An FPGA Based Enterprise SSD Reference Design

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"The IP enabled solutions provider"

Santa Clara, CA
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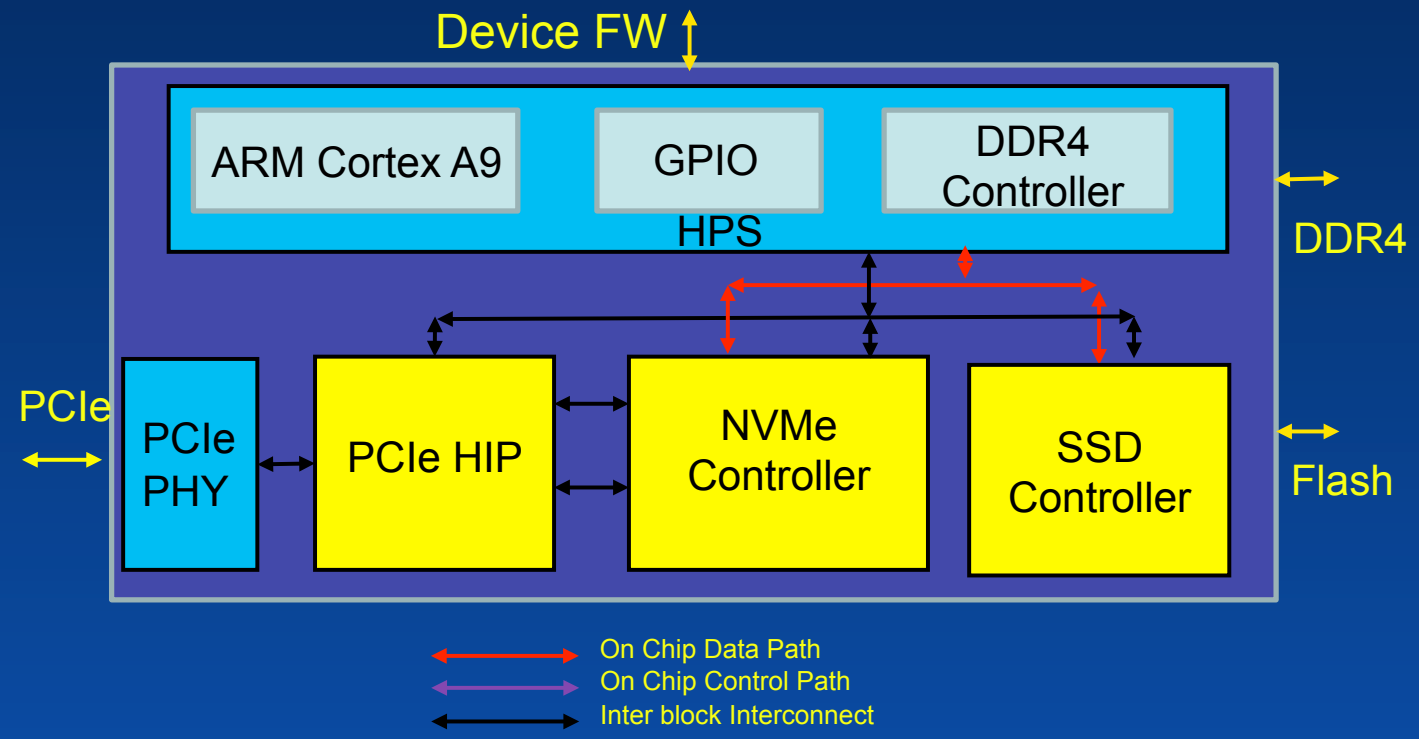
AGENDA

- FPGA Based Enterprise SSDC
- Design Challenges
- Configurable IP Components
- Mobiveil SSDC Reference Design
- Summary

Arria10 Based NVMe Enterprise SSDC Reference Design

NVMe Based Enterprise SSDC



Design Challenges

- Reference Design should be flexible to support different hardware configurations
- Reference Design should be able to handle various target technologies
  - It should be able to handle performance targets across technologies
- Reference Design should allow customization for individual implementations
- Reference Design should provide hooks for Statistics gathering, Error recovery, Reclaim and other value added Enterprise SSD functions

