

# Visualization of Large Graphs

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**Abstract**

## 1 Introduction

size relative to memory and screen space, where memory has larger capacity than screen.

- **small:** fits in memory and on screen, could be drawn by hand
- **medium:** fits in memory and on screen, all details clearly visible
- **large:** fits in memory and on screen (but requires zooming for details)
- **very large:** fits in main memory, but not on screen
- **huge:** does not fit in main memory

note: a graph can be very large with respect to the screen of a handheld device, but at the same time medium size for a high resolution poster

## 2 Models of Computation / Data Management

challenges: graph is big  
relates to data representation

- **random access**
- **external memory** (also random access)
- **streaming**

problems

- models for streaming
- hierarchical storage models for layouts: filtering, coarsening

### 3 Visualization / Presentation

depending on representation (matrix, node-link, inclusion; also: mixed):  
challenges

- hairballs
- labels

visual abstractions to reduce complexity based on

- **global structure** (clustering, hierarchy, ...)
- **local structure** (attached trees, complete bipartite graphs, motifs, ...)

problems

- effective systems based on clustering, filtering
- automated browsing for presenting (very) large graphs (guided tour)
- semantic zoom
- global abstraction, sketching

### 4 Interaction

challenges

- interaction with given layout/drawing
- interaction with data structures (generating views)
- **browsing** (also automated)
- **focus+context**
- **drill-down** (includes on-the-fly layout refinement)

problems

- (coordinated) multi-views: triptychon of two-mode networks
- browsing techniques (magic lenses, fisheye, zooming, etc.)
- querying
- filtering

### 5 Directions