Contention management for Deterministic Networking

Maël Guiraud

DAVID, Université de Versailles Saint Quentin - Nokia Bell Labs France

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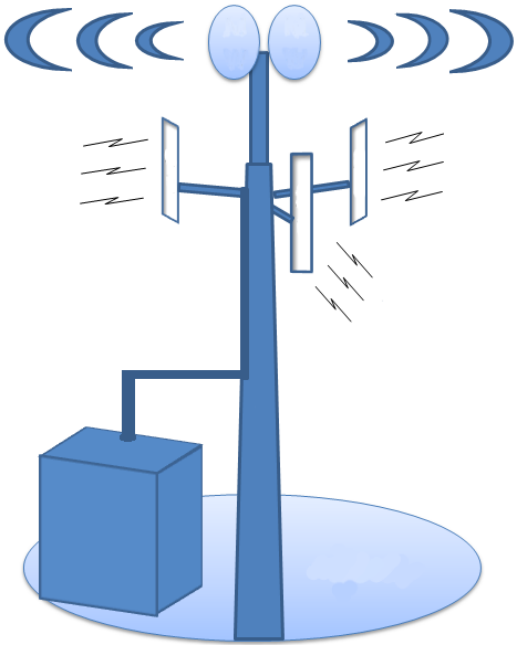
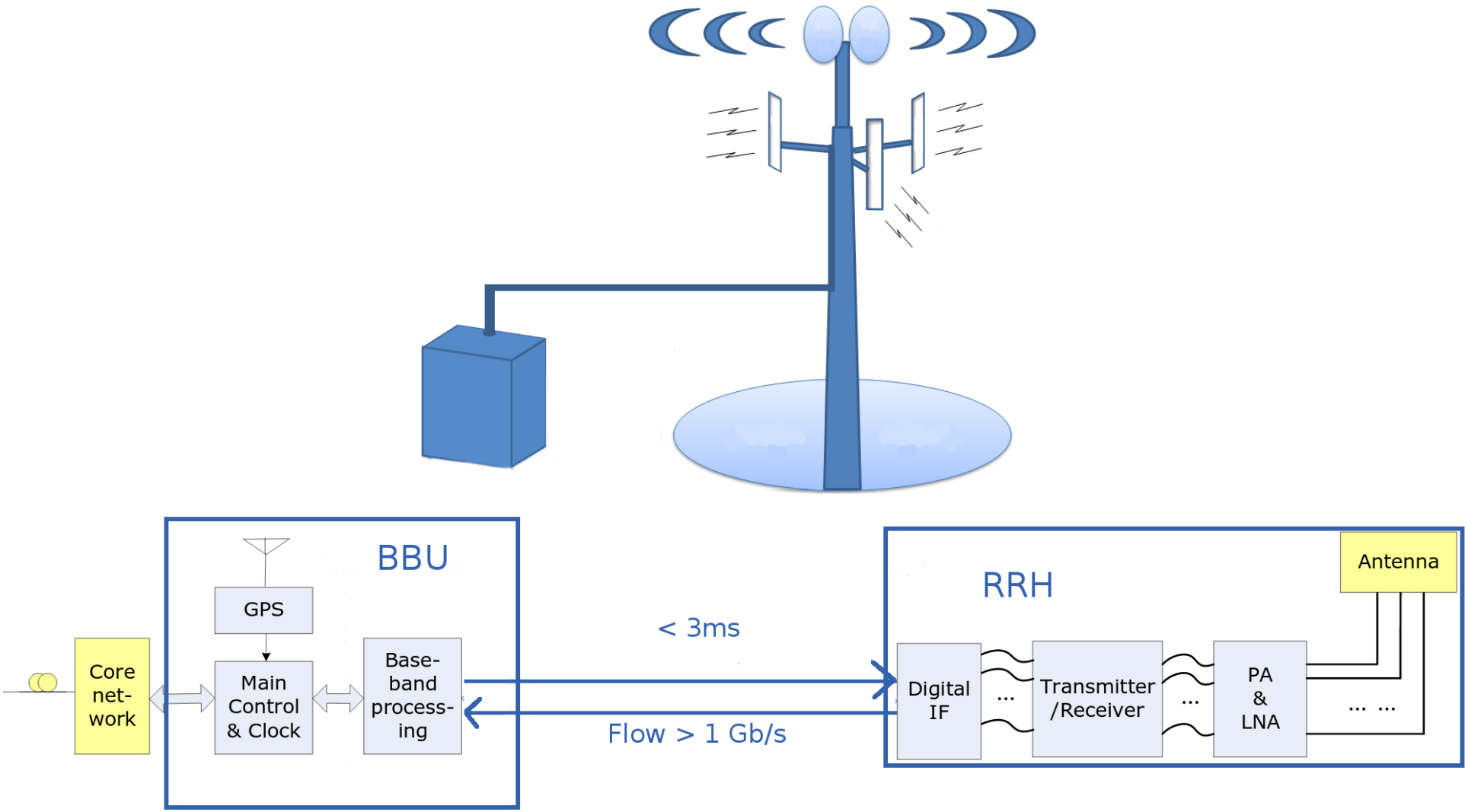
Context

