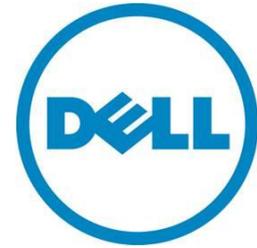

Dell Precision Optimizer



Technical White paper

A software application to maximize workstation performance.

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Overview

The Dell Precision Optimizer is designed to help increase productivity by dynamically configuring a system, keeping the software up to date, and providing an easy-to-use tool which can track resources and their usage over a period of time. Optimization of system performance is essential to any organization dealing with growing application needs and limited resources. Workstation users have specific needs for their workflows that demand maximum performance and reliability so they can remain focused on being creative. However, on any workstation, certain sub-systems may be over-utilized or under-utilized based on the activities being performed.

This scenario typically results in loss of user productivity due to decreased system performance, software maintenance downtimes, and possible lack of system stability. Even if experienced users were ready to fine-tune the system configuration for optimized performance, they face difficulties due to the complexity and number of tools they need to gather the data they require in order to make an informed decision. Further, doing it manually takes time and reduces productivity.

Let us say that the average user loses 15 minutes each day due to an un-optimized system. This causes a loss of more than 60 man-hours of productivity each year (assuming a 5 day work-week and 2 weeks of vacation time). For an enterprise, this loss of productivity is multiplied by the number of employees who are using such un-optimized systems.

It is crucial that the organization has easy-to-use tools that could monitor system resources, track workload characteristics, and help identify problem areas. It would be further helpful if the tools could automatically keep the system software up-to-date and dynamically determine and apply a more optimal configuration of the system components whenever possible.

Dell has addressed the above problems faced by their users with Dell Precision Optimizer software. Dell Precision Optimizer promises to maximize your application's potential by tuning system parameters to an application's unique workload characteristics. For example, assume a user is running a specialized CAD application. Dell Precision Optimizer would determine that the CPU is being run at maximum utilization and the graphics settings are not optimal for this application. In this case, Dell Precision Optimizer would then apply a policy that will ensure that the CPU is in maximum multithreading mode and adjust graphics controller's settings.

This whitepaper describes the features, architecture, and benefits of Dell Precision Optimizer software.

Background

Maximizing system performance requires detailed analysis of resource usage and fine-tuning of system parameters taking into account workload characteristics. Users can maximize their system performance by manually fine-tuning these parameters. However, this is an extremely difficult task because what needs to be tuned is not readily apparent. Users have to dig deep to collect detailed information, figure out which parameters need to be configured and how. This information is not always easily available to their users.

System Administrators struggle to get deep system reports that allow them to study how the hardware is being used. Tools that exist today are difficult and cumbersome to use. Further, critical information such as thermal data, battery health report, *etc.* is usually absent or incomplete. Multiple tools have to be used to collect all the relevant data over a period of time and the System Administrator may have to manually analyze it.

This problem is further compounded by the varying application needs. Different workloads require different tuning to maximize performance. Once again, how to identify the needs of a particular workload and tuning the system configuration based on a change in workload is not obvious to the user. Many users use their systems in "less than optimal mode" which may cause them to perceive the product as lacking or inferior.

Solutions that exist today allow users to configure their system but this capability is typically very limited and requires users to manually make the changes. Once made, the changes are static, which means that the user has to choose between selecting a one-size-fits-all configuration based on the general use of the system or manually recognizing and changing the system parameters every time the user switches between different workloads. While on some systems there are tools that allow certain pre-selected system parameters to be changed by the click of a button, even such changes require user awareness and intervention whenever the workloads are switched.

Dell Precision Optimizer

Dell Precision Optimizer is a software application that dynamically and automatically optimizes the system performance based on workload, software application, and end-user preferences. Dell Precision Optimizer monitors system resource utilization and change in workload to automatically reconfigure system parameters for best performance. The architecture of Dell Precision Optimizer allows the setup of different optimization profiles based on the targeted usage of that workstation. Each Dell Precision Optimizer profile defines a specific workload, how to recognize the workload, and the system configuration changes that are required to optimize performance for that workload.

Dell Precision Optimizer pre-defined application profiles can dynamically detect when supported ISV applications are running and optimize the system for each application.

Dell Precision Optimizer profiles free the user from having to learn or discover how and where to make changes to a particular system parameter (*e.g.*, through BIOS setup, Windows tools/APIs, or Graphics Control Panel) by using Dell Precision Optimizer configuration plug-ins. Each configuration plug-in loaded by Dell Precision Optimizer encapsulates performance engineering know-how to tune its parameters. Similarly, Dell Precision Optimizer uses monitoring plug-ins that free the user from having to know how to read and monitor various system parameters such as resource utilization, *etc.*

Further the Dell Precision Optimizer architecture is extensible and permits new profiles to be added allowing newer workloads and optimizations to be included at any time. Newer configuration and monitoring plug-ins can be developed and included with Dell Precision Optimizer as needed in future releases of the application.

In addition to performance optimization, the Dell Precision Optimizer has the following additional features.

