Intermediate/Advanced Computer Programming

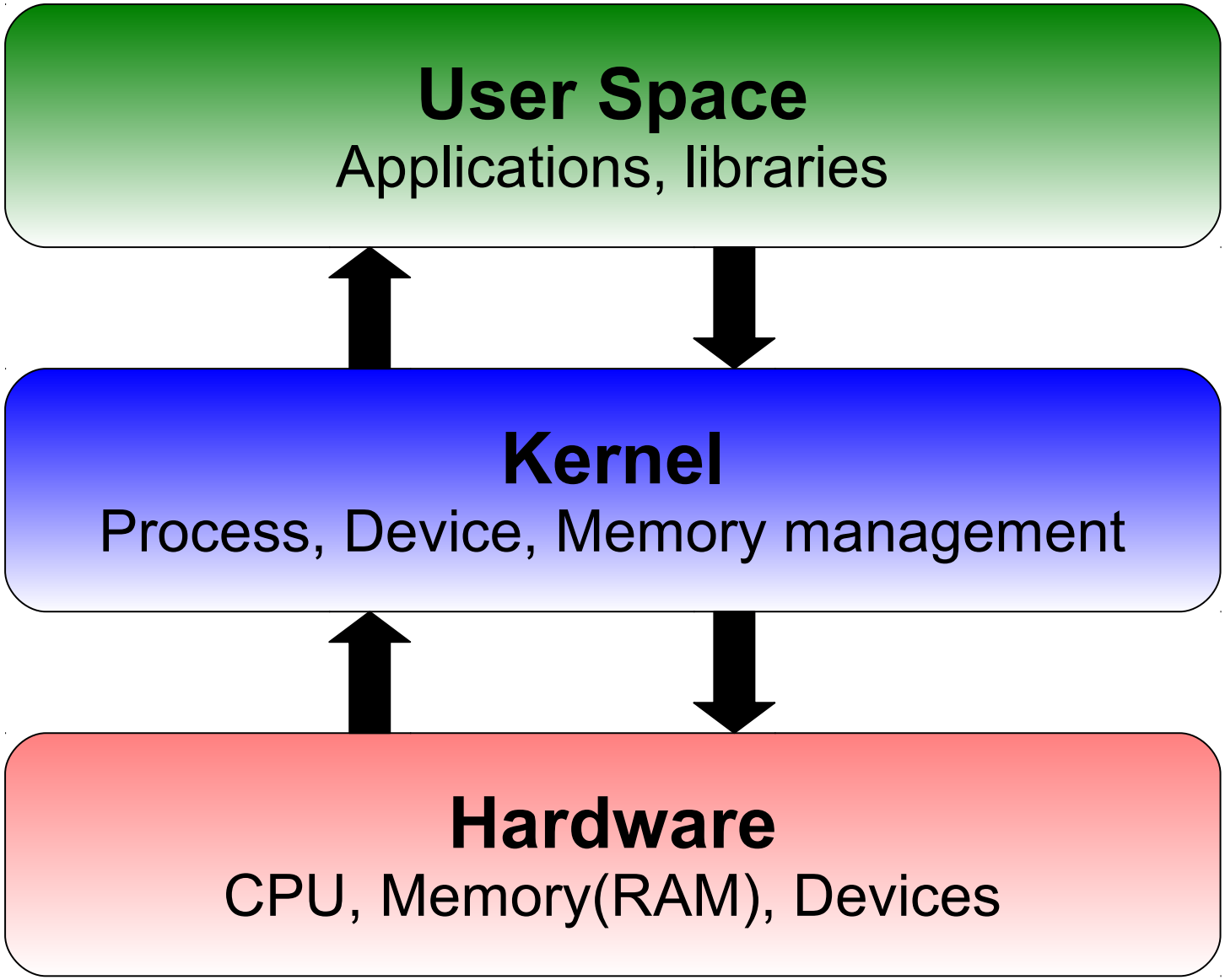
Review

- What is the difference between UNIX and Linux?
- Name/describe the three basic layers of a typical OS
- What is the OS kernel?
- Which memory space do typical C++ applications execute?
- Name some UNIX commands
- Name/describe the steps to create an executable from C++ source code