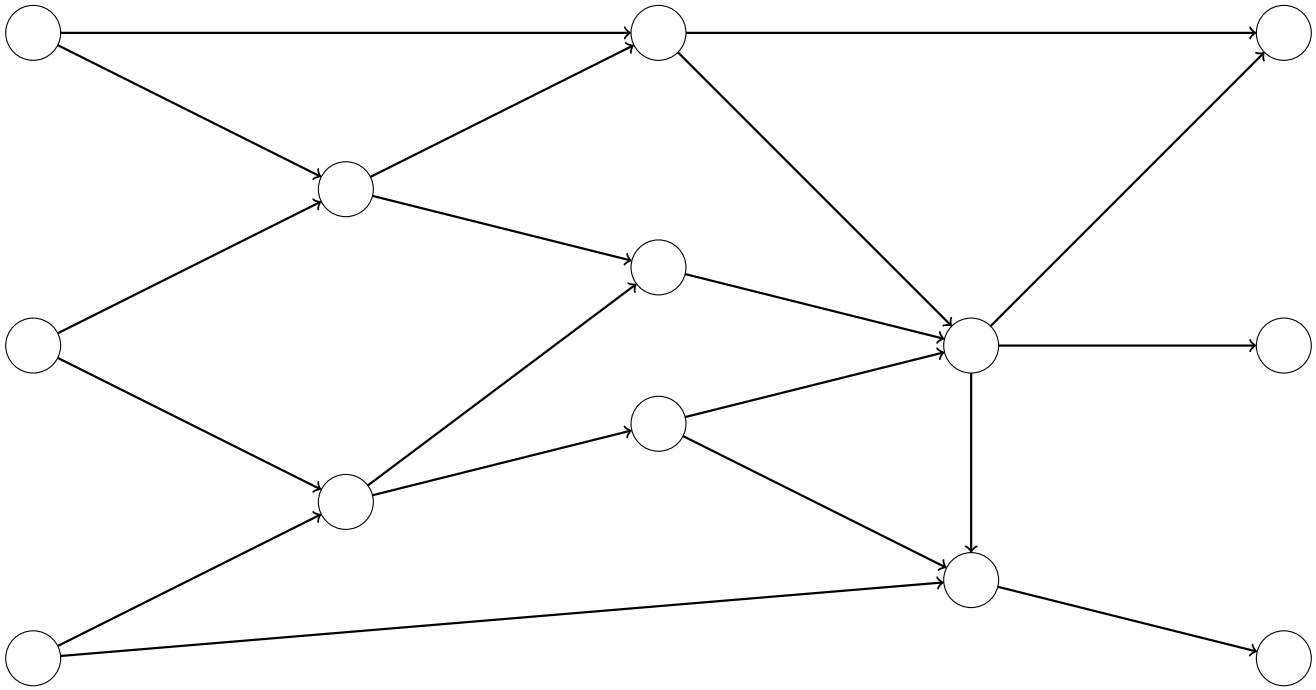


A base transceiver station.