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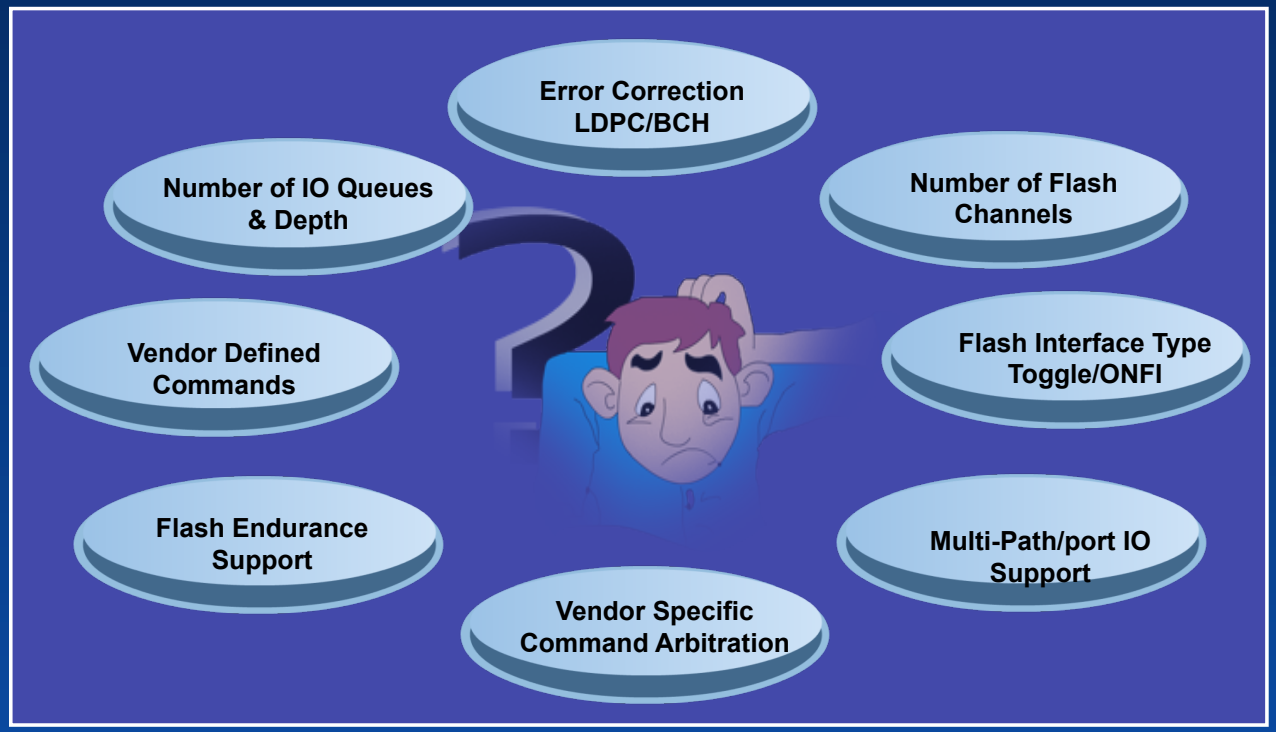
Feature Configurability



