Web graphics

Web Programming

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Outline

Graphics

Extensive use of interactive graphics needed $\longrightarrow$
use Java Applets, Webstart or Flash.

Static graphics or vector graphics $\longrightarrow$
scripting languages with graphics extensions are suitable.

(HTML 5 also supports graphics.)

Graphics on the WWW

- Raster graphics (gif, jpg, png).
- HTML Image maps (<MAP>, raster graphics + coordinates).
- Binary vector graphics: Flash.
- XML-based: SVG (Scalable Vector Graphics).

HTML image maps

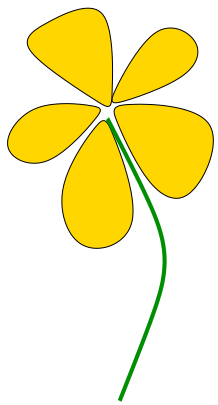
```
<body>
<map name="somemap">
<area shape="rect" coords="400,250,500,300"
          href="file.html#part1">
<area shape="rect" coords="300,180,400,230"
          href="file.html#part2">
</map>
<img src="picture.jpg" usemap="#somemap">
</body>
```

Raster graphics

- Pixel based: points of colours.
- Examples: photographs, paintings, ...
- Formats: jpg, gif, png, ...
- Cannot be indefinitely scaled; has a maximum resolution

Vector graphics

- Constructed from basic shapes: point, line, curve, polygon.
- Examples: maps, UML diagrams, line drawings, ...
- Formats: svg, flash, XML graph formats, ...
- Can be indefinitely scaled (depends on the rendering device).
- Can be manipulated by programs.
- Smaller file size than raster graphics.



SVG example for drawing a rectangle

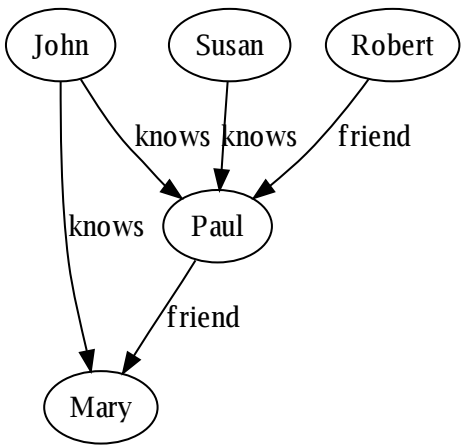
```
<?xml version="1.0" standalone="no"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN"
"http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd">

<svg width="100%" height="100%" version="1.1"
          xmlns="http://www.w3.org/2000/svg">

<rect width="300" height="100" style="fill:rgb(0,0,255)"/>

</svg>
```

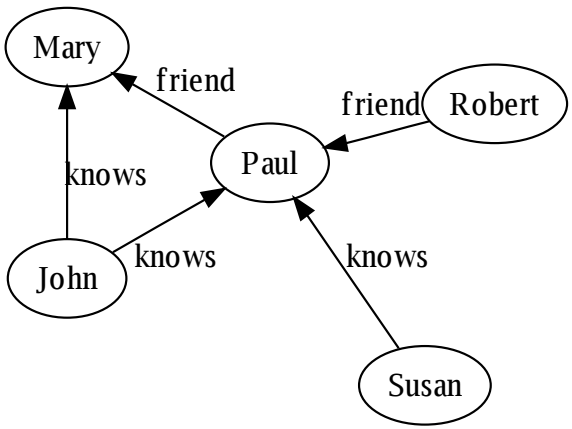
How to use SVG files

- All modern web browsers render SVGs directly.
- Microsoft IE supports SVG since version 9. Prior versions support VML or require plugin.
- There are compatibility issues for more advanced features.
- Many vector graphics tools support SVG.
- APIs for programming languages:
  PHP: XML_SVG, Perl: SVG, Java: Batik SVG Toolkit

Graphs are special kinds of vector graphics

- They contain nodes and edges.
- Moving or removing a node affects its edges.
- Graph editors provide graph layout algorithms.
- Examples: tree structures (XML), flow charts, UML diagrams.





