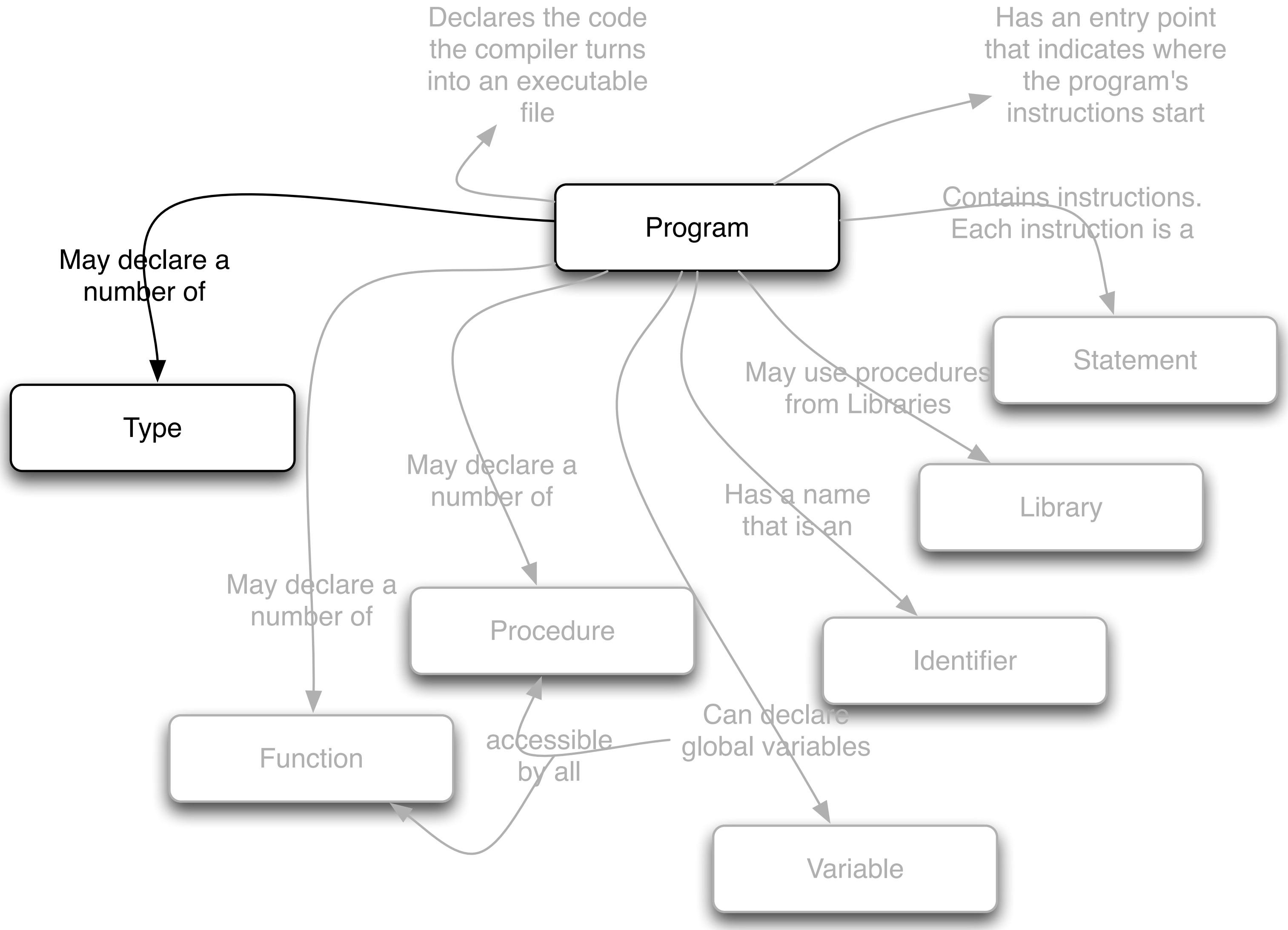
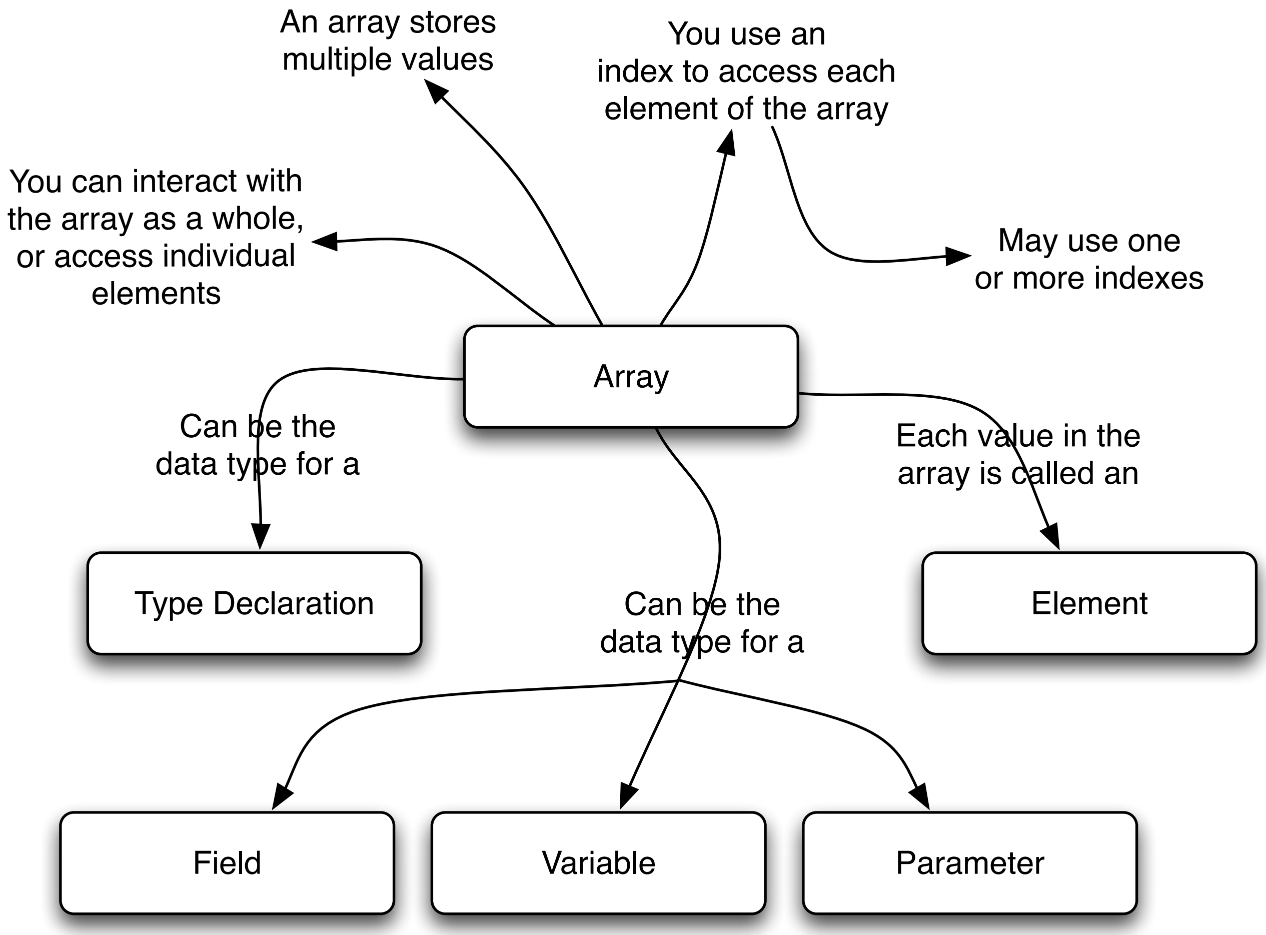
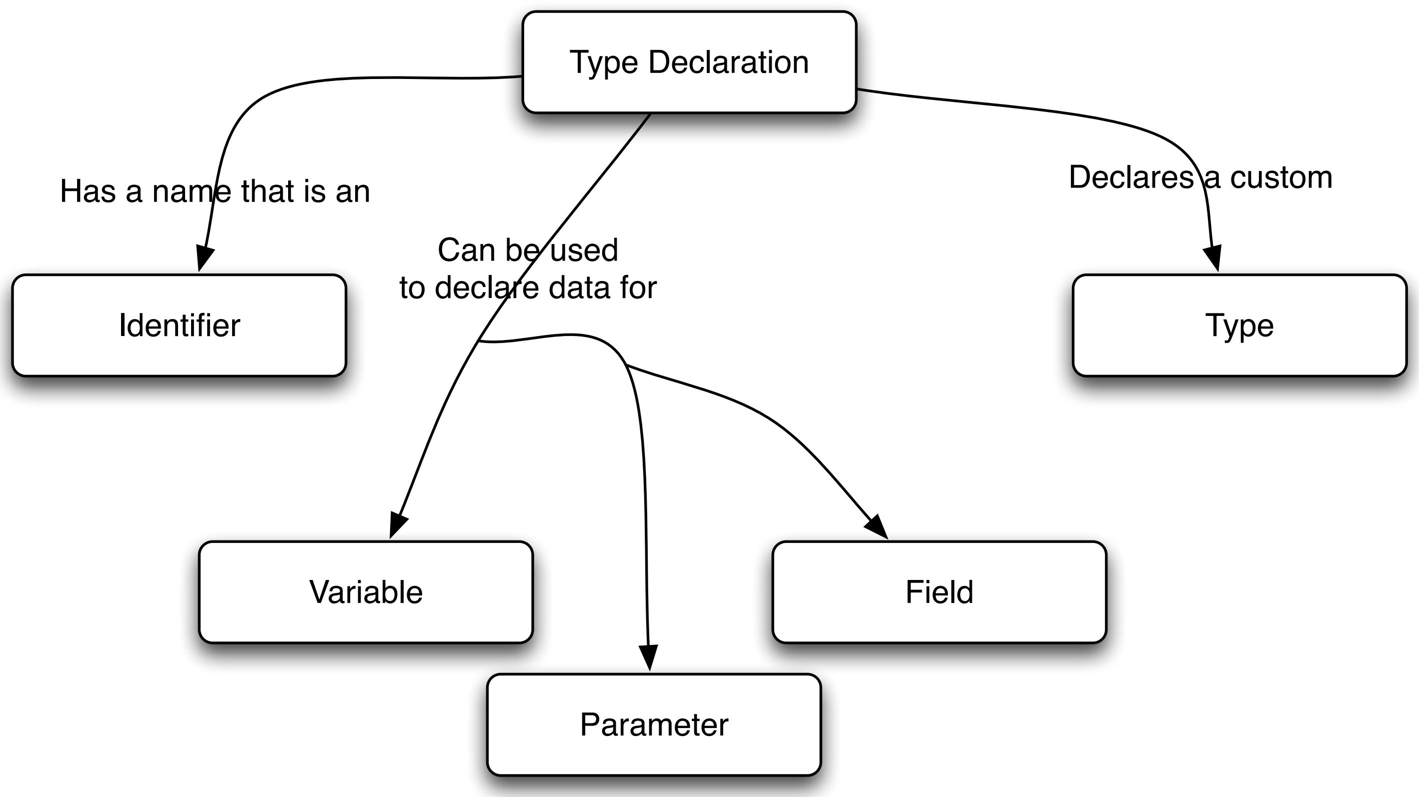
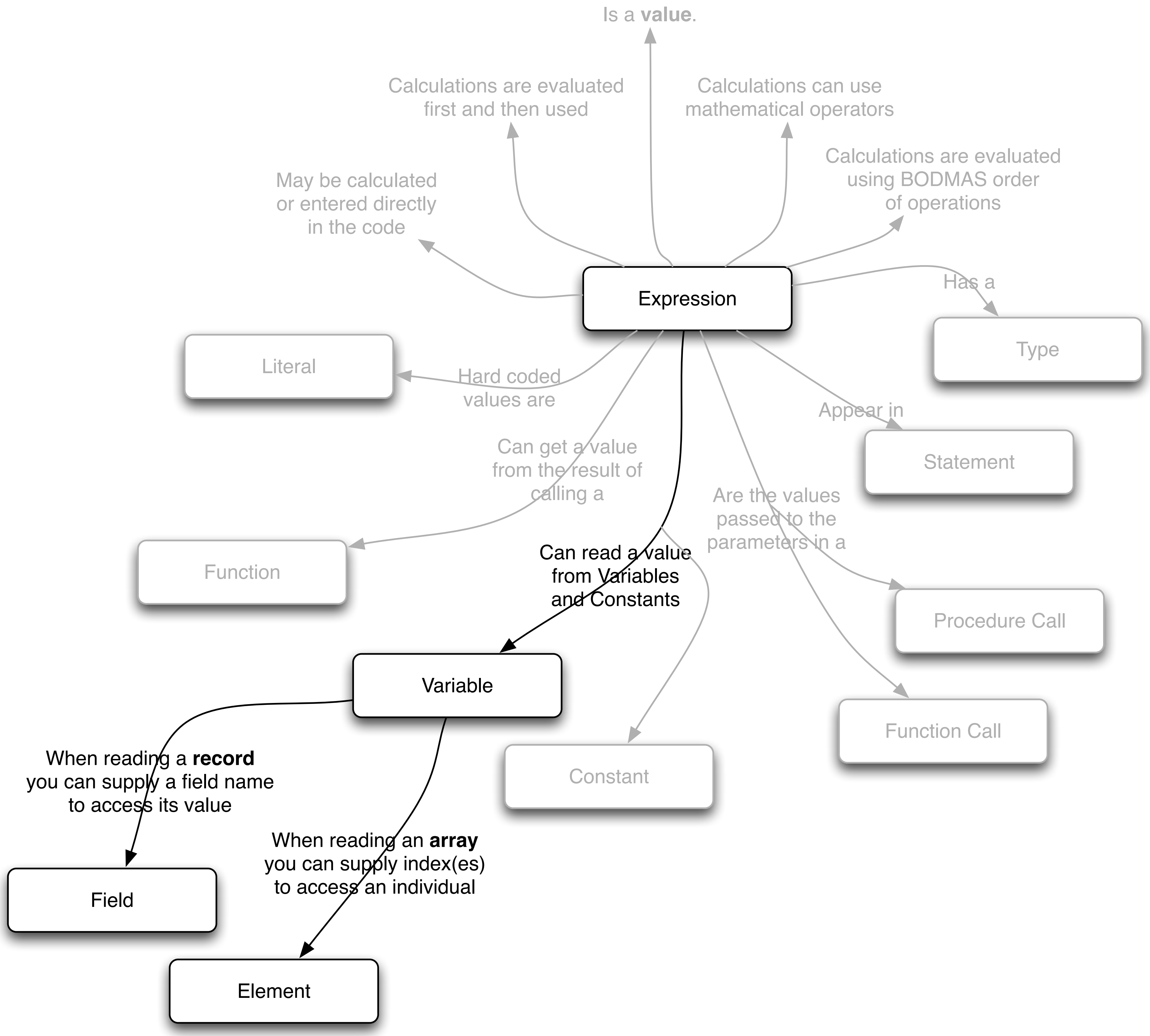