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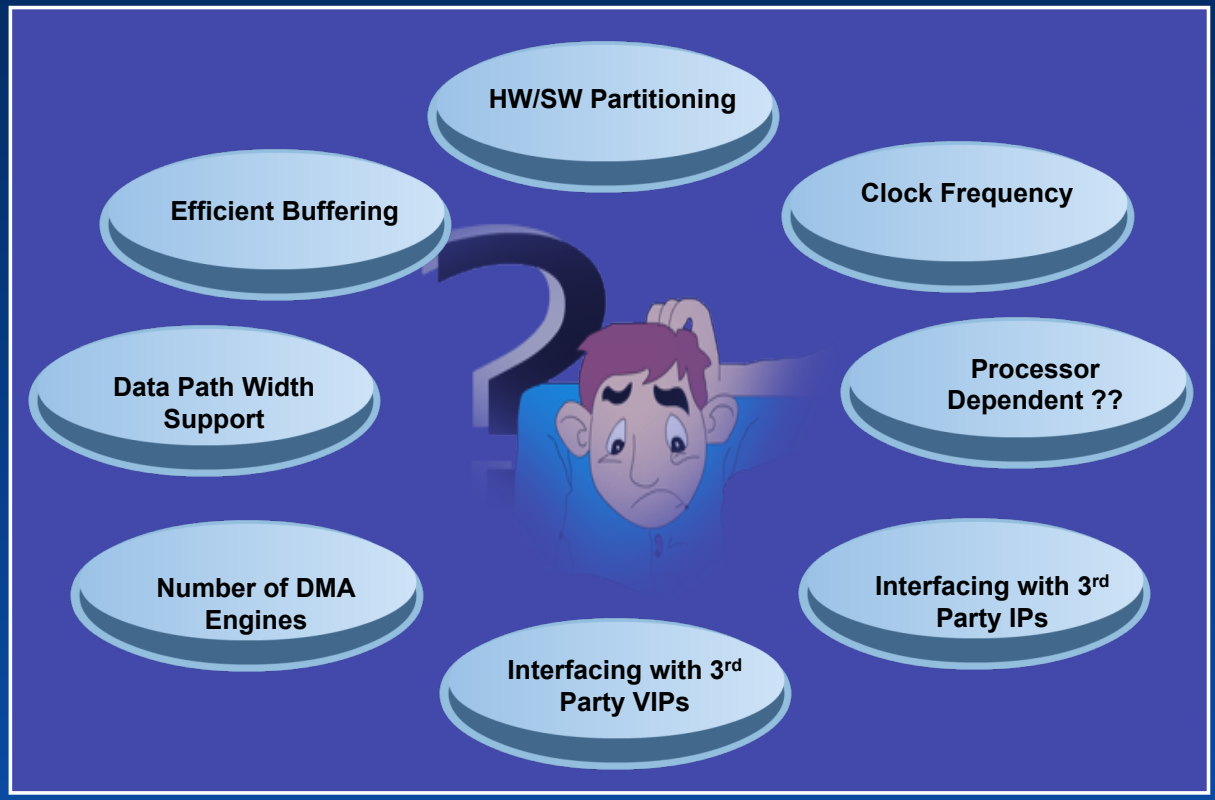
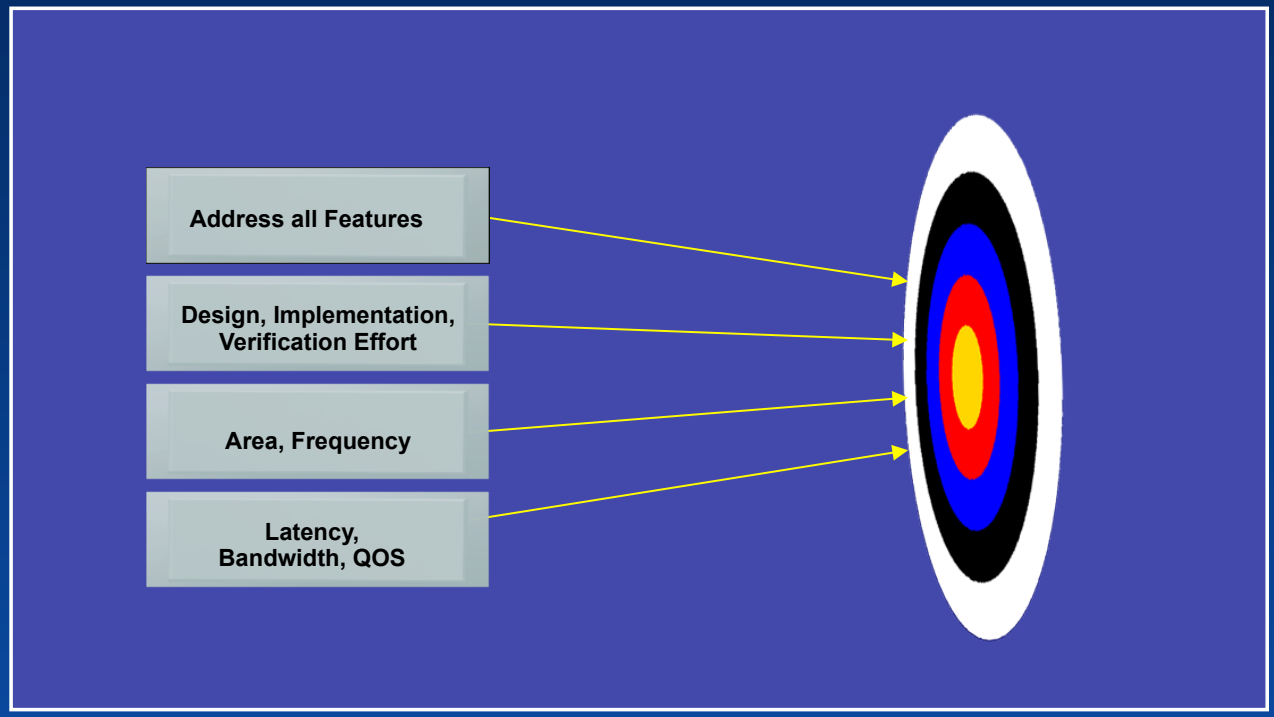
Implementation Challenges