Graph layout software/editors

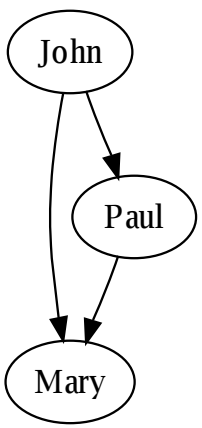
- TouchGraph, spring embedder algorithms
- Java toolkits: Prefuse, ...
- Graphviz: open source graph visualisation software

Graphviz

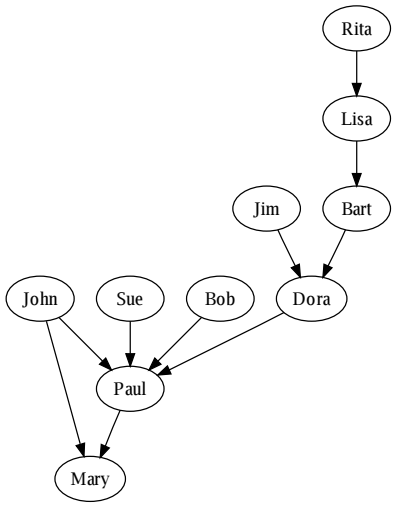
- `www.graphviz.org`
- Directed and undirected graphs.
- Graph layouts: hierarchies, spring, radial, circular.
- Simple text-based format (called “dot format”).
- APIs for different programming languages exist.
- Many output formats: gif, jpg, svg, pdf, ...

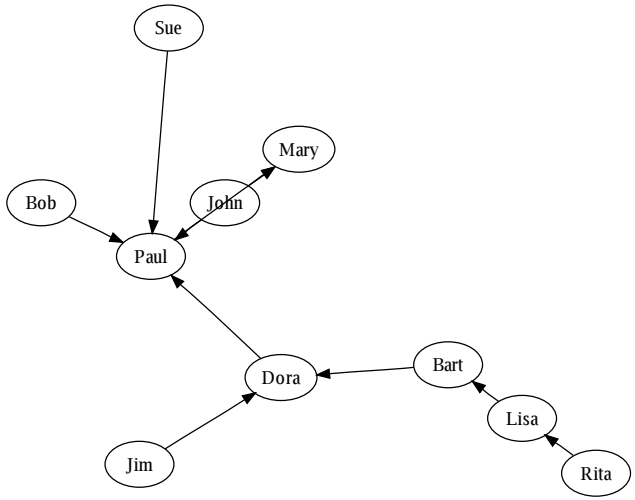
The “dot format”

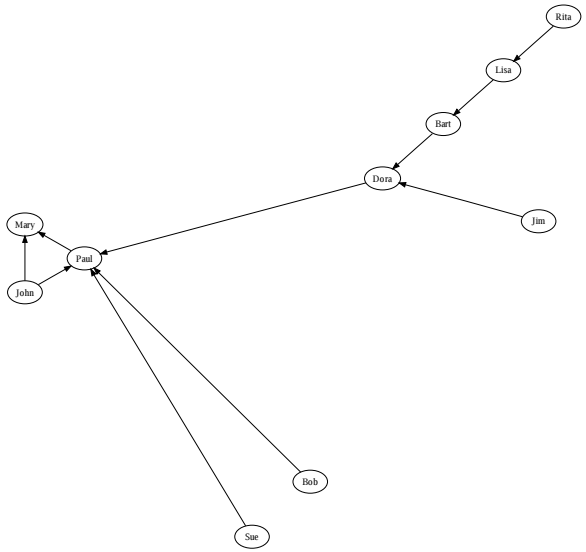
```
digraph names {
node0 [label="John"]
node1 [label="Mary"]
node2 [label="Paul"]
node0 -> node1
node0 -> node2
node2 -> node1
}
```



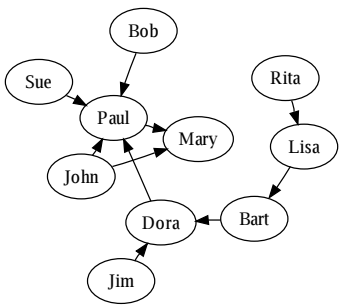
Hierarchical, radial, circular layouts:

