Automatic Wire Routing under Constraints

Supervisor: Dr. Binod Kumar
Academic Year: 2021-2022

Sudip Kumar (B20CS072)

Goal of the Project

- The goal of this project is to perform the routing of a group of signals to a target block of the design in such a manner that a given congestion limit is obeyed and the routing is completed with in a fixed wire length budget.
- One of the secondary objectives can be minimization of wire-length.
- Moreover, the goal also is to identify signals (out of the bunch of identified signals) which can not be routed to the target block with in the specified congestion and wire-length limit.

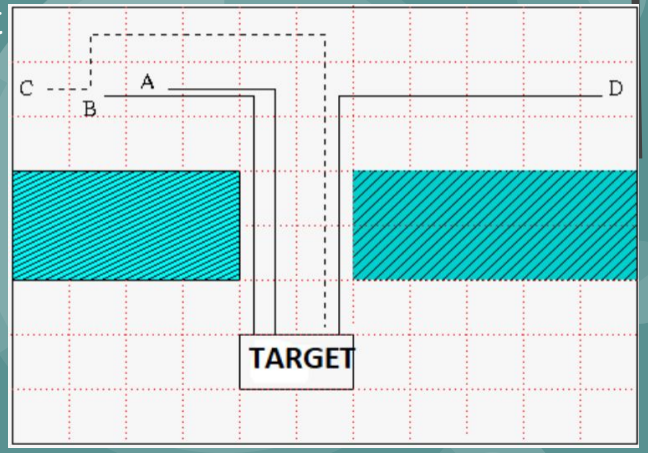
Objective

- Connectivity of most of the signals to the target block
- Minimize congestion
- Minimize total wirelength

Problem Statement

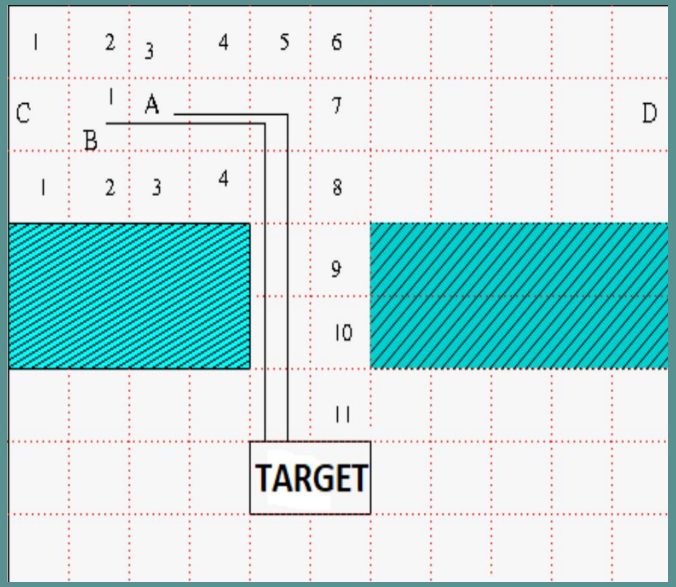
- When few signals are selected for routing to a target block, the routing of these signals needs to take care of the existing routing congestion.
- In some of the previous work, routing algorithms are based on reducing the half-perimeter wire length, measured using Manhattan distance, which is agnostic of the existing routing congestion
- Moreover, the congestion caused by the initial signal routing needs to be considered in for the purpose of final routing of all the desired signals to the target block.

- In given figure We have divided the entire layout area (G) into smaller grids, with the restriction that at most two wires can pass through each Grid. The congestion areas are shaded.
- Let us assume that A and B are the first two signals to be routed to the target block. These Two signals are traced without any difficulty in Routing. Suppose, it is given that the choice for the next signal is either C or D.

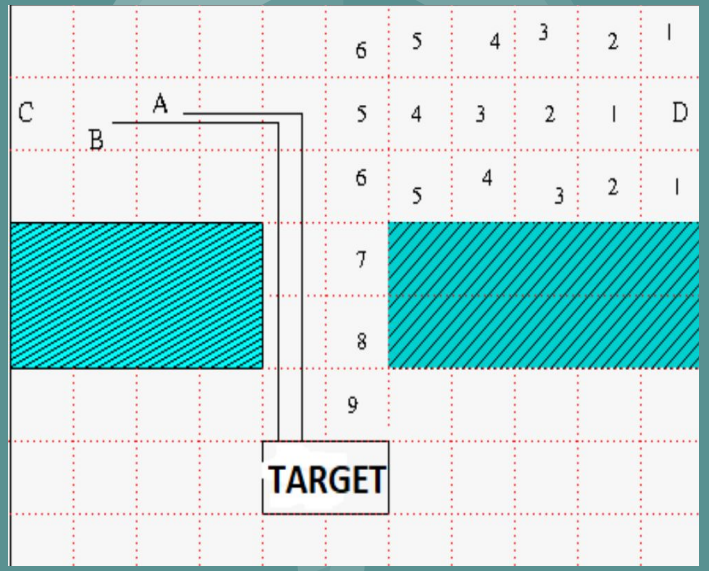


- the Manhattan distance of C is lower than D. However, due to the congestion introduced by wires A and B, the wire length required to route signal C is more than that of D.
- Therefore, merely assuming the magnitude of Manhattan distance for routing impact estimation of the signals is not very useful.

Process



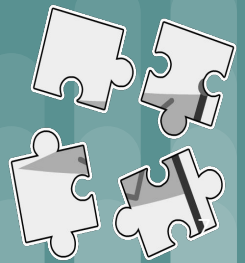
A. Routing conditions for signal C



B. Routing conditions for signal D

Pseudo Code

```
for each signal ff_i in N do
    ffx, ffy ← coordinates of ff_i from placed Coord;
    Value=F_route(ff_i);
    If Value=1, proceed below else skip to next signal;
    For each grid g belonging to G that has a wire routed through it, G[g] = G[g]+1;
    Across G, move above, below, sideways (from east to west and then from north to south) and
     check for Wlimit in each direction;
    Obtain wire length(wl) from ffx, ffy and tbx, tby;
    if G[g] != Wlimit && wl < maxlength then
        Signal can be routed to Target block;
        Update G for smaller grids in this path to Target block;
    end
    else
        Signal can not be routed to Target block;
    end
    Wlength ← wl of routed signal;
end
routed Conn ← routed connections of signals;
```



Results

- Routed connection between input signal and target block [(300,300)] in a grid of 301 x 301
- Routing wire lengths such that given congestion limit , which was considered as 3 is obeyed .
- identification of some signals which can’t be routed within specified congestion considered as 3 .
- Total sum of routing wire length is 3866 unit .
- Runtime of code is 1.174 seconds .
- Algorithm works the best for the routing of group signals to the target block with constraint of congestion limit (3) obeyed and Routing is completed within a fixed wire length budget.

```
Total wire length under the congestion limit considered as 3 is 3866

[Done] exited with code=0 in 1.174 seconds
```

Thank You