

INFOVIS: HIERARCHY AND GRAPHS

SCIVIS: BASIC PRINCIPLES

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2010-2019



INFOVIS: HIERARCHY AND GRAPHS

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Bib: Alexandru C. Telea, Data Visualization: Principles and Practice. (Capítulo 11)

Graphs

- Represent relationships, such as:
 - Communication in Social Networks
 - Network traffic
 - Word semantic
 - Precedence
 - Routes

Trees

- Represent Hierarchy. Native applications such as:
 - Phylogenies
 - Family trees
 - File Structure
 - Government
 - ??

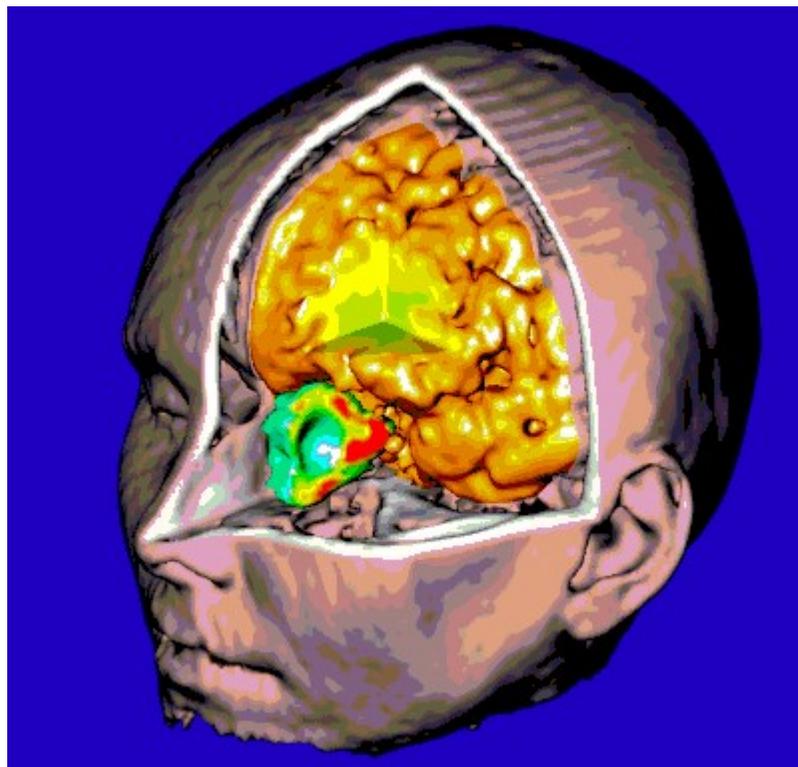
Trees and Graphs – non native

- Abstract structures
 - Similarities
 - Correlations
 - Precedence
 - Transformation
 - Etc.

Types of data and SciVis

- Scientific Visualization vs. Infovis
- Ex:
 - SciVis
 - Mesh with scalar and vector data in each point
 - InfoVis
 - Attribute tables and similarity matrices

Parenthesis: SciVis in contrast with InfoVis



Parenthesis: SciVis in contrast with InfoVis

- SciVis: physical phenomena.
- Measurements and simulations
 - Applications: engineering, medicine, physics and other sciences.
- Data types: scalar, vector, tensor

Data Types in Infovis

- May be more than numbers.
- They can be:
 - Nominal, ordinal, binary, discrete, continuous, and so on
 - Time varying and streaming

Types of Attributes in InfoVis

Tipo de Dados	Domínio do Atributo	Operações	Exemplos
Nominal	Conjunto não ordenado	Comparação (=, ≠)	Texto, referências, elementos sintáticos, qualificadores
Ordinal	Conjunto ordenado	Ordenação (>, <, ≥, ≤)	Pontuação (ex. bom, médio, ruim)
Discreto	Conj. Inteiros e Naturais	Aritmética inteira	Contagem (ex. número de filhos, número de linhas de código, etc..)
Contínuo	Conj Real	Aritmética real	Taxas e medidas (ex. distância, similaridade, altura)
Relacionais	“tuplas” dos nominais	Agrupamentos, coleções	Ex. (co-autores, colegas, sócios, etc..)

Types of Attributes in InfoVis

- Qualitative or quantitative?
 - Nominal and Ordinal qualitative
 - Discrete and continuous quantitative
 - Categorical may be nominal, ordinal, and discrete.

Differences between types of Data in Infovis and SciVis

	Scivis	Infovis
Data domain	spatial $\subset \mathbb{R}^n$	abstract, non-spatial
Attribute types	numeric $\subset \mathbb{R}^m$	any data types
Data points	samples of attributes over domain	tuples of attributes without spatial location
Cells	support interpolation	describe relations
Interpolation	piecewise continuous	can be inexistent

Table visualization

- Each column describes typically a separate attribute.
- Each table cell can have any of the previously mentioned data types.

Table Lens

The screenshot shows a window titled "Table: composite" with a table containing 6 columns: id, category1, name 2, date 3, time, and open. The table is displayed with a magnified view of a specific row range (rows 21128 to 21132). The magnified view is overlaid on a larger, less detailed view of the table. The magnified view shows the following data:

id	category1	name 2	date 3	time	open
21128	bvb	ATB	2005-06-22	14:11	0.595600
21129	bvb	ATB	2005-06-22	13:58	0.595600
21130	bvb	ATB	2005-06-22	13:22	0.595600
21131	bvb	ATB	2005-06-22	13:04	0.600000
21132	bvb	ATB	2005-06-22	12:48	0.600000

Annotations in the image include:

- "focus point" with an arrow pointing to the first row of the magnified view (row 21128).
- "lens width" with a bracket indicating the vertical extent of the magnified view.

