Network Data Analysis

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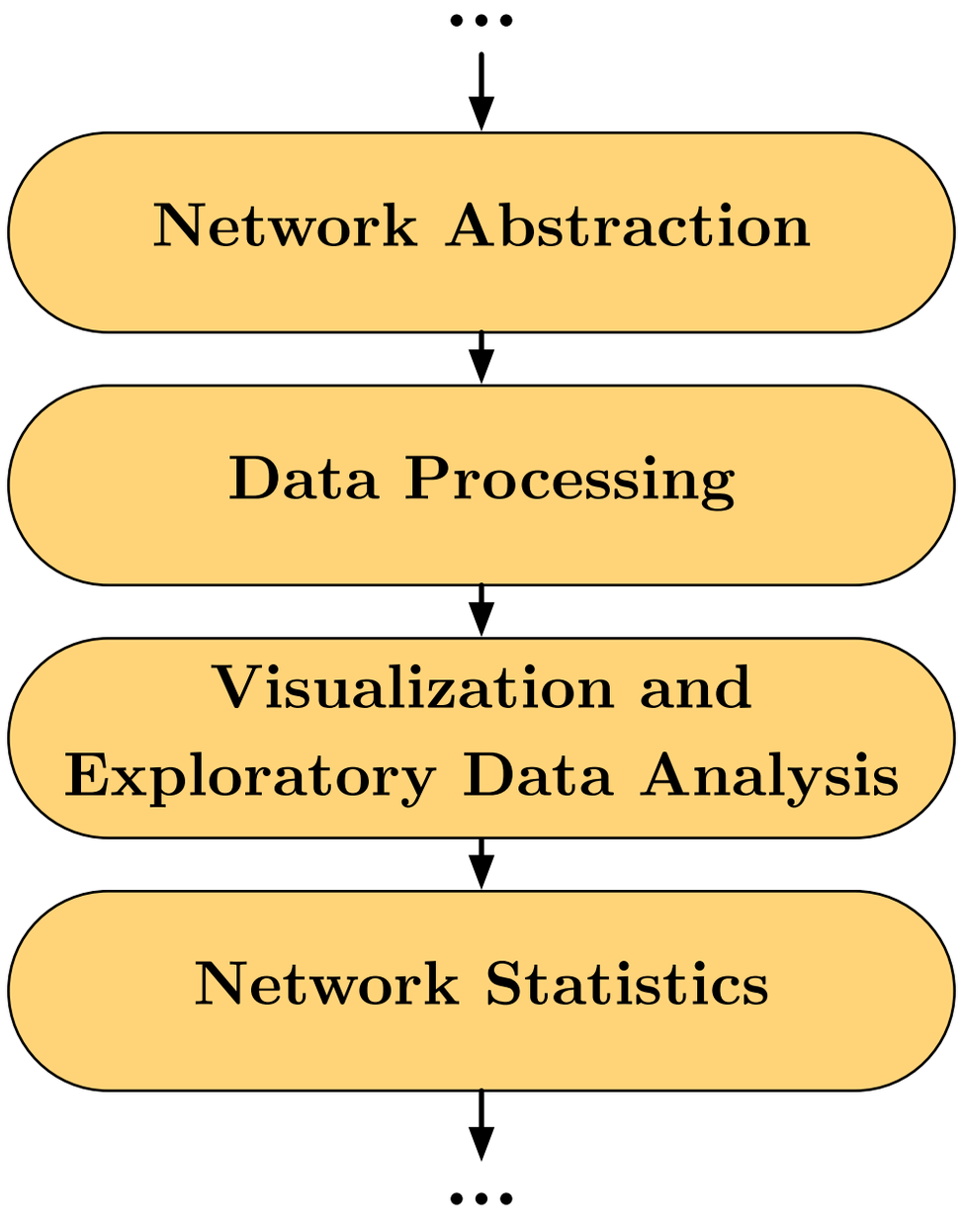
Outline

- A Big Picture View of Network Data Analysis
- Tools of the Trade
- Hands-On!

A Big Picture View of Network Analysis

A Big Picture View of Network Analysis



Before the Network Analysis

- What question are we trying to answer?
- What problem are we trying to solve?
- What sort of data could we collect?
- How will we collect it?

