Performance Analysis of Agent based IPSM for Windows based Operating Systems

Deepshikha Bhargava, Madhavi Sinha

Abstract—All processes prevent casual exchange of data. However, occasionally two processes might need to communicate with each other. One method that enables processes to communicate is called Inter Process Synchronization (IPS). In an Operating System on which several threads run concurrently, it is important to be able to synchronize the activities of various threads. Windows provides several synchronization objects that enable to synchronize a thread's actions with those of another thread. These objects include critical sections, mutexes, events, and semaphores. The different solutions for Inter Process Synchronization problem are suggested [1] where some of these solutions have their own limitations or performance related issues. The agent based approach used in this paper has suggested a new algorithm for agent IPSM which is an attempt to propose an optimal solution to the problem. IPSM stands for Inter Process Synchronization Manager which is an agent used for solving the problem of inter process synchronization. In the present paper agent based Inter Process Synchronization Manager (IPSM) is described and its performance is compared with agent based IPSM on different Windows based operating systems.

Index Terms: Inter Process Synchronization, Inter process Synchronization Manager, agent, IPSM

I. INTRODUCTION

An agent can be defined as a system situated within and part of an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and so as to effect what it senses in the future [2].

The agent based solution through agent IPSM (*Inter process Synchronization Manager)* is capable to function with the operating system. It would also function for multiple concurrent processes those are either CPU bound or I/O bound. The agent would be capable to work for shared resources like CPU, peripherals, memory, files etc [3].

Agent based IPSM is multi agent based, low structured and able to adapt quickly to a changing environment which are properties of the system. Moreover, this agent can operate autonomously, with respect to specific operation and can encapsulate knowledge.

An Agent-Based IPSM can mirror to a large extent the way a distributed environment is organized in practice and can therefore support optimization of processes.

The agent IPSM implementation is an attempt to experiment the algorithmic design [4]. The experimental setup is emphasizing on the IPS situation of Windows based Operating System.

Testing of any system is required to validate the results and to improve the performance. Performance evaluation of the Agent IPSM is basically divided into two modules- (1) Validation of the results (2) Performance Evaluation. The test has successfully been performed on two Windows based operating systems: Windows XP [5] and Windows 2007 operating system.

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In this paper agent based IPSM performance is evaluated and it is compared in both the operating systems. In section II, performance evaluation criteria are explained. In section III the results are validated and then in the section V performance of both the operating systems are compared and discussed. Finally, in section VI conclude the paper with the results.

II. PERFORMANCE EVALUATION

The agent IPSM suggested here is a plug-in for Windows' built-in Task Manager. It expands the basic functionality and gives a powerful control over running processes. The performance analysis of agent based IPSM application is performed on two processes P1 and P2 those are facing the IPS problem. The process P1 and P2 can be described as follows [5]:
 i)   Process P1: defined as a process which is using resource R1 and using resource R2.
 ii) Process P2: defined as a process which is requesting for resource R1 and using resource R2.

At the time of performance evaluation process P1 and P2 triggered at same time ti and are in the state of inter process synchronization problem. The validation of results received is discussed in section III and it is further evaluated for both the operating systems in section IV.

III. VALIDATION OF RESULTS

The parameters are taken into consideration for performance measurement are CPU usage in percentage, CPU waiting time, Memory usage in KBs, Number of page faults and Turn-around Time of CPU. The testing is performed in ten different time intervals T1 to T10 [6].

The test was conducted on eleven parameters out of which only first five parameters were showing the significant results during testing. Hence the test was more focused on these five parameters only.
   i)   CPU usage (in percentage) (CU)
   ii) CPU WAITING TIME (in seconds) (CWT)
   iii) MEMORY USAGE (in KBs) (MU)
   iv) PAGE FAULT (PF)
   v)   TURN-AROUND TIME (in seconds) (TAT)
   vi) VIRTUAL MEMORY SIZE (in KBs) (VMS)
   vii) HANDLES (HD)
  viii) THREADS (TH)
   ix) I/O READ (IOR)
   x)   ST TIME (in hours:minutes:seconds) (ST)
   xi) END TIME (in hours:minutes:seconds) (ET)
The values of the above parameters are retrieved and stored by Test Manager and used these values to show the results.

IV. COMPARATIVE ANALYSIS

The evaluation is further carried out for IPSM mode of Windows XP and Windows 2007 operating system. The comparison is performed on the same five parameters as described in following sub sections.

