



# OBJECTIVE ANALYSIS

## Semiconductor Market Research

### OBJECTIVE ANALYSIS DETAILED REPORT

PROFITING FROM THE NVDIMM MARKET

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#### Abstract:

It appears that NVDIMMs, introduced in 2009, are finally reaching a point of mass adoption. This device is not only used as fail-safe storage for both storage arrays (SAN) and hyperscale data centers, but is helping to accelerate software development for future computing systems that will use storage class memory (SCM) and persistent memory (PM). This report investigates NVDIMM technology, its use, and its future, while explaining how and why it is just now gaining market traction.

Starting with an outline of the technology, and explaining how and why it is used, this study thoroughly explores NVDIMM applications and explains the technology's appeal in each application. The report compiles information that Objective Analysis has acquired from extensive field interviews with NVDIMM manufacturers, OEMs, the design community, and end users. It concludes with an NVDIMM unit shipment forecast by NVDIMM type.

#### Contents:

Executive Summary

What is an NVDIMM?

- NVDIMM history
- Some Background: The Memory/Storage Hierarchy
- Definitions of NVDIMM types: -N, -F, -P
- NVDIMM vs. other technologies in the memory/storage hierarchy
  - NVDIMM vs. SSDs
  - NVDIMM vs. DRAM

NVDIMM Software

- Special BIOS requirements
- Special Operating System requirements
  - Support from the Linux Community
  - Windows NVDIMM Support
- Changes Required of Application Programs

Which applications need NVDIMM?

- What Systems will Use It?
  - Storage Area Networks
  - Hyperscale Computing
  - In-Memory Databases

- High-Performance Workstations
- Why do they need it?
  - Data Loss from Power Failures
  - Persistence in I/O-Bound Systems
- Alternatives to Using NVDIMMs
- NVDIMM Security Concerns

#### Using NVDIMMs to Develop Tomorrow's Computers

- Storage-Class Memory (SCM) and Persistent Memory (PM)
  - Scaling limits: How Persistent Memory will replace DRAM
  - The Economics of Persistent Memory
  - Survey of Persistent Memory technologies
  - Outlook for New Memory Technologies
- Using NVDIMM-N to develop SCM/PM software

#### The Impact of Intel's 3D XPoint Memory and Optane DIMMs

- Optane as a Large (Volatile) Memory
- Optane for Persistence

#### NVDIMM Standardization

- Joint Electron Devices Engineering Council (JEDEC)
- Storage Networking Industry Association (SNIA)
- Unified Extensible Firmware Interface (UEFI)

#### Profiles of NVDIMM Manufacturers

- AgigA/Cypress
- Diablo Technology
- IBM Corporation
- Intel Corporation
- Micron Technology
- Netlist
- Samsung
- SanDisk/Western Digital Corporation
- SK hynix
- SMART Modular Technologies
- Viking Technology/Sanmina
- Windawn
- Xitore
- Etc.

#### NVDIMM Forecasts by Type

- NVDIMM-N
- NVDIMM-P
- NVDIMM-F
- NVDIMM-X
- Combined NVDIMM Forecast

#### Methodology