Scala – From Zero to Testing

https://github.com/ericssmith/neb15

Eric Smith

Goals

Understand library APIs

Write principled code

Organize larger programs

Morning Agenda

- Intro
- IntelliJ
- Essentials
- Collections
- Sequencing

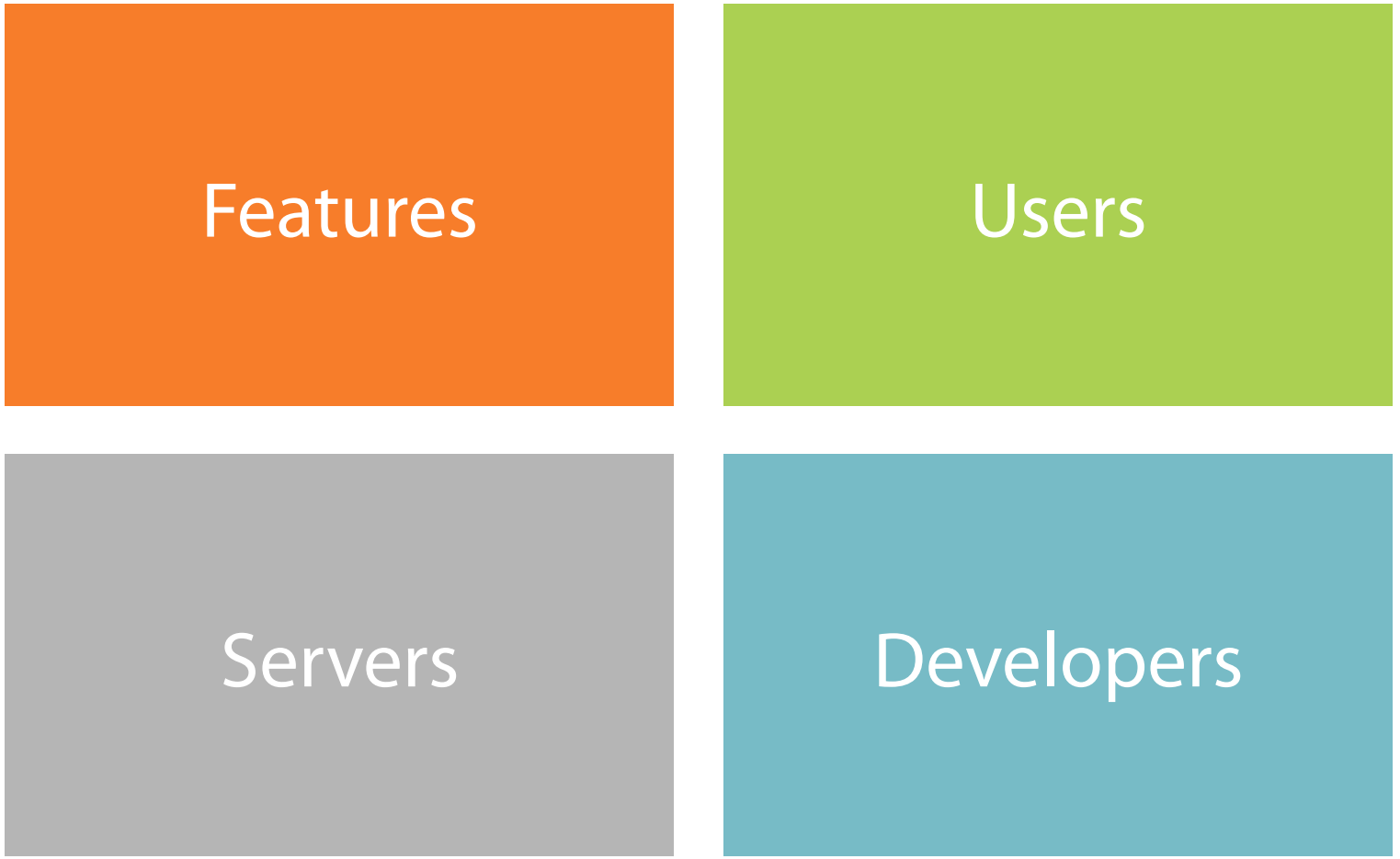
Afternoon Agenda

- Option
- I/O
- Java
- Testing
- Libraries

Scalable language

Scalable language

Scaling



Concepts

Expressions

Functions as values

Subtyping

Polymorphism

Algebraic types

Pattern matching

Abstract types

Modules

Use the worksheet (REPL)

