SOFTWARE MODELS FOR NON CONFLICT SCHEDULE OPTIMIZATION*

K Kolchakov
Institute of Information and Communication Technologies, Bulgarian Academy of Sciences
kkolchakov@abv.bg

Two software models for non-conflict schedule are optimized. The algorithm models using sparse matrixes for non-conflict schedule are optimized. The optimization is related to the process of matrix-masks creation. As result the performance is improved and memory recourses are reduced.

Key words: Network nodes, message switching node traffic, crossbar switch, conflict elimination, packet messages, sparse matrix.

1. Introduction

The software models presented in the paper are related to the algorithms for non-conflict schedule obtaining in Crossbar switching nodes. The target of the research is to define how optimization influences over the performance and memory recourses.

The traffic via Crossbar switching nodes is casual and depends on the users.

The conflicts are available in the following two cases:

- When one source of massage requests communication to two or more massage receivers
- When one massage receiver receives communication requests from two or more massage sources.

The evasion of the conflicts is directly related to the switching node performance.

The status of the switch of the switching node is represented with the so called connection matrix. For N x N dimensional switch the dimension of the connection matrix T is N x N also, where every member $T_{ij} = 1$ if the connection request from i-source to j- receiver exists. In the opposite case $T_{ij} = 0$.

A conflict situation arises if any row of the connection matrix has more than a single 1, which corresponds to the case when one source requests a connection with more than one receiver. The presence of more than a single 1 in any column of the matrix T also indicates a conflict situation, it means that two or more sources have requested a connection with the same receiver.[1].

2. Software models optimization

The optimization is related to the both of high performance algorithms (**CSM** (**C**lassical Algorithm with **S**parse **M**atrixes)[2]) and **JSM** (Algorithm with **J**oint **S**parse **M**atrixes)[2]) and the corresponding software models (**SMCSM**[2] and

*Изследването е финансирано по тема “Моделиране, оптимизация и многокритериално вземане на решения” ИИКТ-БАН 2011-2013г. “Разработка и исследование теоретических методов построения распределенных информационных сетей и систем” ЕБР ИППИ-РАН.

SMJSM[2]). **SMCSM**[2] and **SMJSM**[2] models are optimized related to the matrix-masks creation during initial loading.

Table 1 contains the results of **SMCSM** optimization. Table 2 presents the results of **SMJSM** optimization. From the tables it is visible that for N = 400 and N = 450 for non optimized models there are no results. It is because of lack of memory. While for the optimized models the memory is enough for the same values of N.

The software models are written using MATLAB language and run on DELL Precision 420 workstation.

N	SMCSM	SMCSM	SMCSM-Opt.	SMCSM-Opt.
	Performance [Sec.]	**Memory[MB]**	**Performance [Sec.]**	**Memory [MB]**
50	1,219	4,029	0,782	1,899
100	3,906	32,079	3,703	14,558
150	7,109	108,149	6,703	48,477
200	11,438	256,239	11,770	114,156
250	34,781	500,348	22,578	222,095
300	139,280	864,478	28,156	382,794
350	345,235	1372,628	54,297	606,753
400	-----------------	-----------------	124,250	904,472
450	-----------------	-----------------	230,781	1286,451

Table 1: **SMCSM** and **SMCSM-Opt.** results.

N	SMJSM	SMJSM	SMJSM-Opt.	SMJSM-Opt.
	Performance [Sec.]	**Memory[MB]**	**Performance [Sec.]**	**Memory [MB]**
50	1,290	4,016	0,750	1,664
100	3,240	32,032	3,125	12,629
150	6,985	108,048	6,360	41,894
200	12,170	256,064	11,547	98,459
250	54,180	500,080	21,562	191,324
300	124,656	864,096	39,563	329,488
350	586,719	1372,112	55,406	521,953
400	-----------------	----------------	116,625	777,718
450	-----------------	----------------	183,938	1105,783

Table 2 : **SMJSM** and **SMJSM-Opt.** results.

Figure 1 is a graphical representation of the results of **SMCSM** optimization related to the performance.

