Übung zur Vorlesung

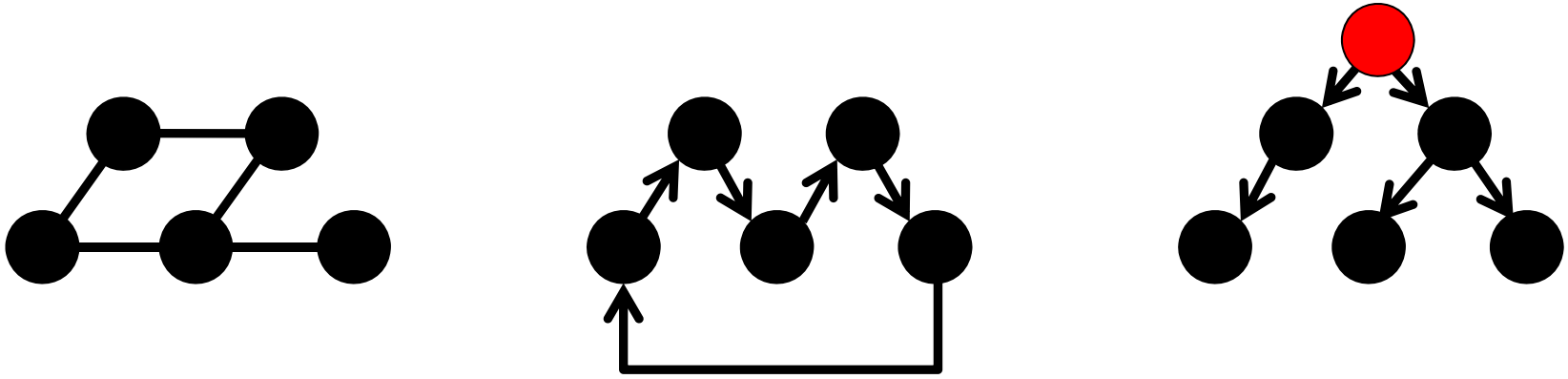
Informationsvisualisierung

Emanuel von Zezschwitz
Ludwig-Maximilians-Universität München
Wintersemester 2012/2013

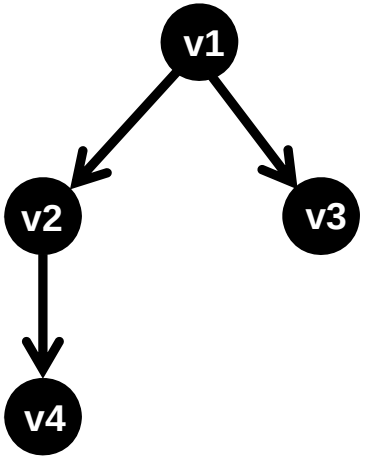
Graphs and Hierarchies

Terminology

- A **Graph** is an abstract representation of a set of objects where relations between objects are represented by links.
- A **Network** is a directed graph.
- A **Tree** is a (usually) directed graph without cycles. There is usually a designated root.



Node-link versus Matrix



VS.

	v1	v2	v3	v4
v1	0	1	1	0
v2	0	0	0	1
v3	0	0	0	0
v4	0	0	0	0

Graph Drawing

Goals [2]:

- Minimize crossing
- Minimize area
- Minimize the sum of the edge lengths
- Obtain a uniform edge length
- Minimize bends

Paradigms [2]:

- Topology – Shape – Metrics
- Hierarchical
- Force – Directed

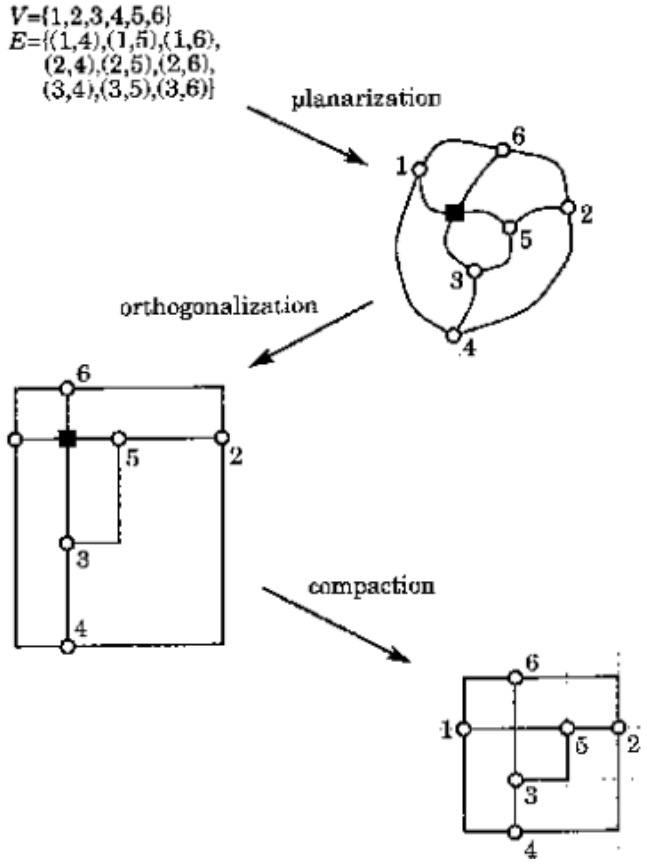
Graph Drawing

Topology – Shape – Metrics [2][4]:

- Draw orthogonal graphs

Approach:

- ✓ Planarization
- ✓ Dummy vertices for crossings
- ✓ Orthogonalization
- ✓ Minimize area



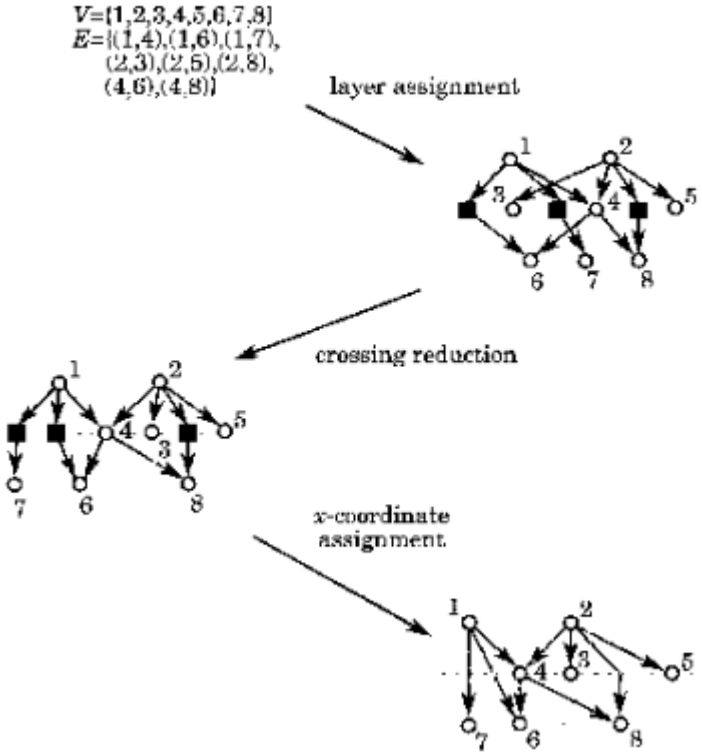
Graph Drawing

Hierarchical [2][4]:

- Draw hierarchical graphs

Approach:

- ✓ Layer assignment
- ✓ Dummy vertices for skipped layers (e.g. L_1 to L_3)
- ✓ Crossing reduction
- ✓ X-coordinate assignment



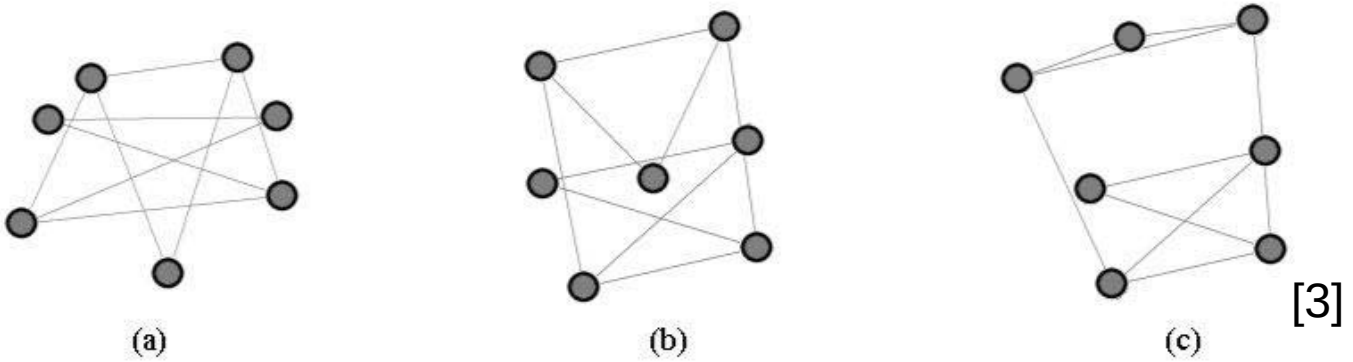
Graph Drawing

Force – Directed (Spring Algorithm) [2][4]:

- Draw self-organizational graphs

Approach:

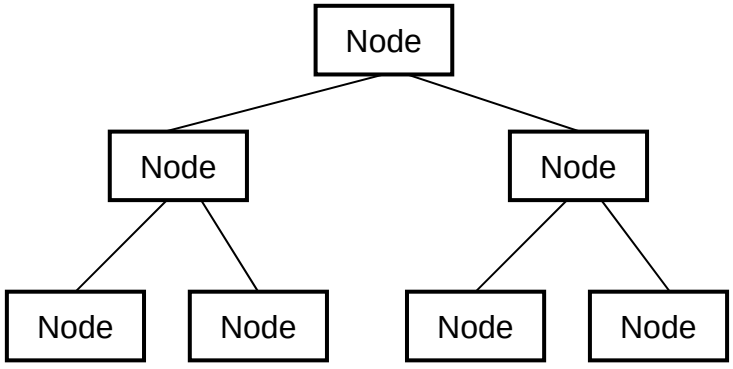
- ✓ Nodes have forces (e.g. electrical repulsion)
- ✓ Edges have forces (e.g. gravitational attraction)
- ✓ Friction to stop the process



[3]

Node-Link vs. Enclosure

- Immediate perception of relations
- Waste of screen real estate



- Space-filling
- Focus on leaf nodes
- Structure gets lost

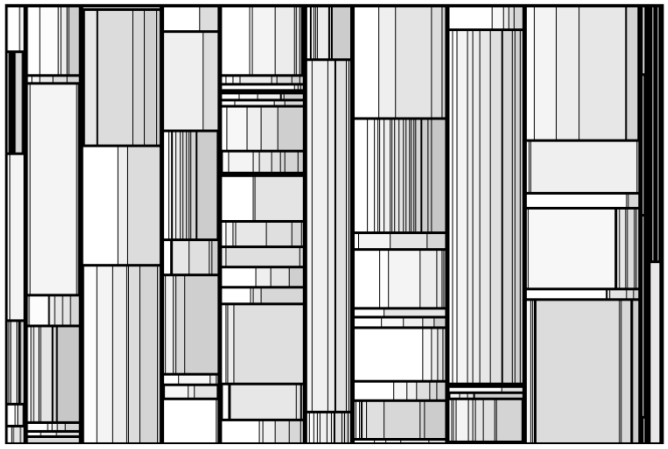
http://newsmap.jp/

Treemap Algorithms [1]

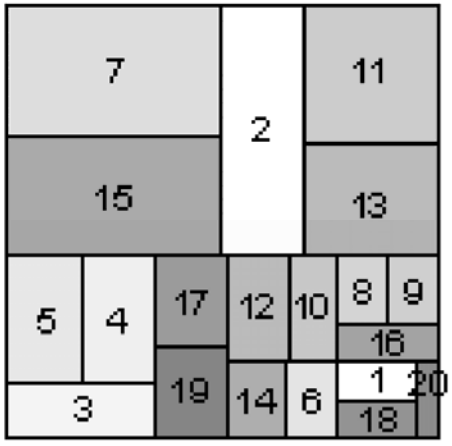
- **Slice-and-Dice**
- Cluster
- Sqarified

