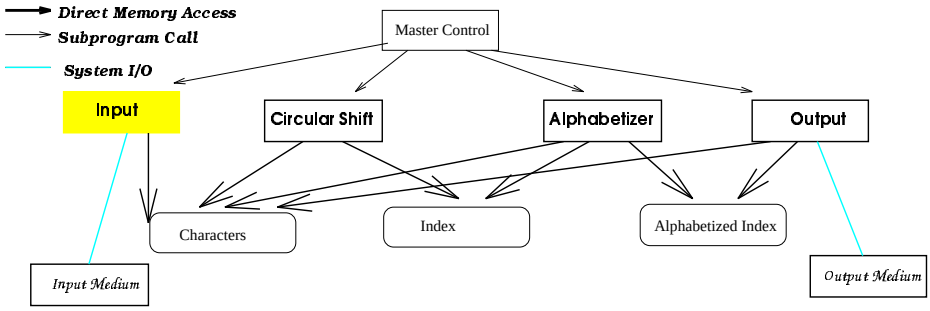
Modularization 1: Shared Data



Data is communicated between the components through shared storage

System KWIC

global: Characters, Index, AlphabetizedIndex

module Input

operation read: data lines from the input medium

operation store: data lines (as packed "Characters" in core)

/ e.g., Characters: packed array [1..10000] of char */*

The KWIC Problem

HOW ARCHITECTURE WINS TECHNOLOGY WARS$THE ART OF SYSTEMS ARCHITECTING

Input

HOW ARCHITECTURE WINS TECHNOLOGY WARS
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Circular Shift

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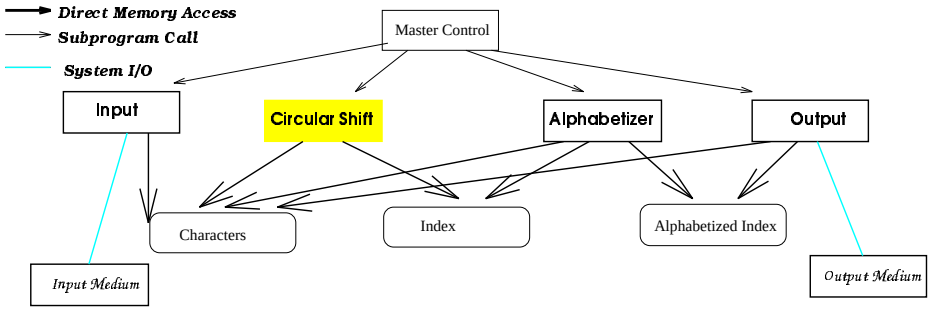
Alphabetizer

Output

Modularization 1: Shared Data



Data is communicated between the components through shared storage

module Circular Shift

operation readChar: packed characters from "Characters"

operation prepare: the starting index of the line (e.g., Index.first) and the offset for each word from the starting position.

/ not a physical circular shift, "Output" does this */*

/ one data structure choice:*

Index

first: ^Characters

*offset: positive integer */*

The KWIC Problem

HOW ARCHITECTURE WINS TECHNOLOGY WARS$THE ART OF SYSTEMS ARCHITECTING **Input**

	first	offset
HOW ARCHITECTURE WINS TECHNOLOGY WARS	1	1
ARCHITECTURE WINS TECHNOLOGY WARS HOW	1	5
WINS TECHNOLOGY WARS HOW ARCHITECTURE	1	18
TECHNOLOGY WARS HOW ARCHITECTURE WINS		
WARS HOW ARCHITECTURE WINS TECHNOLOGY		
THE ART OF SYSTEMS ARCHITECTING	39	1
ART OF SYSTEMS ARCHITECTING THE	39	5
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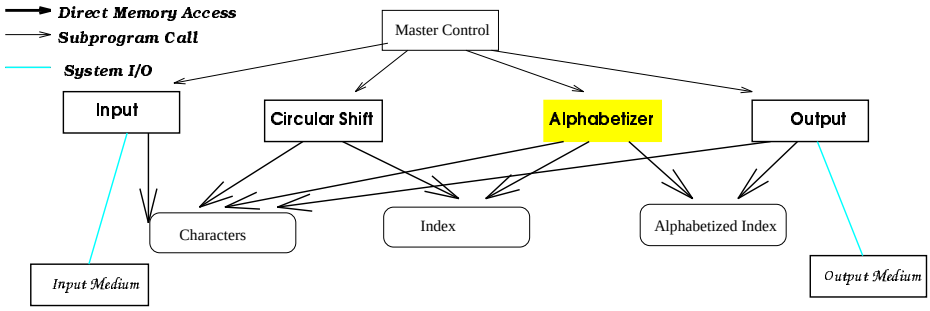
Circular Shift

