CSCI 3130 Software Architectures 2/2

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Software Architecture

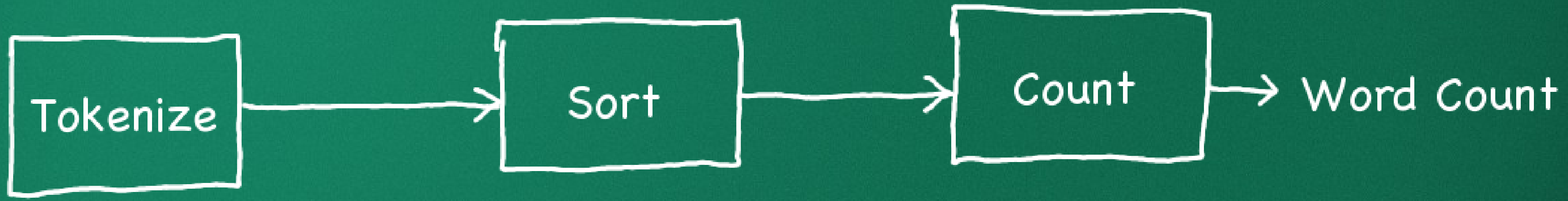
- Helps with:
  - Communication and Understanding
  - Reuse
  - Construction and Evolution
  - Analysis
- Architecture is described using views for different perspectives
  - Most common view: Component & Connector
- Architecture Styles are “Design Patterns” for Software Architectures

Architecture Integrity

- Why listen to the architect?
  - Architecture imposes constraints
  - Constraints allow to make assumptions in other parts of the system
  - If the constraints are not respected, other parts of the system may no longer be compatible
  - Deviation impacts communication, evolution, reuse, analysis

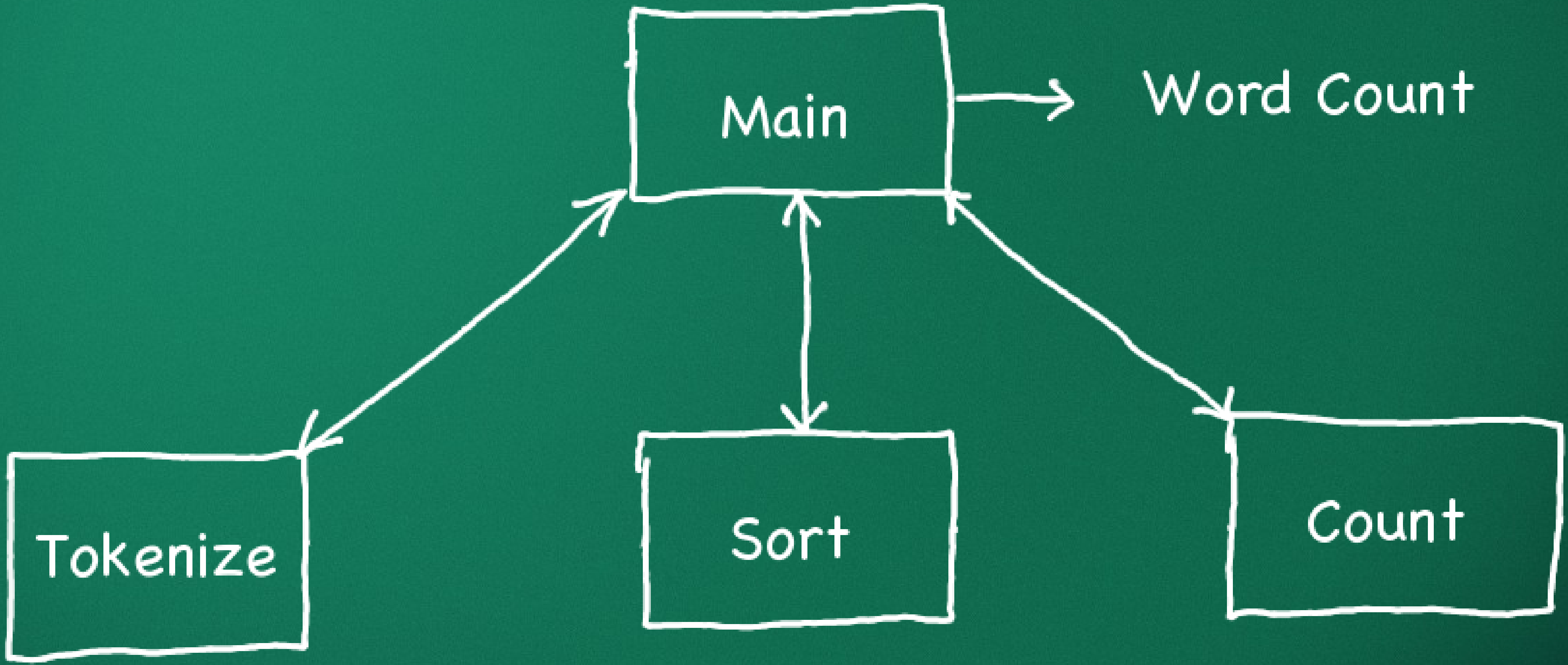
Example: Word Count

Intended Architecture:



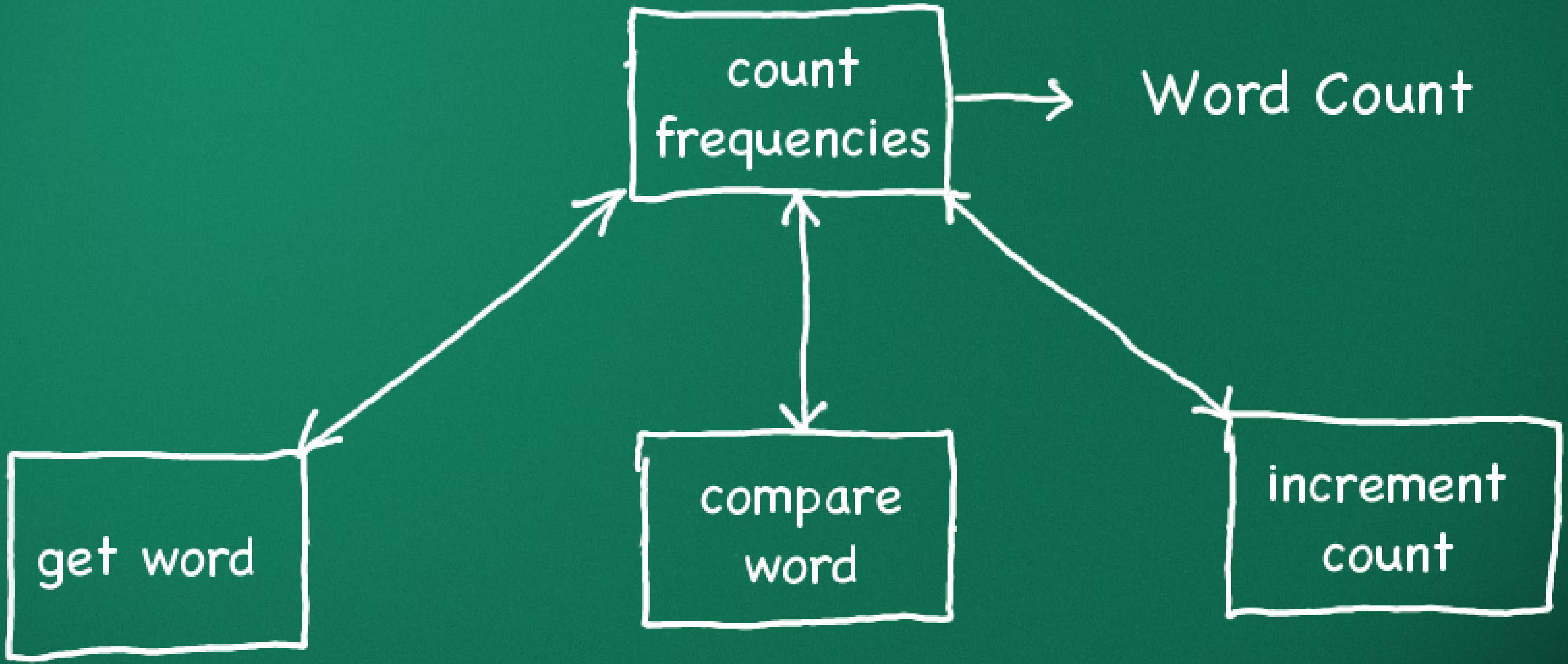
Example: Word Count

Deviating Implementation 1:



Example: Word Count

Deviating Implementation 2:



Deployment: Allocation View

- How to allocate system components to resources:
  - Hardware
  - Network infrastructure
  - Schedules
- Performance analysis and tradeoffs
- Reliability (redundancy ↔ performance)
- Costs

Architecture Documentation

- Diagrams are not sufficent documentation
- Documentation needs to satisfy all stakeholders
- Primary goal is to communicate the architecture:
  - Structure and formulate the documentation with that in mind

Architecture Documentation

Sample Outline:

- Context (diagram)
  - How does the system fit into its environment?
  - Who interacts with the system?
- Relevant Views (C&C, module, allocation)
  - Diagram
  - Describe the elements/components in the view in detail
  - Describe the interfaces between elements/components
  - Rationale for the decisions reflected in the architecture
  - Describe behaviour and processes
  - Combine views if suitable (e.g. C&C + allocation)

Architecture Documentation

- Formal languages:
  - Acme
  - Wright
  - UML (good choice for diagrams)
- English works too
- Don't constrain yourself
  - Use whatever gets the point across.
- Don't overload it
  - One cloud is enough, and it does not need to be sparkly.

Architecture Analysis & Evaluation

- Significant impact on qualitative properties:
  - Performance
  - Reliability
  - Modifiability
  - Portability
- More important than decisions at the implementation level:
  - A faster sorting algorithm only makes the chosen architecture faster, but not better.
- Evaluate an architecture w.r.t. individual properties

Architecture Analysis & Evaluation

- Formal simulation models can help:
  - Difficult to capture all the information to have a representative model.
  - Better choice for increasing system complexity (cost ↔ benefit)
- Alternative: Procedural Approach
  - List attributes to be evaluated
  - Assign an experience-based subjective assessment of the quality to each attribute (e.g. letter grades)

ATAM Architectural Tradeoff Analysis Method

1. Collect Scenarios
   - Use Cases, Error Cases, Exceptional Cases (e.g. high load)
   - Attributes of interest
2. Collect Requirements and Constraints
   - Check SRS for QoS requirements/expectations for each use case / attribute
   - Find quantitative measures
3. Describe architectures that are subject to analysis
4. Analyze attributes w.r.t. Requirements
5. Identify Sensitivity and Tradeoffs
   - Points with most significant impact when changes
   - Impact on other components

ATAM Example

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