Configurable NVMe Based SSDC



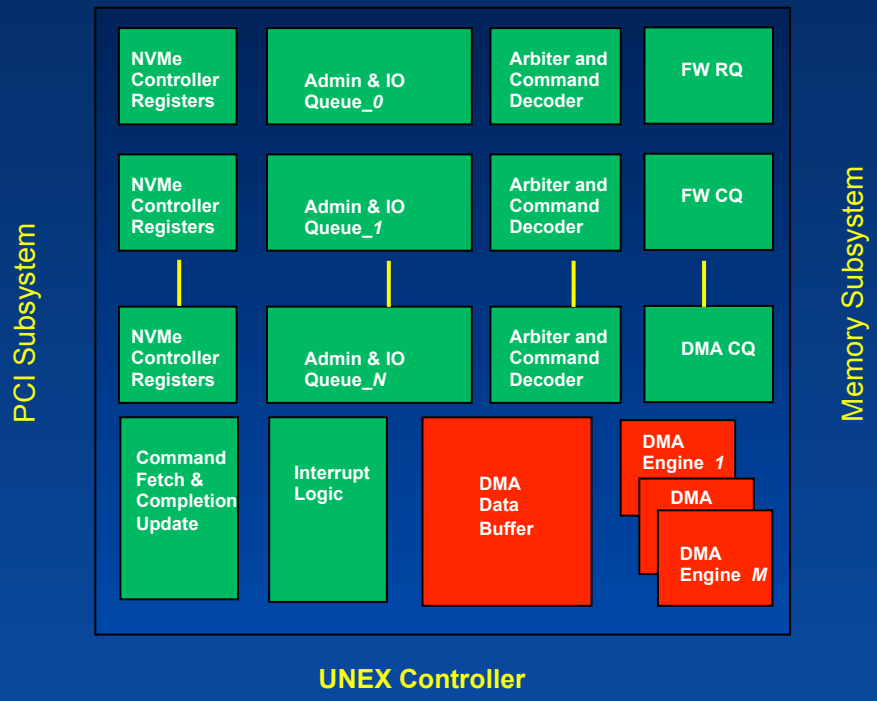
Configurable IP Components

UnH Certified NVM Express Controller *IP* (UNEX)