Network Abstraction

- What are the appropriate network abstractions to answer the questions at hand?
  - What is a node (vertex) in the network?
  - What is a edge (link) in the network?
  - Does modeling the system under consideration as a network make sense?

Data Processing

- How do we convert the data-in-hand into the network abstraction developed in the previous step?
  - What will we compute from the data to generate nodes and edges?
  - Is any of the data missing or obviously corrupted?
  - How will we store the network?

Visualization and Exploratory Data Analysis

- What are the basic properties of the network?
  - How many nodes?
  - How many edges?
  - How dense?
  - What family of degree distribution?

- What large scale structure can we identify using the Mark One Human Eyeball?
  - Are there dense, separated clusters of nodes?
  - Is there a hub-and-spoke structure?

- Are there any anomalies that appear unrealistic?
  - Useful for assessing data quality and double checking data processing.

Network Statistics

- What are the global properties of the network?
  - How many connected components?
  - What diameter?
  - What mean path length?

- What are the local properties of the network?
  - Importance (centrality) of nodes:
    - Degree
    - Eigenvector Centrality
    - Many more

- What are the mid-scale properties of the network?
  - Assortativity / Disassortativity

And Beyond!

- Network Science is a growing field.
- New theory and methodology developed every day.
- The **Awesome Network Analysis** page by François Briatte has an awesome list of resources:

https://github.com/briatte/awesome-network-analysis

Tools of the Trade

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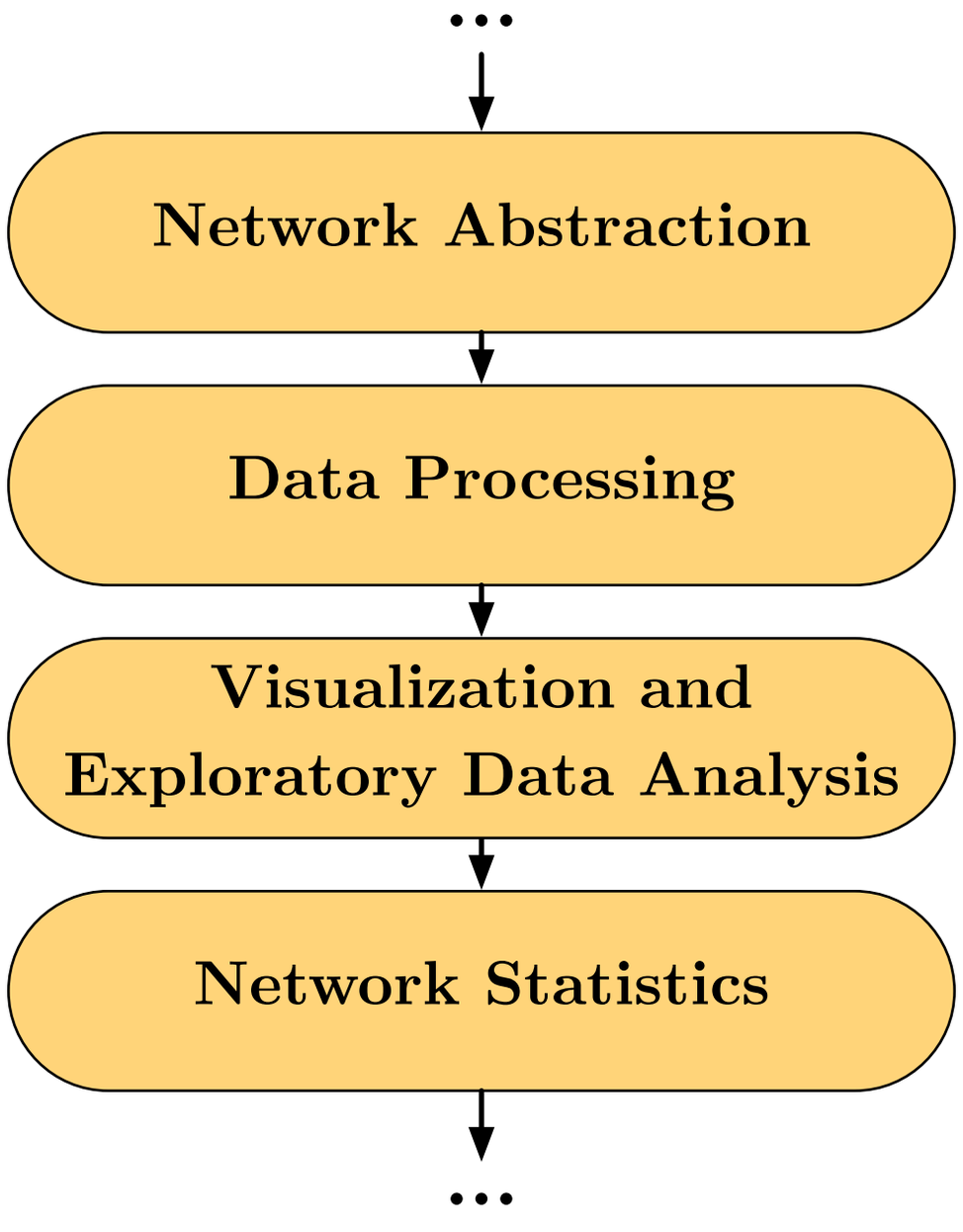