Declares the code the compiler turns into an executable file
Has an entry point that indicates where the program's instructions start
Program
Contains instructions. Each instruction is a
Statement
May declare a number of
Type
May use procedures from Libraries
Library
May declare a number of
Has a name that is an
Identifier
May declare a number of
Procedure
Function
accessible by all
Can declare global variables
Variable


An array stores multiple values
You use an index to access each element of the array
You can interact with the array as a whole, or access individual elements
May use one or more indexes
Array
Can be the data type for a
Each value in the array is called an
Type Declaration
Can be the data type for a
Element
Field
Variable
Parameter


Type Declaration
Has a name that is an
Identifier
Can be used
to declare data for
Declares a custom
Type
Variable
Field
Parameter



Is a **value**.

Calculations are evaluated first and then used

Calculations can use mathematical operators

Calculations are evaluated using BODMAS order of operations

May be calculated or entered directly in the code

Expression

Has a

Type

Literal

Hard coded values are

Appear in

Statement

Can get a value from the result of calling a

Are the values passed to the parameters in a

Function

Can read a value from Variables and Constants

Procedure Call

Variable

Function Call

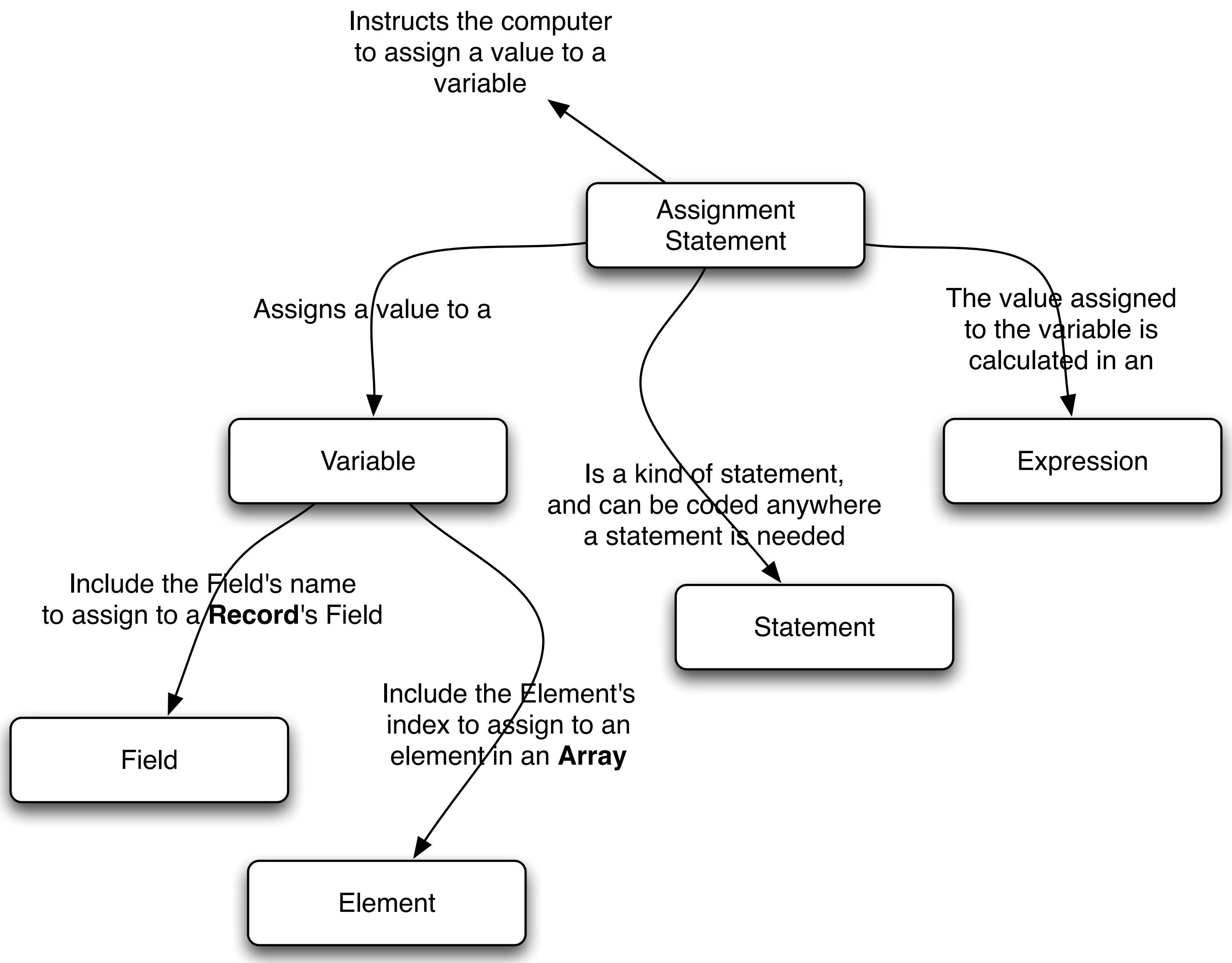
Constant

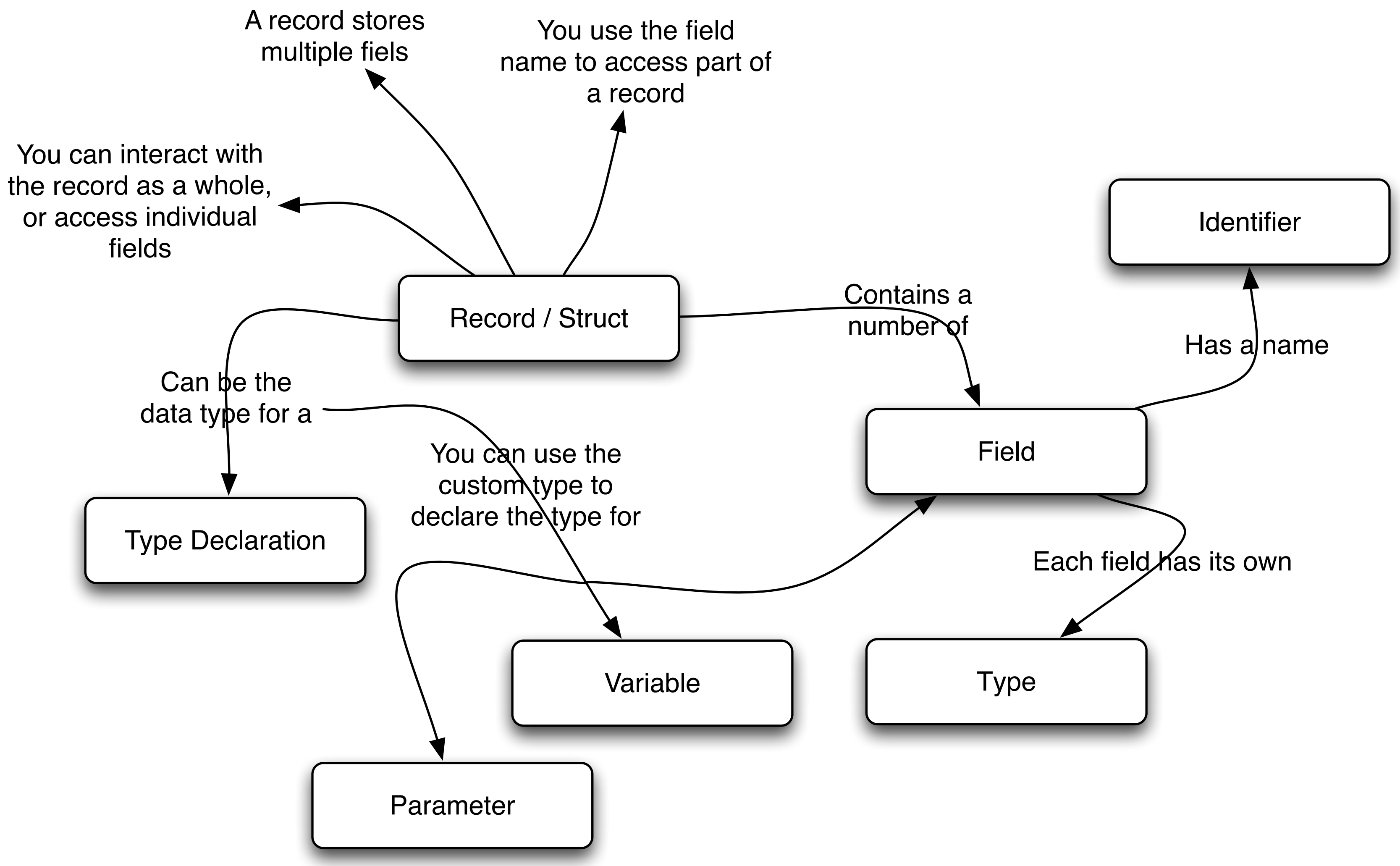
When reading a **record** you can supply a field name to access its value

