An Introduction to Software Architecture Case Studies

Based on David Garlan & Mary Shaw – 94

KWIC

Key Word In Context (KWIC)

- Search index
  - searching for keywords with context sensitive display
  - provides the user with more information

Example

Input: Titles Output: Index

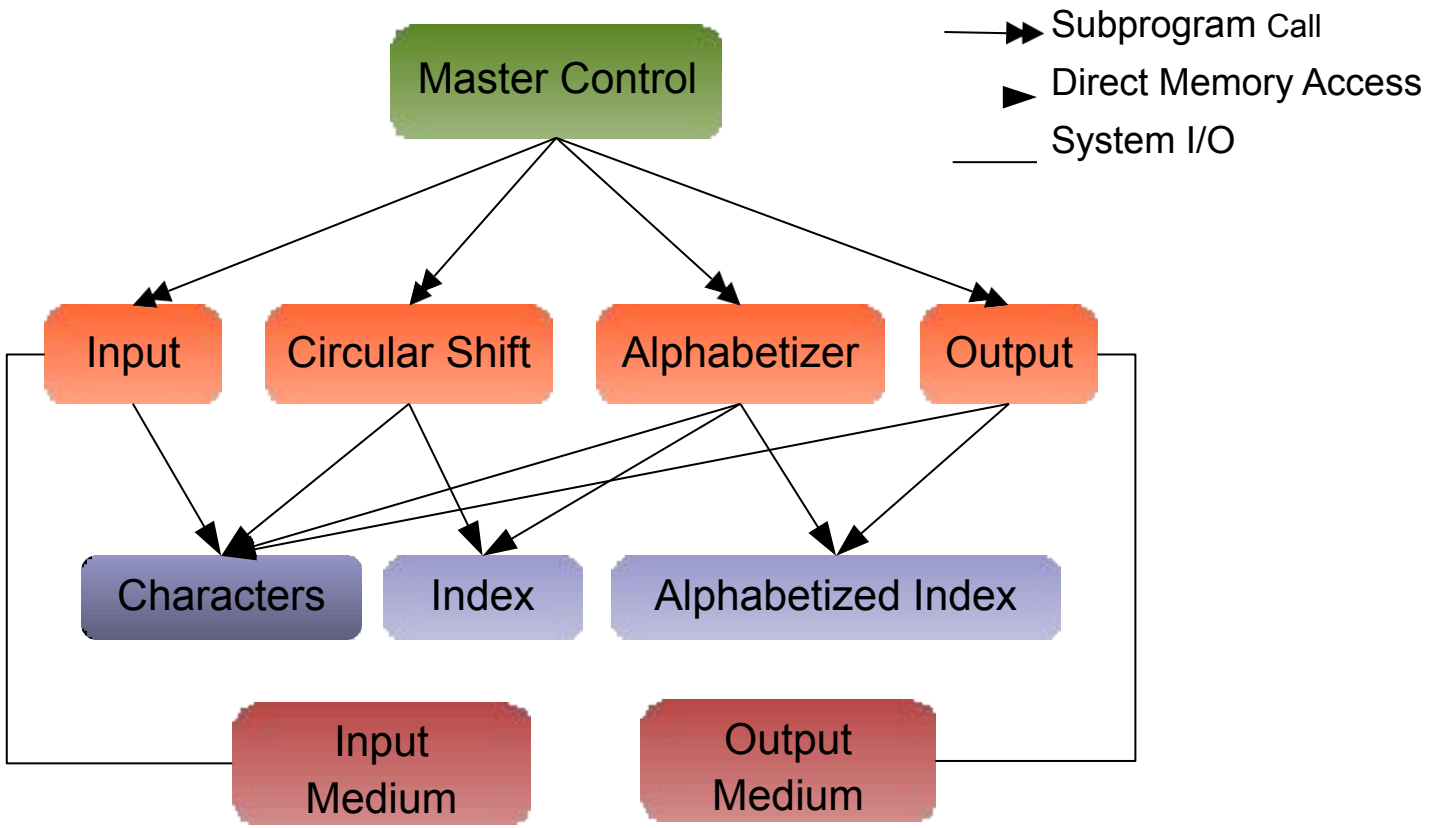
- Clouds are white
- Ottawa is beautiful