- Bewertung durch: *Aspect Ratio, Change, Readability*

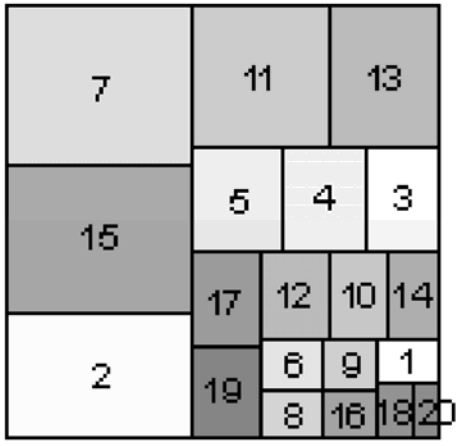
Slice-and-Dice



Cluster

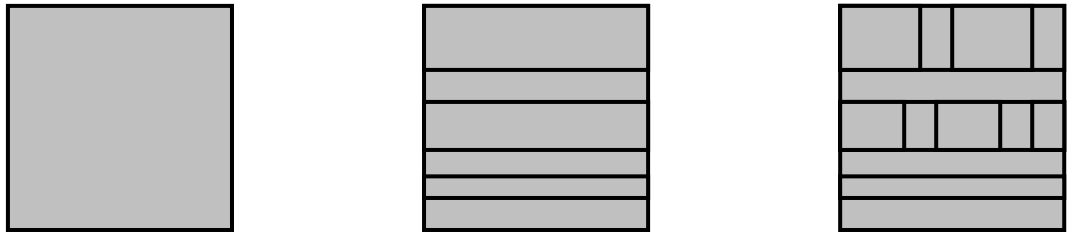


Squarified



Slice-and-Dice

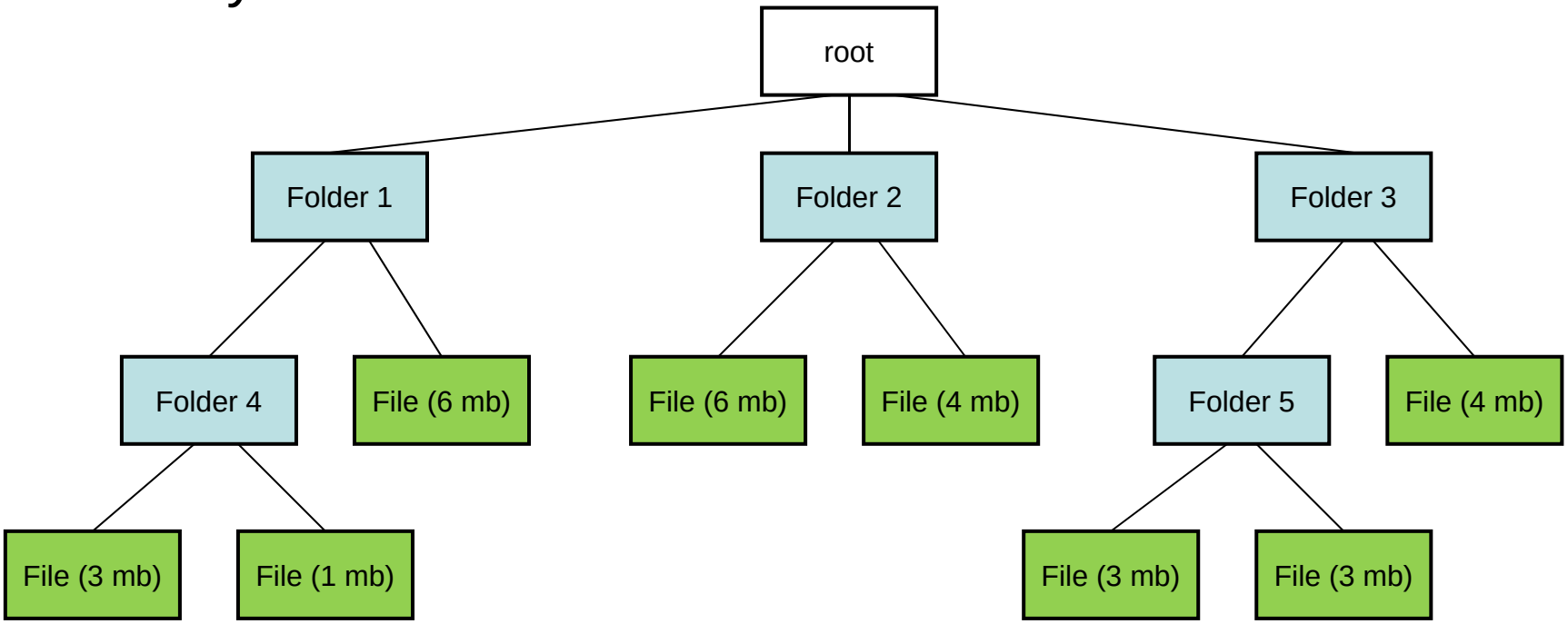
- Algorithm:
  - Use parallel lines to divide a rectangle representing an item into smaller rectangles representing the item's children
  - Each child is allocated a size proportional to some property (additional encoding by color)
  - At each level of the hierarchy switch the orientation of the lines (vertical vs. horizontal)



1. 2. 3.