A. CPU usage in percentage

This is an important parameter of evaluation that checks how much CPU is being used by a process during execution.

The test data shown in Table-I is the comparative analysis of process P1 and P2 in IPSM mode for Windows XP and Windows 2007 operating system.

TABLE I
CPU USAGE IN IPSM MODE IN WINDOWS XP AND WINDOWS 2007

CPU usage in %age	P1 IPSM Windows XP	P2 IPSM Windows XP	P1 IPSM Windows 2007	P2 IPSM Windows 2007
T1	92	6	50	50
T2	93	6	50	50
T3	92	6	50	12
T4	99	0	50	38
T5	92	6	41	0
T6	92	6	40	50
T7	92	7	50	50
T8	92	6	49	50
T9	92	7	50	50
T10	92	6	30	50

After comparative analysis as shown in "Fig. 1" it can be observed that process P1 in IPSM mode of Windows XP operating system is in critical section in all the cases where as process P2 is waiting state.

On the other hand, in Windows 2007 both the processes do not have such clear distinction.

Hence, it can be stated that,

"Processes in running state of Windows XP operating system showing better CPU usage as compared to Windows 2007 operating system."
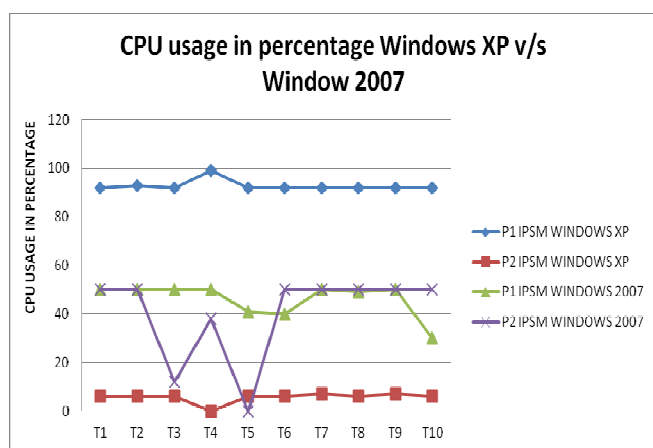

Fig. 1. Comparative analysis of CPU usage in IPSM mode in Windows XP and Windows 2007

B. CPU waiting time in seconds

This parameter checks, how much time (in seconds) a process waits for CPU execution. The CPU waiting time in IPSM mode is also being compared for Windows XP and Windows 2007 operating sytem as shown in Table-II.

TABLE II
CPU WAITING TIME SECONDS IPSM MODE IN WINDOWS XP AND WINDOWS 2007

CPU WAITING TIME IN SECONDS	P1 IPSM Windows XP	P2 IPSM Windows XP	P1 IPSM Windows 2007	P2 IPSM Windows 2007
T1	0	70	23	24
T2	0	31	32	31
T3	0	40	36	37
T4	0	31	1	2
T5	0	32	36	37
T6	0	44	1	2
T7	0	44	10	11
T8	0	53	1	2
T9	0	35	2	1
T10	0	43	6	5

After comparative analysis of CPU waiting time in IPSM as shown in "Fig. 2" for both the operating systems, it can be observed that process P1 of Windows XP is in clear running state and in critical section, hence having less CPU waiting time. Process P2 of Windows XP is consuming more CPU waiting time.

On the other hand, process P1 and P2 in Windows 2007 are having moderate situation where during some time intervals, P1 is in critical section and sometime P2 is in critical section.

Hence it can be stated that,

"CPU waiting time in IPSM mode of Windows XP operating system is showing better results as compared to processes waiting in Windows 2007 operating system."
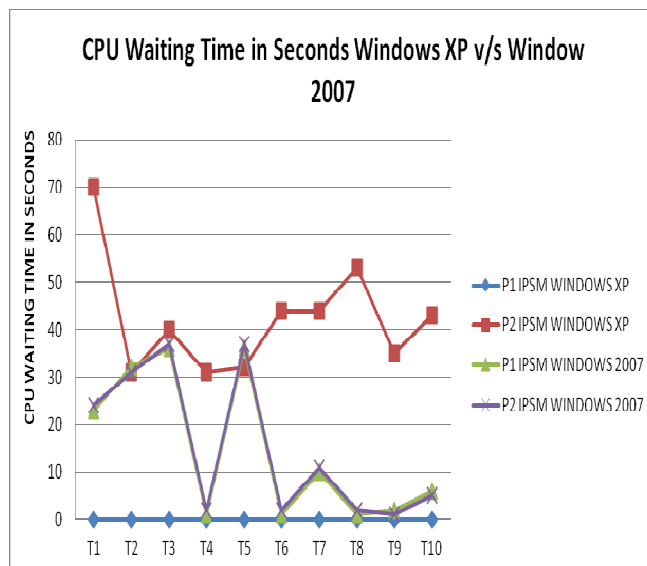

