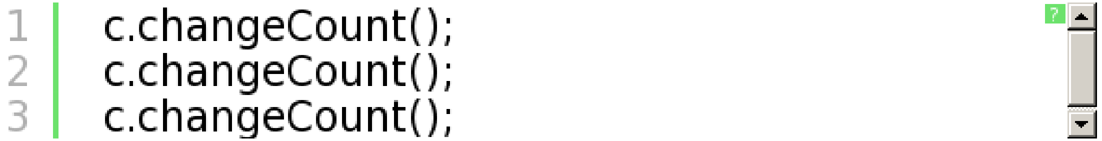
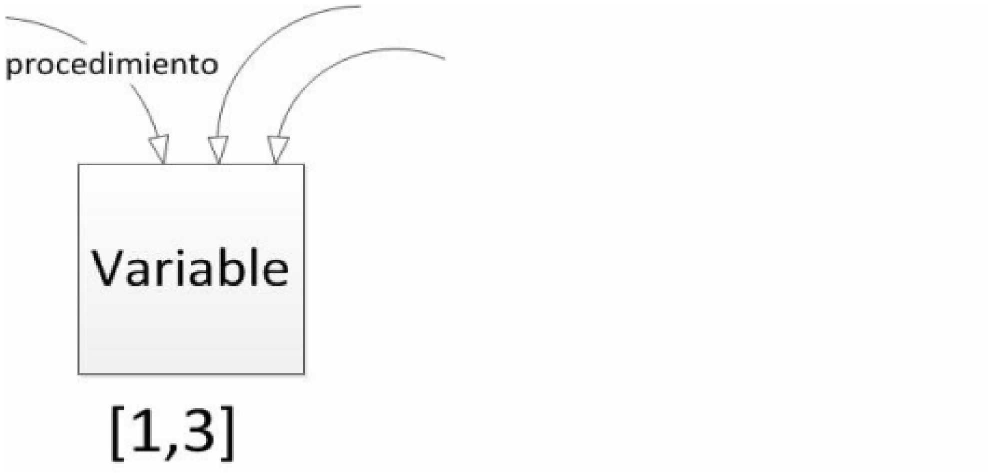


```
c.changeCount();
c.changeCount();
c.changeCount();
```



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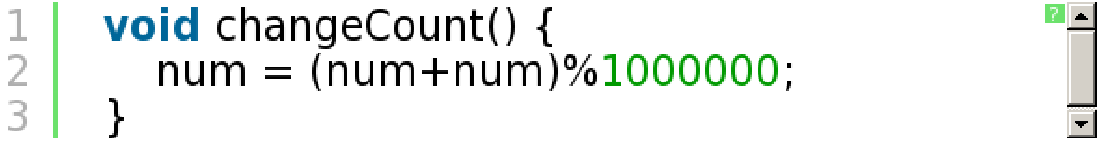
- Modelo Imperativo
  - Modificar variables



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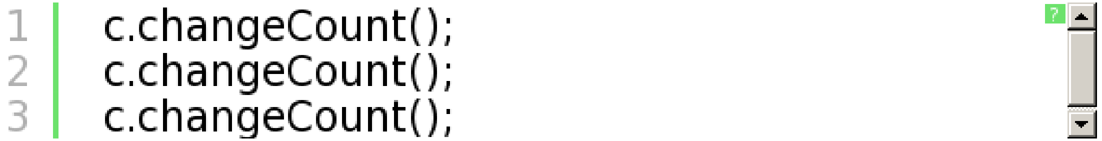

```
c.changeCount();
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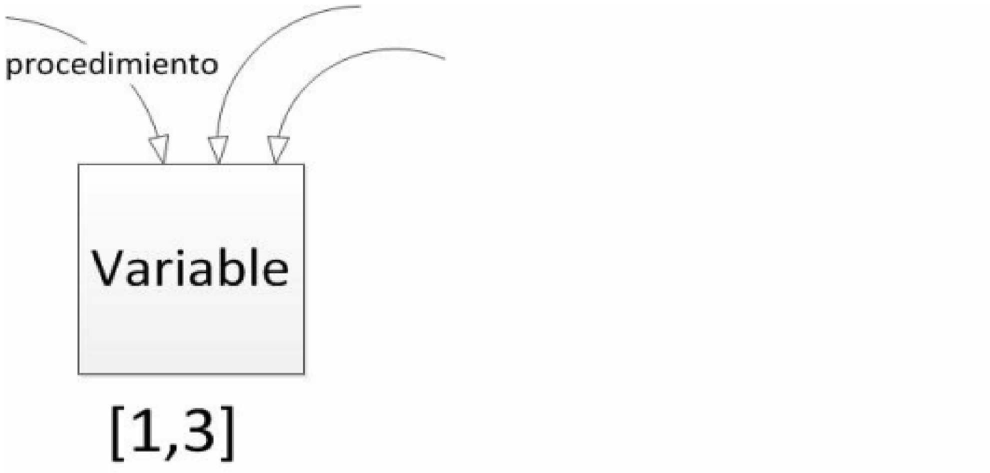
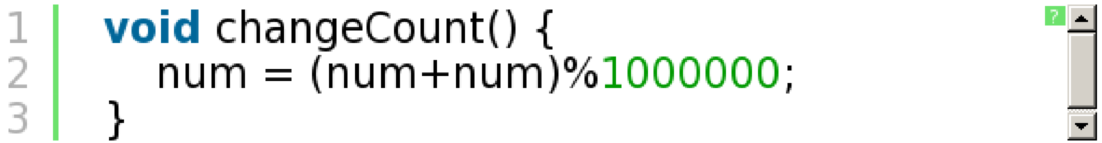
```

- Dependencia temporal



Imperativo vs Funcional

- Modelo Imperativo
    - Modificar variables



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}
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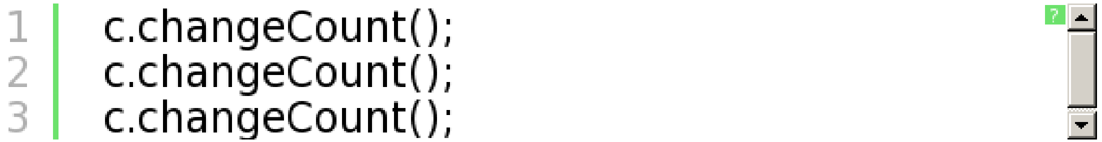
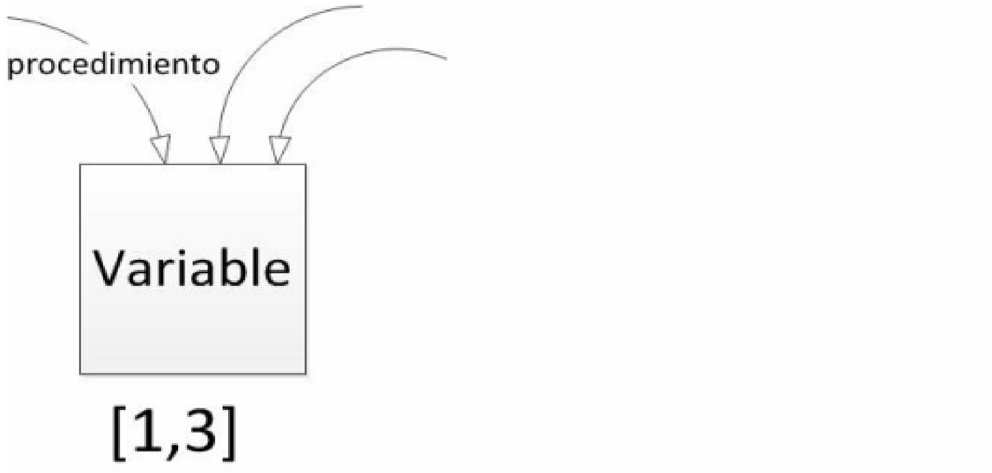


```
c.changeCount();
c.changeCount();
c.changeCount();
```

- Dependencia temporal
- Empeora con concurrencia



Imperativo vs Funcional

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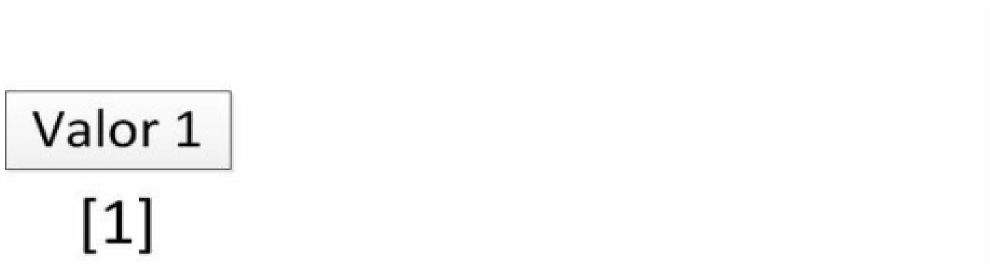

```
[1]
```

Imperativo vs Funcional

- Modelo Funcional

[1]

Imperativo vs Funcional

- Modelo Funcional
  - Combinar funciones

[1]

Imperativo vs Funcional

- Modelo Funcional
  - Combinar funciones
  - Generar un valor a partir del siguiente

[1]