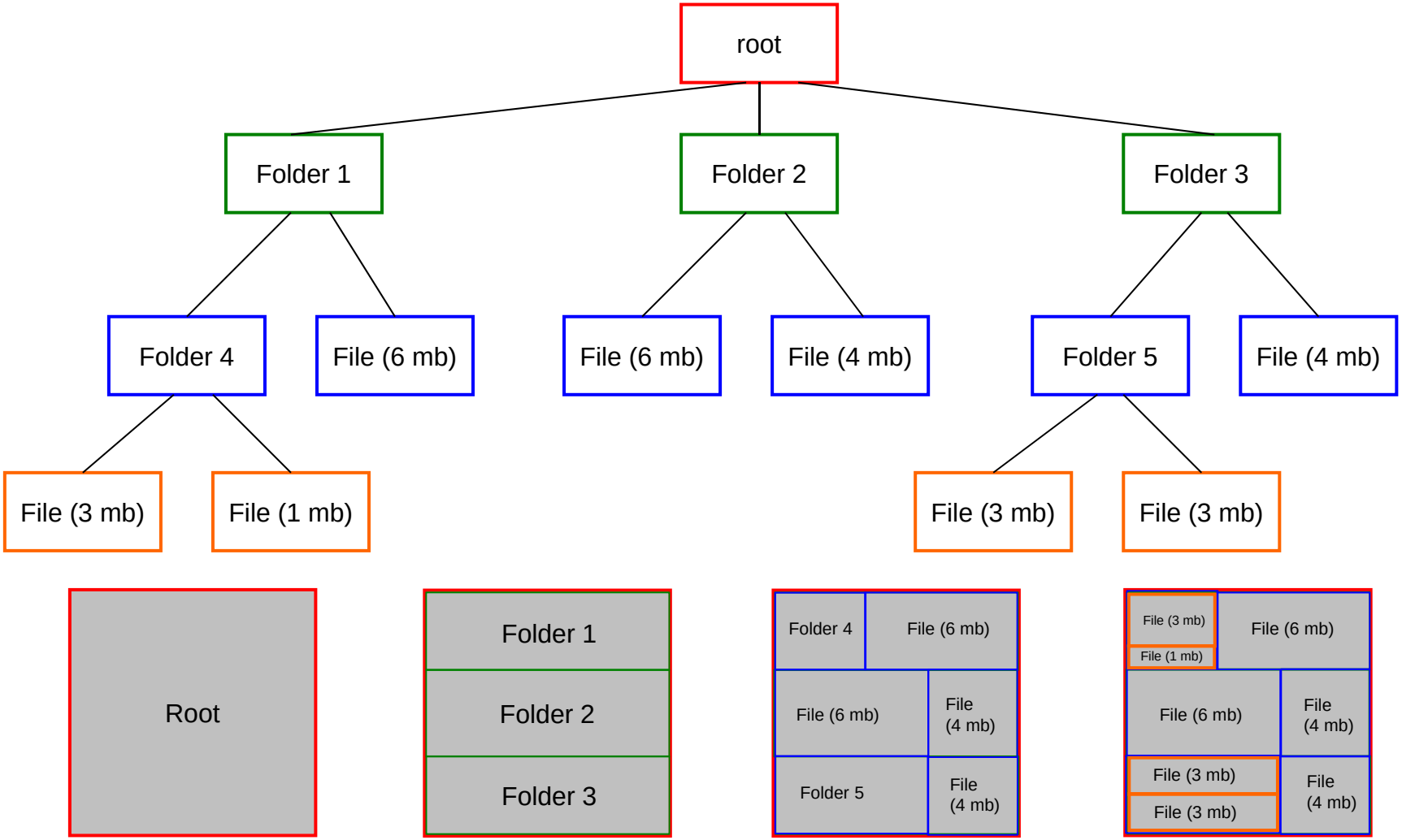
Slice and Dice

- Filesystem:



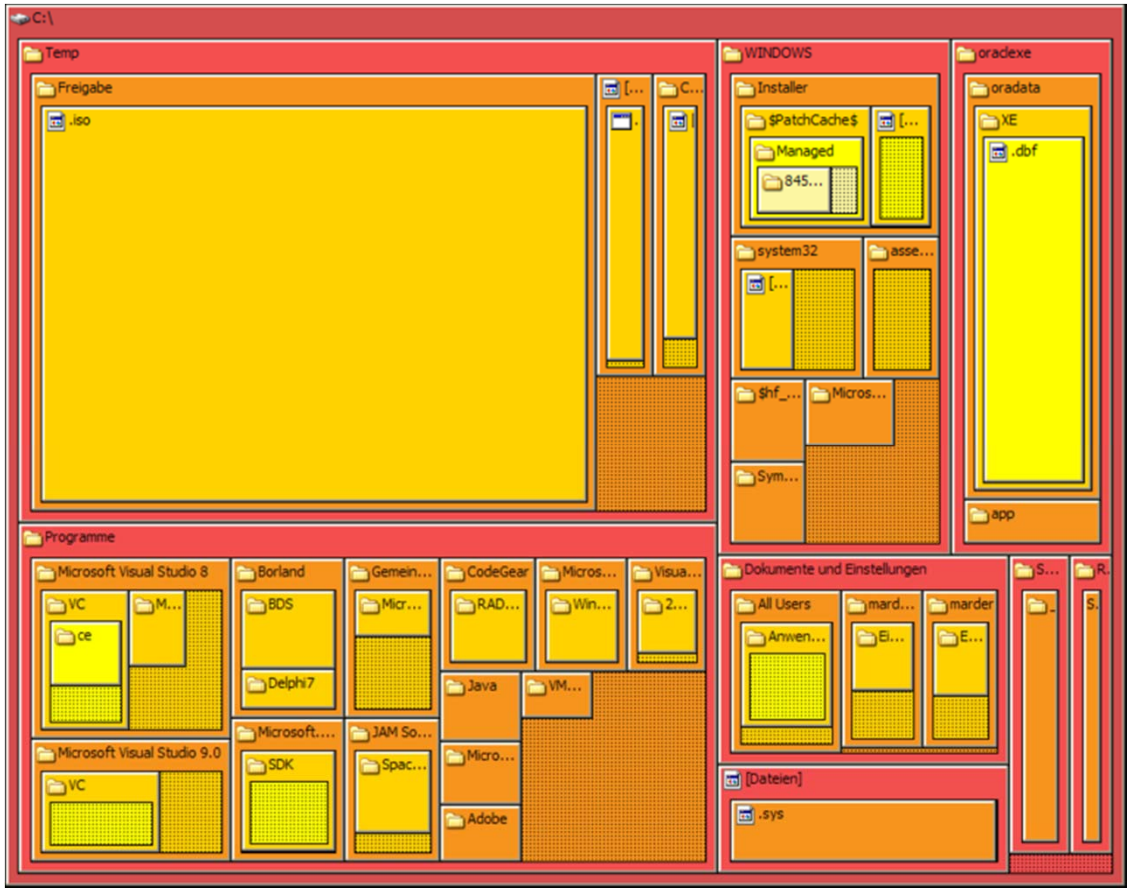
Slice and Dice

- Solution:



Nested Treemap

- Revealing the tree structure (to a certain degree)



© Carnivore1973 (from: wikipedia.org)

Subtree Selection

- Navigate the structure
- Easy access to subtrees
- Still no insights into the overall topology

Time-Based Data

Visualization Basics [6]

Common Questions

- Does a data element exist at a specific time ?
- How long is the time span of the data element ?
- How often does a data element occur ?
- How fast is a data element changing ?
- In what order do data elements appear ? …

Time Axis Configuration

- Discrete time points vs. Interval time
- Linear time vs. Cyclic time
- Ordimal time vs. Continous time

Types of Visualization [6]

Static

- Discrete or continuous data
- Visualization does not change over time
- Explore patterns, time steps without temporal limitations