Code with expressions

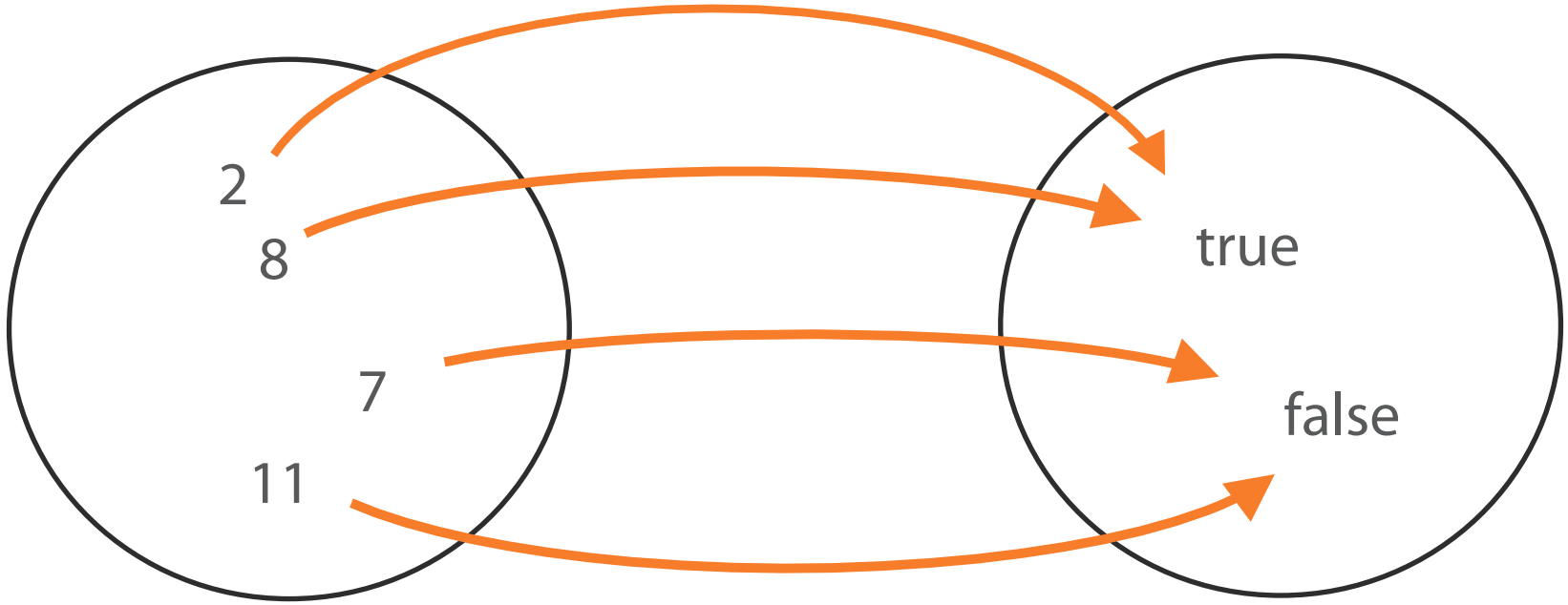
… the thing an expression denotes, i.e., its "value", depends only on the values of its sub-expressions

— Peter Landin

Think in functions

"Even"

What is the relation?



Integer
(Domain)

Boolean
(Codomain)

Domain	Image
....	???
-2	true
-1	false
0	true
1	false
2	true
3	false
4	true
....	???

Scala has modules

Modules

object keyword — no parameters to module
class keyword — parameterized module

Compile faster

Avoid name collisions

Hide things

Reasons we're interested in modules

Use algebraic types

Making types from other types: compound types

Algebra

Elements of one or more sets

Operations on elements of sets

Rules for relating the operations

Cartesian Product

Combining elements from multiple sets

"Product type"

Struct, record, tuples — these are supported in most programming languages.