Tree Visualization

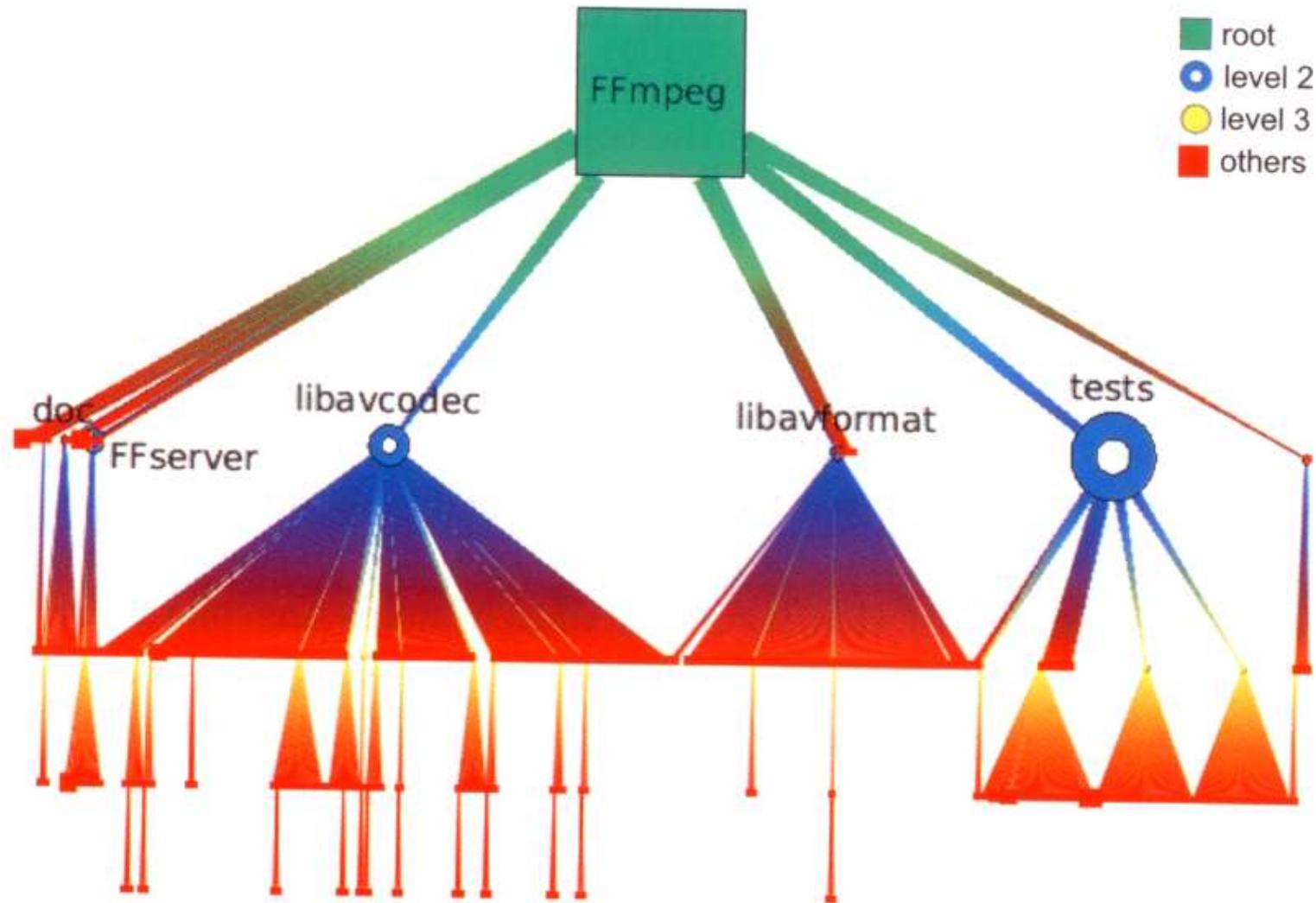
- Árvores são um tipo particular de dados relacionais
- Uma árvore possui um conjunto de nós e arestas
 - Toda aresta liga um par de nós
- Na prática, um par de nós são ligados com base em uma semântica específica

Tree Visualization: ball-and-stick

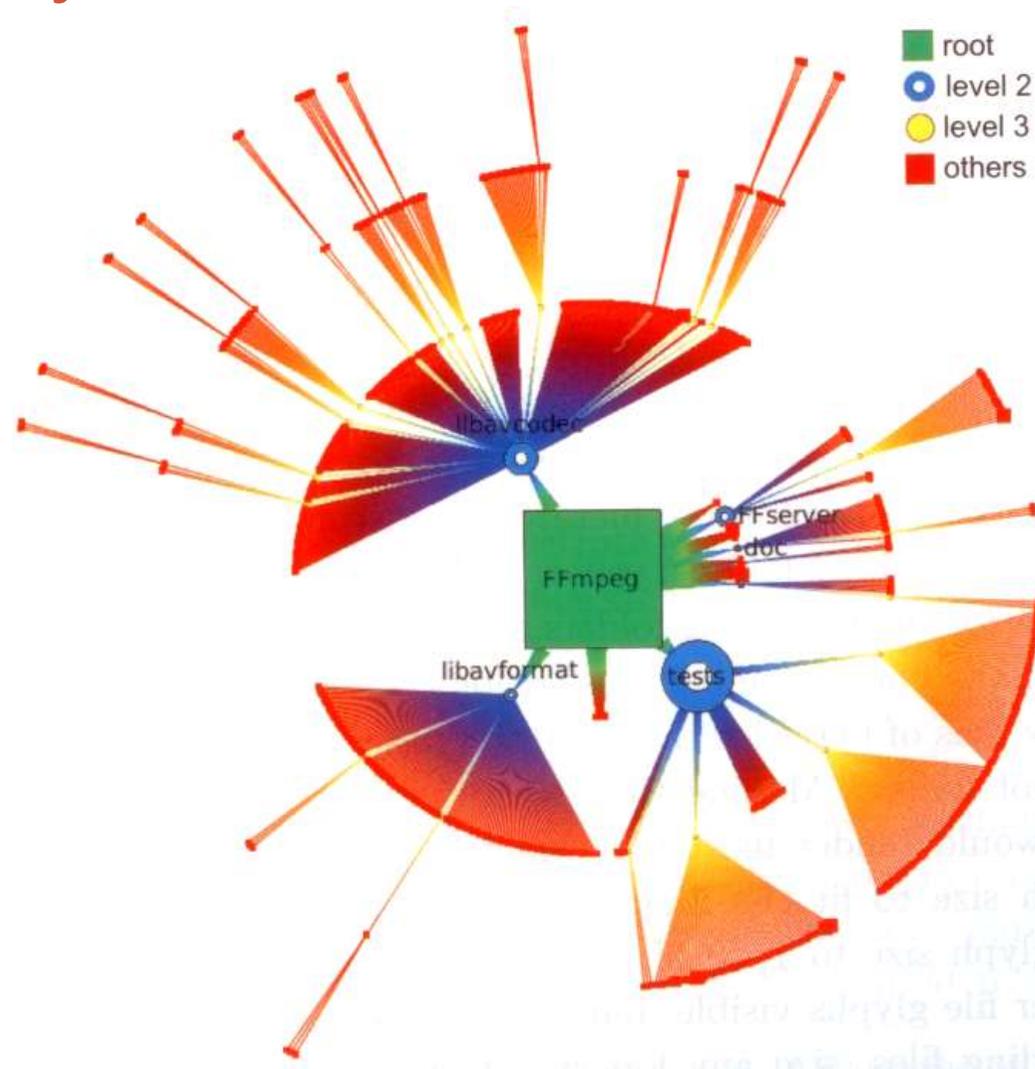
- Ball-and-stick visualization also known as node-and-link visualization
- It maps:
 - Nodes as *glyphs*
 - Edges as lines and shapes
- Much screen space is necessary

