



Flash Memory Summit

# Why Persistent Memory Matters

## *How did we get here, and what lies ahead?*

Jim Pappas

Vice-Chair, SNIA Board of Directors

Director of Technology Initiatives, Intel

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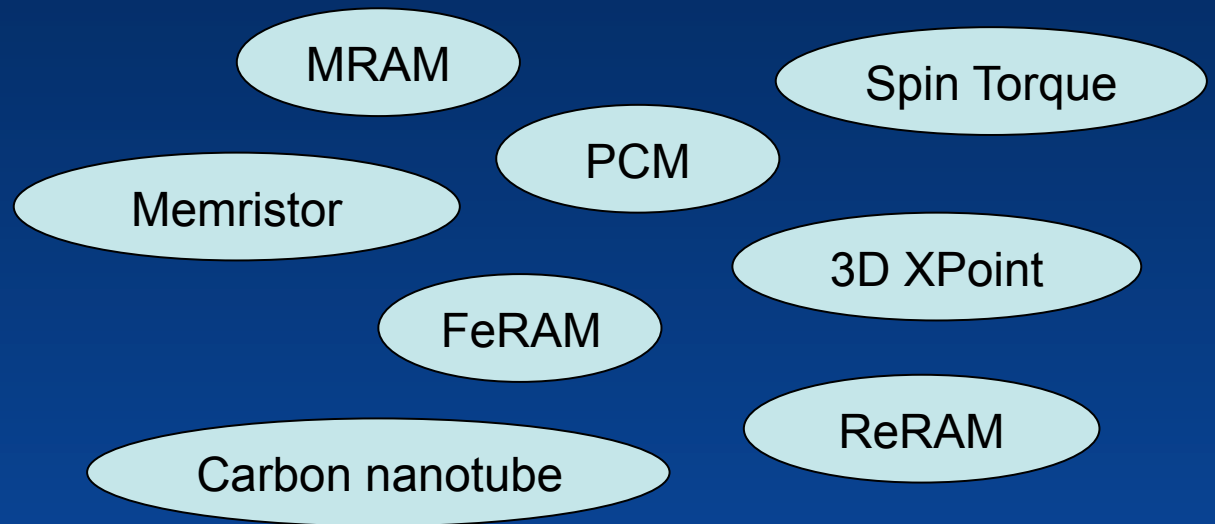
Santa Clara, CA  
August 2018

FMS Persistent Memory Track Presented By:   