*Изследването е финансирано по тема "Моделиране, оптимизация и многокритериално вземане на решения" ИИКТ-БАН 2011-2013г. "Разработка и исследование теоретических методов построения распределенных информационных сетей и систем" ЕБР ИППИ-РАН.

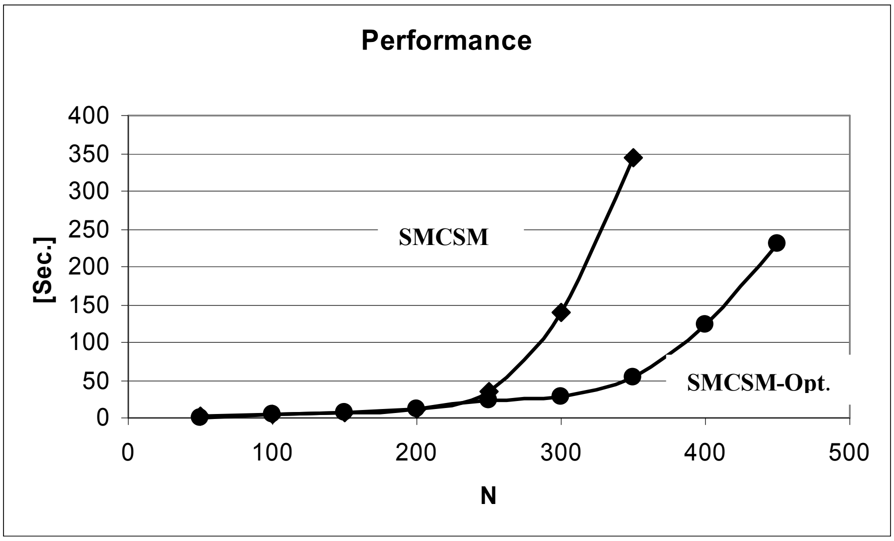

Figure 1 : Graphical results of **SMCSM** optimization relate to the performance.

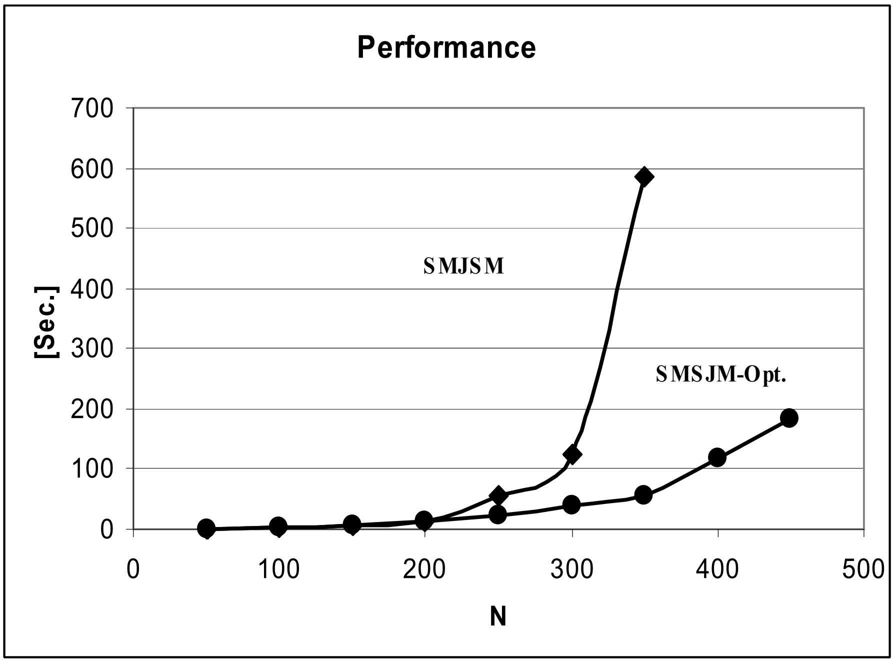

Figure 2: Resalts of **SMJSM** relate to the performance.

*Изследването е финансирано по тема "Моделиране, оптимизация и многокритериално вземане на решения" ИИКТ-БАН 2011-2013г. "Разработка и исследование теоретических методов построения распределенных информационных сетей и систем" ЕБР ИППИ-РАН.