- **a**re white Clouds
- **b**eautiful Ottawa is
- **C**louds are white
- **i**s beautiful Ottawa
- **O**ttawa is beautiful
- **w**hite Clouds are

Solution 1

Main Program/Subroutine with Shared Data

- Functional decomposition
- Components are subroutines



Solution 1

Strengths

- Centralized data
  - efficient representation of data
- Modular decomposition

Weaknesses

- Resistant to change
  - consider the impact of data storage format
  - difficult to enhance the overall functionality
  - reuse of component is difficult

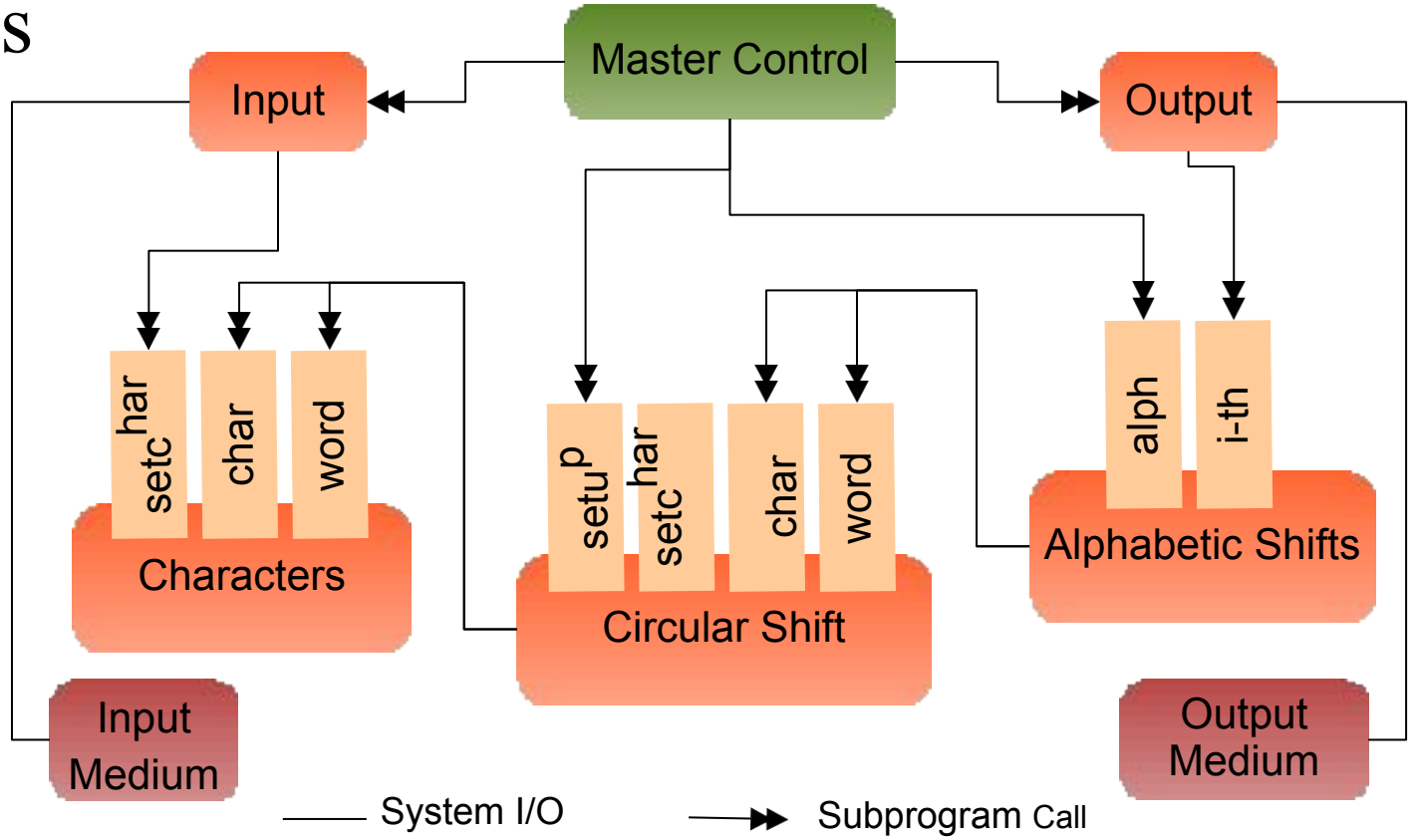
Solution 2

Abstract Data Types

- Similar to one with data encapsulation
  - data access via component interface invocation
  - no direct data access
- Components similar to solution 1