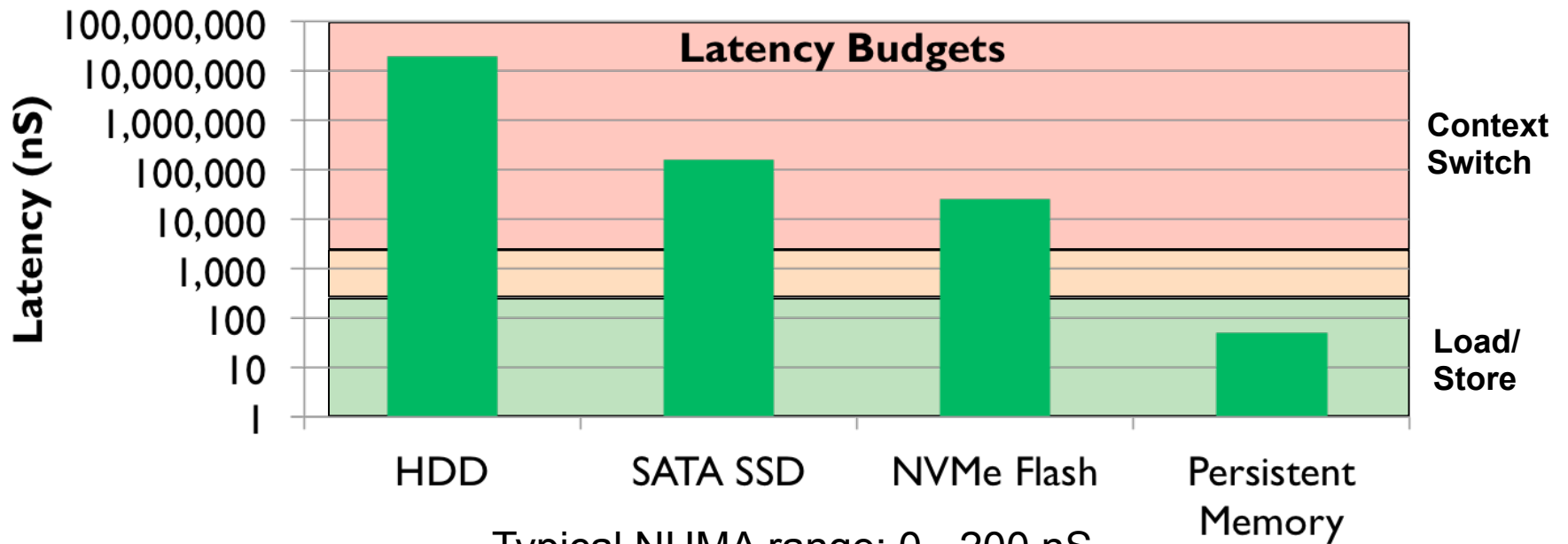


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# How did this PM Effort Start?



# Storage vs. Memory



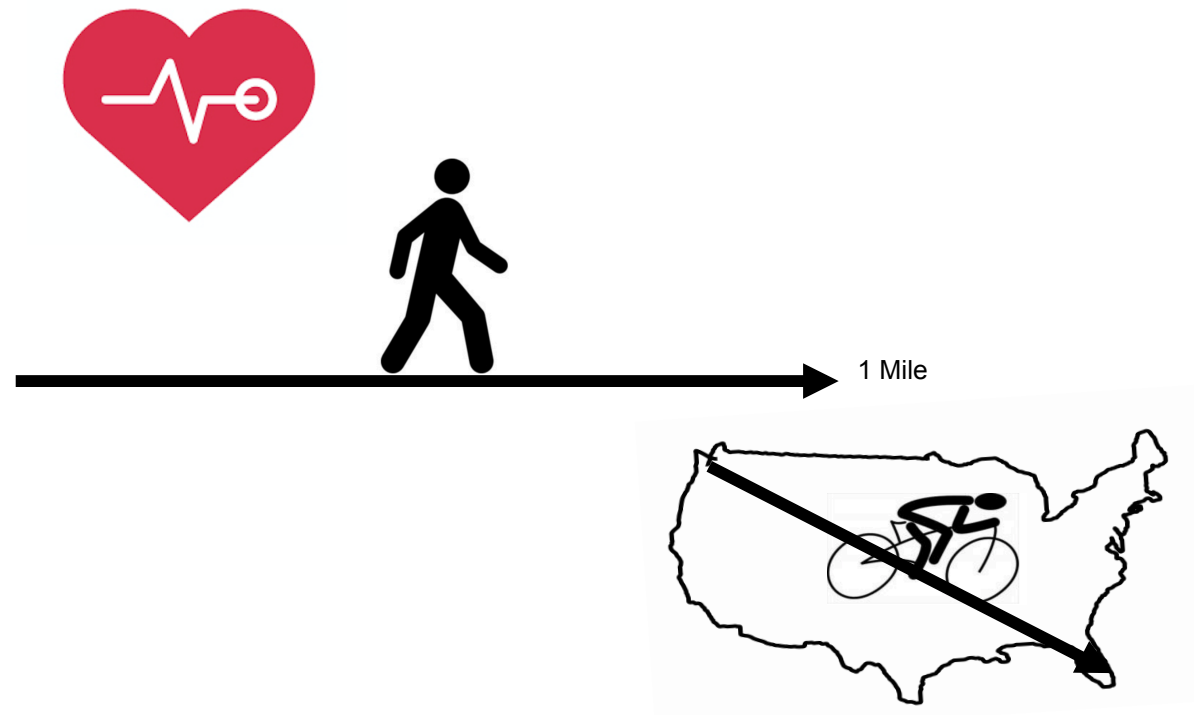
Typical NUMA range: 0 - 200 nS  
 Typical context switch range: above 2-3 uS