Ball-and-stick: file hierarchy

Rooted tree layout

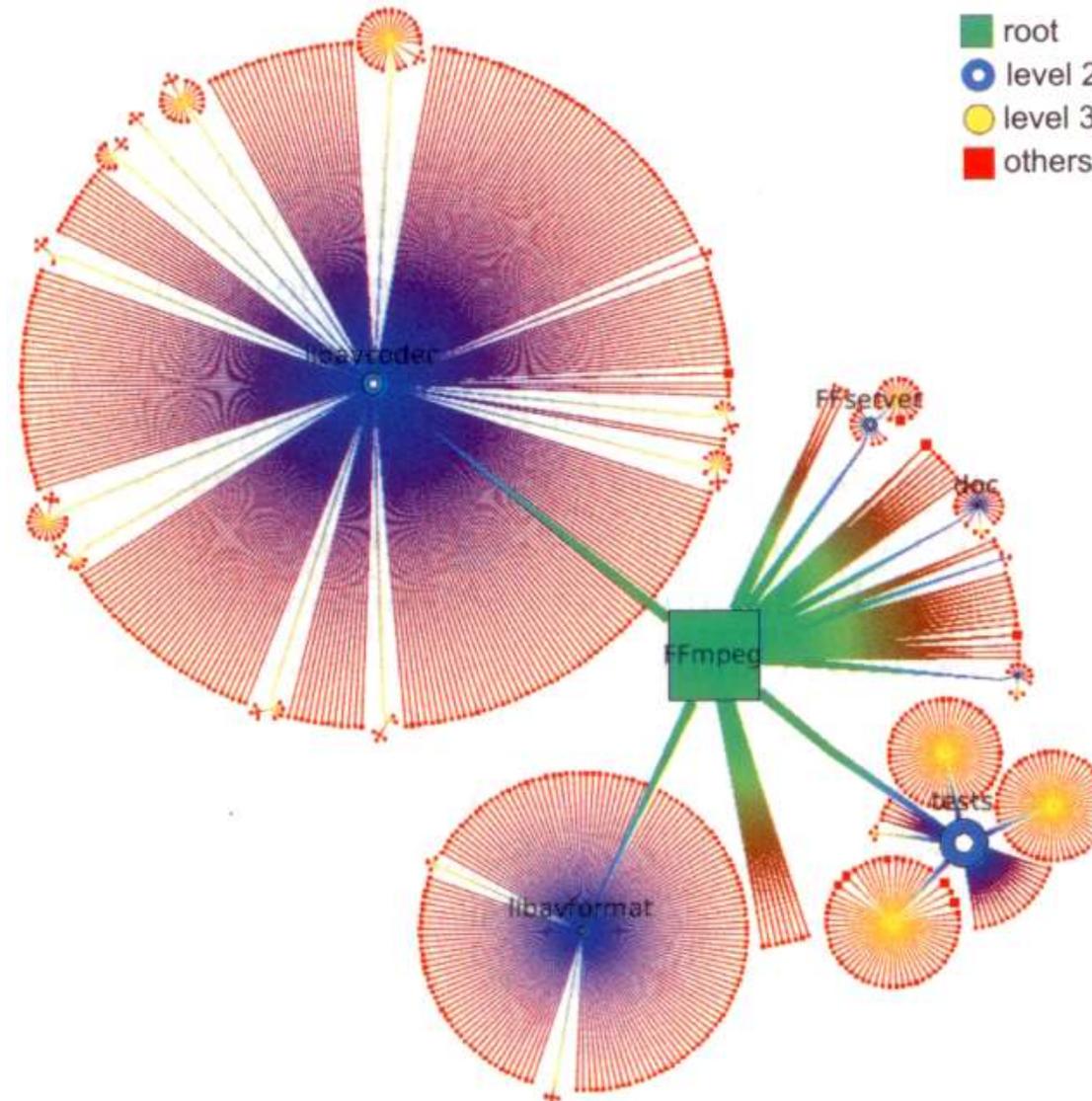


Ball-and-stick: file hierarchy Radial Layout

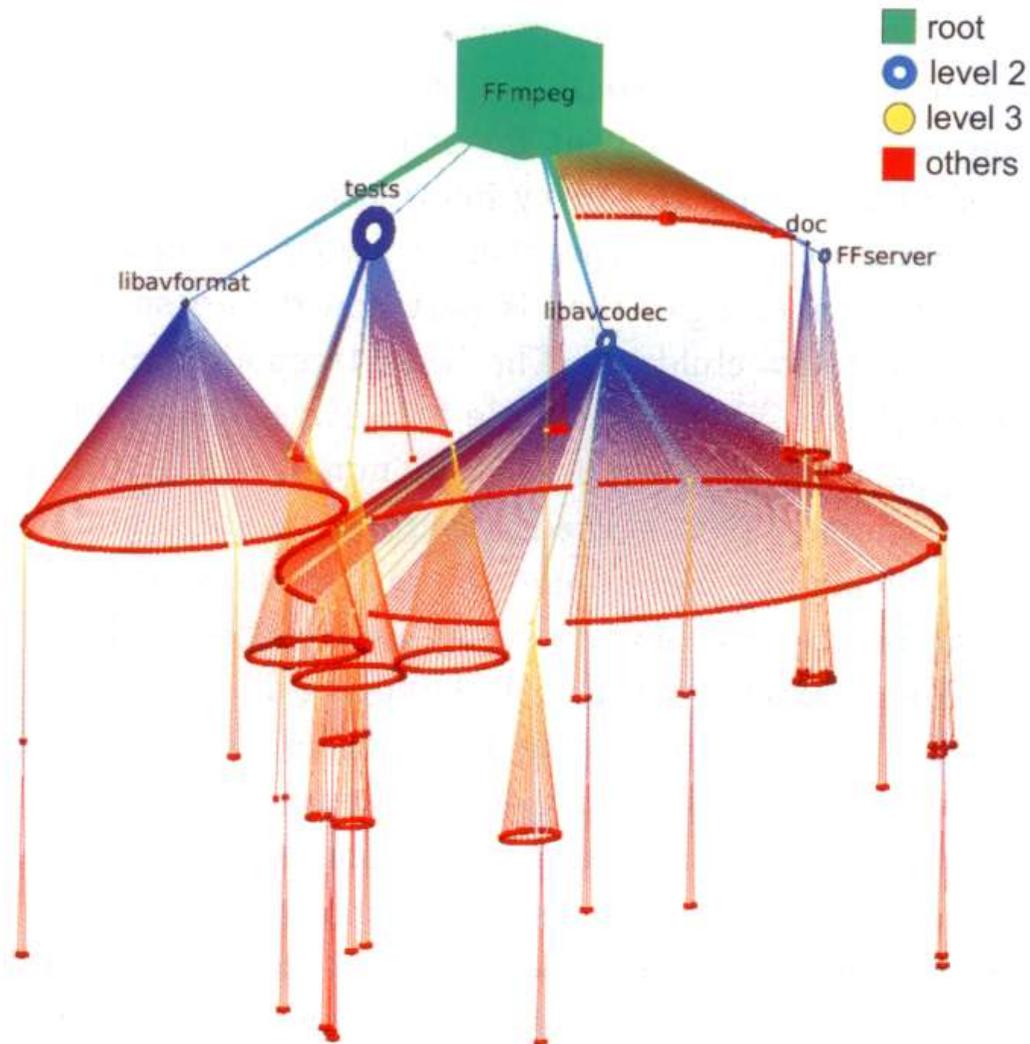


Ball-and-stick: file hierarchy

Bubble-tree Layout



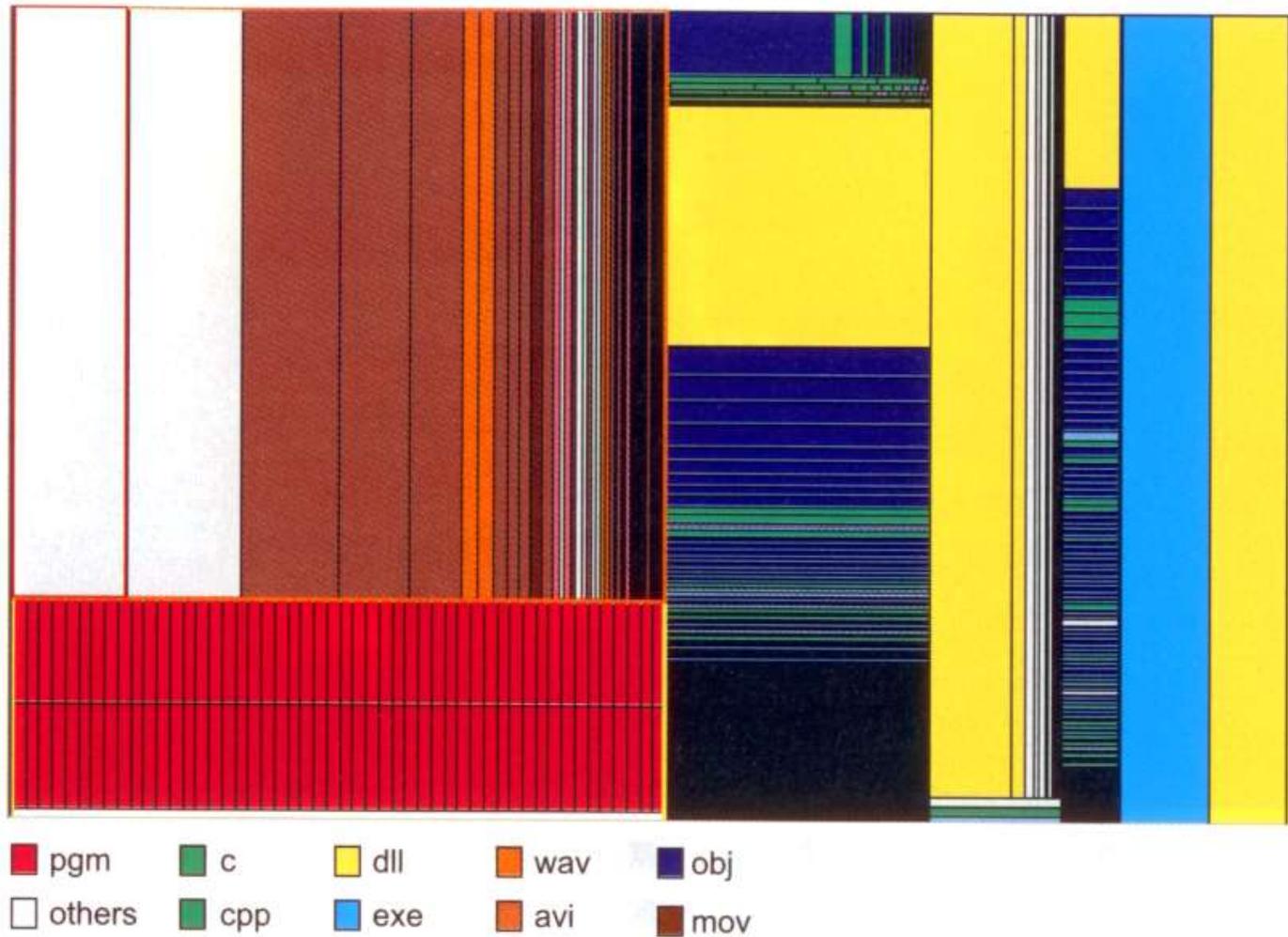
