ezIOmeter

Product Requirements Document (PRD)

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Revision 0.1

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# Revision History

| Revision Number | Description | Name | Revision Date |
| --- | --- | --- | --- |
| 0.0 | First draft | Somers, Jaron | June 2015 |
|  |  |  |  |

# Document Objectives

Overview

This Product Requirements Document (PRD) captures the requirements for the ezIOmeter software. The requirements are derived from the Intel 750 Series Evaluation Guide and how Iometer functions. The PRD stands as engineering commitment to deliver on requirements outlined in the Requirements section below, and provides the project team with the information necessary to design the product, and plan for project management. It also provides a basis to plan for implementation, sales, and support.

The PRD is intended for the following audiences and purposes during the Planning Phase:

* Internal stakeholders use the PRD to understand the feature set of the product.
* Engineers refer to it as they create a high-level design based on requirements.
* Functional area managers and the Program Manager use it to help estimate resource needs and schedules and identify risks for the Program Management Plan.
* Quality Assurance and Test engineers use it to set quality criteria and plan for testing.
* Test Developers use it to create module and platform validation testing plans that support Alpha, Beta and Production Candidate releases.
* Writers use it to plan product documentation.
* Marketing uses it to plan how the organization shall launch and sell the product.
* Product Support engineers use it to plan how the product shall be supported.
* Validation engineers use it as a checklist to verify product functionality and performance.

During the Development Phase, the approved PRD serves as a reference for the project team and internal suppliers to develop a product that adheres to the product requirements. PRD updates shall be communicated to the entire project team.

## Approval

This document shall follow the PLC revision nomenclature as various stages of approval occur:

* Rev 0.0- Rev 0.2 – initial development, stakeholders identified
* Rev 0.3 – Enough content to scope effort, peer review scheduled
  + Initial power, IOPs, latency, and bandwidth targets captured
  + ASIC & Architecture requirements *captured*
* Rev 0.4 – Integrated changes from Peer Review
  + ASIC & Architecture requirements *frozen*
* Rev 0.5 – Updates and alignment based on final HW/ASIC architecture.
  + Initial firmware requirements captured (not complete).
  + Initial industry benchmark targets captured (e.g. PCMark)
  + Aligned with POP L2
* Rev 0.6 – Enough content to scope FW effort, stakeholder review scheduled
  + Firmware requirements *captured*,
* Rev 0.7 – Changes from stakeholder review
  + Firmware requirements *frozen*
  + Aligned with POP L3
* Rev 0.8 – Ratified and change control (Program review)
* Rev 1.0 – Complete
* Rev 1.x – Final “as implemented” update

# Open Items

This section outlines a list of requirement areas that are currently in process but are not yet captured within this PRD. This list is specific to the items being discussed at the publication of this revision. It is expected that these items are reviewed and approved within the POP team prior to integration into the PRD.

Below is the current inspection log. It is intended that both stakeholder and peer reviews will utilize the inspection logs submitted by reviewers to keep comments, changes, and questions logged efficiently.

| ID | Title | Requirement Summary | Specific Requirement |
| --- | --- | --- | --- |
| POR003 | Unique Summary Results File | ezIOmeter should create a unique summary file for the test being ran. | Ideal Filename:  TimeStamp\_TestName\_Summary.csv |
| POR004 | GUI defined test durations | Give the user the ability to adjust test durations via the graphical user interface | Drop down menu of pre-defined test durations or a text box that allows user defined test durations within a limited range. (2 minutes to 20 minutes) |