For convenience on Figure 2 are presented the resalts of **SMJSM** relate to the performance.

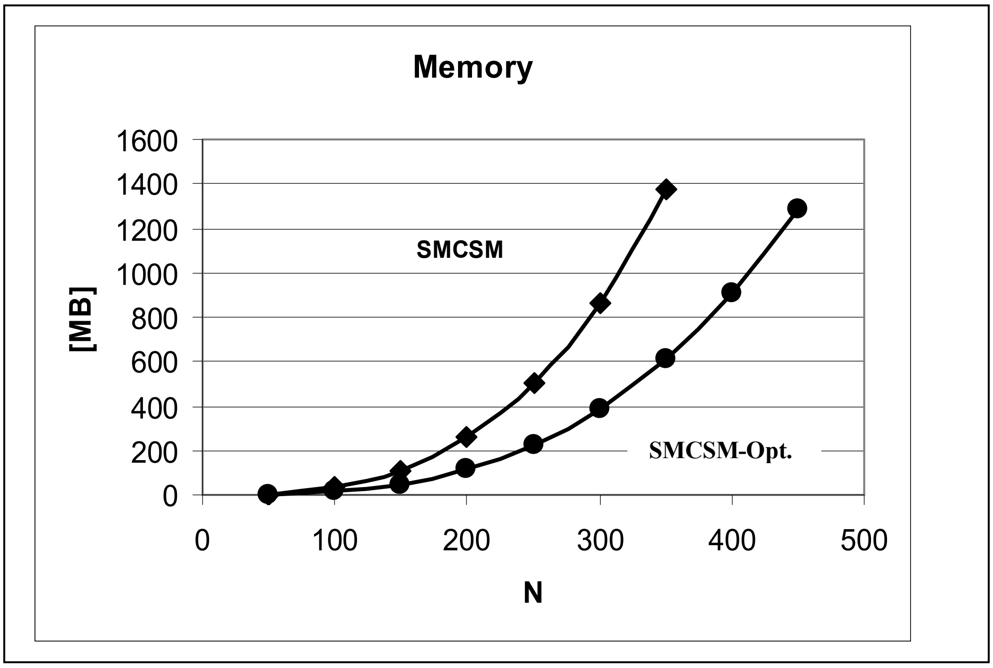

Figure 3: Graphical representation of the results of **SMCSM** optimization related needed memory.

Figure 3 is a graphical representation of the needed memory for **SMCSM** optimization and Figure 4 – for **SMJSM.**

*Изследването е финансирано по тема "Моделиране, оптимизация и многокритериално вземане на решения" ИИКТ-БАН 2011-2013г. "Разработка и исследование теоретических методов построения распределенных информационных сетей и систем" ЕБР ИППИ-РАН.

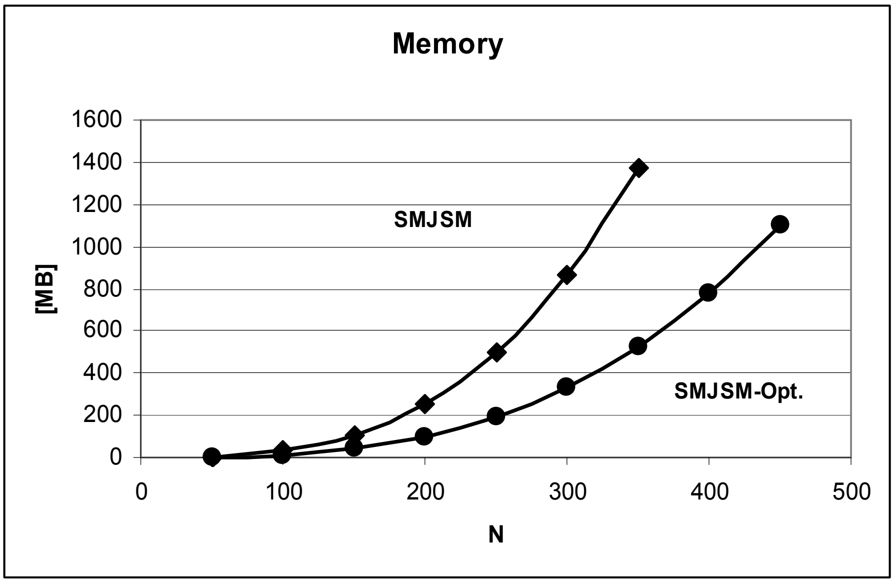

Figure 4: Graphical representation of the results of **SMJSM** optimization related needed memory.