Ball-and-stick: file hierarchy Cone-tree Layout



Treemaps

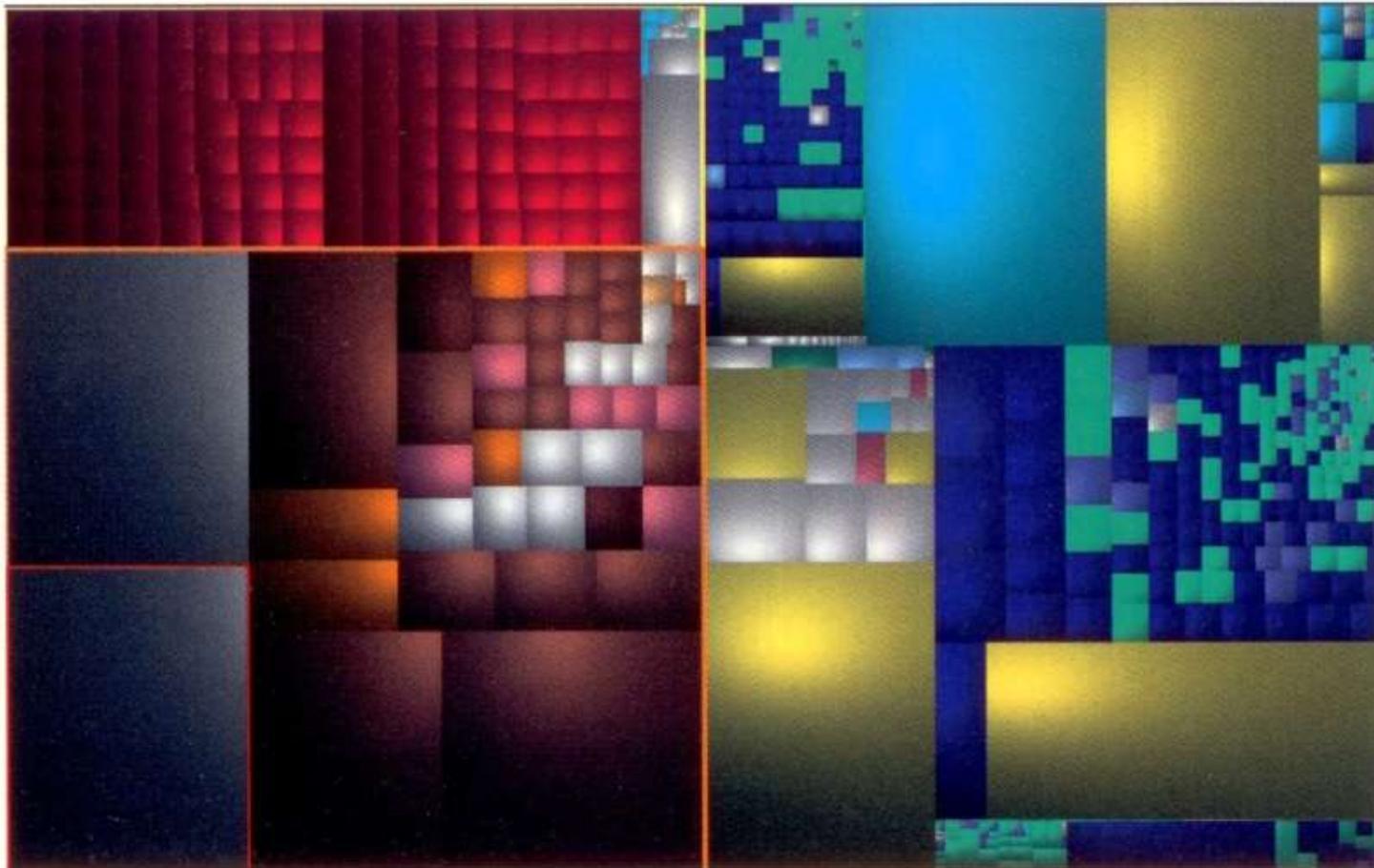
- Presenting tree using all available pixel space
- Main approach
 - Sub-trees are rectangles
 - Rectangles are subdivided to contain further sub-trees.
 - Direction of subdivision is orthogonal to previous level

