**5.** j← number of service point SP at which the vehicle $V_i$ arrived at time t
**6.** r← number of route along which the vehicle $V_i$ travels at time t
**7.** k← number of SP, connected to $SP_j$ in route r
**8.** MCong[j,k] ← congestion status of arc $A_{\mathbf{jk}}$
**9.** TW[r,j] ← required time window for the service point **j** in the route **r**
**10.** $CT_{\mathbf{jr}}$ ← type of congestion;
**11.** $tcong_{jr}^{0}$ ← starting time of congestion occurrence
**12.** $tcong_{jr}^{clear}$ ← expected time of congestion clearance
**13.** *φ*← congestion duration; *c*← road non-congested capacity; *ρ*← road capacity during the congestion; *q* ← arrival rate of vehicles to the congested arc
**14.** Autonomic component $AC_i$ receives a message from vehicle $V_i$
**15.** $CDW_{\boldsymbol{jr}}$← cost to pay the driver that waits at the service point $SP_j$ and executes the route ***r*** (see formulas 2)
**16.** $CTW_{kr}$← cost (penalty) of violation the time windows assigned to the $SP_k$ when executing the route ***r*** (see formulas 2)
**17.** **if** $CDW_{\boldsymbol{jr}} \leq CTW_{kr}$ **then**
**18.** decision: wait at $SP_j$
**19.** **else**
decision: reschedule and generate new route ***r**** (by using the modified ALNS algorithm)
**21.** **end if**
**22.** **if** ***r**** **is null then**
**23.** decision: wait at $SP_j$
**24.** **end if**
**25.** NSSP++ or OSSP++
**23.** store obtained results to TCMD
**24.** **end while**
**25.** display obtained results

## 3. Conclusions

In our paper we described the adaptive algorithm to solve MDVRPTW problem. The algorithm is aimed to account for realistic real-world situation, such as presence of various congestion types. The congestions are the most important critical factors for the successful and practically acceptable solution of the MDVRPTW problem. Since the realistic estimation of congestion duration is rather difficult and non-standard problem, we use the MatSim large-scale agent-based simulation tool which allows users to compose and run complex simulation models that are extremely close to the real-world situations. In particular, this language allows to enter various input parameters, obtain process simulation outputs and a great lot of parameters and distributions functions of simulated processes. Another distinctive feature of our approach is the use of autonomic components ensembles. Each vehicle is associated with the corresponding autonomic component AC (implemented as a virtual machine in datacenter) and exchange on-line information with other vehicles. This allows a vehicle to notify other vehicles about expected and actual congestion. Besides, ACs can reschedule routes in order to find the acceptable alternative routes that enable vehicles to meet time windows requirements and, at the same time, avoid the congested roads. It is necessary to point out that the algorithm of adaptation is able to reschedule and find alternative routed for several vehicle in parallel. The latter significantly increases the performance of proposed approach.

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