- System Health and Maintenance—Framework to ensure the platform has the latest software image (BIOS, Drivers, firmware, ...)
- Track & Analyze—Advanced and preparatory tools to analyze and model system utilization

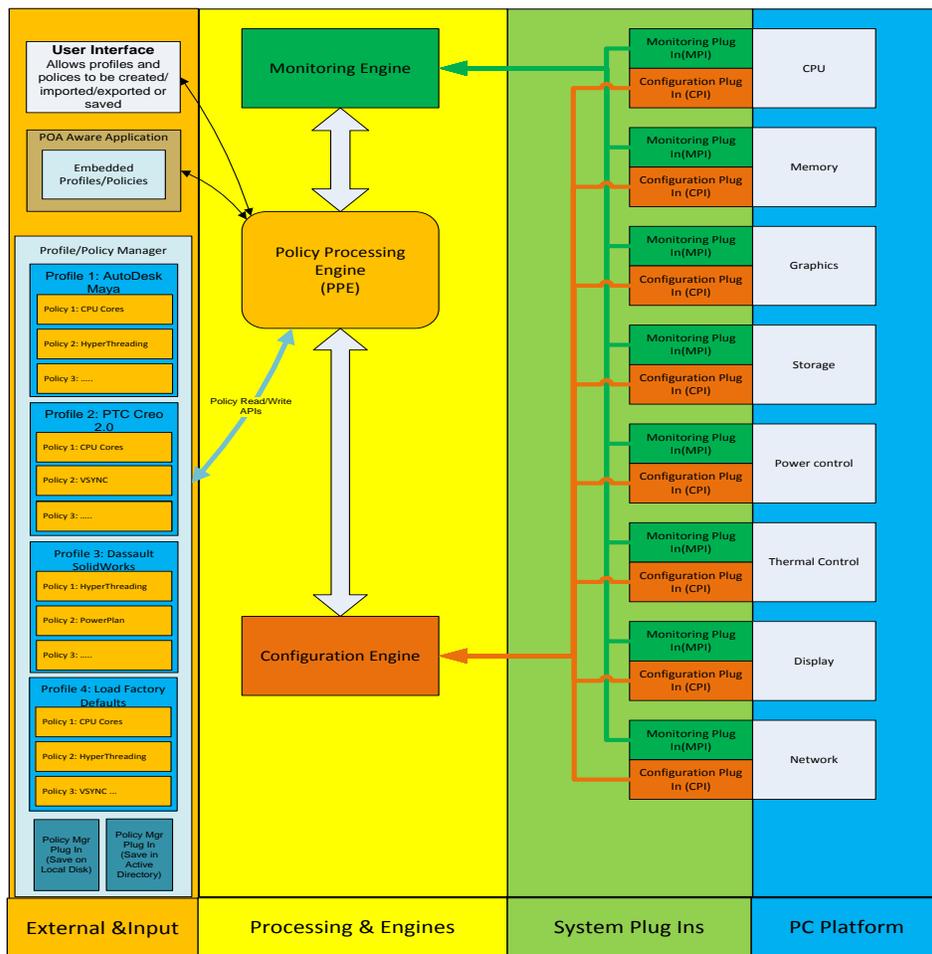
Dell Precision Optimizer Architecture

The Dell Precision Optimizer performance subsystem consists of the following modules:

- Policy Processing Engine (PPE)
- Monitoring Engine (ME)
- Monitoring Plug In(s) (MPI)
- Configuration Engine (CE)
- Configuration Plug In(s) (CPI)
- Profile Manager (PM)

The following diagram shows the architecture of the Performance sub-system in Dell Precision Optimizer:

Figure 1. Application Principal Architecture



Policy Processing Engine (PPE)

Dell Precision Optimizer

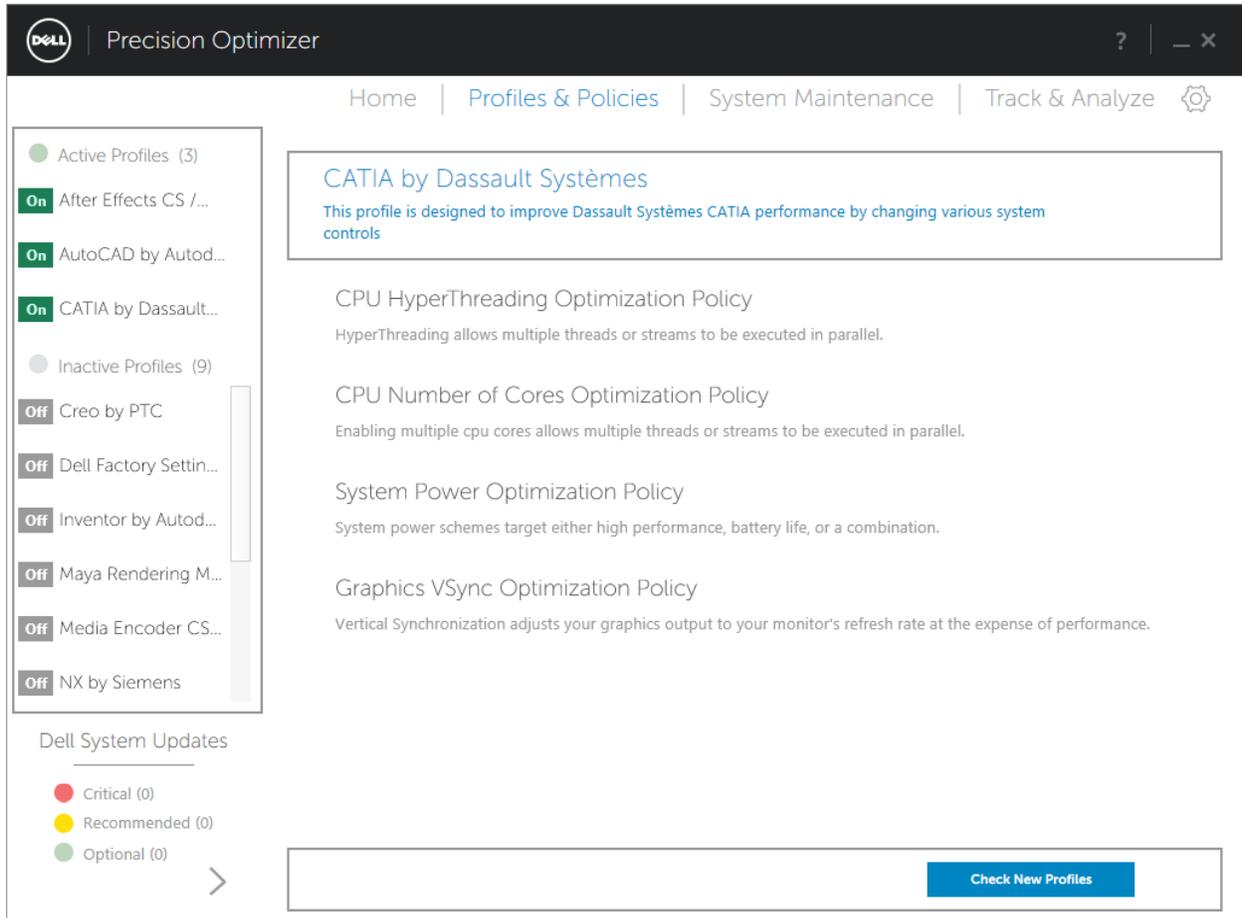
Dell Precision Optimizer optimizes system performance by implementing a Policy Processing Engine (PPE) which performs dynamic configuration of systems based on certain triggers. It can monitor the computer to optimize performance by applying recommended settings thereby enhancing the user's productivity and their ability to meet goals.