Imperativo vs Funcional

- Modelo Funcional
    - Combinar funciones
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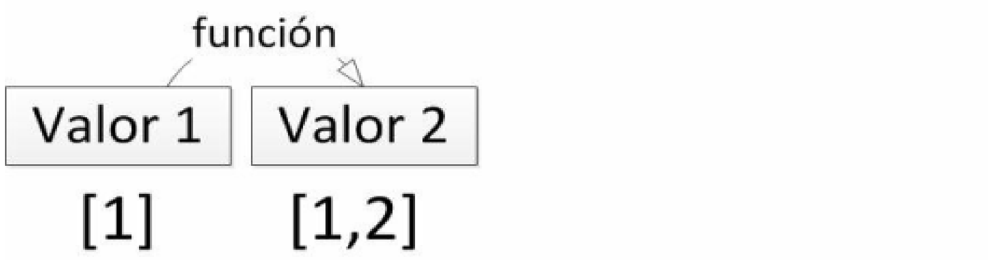
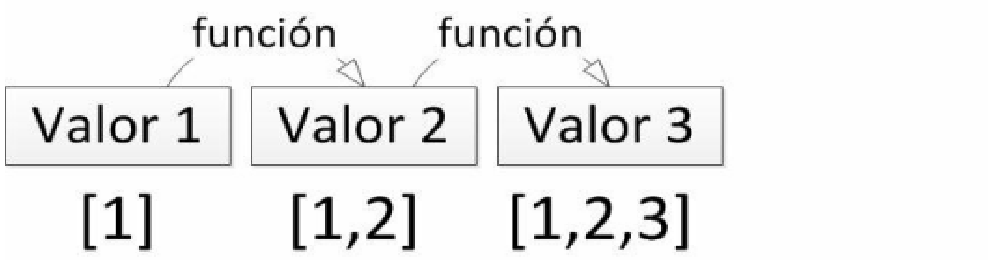


Imperativo vs Funcional

- Modelo Funcional
  - Combinar funciones
  - Generar un valor a partir del siguiente



Imperativo vs Funcional

- Modelo Funcional
  - Combinar funciones
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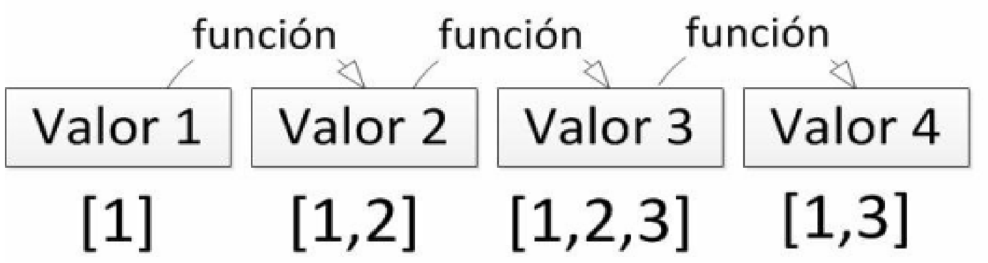

Imperativo vs Funcional

- Modelo Funcional
  - Combinar funciones
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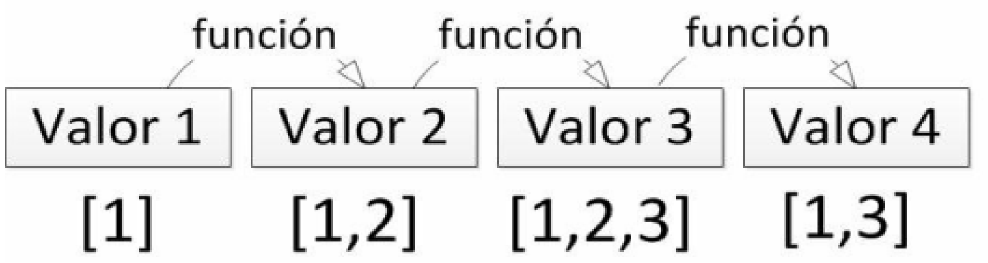
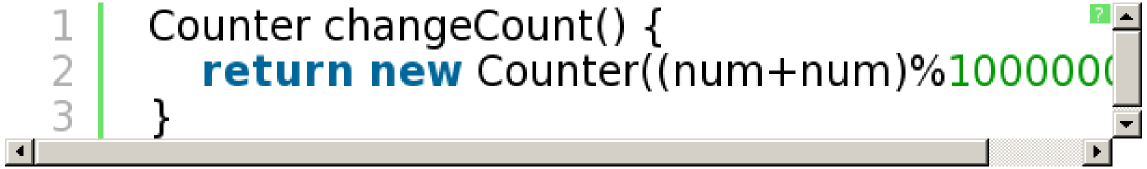


función función función

Valor 1 Valor 2 Valor 3 Valor 4

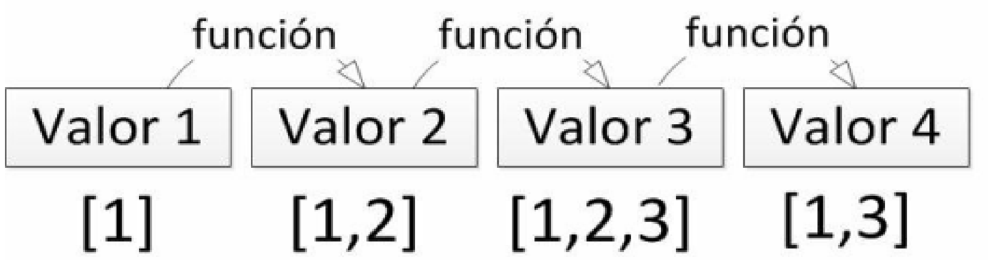
[1] [1,2] [1,2,3] [1,3]

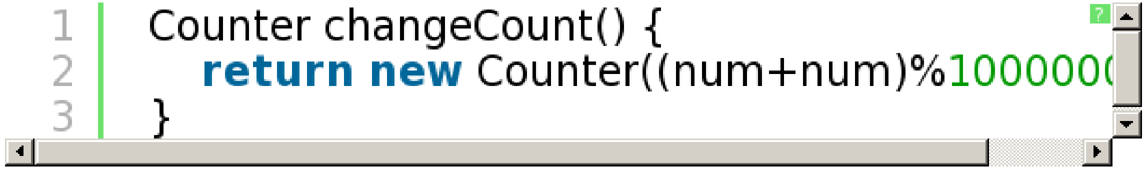


```
Counter changeCount() {
   return new Counter((num+num)%1000000
}
```

Imperativo vs Funcional

- Modelo Funcional
    - Combinar funciones
    - Generar un valor a partir del siguiente





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```
c.changeCount().
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```

Imperativo vs Funcional

- Modelo Funcional
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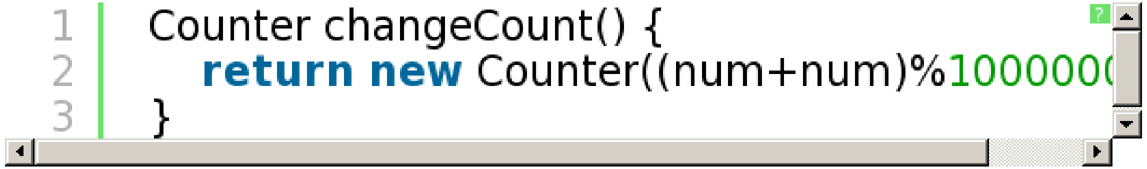
  - Generar un valor a partir del siguiente