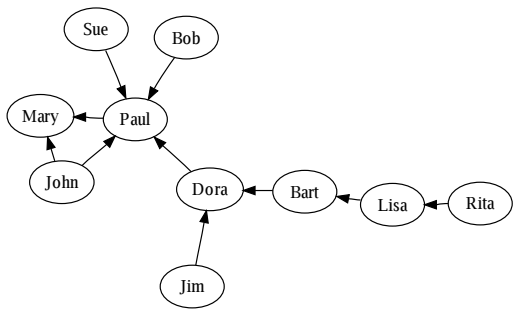






Spring layouts:



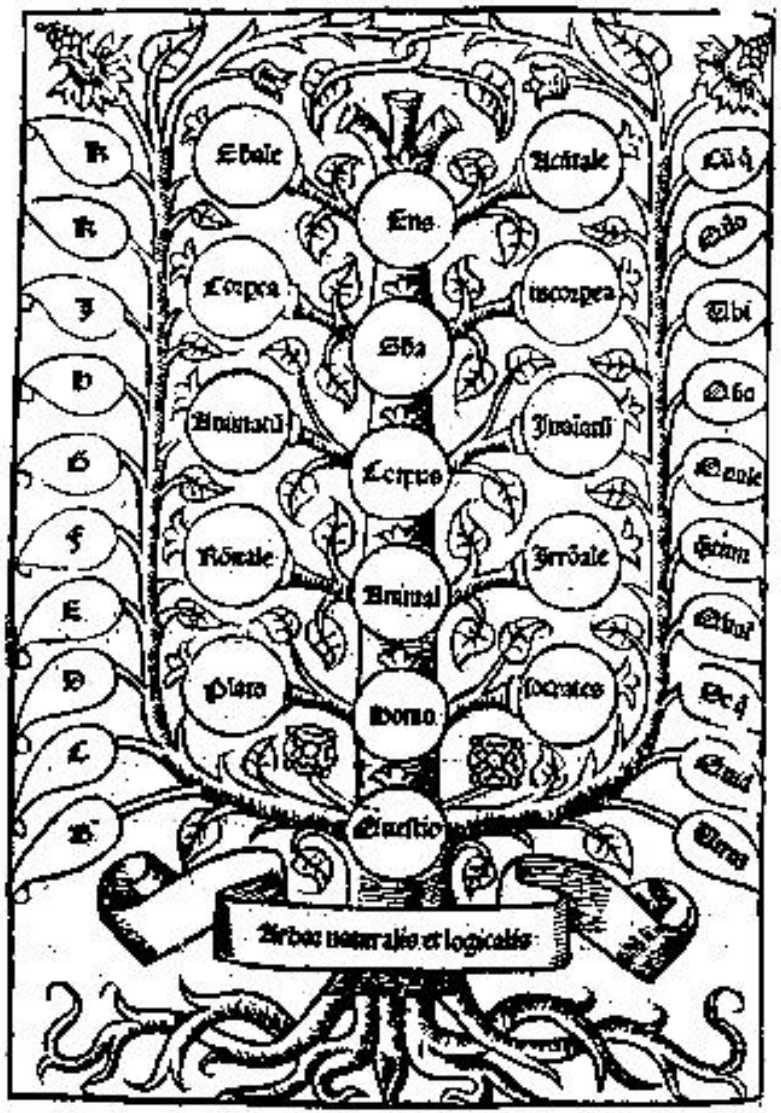


Sample Graphviz Applications

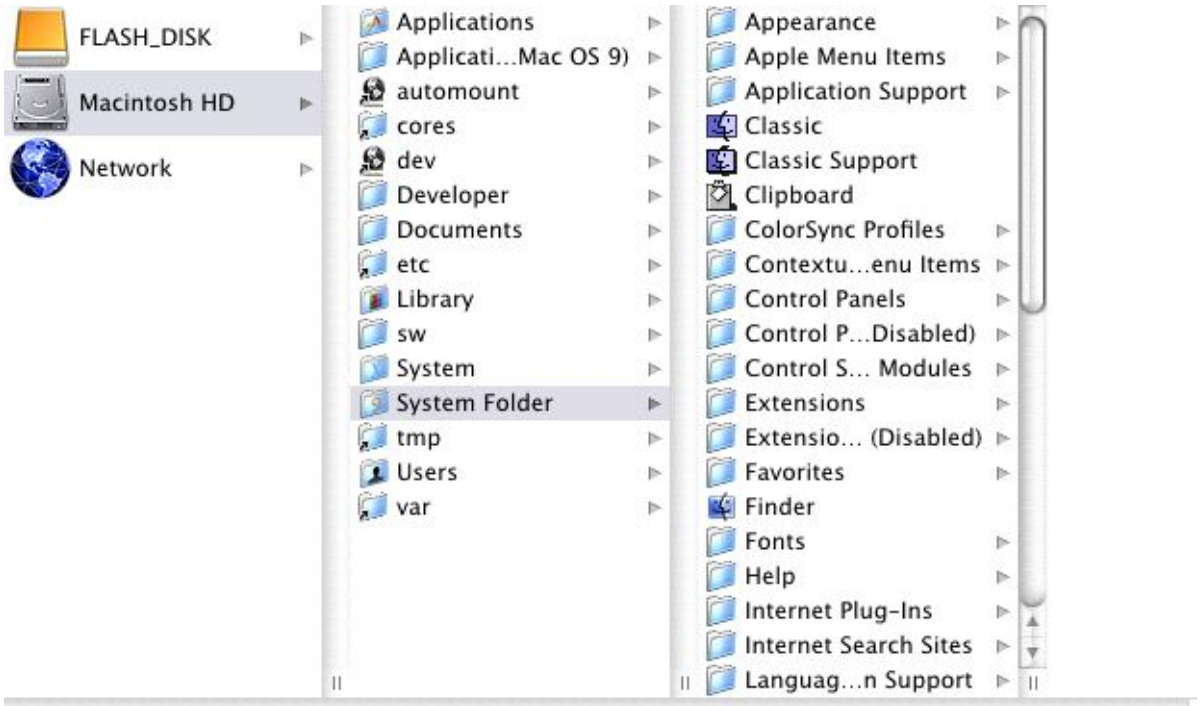
For visualisation of ...

- Database schemata