Context

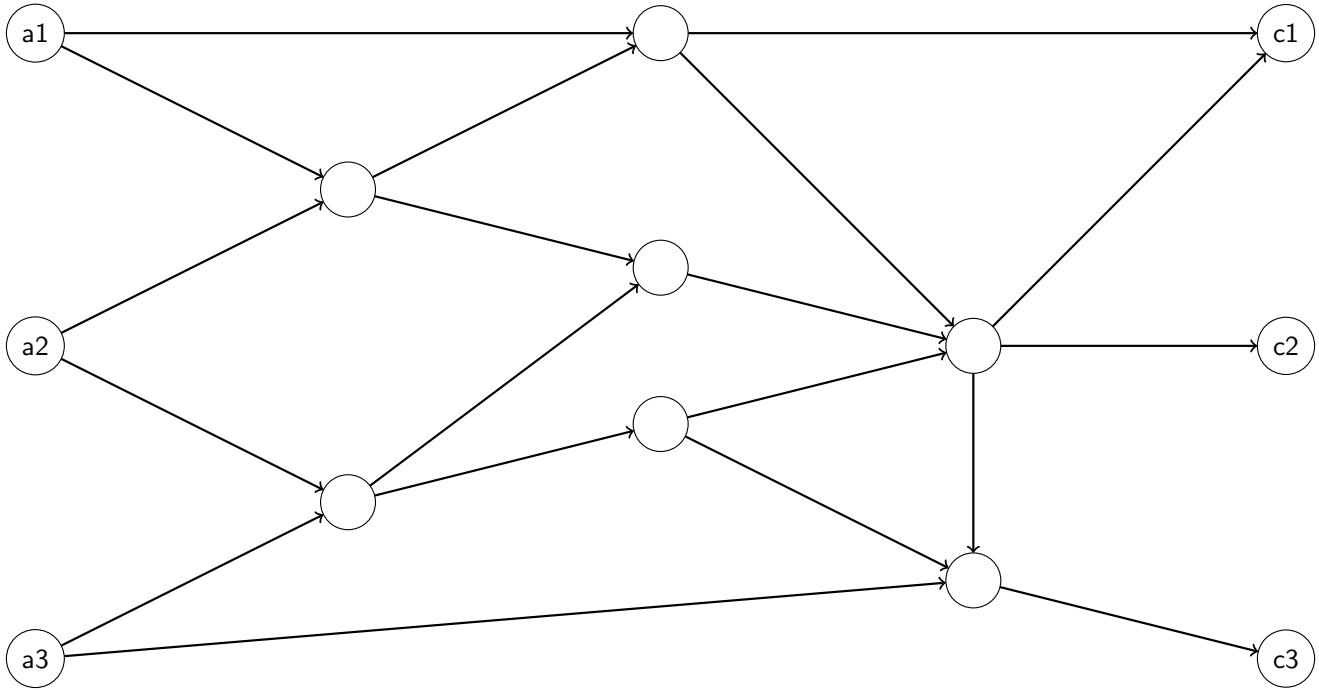

BBU
GPS
Core net-work
Main Control & Clock
Base-band process-ing
< 3ms
Flow > 1 Gb/s
RRH
Antenna
Digital IF
Transmitter /Receiver
PA & LNA

Model



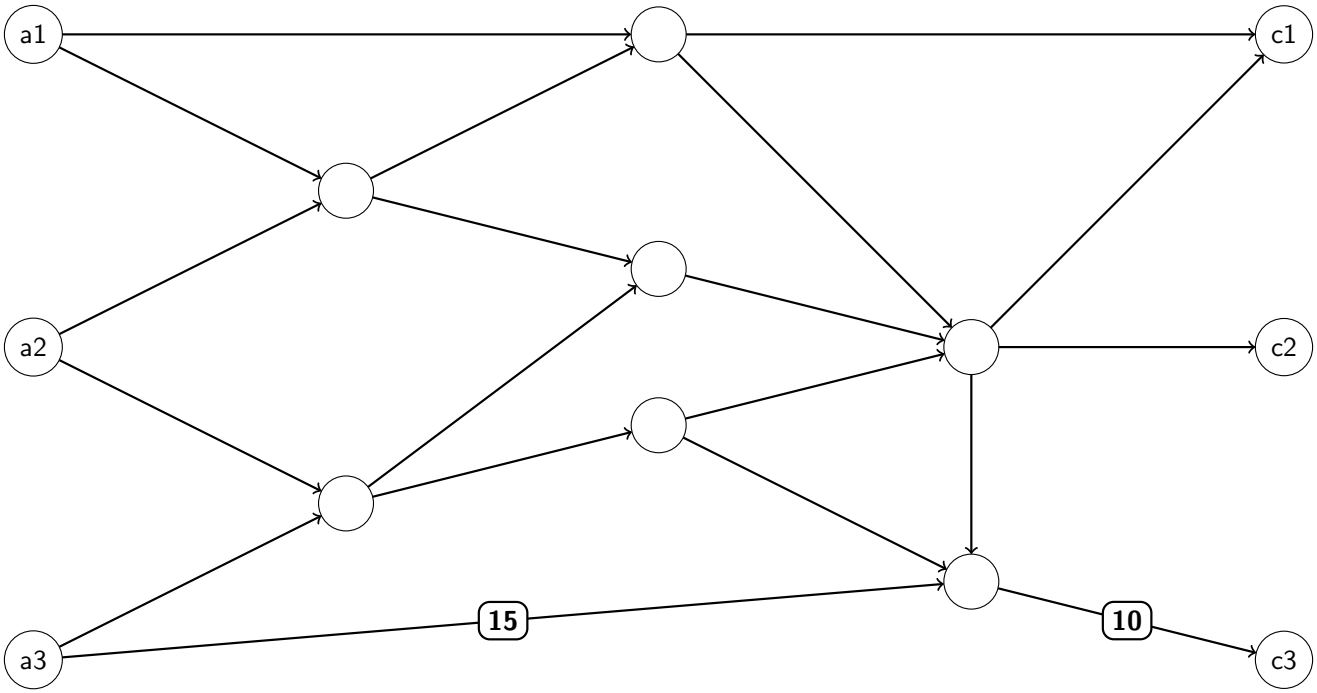
Network $\rightarrow$ Graph $G = (V, A)$.