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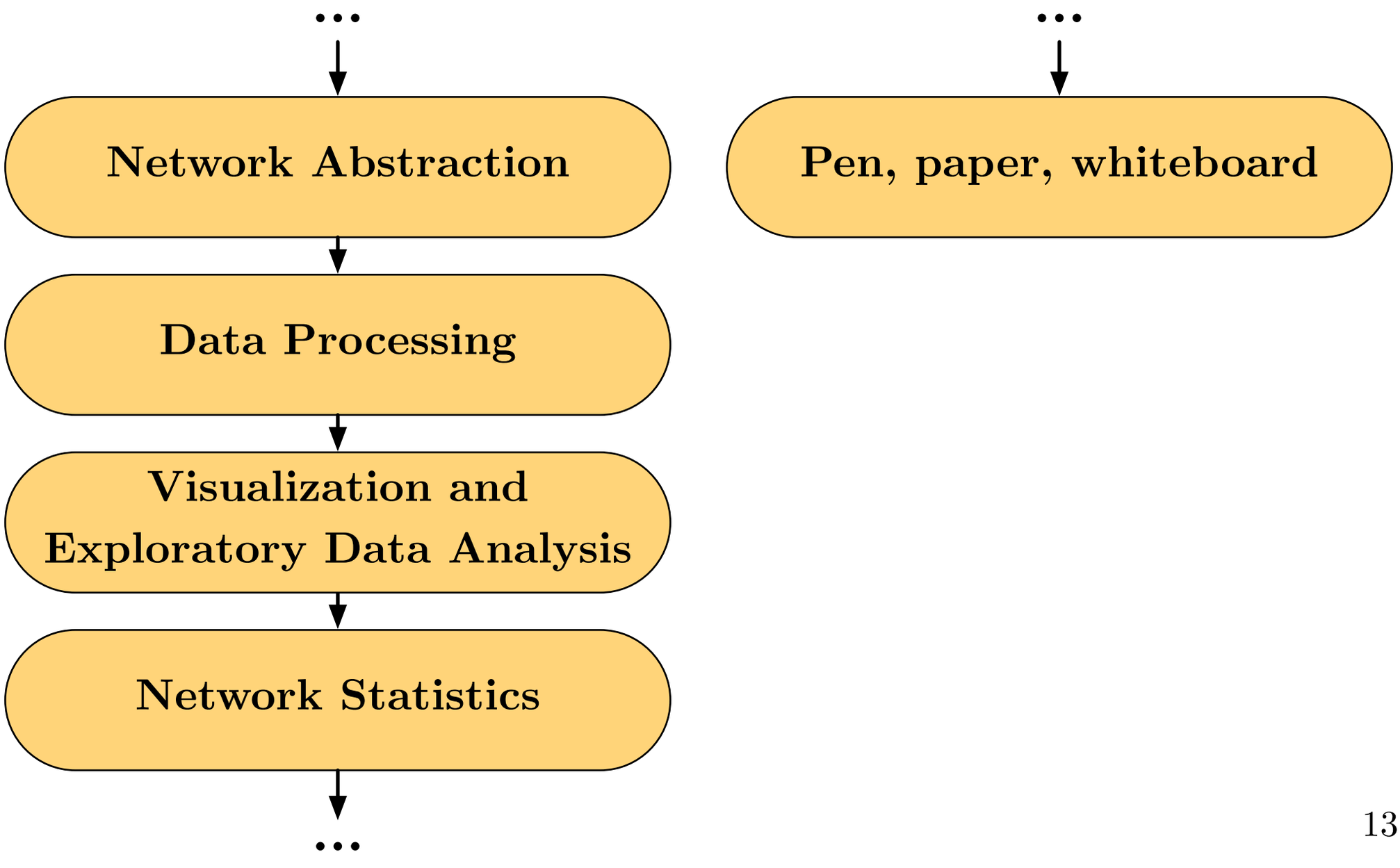

