Scheduling Multi-source Divisible Loads on an Arbitrary Networks with Granularity Constraints*

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Abstract. Many interconnection networks have been proposed and studied in the work to date on divisible load scheduling.

I want to focus on multi-source data injection problem.The practical machines have load injected into their interconnection fabric at multiple points simultaneously.

I want to consider from the following perspectives:

- The topology of networks:
    1. linear chain, buses[5], trees[7], tori, regular mesh[12], hypercubes[1],general networks[3]
    2. Kinetic clustering method[9] which means the user can add/drop some data injection source during the system is running.
    3. Constrain of Data injection position. For example, the company need there must be a data injection in one specific location and we can decide the other locations
- Data property:
    1. Big Chunk Data: for example the big flat file[5], we try to minimize the total time
    2. Streaming Data: for example Surveillance video[2] [10], mobile phone camera video stream. Optimize the max flow in the data network in a stable situation.
    3. Data has granularity limitation[8]
- Node :
    1. workstations or sensor node has a limit buffer size[8]
- Method:
    1. Superposition[11][6]
    2. Queue theory. not only consider the M/M/1[4], we also can think about the M/M/K or different data distribution function. which means some nodes consist of a cluster and share the memory together.

Key words. divisible load theory, granularity, queuing theory, kinetic clustering, superposition, three-dimensional network

1. Introduction.

I have implemented four algorithms in the past week, which are queuing theory M/M/11, M/M/K 2 queue model simulation.

I simulate there are total 500 or 900 vehicles comes with *Possion* process, with different λ and μ . In the Fig 1, which indicate that if the coming rate λ exceed the service rate μ the queue length with grows. If the coming rate λ is smaller or equals than the service rate μ. The queue length can is small enough.

In the Fig 2, which simulate there are 900 vehicles come as a *Possion* process and there are $K = 3$ workstations to support the service. We assume each station has the homogeneous processing capacity μ. If the unified ability $\frac{\mu}{K}$is smaller than λ , the mean length of the queue is growing. If the unified service capacity is greater than λ , the mean length of the queue keeps short.

In addition, I also reproduce the DTL for daisy chain link and single level tree topology.

If the $M = 5$, $w \times Tcp = 1$ and $z \times Tcm = 1$ then the chain DTL α fragment is following

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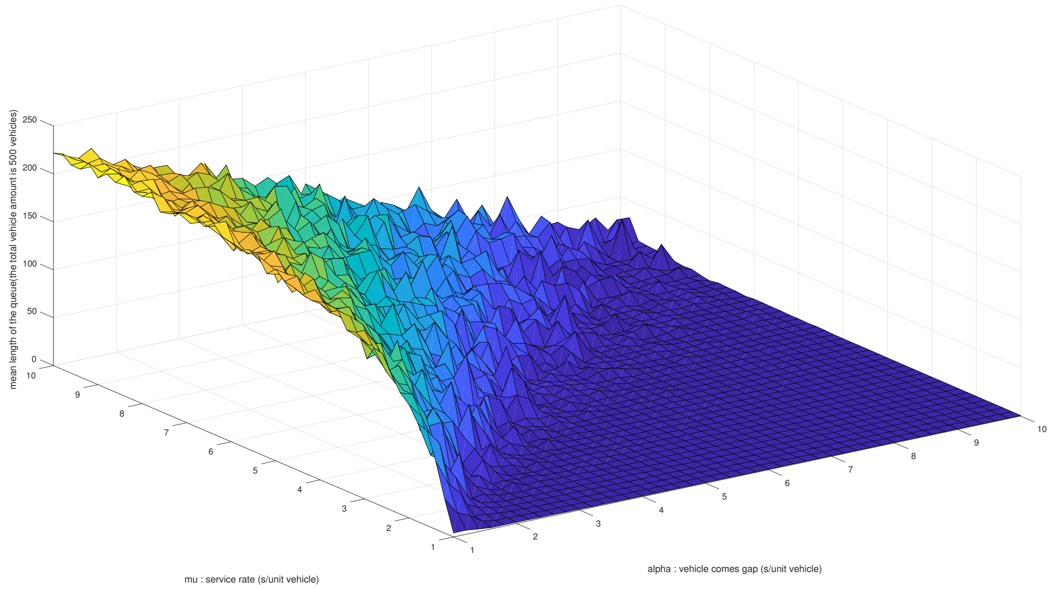

Figure 1. *M M 1 simulation*

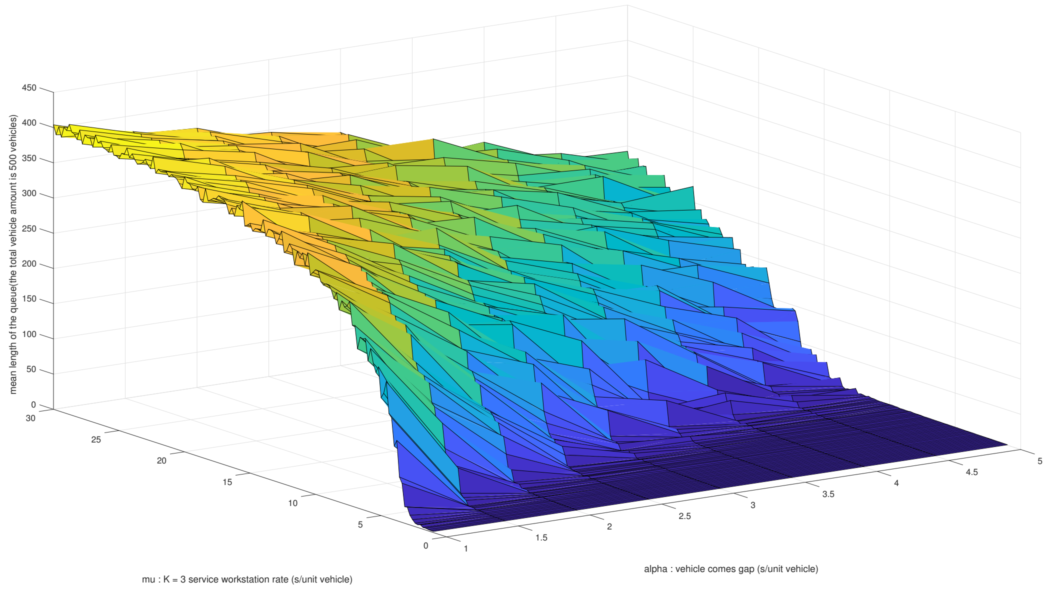

Figure 2. *M M K simulation*

Table 1
5 Node Daisy Chain Link fragment ratios under DTL

α_0	α_1	α_2	α_3	α_4
0.6182	0.2364	0.0909	0.0364	0.0182

Table 2
4 Node 3 installment single level tree fragment ratios under DTL

α_0	α_1	α_2	α_3	α_4	α_5	α_6
0.5000	0.2407	0.0174	0.0013	0.1249	0.0090	0.0006
α_7	α_8	α_9	α_{10}	α_{11}	α_{12}	
0.0648	0.0047	0.0003	0.0336	0.0024	0.0002	

If the $M = 4$, installment $N = 3$ and $w \times Tcp = 1$ and $z \times Tcm = 1$ then single level tree α ratio

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