N	**SMCSM-Opt.**	**SMCSM-Opt.**	**SMJSM-Opt.**	**SMJSM- Opt.**
	Saved time [%]	**Needed memory-decrease[%]**	**Saved time [%]**	**Needed memory-decrease[%]**
50	35,849	52,866	41,860	58,565
100	5,197	54,618	3,549	60,573
150	5,711	55,175	8,947	61,226
200	-2,902	55,449	5,119	61,549
250	35,085	55,611	60,203	61,741
300	79,784	55,719	68,262	61,869
350	84,272	55,796	90,556	61,195

Table 3: Shows the saved time because of performance improvement and memory reduction using the results of Table 1 and Table 2.

*Изследването е финансирано по тема “Моделиране, оптимизация и многокритериално вземане на решения” ИИКТ-БАН 2011-2013г. “Разработка и исследование теоретических методов построения распределенных информационных сетей и систем” ЕБР ИППИ-РАН.

3. Conclusion

The saved time due to the improved performance in the both models depends on N. The saved time trends to increase increasing N. Needed memory decrease is about 55% for **SMCSM - Opt.** and about 61% for **SMJSM - Opt.** is not depending on N. Es a conclusion the optimization is recommended for matrix size more than N= 200.

REFERENCES

1. K.Kolchakov, "An Approach for Performance Improvement of Class of Algorithms for Synthesis of Non-conflict Schedule in the Switch Nodes" , Proceedings of the 11th International Conference on Computer Systems and Technologies, CompSysTech'10, 17-18 June 2010, Sofia, Bulgaria, pp.235-239, ISBN 978-1-4503-0243-2.
2. Kolchakov K., Software Models with Sparse Mask Matrixes for Non-Conflict Schedule obtaining in a Switching Node, Доклад в трудове на международна конференция (DCCN – 2009), "Distributed Computer and communication networks DCCN 2009", Moscow: R&D Company "Information and Networking technologies" ISBN 978-5-9901871-1-5 София, България, Октомври 5 – 9, 2009, стр. 121-126.
3. K.H.Kolchakov, An approach for non-conflict schedule synthesis – modeling and optimization, Доклад в Сборник научных трудов том 10 Интелектуальные системы и технологии УДК 004.896(06), Научная сесия МИФИ – 2008, Москва 2008, стр. 100 – 101, ISBN 978-5-7262-0883-1.
4. Kolchakov K., A Modeling Approach for Obtaining of a Non – Conflict Schedule, Доклад в трудове на международна конференция (DCCN – 2007), Москва, Русия, Септември 10 – 12, 2007, стр. 168 – 173.
5. Kolchakov K.H., Non-conflict Schedule Synthesis Based on Communication Matrix Scanning, Доклад в Сборник научных трудов том 3 Интелектуальные системы и технологии, Научная сесия МИФИ – 2007, Москва 2007, стр.132 - 133.
6. Ташев Т., Железов Р. Моделирование виртуальных выходных очередей для коммутационного узла обобщенными сетями. Proc. of Int. Workshop "Distributed Computer and Communication Networks – DCCN'2010", October 26-28 2010, Moscow, Russia. RDC "INT", Moscow, Russia, 2010, pp.198-203. ISBN 978-5-9901871-2-2.

*Изследването е финансирано по тема "Моделиране, оптимизация и многокритериално вземане на решения" ИИКТ-БАН 2011-2013г. "Разработка и исследование теоретических методов построения распределенных информационных сетей и систем" ЕБР ИППИ-РАН.