# Glossary

| Term | Definition |
| --- | --- |
| AIC | Add-In Card |
| Alpha | A term used to define the quality state of software: Alpha is software that is code and feature incomplete |
| BER | Bit error rate, or ratio of bits that have errors relative to the total number of bits received |
| Beta | A term used to define the quality state of software: Beta is considered code and feature complete, however, may still require bug fixes |
| BIOS | Basic Input / Output System |
| Chipset | A term used to define a collection of integrated components required to make a PC function. |
| CRC | Cyclic Redundancy Check |
| DMA | Direct Memory Access |
| eNVMHCI | Enterprise Non-Volatile Memory Host Controller Interface, the command protocol for high performance PCIe based non-volatile memory products (now known as NVM Express (NVMe)) |
| FMI | Far Memory Interface protocol (Intel IP) |
| GB | Gigabyte defined as 230 bytes |
| GUI | Graphical User Interface |
| HCI | Host Controller Interface |
| HCT | Hardware Compatibility Test |
| HDD | Hard Disk Drive |
| Hot Plug | A term used to describe the removal or insertion of an SSD when the system is powered on. |
| ID | Identifier |
| IOCTL | Input / Output Control |
| IOPs | I/O’s per second, unit of measure for performance |
| IP | Intellectual Property |
| LED | Light Emitting Diode |
| M.2 | M.2 NGFF |
| MB | Megabytes defined as 1x106 bytes (note that it is not defined as 220 bytes) |
| MP | Multi-Processor |
| MTBF | Mean time between failure |
| NTFS | NT File System from Microsoft |
| NVM Express or NVMe | Non-Volatile Memory Express, the command protocol for high performance PCIe based non-volatile memory products (previously known as eNVMHCI) |
| ODM | Original Device Manufacturer |
| OEM | Original Equipment Manufacturer |
| OS | Operating System |
| Port | The point at which a drive physically connects to the system. |
| PRD | Product Requirements Document |
| PRM | Programmers Reference Manual |
| Production Candidate (PC) | A term used to define the quality state of software: Production Candidate is software that is code and feature complete, has complete bug fixes, however is not WHQL certified. |
| Production Version (PV) | A term used to define the quality state of software: Production Version is software that is code and feature complete, has complete bug fixes, and is WHQL certified. |
| Prototype | A term used to define the quality state of software: Prototype is software that is code and feature incomplete, however, is designed to showcase a “proof of concept” technology. A prototype may or may not result in a Production Version. |
| RAID | Redundant Array of Independent Disks |
| RAM | Random Access Memory: usually refers to the system’s main memory |
| ROM | Read Only Memory |
| RTM | Release To Manufacture |
| PCIe | PCI Express |
| SiP | System in Package |
| SMART | Self-Monitoring, Analysis and Reporting Technology: an open standard for developing hard drives and software systems that automatically monitors a hard drive’s health and reports potential problems. |
| SP# | Service Pack (number) |
| SSD | Solid State Drive |
| SW | Software |
| TBD | To Be Determined |
| TM&B | Trademark and Branding |
| UI | User Interface |
|  |  |

# Related Documents

| Date or Rev. # | Title | Location | Hidden |
| --- | --- | --- | --- |
| March 2015 | Intel 750 Series Evaluation Guide | <http://www.intel.com/support/ssdc/hpssd/ssd-750/sb/CS-035497.htm?wapkw=750+series+evaluation> |  |
| 2003.12.16 | Iometer User’s Guide | <http://sourceforge.net/p/iometer/svn/HEAD/tree/trunk/IOmeter/Docs/Iometer.pdf?format=raw> |  |

# Requirements

## Overview

ezIOmeter is a Windows based Client NVMe focused benchmark tool that is simple to use.

ezIOmeter is essentially an outside “wrapper” program that utilizes Iometer 1.1’s command line functionality to run industry trusted Iometer tests.

32 and 64-bit Windows 7, 8, 8.1, and 10 operating systems can support Iometer.

This tool is optimized for the general client consumer who wishes to test their drive but does not have the time to put in the effort to use Iometer effectively.

Intel internal requirements, with OEM customer needs, drove the contents of this PRD. This document is intended for use by Intel engineers as a reference for implementing this product. This PRD contains functional and non-functional requirements that shall govern the development, testing, and release of all components and collateral distributed under the name ezIOmeter.

## Planning Requirements and Engineering Commitments

In order to allow future understanding of original Planning requirements (POP) and Engineering’s ability to support the requirements, the PRD has been formatted in such a way to ensure both types are captured.

For each item in the PRD, there is a specified “Requirement” column which aligns to the Planning requirements which were requested at the beginning of the program – each item is denoted with a Y/N/D or a value that was requested from POP. If there are cases where the “Engineering Commit” differs from the planning requirement, then an “EC” entry is noted within the appropriate column – additionally the cell will be colored YELLOW to further highlight the difference. A set of examples are listed below as a reference (these are not actual requirements). For the cases where no “EC” is documented, which is expected to be the majority of cases, then Engineering is committed to meet the requirement as specified.

**EXAMPLE Only:**

| ID | Title | Requirement Summary | Specific Requirement |
| --- | --- | --- | --- |
| NUM001 | RequirementA | This is the first requirement for height. | <=5mm |
| NUM002 | RequirementB | This is the second requirement for power consumption. | <4W  EC : <4.5W minimum req met. Above is stretch goal. |

It is expected that all Planning requirements are captured prior to POP L2 closure within the PRD by revision 0.5. It is Engineering’s responsibility to respond within the “EC” commitments prior to POP L3 closure within PRD v0.7. Following POP L3, the PRD will be under revision control.

Any new requirements added to the PRD following POP L3 must have been processed through an RCR, and must be integrated into the PRD once Engineering Commit is secured. It is required that these items be captured as “EC” to clarify that the requirement was added post-POP L3.

