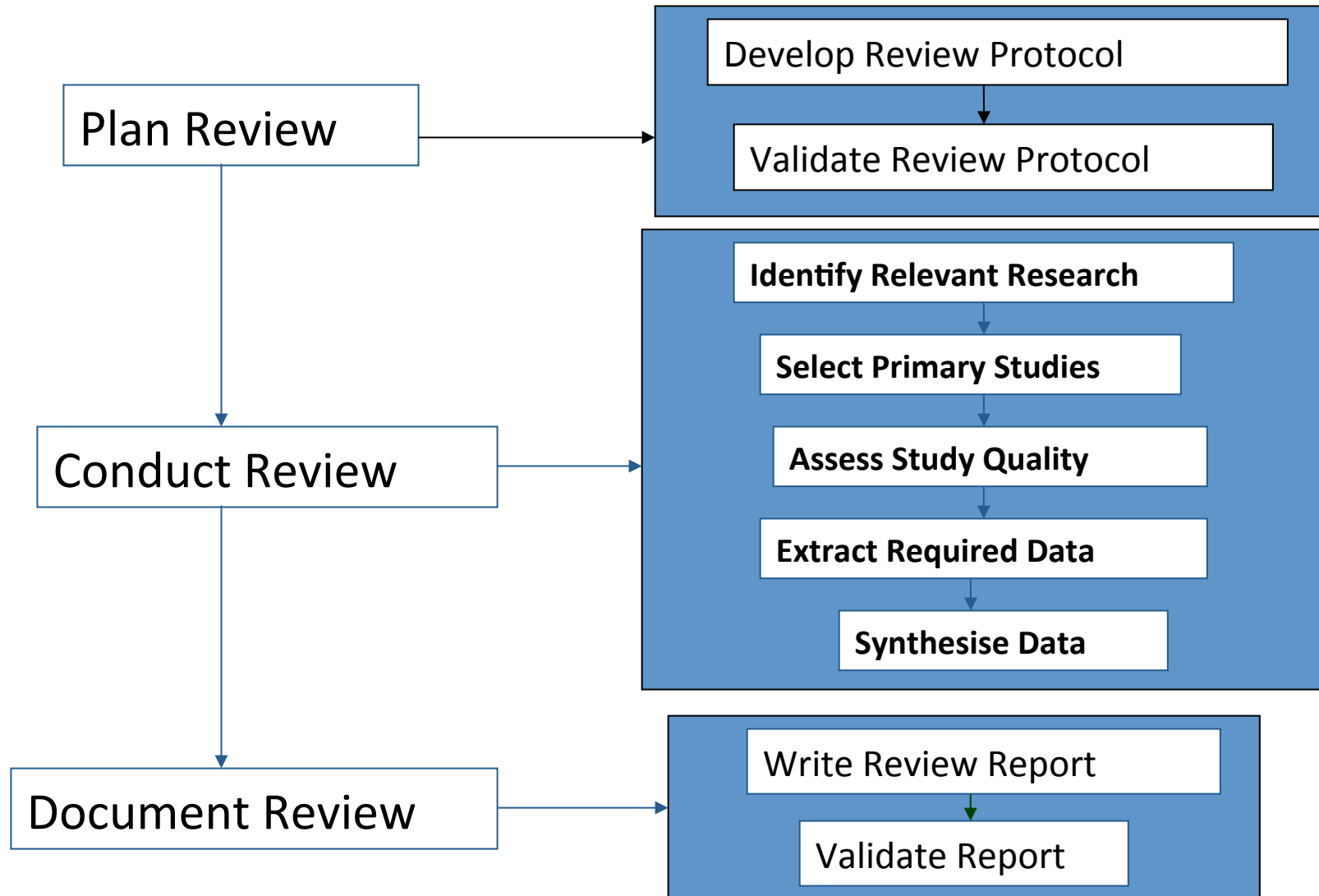# Systematic Review

Ivica Crnkovic 2011

Systematic Reviews - 1/2

- A systematic review is
  - An overview of research studies (literature) that uses explicit and reproducible methods
- Systematic reviews aim to synthesise existing research
  - Fairly (without bias)
  - Rigorously (according to a defined procedure)
  - Openly (ensuring that the review procedure is visible to other researchers)

Systematic Reviews – 2/2

- Support Evidence-based paradigm
  - Start from a well-defined question
    - Step 1
  - Define a repeatable strategy for searching the literature
    - Step 2
  - Critically assess relevant literature
    - Step 3
  - Synthesise literature
    - Step 4 (but only partially)