Treemaps: file hierarchy



Treemaps: file hierarchy

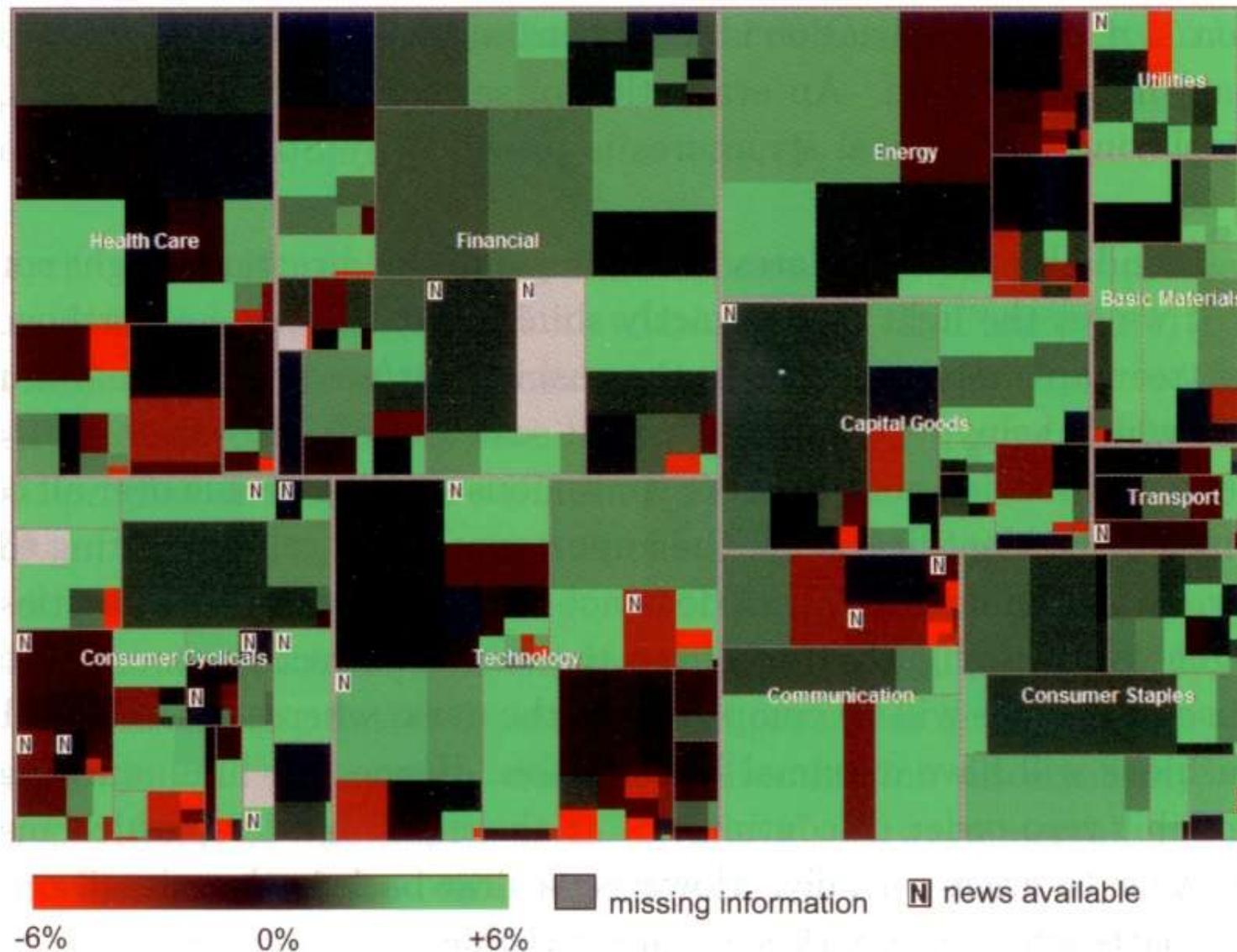
Squarified treemap layout



Treemaps: stock Market evolution in a year

- Rectangle
 - Firm
- Size
 - Capitalization in the market
- Color
 - Price fluctuation in the period
- *Glyph* 'N' indicates companies with interesting News in the financial Market.

Treemaps: evolução das bolsas no período de um ano



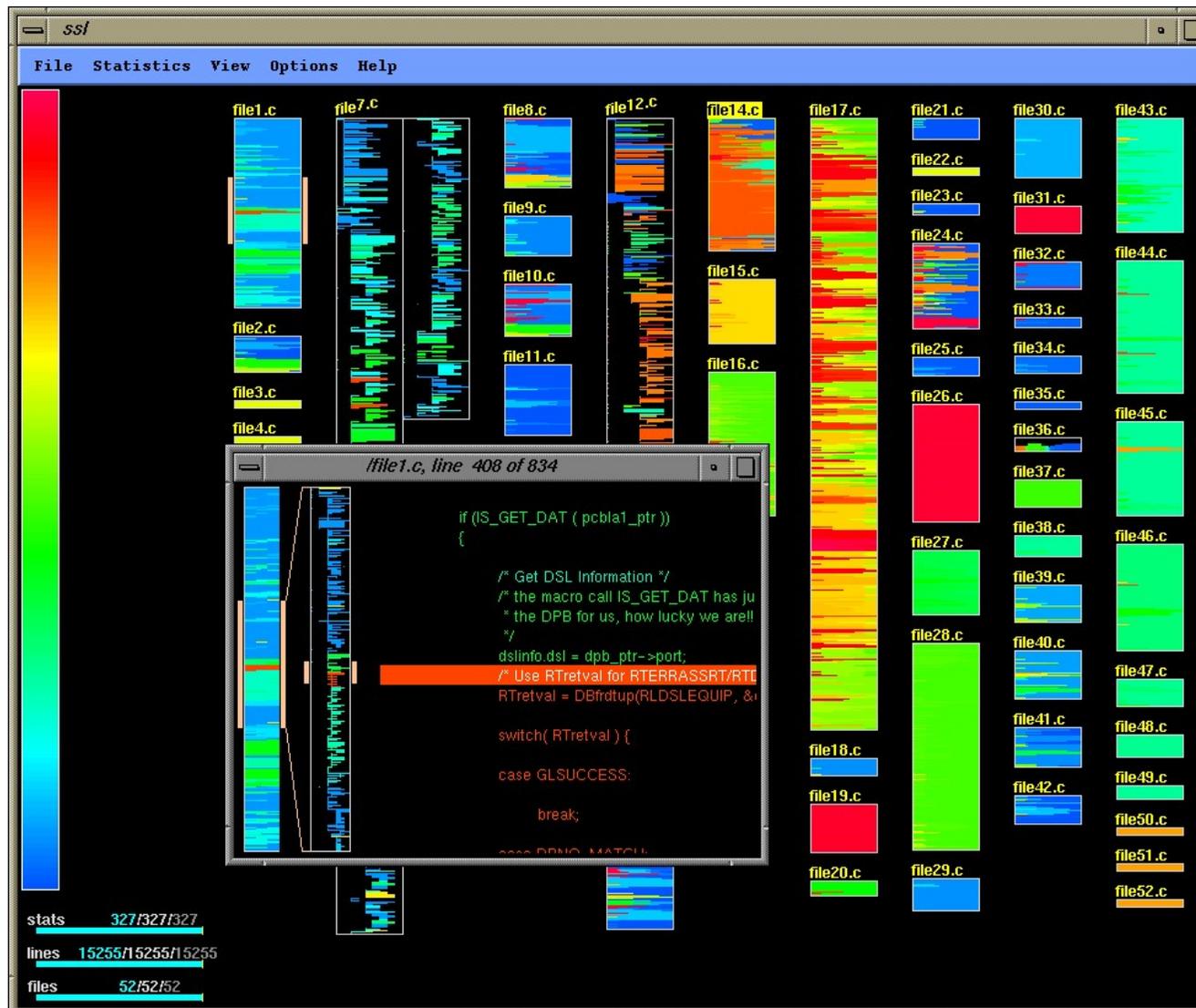
A special type of text

- Program/system code
- Software Evolution
- Plagiarism?