Fig. 2. Comparative analysis of CPU waiting time in IPSM mode in Windows XP and Windows 2007

C. Memory usage in KBs

Another parameter on which the comparison carried out is Memory usage. It states how much memory space (in KB) is used by a process. Memory usage in IPSM mode of Windows XP and Windows 2007 is shown in Table-III.

TABLE III
MEMORY USAGE IN IPSM MODE IN WINDOWS XP AND
WINDOWS 2007

Memory Usage in KB	P1 IPSM Windows XP	P2 IPSM Windows XP	P1 IPSM Windows 2007	P2 IPSM Windows 2007
T1	2940	2924	3236	3244
T2	2944	2924	3248	3396
T3	2948	2940	3316	3256
T4	2940	2936	3244	3236
T5	2944	2928	3336	3320
T6	2940	2924	3232	3236
T7	2948	2932	3240	3232
T8	2944	2924	3240	3228
T9	2948	2924	3228	3236
T10	2944	2936	3244	3248

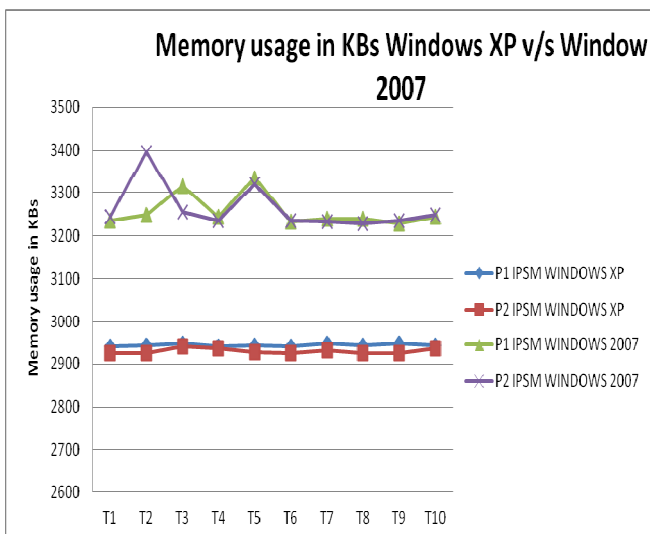"Fig. 3" showing the comparative analysis of memory usage for both the operating systems.

Fig. 3. Comparative analysis of memory usage in IPSM mode in Windows XP and Windows 2007

After comparative analysis of memory usage in IPSM mode of Windows XP and Windows 2007 operating system it is observed that processes P1 and P2 both are consuming lesser memory in Windows XP operating system as compared to Windows 2007 operating system.

This is the only case where Windows 2007 operating system is showing better results. Hence it can be stated that,

"Processes in Windows 2007 consume lesser memory as compared to Windows XP operating system."

D. Number of page faults

Both the operating systems are further compared on parameter number of page faults as shown in Table-IV. This parameter belongs to the Number of page faults occurred for a process.

TABLE IV
NUMBER OF PAGE FAULTS IN IPSM MODE IN WINDOWS XP
AND WINDOWS 2007

NO. OF PAGE FAULTS	P1 IPSM Windows XP	P2 IPSM Windows XP	P1 IPSM Windows 2007	P2 IPSM Windows 2007
T1	749	745	3574	3577
T2	750	745	3621	3667
T3	751	749	3736	3631
T4	750	748	3618	3614
T5	750	746	3748	3748
T6	749	745	3614	3620
T7	751	747	3627	3642
T8	750	745	3627	3627
T9	751	745	3618	3631
T10	750	748	3592	3610

After comparative analysis of number of page faults as shown in "Fig. 4" in both the operating systems it is showing contradictory results.

The number of page faults is decreasing in Windows 2007 operating system. It is showing better result as compared to Windows XP operating system.