Model



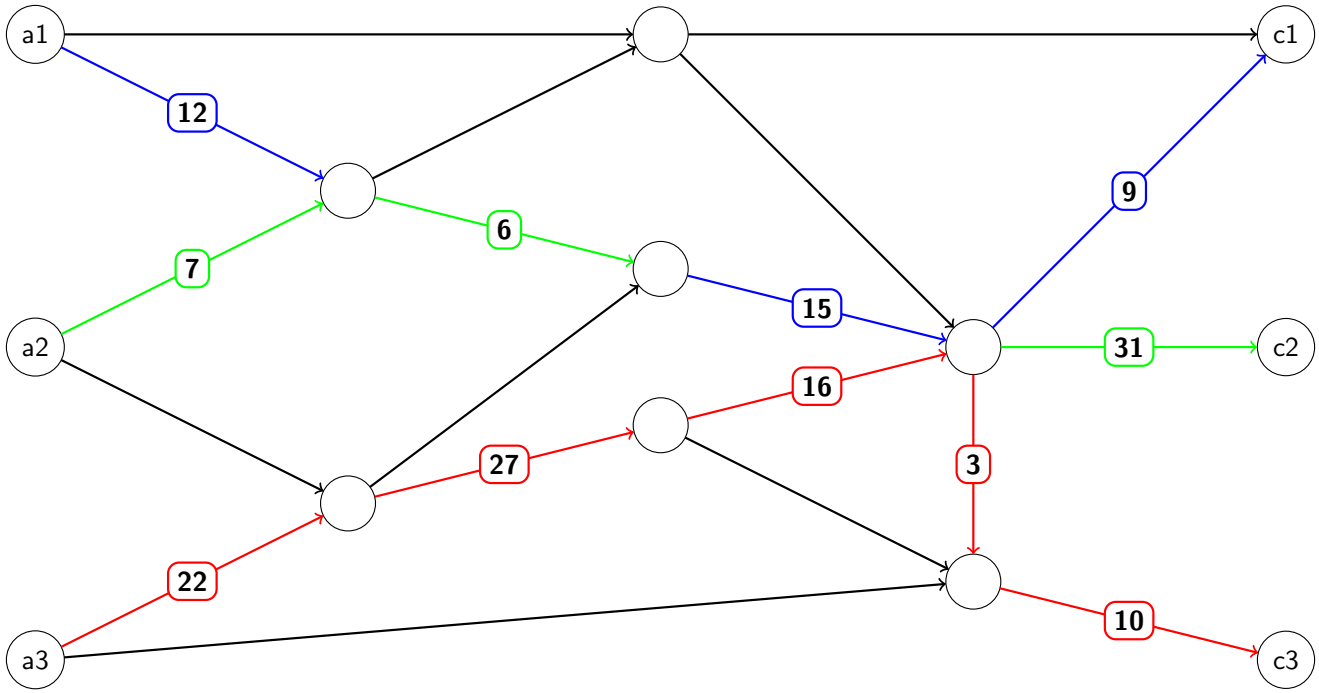
RRH / BBU $\rightarrow$ set of vertices A (Antennas) and C (Computation).

Model



Physical Delay of a link $\rightarrow$ Weight on arcs.

Model



Coherent routing.

Message sending

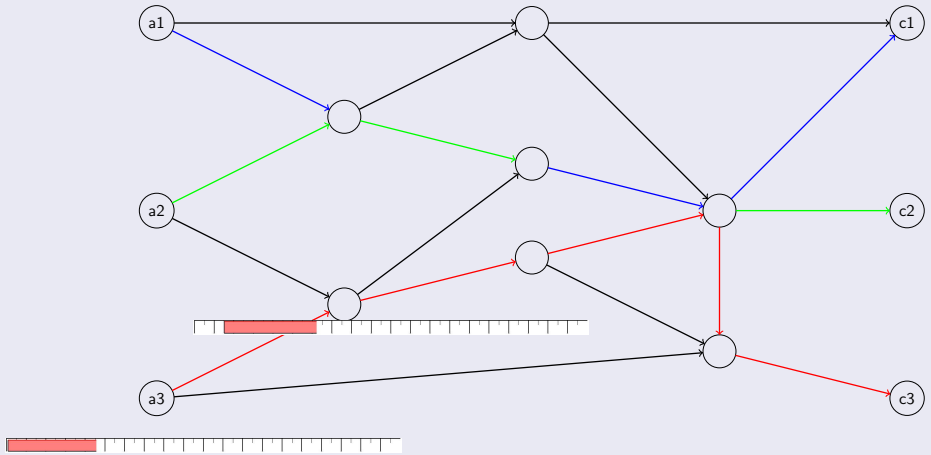
Slotted time

A time (in slots) can be :