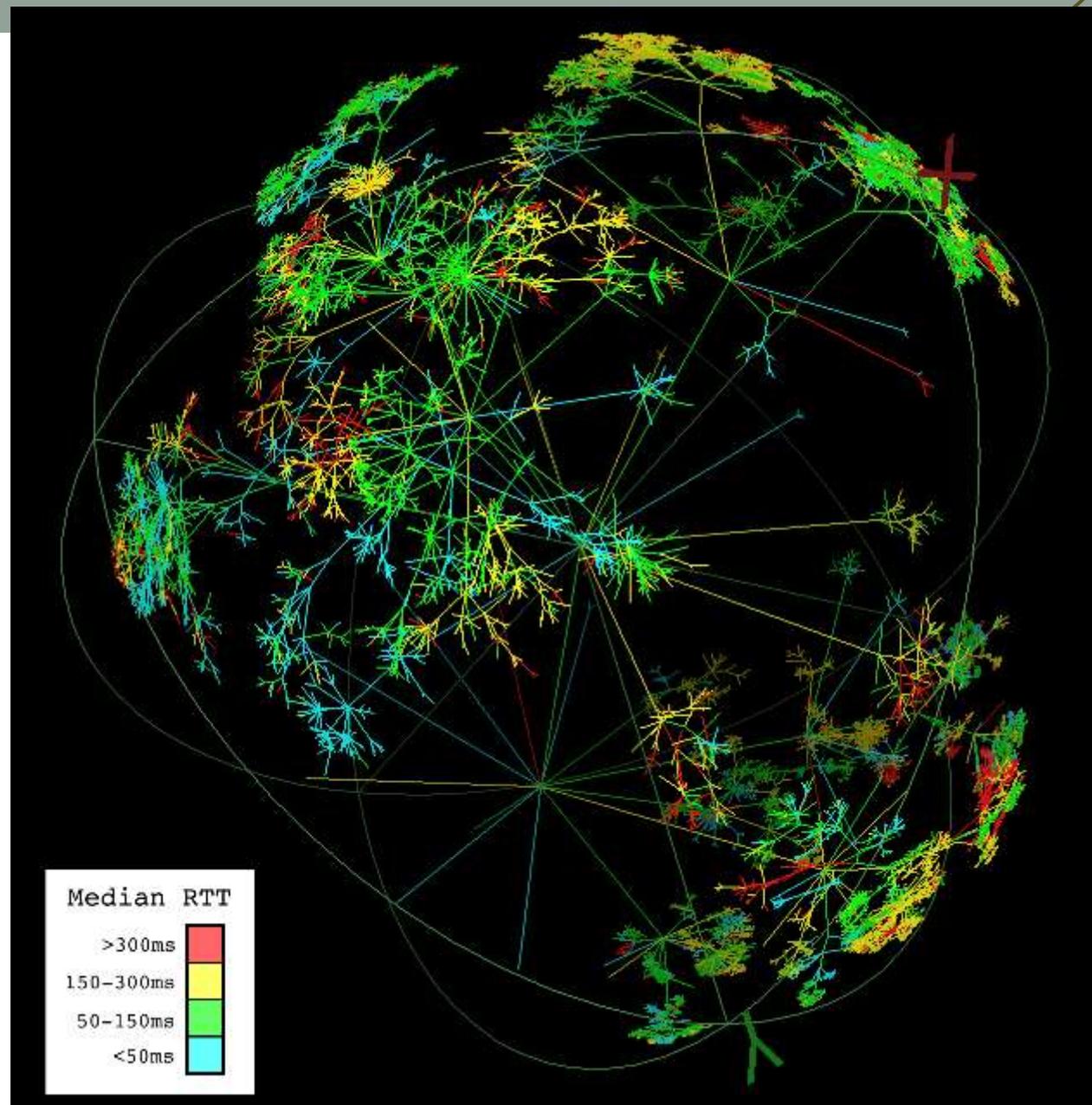
Example: Code

- Visualization of C code with Seesoft
- Colors: age
 - Red recently modified
 - Blue code not changed for a log time.
- Small Windows with details
 - Actual source code

Code

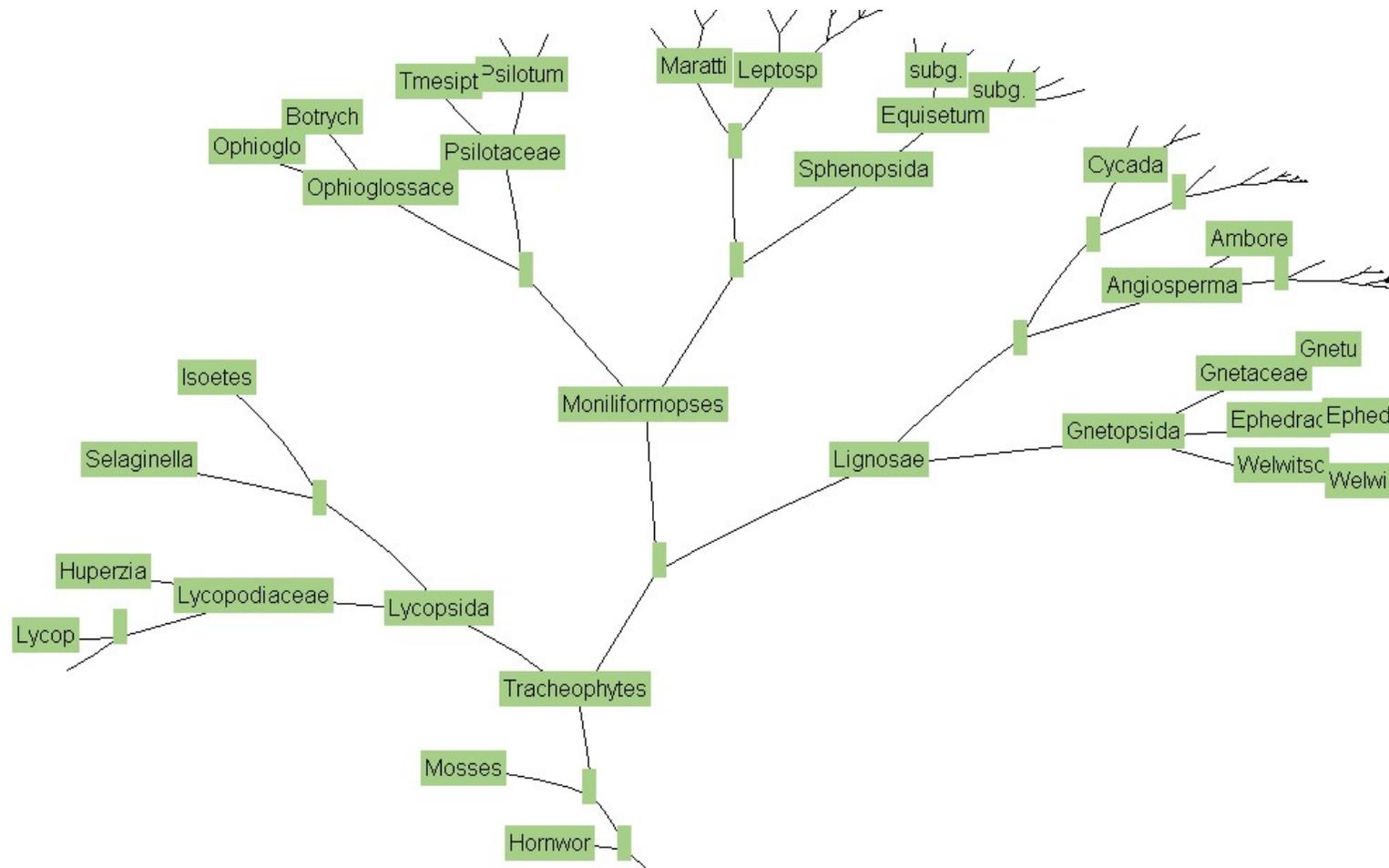


Example: Large Graphs (walrus)