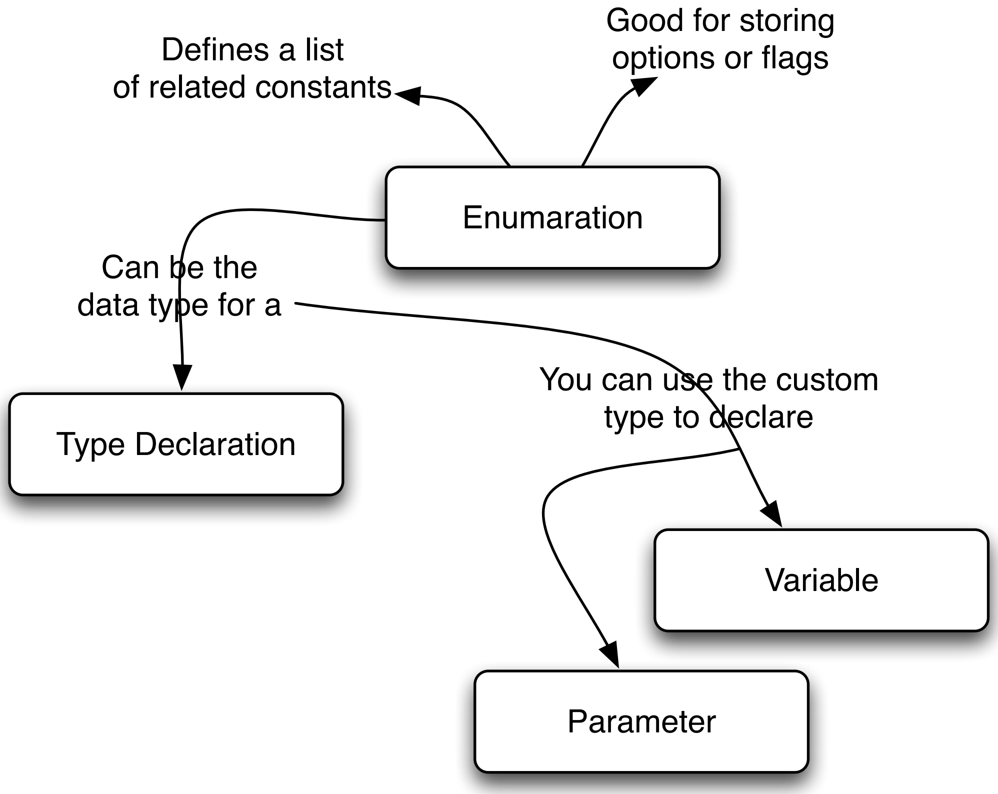
When reading an **array** you can supply index(es) to access an individual

Field

Element


Instructs the computer to assign a value to a variable
Assignment Statement
Assigns a value to a
The value assigned to the variable is calculated in an
Variable
Is a kind of statement, and can be coded anywhere a statement is needed
Expression
Include the Field's name to assign to a **Record**'s Field
Statement
Include the Element's index to assign to an element in an **Array**
Field
Element


A record stores multiple fiels
You use the field name to access part of a record
You can interact with the record as a whole, or access individual fields
Identifier
Record / Struct
Contains a number of
Has a name
Can be the data type for a
You can use the custom type to declare the type for
Field
Type Declaration
Each field has its own
Variable
Type
Parameter