PPE is implemented as a Windows Service which starts execution as soon as the machine boots up regardless of whether the user is logged on. It loads the Configuration Engine and Monitoring Engine after validating the digital signature of the files. Finally, it executes the profile(s) saved for that machine and registers as a COM server.

Dell Precision Optimizer uses XML-based profile and policy definitions. PPE uses the interface provided by Profile Manager to save and retrieve XML profiles and XML policies. A policy defines a *trigger condition* and the *actions* that are taken when the policy triggers. Each policy executes in a separate system thread and uses the monitoring engine to monitor the system parameters that make up the *trigger*. When a *trigger condition* is met, the policy thread changes the system configuration as specified in the *action* by calling the configuration engine.

Sets of policies that are grouped together to achieve a common performance objective are called a Profile. ***Profiles & Policies*** are identified by a name. Multiple profiles can be executed in parallel.

Figure 2. Screen shot of Dell Precision Optimizer application performance sub-system



COM Interface and ISV Connectivity

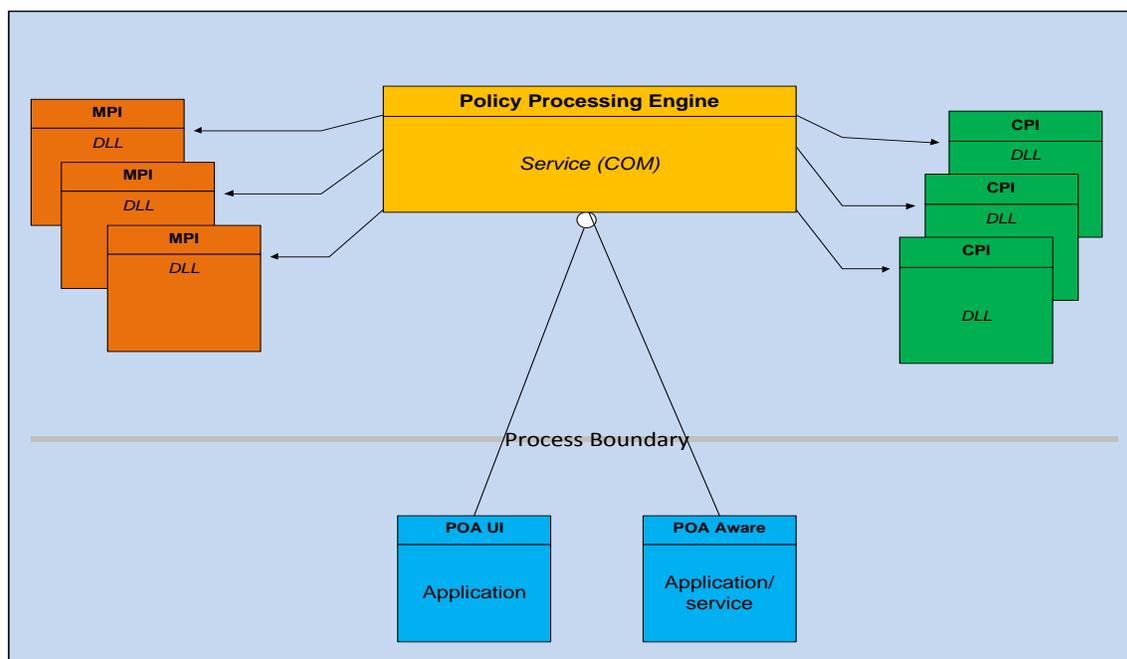
PPE provides a COM interface which can be used to perform the following tasks:

- Activate or de-activate user profiles as users log on or log off.
- Enumerate input and output parameters which can be used to define new policies.
- Save and retrieve profiles and policies for machines, users, or 3rd party Dell Precision Optimizer-aware applications.
- Allow Monitoring Plug-Ins (MPIs) and Configuration Plug-Ins (CPIs) to be installed or uninstalled dynamically after Dell Precision Optimizer has already been installed.