Modularization 1: Shared Data



Data is communicated between the components through shared storage

module Alphabetizer

operation readChar: packed characters from "Characters"

operation readIndex: from "Index"

operation alphabetize: convert "index" to an "alphabetized index" by listing the circular shifts alphabetically

/ as with "Circular Shift", no explicit representation */*

/ sorting algorithm hidden */*

/ as with "Circular Shift", local data structure hidden */*

The KWIC Problem

HOW ARCHITECTURE WINS TECHNOLOGY WARS$THE ART OF SYSTEMS ARCHITECTING **Input**

	first	offset
HOW ARCHITECTURE WINS TECHNOLOGY WARS	1	1
ARCHITECTURE WINS TECHNOLOGY WARS HOW	1	5
WINS TECHNOLOGY WARS HOW ARCHITECTURE	1	18
TECHNOLOGY WARS HOW ARCHITECTURE WINS		
WARS HOW ARCHITECTURE WINS TECHNOLOGY		
THE ART OF SYSTEMS ARCHITECTING	39	1
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ARCHITECTING THE ART OF SYSTEMS	39	20
ARCHITECTURE WINS TECHNOLOGY WARS HOW	1	5
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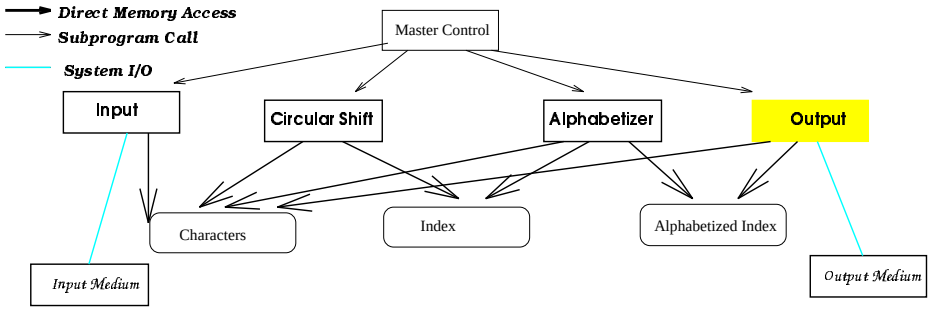
Circular Shift

Alphabetizer

Modularization 1: Shared Data



Data is communicated between the components through shared storage

module Output

operation readChar: packed characters from "Characters"

operation readIndex: from "AlphabetizedIndex"

operation print: list all the circular shifts using "Characters" and "AlphabetizedIndex"

/ a candidate algorithm:*

loop i

go to position (first-i, offset-i) and print everything before $;

go to position (first-i, 1) and print everything before (first-i, offset-i)/*

pool

The KWIC Problem

HOW ARCHITECTURE WINS TECHNOLOGY WARS$THE ART OF SYSTEMS ARCHITECTING **Input**

	first	offset
HOW ARCHITECTURE WINS TECHNOLOGY WARS	1	1
ARCHITECTURE WINS TECHNOLOGY WARS HOW	1	5
WINS TECHNOLOGY WARS HOW ARCHITECTURE	1	18
TECHNOLOGY WARS HOW ARCHITECTURE WINS		
WARS HOW ARCHITECTURE WINS TECHNOLOGY		
THE ART OF SYSTEMS ARCHITECTING	39	1
ART OF SYSTEMS ARCHITECTING THE	39	5
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SYSTEMS ARCHITECTING THE ART OF		
ARCHITECTING THE ART OF SYSTEMS	39	20
ARCHITECTING THE ART OF SYSTEMS	39	20
ARCHITECTURE WINS TECHNOLOGY WARS HOW	1	5
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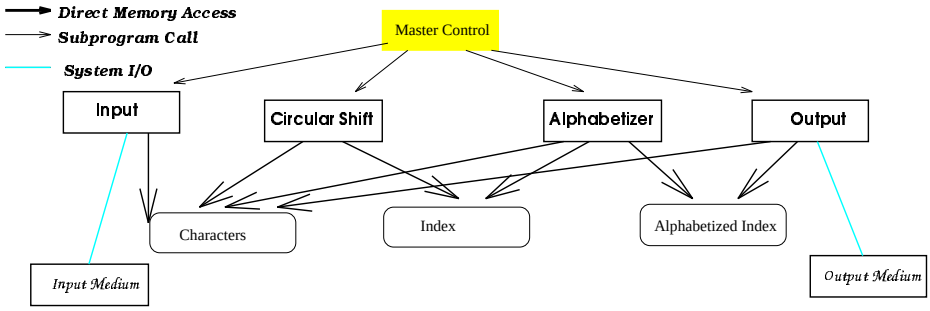
Circular Shift