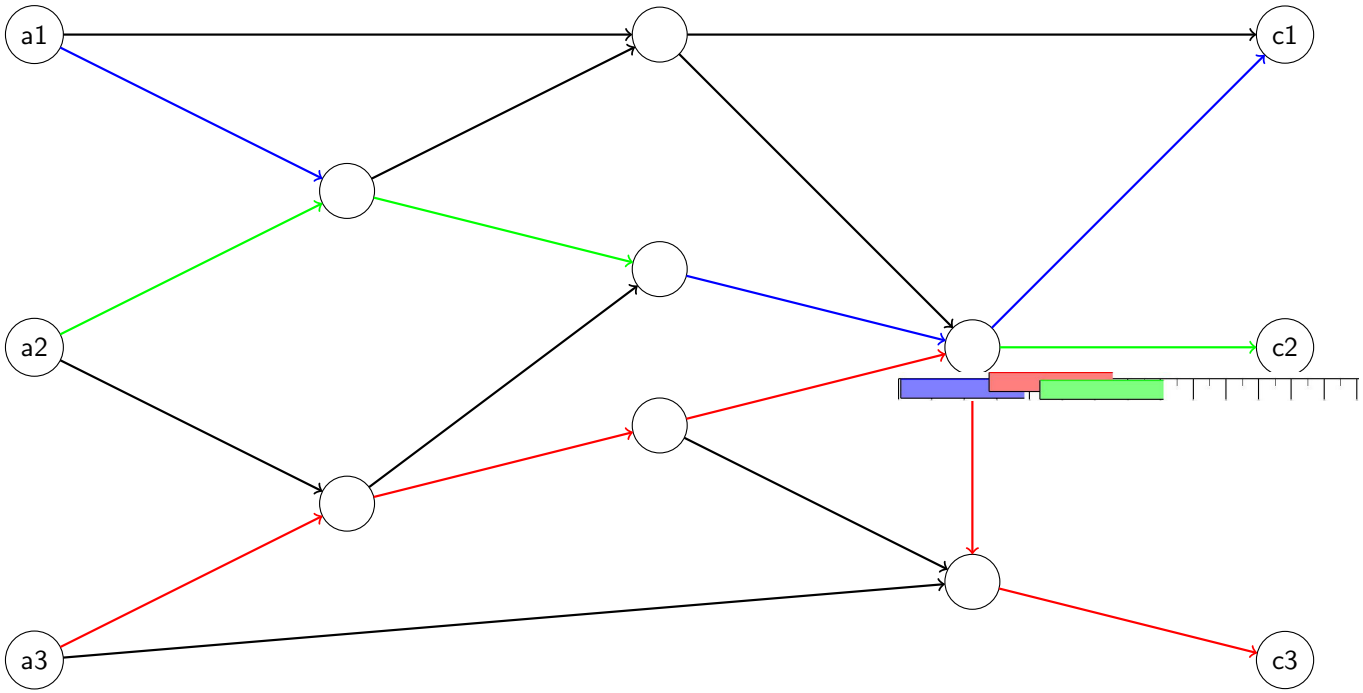
- A delay on a link.
- The time taken to emit a message.

Message sending

Reserving slots on a route.