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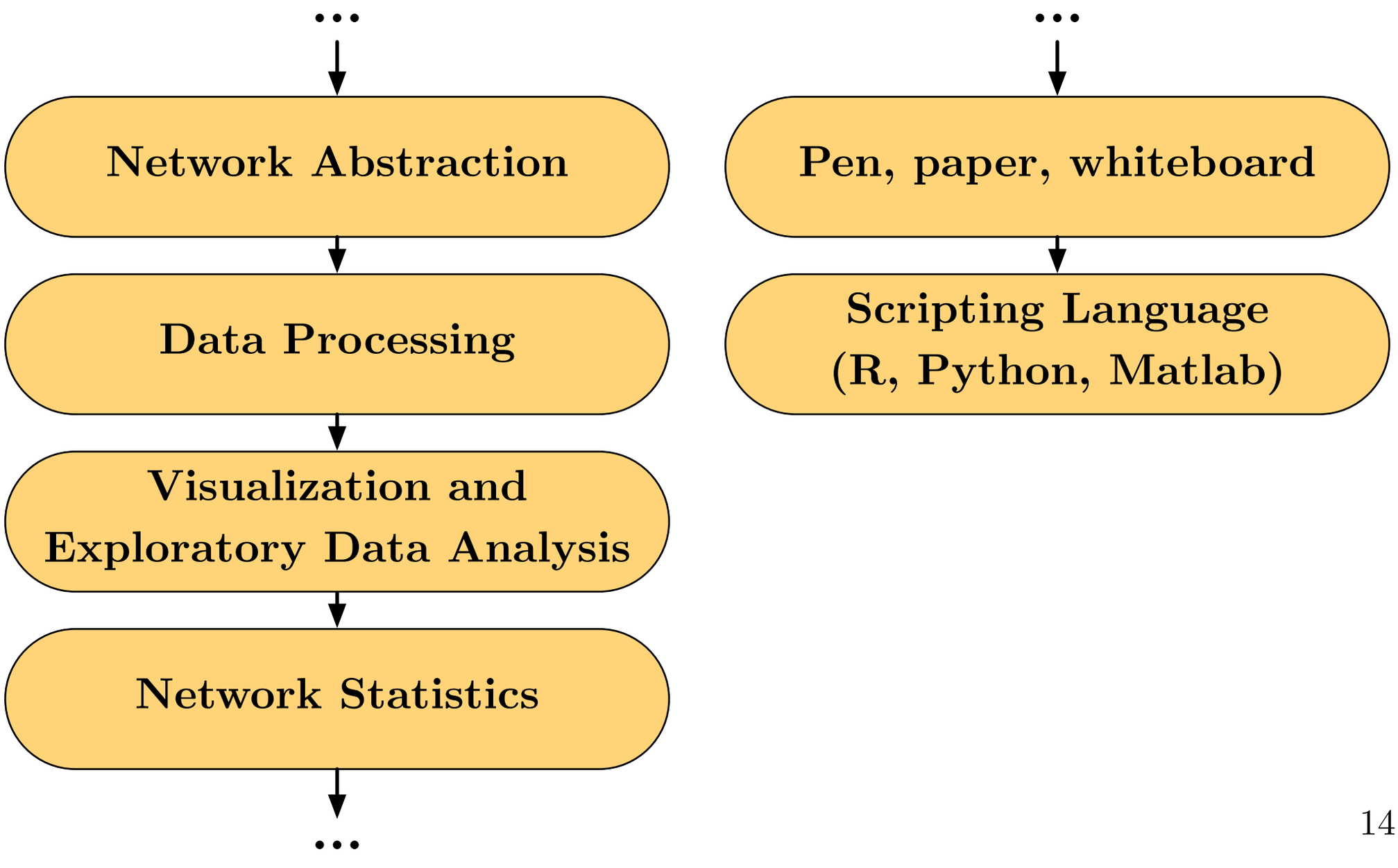

