

The logo for ip-maker, featuring the text 'ip-maker' in a white, cursive font with a blue underline, set against a background of server racks.

# High Performance NVMe for PCIe-based storage

IPM-NVMe

## NVM Express compliant

### Key Features

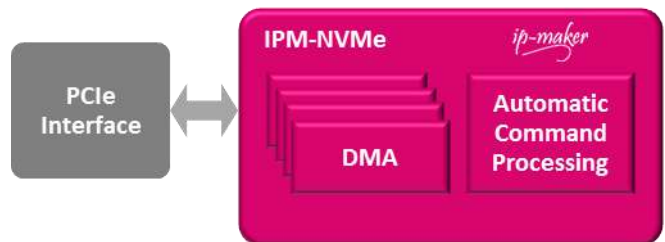
- ↪ NVM Express Compliant
- ↪ Automatic Command Processing
- ↪ Multi-Channel DMA
- ↪ Up to 65536 I/O queues
- ↪ Weighted round robin queue arbitration support
- ↪ All commands/log management
- ↪ Legacy interrupt/MSI/MSI-X support
- ↪ Full NVMe registers support
- ↪ Asynchronous event management
- ↪ Low Power architecture
- ↪ Available for PCIe Gen1/2/3/4/5

### Overview

Typical storage controllers are composed of a communication interface and a Nandflash controller. In this case, all the data flow is managed by the external host processor. However, this architecture cannot sustain high performance applications. The NVMe IP core designed by IP-Maker is a powerful data transfer manager integrated into the PCIe SSD Controller between the communication interface and the Nandflash controller, therefore off-loading the host CPU.

The IP-Maker NVMe IP is UNH-IOL NVM Express compliant. It is part of the official NVMe integrator's list:

<https://www.iol.unh.edu/registry/nvme>



### Benefits

- ↪ UNH-IOL NVM Express certified
- ↪ Ultra low latency
- ↪ Very high throughput
- ↪ Low power architecture
- ↪ Low gate count
- ↪ Cost reduction thanks to interface standardization
- ↪ Validated IP reduces time to-market

### Hardware acceleration architecture

- **Ultra low latency : 300ns**
- **High IOPS : 1.5MIOPS**

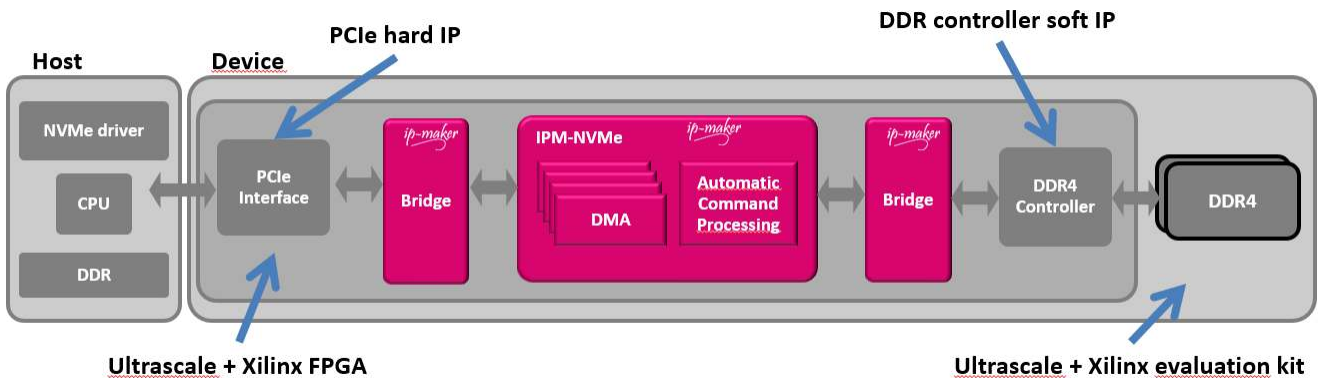
### Deliverables

- ↪ Verilog RTL source code
- ↪ Low level firmware
- ↪ Synthesis scripts
- ↪ Technical documentation
- ↪ Technical support

The logo for nvm EXPRESS, with 'nvm' in a bold, black, sans-serif font and 'EXPRESS' in a smaller, blue, sans-serif font below it, all in a white box.The logo for ip-maker, featuring the text 'ip-maker' in a white, cursive font with a blue underline, set against a background of server racks.

## Reference Design

The NVMe IP can be used in both ASIC and FPGA. It has been ported and validated on multiple Xilinx Ultrascale; Ultrascale + and 7-series FPGAs. The following reference design is available for evaluation and demonstration purpose.



## Applications

### PCIe SSD

The IP-Maker NVMe IP, integrated with the IP-Maker UNFC flash and BCH ECC controllers IP can be used for a whole PCIe SSD design. It provides all the necessary features for both consumer and enterprise products.

### NVMe NVRAM drive

Adding NVRAM technology to the low latency NVMe reference is a smart choice for NVMe NVRAM drives design. This solution may provide both capacity and performance. Then, such NVMe NVRAM drives could be used for high performance OLTP databases, big data analytics or BI applications.

### Persistent Memory SSD

NVMe NVRAM drives is a perfect starting point before moving to the next generation of non-volatile memories such as MRAM or RRAM. These memories come with a very low latency compared to Nandflash. With a successful NVMe NVRAM design, a new design based on such memories will be successful as well.

### Host Bus Adapter (HBA)

The NVMe IP could also be used in a PCIe-based storage product without using any embedded NVM media, but instead providing connectivity to other devices such as SATA SSD, HDD or network interface.

### NVMe to NVMe

The IP core can be used to agglomerate multiple data flow to multiple NVMe storage endpoints. This allows to add quality of service (encryption, duplication ...) in total transparency of your global system.



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