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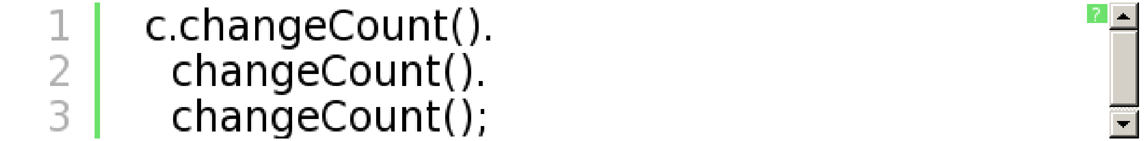

```
c.changeCount().
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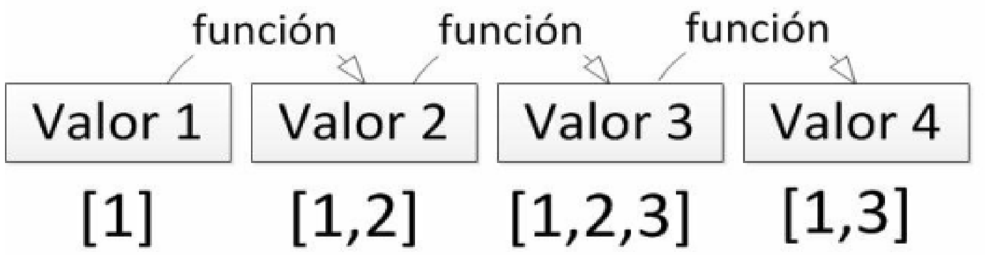
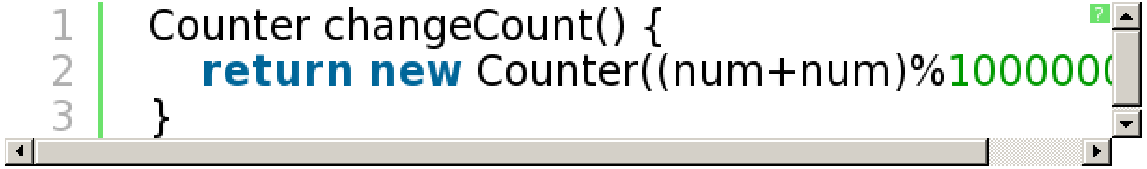
- Transparencia referencial



Imperativo vs Funcional

- Modelo Funcional
    - Combinar funciones
    - Generar un valor a partir del siguiente



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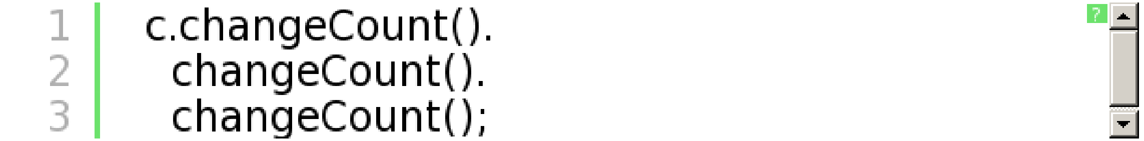

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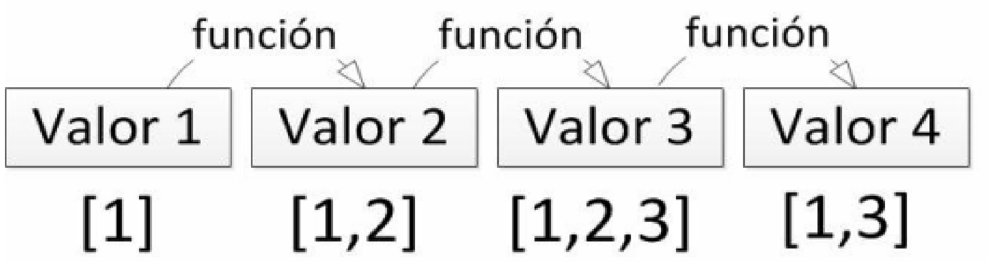
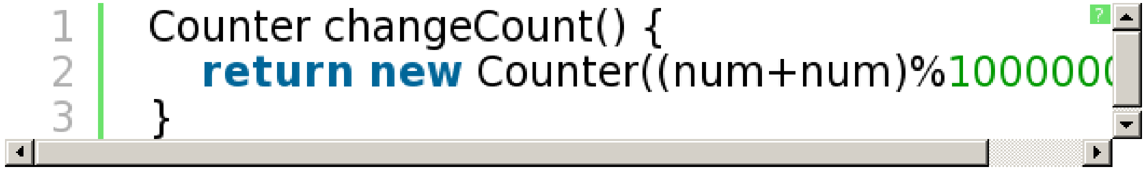
```

- Transparencia referencial
- Comparticion sin peligro



Imperativo vs Funcional

- Modelo Funcional
    - Combinar funciones
    - Generar un valor a partir del siguiente



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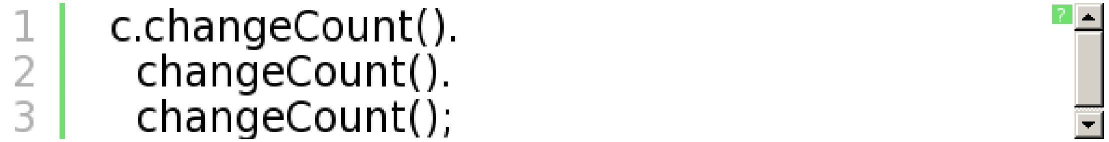

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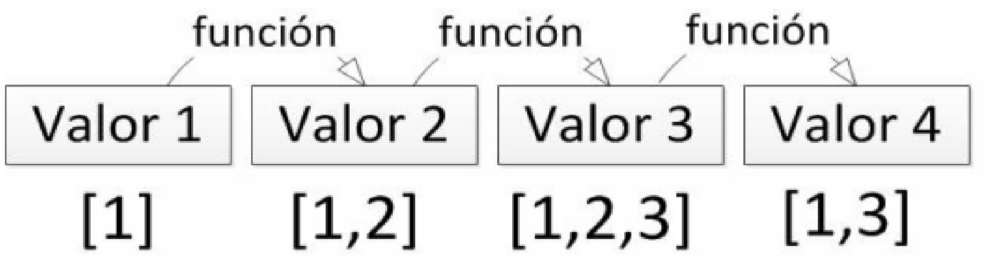


función función función

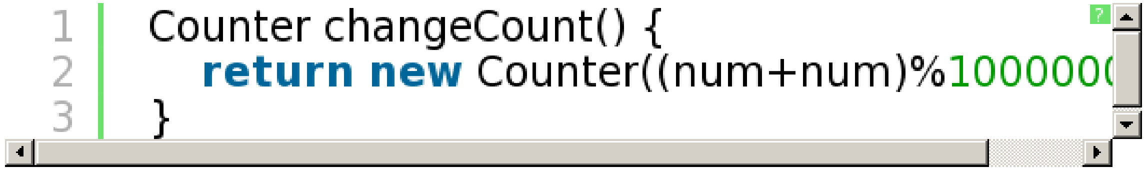
Valor 1 | Valor 2 | Valor 3 | Valor 4

[1] [1,2] [1,2,3] [1,3]

- Transparencia referencial
- Comparticion sin peligro
- Genera mas basura

Imperativo vs Funcional

- Modelo Funcional
  - Combinar funciones
  - Generar un valor a partir del siguiente



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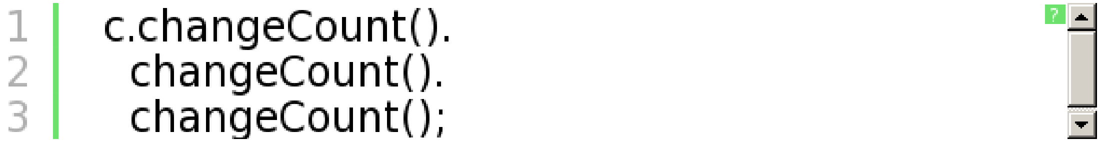