- XML DTDs and class hierarchies
- Web site paths traversed by users
- Apache log files and firewall rules
- UML diagrams from program code

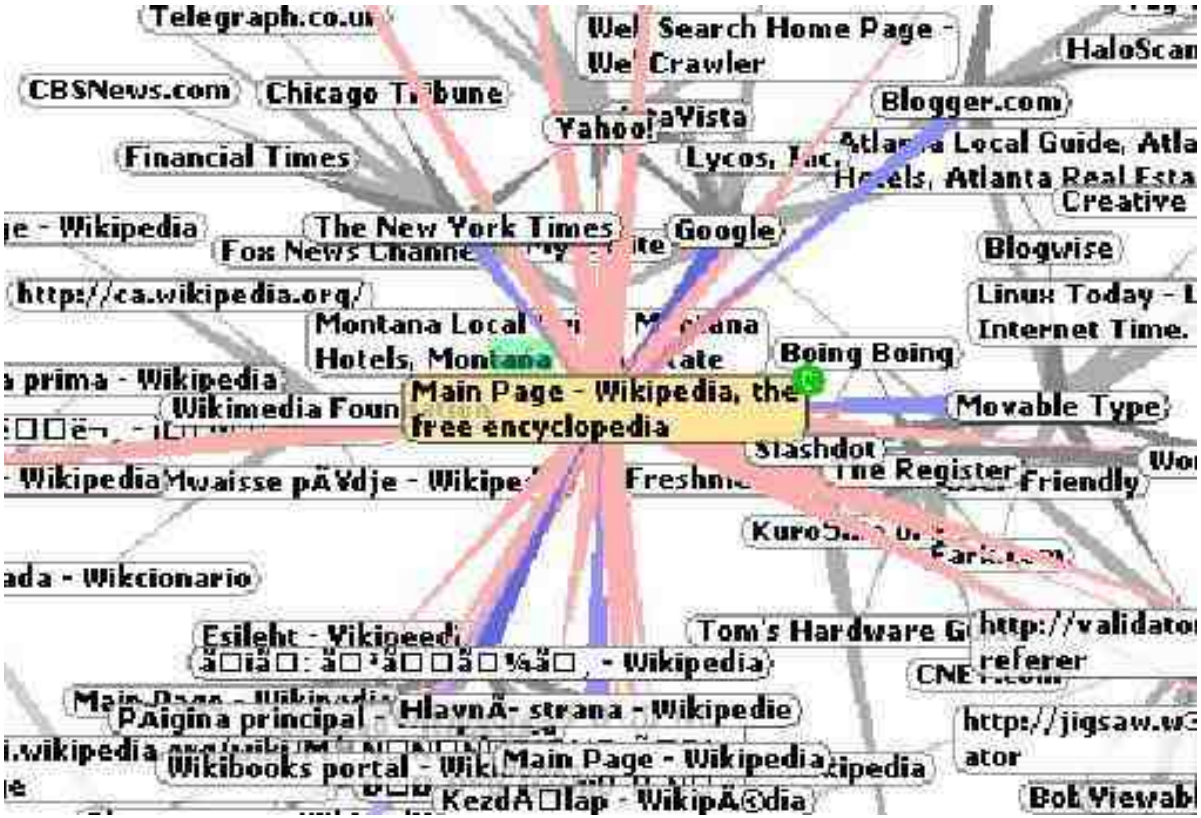
Tree of Porphyry (Lull's version, 1305)