<http://www.caida.org/tools/visualization/walrus/>

Example: Hyperbolic Trees



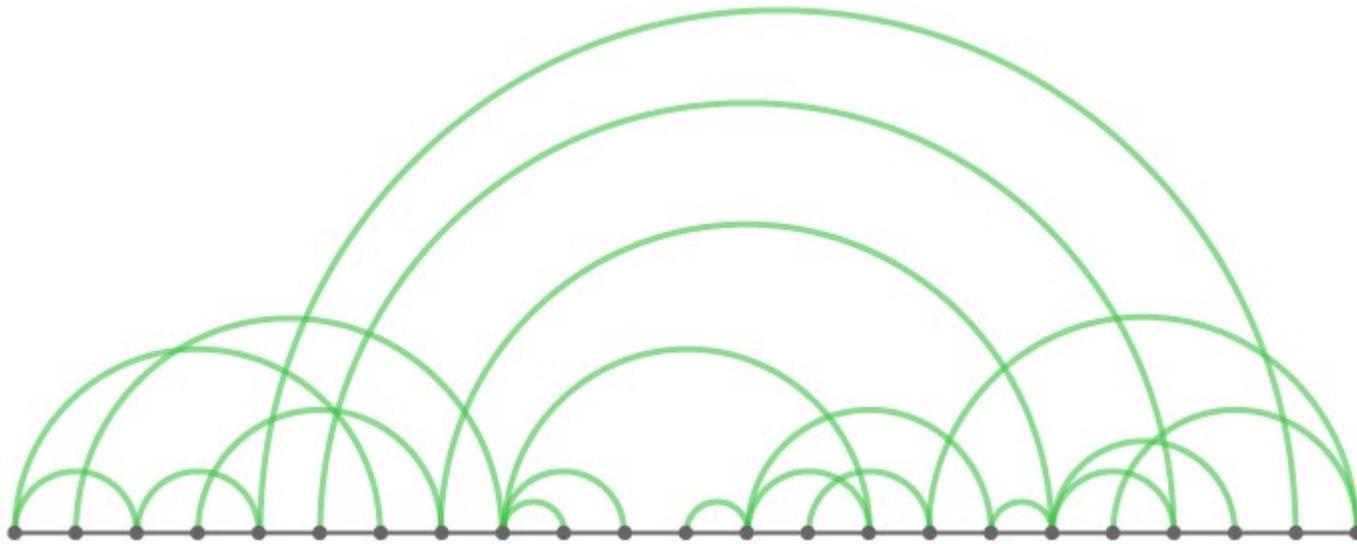
<http://ucjeps.berkeley.edu/map2.html>

Graph Layouts

- Node – link
 - Force-based
 - Ring
 - Spectral or Connectivity – based
 - Arcs - linear

Graph Layouts

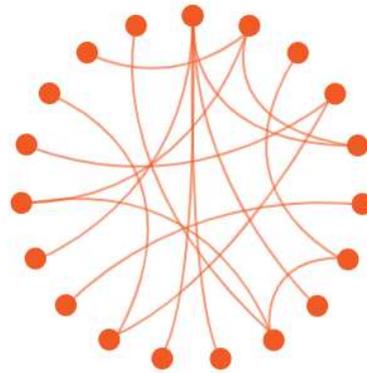
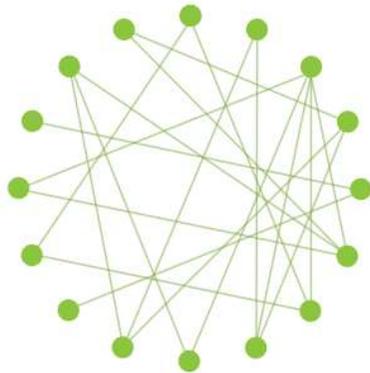
- Arcs



<https://datavizcatalogue.com/>

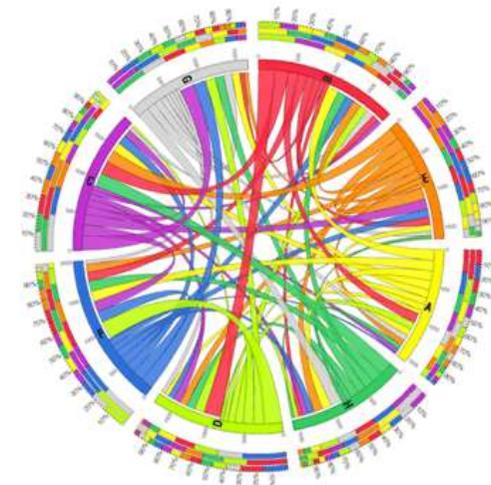
Graph Layouts

- Ring / chord



<https://datavizcatalogue.com/>

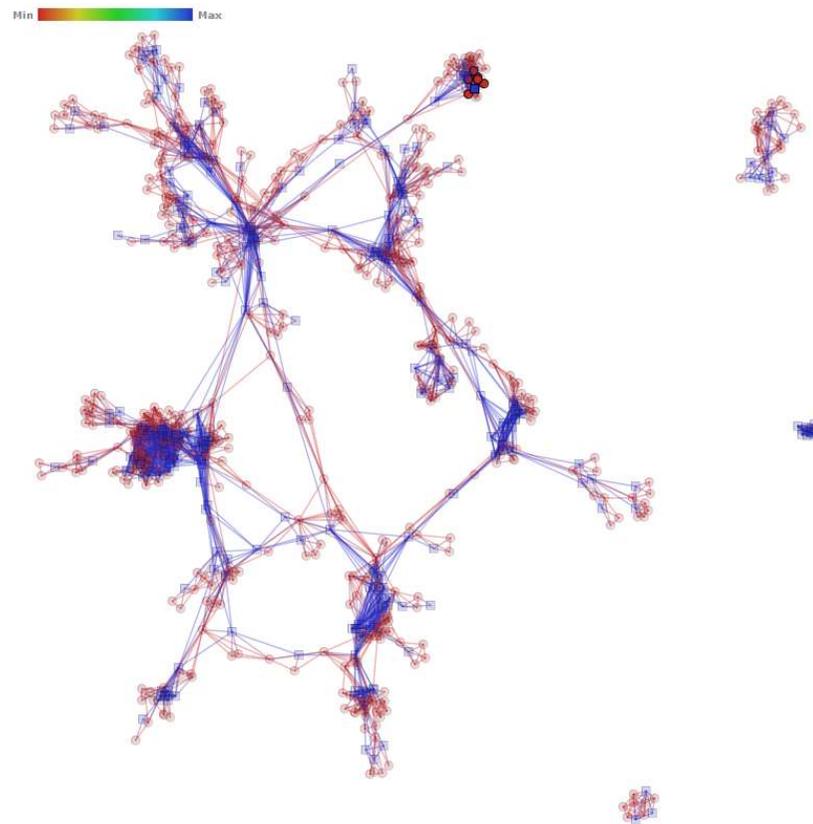
	A	B	C	D	E	F	G	H
A	54	133	157	94	88	141	167	133
B	49	113	111	113	202	53	7	92
C	66	130	69	162	123	62	106	117
D	60	138	49	85	98	98	122	87
E	53	88	15	91	91	20	69	127
F	118	32	62	139	135	95	60	64
G	114	108	73	44	103	139	37	145
H	74	110	84	120	9	41	45	131