Systematic Review Process

Plan Review

Develop Review Protocol

Validate Review Protocol

Conduct Review

Identify Relevant Research

Select Primary Studies

Assess Study Quality

Extract Required Data

Synthesise Data

Document Review

Write Review Report

Validate Report

Developing the Protocol

- Review protocol
  - Specifies methods to be used for a systematic review
  - Predefined protocol
    - Reduces researcher bias by reducing opportunity for
      - Selection of papers driven by researcher expectations
      - Changing the research question to fit the results of the searches
  - Good practice for any empirical study

Protocol Contents -1/2

- Background
  - Rationale for survey

- Research question
  - Critical to define this before starting the research
  - Strategy used to search for *primary sources*
    - Individual studies of the phenomenon of interest

Protocol Contents – 2/2

- ## Strategy to find primary studies
  - Search terms, resources, databases, journals, conferences
  - Procedures for storing references
  - How publication bias will be handled
    - Grey literature
    - Direct approach to active researchers
  - How completeness will be determined
    - Useful to have the baseline paper to set start date

- ## Selection Strategy
  - Inclusion/exclusion criteria
    - Handling multiple papers on one experiment

Protocol Contents- 2/3

- Quality assessment criteria
  - Criteria used to evaluate quality of primary sources
- Data extraction
  - What data will be extracted from each primary source
  - How to handle missing information
  - How data reliability will be addressed
    - Usually multiple reviewers
  - Where data will be stored
- Procedures for data synthesis
  - Formats for summarising data
  - Measures and analysis if meta-analysis is proposed
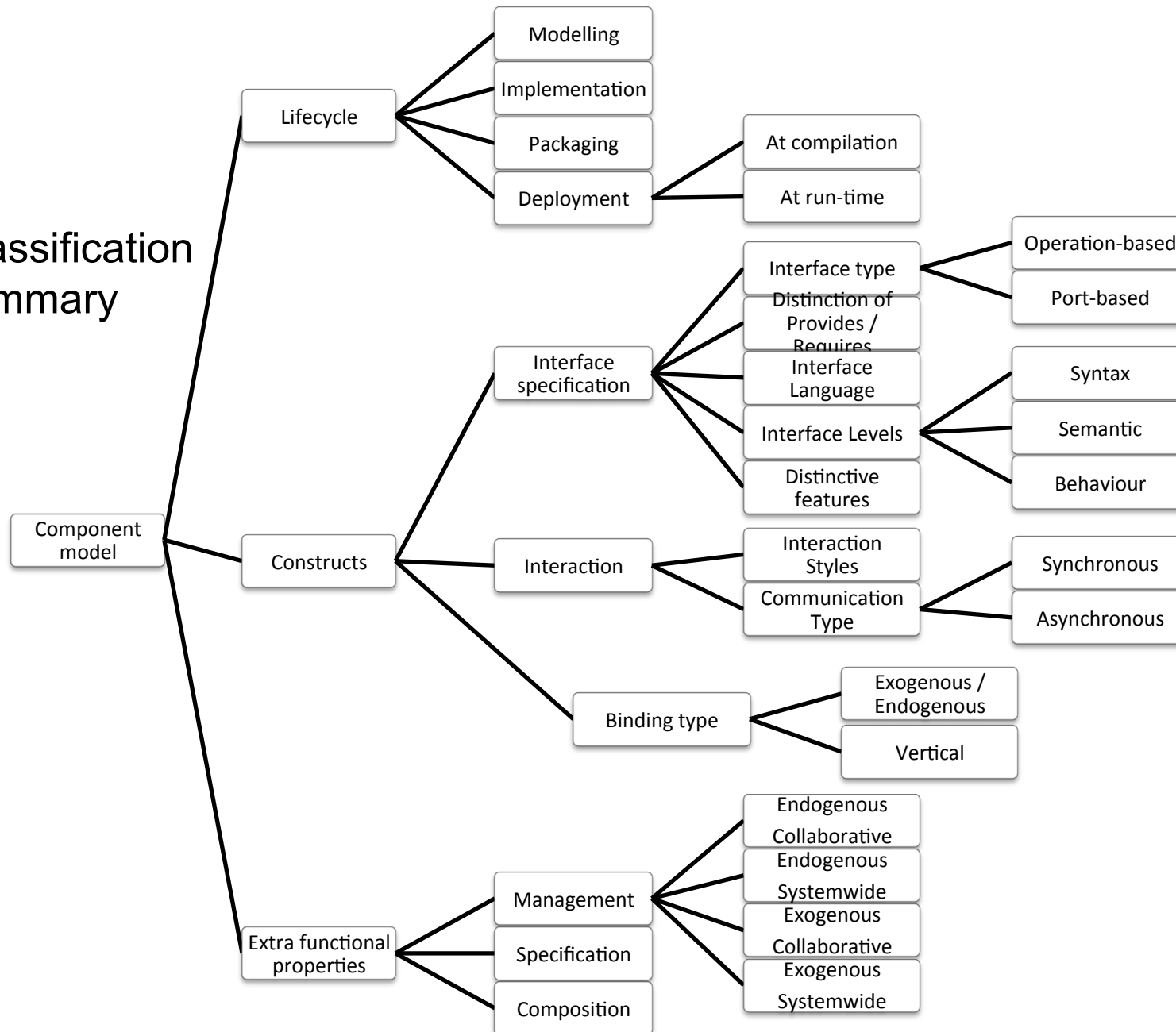- Should tested during protocol construction

What if several researchers do the review?