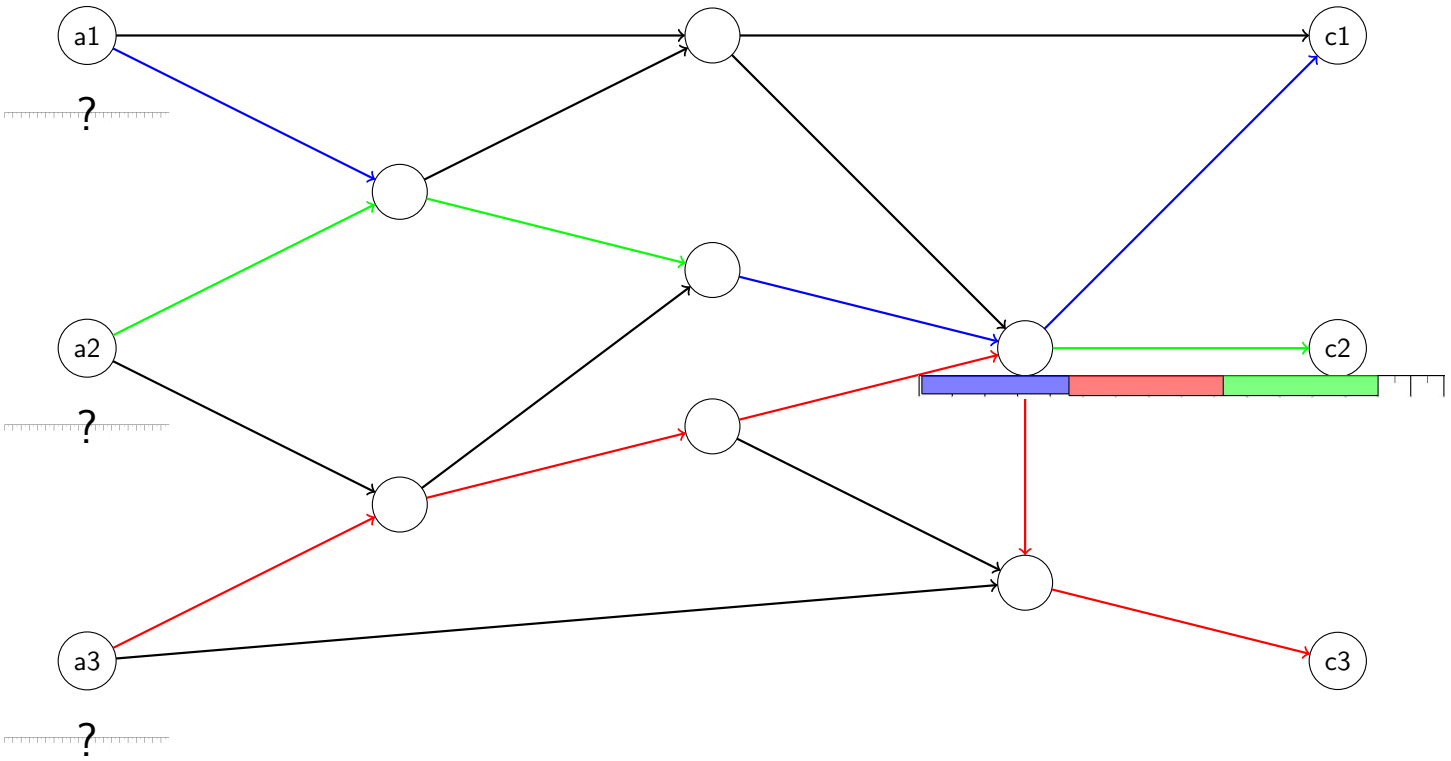


Collisions



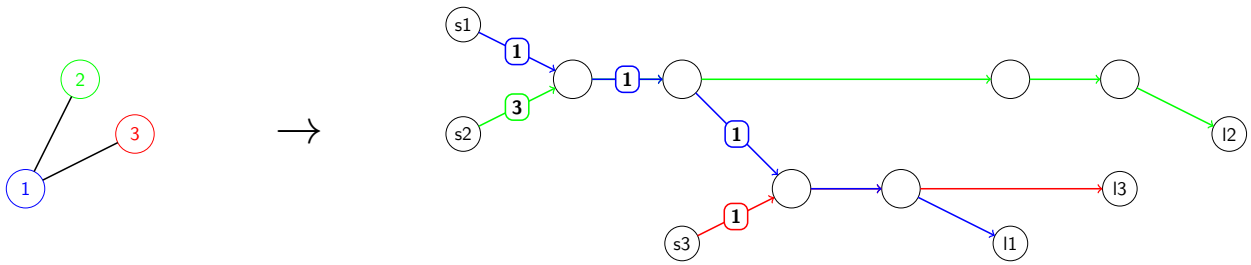
There is a collision when a slot is used by many routes.

Problem



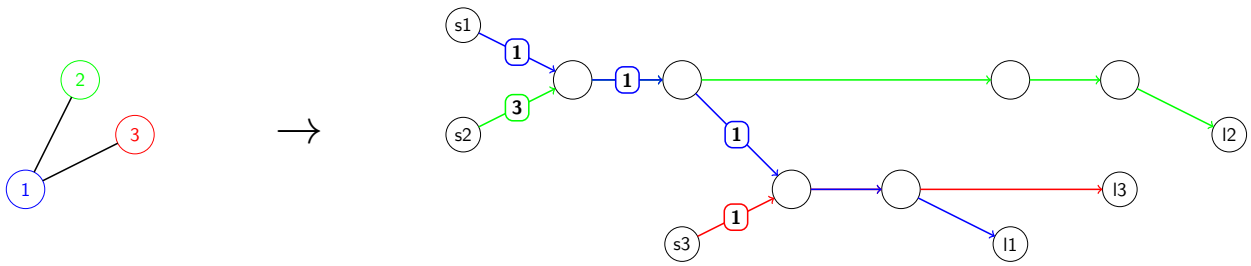
The problem is to find the good starting time for each route such that there is no collision, considering a periodic process.

