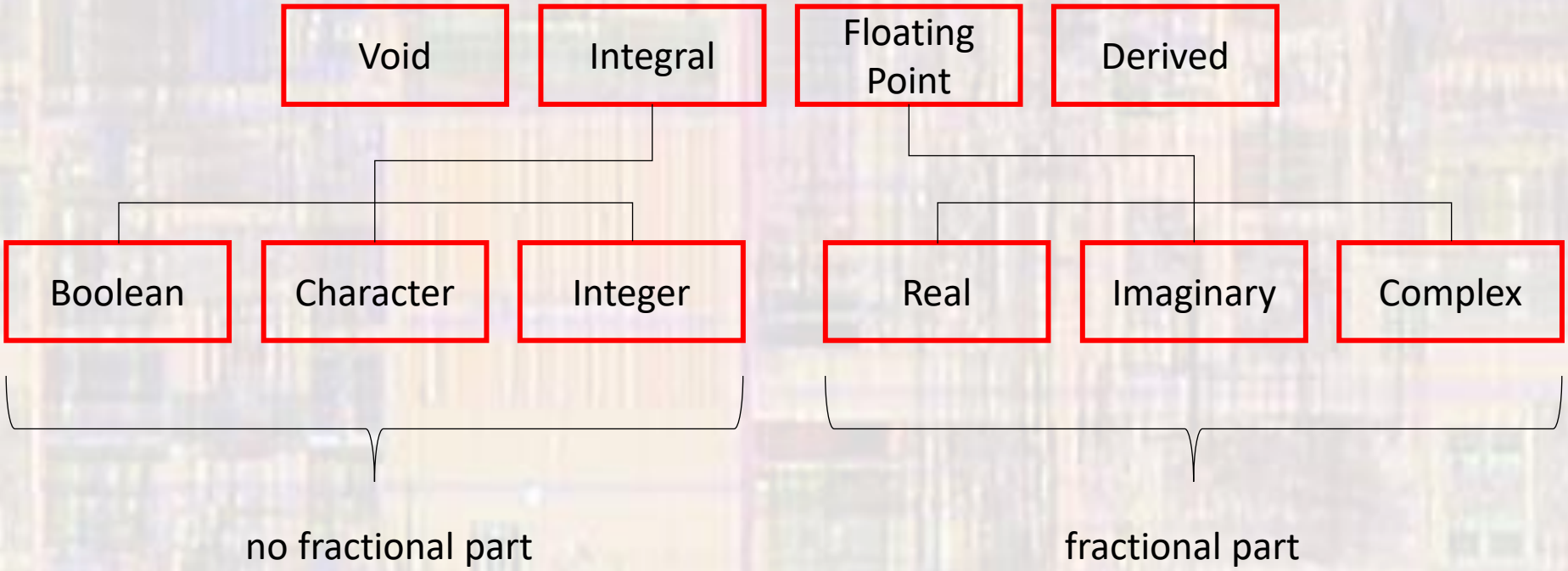
Type Conversion

Last updated 6/16/23

These slides introduce type conversion in C

Type Conversion

- Type conversion – changing a value from one type to another



Type Conversion

- Suppose we had the following expression:

voltage * current

where: voltage was a variable of type int (5)
current was a variable of type float (2.5)

what would the expression evaluate to?

Type Conversion

- Implicit Type Conversion
  - Type conversions done automatically by the compiler
  - Each type has a RANK

bool < char < short < int < long < long long < float < double < long double

complex types match the floating types

Type Conversion

- Implicit Type Conversion

int * float → float

1) int expression temporarily promoted to float
2) multiplication
3) result is of type float

   The original int is NOT CHANGED

char + long int → long int

1) char expression temporarily promoted to long int
2) addition
3) result is of type long int

   The original char is NOT CHANGED

Type Conversion

- Implicit Type Conversion
  - No Side Effect

int days;
float rate;

days * rate → float

The variable days remains an int

No variable types are changed in this process

Type Conversion

- Explicit Type Conversion
  - Cast or casting
  - Force a temporary type conversion on an expression
  - Use the unary operator “type cast”

(desired_type) var

Precedence	Operator	Description	Associativity
1	++ --	Suffix/postfix increment and decrement	Left-to-right
	()	Function call	
	[]	Array subscripting	
	.	Structure and union member access	
	->	Structure and union member access through pointer	
	(*type*){*list*}	Compound literal(C99)	
2	++ --	Prefix increment and decrement	Right-to-left
	+ -	Unary plus and minus	
	! ~	Logical NOT and bitwise NOT	
	(*type*)	Type cast	
	*	Indirection (dereference)	
	&	Address-of	
	sizeof	Size-of	
	_Alignof	Alignment requirement(C11)	
3	* / %	Multiplication, division, and remainder	Left-to-right
4	+ -	Addition and subtraction	

Type Conversion

- Explicit Type Conversion

```
int a;
int b;
a = 5;
b = 2;
```

a/b	2	
(float) a / b	5.0 / 2 → 5.0 / 2.0 → 2.5	a remains an int
a / (float) b	5 / 2.0 → 5.0 / 2.0 → 2.5	b remains an int
(float) (a/b)	(float) (5/2) → (float) 2 → 2.0	

explicit

implicit

Type Conversion

- Explicit Type Conversion
  - No Side effect

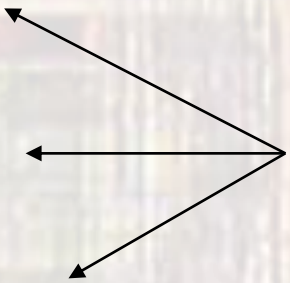
```
int a;
int b;
a = 5;
b = 2;
```

(float) a / b a = 5

a / (float) b b = 2

(float) (a/b) a = 5, b = 2

No variable types are changed in this process



Type Conversion

- Assignment Type Conversion
  - Assignment operator =
    - value – evaluate right side expression
    - side effect – left side is assigned the value after conversion (promotion or demotion) to the matching type of the left side

```
int a;
float b;
int c;
b = 12.3;
c = 5;
a = b / c;
```

c is promoted to type float for the division
right side is evaluated 12.3 / 5.0 → 2.46 of type float
right side value is demoted to match the receiving variable (int)
a = 2

Regardless of any implicit or explicit type conversions, the assignment operator side effect cannot change the type of a receiving variable

Type Conversion

- Assignment Type Conversion
  - Assignment operator =
    - value – evaluate right side expression
    - side effect – left side is assigned the value after conversion (promotion or demotion) to the matching type of the left side

```
int a;
int b;
float c;
a = 5;
b = 7;
c = a + b;
```

right side is evaluated 5 + 7 → 12 of type int

right side value is promoted to match the receiving variable (float)

c = 12.0

Regardless of any implicit or explicit type conversions, the assignment operator side effect cannot change the type of a receiving variable