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# Relative media speeds

- ▶ Memory (10's ns)
- ▶ SSD (10's us)
- ▶ HDD (10's ms)



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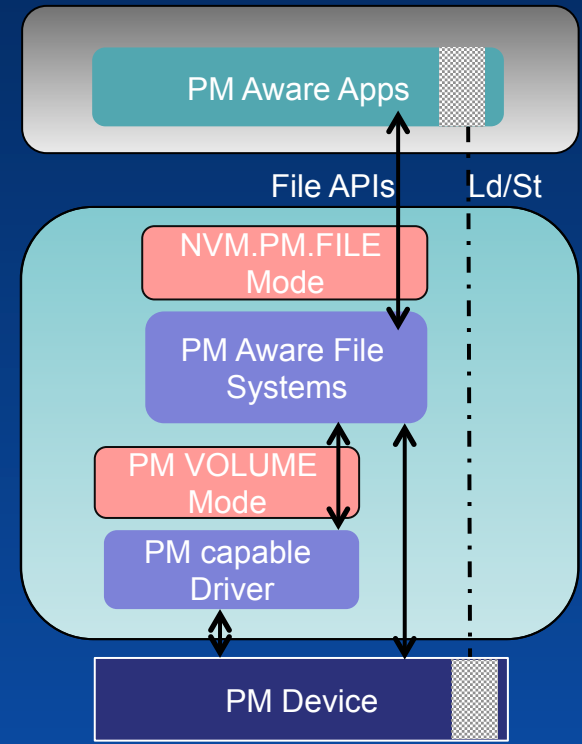
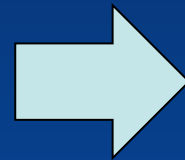
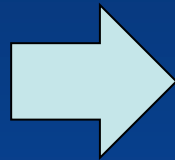


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# SNIA NVM Programming TWG

Formed 06-11-2012

- Dell
- EMC
- Fujitsu
- HP
- Intel
- Netapp
- Oracle
- QLogic





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## Operating System Support “The obvious next focus”

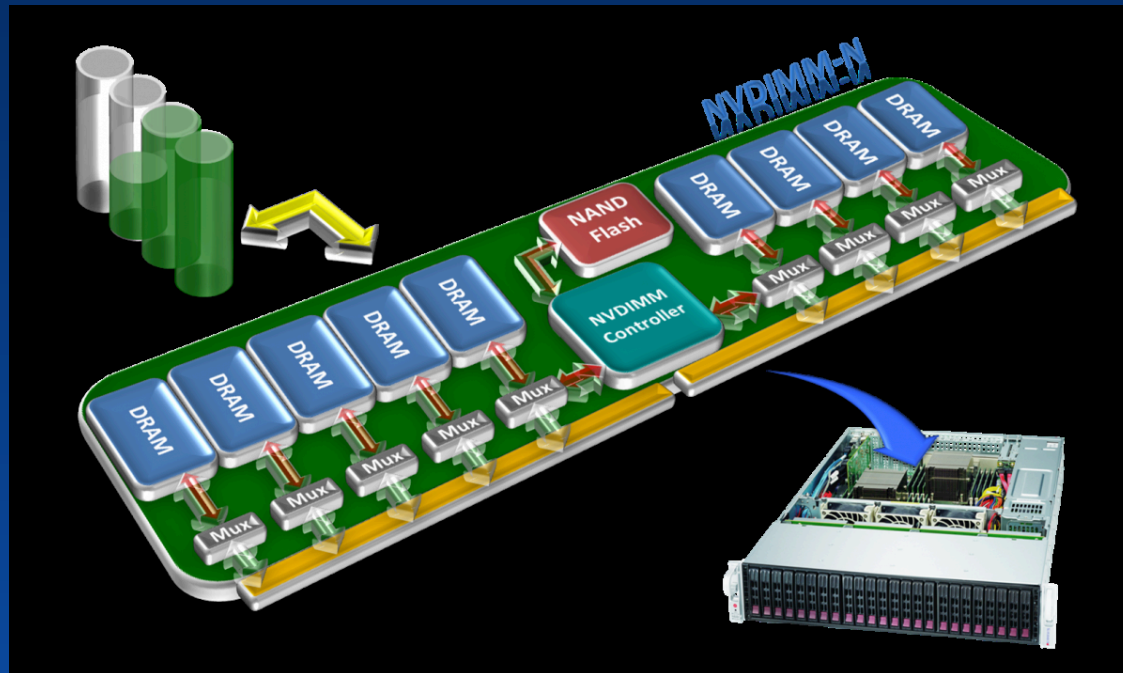
- Both Linux and Microsoft joined the SNIA effort to help steer the direction of PM.
  - Applications have direct Load/Store access to PM
  - End result: Both OS's are structured almost identically (ex: DAX)
- VMWare has also offered support for PM