Defines a list of related constants

Good for storing options or flags

Enumaration

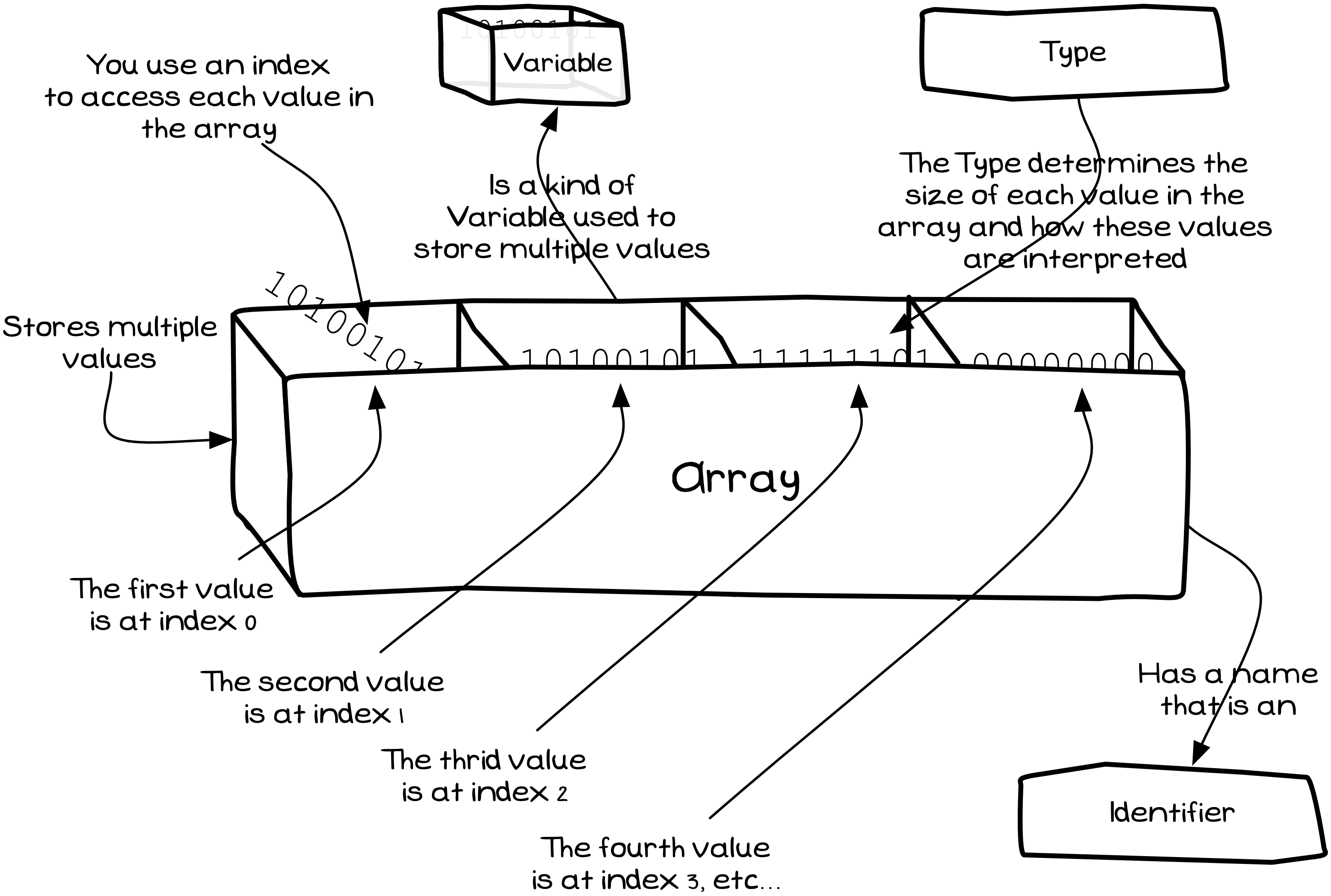
Can be the data type for a

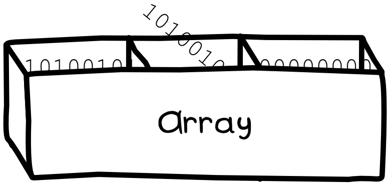
Type Declaration

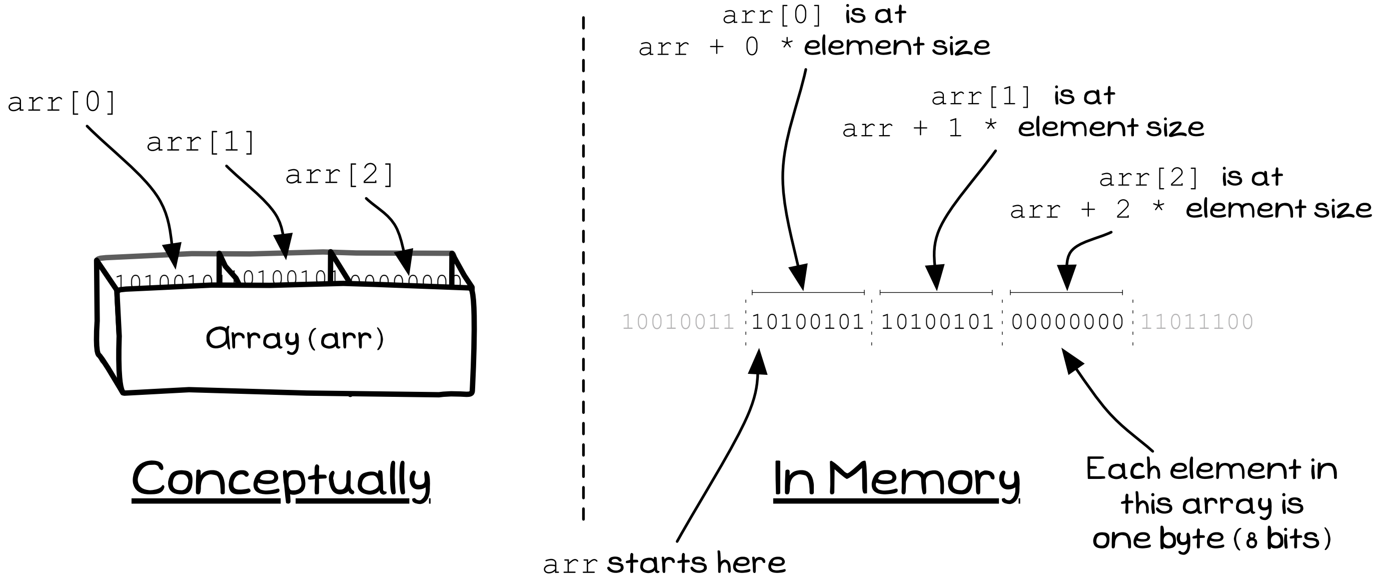
You can use the custom type to declare

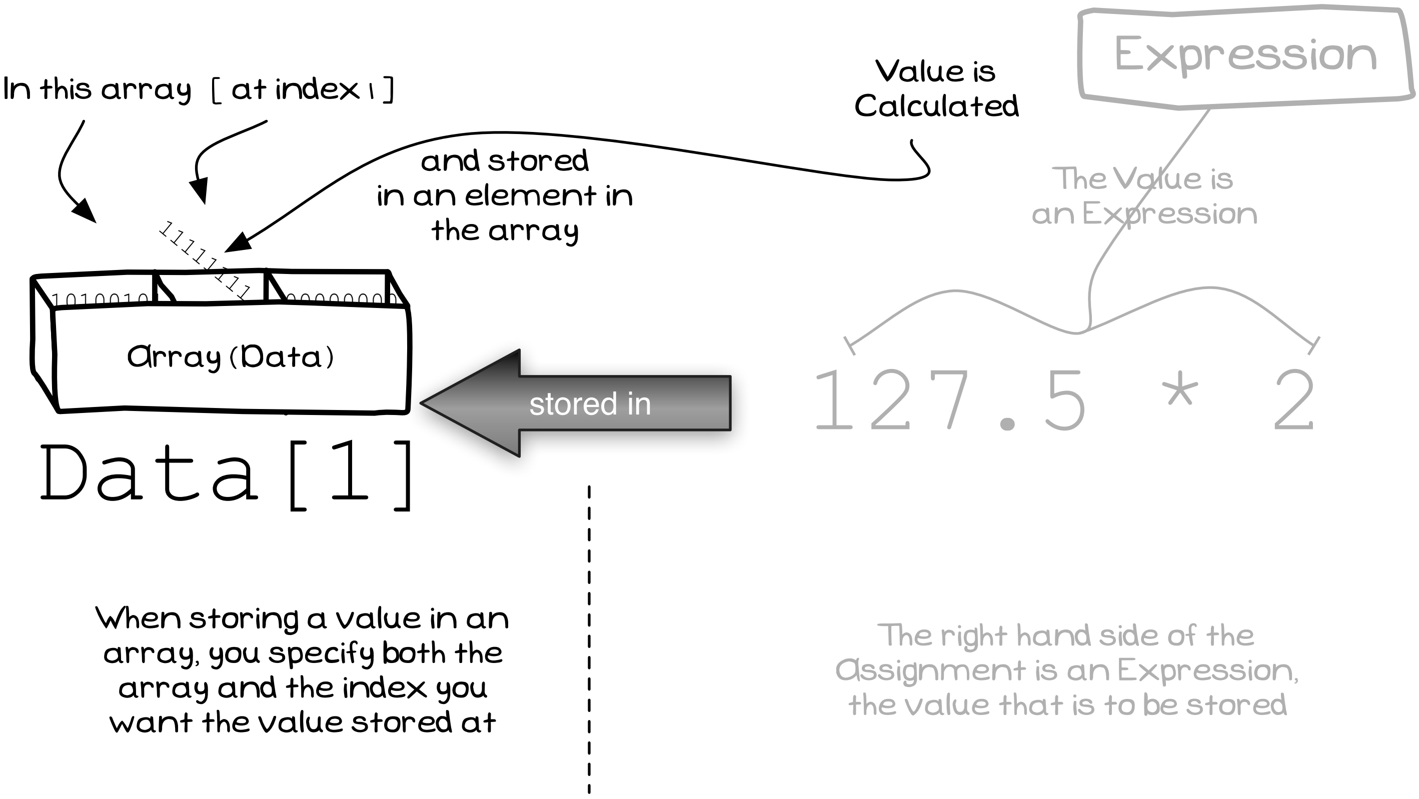
Variable

Parameter


Variable
10100101
Type
You use an index to access each value in the array
Is a kind of Variable used to store multiple values
The Type determines the size of each value in the array and how these values are interpreted
Stores multiple values
10100101
10100101
11111101
00000000
Array
The first value is at index 0
The second value is at index 1
The thrid value is at index 2
The fourth value is at index 3, etc...
Has a name that is an
Identifier

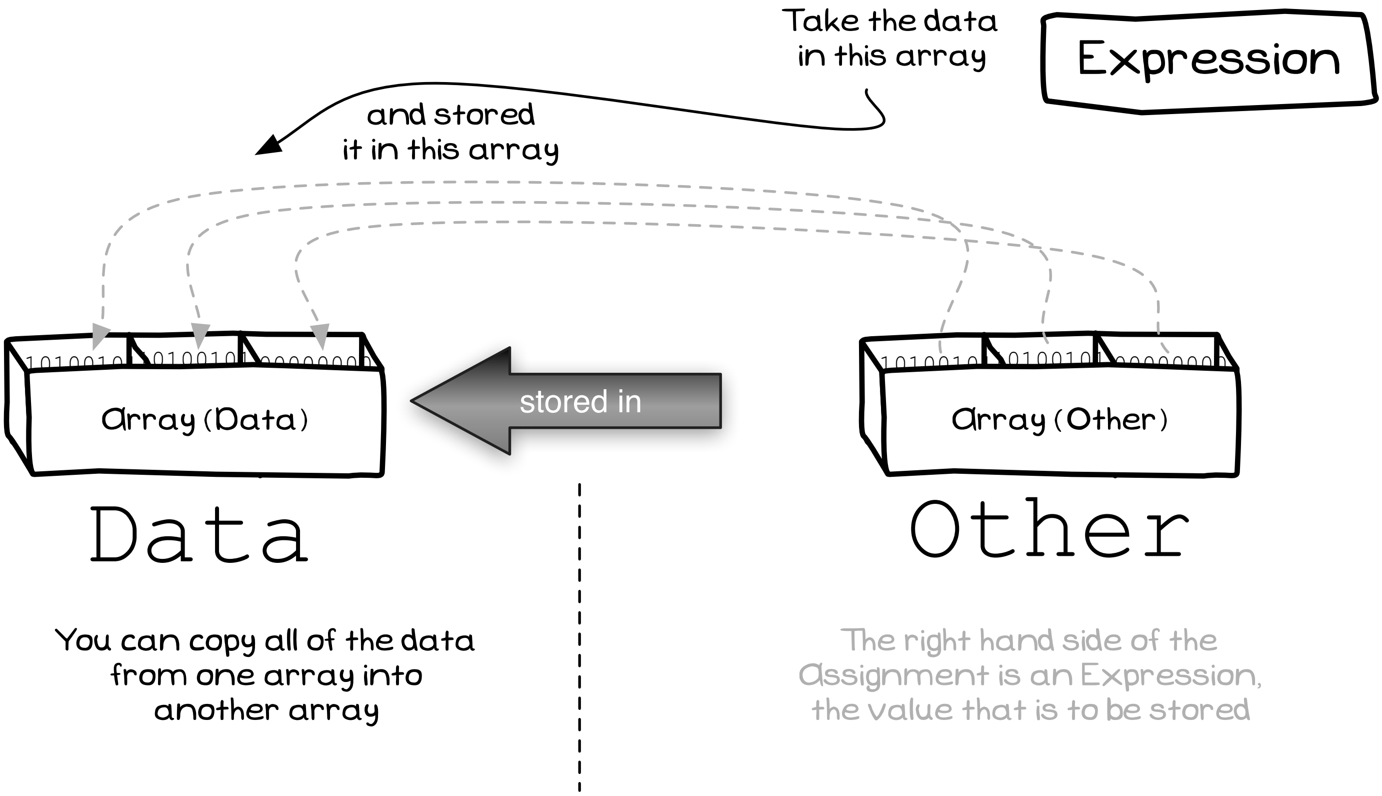

10100101
10100101
00000000
Array


arr[0]
arr[1]
arr[2]
10100101
10100101
00000000
Array (arr)
Conceptually
arr[0] is at
arr + 0 * element size
arr[1] is at
arr + 1 * element size
arr[2] is at
arr + 2 * element size
10010011
10100101
10100101
00000000
11011100
In Memory
arr starts here
Each element in this array is one byte (8 bits)


In this array [at index 1]
Value is Calculated
and stored in an element in the array
Expression
The Value is an Expression
11111111
1010010
00000000
Array (Data)
stored in
Data[1]
127.5 * 2

When storing a value in an array, you specify both the array and the index you want the value stored at

The right hand side of the Assignment is an Expression, the value that is to be stored

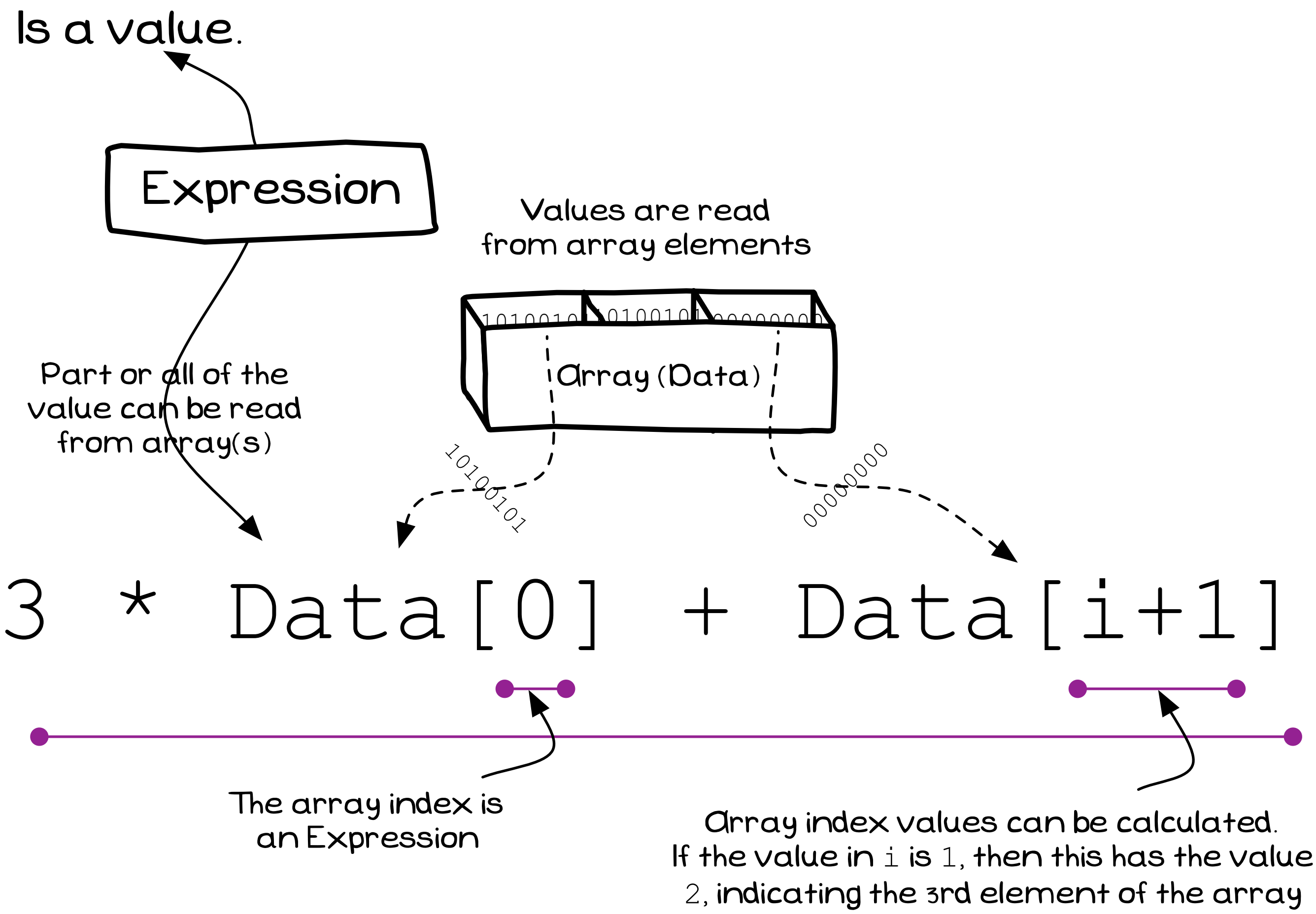


Take the data in this array

and stored it in this array

You can copy all of the data from one array into another array

The right hand side of the Assignment is an Expression, the value that is to be stored



Is a value.