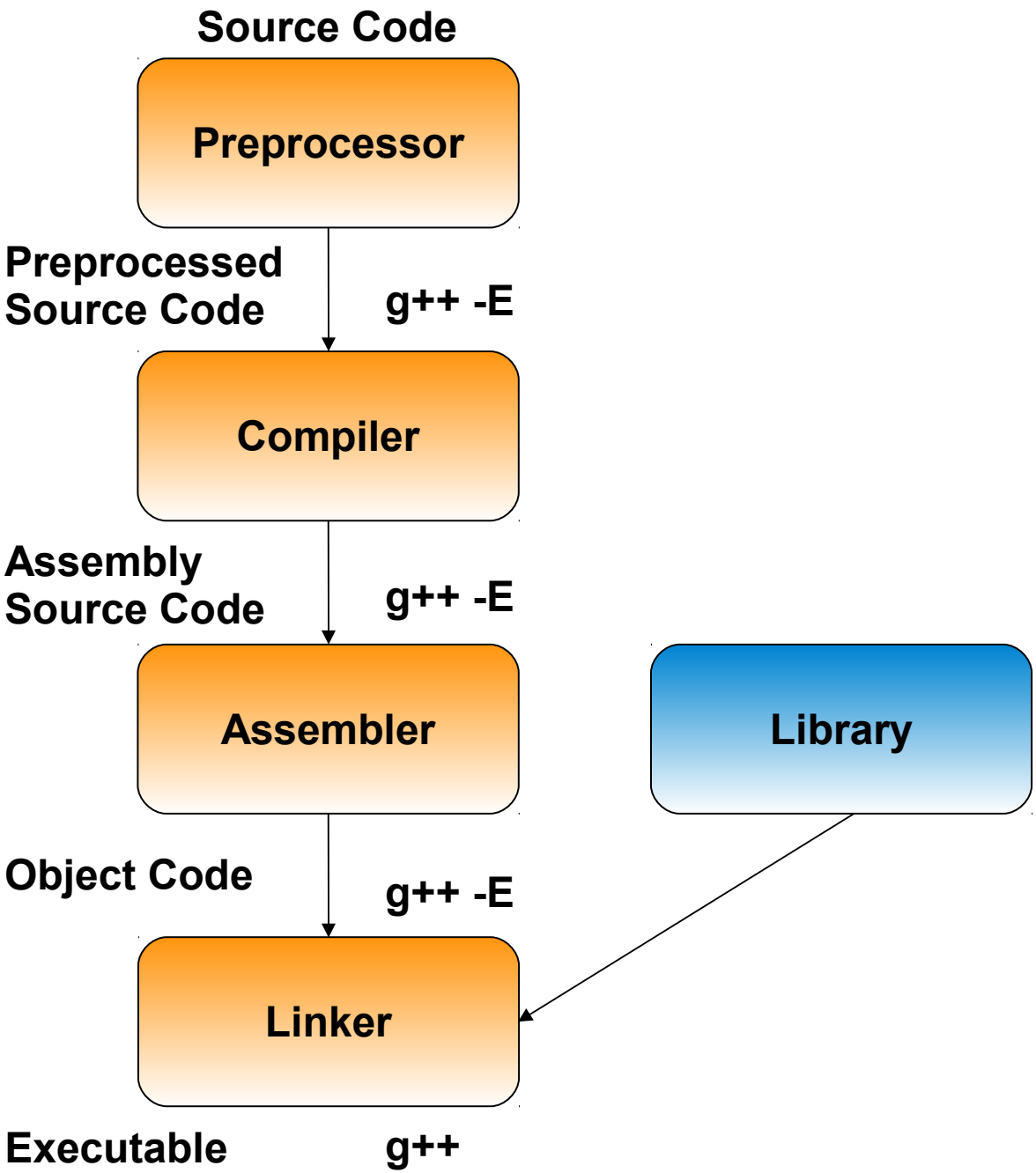
Unix

- Single UNIX Specification defined by the Open Group
- Standard definition for the Unix system API
  - Specifies requirements for a UNIX system
- Not code
  - Allows different implementations
- Contains POSIX specifications
- Defines system interfaces, headers, commands, and utilities
- http://pubs.opengroup.org/onlinepubs/009695399/

Operating System (OS)