- They do the review separately

- They compare results

- To which extent their results agree?

- Use Fleiss' kappa, a statistical measure for assessing the reliability of agreement between a fixed number of raters

- http://www.scopus.com/home.url

Systematic Review for component models

- Overall Question
  - **Which characteristics of component models are described in research literature?**

  - Research based on paper
    - A Classification Framework for Software Component Models, *Ivica Crnkovic, Séverine Sentilles, Aneta Vulgarakis, and Michel R. V. Chaudron*

Classification summary

- Component model
  - Lifecycle
    - Modelling
    - Implementation
    - Packaging
    - Deployment
      - At compilation
      - At run-time
  - Constructs
    - Interface specification
      - Interface type
        - Operation-based
        - Port-based
      - Distinction of Provides / Requires
      - Interface Language
      - Interface Levels
        - Syntax
        - Semantic
        - Behaviour
      - Distinctive features
    - Interaction
      - Interaction Styles
      - Communication Type
        - Synchronous
        - Asynchronous
    - Binding type
      - Exogenous / Endogenous
      - Vertical
  - Extra functional properties
    - Management
      - Endogenous Collaborative
      - Endogenous Systemwide
      - Exogenous Collaborative
      - Exogenous Systemwide
    - Specification
    - Composition

Refined Questions

- Which research literature address the following questions:

    1. How the component models support lifecycle of component and component-based systems?

    2. Which are the important elements in component models that describe components specification and integration?

    3. Which are the important elements that describes extra-functional properties in component models

Example: Refined Questions for Component models lifecycle

1. How the component models support lifecycle of component and component-based systems?

2. How component models support modeling and design?

3. How component models provide support for implementation?

4. How component models use repositories?

5. How component models support component deployment?

Example: Keywords

1. *("Component model" or "component") and ("lifecycle")*
2. *("Component model" or "component") and "modeling"*
3. *("Component model" or "component") and and "design"*
4. *("Component model" or "component") and "packaging"*
5. *("Component model" or "component") and "storage"*
6. *("Component model" or "component") and "repository"*
7. *("Component model" or "component") and "deployment"*
8. *("Component model" or "component") and "plug-and-play"*
9. *("Component model" or "component") and "integration*

Assignment

- Provide a systematic review of characteristics of component models for one of the basic characteristics

  a) lifecycle, or b) construction, or d) extra-functional properties

  Alternatives:

  – One student provides the review

  – Two students together provide the review with a separate reading abstracts and using Fleiss kappa to show the agreement.

Research Databases

- SCOPUS http://www.scopus.com/home.url
- ACM Digital Library (http://portal.acm.org)
- Compendex (http://www.engineeringvillage.com)
- IEEE Xplore (http://www.ieee.org/web/publications/xplore/)
- ScienceDirect – Elsevier (http://www.elsevier.com)
- SpringerLink (http://www.springerlink.com)
- Wiley InterScience (http://www3.interscience.wiley.com)
- ISI Web of Science (http://www.isiknowledge.com).

Assignment steps 1/2

- Select the main question
- Specify the sub-questions
- Identify the keywords
- Identify a database to be searched in
- Run the queries with keywords
- Extract the list of papers (references+ abstracts)
  - Extract the papers in a way that it is easy to process them. Suggestion: use Medeley (http://www.mendeley.com/) for storing references

Assignment steps 2/2

- Read the selected papers titles and the abstracts and select the papers that are relevant (for two reviewers: each reviewer does it separately)
- List these papers
- In a case of two reviewers: Check agreement with Fleiss' kappa. Discuss the papers that differ and make a choice to select it or not.
- Make statistics of the selected papers (as done in **Architecting Software for Evolvability: A Systematic Review,** Hongyu Pei Breivold, Ivica Crnkovic, Magnus Larsson) – citation, year distribution, etc…
- Categorize the papers according to the sub-characteristics specified in the classification framework (page 11)

Actions

- Select a topic/question (one or two students)
- Mail to ivica.crnkovic@mdh.se the choice
- Identify questions, keywords, and database
- Mail to ivica.crnkovic@mdh.se the choice
- Continue with the work
- Write a report

References for the systematic review

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