Dell Precision Optimizer has an SDK that can be used by ISVs to define their own profiles and optimize the system performance for specific application needs

An example of this capability is the following: A Computer Aided Design (CAD) application running on a Dell Precision system could be modified by the ISV to support the Dell Precision Optimizer SDK. This ISV application could then inform Dell Precision Optimizer when it is about to do a graphics intensive rendering operation and Dell Precision Optimizer could automatically increase the GPU clock to maximum performance.

Figure 3. PPE Interfaces



Monitoring Engine (ME)

Dell Precision Optimizer Monitoring Engine (ME) is implemented as a digitally signed C++ DLL which exports a set of functions that are invoked by the PPE. ME is responsible for enumerating the Monitoring Plug-Ins (MPIs) currently installed in the system. ME also validates the authenticity of the MPI DLL by validating the digital signature of the DLL file before loading it.

Monitoring Plug-Ins (MPI)

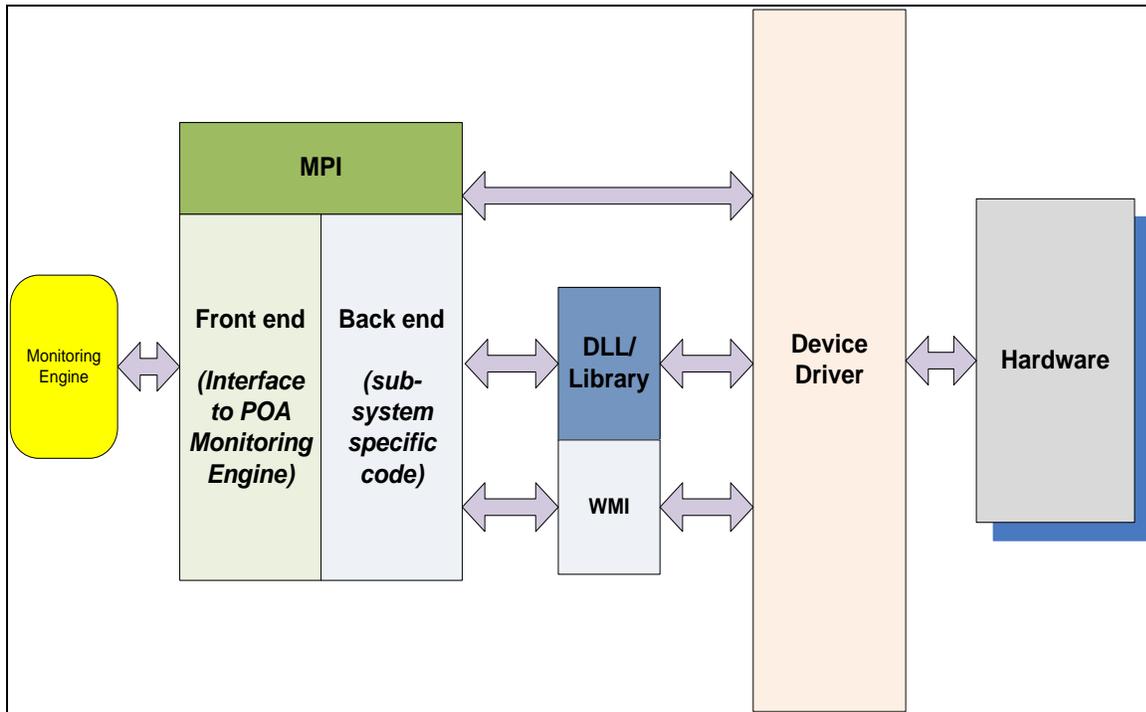
Monitoring Plug-Ins (MPIs) are implemented as digitally signed C++ DLLs which export a set of functions that are used by the Monitoring Engine (ME). Each MPI DLL must be digitally signed to allow ME to validate its publisher.

The Dell Precision Optimizer installer package installs MPIs and associated libraries and device driver (if any). However, it is also possible to install or uninstall additional MPIs in the future.

Each MPI has a unique GUID along with an easily recognizable unique identifier called "*plug-inId*" which can be used to identify the sub-system. Further, the MPIs also assign unique identifiers to each input parameter that they expose. This is called "*paramId*". Any input parameter in the system can then be uniquely referred to using the fully qualified name "*plug-inId.paramId*".

For example, if an MPI named "System" exposes a parameter named "PowerPlan", we can refer to this input parameter as "System.PowerPlan".

Figure 4. Monitoring Engine and MPI subsystem



Configuration Engine (CE)

Dell Precision Optimizer Configuration Engine (CE) is implemented as a digitally signed C++ DLL which exports a set of functions that are invoked by the PPE. CE is responsible for enumerating the Configuration Plug-Ins (CPIs) currently installed in the system. CE also validates the authenticity of the CPI DLL by validating the digital signature of the DLL file before loading it.