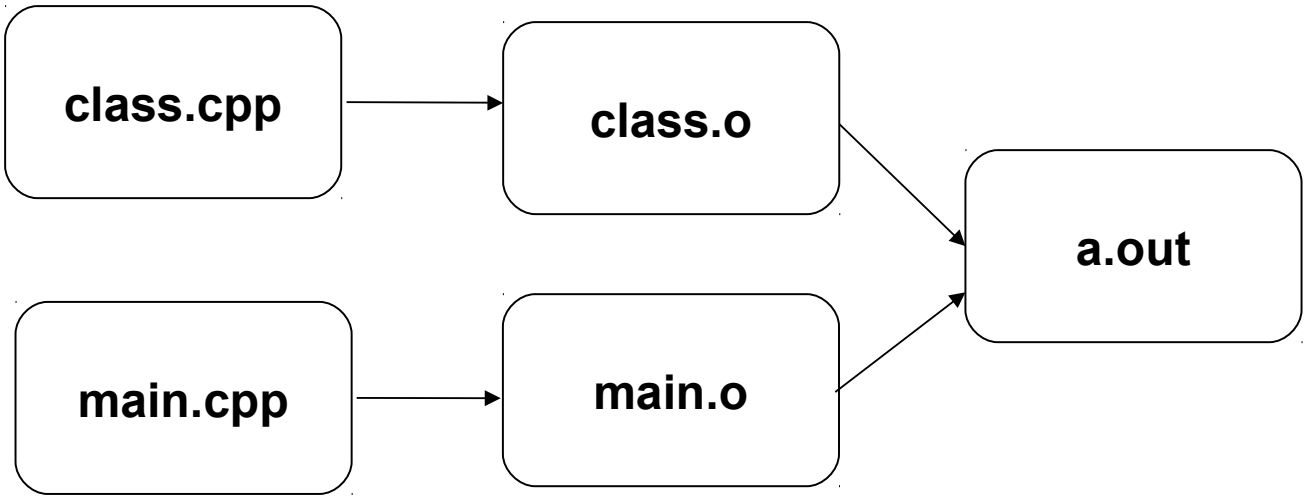
Building an Executable



Building an Executable

- Machine code
  - Language directly understandable by the hardware (e.g. 1's and 0's)
- Assembly code
  - Human readable machine code
- Object code
  - Separate portions of machine code that have not been linked into a complete executable
- Executable
  - Encoded instructions to perform a task