Expression

Values are read from array elements

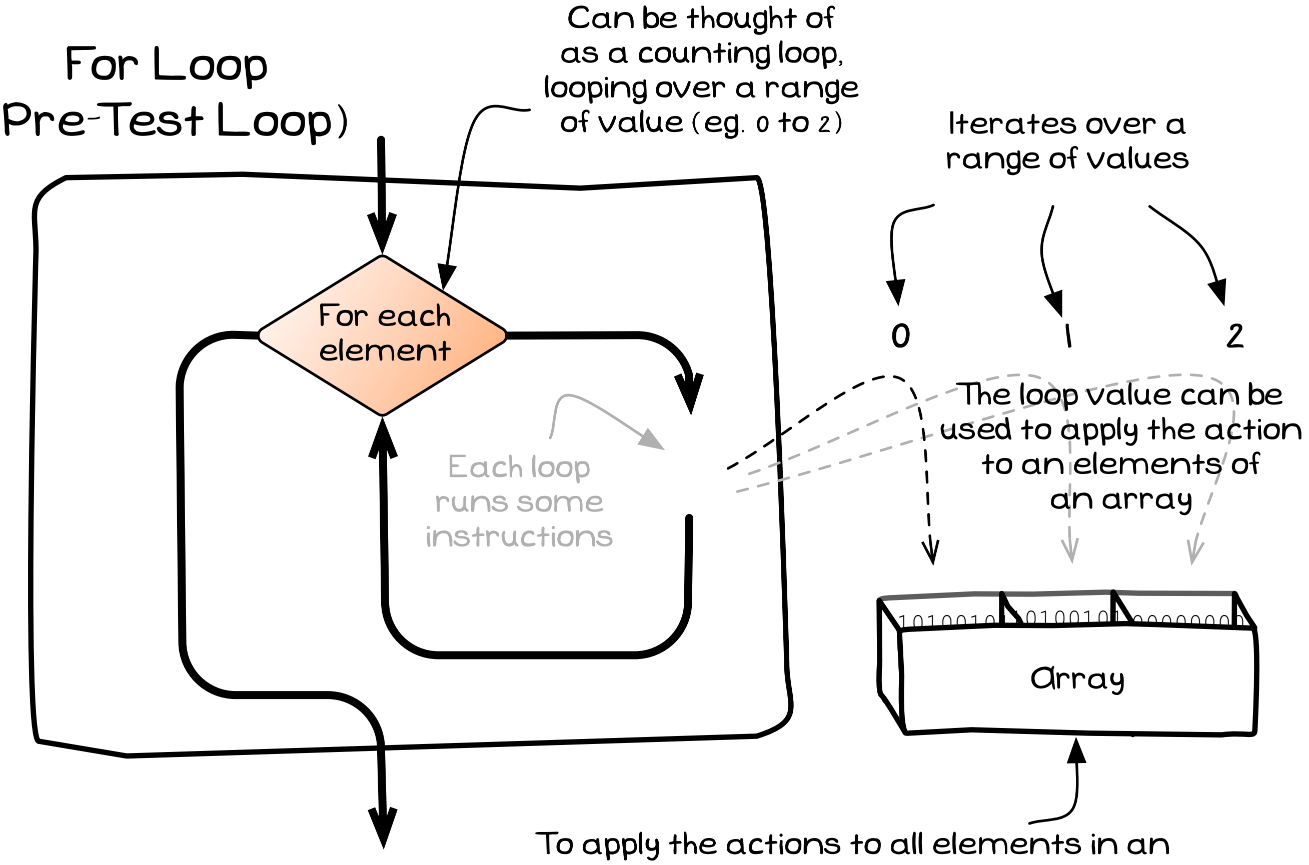
Part or all of the value can be read from array(s)

```
3 * Data[0] + Data[i+1]
```

The array index is an Expression

Array index values can be calculated. If the value in `i` is `1`, then this has the value `2`, indicating the 3rd element of the array

For Loop
(Pre-Test Loop)



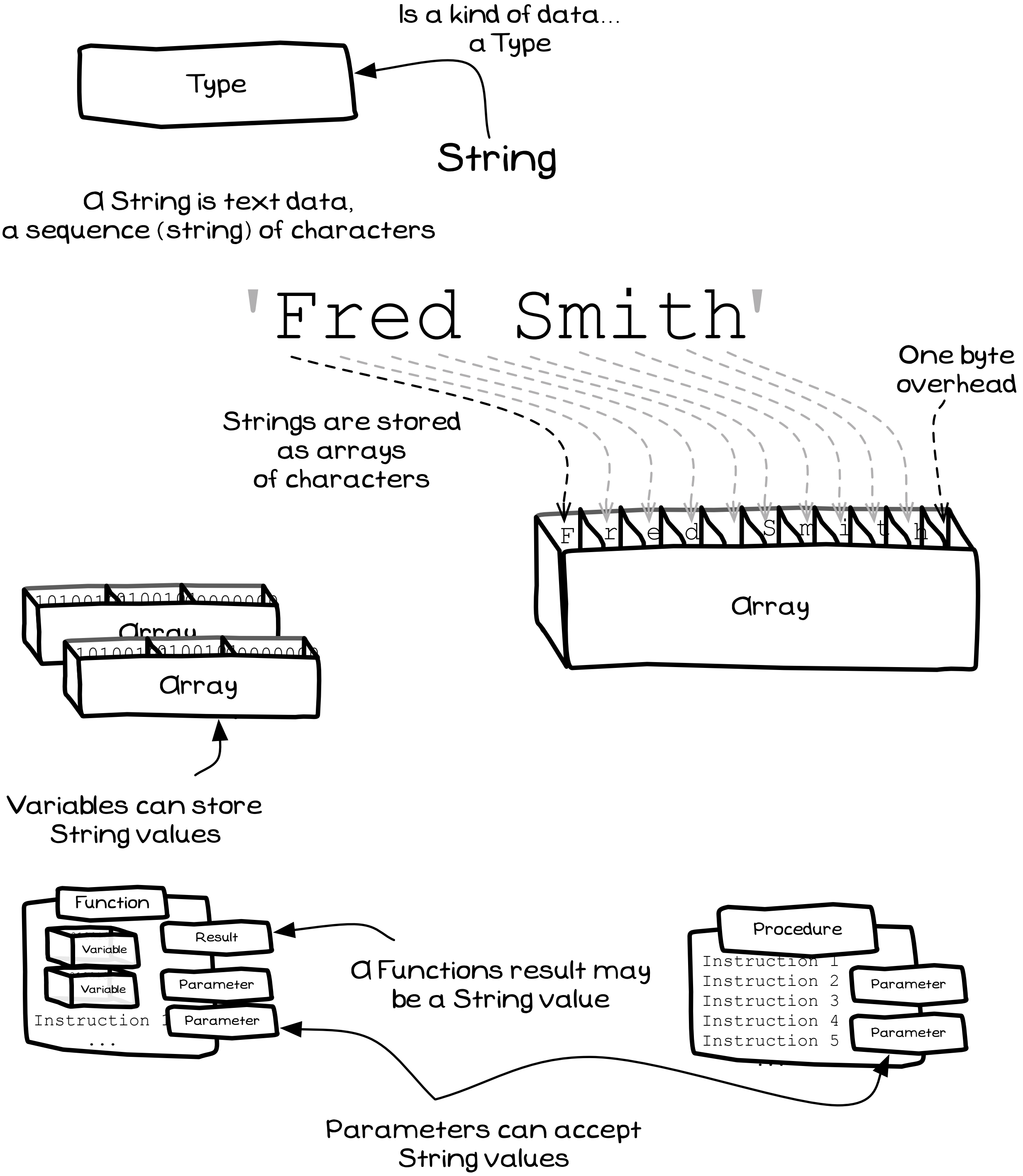
Can be thought of as a counting loop, looping over a range of value (eg. 0 to 2)

Iterates over a range of values

Each loop runs some instructions

The loop value can be used to apply the action to an elements of an array

To apply the actions to all elements in an array the for loop is used to count from the array's lowest index to its highest index.



Is a kind of data...
a Type

String

A String is text data,
a sequence (string) of characters

'Fred Smith'

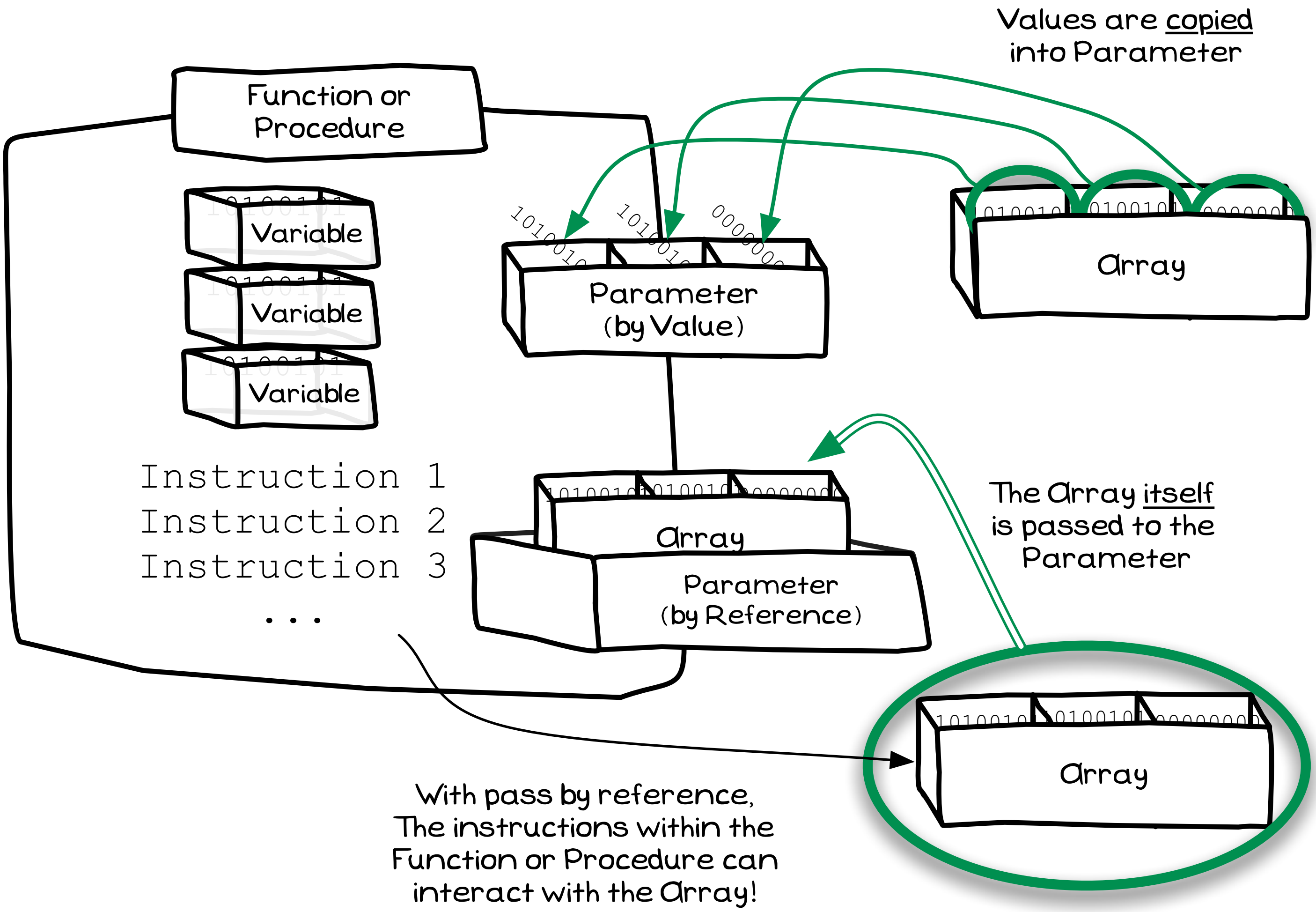
Strings are stored
as arrays
of characters

