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iolo Labs Research Study

# The Impact of Time/Usage and PC Tune-Up Software on Selected PC Performance Factors

# INTRODUCTION

## Background

Users have long reported that their PC's performance declines over time and with use, steadily becoming slower and unstable[1] [2]. The causes of these problems and slowdowns appear to be wide-ranging– settings become obsolete as applications and devices are installed and uninstalled, unneeded commands run every time the computer is started, and unnecessary files are left behind from internet and computing activities.

Tune-up software was designed to reverse these types of degradations in computer performance. A PC tune-up can entail different repairs and optimizations, but it typically includes diagnosing and fixing errors, cleaning out unneeded files, eliminating corrupted or obsolete settings, and adapting system configurations to enhance speed and stability.

## Purpose of study

This study was designed to measure whether certain indicators of PC performance worsen over time and to quantify the impact a tune-up has on such performance degradation.

Specifically, the study is designed to:

- Quantify changes over time by observing selected performance factors for machines starting from a brand-new PC to one that is two years old, which has been reported as the average age that computers are discarded. [3]
- Quantify the impact of a tune-up by comparing selected performance factors for machines that have not undergone a tune-up to machines that have undergone a tune-up.

# METHODOLOGY AND PROCEDURES

## Testing environment

For testing, simulations were developed based on observation of real PCs obtained from real users. Both physical machines and PC snapshots were obtained to develop computer models of the average state of PCs at specific ages (or "machine states"), ranging from a new machine to one that is twenty-four months old. The study defines each of the machine states as follows:

| | |
|---|---|
| 0 month | A PC that simulates the typical state of a computer that is either brand-new or recently had its operating system installed. |
| 3 month | A PC that simulates the typical state of a computer that has been used for three months. |
| 6 month | A PC that simulates the typical state of a computer that has been used for six months. |
| 24 month | A PC that simulates the typical state of a computer that has been used for twenty-four months. |

All the simulations were:

- Created and tested using commercial virtualization software.
- Based on the machine class "Home Office." At the time of testing, a "Home Office" class was defined with the following configurations: 32-bit Windows XP operating system, 2 GHz CPU, and 1 GB RAM.
- Installed with the latest version of a 3rd party internet security product.
- Verified to be free of parasites, such as viruses, adware, spyware, and other malicious software.

## Tune-up methodology

This study tests selected performance factors for an un-tuned PC (one that has not undergone a tune-up) and a tuned PC (one that has undergone a tune-up).

In general terms, a tune-up is a software-based process designed to reverse the degradation of PC performance. A tune-up can entail different repairs and optimizations, but it typically includes fixing errors, cleaning out unneeded files, eliminating obsolete settings, and adapting system settings to improve speed and stability.

For the purposes of this study, the tune-up software used for testing was iolo System Mechanic v 8.5.6. The following tools in System Mechanic were run:

- Defragment Memory
- Repair Registry Problems
- Defragment Hard Drive
- Optimize Windows Startup

- Defragment and Compact Registry
- Remove Junk Files

After running the tools, the machines were restarted.

## Performance factors

Experimenters observed and measured the following:

| Factor | Reason for testing | Measurement |
|---|---|---|
| **Windows startup time** | Many users have reported frustration with computers that take a long time to start. Startup time is a key component of user perception of PC performance. | Measured from when the PC is powered on to when the CPU reaches its minimum average idle state (until the average deviation in CPU usage percentage has stabilized). |
| **CPU idle usage** | During idle time, a PC may occasionally run desired actions, such as a virus scan, but a consistently high CPU idle usage percentage indicates an excessive number of background processes are running at all times while the computer is on. | Reported by Windows Task Manager's CPU Usage monitor. |
| **Memory availability** | A higher amount of physical memory means more space is available for high-performance temporary data storage. When there is a shortage of this memory, programs do not have enough memory to function at optimal speeds. | Reported by Windows Task Manager's data on Physical Memory Usage. |
| **Amount of system clutter** | Temporary files and file remnants left behind after sudden shutdowns or program-related errors can accumulate and unnecessarily consume memory and drive space. | Amount of drive space taken up by unnecessary files as defined and reported by iolo System Mechanic version 8.5.6. |