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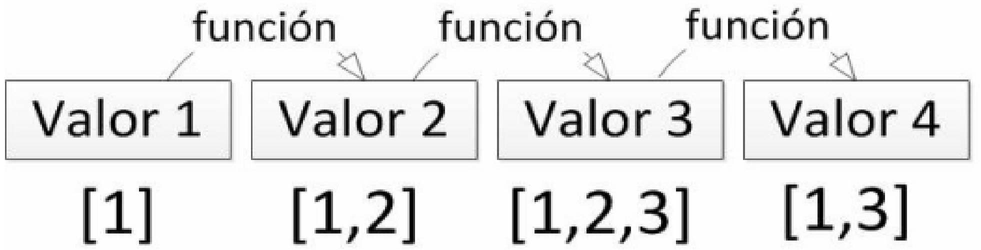
  changeCount();
```

- Transparencia referencial
- Comparticion sin peligro
- Genera mas basura
- Necesita estructuras especificas



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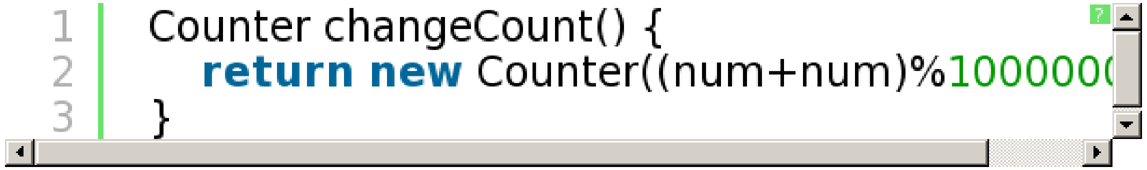

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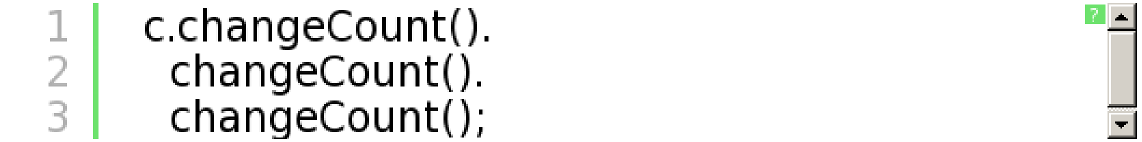

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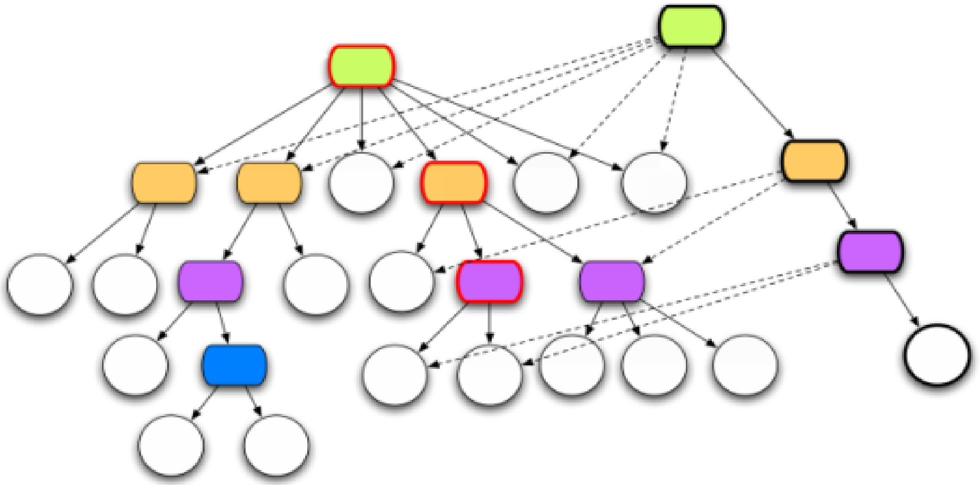
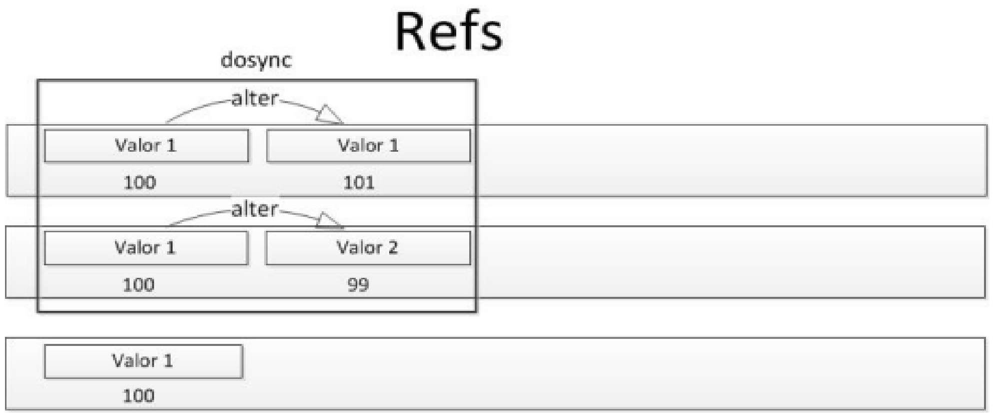


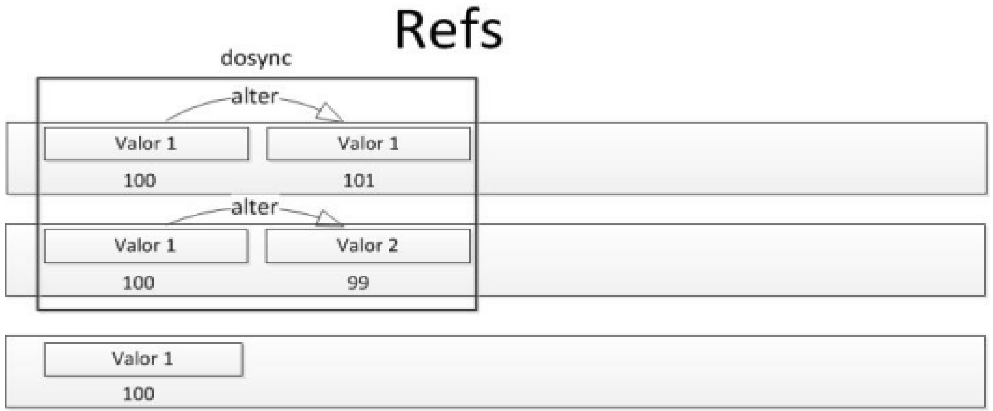
STM

STM


Refs
dosync
alter
Valor 1
100
Valor 1
101
alter
Valor 1
100
Valor 2
99
Valor 1
100

STM

- Software Transactional Memory

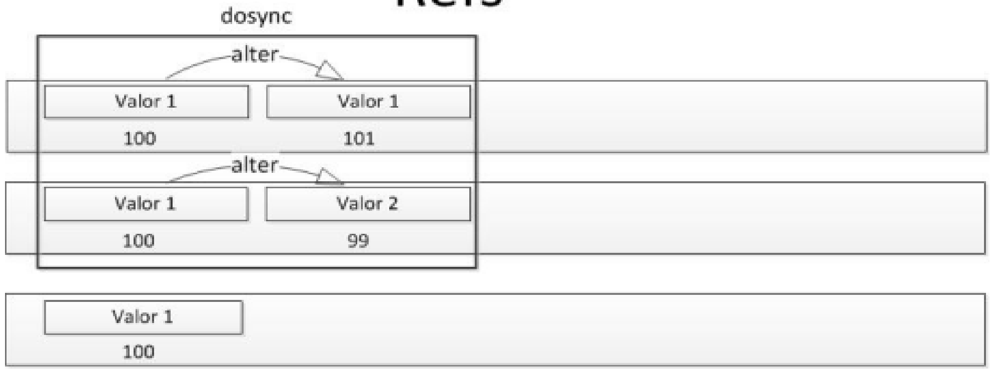


STM

- Software Transactional Memory

```clojure
(def mi-ref (ref 1))
```

Refs

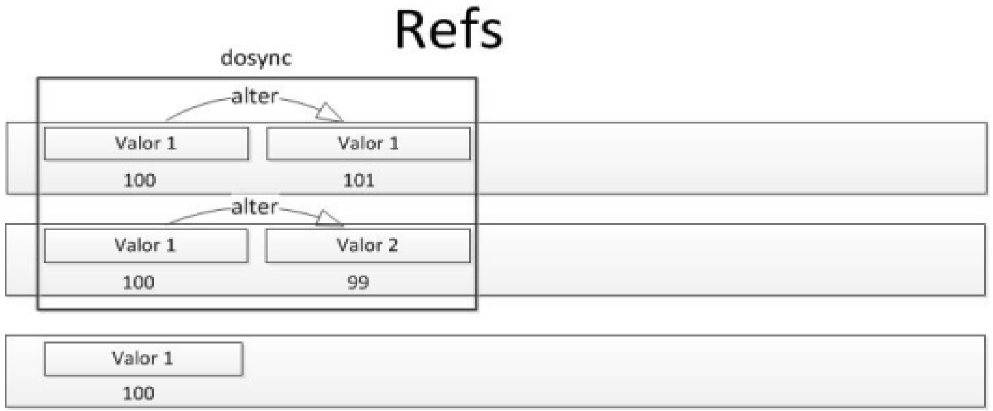


STM

- Software Transactional Memory

```
(def mi-ref (ref 1))
```

- Transacción



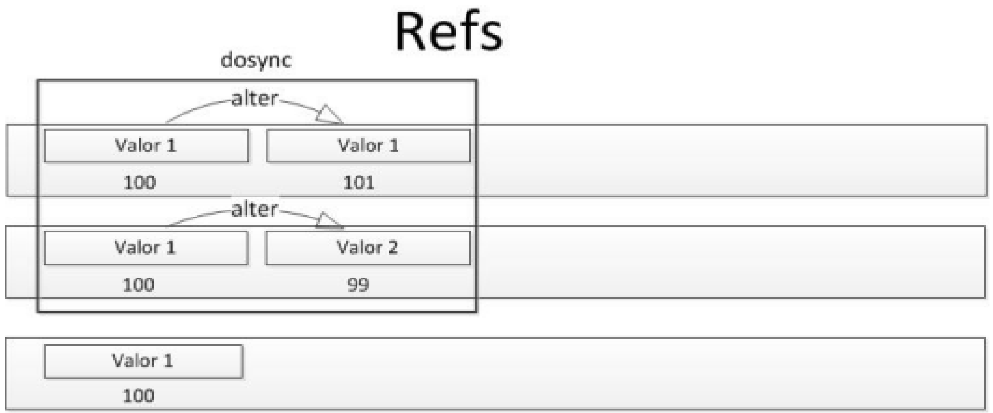
STM

- Software Transactional Memory

```clojure
(def mi-ref (ref 1))
```

- Transacción

```clojure
(dosync ...)
```



STM

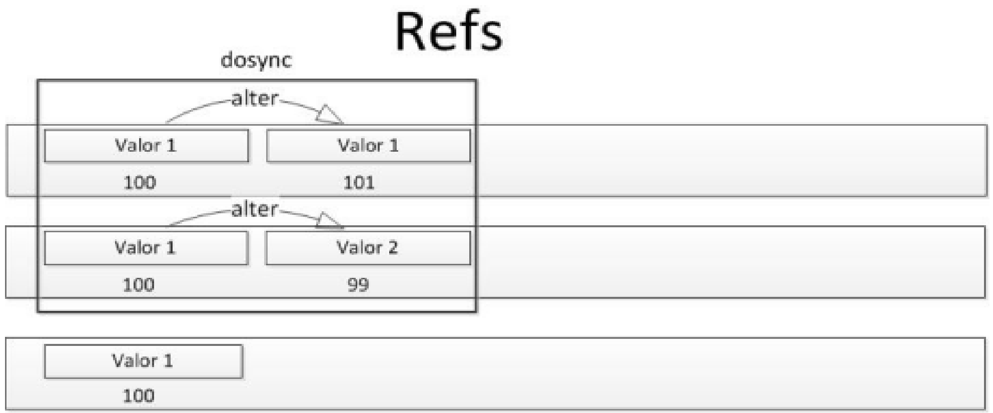
- Software Transactional Memory

```
(def mi-ref (ref 1))
```

- Transacción

```
(dosync ...)
```

```
(alter mi-ref inc)
```



Refs

STM

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- Transacción