Disjoint Union

Union of two or more sets without overlap

"Sum type"

These are not present in most programming languages.

```
data Shape = Circle Float | Rectangle Float Float

getShapeArea s = case s of
                   Circle r -> 3.14 * r * r
                   Rectangle l w -> l * w
```

Haskell

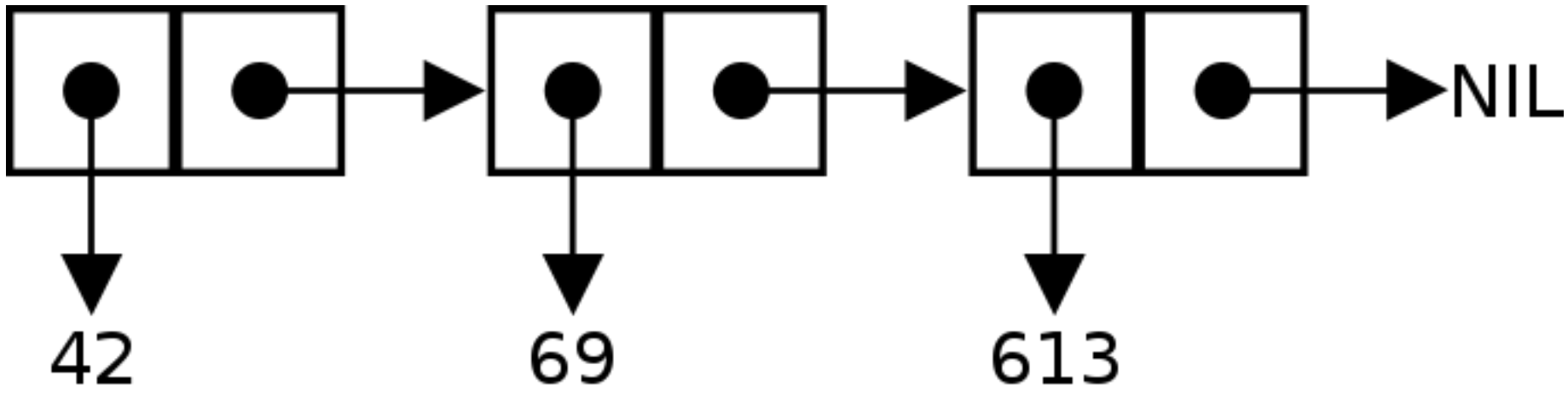
Eric likes Haskell. Haskell has nice motivating examples of many things.

```
type shape = Circle of float | Rectangle of (float * float)

let get_shape_area s = match s with
  | Circle r -> 3.14 *. r *. r
  | Rectangle (x, y) -> x *. y
```