NVM Express (UNEX) Controller

- ✓ Highly Configurable
- ✓ Technology Independent

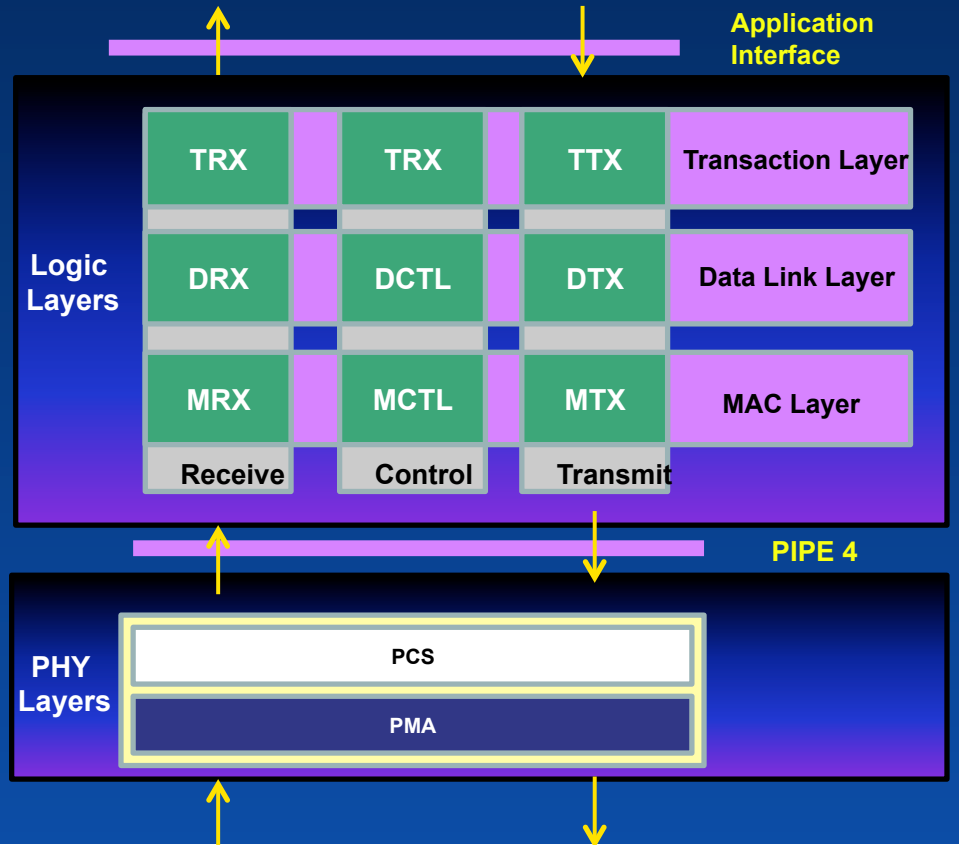
UNH Certified



PCI Express Controller (GPEX)

PCI Express (GPEX)

