

Routing paths in 2, 2½, 3 and 4 dimensions.

15-48 EC masters' thesis project

For: Master Students that know how to program - and are interested.
If you've ever done a course in heuristics, it is a pre.
Load: 15 - 48 EC, depending on blocks (see below)
Period (approx.): From September 2021 onward
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Introduction video: <https://bit.ly/3DWGFrG>

About the project

Wiring chips or pipes can be modeled through a base layer with terminals to be connected, and upper layers through which the paths (situated in a pathlist) can be routed. The more paths, and the smaller the area of the base layer, the unlikelier it is that the pathlist can actually be routed [1]. This is the work by UvA-student Reitze jansen, and it has been published in 2020. We want to extend this result, in terms of dimensionality.

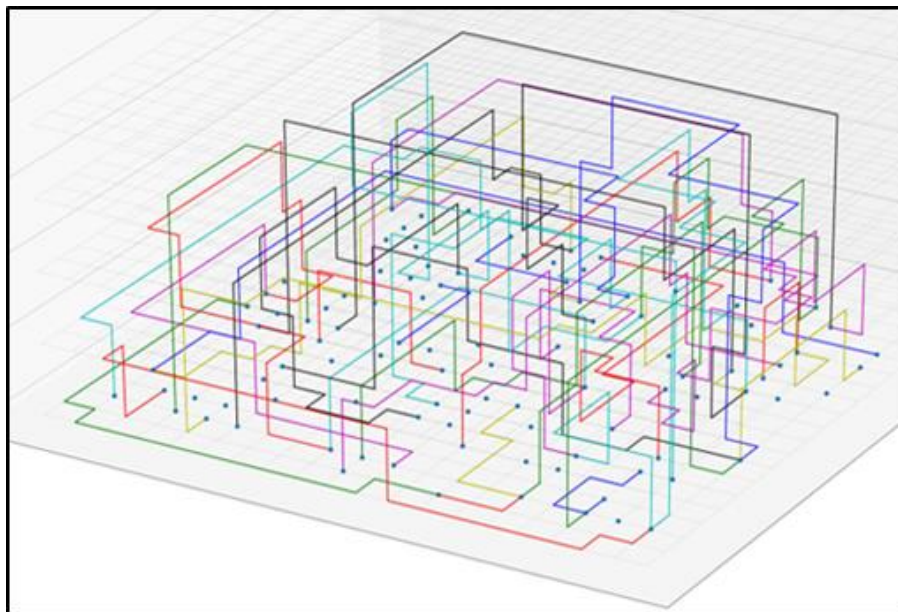


Figure 1: A fully routed pathlist connecting terminals in a base layer (source: [1]).

Each block is about 15-18 EC's worth. You can choose blocks to your liking, though there is a strong recommendation for doing Block #1 first. Generally, we can adapt blocks as we go along, but once a block is finished, we're not going back, only forward.

Block #1

Read Reitze Jansen's paper [1] and implement the A* algorithm for routing terminal pairs. First, try to route purely 2D floorplans. Maybe it is simply an option to use Jansen's meshes without upper layers. See how the pathlist length influences routability, and start without permutations. Is there a 'threshold point'? Does it look like the routability threshold point in Jansen's work?

Block #2

Let's try to extend to full 3D, by putting the terminals in a $W \times W \times W$ mesh, but not on the base layer, but anywhere in the mesh. This should improve routability. Considering the incredible amount of data in Jansen's paper, it might be wise to make a selection of pathlist-lengths. Again, see how the pathlist length influences routability, and start without permutations. Is there a 'threshold point'? Does it look like the routability threshold point in Jansen's work?

Block #3

Let's do the whole thing in 4 dimensions. That is no longer amenable to imagery, but it can still be done. Again: assess the routability. Is there a relationship with the problems of other dimensionalities? This could be a lot of work. Choices will have to be made to keep the workload at acceptable levels.

References

[1] Jansen, Reitze, Yannick Vinkesteyn, and Daan van den Berg. "On the solvability of routing multiple point-to-point paths in manhattan meshes." Proceedings of the 2020 Genetic and Evolutionary Computation Conference Companion. 2020.