

Dependently Typed Assembly for Secure Linking

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Linking requires types

`import f : A.`



`export f : A.`

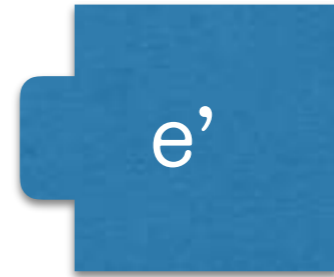


Linking requires types

`import f : A.`



`export f : A.`



Type Checker:

You are go for linking.

Linking requires types

import f : A.

export f : B.



Type Checker:

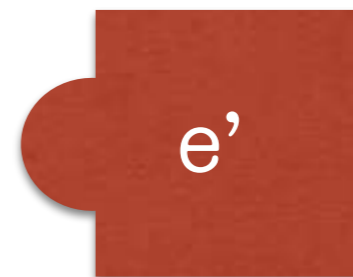
Error, expected A but found B

Linking requires types

import f : A.



export f : B.

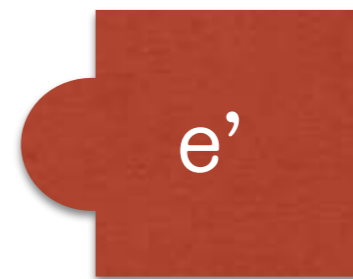


Linker:

Sure, there's an f.

Linking requires types

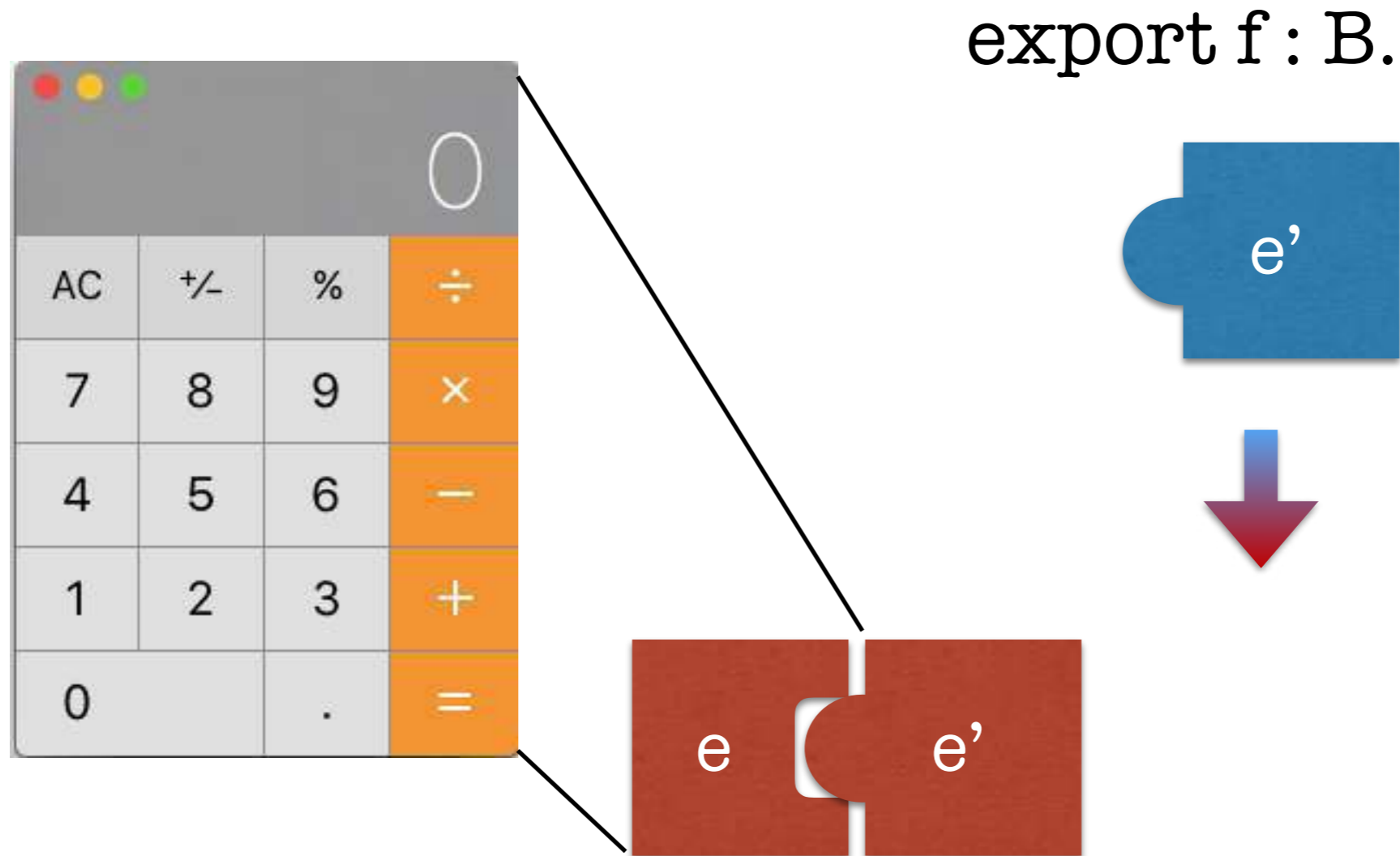
export f : B.



Linker:

Sure, there's an f.

Linking requires types



Linker:

Sure, there's an f.

Type Preservation

Theorem. (Type Preservation)

If

$e : A$

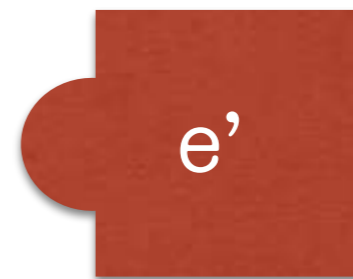
then

$e^+ : A^+$

compiles to

Linking requires types

`export f : B.`



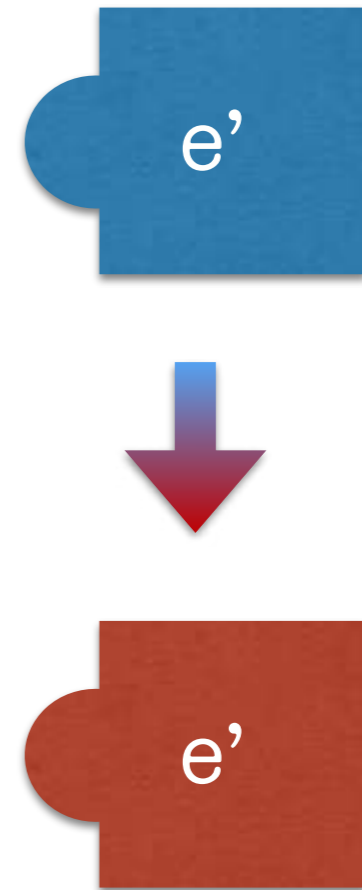
Linker/Type Checker:

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: $\Pi$ (r1:int32), pf:r1 = 0):  
    jmp rk;
```

First, some syntax

Start of block

Block preconditions



```
label_name(r1:int32, rk: $\Pi$ (r1:int32), pf:r1 = 0):  
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First, some syntax

Start of block

Block preconditions

```
label_name(r1:int32, rk: $\Pi$ (r1:int32), pf:r1 = 0):  
  jmp rk;
```

Continuation/Post-conditions

One more thing

```
extern label_name :  $\Pi(r1:int32, rk:\Pi(r1:int32))$ ;
```


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;
```

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.