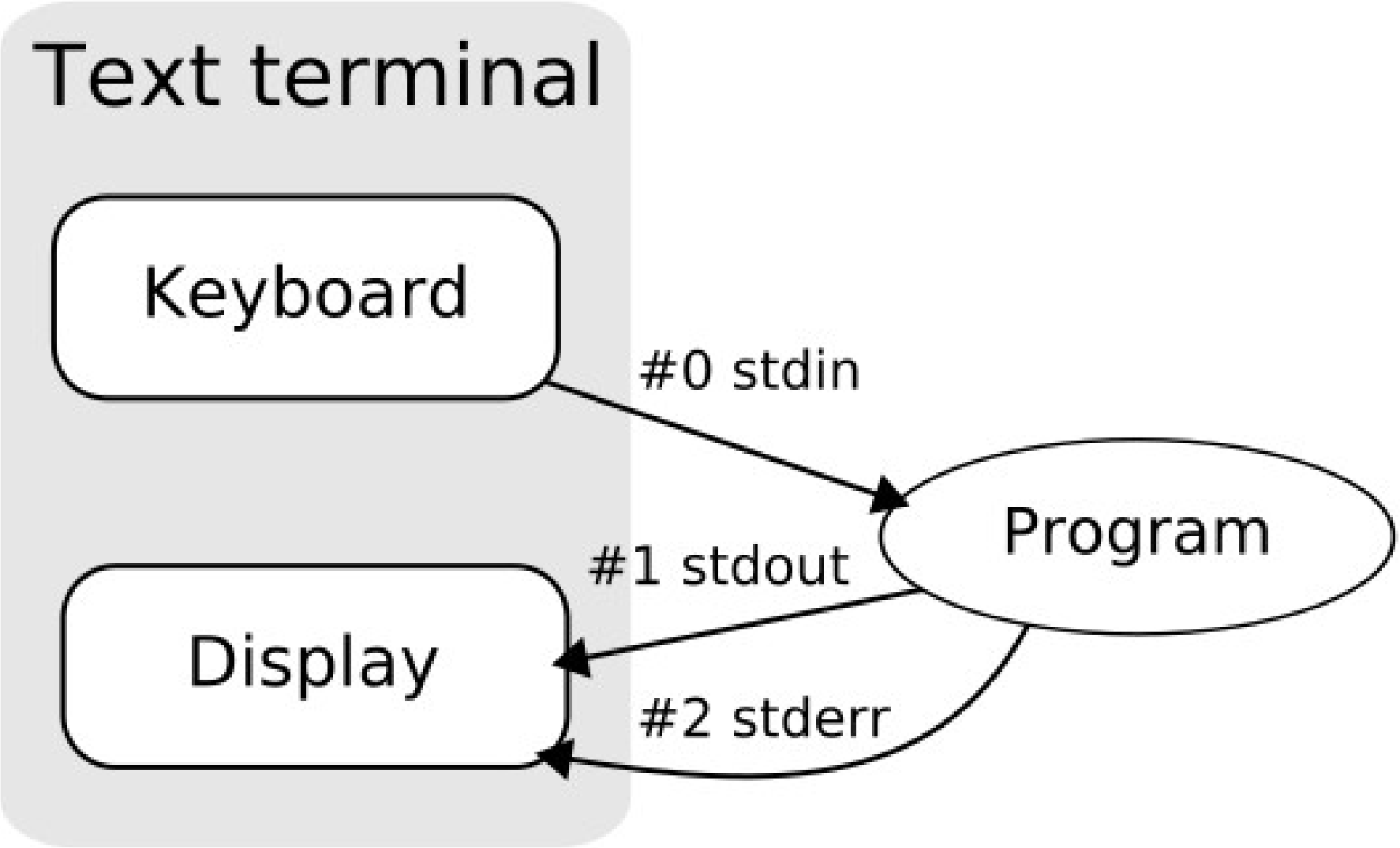
Building an Executable



Unix Commands

- ls
  - List directory contents
- mkdir
  - Make directories
- man
  - Online manual pages
- cat
  - Output file contents

Redirecting/Piping



Redirecting/Piping

- Streams/channels
  - flow of input and output between a program and its environment
  - Standard streams
    - Initial connections when program begins
- **command > file**
  - Output redirected to file
  - File is truncated if it already exists, otherwise file is created
- **command >> file**
  - Redirect output to file
  - Append output to file if it already exists, otherwise create file
- **command < file**
  - Contents of file are used as input to command (rather than keyboard)

Effective Programming

Process to Build Program

1) Define the problem
   - Specifications
   - Examples
1) Design the program
   - Diagrams
   - Pseudo-code
1) Write the source code (e.g, functions, classes)
2) Test the program
3) Repeat steps 1-4 until desired program is verified/created

Testing

- Ensure that program performs correctly
- Exhaustive testing
  - For all inputs, do we get the correct output
  - Time consuming
  - Impractical
- Test boundary conditions
  - Zero
  - Largest number
  - Smallest number
  - Positive numbers
  - Negative numbers

Process to Coding

1) Comment
2) Code
3) Compile
4) Execute

Process to Coding

1) Comment
2) **THINK**
3) Code
4) **THINK**
5) Compile
6) Execute

Code Evaluation

- Correctness
- Quality of Code
  - Readability
  - Conveying program semantics to the compiler
  - Scalability
  - Efficiency

Comments

A program serves two masters.

- Code tells the computer what to do.
- Comments describe what the program does to the poor programmer who has to maintain it.

There are two types of comments in C++.

```
// Comments that begin with double-slash
// and go to the end of line

/* Comments that start with slash/star */
/*and go to star/slash */
/*
 * The second version can be used
 * for multi-line comments
 */
```

Precedence Rules

- ANSI Standard Rules
- 1. () [] -> .
- 2. ! ~ ++ -- (type) - (unary) * (dereference) & (address of) sizeof
- 3. * (multiply) / %
- 4. + -
- 5. << >>
- 6. < <= > >=
- 7. == !=
- 8. & (bitwise and)
- 9. ^

10. |
11. &&
12. ||
13. ?:
14. = += -= etc.
15. ,

Practical Precedence Rules

1. * (multiply) / %
2. + -

- Put parentheses around everything else.

Initializing Variables

- Variable = value;
  - int var = 5;
- C++ style
  - int var(5);
- Arrays
  - int temperature[4] = {100, 95, 92, 98};
  - int temperature[] = {100, 95, 92, 98};
  - First element is temp[0]
  - Last element is temp[3]

C++ Strings

Bring in the string package using the statement:

```
#include <string>
//Declaring a string
   string my_name; // The name of the user
```

Assigning the string a value:

```
   my_name = “Student";
```

Using the “+” operator to concatenate strings:

```
first_name = “student"; last_name = “student";
full_name = first_name + " " + last_name;
```

Arrays

- Bounds
  - int temperature[4] = {100, 95, 92, 98};
  - int tmp = temperature[3];
  - int tmp = temperature[55];
  - temperature[55] = 85;
- Multi-dimensional arrays
  - *type variable[size1][size2];*

```
int matrix[2][4]=
{
        {1,2,3,4},
        {10,20,30,40}
};
```

if Statement

- General form:

  if (*condition)*

  statement;

- If the condition is true (non-zero), the statement is executed.
- If the condition is false (zero), the statement is not executed.

- Example:

```
if (total_owed <= 0)
 std::cout << "You owe nothing.\n";
```

Loops

- Sequence of statements that can be executed more than once in succession

for (initializer ; condition ; iteration statement)

body-statement;

- How can we write an equivalent while loop?

Loops

for (initialization ; condition ; iteration statement)

body-statement;

initialization;

while (*condition)* {

body-statement;

iteration statement;

}