One byte
overhead

Variables can store
String values

A Functions result may
be a String value

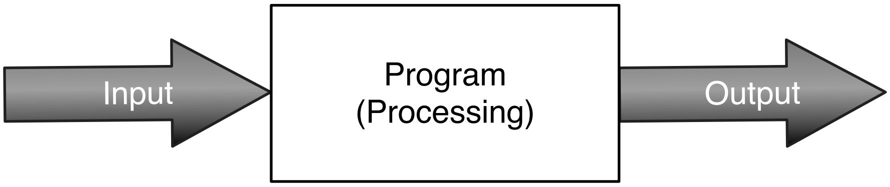
Parameters can accept
String values

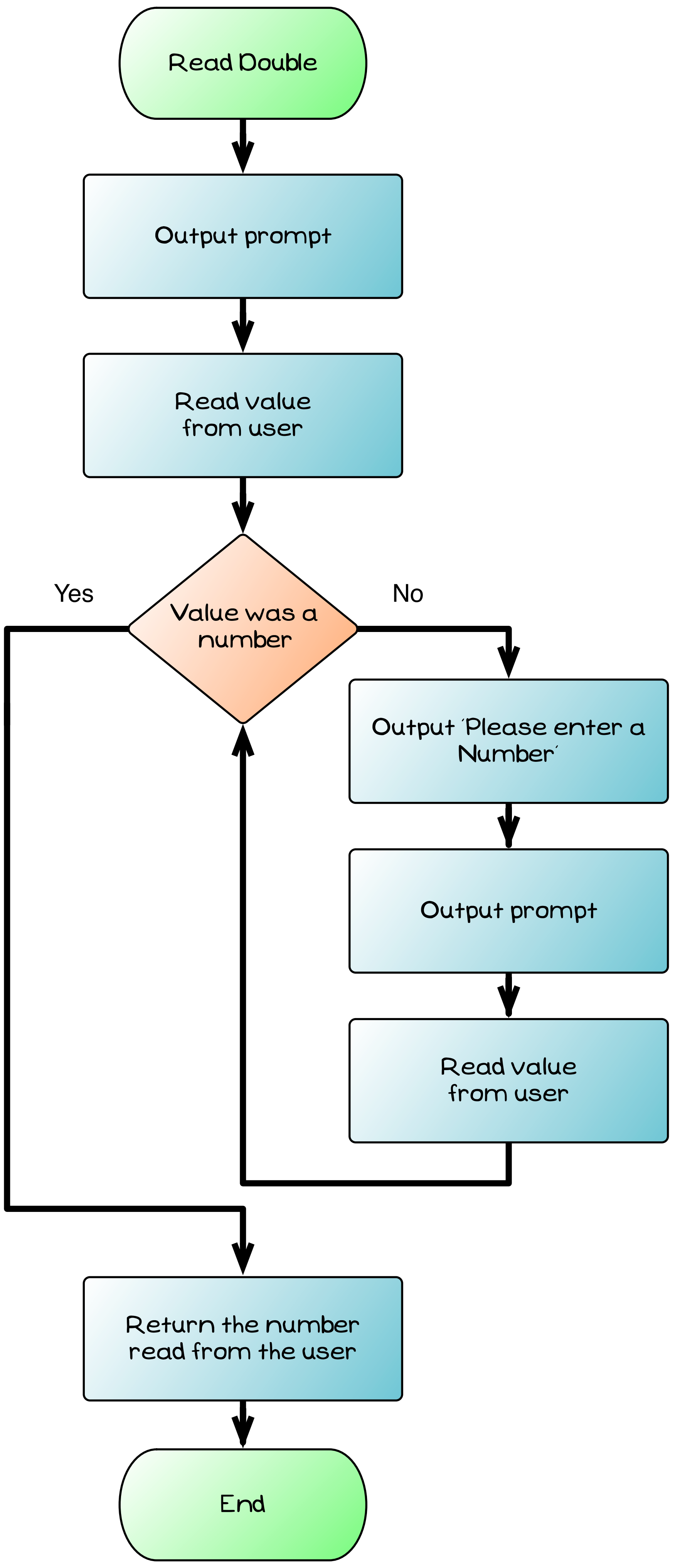


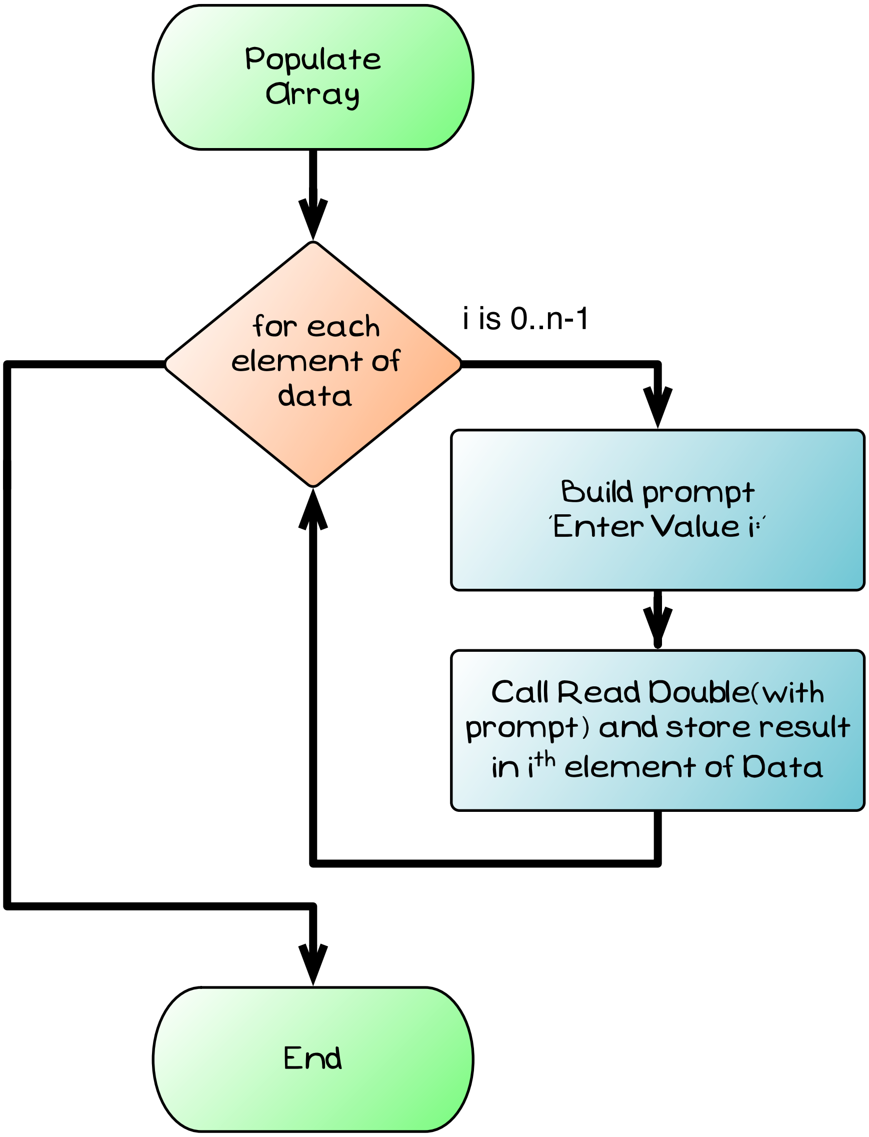
Values are copied into Parameter

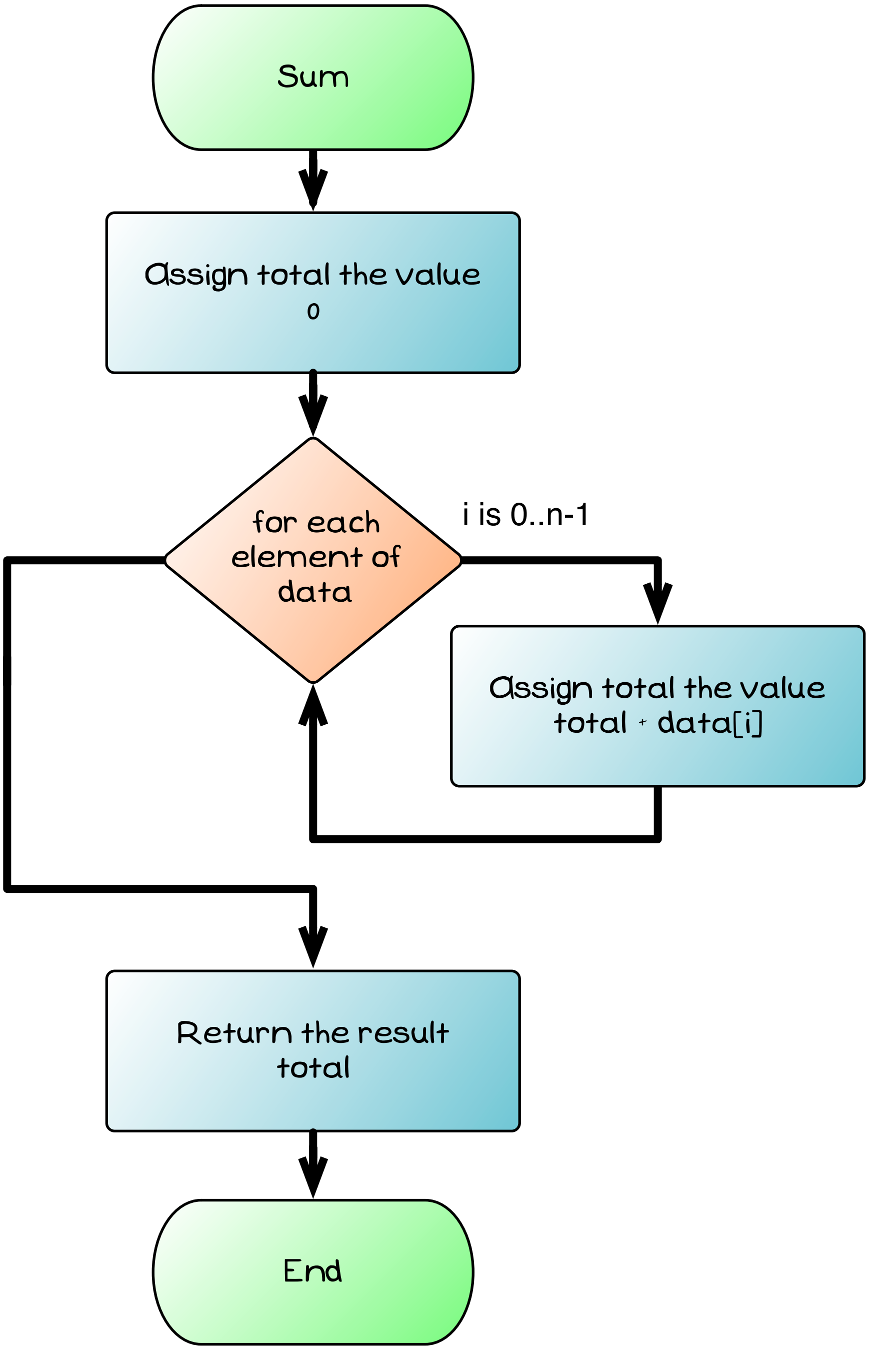
The Array itself is passed to the Parameter