```
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```

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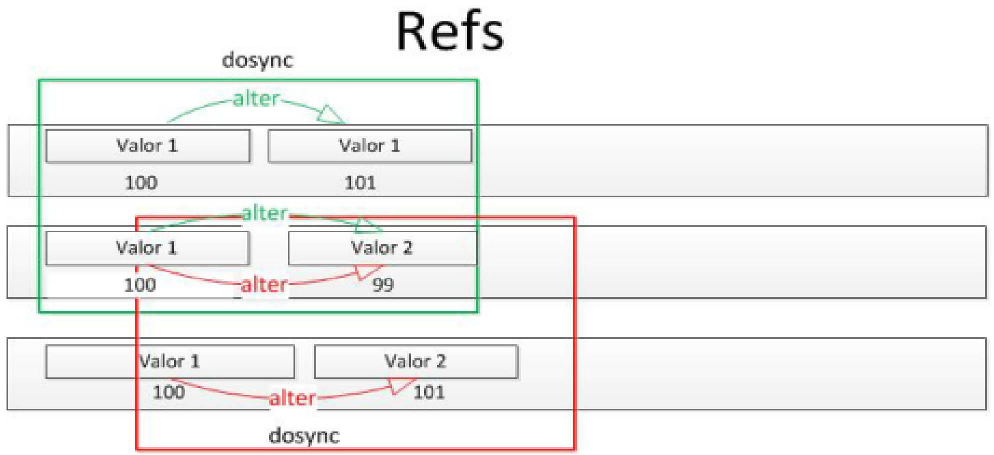
Refs

STM

- Software Transactional Memory

```
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```
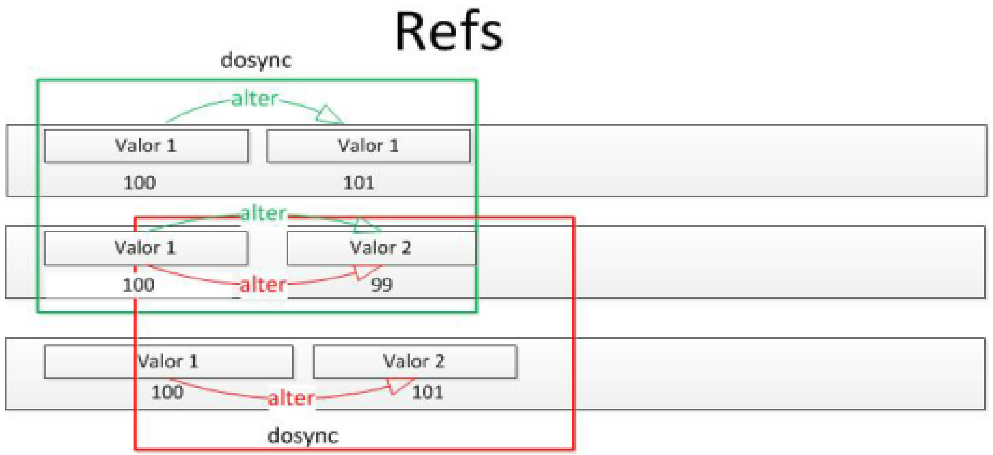

- Transacción

```
(dosync ...)
```

```
(alter mi-ref inc)
```

- Multiversion Concurrency Control (MVCC)



STM

- Software Transactional Memory

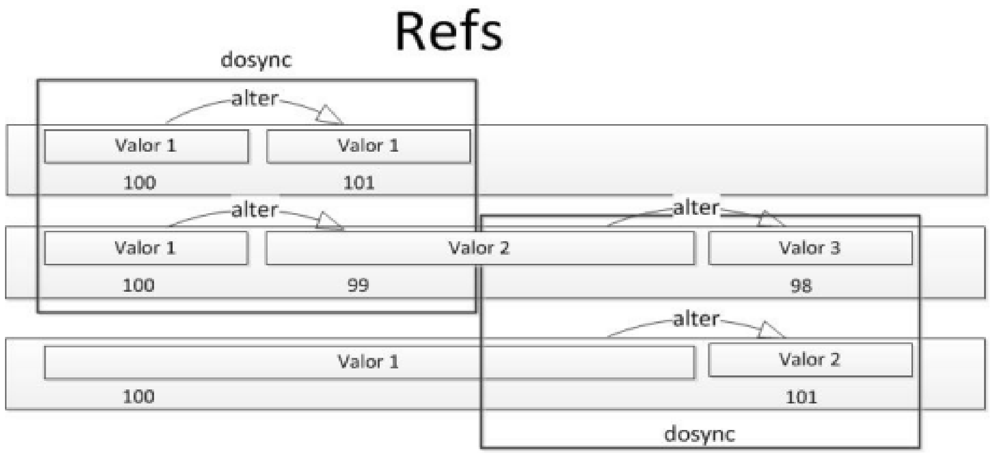
```clojure
(def mi-ref (ref 1))
```

- Transacción

```clojure
(dosync ...)
```

```clojure
(alter mi-ref inc)
```

- Multiversion Concurrency Control (MVCC)



STM

- Software Transactional Memory

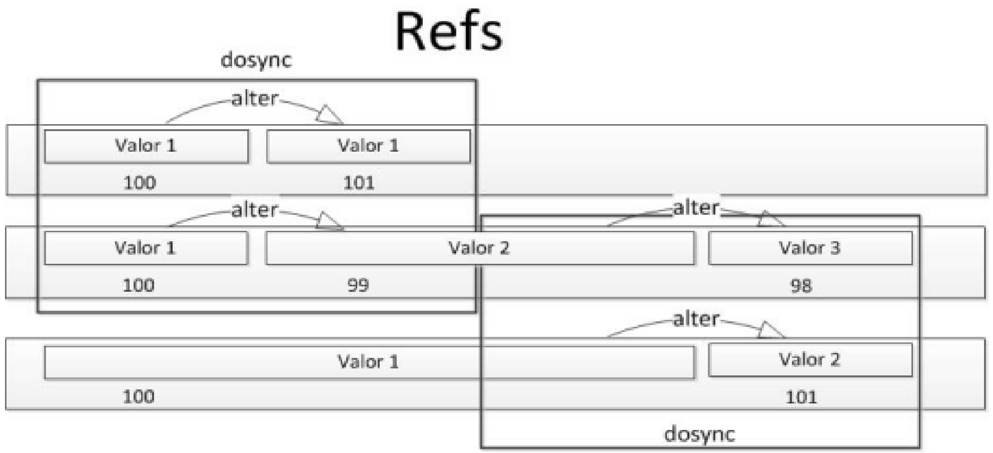
```
(def mi-ref (ref 1))
```

- Transacción

```
(dosync ...)
```

```
(alter mi-ref inc)
```

- Multiversion Concurrency Control (MVCC)
- ... and Retry



STM

- Software Transactional Memory

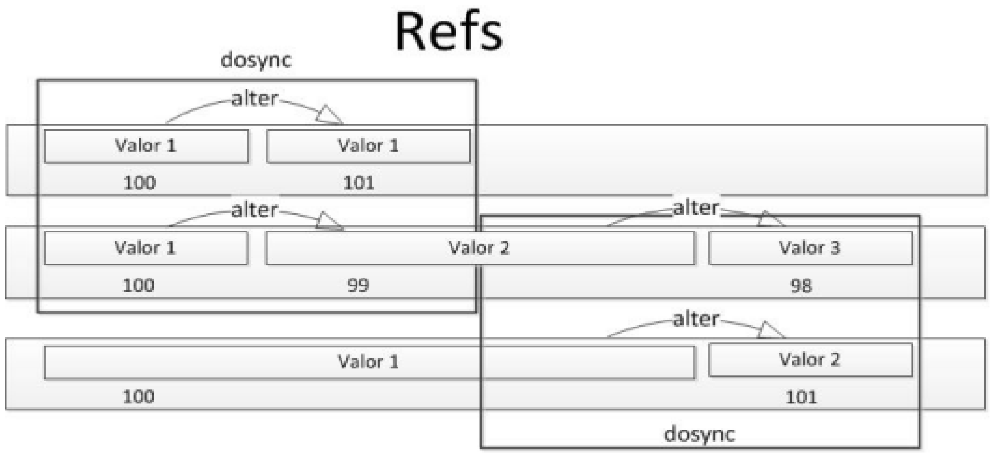
```
(def mi-ref (ref 1))
```

- Transacción