Solution 2

Abstract Data Types



Solution 2

Advantages

- Handles change well
  - algorithm and data are encapsulated in individual modules
- Reuse
  - modules interact via defined interfaces

Disadvantages

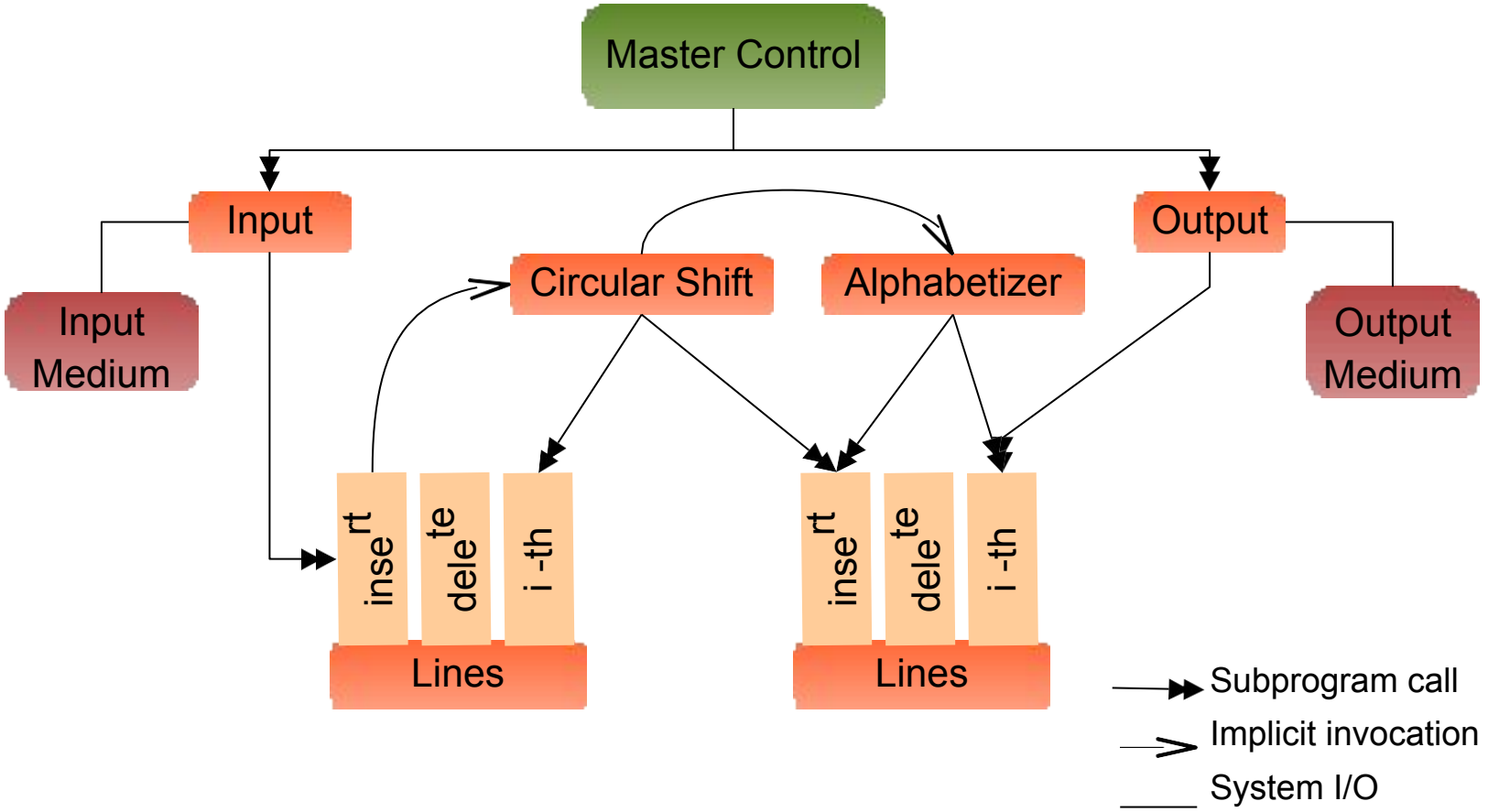
- Evolution still a problem
  - to add new features may require changes to existing or addition of new components