OCaml

List from *cons* cells



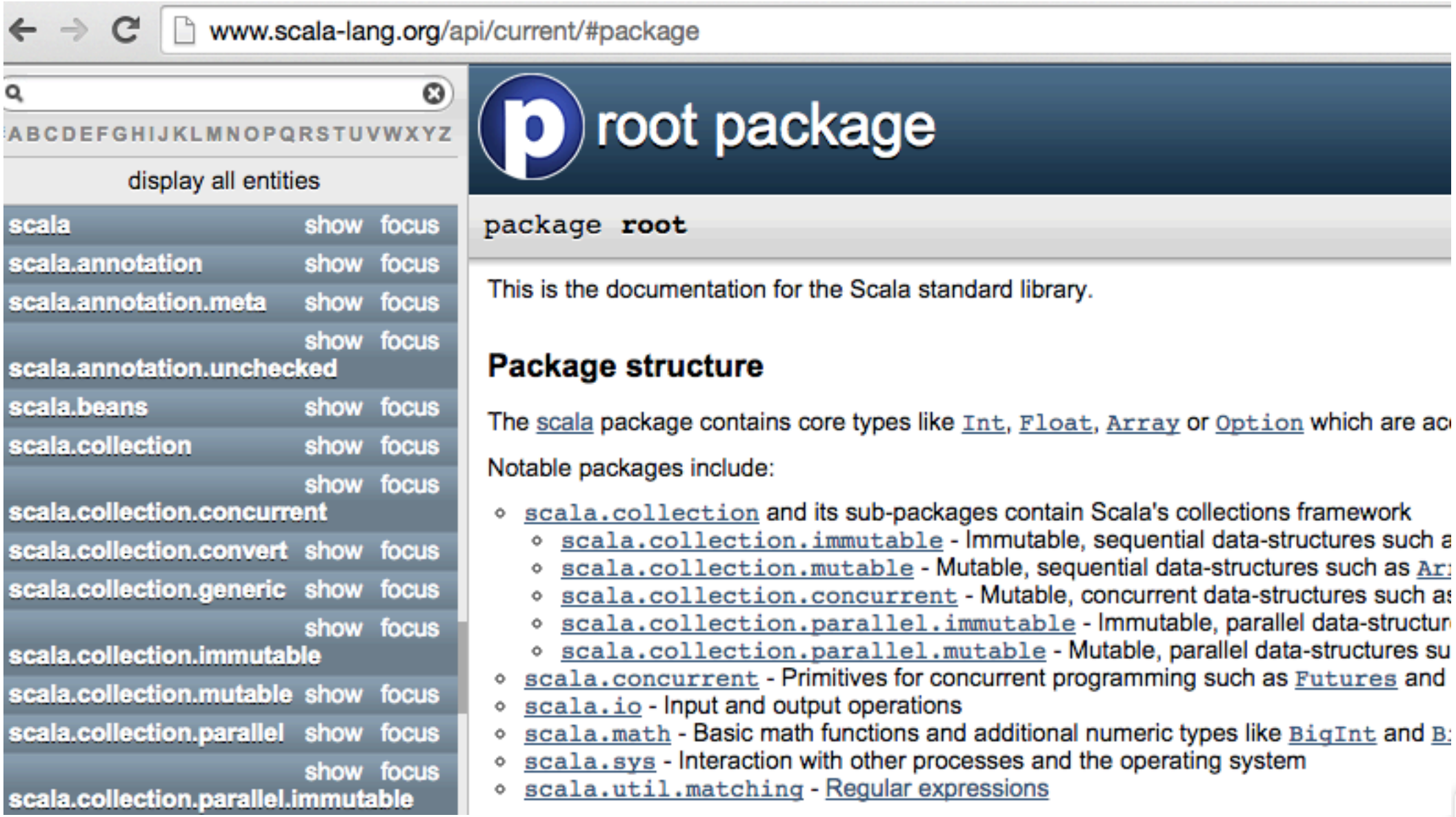
List(42, 69, 613)

42 :: 69 :: 613 :: NIL

Cons(42, Cons(69, Cons(613, NIL)))

Know the Collections

Scala Libraries



Collections – Performance

	head	tail	apply	update	prepend	append	insert
immutable							
`List`	C	C	L	L	C	L	-
`Stream`	C	C	L	L	C	L	-
`Vector`	eC	eC	eC	eC	eC	eC	-
`Stack`	C	C	L	L	C	C	L
`Queue`	aC	aC	L	L	L	C	-
`Range`	C	C	C	-	-	-	-
`String`	C	L	C	L	L	L	-

C	The operation takes (fast) constant time.
eC	The operation takes effectively constant time, but this might depend on some assumptions such as maximum length of a vector or distribution of hash keys.
aC	The operation takes amortized constant time. Some invocations of the operation might take longer, but if many operations are performed on average only constant time per operation is taken.
Log	The operation takes time proportional to the logarithm of the collection size.
L	The operation is linear, that is it takes time proportional to the collection size.
-	The operation is not supported.