- ✓ Highly Configurable
- ✓ Technology Independent
- ✓ System Validated



Gen4/3/2/1
Endpoint
Root Complex
Dual Mode
Switch Port
Switch
AMBA
X1 to x16

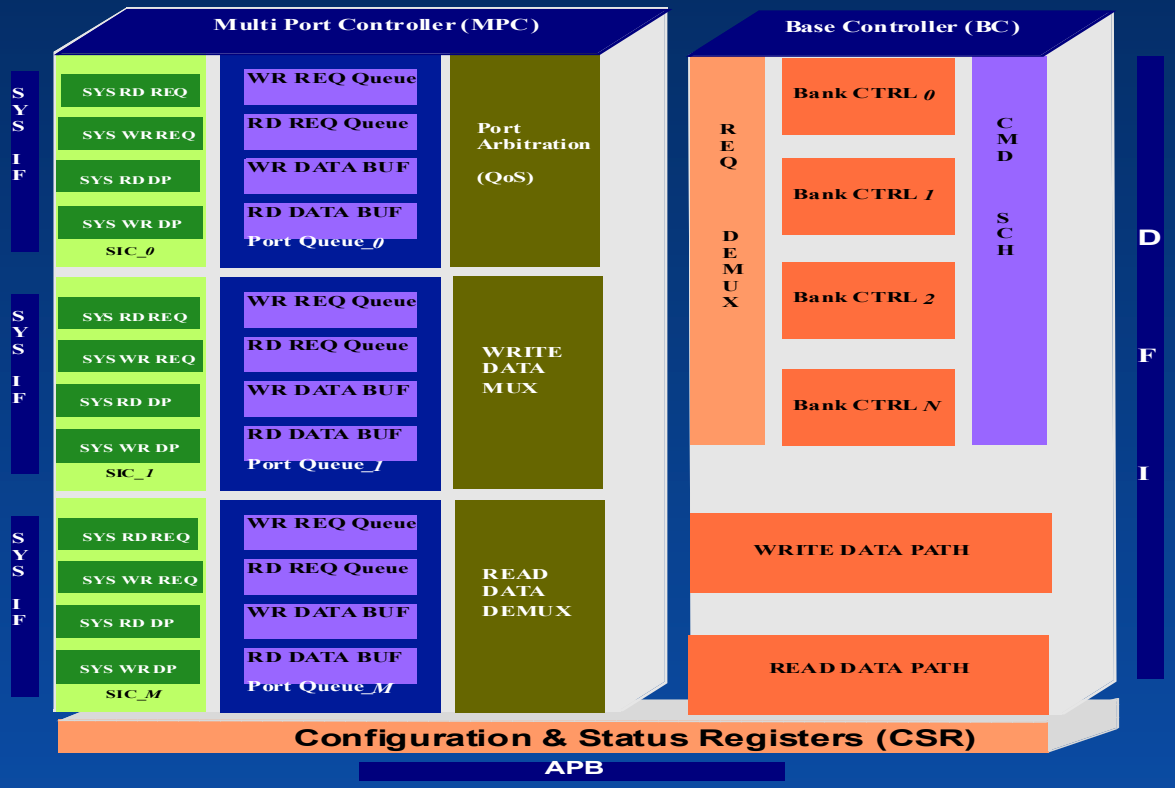
DDR4 Memory Controller

DDR3/4 Controller Requirements

- Compliant with AXI4
- Compliant with DFI 3.1 Interface
- Supports QoS through various arbitration schemes
- Configurable and programmable address mapping
- Supports up to 4 ranks
- Supports following BC Clock to PHY Clock ratio
  - 1:1 (Full-rate Mode)
  - 1:2 (Half-rate Mode)
  - 1:4 (Quarter rate Mode)
- Supports Burst Length 4, 8, 16
- Supports Active/Precharge Power down
- Supports software and hardware driven Self Refresh entry and exit
- Supports Auto-refresh and per-bank refresh
- Supports ECC Checking and Correction (optional)
- Supports automated memory initialization
- Supports ZQ Calibration