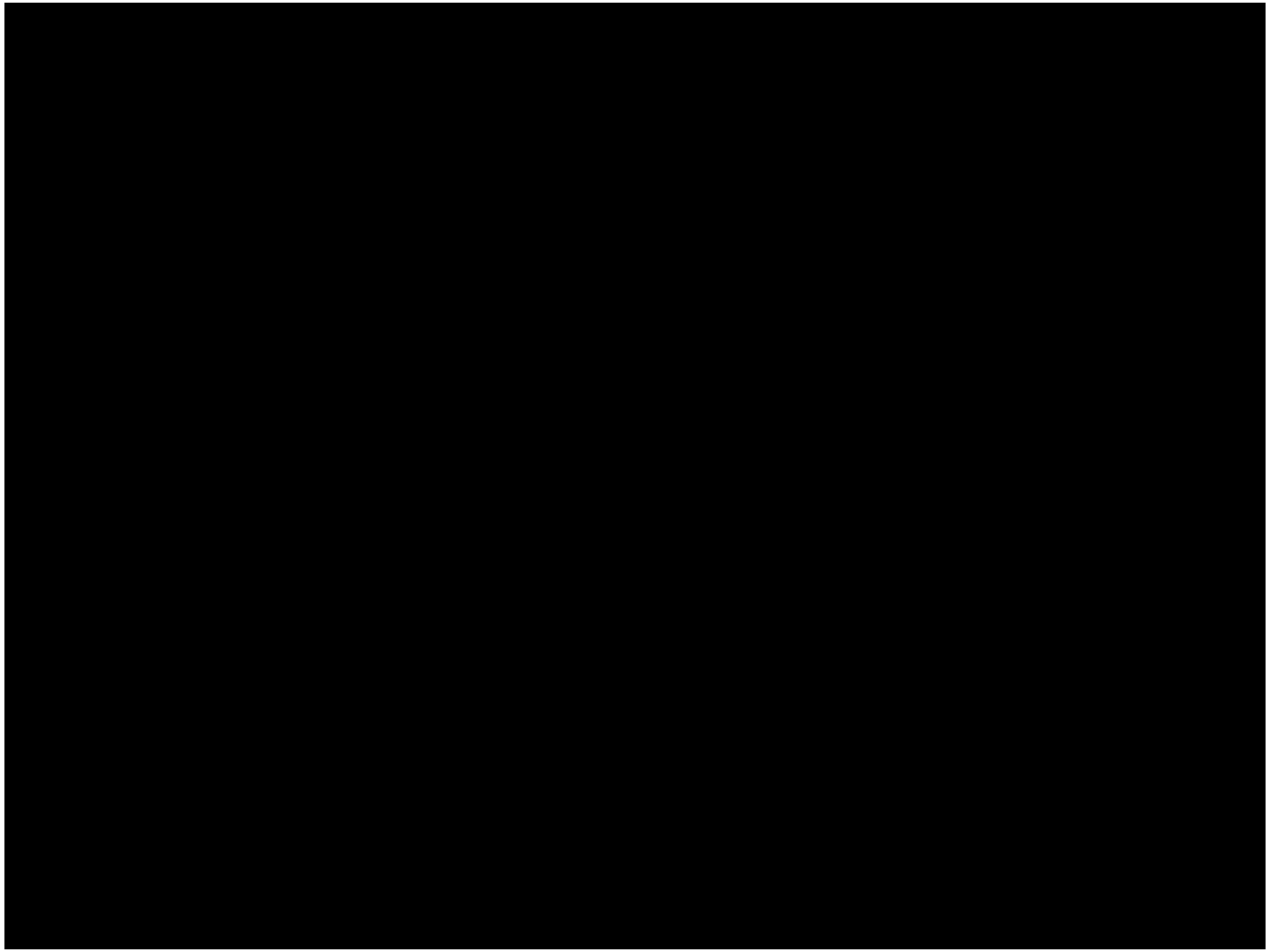
Dynamic

- Discrete or continuous data
- Visualization changes over time
- Conclusion of temporal behavior