Configuration Plug-In(s) (CPI)

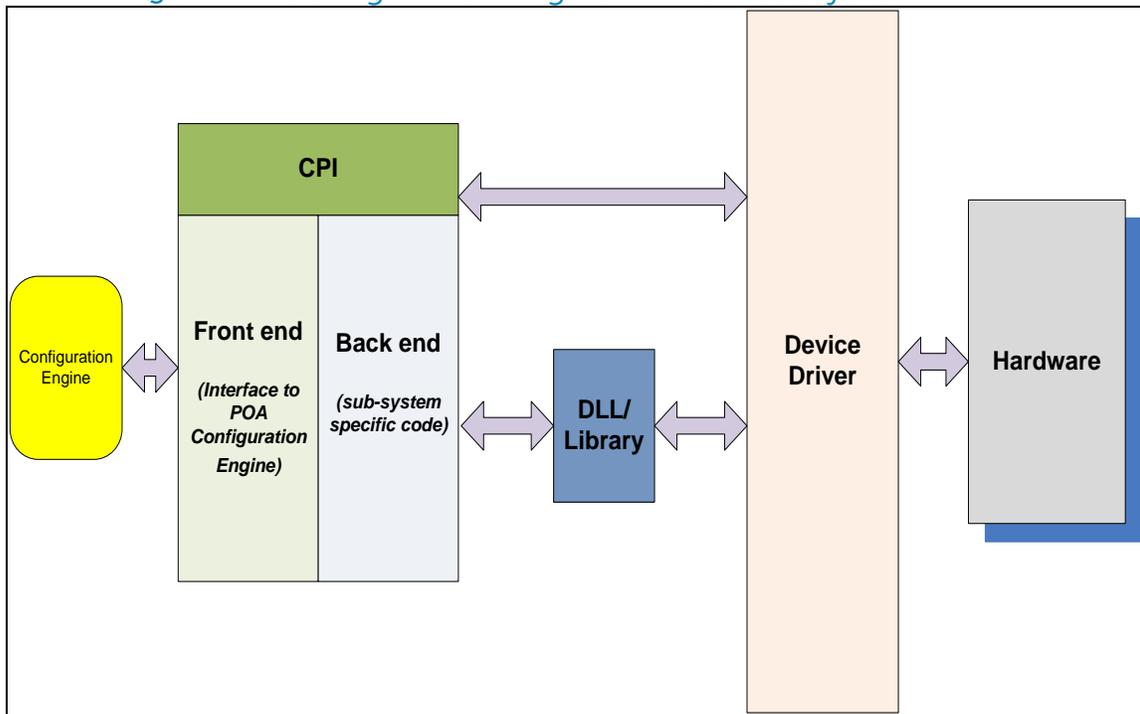
Configuration Plug-Ins (CPIs) are implemented as digitally signed C++ DLLs which export a set of functions that are meant to be used by the Configuration Engine (CE). Each CPI DLL must be digitally signed to allow CE to validate its publisher.

The Dell Precision Optimizer installer package installs CPIs and associated libraries and device drivers (if any). However, it is also possible to install or uninstall additional CPIs in the future.

Each CPI has a unique GUID along with an easily recognizable unique identifier called "*plug-inId*" which can be used by the Dell Precision Optimizer to identify the sub-system. Further, each CPI also assigns a unique identifier to each output parameter that it exposes. This is called "*paramId*". Any output parameter in the system can then be uniquely referred to using the fully qualified name "*plug-inId.paramId*".

For example, if a CPI named "CPU" allows hyper threading to be enabled or disabled, we can refer to this output parameter as "CPU.Hyperthreading".

Figure 5. Configuration Engine and CPI subsystem



Profile Manager

Profile Manager is implemented as a digitally signed C++ DLL which exports a set of functions that are used by PPE. The Profile Manager saves & retrieves profiles and policies from the local hard disk.

Benefits

- **Dynamic Optimization**—responds to changing workloads

Dell Precision Optimizer enables the system to smartly and dynamically adapt to changing workloads. Multiple profiles for different workloads can be active simultaneously freeing the user from the task of monitoring changes in workloads and taking corrective action.

Users do not have to monitor and manually adjust their system parameters to optimize performance every time the workload changes.

- **Automatic Optimization**—no user intervention or know-how needed

All systems ship with some default factory settings which may not provide the best performance under all workloads. Dell Precision Optimizer addresses this problem with the Profile & Policy Engine. Once profiles have been defined and activated in Dell Precision Optimizer, monitoring detailed resource usage and identifying the workload to configure system parameters best suited to the current workload is now automatically taken care of by Dell Precision Optimizer.

Users no longer have to dig deep to manually make configuration changes or collect information that is not readily available to them.

- **Extensible**—allows newer workloads to be optimized

Dell Precision Optimizer's extensible architecture allows newer workloads to be categorized by defining newer profiles as needed. Also, newer configuration and monitoring plug-ins can be installed to allow future or platform-specific sets of parameters to be monitored and/or configured.