# Results and Discussion

## Windows startup time

Windows startup time is the length of time it takes for a PC to completely start the operating system and finish loading any programs associated with initial startup. Startup time was measured from when the PC is powered on to when the CPU reaches its minimum average idle state. iolo Labs uses a internally developed tools for monitoring CPU usage as the PC starts and capturing when this usage percentage has reached a stable average level.

REASON FOR TESTING: Many users have reported frustration with computers that take a long time to start. Startup time is a key component of user perception of PC performance.

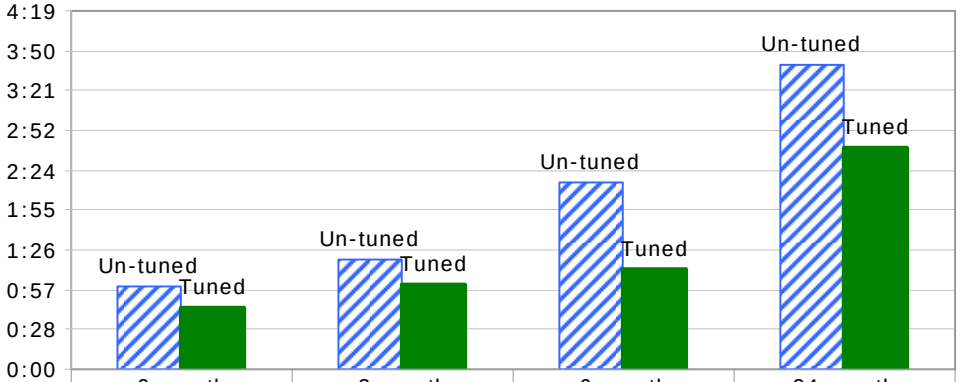
**RESULTS: Un-tuned PC**

0 month: 1:00 minute
3 month: 1:20 minutes
6 month: 2:15 minutes
24 month: 3:40 minutes

**RESULTS: Tuned PC**

0 month: 0:45 seconds
3 month: 1:02 minutes
6 month: 1:13 minutes
24 month: 2:40 minutes

IMPACT OF TIME: *Figure 1* illustrates the increases in startup time, both before and after a tune-up. Without a tune-up, a 2-year period saw an increase from one minute to 3 minutes, 40 seconds – a 267% increase. For a tuned PC, startup times increased at roughly the same factor – 256% – but at two years, the tuned PC was 27% faster than the un-tuned PC.




| | 0 month | 3 month | 6 month | 24 month |
|---|---|---|---|---|
| Un-tuned | 1:00 | 1:20 | 2:15 | 3:40 |
| Tuned | 0:45 | 1:02 | 1:13 | 2:40 |
| Improvement | 25% | 23% | 46% | 27% |

**Figure 1: Windows startup time before and after a tune-up**

IMPACT OF TUNE-UP: Averaged across the tested machine states, a tune-up resulted in a startup time that was 30% faster. Also of note is that even for a new (0-month) machine, startup time improved with a tune-up: one minute compared to 45 seconds—a 25% reduction in time.

OTHER OBSERVATIONS: As part of the incremental machine state simulations, additional software was seen at each greater age to reflect a common level of user-desired programs that have been added to the PC. These user-desired programs appear to significantly add to startup time, suggesting a strong general correlation between amounts of installed software and rising startup times.

## CPU idle usage

CPU usage is the amount of time the CPU spends processing user applications and high-level Windows functions. CPU idle usage is the percentage of CPU usage that occurs when a computer is idle (on but not being used by a person).

REASON FOR TESTING: A consistently high CPU idle usage percentage indicates that an excessive number of background processes are running and using system resources.