Persistent Memory support in OS's ahead of volume adoption



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# PM Usage Launch on NVDIMMs!



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## NVDIMMs

- NVDIMMs become the first HW available to run PM Applications.
  - Success stories emerge highlighting the application benefits of PM.
  - Example: “Tail of Log” for SQL Server
- Alliance formed between JEDEC and SNIA to effectively drive adoption of the technology

**NVDIMMs Prove the Benefits of PM**





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# Early PM System Support and Applications



A sample of companies publically showing PM support



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# Persistent Memory What's Next?

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## Native Persistent Memory Media

- Persistent Memory initiative was formed on the expectation of next-generation memory to be successfully launched.
  - In at least one case, we know that next generation PM is sampling to application developers.
  - Significant increase being seen in new application vendors requesting enabling in application development.

**All Indicators suggest Native PM Platforms are Imminent**



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# Remote Persistent Memory

- Remote Persistent Memory (RPM) allows the programming model to extend beyond a single node, to datacenter (or beyond) scalability.
  - RPM is the basis for a relationship between Open Fabrics Alliance (OFA) and SNIA.
  - The first use case (High Availability) defined and spec in progress
  - New usage models are in the queue... example, pooled PM and memory-centric architectures.



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# Persistent Memory Persistent Memory Threat Model

- SNIA has published the Persistent Memory Threat Model
  - In some cases, PM offers advantages... starting fresh without legacy, and with security in mind.
  - Ongoing work to understand any risks, and to make recommendations and requirements to minimize risks, and maximize benefits of PM.

Proactively working on security shows responsible leadership



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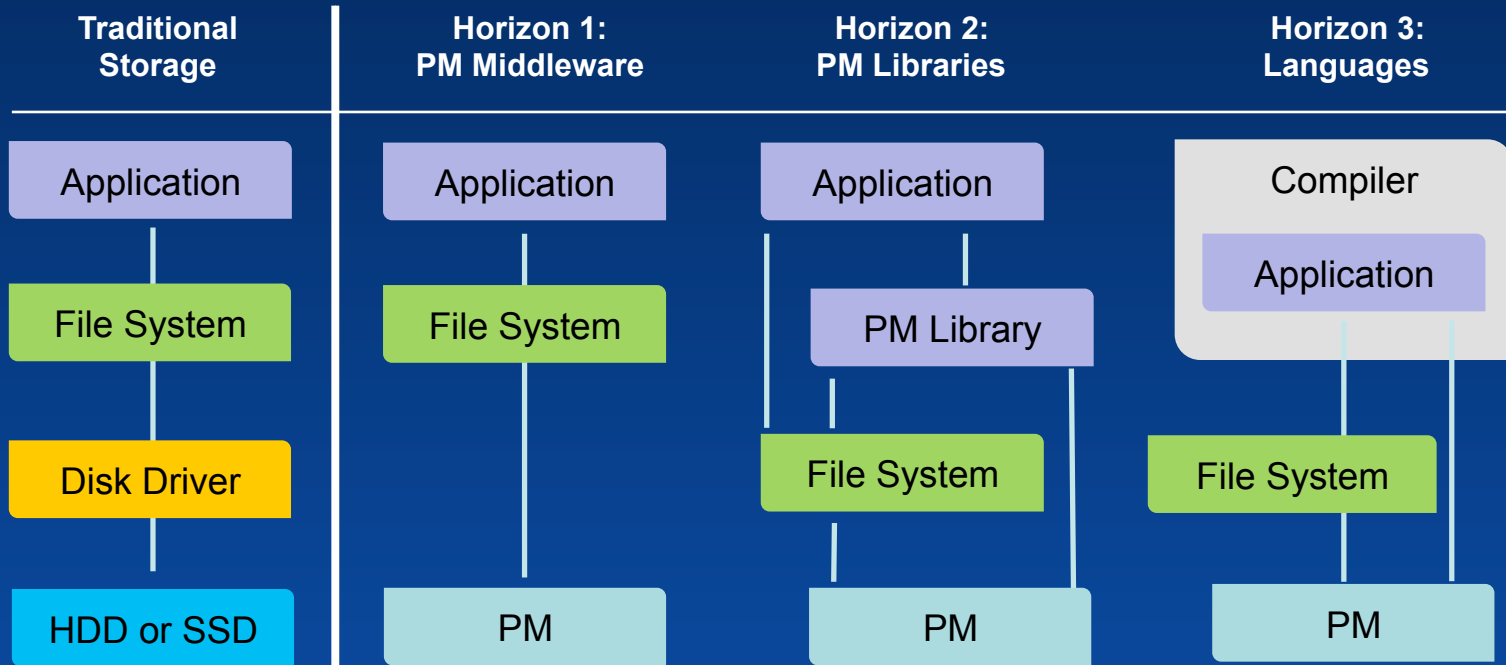
# Persistent Memory Applications