Alphabetizer

Output

Modularization 1: Shared Data



Data is communicated between the components through shared storage

module Master Control

/ control the sequencing among the four modules */*

operation main: */* batch mode, original proposal by Parnas */*

Input;
Circular Shift;
Alphabetizer;
Output

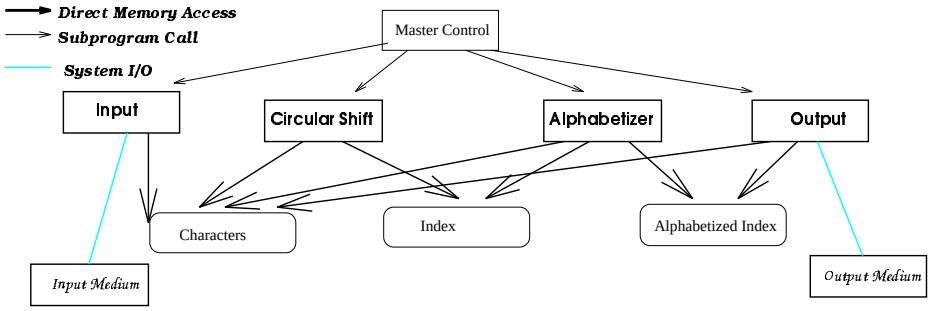
/ incremental mode -> loop*/*

/ concurrent mode?*/*

The KWIC Problem

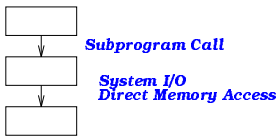
- *Non-Functional Requirements*
  - ***modifiability --- changes in processing algorithms*** -
    - e.g., line shifting: one at a time as it is read or ***-> affects alphabetizer***
      all after they are read or
      on demand when the alphabetization requires a new set of shifted lines
    - e.g., batch alphabetizer vs. incremental alphabetizer ***-> affects circular shift***
  - ***modifiability --- changes in data representation*** -
    - e.g., storing chacters, words and lines
      (e.g., in 1-d array/2-d array/linked-array, compressed vs. uncompressed)
      storing circular shifts explicitly or implicitly (as pairs of index and offset)
      core storage vs. secondary storage ***-> affects almost all modules***
  - ***enhanceability --- additions of (enhancement to) system function*** +
    - e.g., to eliminate noise words *(where? -> Input -> Circular Shift -> Alphabetizer -> Output ->)*
      (e.g., "a", "an", "the", "and", "or", "in", "of", "with", "for", "I", "you", "it", "they", ...)
      the user deletes lines from the original or shifted lines
      (creates blank entries in "Index" -> Alphabetizer needs to change)
  - ***performance --- space and time***
    + efficient data representation, as the same storage is shared
    + fast, thanks to no copying of data
  - ***reusability --- to what extent can the components serve as reusable entities?***
    - low, due to dependence on shared data and format
    (e.g., Alphabetizer cannot assume full explicit representation by Circular Shift)

Modularization 1: Shared Data



The architecture

- style: ***Shared Data***
- component: ***Processes & Data*** ***(per individual descriptions)***
- glue: ***Direct Memory Access*** ***Subprogram Call*** ***System I/O***
- constraint: ***Data is communicated between the components through shared storage***
- pattern:



- rationale: ***(if selected, NFRs)***

+ some intuitive appeal, as distinct computational aspects are isolated in different modules
o shared data still abundant (although OO style becoming popular)