Solution 3

Implicit Invocation

- Similar to solution 1
  - shared data
- Two main differences
  - data is more abstract
    - underlying storage is not exposed to components
  - components are invoked implicitly
    - e.g. when a line is added

Solution 3



Calls to circular shift and alphabetizer are implicit, and are the result of inserting lines

Solution 3

Advantages

- Strong evolution path
  - functional enhancements are easy
  - new components can be attached and removed
  - components are shielded from data storage representation
    - **REALLY WHY?**
- Minimal component coupling/dependency
  - data events are the source of all interactions

Solution 3

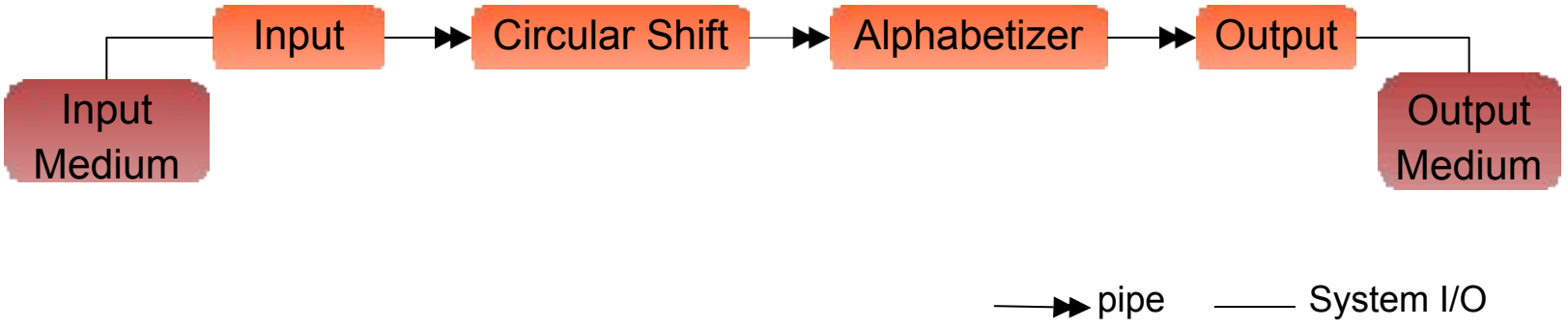
Disadvantages

- Difficult to control the ordering of processing
- Requires more storage capacity
  - **IS THIS REALLY A DISADVANTAGE?**

Solution 4

Pipes & Filters

- Four filters
  - input, shift, alphabetize, output
  - each filter can compute when data is available at the input
  - data sharing is restricted by pipes



Solution 4

Advantages

- Intuitive flow of processing
- Reuse
- Evolution
  - new filters can be easily added

Solution 4

Disadvantage

- Virtually impossible to support an interactive system
- **Is this a true pipes & filters?**
  - consider the data flow
- What is the LCD data unit?

Comparison

	Shared Memory	ADT	Implicit Invocation	Pipe & Filter
change in algorithm	□	□	□	□
change in data representation	□	□	□	□
change in functionality	□	□	□	□
performance	□	□	□	□
reuse	□	□	□	□

Reading

Will be on exam

- Case Study 2: Instrumentation Software
- Case Study 3: A Fresh View of Compilers

Will not be on exam

- Case Study 4: A Layered Design with Different Styles for the Layers
- Case Study 5: An Interpreter Using Different Idioms for the Components