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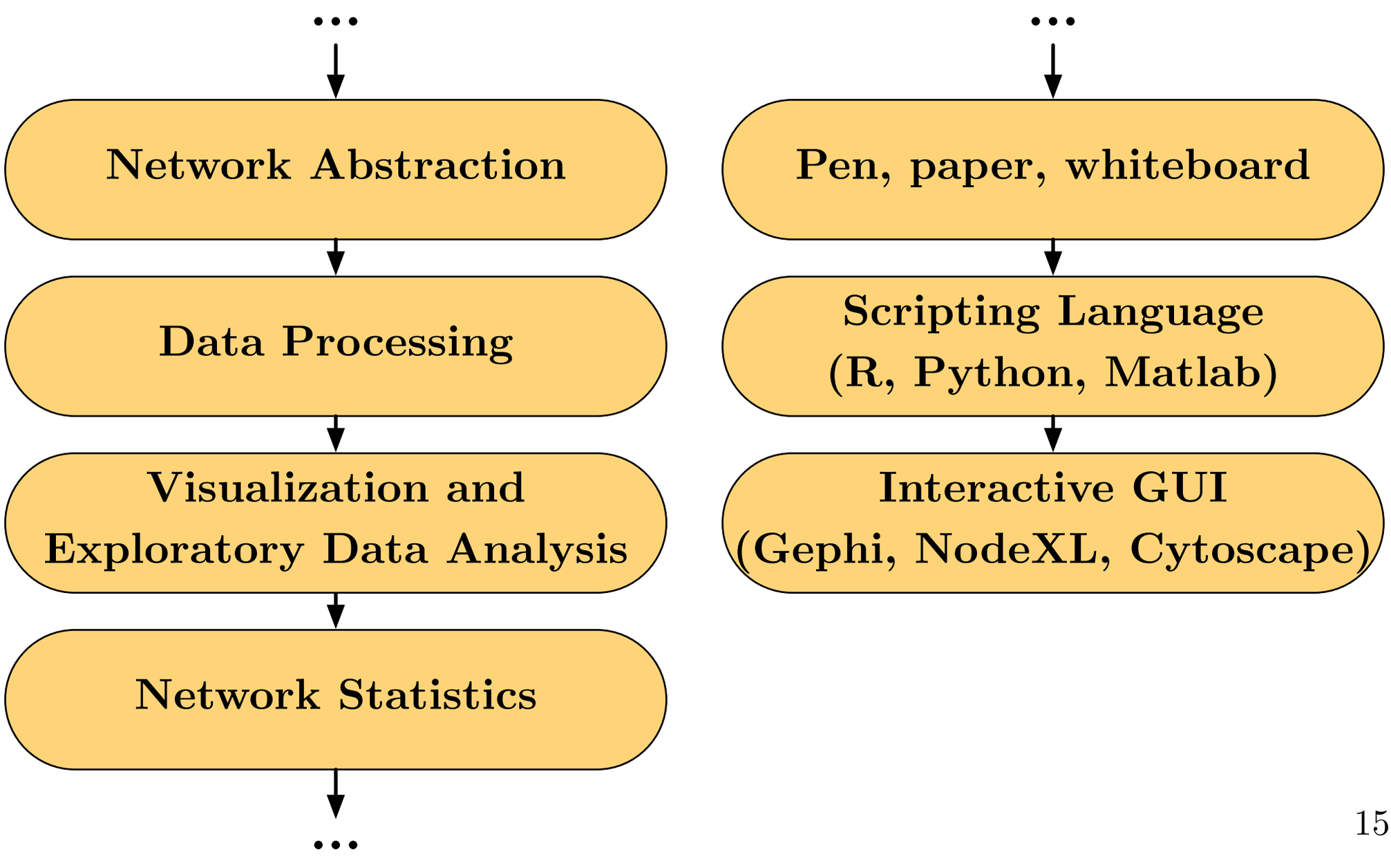