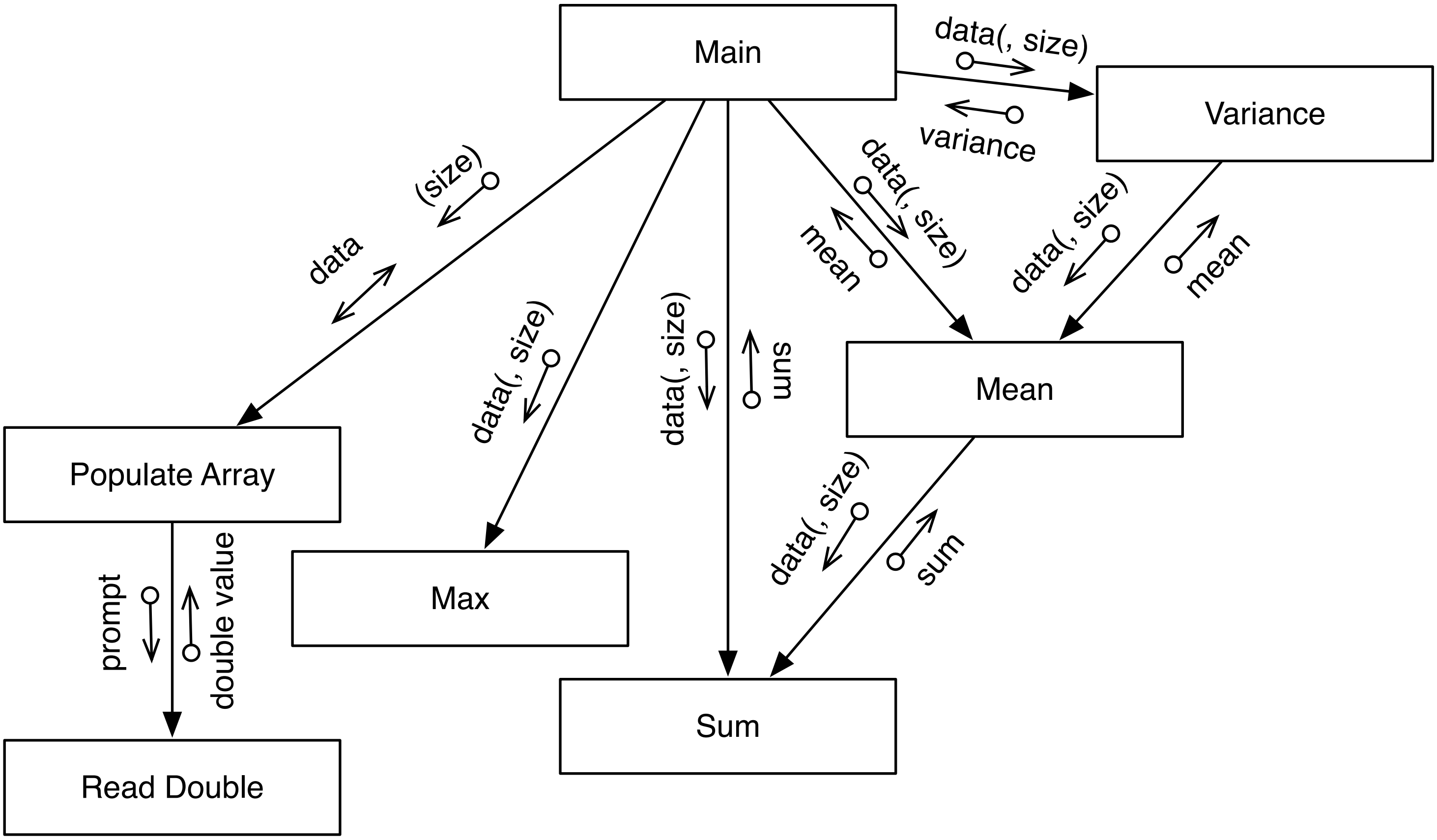
With pass by reference, The instructions within the Function or Procedure can interact with the Array!

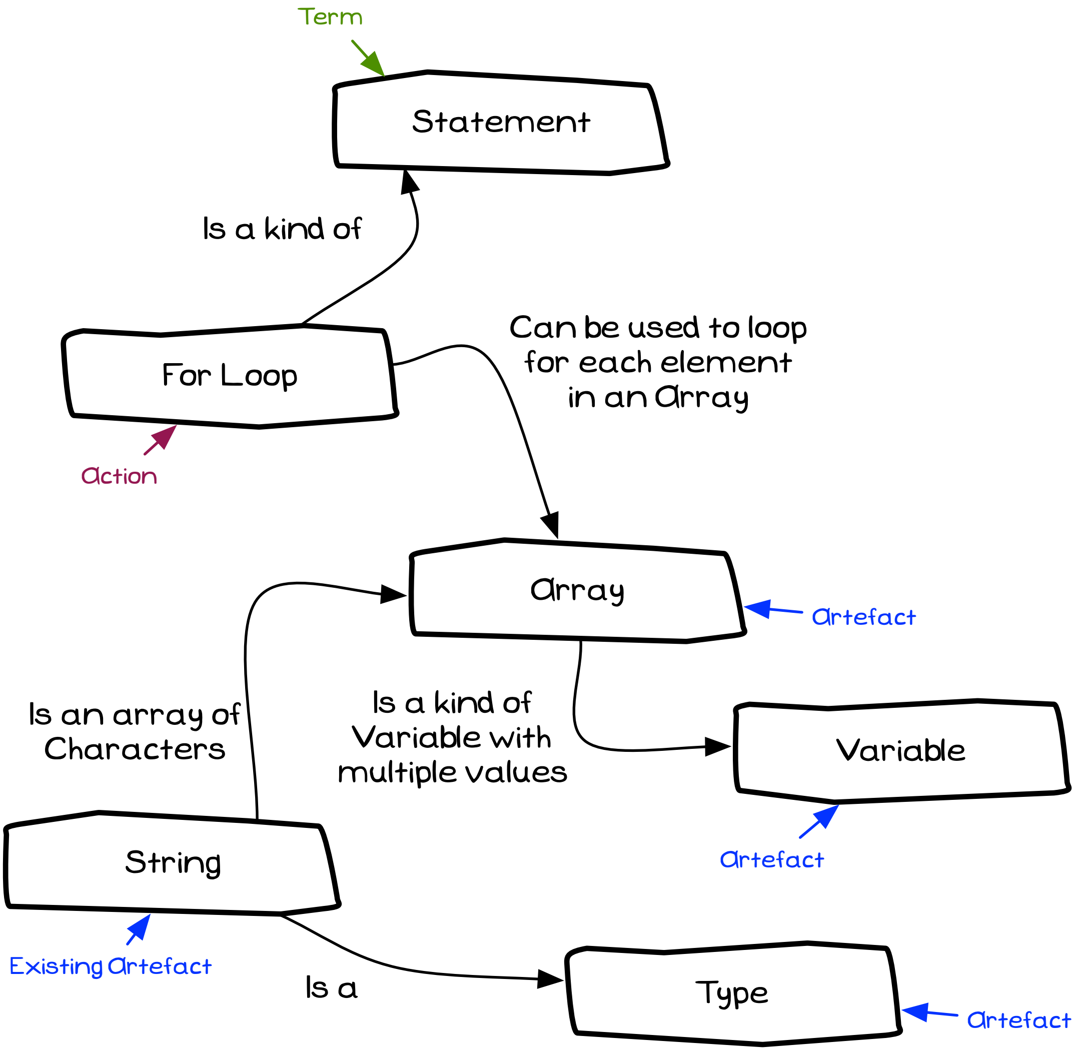

Input
Program
(Processing)
Output

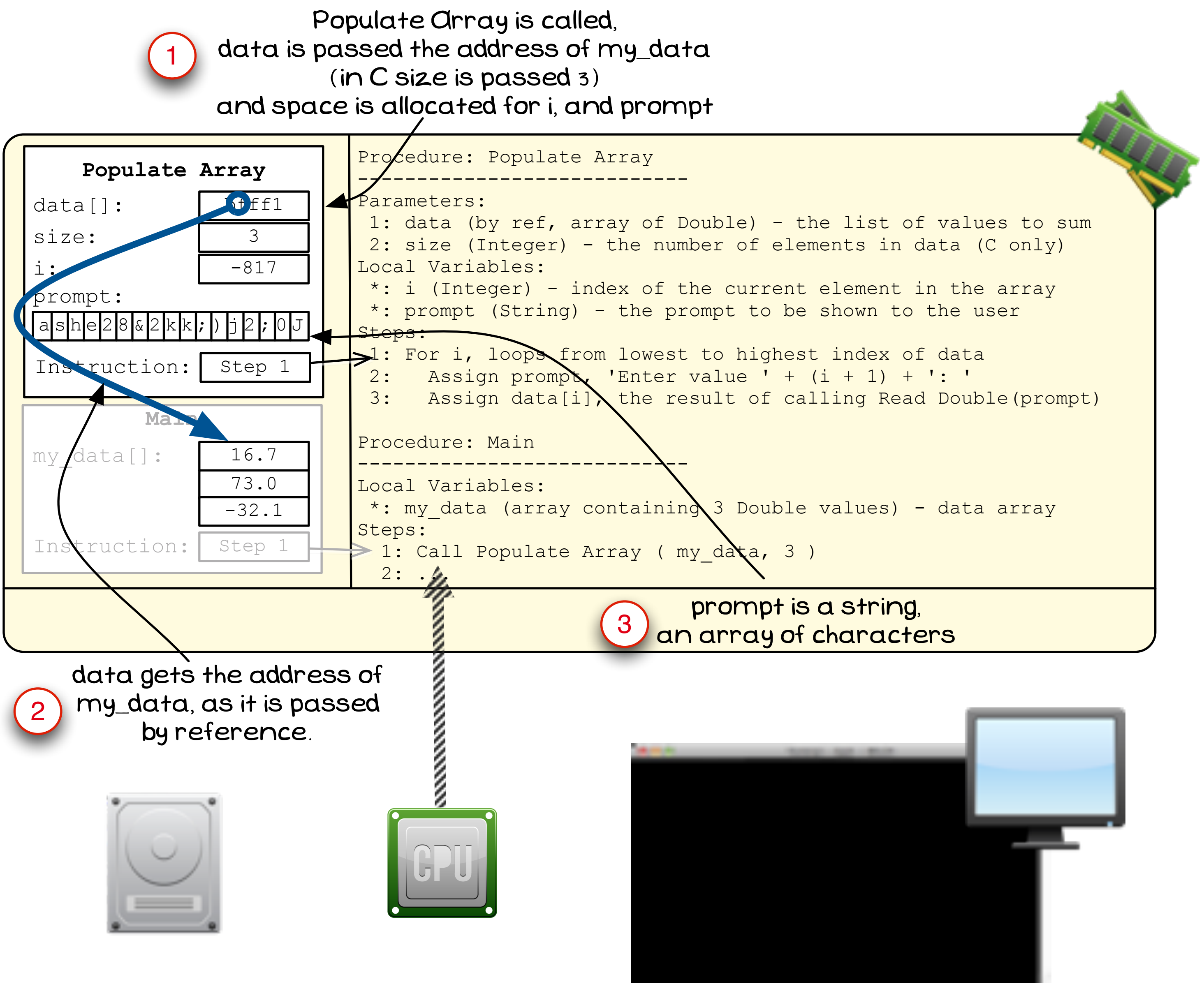

Read Double
Output prompt
Read value from user
Value was a number
Yes
No
Output 'Please enter a Number'
Output prompt
Read value from user
Return the number read from the user
End