## Product Exceptions

During the project execution phase, and leading up to production, it may be the case that a Product Development Team (PDT) elects to productize a solution that does NOT meet all PRD requirements, even the Engineering Commits. Any PRD items that are not met at the QS milestone must be captured in this section. This section must be updated at the PRQ milestone, in case any exceptions are resolved or new items arise for final product.

| ID | Title | SKU Requirement | Exception details |
| --- | --- | --- | --- |
|  |  |  |  |
|  |  |  |  |

The ID & Title in the above table must match the requirement as specified later in this document. The “SKU Requirement” will call out which SKU’s are affected (capacity, form factor). The “Exception Details” must concisely outline how the requirement is not being met.

Upon resolution to an exception, the appropriate item shall be removed from this table.

It is expected that addition/subtraction of “Product Exceptions” in this section will be done in a new revision of the PRD, whether they accompany other PRD changes or not.

## General Requirements

| ID | Title | Requirement Summary | Exception Details |
| --- | --- | --- | --- |
| PCGR001 | Legal name | ezIOmeter |  |
| PCGR002 | Compatibility | Supported on 64-bit versions of Windows 7, 8, 8.1, 10 |  |
| PCGR003 | Installation | The installation of ezIOmeter should be automated given the users permission followed by an installation guide. |  |

## Software Requirements

| ID | Title | Requirement Summary | Exception Details |
| --- | --- | --- | --- |
| PCSR001 | Utilization of trusted Iometer (v1.1) methods | ezIOmeter will utilize Iometer as a distributed system where ezIOmeter sends workloads to Iometer and Iometer performs the storage analysis and produces the IO with the help of Dynamo. |  |
| PCSR002 | GUI Result Table | ezIOmeter produces visual representations of the result file from Iometer via the GUI after the specified test is complete. |  |
| PCSR003 | Optional Tests | The user will be able to use the mouse to left-click a check box to select or deselect a test to run |  |
| PCSR004 | Results file review | User will be able to review the results in a comma separated values file that lists the results for saving. |  |
| PCSR005 | Dismiss Workload Message | A user will be able to dismiss the “Running Workload…” message. |  |
| PCSR006 | Dismiss all tests | A user will be able to cancel/abort all tests that are currently queued. |  |
| PCSR007 | Test Formatted Drives | The user will be able to select from a list of formatted drives that are available locally to the computer. |  |
| PCSR008 | Free space viewable for selectable drives | The drop down list of selectable drives should display the amount of free space available on the drive. |  |
| PCSR009 | Drive Description | The drop down list of selectable drives should display the drive letter and name of the available drives. |  |
| PCSR010 | Default settings.conf | The default settings.conf defined values:  # Number of seconds each workload is run.  workload\_duration\_sec=120  # A comma separated list to determine what order to run workloads.  # Note: Use same name as .icf but without the extension.  workload\_run\_order=128KB Sequential Writes Queue Depth 32,128KB Sequential Reads Queue Depth 32,4KB Random Writes Queue Depth 32,4KB Random Reads Queue Depth 32  # Number of seconds to wait before preforming the next workload.  sleep\_between\_tests\_sec=5  # Mean IOps  mean\_iops\_bucket\_order=backward  mean\_iops\_bucket0=999999999  mean\_iops\_bucket1=999999999  # Stdev IOps  stdev\_iops\_bucket\_order=backward  stdev\_iops\_bucket0=999999999  stdev\_iops\_bucket1=999999999  # Min IOps  min\_iops\_bucket\_order=backward  min\_iops\_bucket0=999999999  min\_iops\_bucket1=999999999  # Max IOps  max\_iops\_bucket\_order=backward  max\_iops\_bucket0=999999999  max\_iops\_bucket1=999999999  # Mean MBps  mean\_mbps\_bucket\_order=backward  mean\_mbps\_bucket0=999999999  mean\_mbps\_bucket1=999999999  # Stdev MBps  stdev\_mbps\_bucket\_order=backward  stdev\_mbps\_bucket0=999999999  stdev\_mbps\_bucket1=999999999  # Min MBps  min\_mbps\_bucket\_order=backward  min\_mbps\_bucket0=999999999  min\_mbps\_bucket1=999999999  # Max MBps  max\_mbps\_bucket\_order=backward  max\_mbps\_bucket0=999999999  max\_mbps\_bucket1=999999999  # Latency  latency\_bucket\_order=backward  latency\_bucket0=999999999  latency\_bucekt1=999999999 |  |
| PCSR012 | Uninstallation | The software shall be able to be uninstalled by double clicking an uninstaller. The uninstaller should remove all of the files that were originally installed. |  |

## Performance Requirements

**Model and Workload assumptions:**

| **ID** | **Title** | **Requirement Summary** | **Exception** |
| --- | --- | --- | --- |
| PCPR001 | ezIOmeter Test Duration | ezIOmeter must be able to run each workload for 2 minutes. |  |
| PCPR002 | Timely result file | ezIOmeter writes a result file directly after a test so the user does not wait for their results |  |
| PCPR003 | Start up | ezIOmeter must start up and initialize in under 20 seconds. |  |

## Performance Measurement Methodology

All IOMeter-based performance requirements are based on a Windows Operating Systems with the system configuration specified in the Intel 750 Series Evaluation Guide. ezIOmeter is required to meet the same performance specifications as listed in the Evaluation Guide.