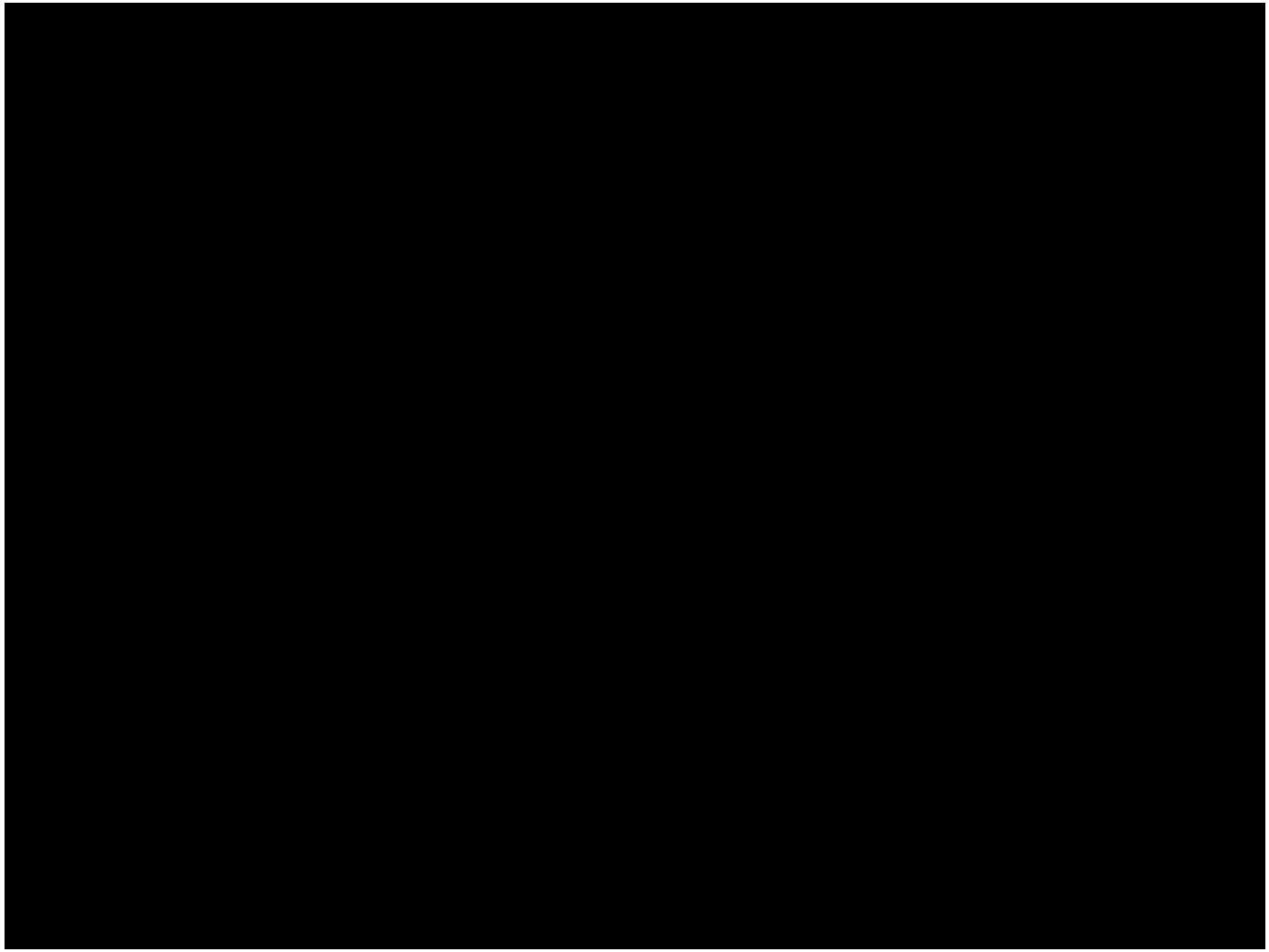
Event-based

- Discrete, continuous and event-based data
- Changes in data can not be foreseen

Example: KronoMiner [5]



Example: LastHistory [3]



Project: Barkeeper

Barkeeper: Roadmap

- **Finale Abgabe: 13.12.12 – 12:00 Uhr**
- Zusätzlich Präsentation an einem frei wählbarem Übungstermin oder persönlich bei Emanuel:
  - Es werden keine perfekten Endversionen erwartet.
    - Wer hat was gemacht?
    - Was wurde umgesetzt?
    - Was wurde aus den Daten abgeleitet?

- Notifikation über 5% Notenbonus am 17.12.12 per E-Mail.
- Weiterentwicklung des Projekts in den Wochen nach Weihnachten
  - erneute Chance auf (weitere) 5%
  - Anforderungen (sowie Namen zu Ids ;)) werden noch vor Weihnachten bekannt gegeben

References

[1] Benjamin B. Bederson, Ben Shneiderman, and Martin Wattenberg. 2002. Ordered and quantum treemaps: Making effective use of 2D space to display hierarchies. *ACM Trans. Graph.* 21, 4 (October 2002)

[2] Di Battista, G. , Eades, P., Tamassia, R., Tollis, I., Graph Drawing: Algorithms for the Visualization of Graphs, Prentice Hall, Upper Saddle River, 1999

[3] Dominikus Baur, Frederik Seiffert, Michael Sedlmair, and Sebastian Boring. 2010. The Streams of Our Lives: Visualizing Listening Histories in Context. *IEEE Transactions on Visualization and Computer Graphics* 16, 6 (November 2010), 1119-1128.

[4] Germano, T. Graph Drawing. 1999. http://davis.wpi.edu/~matt/courses/graphs/, last visited: 26.11.2012

[5] Jian Zhao, Fanny Chevalier, and Ravin Balakrishnan. 2011. KronoMiner: using multi-foci navigation for the visual exploration of time-series data. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '11). ACM, New York, NY, USA, 1737-1746.

[6] Wolfgang Müller and Heidrun Schumann. 2003. Visualization for modeling and simulation: visualization methods for time-dependent data - an overview. In Proceedings of the 35th conference on Winter simulation: driving innovation (WSC '03). Winter Simulation Conference 737-745.