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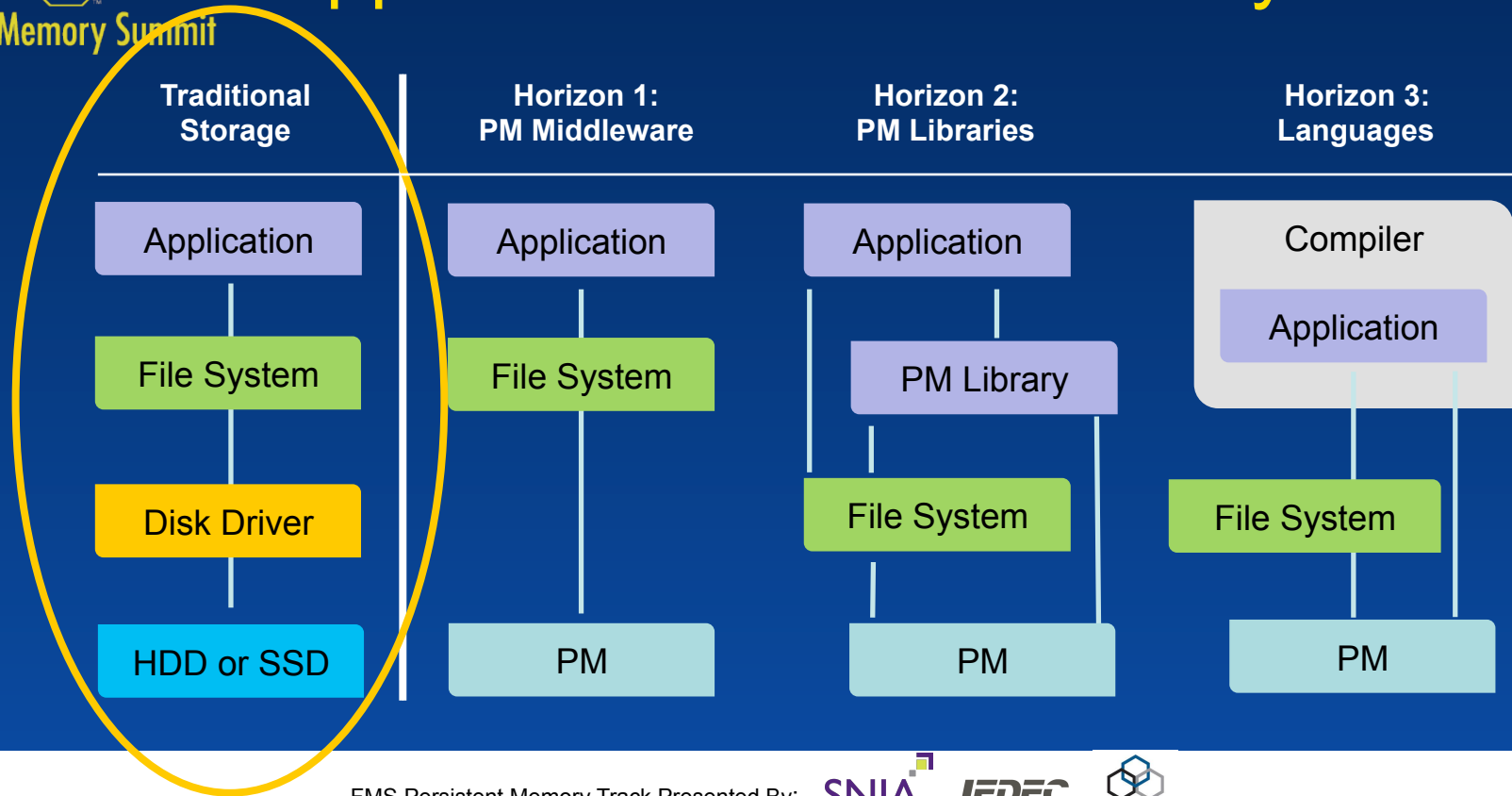
# Application Horizons