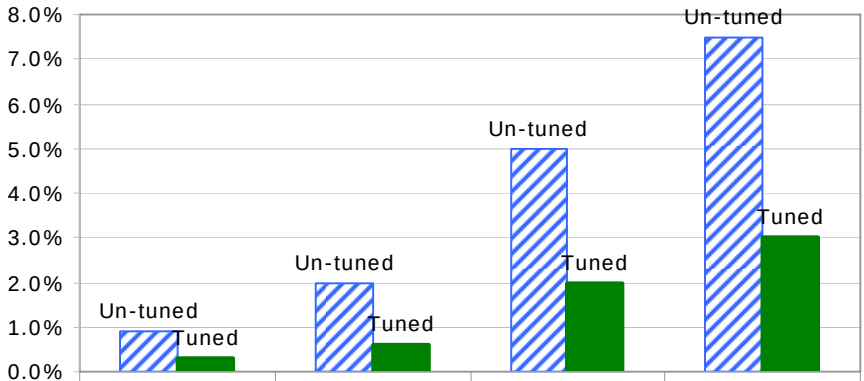
**RESULTS: Un-tuned PC**

0 month: 0.9%
3 month: 2.0%
6 month: 5.0%
24 month: 7.5%

**RESULTS: Tuned PC**

0 month: 0.3%
3 month: 0.6%
6 month: 2.0%
24 month: 3.0%

IMPACT OF TIME: *Figure 2* illustrates the rise in CPU usage when the PC is idle; both the tuned and un-tuned machine saws increases. Over a 24-month period without a tune-up, this utilization increases from 0.9% to 7.5%; a tuned machine increases from 0.3% to 3.0%.




| | 0 month | 3 month | 6 month | 24 month |
|---|---|---|---|---|
| Un-tuned | 0.9% | 2.0% | 5.0% | 7.5% |
| Tuned | 0.3% | 0.6% | 2.0% | 3.0% |
| Improvement | 67% | 70% | 60% | 60% |

**Figure 2: CPU Idle Usage before and after a tune-up**

IMPACT OF TUNE-UP: At all the tested machine ages, the CPU idle usage for an tuned PC is less than half of the usage for an un-tuned PC. Averaged across the periods, a tune-up resulted in a significant 64% reduction in CPU idle usage.

OTHER OBSERVATIONS: Similar to observations from the Windows startup time tests, the results of these tests suggest an incremental rise in CPU idle usage as more user-desired programs are installed, some of which remain resident in memory at all times consuming background CPU resources.

## Memory availability

Memory availability is the percentage amount of random access memory (RAM) a PC has available. RAM is the working memory where data is temporarily stored for various processes. Note that virtual memory and disk-based page files are specifically excluded from this measurement.

REASON FOR TESTING: A higher amount of physical memory means more space is available for high-performance temporary data storage. When there is a shortage of this memory, programs do not have enough memory to function at optimal speeds.

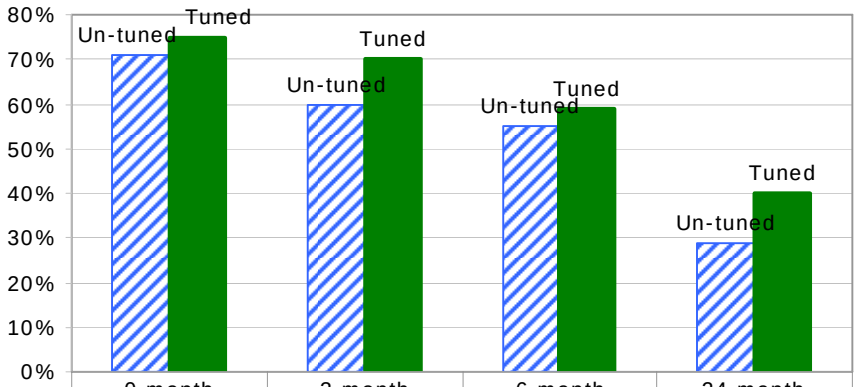
**RESULTS: Un-tuned PC**

0 month: 71% (727 MB)
3 month: 60% (614 MB)
6 month: 55% (563 MB)
24 month: 29% (296 MB)