Use Option

Prefer Option functions over pattern matching

Use Scalaz Disjunction

\/

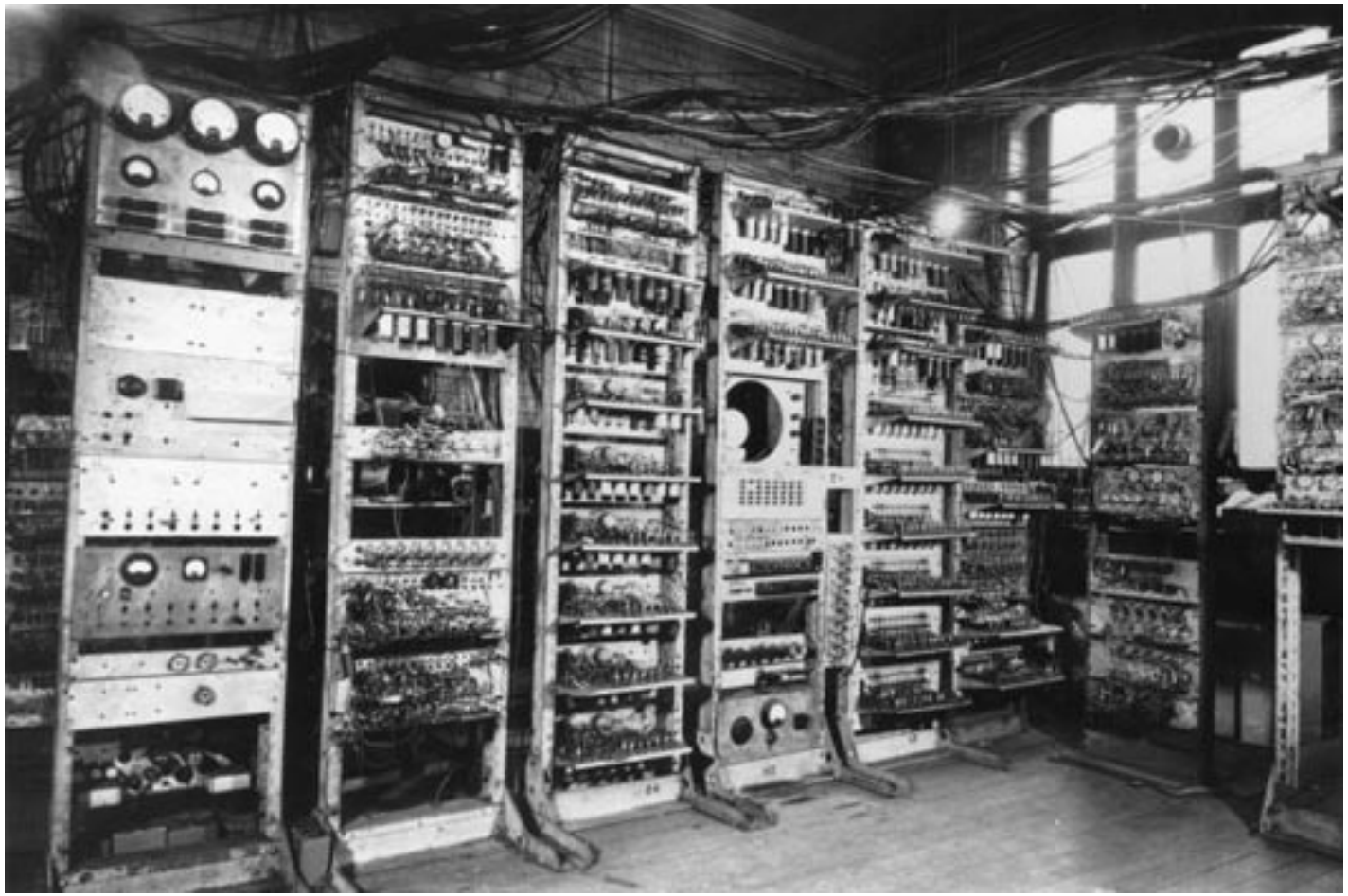
Keep side-effecting code
on the outside of the program

Avoid statements and variable assignment

Von Neumann programming languages use variables to imitate the computer's storage cells; control statements elaborate its jump and test instructions; and assignment statements imitate its fetching, storing, and arithmetic.

— John Backus

Manchester "Baby"



But one day it stopped, and there, shining brightly in the expected place, was the expected answer. It was a moment to remember. This was in June 1948, and nothing was ever the same again.

— Frank Williams

… the realization came over me with full force that a good part of the remainder of my life was going to be spent in finding errors in my own programs.

— Maurice Wilkes