Dependently Typed Assembly for Secure Linking

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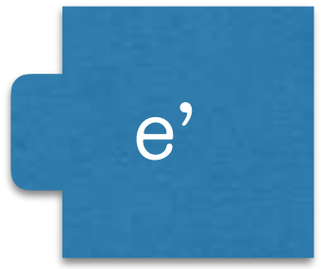
Linking requires types

import f : A.

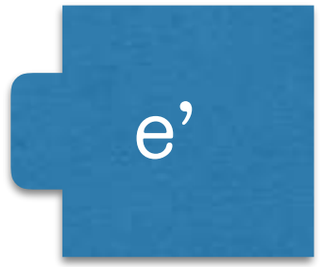
export f : A.



Linking requires types

import f : A.

export f : A.



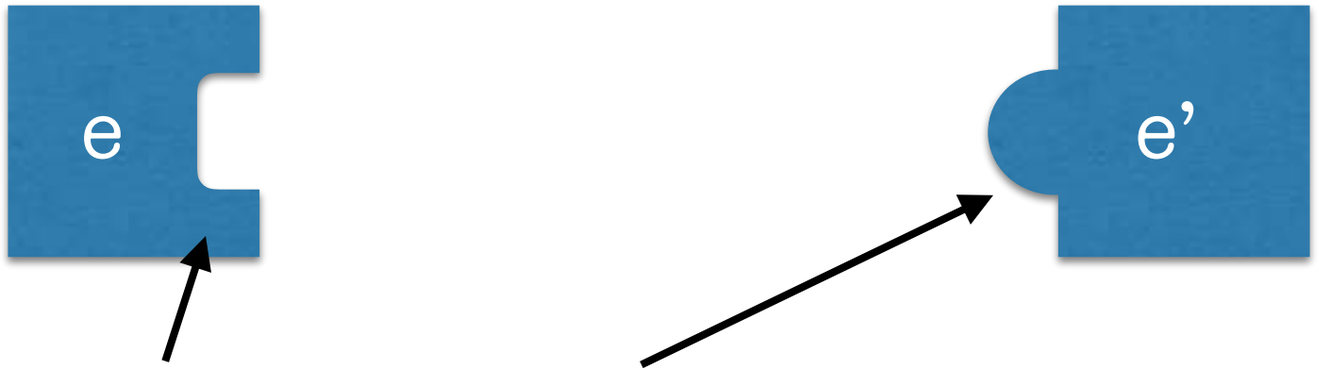
Type Checker:

You are go for linking.

Linking requires types

```
import f : A.
```

```
export f : B.
```



Type Checker:

Error, expected A but found B

Linking requires types

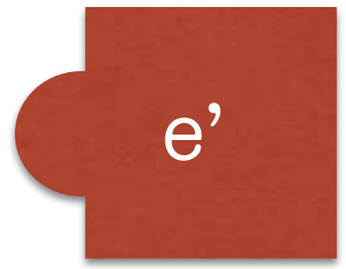
```
import f : A.
```


```
export f : B.
```

Linker:
Sure, there’s an f.