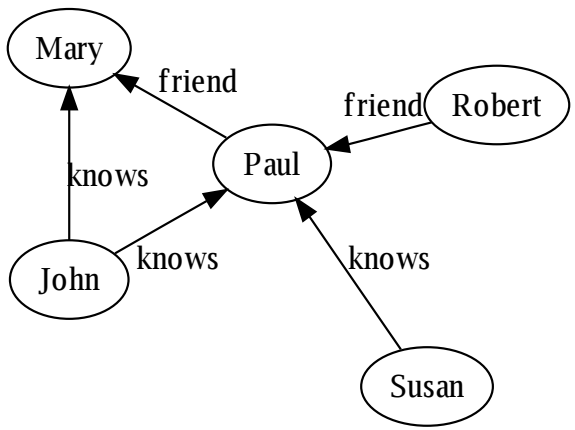
File hierarchy display (MacOS)



Spring Embedder Graphs - TouchGraph



Social Networks



6 degrees of separation

Do you know the Prime Minister?
Do you know someone who knows the Prime Minister?
Do you know someone who knows someone who knows the PM?
...

The claim: everybody is connected to everybody else by at most 6 degrees of separation.
$\Longrightarrow$ It is a **small world**.

Small-world networks

- Small world effect: small average node-to-node distance ("6 degrees of separation")
- Clustering:
  your friends also tend to be friends among each other
- Hubs and resources

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Google's PageRank:
pages that are more linked to get a higher rank.

ImageMagick

A software suite to create, edit, and compose raster graphics.

- convert: for converting between formats, changing size, etc
- identify: for describing image formats and metadata

Available for free for PC, Mac, Linux.

ImageMagick's convert

Reducing file size:

```
convert -resize 800 file1.gif file2.gif
```

Combining several jpgs into a pdf and reducing size:

```
convert -resize 500 -density 70 *.jpg result.pdf
```

Creating a favicon:

```
convert favicon.png -resize 16x16! favicon.bmp
mv favicon.bmp favicon.ico
```

Image metadata

Magic number: historically in Unix, a number that identifies the file format and is part of the file's header information. The purpose was so that double clicking the executable would start the right program without relying on the file's extension.

These days many file types contain a header with metadata about the file.

JFIF/EXIF data

Jpeg files contain two types of header information: JFIF and EXIF.

Examples of jpeg metadata:

- colour information
- height and width
- camera type
- file creation date and time

ImageMagick's identify

Print filename and date:

```
identify -format "%f %[EXIF:DateTime]\n" filename.jpg
```

Print all of the metadata:

```
identify -verbose filename.jpg
```

Metadata can be removed with convert -strip