Hence it can be stated that,

"Number of page faults reduce in IPSM mode of Windows 2007 operating system as compared to Windows XP operating system."
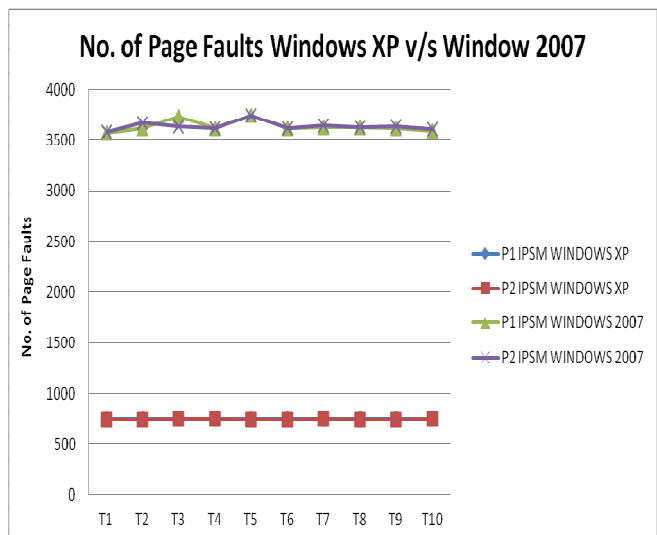

Figure 4. Comparative analysis of number of page faults in IPSM mode in Windows XP and Windows 2007

E. Turn Around time in seconds

This is the time (in seconds) which a process takes in execution. After comparative analysis of turn around time in IPSM mode for both the operating system as shown in Table-V and "Fig. 5", it is observed that processes P1 and P2 running in Windows 2007 system consume lesser turn around time as compared to Windows XP operating system.

TABLE V
TURN AROUND TIME IN IPSM MODE IN WINDOWS XP AND
WINDOWS 2007

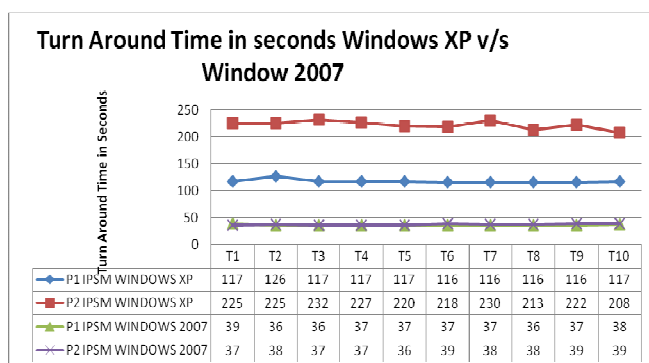| TURN AROUND TIME IN SEC	P1 IPSM Windows XP	P2 IPSM Windows XP	P1 IPSM Windows 2007	P2 IPSM Windows 2007
T1	117	225	39	37
T2	126	225	36	38
T3	117	232	36	37
T4	117	227	37	37
T5	117	220	37	36
T6	116	218	37	39
T7	116	230	37	38
T8	116	213	36	38
T9	116	222	37	39
T10	117	208	38	39

Figure 5. Comparative analysis of Turn Around Time in IPSM mode in Windows XP and Windows 2007

Hence it can be stated that,

"Processes running in Windows 2007 operating consume lesser Turn Around Time as compared to Windows XP operating system."

V. CONCLUSION

In this paper five parameters are successfully tested and proved subsequently on Windows XP based operating system and Windows 2007 operating system.

It can be proved from section IV that the agent based IPSM is showing following results after comparison between Windows XP based operating system and Window 2007 operating system:

i) Processes in running state of Windows XP operating system showing better CPU usage as compared to Windows 2007 operating system.

ii) CPU waiting time in IPSM mode of Windows XP operating system is showing better results as compared to processes waiting in Windows 2007 operating system.

iii) Processes in Windows 2007 consume lesser memory as compared to Windows XP operating system.

iv) Number of page faults reduce in IPSM mode of Windows 2007 operating system as compared to Windows XP operating system

v) Processes running in Windows 2007 operating consume lesser turn around time as compared to Windows XP operating system.

As a whole it is proved that,

"Windows XP based operating system consumes better CPU usage and CPU waiting time as compared to Windows 2007 operating system. On the other hand, Windows 2007 operating system consumes lesser memory, page faults and turn around time as compared to Windows XP operating system."

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