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Investigation and Feasibility Study of Linux and Windows in the Computational Processing Power of ANSYS Software

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Abstract: *The operating system is a general program which manages a variety of hardware and software resources. Most operating systems such as Windows, Linux and, etc. are usually designed graphically. Of course, these have the advantages and disadvantages, the user can choose each of these operating systems according to your type of usage. The most important and most used operating systems are Windows and Linux which are used in the various applications. Today, in the various industries, the fast data processing has become an important problem in the application software such as ANSYS and etc. It may take days or weeks to process a large model in the ANSYS software which reduces the efficiency. The general idea of this research is to select the best operating system which has the best performance and speed in executing ANSYS software files. For this purpose, first, ANSYS fluent software executes on Windows 7 and Linux CentOS 7 operating systems with the same hardware and four processing files run in it and then, the software performance is compared in the serial and parallel modes in both operating systems and finally, the best operating system is selected which has the highest performance and speed in executing ANSYS software files after comparing.*

Keywords: *Operating system, ANSYS, Windows, Linux*

INTRODUCTION

Windows and Linux operating systems are designed and implemented to manage system resources and in fact, an interface between the user and the hardware on the computer. Although the two operating systems can have the same capabilities, these also have obvious differences which are observed both in the work method and communicating with the user. Beside all these differences, it should be noted that Windows is a fully commercial product and belongs to Microsoft Company; but, unlike Windows, the Linux is a free and open source operating system and no single company supports and manages it. Linux is not an operating system. But, it becomes a complete operating system using tools which have been produced by the Open Source GNU Project for it, for this reason, Linux is usually called GNU / Linux and it can be used in the many applications such as servers, workstations, desktop computers, supercomputers, industrial and medical devices by adding other open source software to it which have embedded systems (Jonathan DePrizio, 2005; Swap Faq, 2011). ANSYS is a very powerful software suite and it includes a wide variety of static, dynamic, and (modal, harmonic, spectral, and etc.) vibrations, heat transfer, fluid, acoustic, piezoelectric, electrostatic, electromagnetic problems of structures

in the transient and steady, linear and nonlinear states using the techniques such as finite element, finite volume, and etc. The unique abilities of this program have made it the most widely used simulation program in the simulation of coupled problems (which are a combination of structural, fluid, thermal, electromagnetic fields, etc.). Fluent is a solver in the heat transfer and fluid flow simulation (CFD). It was purchased by ANSYS Inc. in 2006 and renamed ANSYS Fluent. The programming language of Fluent is C. The software abilities are the simulation of the compressible and incompressible flow, steady and transient flow, laminar, turbulent, and viscous flow, heat exchangers, multiphase flows, combustion, and etc. (Renxi Hu et al, 2005; ANSYS, 2016; ANSYS, 2011).

Today, in the various industries, the fast data processing has become an important problem in the application software such as ANSYS and etc. It may take days or weeks to process a large model in the ANSYS software which reduces the efficiency that it takes a lot of time to create the model. So, a proper operating system should be selected for using in the heavy processing.

Literature

Al-Rayes (Al-Rayes, 2012) examined the strengths and weaknesses of Windows and Linux operating systems. He studied the various factors and concluded that IT professionals intend to use the Linux operating system in their technology environments due to the low cost of Linux servers.

West and Dedrick (West J et al, 2001) examined and compared the strengths and weaknesses servers which operated with Windows and Linux. Their proposed approach was that companies could use the Linux operating system as an open source system on their servers with low investment.

Economides, and Katsamakas (Economides N et al, 2006) reviewed and compared the software developers of Linux and Windows. They developed a model in order to compare the motivation of investment in applications in the Linux and Windows operating system. They concluded that investment has a high profitability in the open source software.

Salah and Kahtani (Salah K et al, 2010) experimentally reviewed and compared the Snort NIDS performance under Linux and Windows Server 2003 operating systems. They identified the key parameters of both operating systems which showed precise control over the bandwidth percentage of processor allocated to the Snort program and the parameters could affect its performance. They concluded that Linux has a significant performance than Windows for Snort especially under various traffic and destructive conditions.

3. Discussion

Introducing the operating system and computer system specifications

First, the ANSYS 17.2 software is installed on the Windows 7 and Linux CentOS 7 operating systems with the same specifications. In order to test, four projects are tested on both operating systems by ANSYS Fluent in 2D serial and parallel modes and then, the best operating system is selected by the comparison.

The specifications of the computer system are as follows:

- CPU: AMD 8320, 3.5 GHz, 8 Cores
- RAM: 16 GB DDR3
- Graphic: Ati 6670, 128 bit

The premixed flow combustion in a conical chamber using a finite-rate chemistry model

The purpose of this experiment is to simulate premixed combustion of methane and air in a conical reactor. A nozzle is embedded in the center of the conical combustion chamber that the dilute methane-air mixture of enters to it at speed of 60 m/s and a temperature of 650 K. The combustion is a combination of several complex reactions between CH4, O2, CO2, CO, H2O, and N2. The high-velocity flow exits from the coaxial outlet after reversing the direction in the combustion chamber.