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# Application Horizons - Today

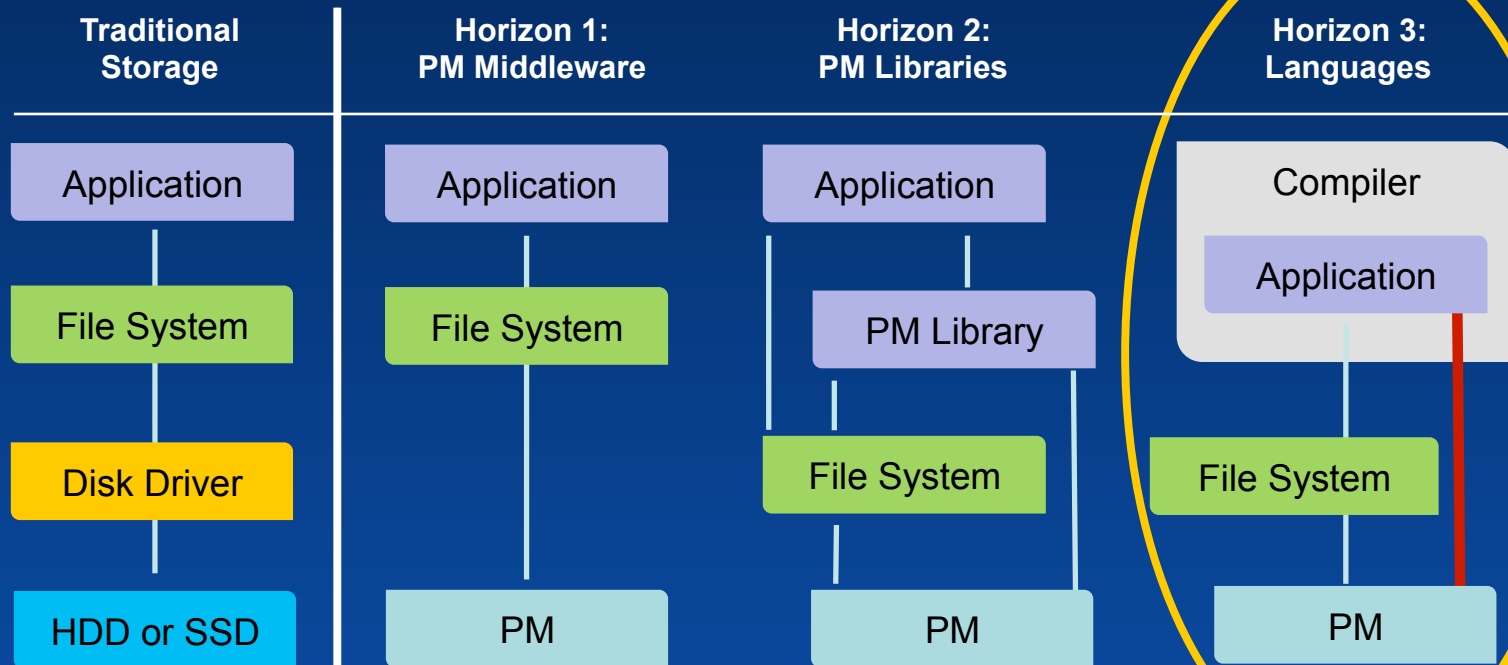






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# Application Horizons – Ultimate Goal





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# Application