- **Performance**—increased application performance due to optimal configuration

See Adobe® Creative Cloud®

Adobe Photoshop® CS/CC

Adobe Premiere® Pro CS/CC

Adobe After Effects® CS/CC

Adobe Media Encoder® CS/CC

Autodesk® 3ds Max®

Autodesk AutoCAD®

Autodesk Inventor®

Autodesk Maya®

Dassault Systèmes SolidWorks®

Dassault Systèmes CATIA®

Dell Precision Factory Default Settings

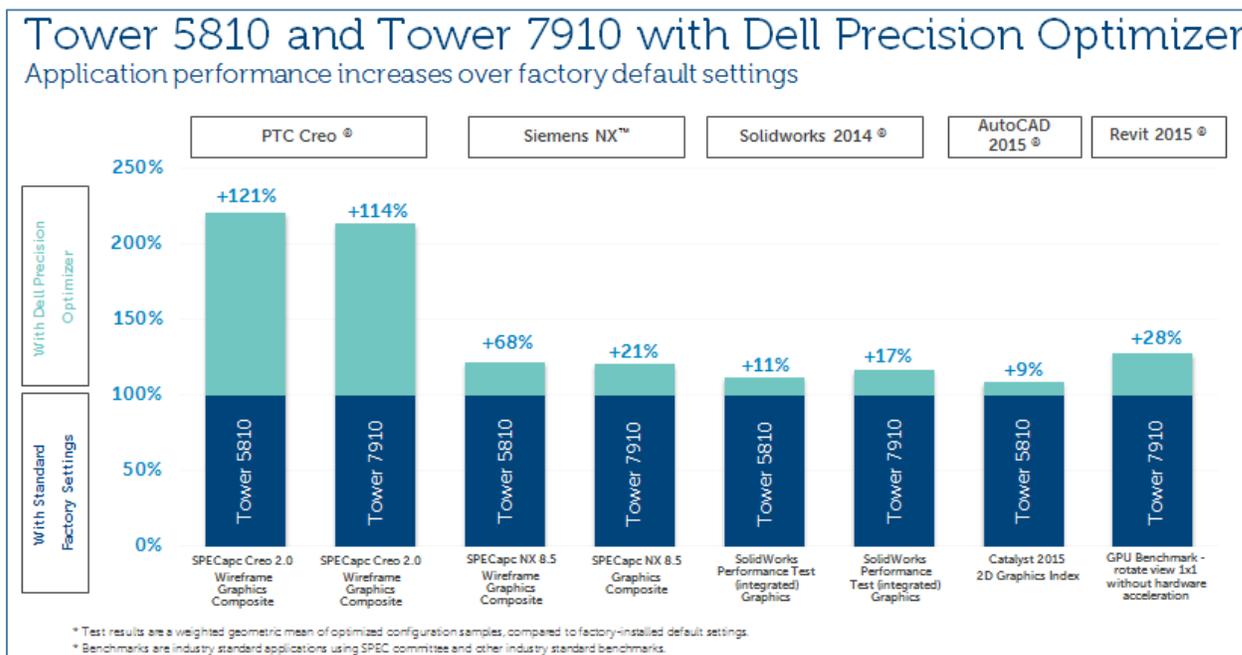
PTC® Creo®

Siemens NX™

Performance Measurements for actual performance improvements (compared to factory default settings on the same system) measured in the lab using Dell Precision Optimizer profiles created for optimizing the following applications.

- Adobe® Creative Cloud®
- Adobe Photoshop® CS/CC
- Adobe Premiere® Pro CS/CC
- Adobe After Effects® CS/CC
- Adobe Media Encoder® CS/CC
- Autodesk® 3ds Max®
- Autodesk AutoCAD®
- Autodesk Inventor®
- Autodesk Maya®
- Dassault Systèmes SolidWorks®
- Dassault Systèmes CATIA®
- Dell Precision Factory Default Settings
- PTC® Creo®
- Siemens NX™

Figure 6. Performance Measurements



- **Expert Advice**—application developers / ISVs can define Dell Precision Optimizer profiles best suited

Dell Precision Optimizer includes Dell created profiles for popular workstation ISV applications. These profiles have been tested in Dell labs and found to increase application performance using standard benchmarks.

In addition, Dell Precision Optimizer Software Development Kit (SDK) enables application developers and ISVs to take control of their application's performance needs. These experts can create profiles that optimize the Dell system whenever the application is executing to ensure best user experience.

- **Comprehensive Reports**—deep inventory and usage data

Dell Precision Optimizer can help you get extensive system reports to troubleshoot hardware and software issues with the click of a button. Dell Precision Optimizer Track & Analyze subsystem eliminates the need for the system administrator to use multiple complex tools in order to get this data. These reports are presented in easy to understand graphical format and contain advanced resource utilization data that can be extremely useful in optimizing your system.

- **Access**—easy access to difficult to obtain or platform-proprietary data

Dell Precision Optimizer capitalizes on Dell's know-how and expertise to get system specific extensive reports via Dell Smart Tracking. These reports include hard-to-get information such as fan speed, thermal data from various sensors on the system, battery charge and discharge information, CPU and memory utilization, *etc.*

- **Up-to-date system**—improves user productivity and reduces down time

Dell Precision Optimizer frees you up to spend more time working to meet your goals and less time configuring and maintaining your system. It keeps your system updated by automatically downloading and installing Dell certified drivers and software for your specific configuration.

You no longer have to manually search and install the latest software for your specific make, model, operating system and configuration.

- **Productivity**—improves user productivity

Users can now focus on performing their actual tasks instead of spending time performing housekeeping tasks such as installing software updates, optimizing the performance for each workload, searching for data to help them identify problems with system performance, *etc.* This should greatly improve productivity and increase overall user satisfaction with Dell Precision workstations.

- **Integrated & Intuitive UI**—one stop shop

Dell Precision Optimizer provides an easy to use UI to monitor your computer's utilization, performance and software updates from one location.

- **Innovative & Competitive**

Extensible and modular application that is takes workstation performance to the next level. Dell Precision Optimizer is New, Unique & Different.

- Dynamic adjustments of system configurations
- Automatic detection of applications and workloads

Dell Precision Optimizer

- Modular architecture
- Scalable plug ins for future platform expansion
- Provides COM based SDK for ISVs
- Based on Dell proprietary software architecture.