```
(dosync ...)
```

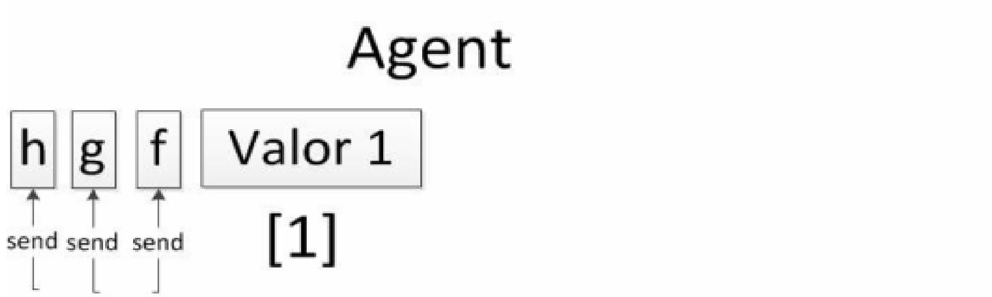
```
(alter mi-ref inc)
```

- Multiversion Concurrency Control (MVCC)
- ... and Retry
- Prohibidos efectos secundarios!!



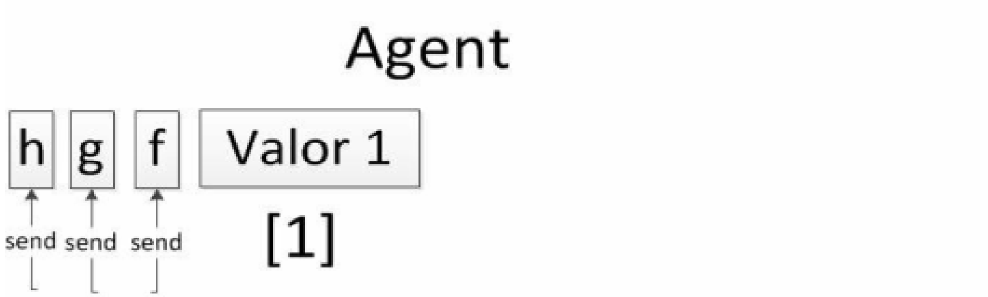
Agent

Agent



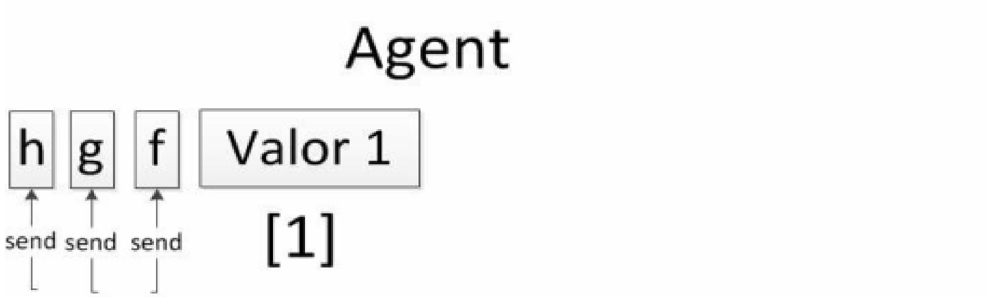
Agent

- Comportamiento asíncrono



Agent

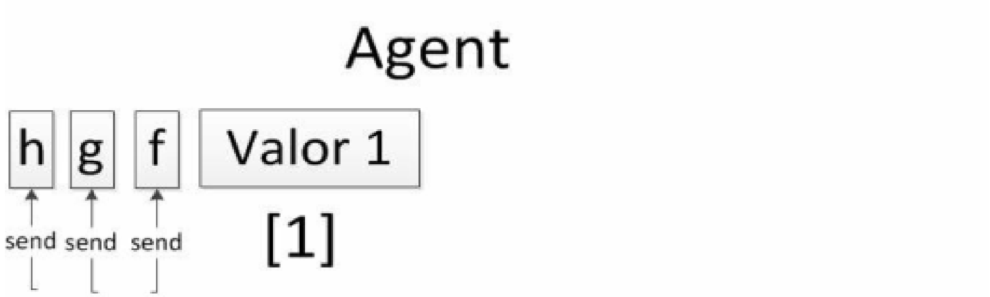
- Comportamiento asíncrono
- Ejecucion secuencial



Agent

- Comportamiento asíncrono
- Ejecucion secuencial

```
(def james (agent "bond"))
```

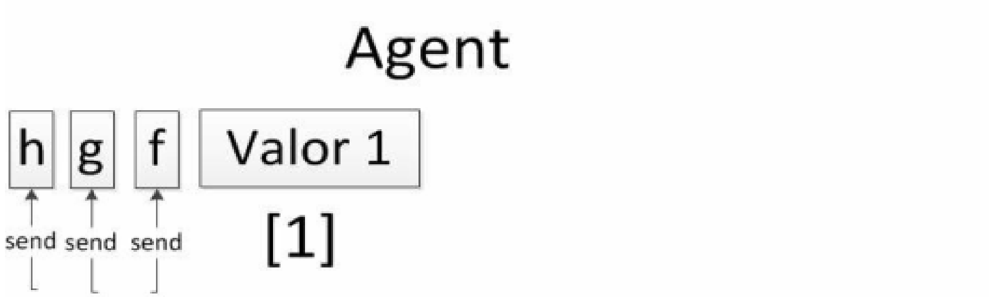


Agent

- Comportamiento asíncrono
- Ejecucion secuencial

```
(def james (agent "bond"))
```

```
(send james str " 007")
```



Agent

- Comportamiento asíncrono
- Ejecucion secuencial

```
(def james (agent "bond"))
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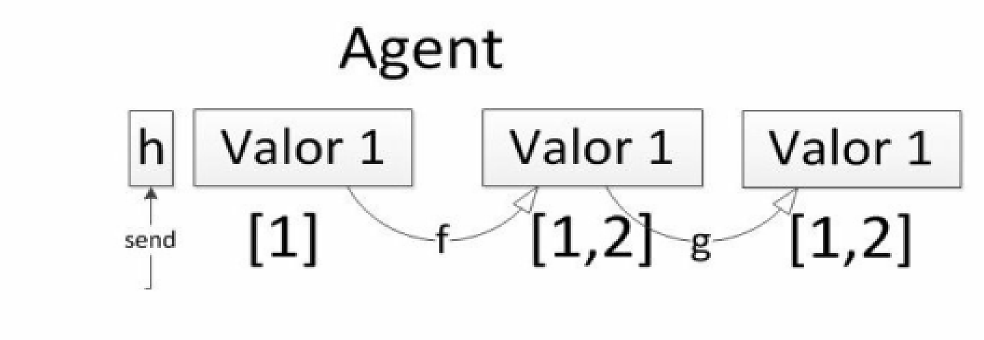

Agent

- Comportamiento asíncrono
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(def james (agent "bond"))
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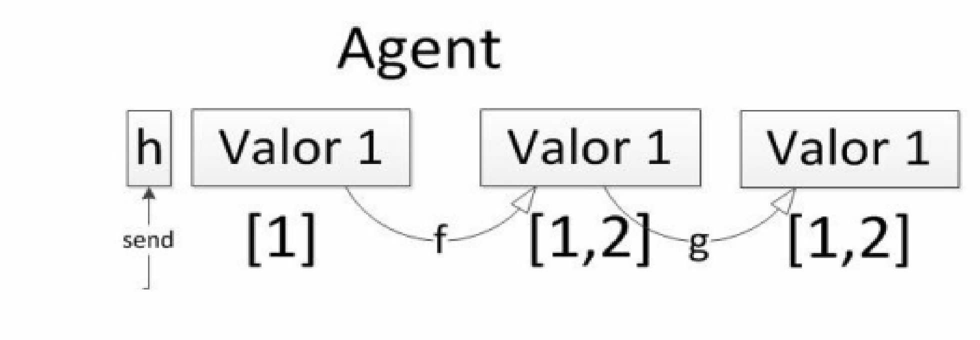
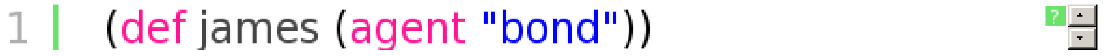
- Ejecucion de entrada/salida



Agent

- Comportamiento asíncrono
- Ejecucion secuencial



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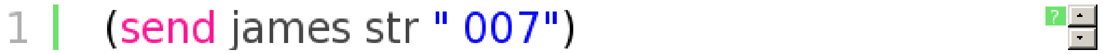

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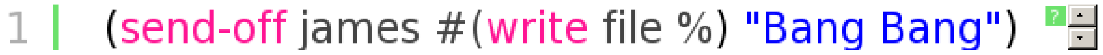
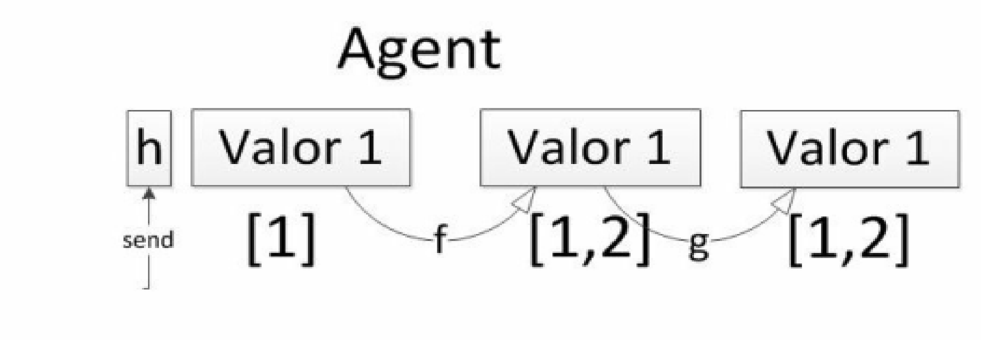
- Ejecucion de entrada/salida



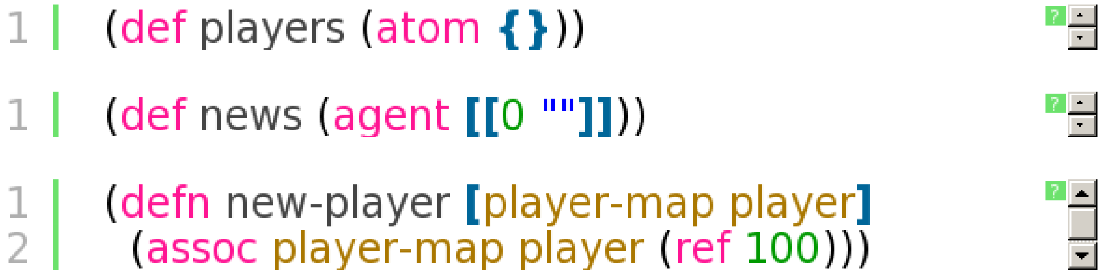
```
(send-off james #(write file %) "Bang Bang")
```



Implementacion del juego

Implementacion del juego

- Ejemplo en el juego



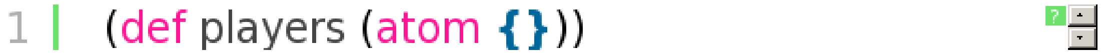
```clojure
(def players (atom {}))
```

```clojure
(def news (agent [[0 ""]]))
```

```clojure
(defn new-player [player-map player]
  (assoc player-map player (ref 100)))
```