Development Enabling

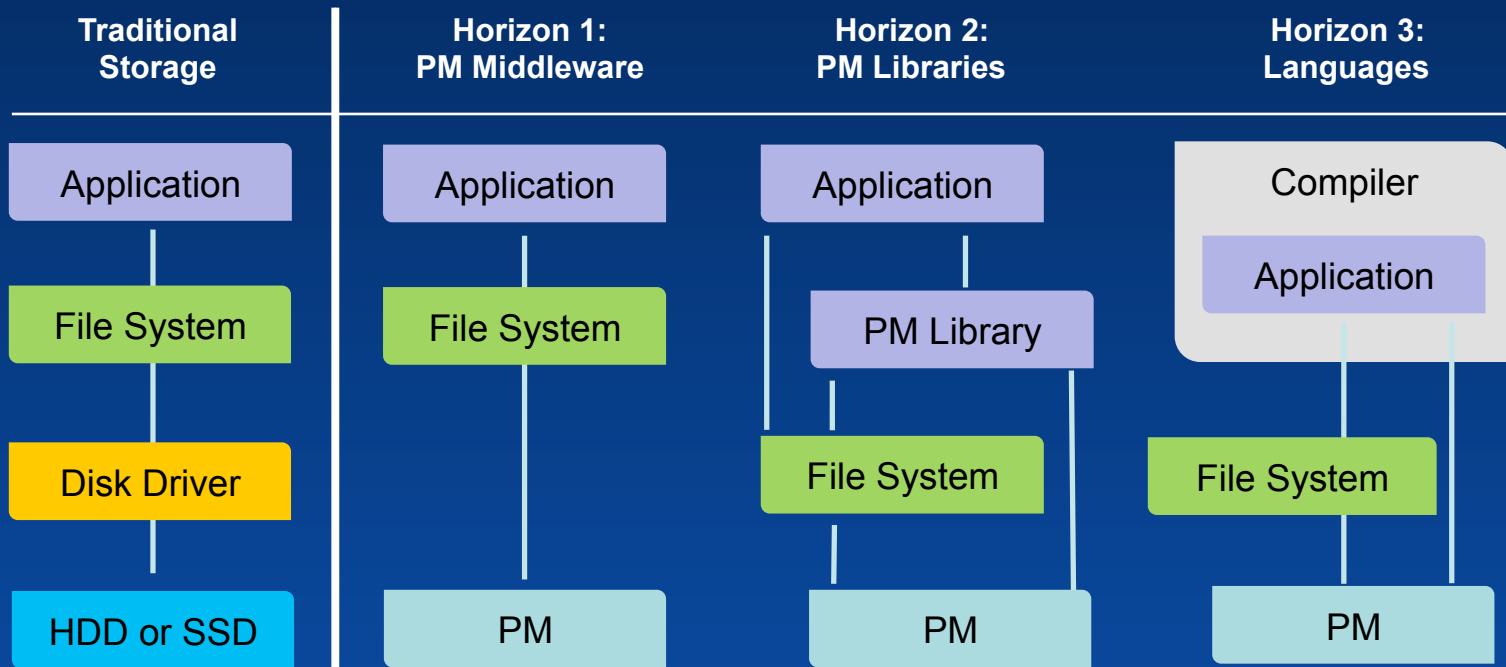
- SNIA PM Application Enabling
  - A program is needed to enable the application development community to build native PM applications
  - Early planning stages... expected program in '19