Additional Features

Dell Precision Optimizer application provides the following additional features:

- System Health and Maintenance
- Track & Analyze

System Health and Maintenance

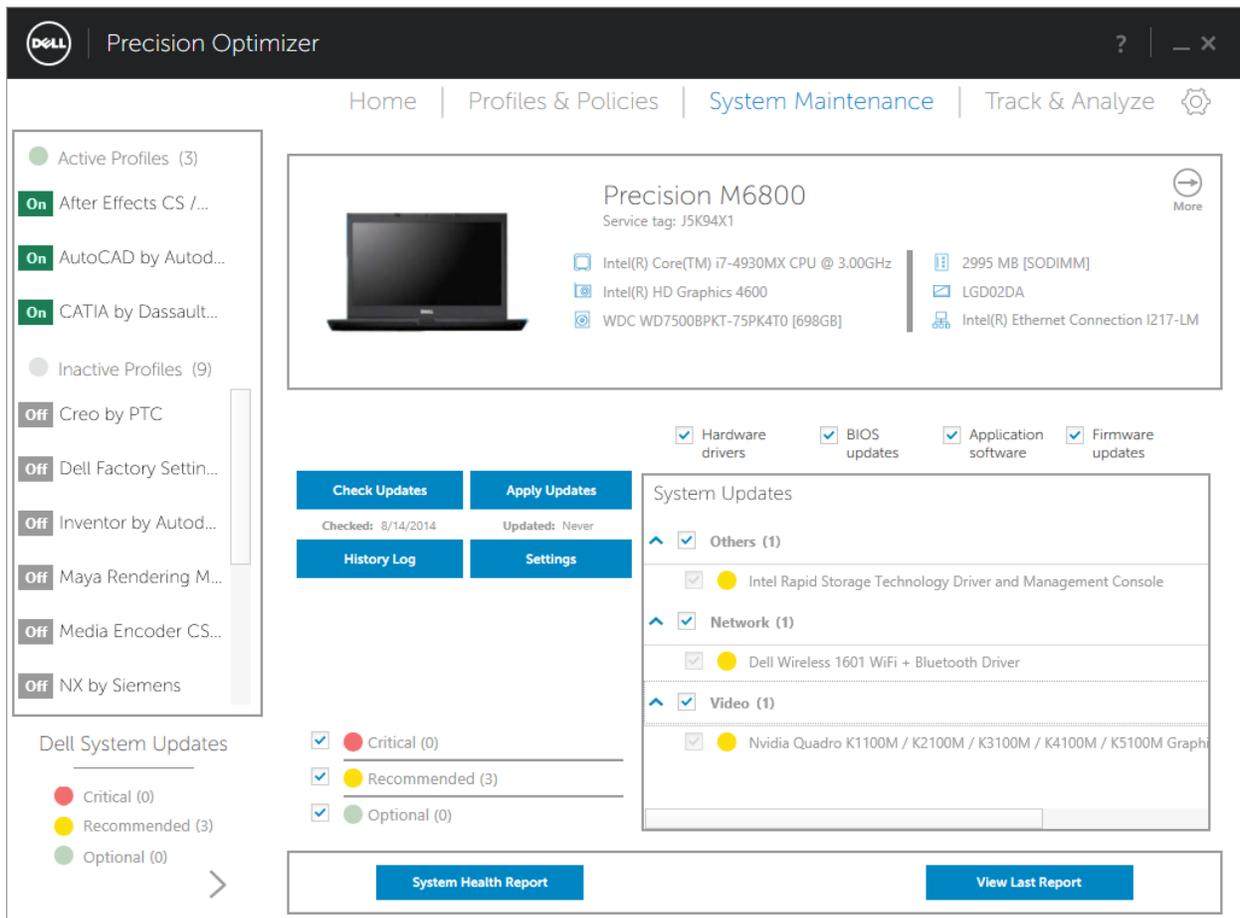
Dell Precision Optimizer maintains the system's health by ensuring that the platform has the latest image (i.e., latest BIOS, device drivers, and software components) for the specific system configuration. It uses an engine that can automatically download and install the software or simply inform the user when new updates are available.

Dell Precision Optimizer System Maintenance engine categorizes all available updates based on:

- Type—Hardware Drivers/BIOS Updates/Application Software/Firmware Updates
- Category—Audio/Mouse & Keyboard/Storage/Chipset/Network & Bluetooth/Video/All others
- Criticality—Critical/Recommended/Optional

With this feature, Dell Precision Optimizer frees the system administrators to spend more time being productive to meet their goals. It reduces downtime by ensuring that the system stays updated by automatically downloading and installing Dell certified drivers and software. Administrators also have the ability to block out undesired updates by using the filters mentioned above.

Figure 7. Screen Shot of Dell Precision Optimizer System Maintenance



System Health Dashboard

Easy access to some of the system health reports such as:

- System Reliability and Diagnostic Report
- System Battery Health and Usage Report
- System Stability Index Report