**RESULTS: Tuned PC**

0 month: 75% (768 MB)
3 month: 70% (716 MB)
6 month: 59% (604 MB)
24 month: 40% (409 MB)

IMPACT OF TIME: *Figure 3* illustrates the decreases in memory availability over time. Over the 24-month period for the un-tuned machine, available memory saw an average decline of 59%, with only 29% available at the end of the time period. The decreases for the tuned machine were less dramatic, with an average decline of 43%, and 40% available after two years.




| | 0 month | 3 month | 6 month | 24 month |
|---|---|---|---|---|
| Un-tuned | 71% | 60% | 55% | 29% |
| Tuned | 75% | 70% | 59% | 40% |
| Improvement | 6% | 17% | 7% | 38% |

**Figure 3: Memory availability before and after a tune-up**

IMPACT OF TUNE-UP: Comparing un-tuned to tuned, the amount of available memory increasingly worsened over time. At the zero-state, the amount of memory available was similar, but significant differences were seen at the 24-month period: the tuned machine has 38% more memory than the un-

tuned machine. Averaged across the periods, a tune-up resulted in 17% more memory available.

OTHER OBSERVATIONS: Similar to observations from the Windows startup time tests, the results of these tests suggest an incremental decrease in memory availability as more user-desired programs are installed.

## System clutter

System clutter refers to the temporary files and file remnants left behind after sudden shutdowns or program-related errors.

REASON FOR TESTING: These unnecessary files can accumulate and consume drive space and memory. Instead of focusing on needed processing, Windows is using resources to process useless items.

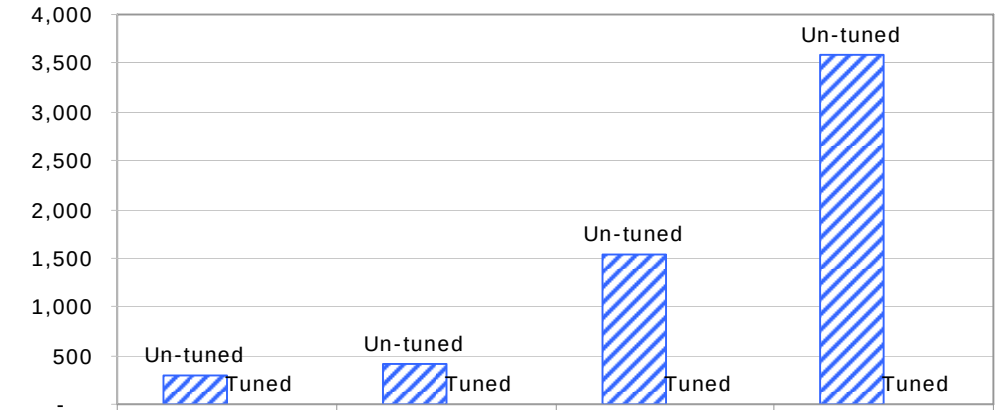
**RESULTS: Un-tuned PC**

0 month: 300 MB
3 month: 417 MB
6 month: 1.5 GB (1536 MB)
24 month: 3.5 GB (3584 MB)

**RESULTS: Tuned PC**

0 month: 0 MB
3 month: 0 MB
6 month: 0 MB
24 month: 0 MB

IMPACT OF TIME: *Figure 4* illustrates the increase in system clutter over time. Without a tune-up, the amount of clutter rapidly increased. After two years of no tune-ups, a significant 1,095% increase in the amount of clutter was seen.




| | 0 month | 3 month | 6 month | 24 month |
|---|---|---|---|---|
| Un-tuned | 300 | 417 | 1,536 | 3,584 |
| Tuned | 0 | 0 | 0 | 0 |

**Figure 4: Clutter (in MB) before and after a tune-up**

IMPACT OF TUNE-UP: With tune-ups, the levels of clutter for all machines states was kept to zero.

