UNIVERSITÄT ZU LÜBECK

Space-Efficient Algorithms for Hard Graph Problems

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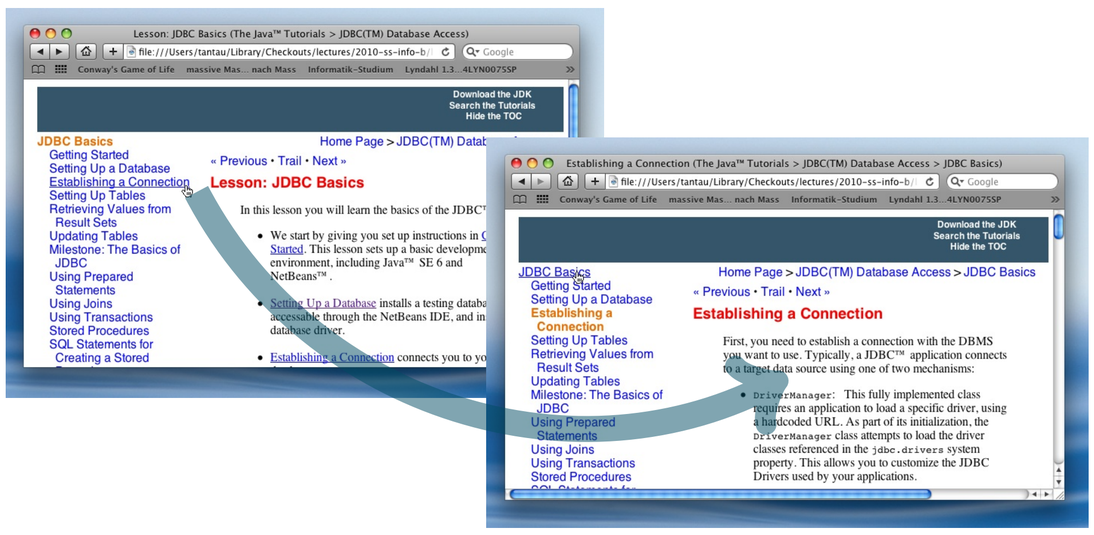
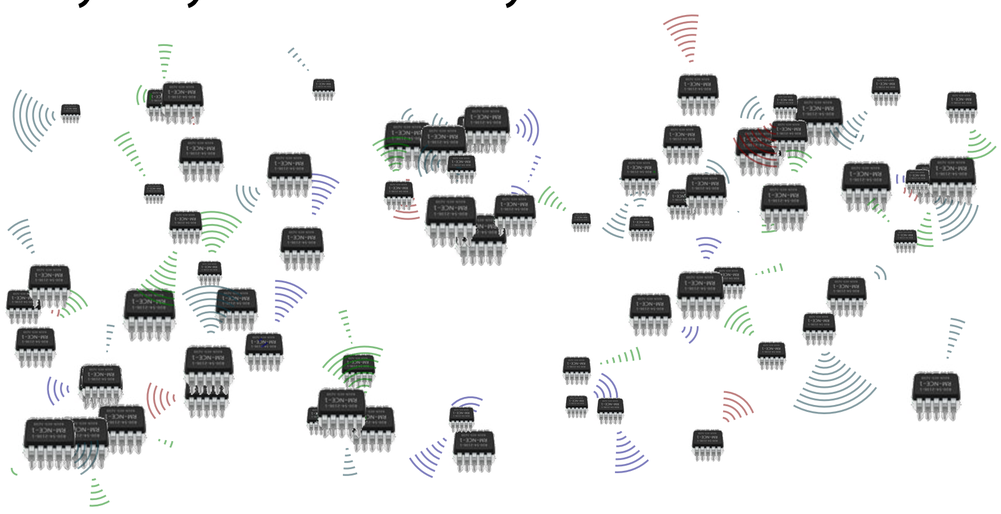
Motivation: Huge Graphs, Litte Space

The *web graph* is too large to store in a normal computer – not even Google can do that.



In a *smart dust network* each "dust particle" has only very little memory.



Goal: Solving Graph Problems – Using Little Space

Reingold showed in 2006 that *paths in undirected graphs* can be computed space-efficiently.

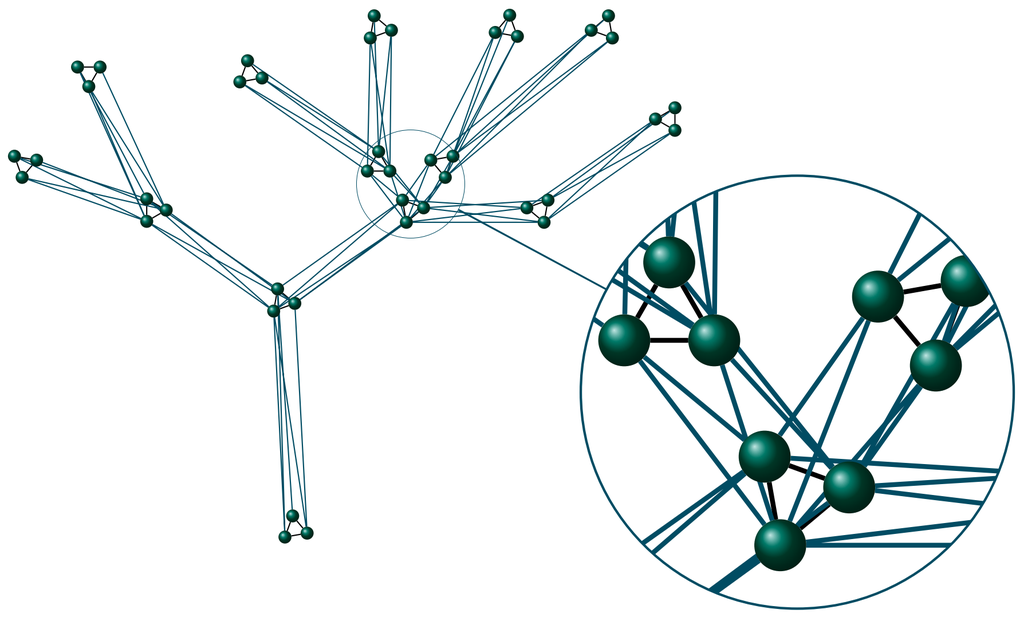
It is an open problem to compute the *diameter of the web* as space-efficiently.

An even harder problem is to compute how many *frequencies are needed in a smart dust network* so that no interference occurs.

Graphs Having Special Properties

When no method is known for solving a particular graph problem using little space, it can help to *study special kinds of graphs*.

An example are *graphs of bounded tree width*. They "look like a tree from far away."



Another important class are *planar graphs*. They arise in map drawing, but also when smart dust settles on a surface.

Recent Advances

Recently, *space-efficient algorithms* have been developped that work for the above graphs.

For *graphs of bounded tree width* they include:

- Computing distances
- Counting the number of possible paths
- Solving the frequency problem

For *planar graphs* they include:

- Testing, whether a graph is planar
- Testing, whether graphs are isomorphic (same edges, only depicted differently)

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