DDR4 Memory Controller

- ✓ Highly Configurable
- ✓ Technology Independent



SSD Controller

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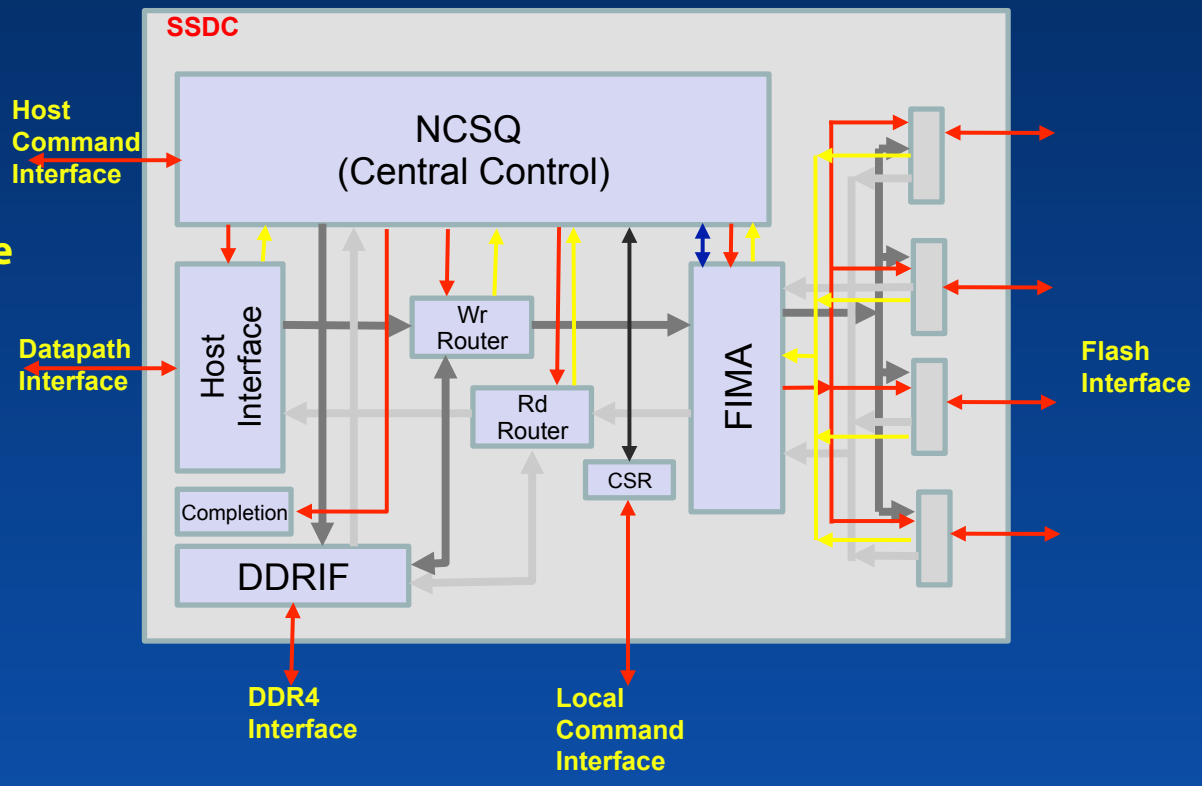
SSD Controller

- ✓ Highly Configurable
- ✓ Technology Independent



SSD Controller Requirements

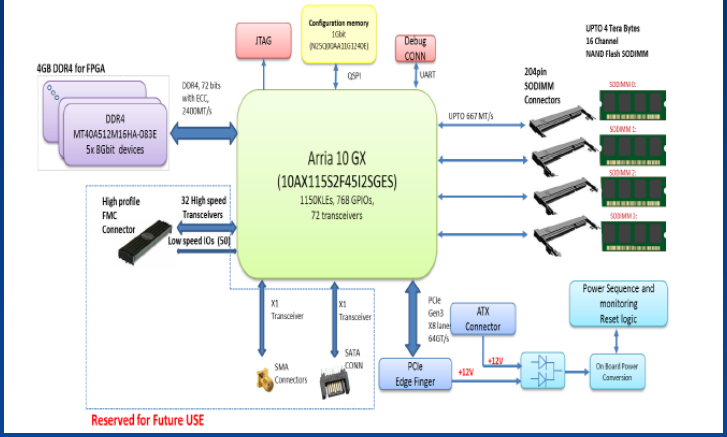
- ✓ **Highly Configurable**
- ✓ **Technology Independent**

- **NAND Core Sequencer**
  - FTL in Hardware
  - Manages all Flash Translation Tables
  - Provides Interface to Device FW for Reclaim, Flash endurance Error Logging and other diagnostic feature implementation
- **Flash Interface and Media Access**
  - Temporal Sequencing of Read/Write Commands to obtain maximum performance
  - Striping and De-striping of data between multiple flash channels (Scatter/Gather).
  - Manage the Usage Pools of data (like Hot/Cold Data)
  - Implements ECC
  - Implements Encryption/Decryption
  - Implements Compression/Decompression

SSD Controller Requirements

- **Host Interface**
  - Interfaces with NVMe Host Command Path
  - Interfaces with NVMe Host Data Path
- **Flash Channel Controller**
  - Implements Flash Interface State Machine
  - Implements Flexible Architecture to support various Flash devices
  - Allows Control Interface to Manage Flash through Test mode (Endurance Support)

NVMe Based Enterprise SSD Reference Board



- High Performance SSD Reference Design with TLC NAND Technology
- Altera PCIe HIP based solution
- UNEX (Universal NVM Express controller) Compliant to NVMe 1.2 specifications
- Up to 16 channels of NAND flash array
- Offers up to 4TB Capacity
- Can be used for Various Flash Device