Implementacion del juego

- Ejemplo en el juego



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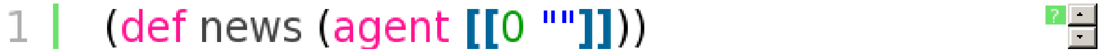

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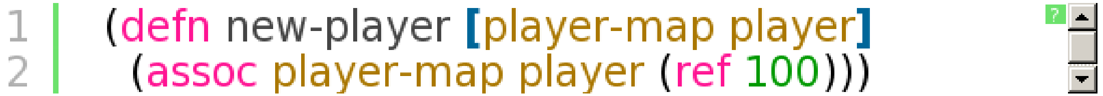

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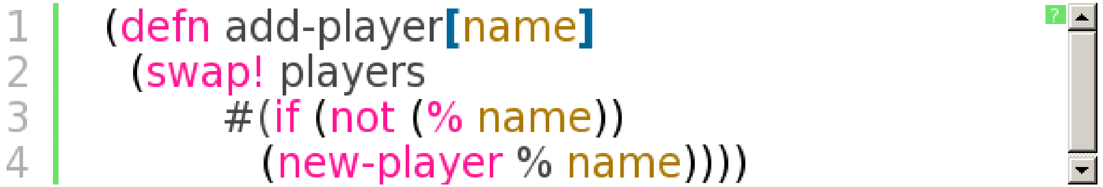
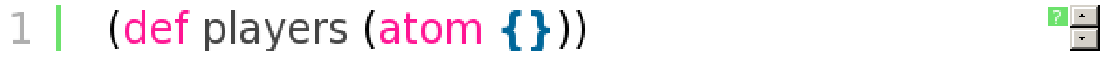


```
(defn add-player[name]
  (swap! players
     #(if (not (% name))
       (new-player % name))))
```

Implementacion del juego

- Ejemplo en el juego



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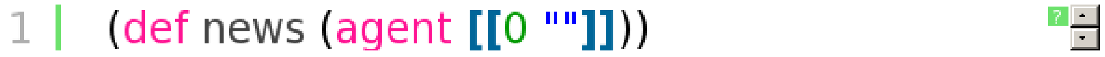

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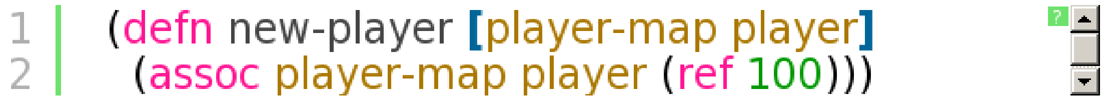

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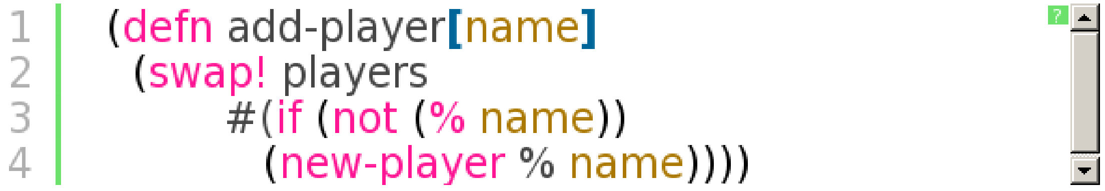

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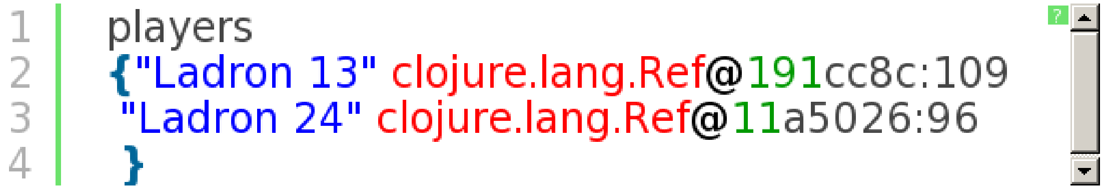
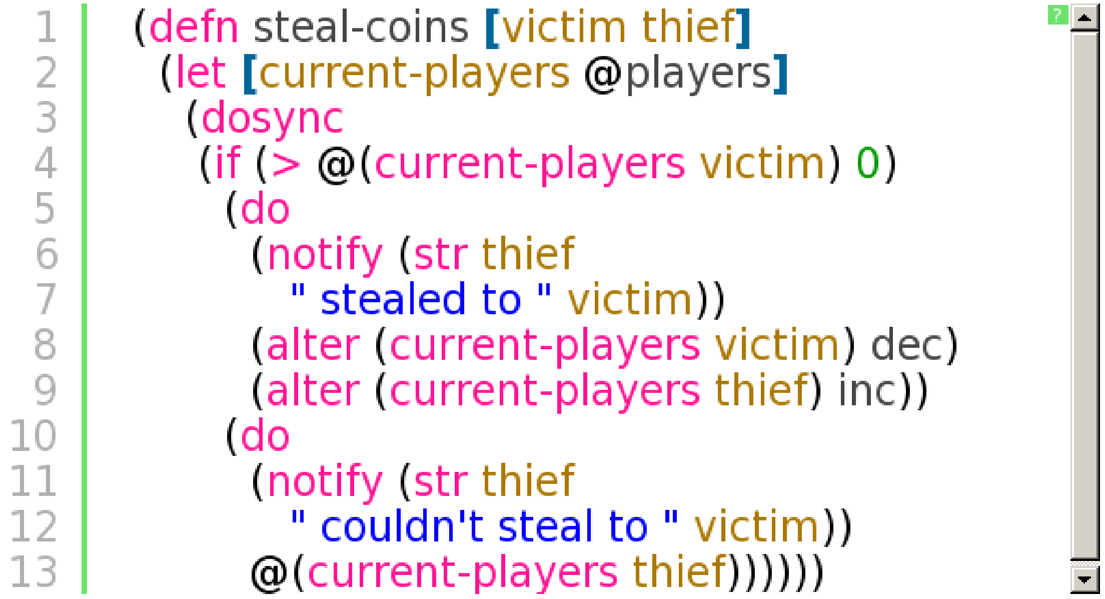


```
players
{"Ladron 13" clojure.lang.Ref@191cc8c:109
 "Ladron 24" clojure.lang.Ref@11a5026:96
 }
```



```
(defn steal-coins [victim thief]
  (let [current-players @players]
    (dosync
     (if (> @(current-players victim) 0)
       (do
         (notify (str thief
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         (alter (current-players victim) dec)
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       (do
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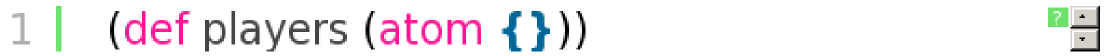
Implementacion del juego

- Ejemplo en el juego



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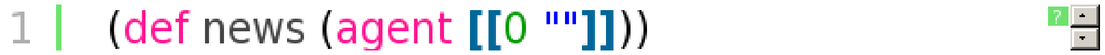

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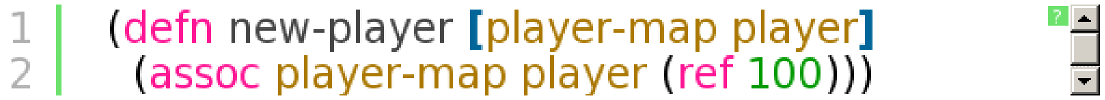

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(defn new-player [player-map player]
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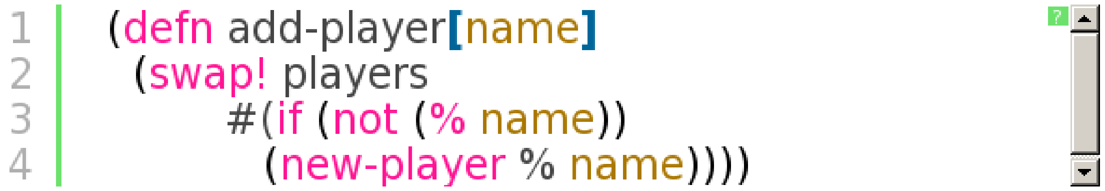
```



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(defn add-player[name]
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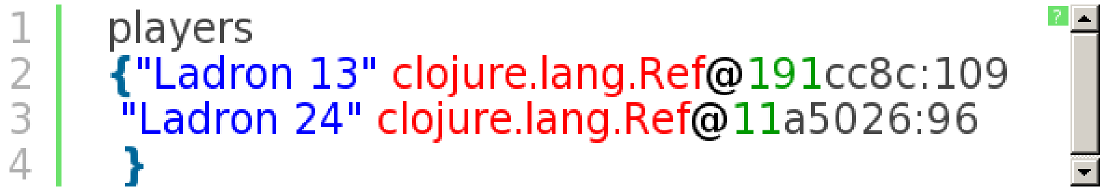