## Environmental Requirements

| ID | Title | Requirement Summary | Exception details |
| --- | --- | --- | --- |
| PCER001 | System Requirements | The system must have at the least these components:  CPU: 1 gigahertz (GHz) or faster x86- or x64-bit processor with SSE2 instruction set  RAM: 1 gigabyte (GB) RAM  Hard Drive: 10.0 gigabytes (GB) available  Display: DirectX 9 compatible graphics card  OS: 32 or 64-Bit versions of Windows 7, 8, 8.1, 10 |  |
| PCER002 | System Recommendation | For optimal performance analysis of the drive, we recommend having a CPU with four cores or more to fully utilize NVMe capabilities. |  |

## Label Requirements

| **ID** | **Title** | **Requirement Summary** | **Exception** |
| --- | --- | --- | --- |
| PCLR001 | Taskbar Icon | ezIOmeter should display the icon on the Windows Taskbar |  |
| PCLR | Window Icon | ezIOmeter should display the icon on the Window of the application. |  |

## Packaging Requirements

| **ID** | **Title** | **Requirement Summary** | **Requirement** |
| --- | --- | --- | --- |
| PCPR001 | Product Package | ezIOmeter will be packages in an installer | Y |
| PCPR002 | Installation | ezIOmeter will be installed by having the user double click the ezIOmeter\_Setup.exe and following the setup instructions. | Y |
| PCPR003a | Package Contents | ezIOmeter will be installed with the following default directory structure at  C:\Program Files(x86)\ezIOmeter | Y |
| PCPR003b | Configuration Files | ezIOmeter’s standard Iometer configuration files:  \IometerConfigFiles\128KB Sequential Writes Queue Depth 32.icf  \IometerConfigFiles\128KB Sequential Reads Queue Depth 32.icf  \IometerConfigFiles\4KB Random Writes Queue Depth 32.icf  \IometerConfigFiles\4KB Random Reads Queue Depth 32.icf | Y |
| PCPR003c | Installed Programs | ezIOmeter will have Iometer(v1.1 custom) and Dynamo installed at these locations:  \Iometer\IOmeter.exe  \Iometer\Dynamo.exe | Y |
| PCPR003d | Installed Support | ezIOmeter relies upon the .NET Framework 4.5 which will be installed at:  \Support\dotNetFx45\_Full\_setup.exe (.NET Framework 4.5) | Y |
| PCPR003e | Results | ezIOmeter will write the results to the directory installed at:  \Results\ | Y |
| PCPR003f | Program support/Misc. | ezIOmeter will also be installed with the following files at its home directory:  ezIOmeter\_User\_Guide.pdf  uninstall.exe  MathNet.Numerics.dll  MathNets.Numerics.xml  ezIOmeter\_Lib.dll  ezIOmeter.exe  settings.conf | Y |

## Legal Requirements

| **ID** | **Title** | **Requirement Summary** | **Requirement** |
| --- | --- | --- | --- |
| PCLG001 | Protex IP | All code (SW Tools) that get compiled into executables will be run through Protex IP. | Y |
| PCLG002 | IP Plan | All SW projects will be included in an IP plan approved by Intel. | Y |
| PCLG003 | One Time Technical Review for Encryption | Pertinent features of product encryption shall go through a required “one time government technical review” process. This mandatory step must be done prior to export outside the US and Canada.  Once a review is completed, the encryption item (software or hardware) shall become eligible for a licensing authority that can be used by all exporters, not just Intel. | Y |
| PCLG004 | Product Localization | Product identification strings shall be localized | N |
| PCLG005 | Product Document Localization | Product documentation shall be localized | Y |
| PCLG006 | Engineering Document Localization | All engineering documentation will be maintained in English only | Y |
| PCLG007 | Document Review | All text displayed to the user and supplied documentation must be reviewed by legal for every external release | Y |
| PCLG008 | License Review | Any associated license agreement shall be reviewed by legal prior to every external release | Y |
| PCLG009 | Certificate of Origin (COO) | A COO shall be completed by the business unit and approved by Legal prior to the software being released to external parties | Y |