http://circo.ca/intro/tabular_visualization/

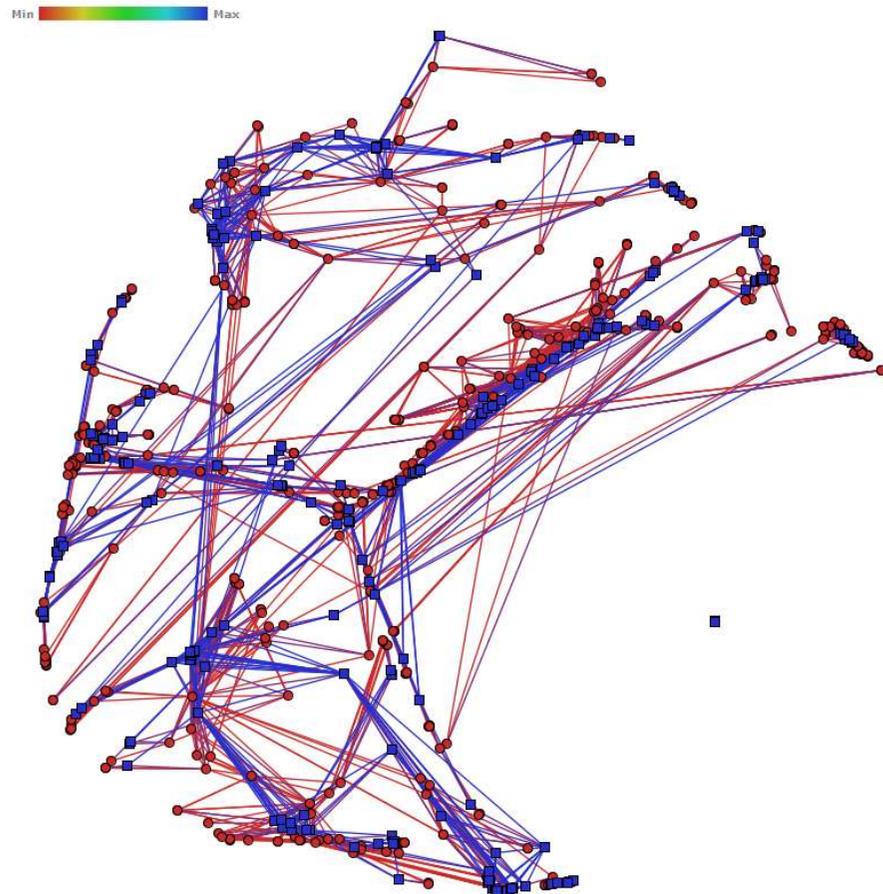
Graph Layouts

- Force-based



Graph Layouts

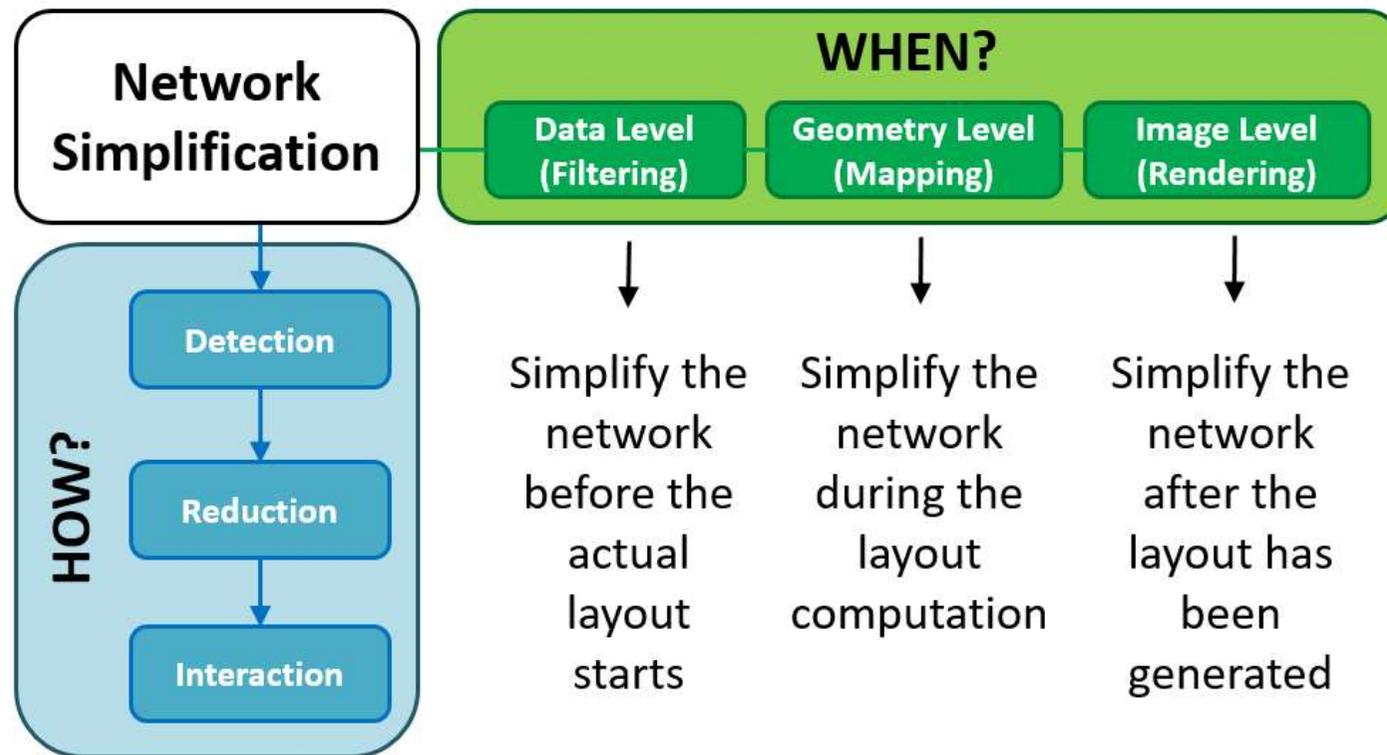
- Connectivity based / Spectral



Large Graphs

- Compact/ Multiscale views

A Conceptual Framework to Solve this Problem



Fonte: Hans-Jörg Schulz, Christophe Hurter. Grooming the hairball - how to tidy up network visualizations?. INFOVIS 2013, IEEE Information Visualization Conference, Oct 2013, Atlanta, United States.

References

- Alexandru C. Telea. **Data visualization: principles and practice**. A K Peters. Ltd. Capítulo 11.
- MARTINS, R.; ANDERY, G. F.; HEBERLE, H.; PAULOVICH, F. V.; LOPES, A. A.; PEDRINI, H.; MINGHIM, R. **Multidimensional Projections for Visual Analysis of Social Networks**
Journal of Computer Science and Technology (2012)