Populate Array
for each element of data
i is 0..n-1
Build prompt 'Enter Value i:'
Call Read Double(with prompt) and store result in i^th element of Data
End


Sum
Assign total the value 0
for each element of data
i is 0..n-1
Assign total the value total + data[i]
Return the result total
End


Main
data(, size)
variance
Variance
(size)
data
data(, size)
mean
data(, size)
mean
data(, size)
data(, size)
sum
Mean
Populate Array
data(, size)
sum
prompt
double value
Max
Sum
Read Double


Term
Statement
Is a kind of
For Loop
Action
Can be used to loop for each element in an Array
Array
Artefact
Is an array of Characters
Is a kind of Variable with multiple values
Variable
Artefact
String
Existing Artefact
Is a
Type
Artefact



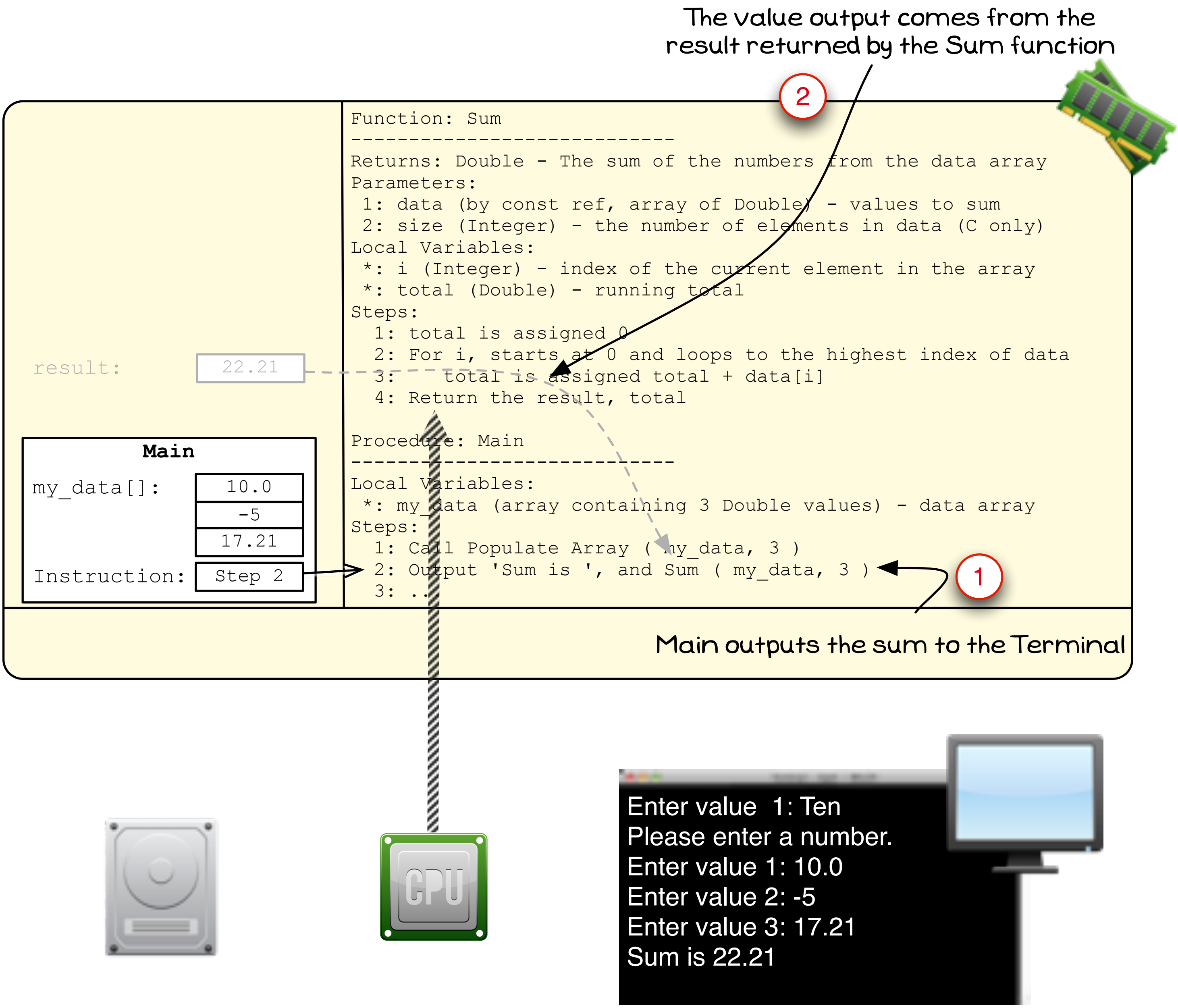
```
Procedure: Populate Array
-----------------------------
Parameters:
 1: data (by ref, array of Double) - the list of values to sum
 2: size (Integer) - the number of elements in data (C only)
Local Variables:
 *: i (Integer) - index of the current element in the array
 *: prompt (String) - the prompt to be shown to the user
Steps:
 1: For i, loops from lowest to highest index of data
 2:   Assign prompt, 'Enter value ' + (i + 1) + ': '
 3:   Assign data[i], the result of calling Read Double(prompt)

Procedure: Main
-----------------------------
Local Variables:
 *: my_data (array containing 3 Double values) - data array
Steps:
  1: Call Populate Array ( my_data, 3 )
  2: ...
```

1 Populate Array is called,
data is passed the address of my_data
(in C size is passed 3)
and space is allocated for i, and prompt

2 data gets the address of
my_data, as it is passed
by reference.

3 prompt is a string,
an array of characters



The value output comes from the result returned by the Sum function

2

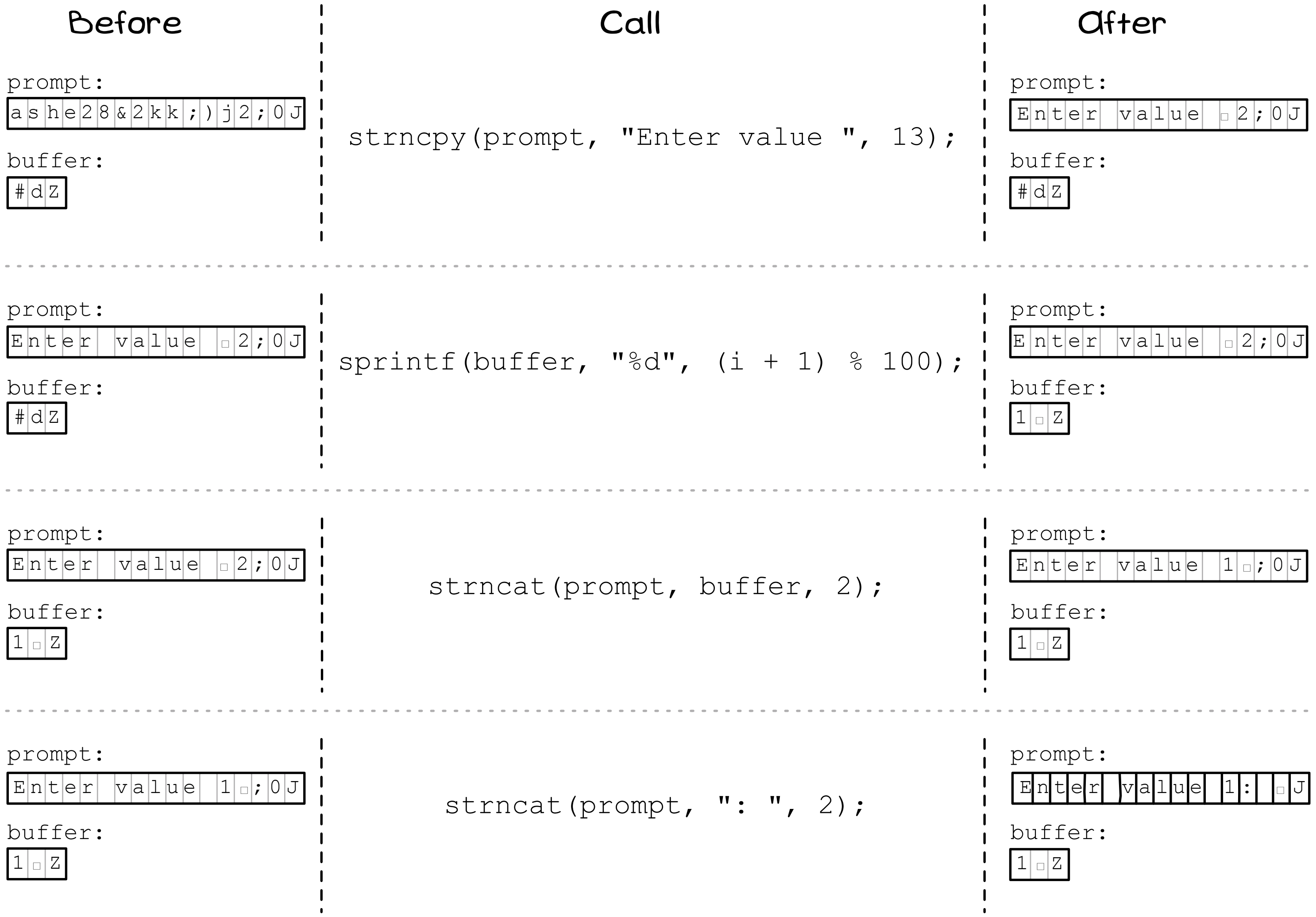
```
Function: Sum
----------------------------
Returns: Double - The sum of the numbers from the data array
Parameters:
 1: data (by const ref, array of Double) - values to sum
 2: size (Integer) - the number of elements in data (C only)
Local Variables:
 *: i (Integer) - index of the current element in the array
 *: total (Double) - running total
Steps:
  1: total is assigned 0
  2: For i, starts at 0 and loops to the highest index of data
  3:    total is assigned total + data[i]
  4: Return the result, total

Procedure: Main
----------------------------
Local Variables:
 *: my_data (array containing 3 Double values) - data array
Steps:
  1: Call Populate Array ( my_data, 3 )
  2: Output 'Sum is ', and Sum ( my_data, 3 )
  3: ...
```

1

Main outputs the sum to the Terminal

```
Enter value  1: Ten
Please enter a number.
Enter value 1: 10.0
Enter value 2: -5
Enter value 3: 17.21
Sum is 22.21
```

Before
Call
After
prompt:
ashe28&2kk;)j2;0J
buffer:
#dZ
strncpy(prompt, "Enter value ", 13);
prompt:
Enter value □2;0J
buffer:
#dZ
prompt:
Enter value □2;0J
buffer:
#dZ
sprintf(buffer, "%d", (i + 1) % 100);
prompt:
Enter value □2;0J
buffer:
1□Z
prompt:
Enter value □2;0J
buffer:
1□Z
strncat(prompt, buffer, 2);
prompt:
Enter value 1□;0J
buffer:
1□Z
prompt:
Enter value 1□;0J
buffer:
1□Z
strncat(prompt, ": ", 2);
prompt:
Enter value 1: □J
buffer:
1□Z