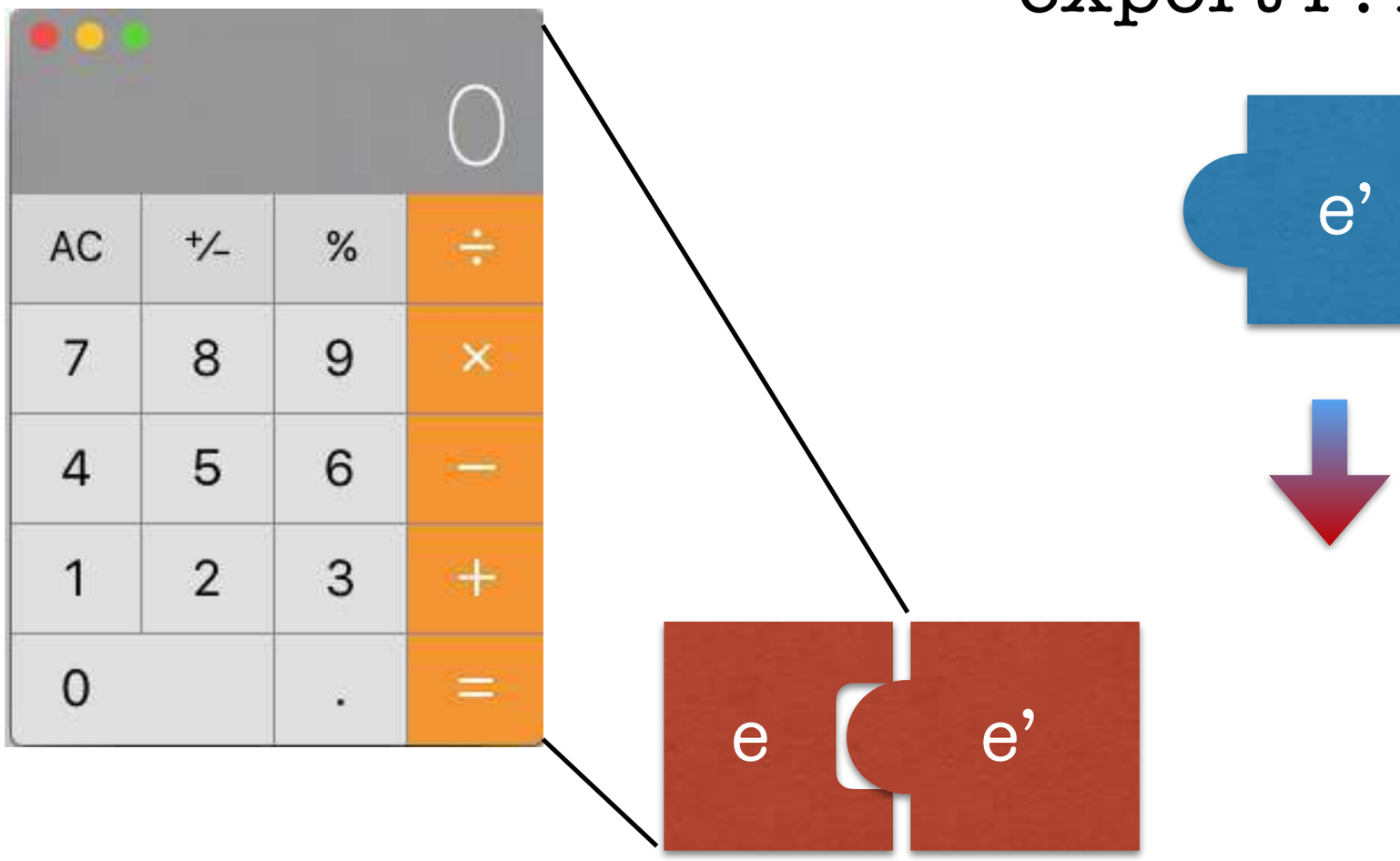
Linking requires types

export f : B.



Linker:
Sure, there’s an f.

Linking requires types



Linker:
Sure, there’s an f.

Type Preservation

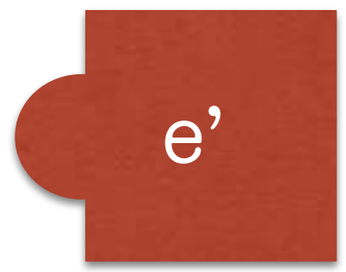
Theorem. (Type Preservation)

If $e : A$

then $e^+ : A^+$ compiles to

Linking requires types

export f : B.



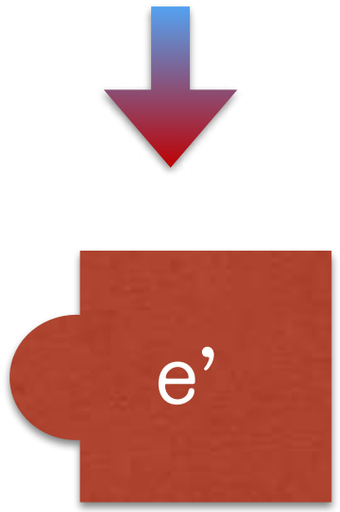
Linker/Type Checker:
Error: expected A+ but found B+

Okay, I get it…

abstractly

The Problem

```
export eq_mask: x:uint32_s → y:uint32_s →
                          {z:uint32_s |
   if reveal x = reveal y
      then reveal z = 0xffffffff
      else reveal z = 0x0}
```



The Solution:

Dependently Typed Assembly

First, some syntax

Start of block

```
label_name(r1:int32, rk:Π(r1:int32), pf:r1 = 0):
                jmp rk;
```

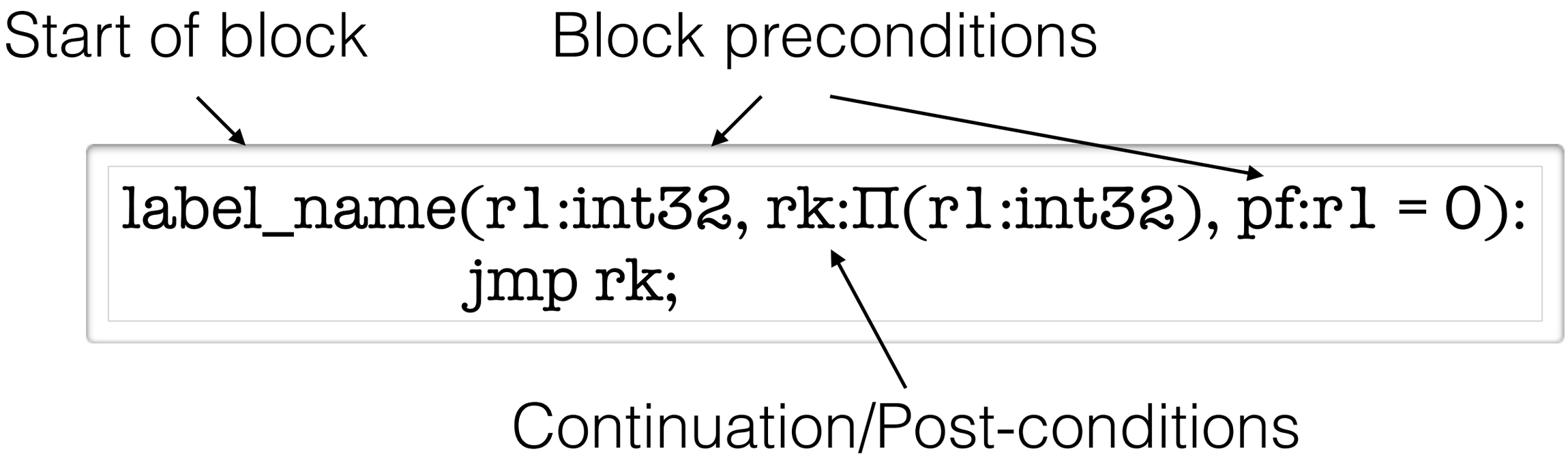
First, some syntax

Start of block

Block preconditions

```
label_name(r1:int32, rk:Π(r1:int32), pf:r1 = 0):
        jmp rk;
```

First, some syntax



One more thing

```
extern label_name : Π(r1:int32, rk:Π(r1:int32));
```

The Solution:

Dependently Typed Assembly

```
extern uint32_s : Type;

extern uint32_s=(x:uint32_s, y:uint32) : Prop;
```

The Solution:

Dependently Typed Assembly

```
extern uint32_s : Type;

extern uint32_s=(x:uint32_s, y:uint32) : Prop;

eq_mask(r1:uint32_s, r2:uint32_s,
     rk:Π(r3:uint32_s, pf:
          (And (r1 = r2 -> uint32_s= r3 0xffffffff)
               (r1 != r2 -> uint32_s= r3 0x0)))):
....
```

The Solution:

Dependently Typed Assembly

```
extern uint32_s : Type;

extern uint32_s=(x:uir
```

r1 and r2 are live, secure Integers

```
eq_mask(r1:uint32_s, r2:uint32_s,
      rk:Π(r3:uint32_s, pf:
            (And (r1 = r2 -> uint32_s= r3 0xffffffff)
                 (r1 != r2 -> uint32_s= r3 0x0)))):
....
```

The Solution:

Dependently Typed Assembly

```
extern uint32_s : Type;
```

post condition: r3 is secure integer, plus proof objects

```
eq_mask(r1:uint32_s, r2:uint32_s,
     rk:Π(r3:uint32_s, pf:
          (And (r1 = r2 -> uint32_s= r3 0xffffffff)
               (r1 != r2 -> uint32_s= r3 0x0)))):
....
```

Secure Linking

Linker/Type checker:
Type error: e trying to branch secure integer.