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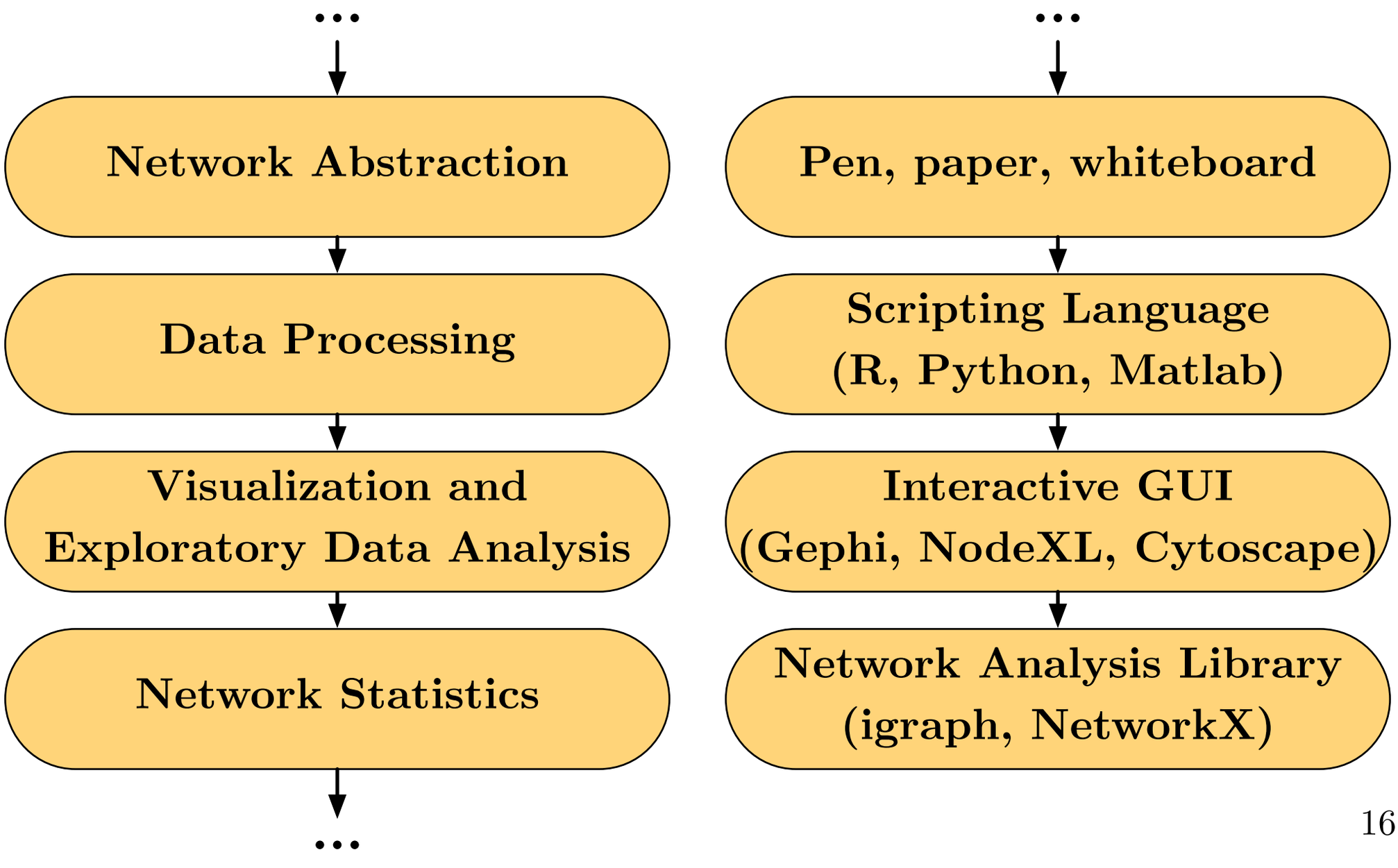