# Conclusion and Discussion

## Impact of time/usage

The study found that over a two-year period:

- Un-tuned machines reflected a Windows startup time that increased from 1:00 at zero months to 3:40 at 24 months, while tuned machines increased from 0:45 to 2:40 during the same time period.
- Un-tuned machines reflected a CPU idle usage that increased from 0.9% at zero months to 7.5% at 24 months, while tuned machines increased from 0.3% to 3.0% during the same time period.
- Un-tuned machines reflected a memory availability that decreased from 71% at zero months to 29% at 24 months, while tuned machines decreased from 75% to 40% during the same time period.
- For the un-tuned machine, system clutter increased by a factor of 10 (a 1,095% increase); the amount of clutter on the tuned machine was kept to zero.

## Impact of tune-up

The study found that over a two-year period, un-tuned machines exhibited significantly higher rates of performance degradation when compared to tuned-machines:

- A PC tune-up resulted in a Windows startup time that was 30% faster on average.
  - At zero months, a tuned PC started Windows 25% faster than an un-tuned PC
  - At 24 months a tuned PC started Windows 37.5% faster than an un-tuned PC.
- A PC tune-up resulted in 64% less CPU idle usage on average.
  - At zero months, a tuned PC exhibited 66% less CPU idle usage than an un-tuned PC.
  - At 24 months a tuned PC exhibited 60% less CPU idle usage than an un-tuned PC.
- A PC tune-up resulted in 15% more memory availability on average.
  - At zero months, a tuned PC had 5.6% more available memory than an un-tuned PC.
  - At 24 months, a tuned PC had 37.9% more available memory than an un-tuned PC.
- A PC tune-up keep clutter at zero, while an un-tuned PC had an average of 1.45 GB.
  - At zero months, a tuned PC had no clutter, while an un-tuned PC had 300 MB.
  - At 24 months, a tuned PC had no clutter, while an un-tuned PC had 3.5 GB.

## Discussion

The study confirms that various indicators of PC performance do degrade over time and with use. Significant degradations were found for all of the tested performance factors. The study also confirms that PC tune-ups are effective in reversing this performance degradation. The most notable changes were found in the areas of system clutter and CPU idle usage; both saw marked improvements. The next most dramatic improvements were seen in the reduction of Windows startup time. Finally, the increase in available memory also resulted in measurable improvements.

The study's machine state simulations (which are based on real usage samples) replicate the increasing number of programs and files that are installed on typical machines the longer they are used. While regular tune-ups clearly reduced the effects of performance degradation, it was observed during simulations that the natural succession of programs intentionally installed and operated by the user ("natural machine load") represented an ordinary and expected consumption of resources, which correlated to a similarly anticipated reduction in available performance as indicated by several of the tests.

The implication of natural machine load is that along with regular PC tune-ups, certain user-driven behavior can impact performance. Based on these simulations and the results of this study, significant additional performance improvements may be achieved by regularly reviewing the programs stored on PCs and removing those that are no longer used or needed.

# FURTHER RESEARCH

This study presents initial findings related to the degradation of performance over time and the impact of PC tune-up software. Further testing will:

- Identify additional measures for quantifying performance.
- Test the impact of other tools in iolo System Mechanic.
- Test and compare the impact of iolo System Mechanic with other tune-up software.
- Examine additional performance factors.
- Include testing based on other machine classes and machine states.

## REFERENCES

[1] Livingston, Brian. 1999, June 14. "Prepare your PC for faster performance and more reliability under Windows." *InfoWorld*. 21, no. 24: 48.

[2] Scottberg, Erin. 2009, March. "Make Your PC Boot Faster." *Popular Mechanics* 186.3, p. 105-107.

[3] Greenpeace. *The e-waste problem*. Retrieved from http://www.greenpeace.org/international/campaigns/toxics/electronics/the-e-waste-problem