The Mobiveil Team

- **Leadership**
  - **Management with 25+ years experience in Semiconductor/Silicon IP/Systems software**
  - **Previously founded GDA Technologies, Inc and grew to strong IP and Services group , 500+ engineers strong**
  - **5 Patents in Flash Storage and Reliability**

Key differentiators

Developed several highly configurable key high speed IP blocks in the last 15+ years (PCI Express, Hyper Transport, Serial RapidIO, SPI4.2, DDR4/3, NVMe and Enterprise Flash Controllers)

Locations

Headquarters in Milpitas, CA
India design centers: Chennai & Bangalore
Sales: Offices/Reps worldwide

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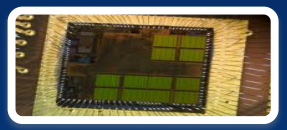
Mobiveil IP Advantages



Market leading & most exhaustively proven cores in the market: *Industry leaders are using these cores*

nvm EXPRESS

Consortium Participation : *RIO – Member, PCISG – Member, HMC - Member*

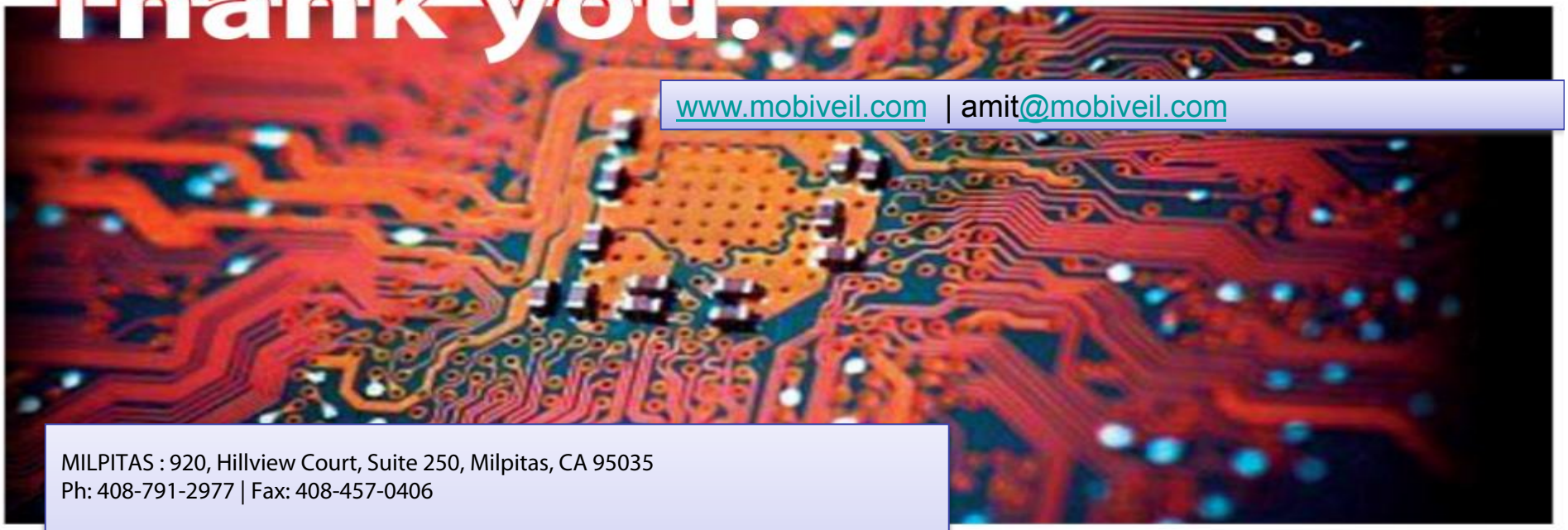
Superior Technical Solution: *Most Feature rich IP, Complete Customization and delivery Solution*

Support: *Clear IP Focus & Worldwide Support*

3rd Party Partnerships for complete Solution: *(Verification and PHY IPs)*

Standard Body Certified Cores: *All Mobiveil IPs are validated and certified: PCI Plug fest, UNH, RTA*

Thank you.



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