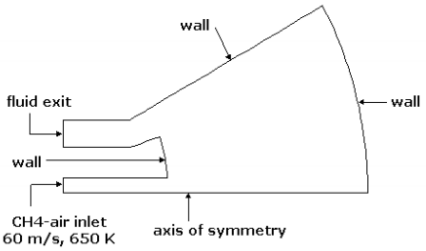

Figure 1: The schematic of model

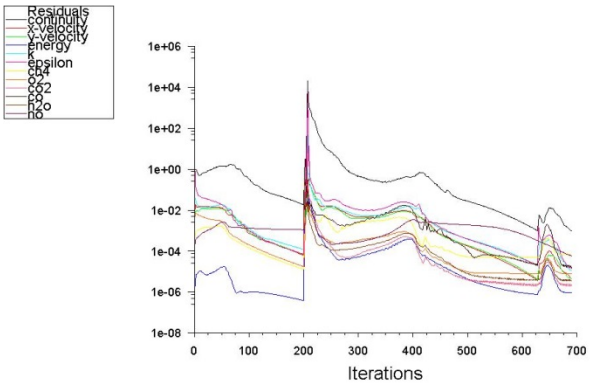

Figure 2: Data Analysis Results with ANSYS Fluent

Runtime in three operating systems (2D):

Table 1: Measurement of runtime

operating systems	Serial	Parallel (8 cores)
Windows 7 64bit	1/856 sec	0/739 sec
CentOS 7.4 64bit	2/917 sec	0/600 sec

As can be seen, Windows 7 has a better performance than CentOS in the serial mode, but, in the parallel mode, CentOS performs better than Windows 7. (It should be noted that Only CPU cores have been used in the parallel mode).

The simulation of multiple coal reactions in Ansys Fluent

In this section, the combustion system is a two-dimensional duct. The inlet of the two-dimensional duct is divided into two flows. One is a high-speed flow from the duct center at a speed of 50 m/s and a slot of 0.125 m and the speed and slot of second flow are 15 m/s and 0.375 m, respectively. The temperature of both flows is 1500 K. Also, the coal particles enter the furnace from near the center with a flow rate of 0.1 kg/s. The wall temperature of the duct is constant and equal to 1200 K. The flow is also turbulent.

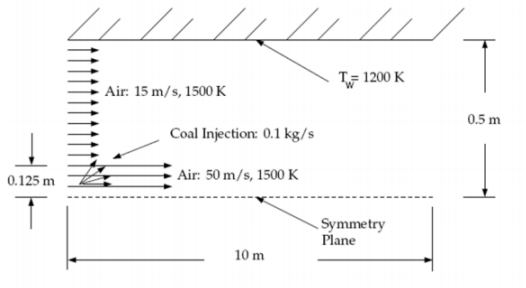

Figure 3: Schematic of the problem

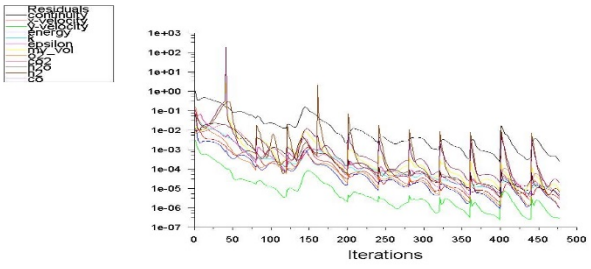

Figure 4: Data Analysis Results with ANSYS Fluent

Runtime in two operating systems (2D):

Table 2: Measurement of runtime

Operating system	Serial	Parallel
Windows 7 64bit	9/126 sec	Total wall-clock time = 9/971 sec Total dpm solve time = 9/496 sec
CentOS 7.4 64bit	14/217 sec	Total wall-clock time = 2/744 sec Total dpm solve time = 2/203 sec

As shown in the above table, Windows 7 has a better performance than CentOS in serial mode; but, CentOS has an extraordinary performance than Windows 7 in parallel mode.

The optimization of airfoil NACA0012 and ANSYS Adjoint Solver

In this section, the basis of the ANSYS Adjoint Solver has been reviewed. This method is used to optimize the airfoil NACA 0012. The problem is modeled as a steady model and the flow is considered incompressible.

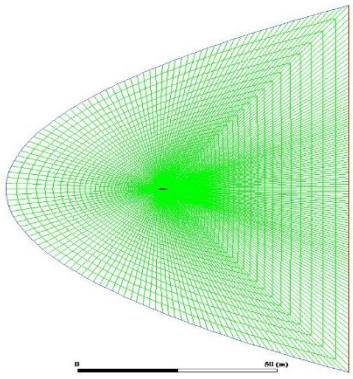

Figure 5: modeling

Runtime in three operating systems (2D):

Table 3: Measurement of runtime

operating system	Serial	Parallel
Windows 7 64bit	95/675 sec	25/940 sec
CentOS 7.4 64bit	108/603 sec	12/097 sec

According to these observations, like previous comparisons, Windows 7 has better performance than CentOS in serial mode. But, CentOS exhibited its high performance in the parallel mode.