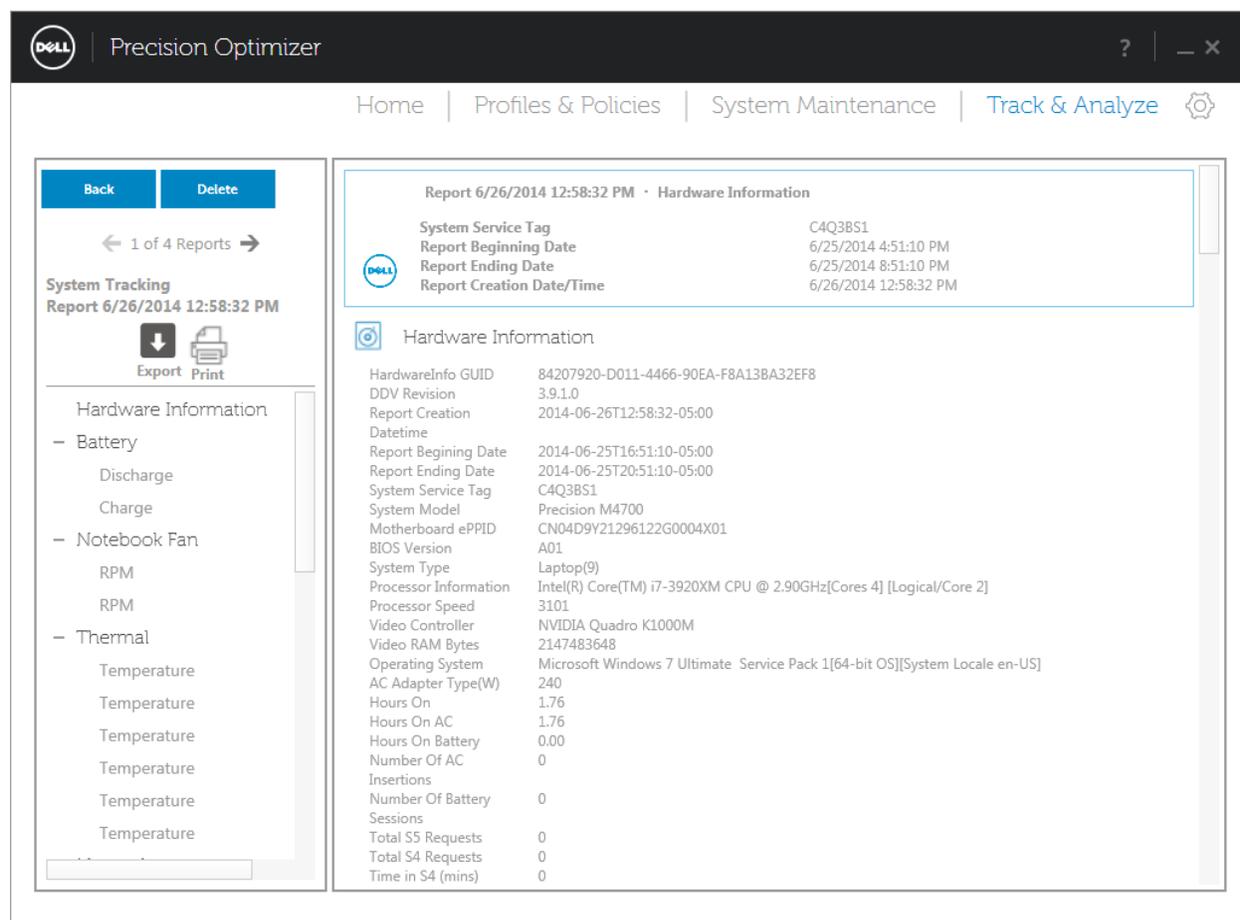
Track & Analyze

Dell Precision Optimizer enables a user to record system resource usage and performance with the help of a powerful engine called *Dell Smart Tracking*. This engine can run extensive reports to help you troubleshoot hardware and software problems that might obstruct your productivity.

The information included in these reports contain hard-to-gather data such as fan speed statistics, thermal data from various sensors on the system, battery charge and discharge information, CPU and

memory utilization, and so on. Once the user enables Dell Smart Tracking, the system gathers data for a period of time before the final report is generated and ready to view. The duration for which this information is collected is under the user's control. Once the report is ready it is presented to the user in an easy to understand graphical format.

Figure 8. Screen shot of Dell Precision Optimizer Track & Analyze subsystem



Dell Smart Tracking reports contain a wealth of information which is not easily available from any single toolkit. Further, some of this information is Dell specific and may not be available from any other source. Having the ability to generate such extensive reports at the click of a button allows system administrators to troubleshoot problems before they occur. If these reports are generated periodically, they also provide the system administrator valuable insight into the usage patterns and health of their systems.

Analyze Workload

This feature allows the user to analyze their work load and determine if it is CPU, Memory, Graphics or Disk I/O intensive. One can potentially run this analysis multiple times with different system configurations to determine the optimal configuration for their workloads.

In some cases, there may be hardware upgrade options available from Dell that might benefit the user. One can chose the "Upgrade Options" links to explore these.



Conclusion

Inefficient use of system resources typically results in loss of user productivity due to decreased system performance. Application workloads have varying requirements which are hard to determine. Users typically do not have the information necessary to fine tune their system's performance based on workload.

Dell Precision Optimizer fills this need by providing a scalable profile-based performance engine which can dynamically detect a change in workload and automatically adjust the system parameters to optimize the performance of the current workload.

This new version of Dell Precision Optimizer provides the user with a simple and easy to analyze their work loads and determine if possible system configuration changes exists that may help improve the performance,

In addition, Dell Precision Optimizer provides a central location where users can ensure their system software is up to date and can easily generate reports of system activity. These features make Dell Precision Optimizer an essential productivity enhancing tool which can keep pace with the user's needs. By making such an application available, Dell is fulfilling its commitment to provide innovative and high quality solutions to its customers.

Finally, every Dell has made it convenient for the user to get new Profiles as when Dell releases them by using the "Check New Profiles" feature, no need to upgrade the software to get new Profiles.

In summary Dell Precision Optimizer is ...

- **Ever ready**—Dynamically configures and/or updates the system to suit application needs
- **Adaptive**—Growing number of policies and profiles to handle different workloads on your system
- **Simple**—User interface allows you to monitor your computer's utilization, performance, and software updates from one location