NP-Hardness



Reducing an instance of k-coloring into an instance of our problem.

NP-Hardness



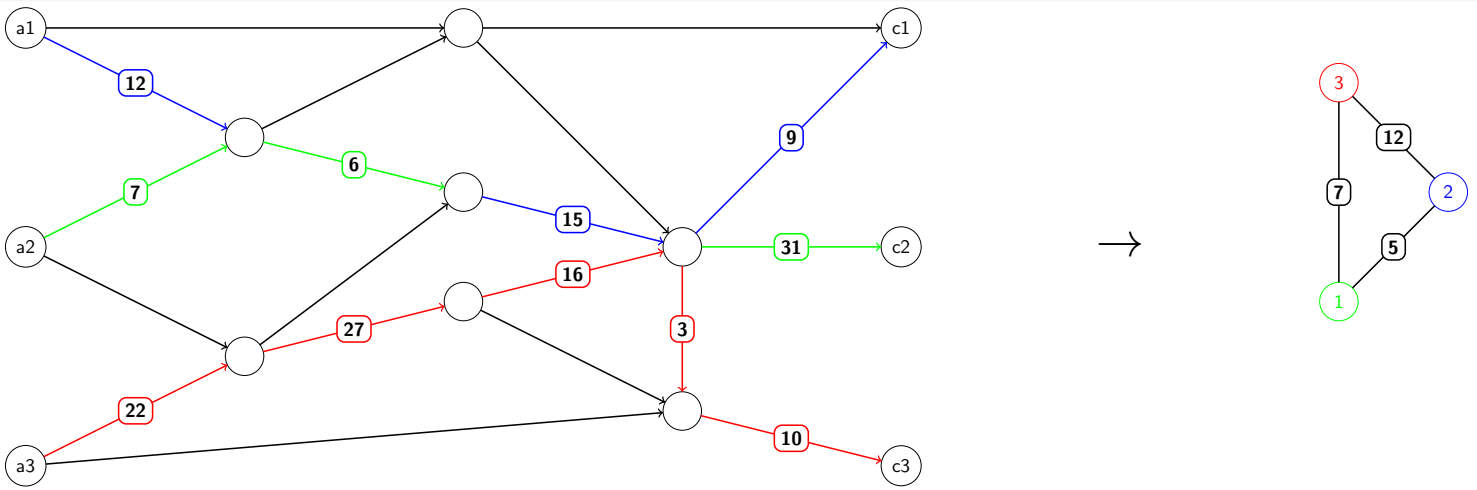
Give to the route 1 the offset(color) 0, and the route 2 and 3 the offset(color) 1.
There is a 2 periodic affectation of the graph.

Conflict Graph

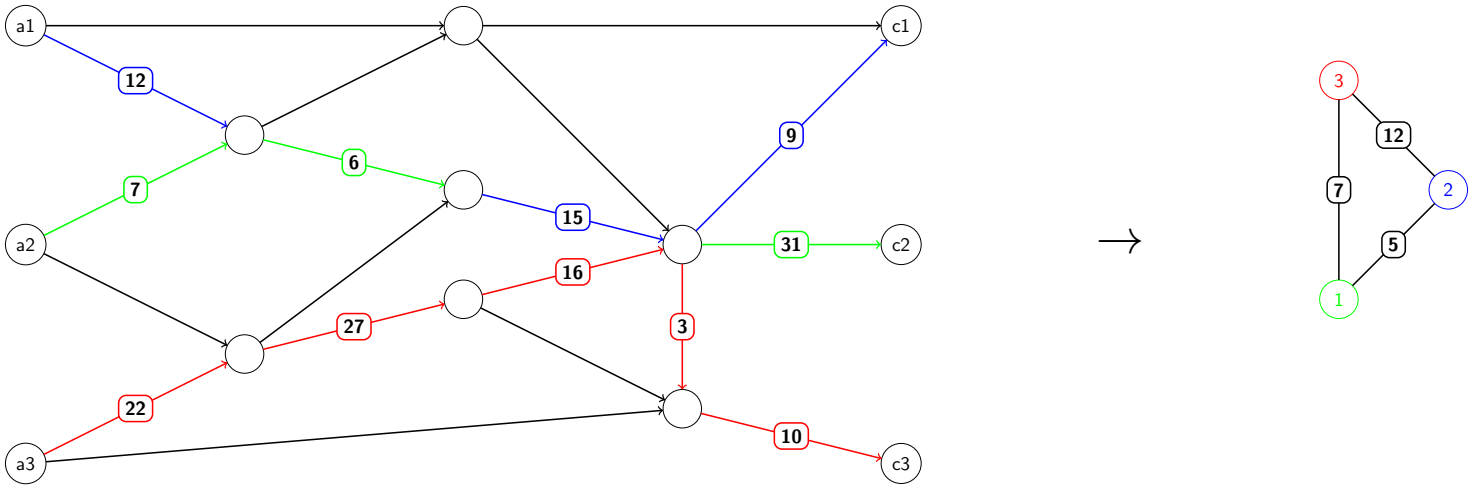
Conflict graph

A conflict graph, is a digraph in which:

- The vertices are the route of the network.
- There is an edge between two vertices if the two routes have a common path.
- The weight on the edges is the difference between the conflict point and the sources of the routes.