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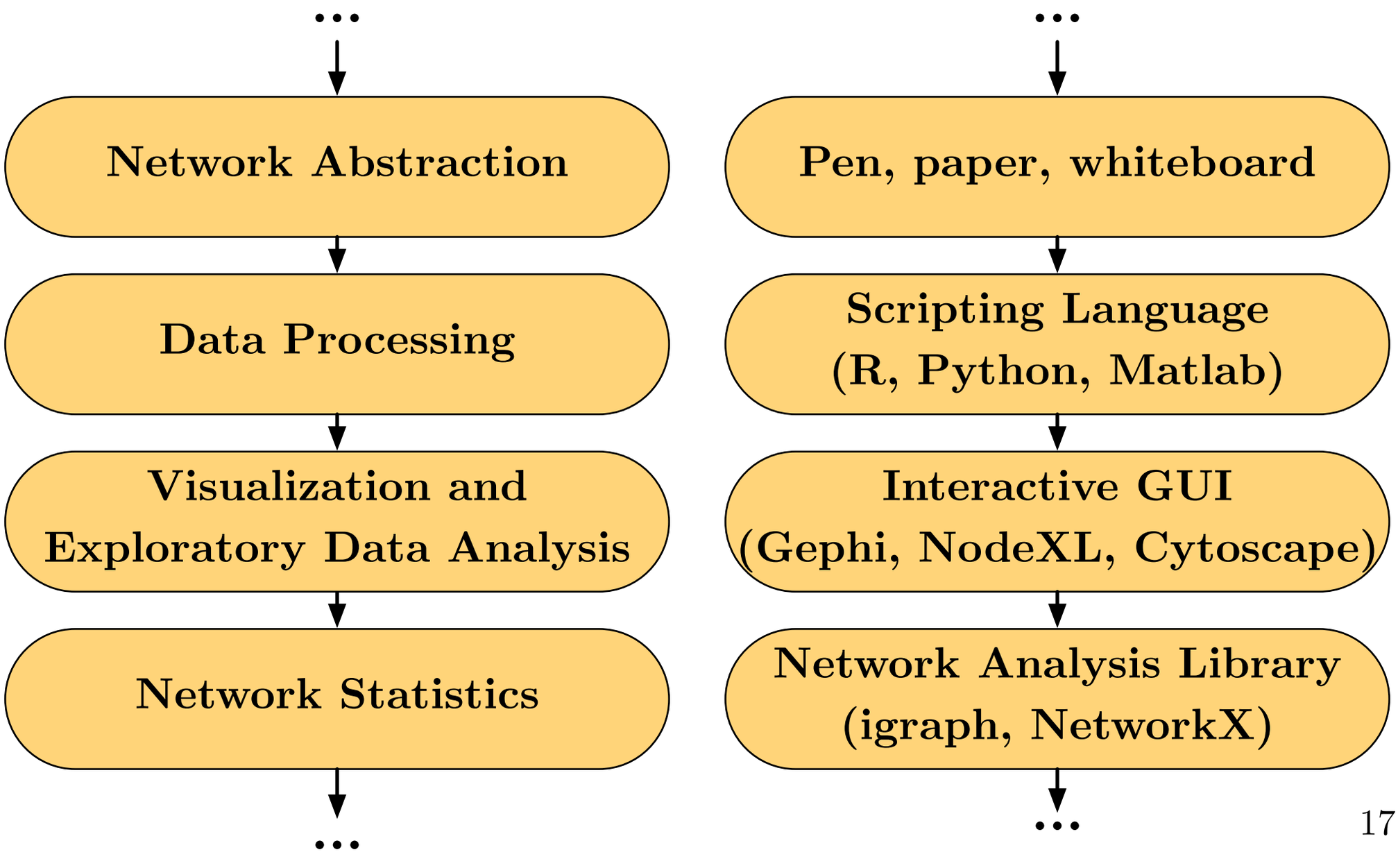

Hands-On

github.com/ddarmon/sfinsc-day1