Media Recorder: How Power Saving Technology affects Video Recording

By Olga Krips, Viktor Kovács and Niek Wilmink

Computer power saving technology is developed to lower energy use and extend processor life. However, these power saving options can interfere with video recording software. This paper explains why accurate video recording is essential if you work with Noldus software, how power saving technology can interfere and how you can solve this problem.

The Media Recorder can create MPEG-4 or H.264 files from many different input sources. The files can subsequently be used in the Noldus software programs The Observer XT, EthoVision XT and FaceReader. These programs can calculate very accurate statistics like walking speed of the test subjects, or durations of certain behaviors. However, for this purpose, it is necessary that the time information in the video files created by the Media Recorder is absolutely correct. If some frames are "dropped" by the Media Recorder, the video length is shorter than it should be (see Figure 1). Subsequent use of such a video in, for example, EthoVision, The Observer XT, or FaceReader results in incorrect calculation of durations, speeds and other statistics.
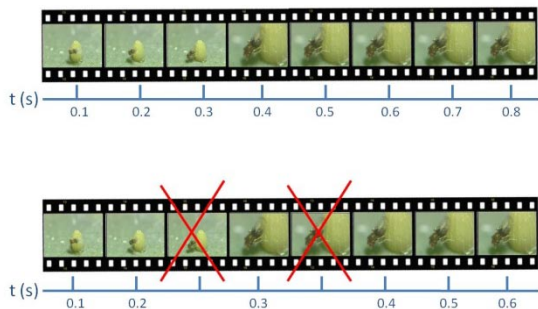

Figure 1. Top picture: correct video file. Bottom picture: two frames are dropped which results in an incorrect video length.

Power saving technology

When a computer processor runs at normal capacity, it uses a significant amount of energy. When the same processor runs at a lower frequency (speed), or voltage, it generates less heat and consumes less power. This can conserve battery power in notebooks, extend processor life, and reduce noise generated by variable-speed fans. Therefore, power saving technology has been introduced for desktop computers and laptops.

How does it work?

To reduce processor power consumption, these technologies permit the processor to run at reduced voltages and clock frequencies. These processor states are also referred to as performance states or C-states.

What are the power saving options called?

Different processors have different power saving options.

Intel processors

SpeedStep (Laptop)

C-States Control and SpeedStep (Desktop)

Via processors

PowerSaver

AMD processors

PowerNow! and Cool'n'Quiet

Power saving technology and video files

Power saving technology unfortunately has a significant drawback when recording or playing back video files. When the processor performance state changes, access to system memory is temporarily blocked. As a result, streaming devices dependent on accessing memory may be starved of data. This results in glitches or drop-outs in recording or playback. Additionally, running a processor in a low-performance mode may not provide enough processing power to properly render a video stream.

Figure 2 and 3 explain this problem in more detail.

What is often believed to happen: The Waterfall model

Figure 2 shows the waterfall model. People often think power saving technology works according

to this model. If a computer is idle for a certain period of time, the C-State of the computer makes a transition into a higher power saving level (from C0 to C1, from C1 to C2 etc). During every transition, access to the system memory is blocked. If the video recording program tries to access the memory during a transition, a frame will not be recorded. In the example of Figure 2, there are four transitions in C-State. Imagine the worst case scenario in which the recording program drops a frame at every transition. In this case the video file would miss four frames. At a frame rate of 30 frames per second, this results in a video file that is 0.13 seconds shorter than it actually should be. It is of course unlikely that a frame is dropped at every transition, but the example explains the problem that can be caused by transitions in C-State.
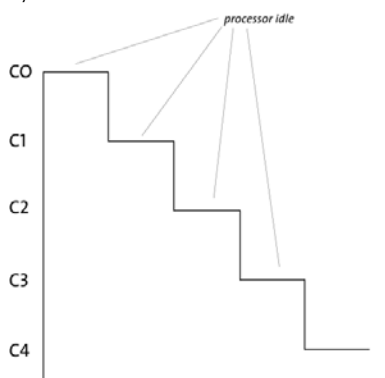

Figure 2. The waterfall model. Every time the processor is idle for a certain time, the C-State changes into a higher power saving level.

What actually happens

However, in reality a C-state is not a static situation. During a certain C-State, the computer continuously oscillates between the high-performance level and the higher power-saving level (see Figure 3). There can be hundreds, or even thousands oscillations per second. And for every oscillation,
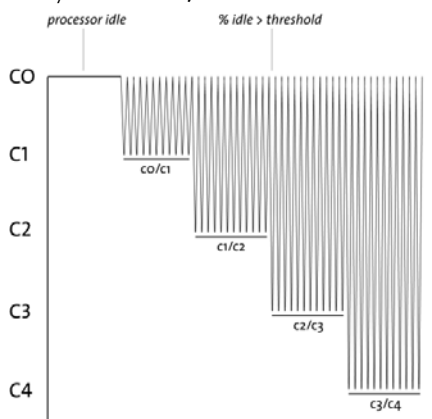

Figure 3. What actually happens during a C-State higher than C0. The computer continuously oscillates between C0 and the higher C-State.

access to the memory of the computer is temporarily blocked. Therefore, the chance that frames are dropped is hundreds or even thousands times higher than in the example described in the Waterfall model. Hence, the number of dropped frames will be much higher and the video file will be much shorter than it actually should be.

How to solve this?

For correct creation of video files with the Media Recorder and EthoVision XT power saving options should be switched off. This can only be done in the BIOS of the computer. When you ordered a computer from Noldus IT, you either received a Dell Precision™ T3500 workstation or a Dell Precision™ M4500 Laptop or a successor. The power saving options are already correct when Noldus IT delivered the computer. If you purchased one of these computers yourself, go to the BIOS by pressing the **F2** key during startup of your computer.

- **Dell Precision™ T3500 workstation**

    Click **Performance** and subsequently click **C-States Control**. Deselect the checkbox in front of **C-States Control** in the right-upper part of your screen. By default the power saving option **SpeedStep** is disabled. Check whether this is the case. Exit the BIOS and click **Yes** when the **question Do you want to save changes?** shows up.

- **Dell Precision™ M4500 Laptop**

    Click Performance and subsequently click **SpeedStep**. Deselect the checkbox in front of **SpeedStep** in the right-upper part of your screen. Exit the BIOS and click **Yes** when the question **Do you want to save changes?** shows up.

For other processors, disable **PowerNow!** and **Cool'n'Quiet** (AMD processors), or **PowerSaver** (VIA processors) in the BIOS. We recommend the use of the Dell Precision™ workstations with the Media Recorder. The Media Recorder has been tested with and optimized for Intel processors used in these workstations.

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Reference
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