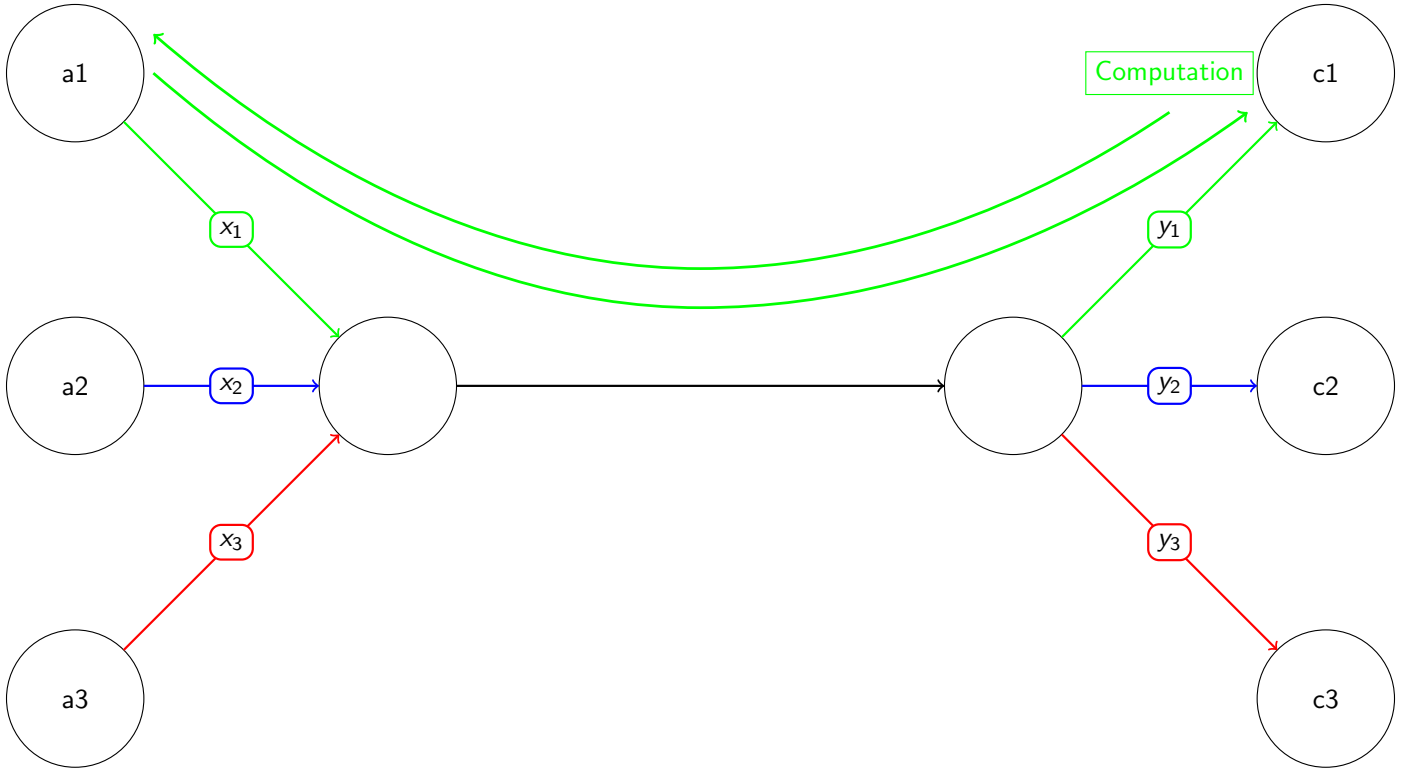


Conflict Graph



Labelling the conflict graph $\rightarrow$ finding a scheduling for the graph G.

General Problem



The second scheduling depends of the first.
The goal is to minimise the maximal latency on the routes.

Longest Shortest Greedy versus Random

LSG Random LSG $\rightarrow$ far from the deadline.
Random $\rightarrow$ 10% solutions with $T_{max} >$ deadline for 5 flows.

Conclusion

Results:

- An heuristic giving good results compared to statistical approach.
- An Algorithm giving optimal solutions for some parameters.

Further research:

- Improve the model.
- Study other topologies.