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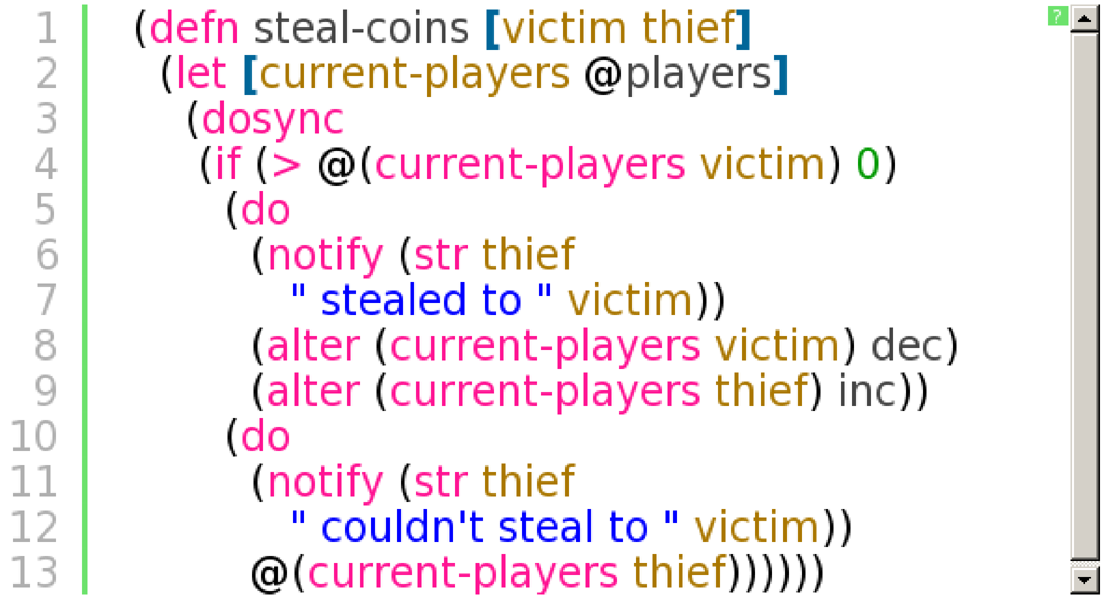

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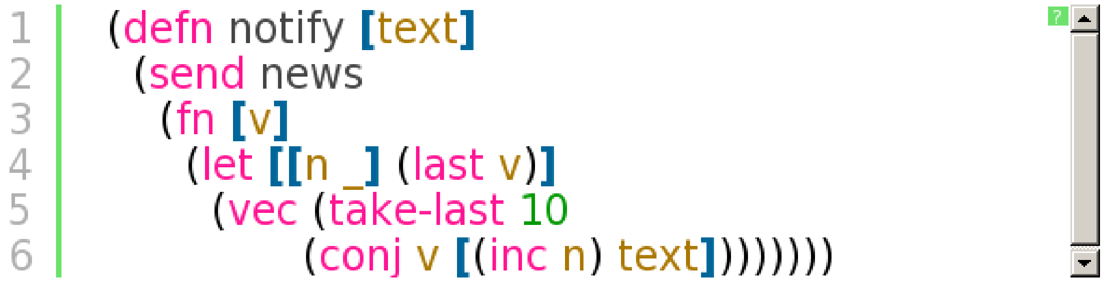

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(defn notify [text]
  (send news
    (fn [v]
      (let [[n _] (last v)]
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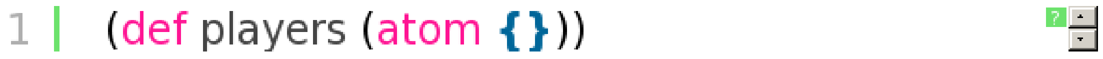
```

Implementacion del juego

- Ejemplo en el juego



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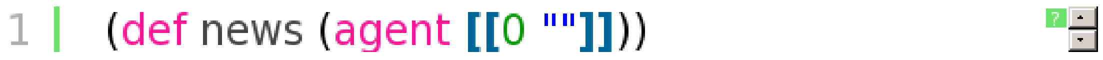

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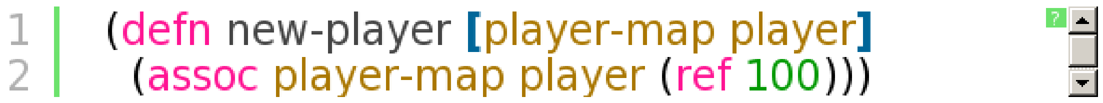

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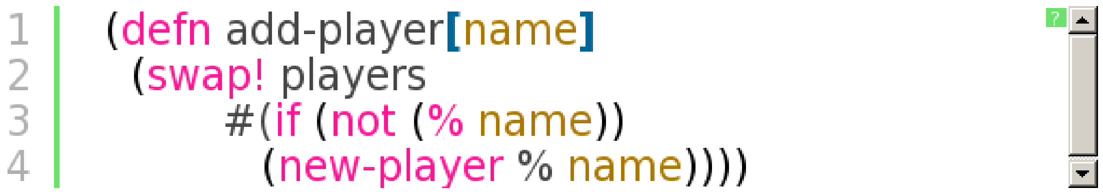

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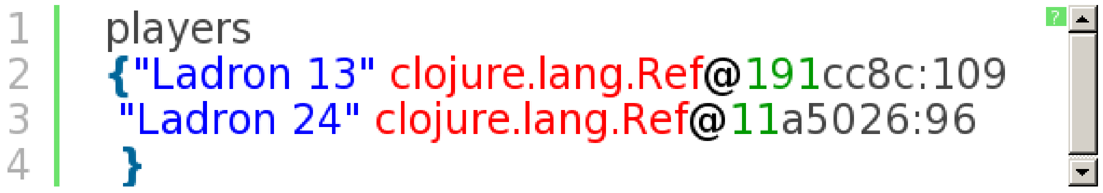

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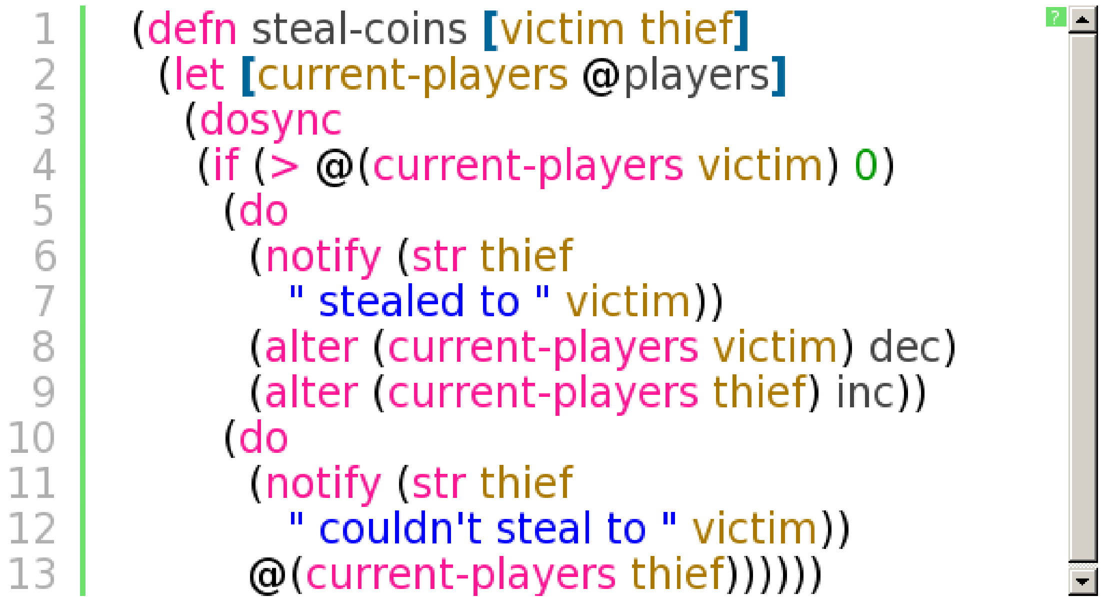

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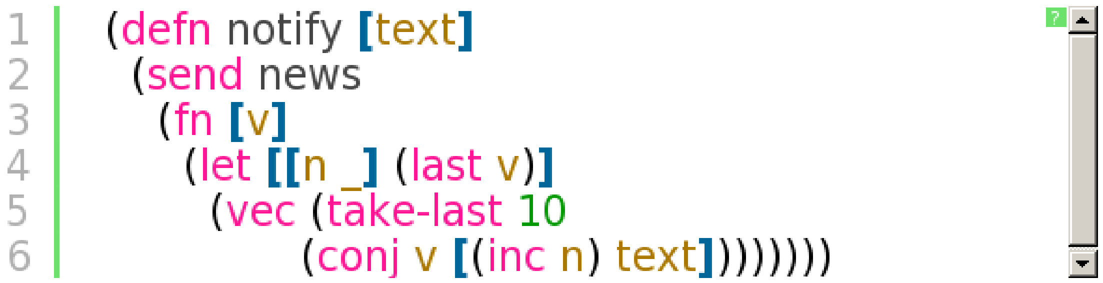

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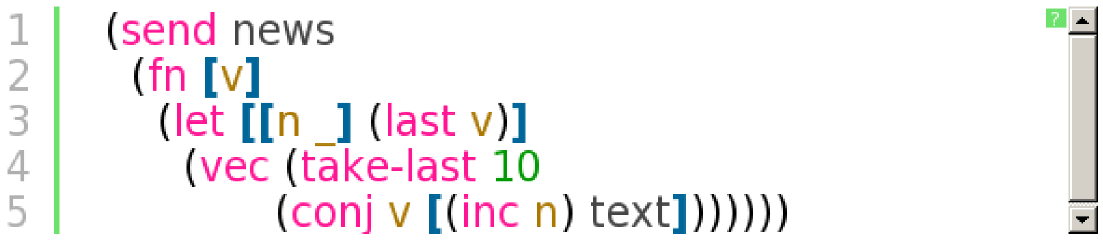

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