The simulation of flow and heat transfer in mix knee with Ansys Fluent

Here, the cool fluid enters through the big inlet at 20 °C and is mixed with warmer fluid which enters the knee from the smaller inlet. The modeled flow is turbulent. Since the geometry of mix knee is symmetrical, only half the knee is needed to simulate.

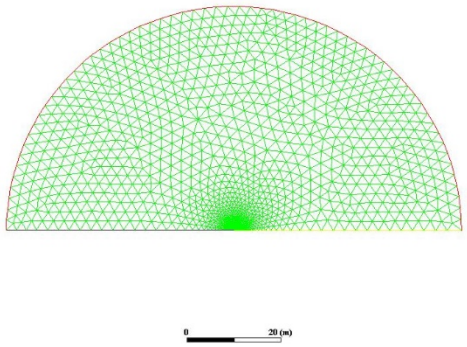

Figure 6: meshing of model

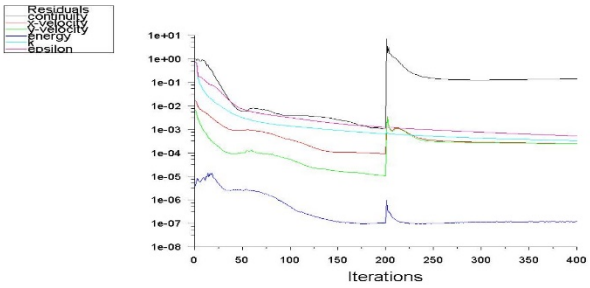

Figure 7: Data Analysis Results with ANSYS Fluent

Runtime in two operating systems (2D):

Table 4: Measurement of runtime

operating system	Serial	Parallel
Windows 7 64bit	463/261sec	124/214 sec
CentOS 7.4 64bit	337/567 sec	54/705 sec

It can be seen from the table that CentOS represents extraordinary performance compared to Windows 7 in serial and parallel modes. In the other words, as the processing volume of files increases in windows 7, the performance speed of the system decreases.

4. Conclusion

Today, the selection of the best computer hardware and the operating system is more important for the heavy processing tasks such as ANSYS and etc. in the various industries due to heavy projects which require heavy software processing. Such that the runtime of the processing projects can be reduced by choosing the proper hardware and operating system that this will increase the efficiency. One of the most important discussions is the selection of the operating system. Today, there are several operating systems such as Windows, Linux, and etc. each of which has the different applications.

The purpose of this research is to find the best operating system that has the most performance in executing ANSYS software. Therefore, Windows and Linux operating systems were considered for this research that Windows 7 was selected from the Windows operating system and CentOS 7 was chosen from the Linux operating system. The reason for this choice is that these two operating systems were the best of all. These two operating systems were installed on a system with the same specifications. Then, the ANSYS software was installed on them and four files were tested on them by ANSYS Fluent. The obtained results show Linux CentOS has extraordinary performance in parallel mode, and in serial mode, as the file gets heavier, it shows good performance. It is recommended to use the GPU core for improving the performance of running ANSYS files on the CentOS Linux operating system. Also, multiple computers can be parallelized together by powerful CentOS operating system. This will increase the performance of the operating system in the implementation of the ANSYS software.

5. References

[1] Jonathan DePrizio, "5 Things New Linux Converts Should Know", 2005.

[2] "Swap Faq". Community Ubuntu Documentation. help.ubuntu.com. 26 November 2010. https://help.ubuntu.com/community/SwapFaq. Retrieved 20 February 2011..

[3] Hu renxi, Wang qingwu, etc, ANSYS 8.2 mechanical design advanced application examples [M]. Beijing: Machinery Industry press, 2005.

[4] ANSYS, Inc. ANSYS FLUENT 12.0 Theory Guide, January 2016.

[5] ANSYS, Inc. ANSYS FLUENT 12.0 UDF Manual, November 2011.

[6] ANSYS, Inc. ANSYS FLUENT 12.0 User's Guide, November 2011.

[7] Al-Rayes, “Studying Main Differences Between Linux &Windows Operating Systems,” International Journal of Electrical & Computer Sciences IJECS-IJENS Vol:12 No:04, 2012 .

[8] J. West, and J. Dedrick, “Proprietary vs. Open Standards in the Network Era:An Examination of the Linux Phenomenon," Proceedings of the 34th Hawaii International Conference on System Sciences - 2001.

[9] N. Economides, and E. Katsamakas, “Linux vs. Windows: A Comparison of Application and Platform Innovation Incentives for Open Source and Proprietary Software Platforms,” The Economics of Open Source Software Development Jiirgen Bitzer and Philipp J. H. Srhroder (Editurs), 2006 Published by Elsevier B.V.

[10] K. Salah, and A. Kahtani, “Performance evaluation comparison of Snort NIDS under Linux and Windows Server,” Journal of Network and Computer Applications journal homepage: www.elsevier.com/locate/jnca, 2010.