**Goal: Accelerate Development of PM Applications**



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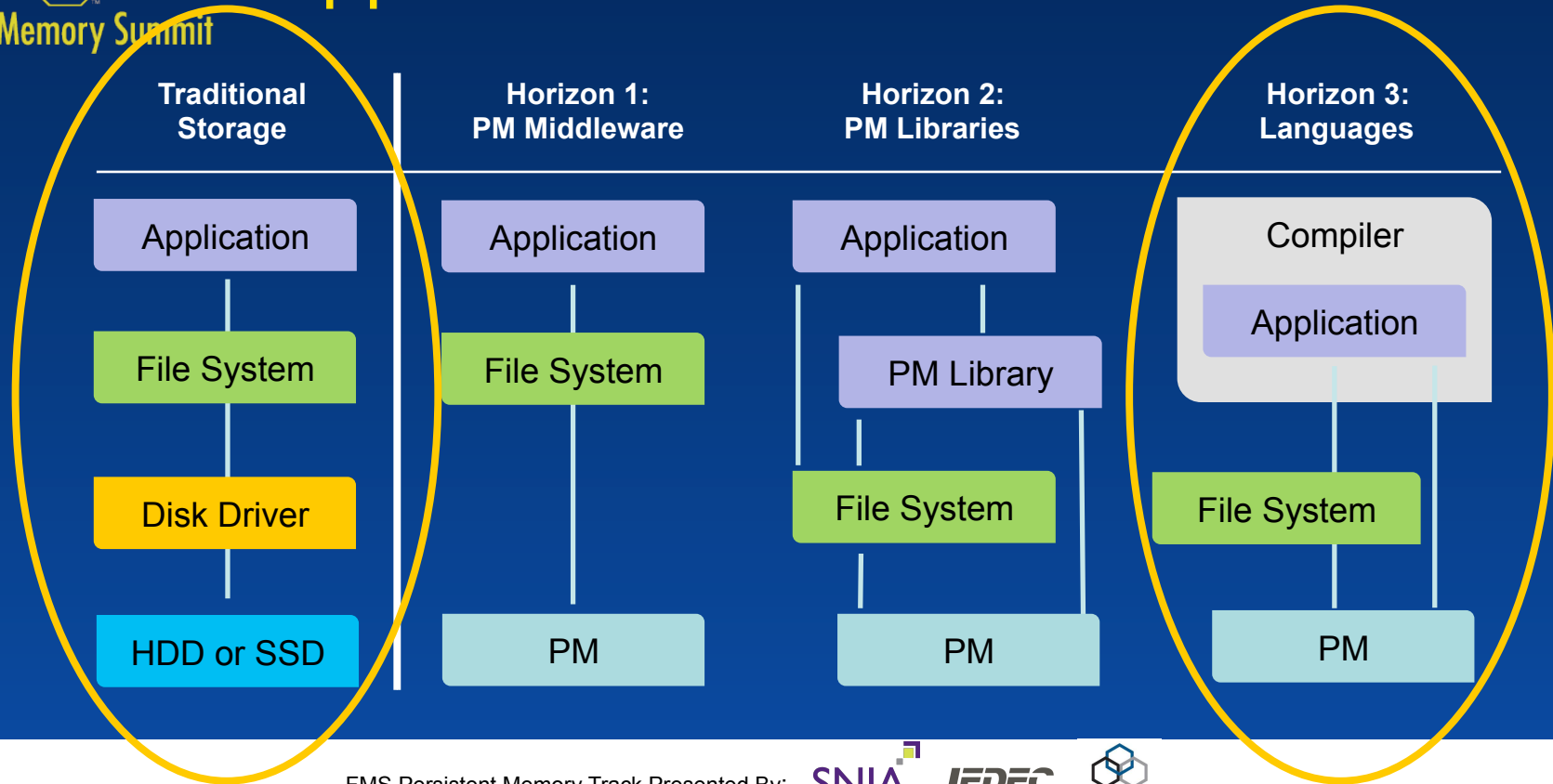
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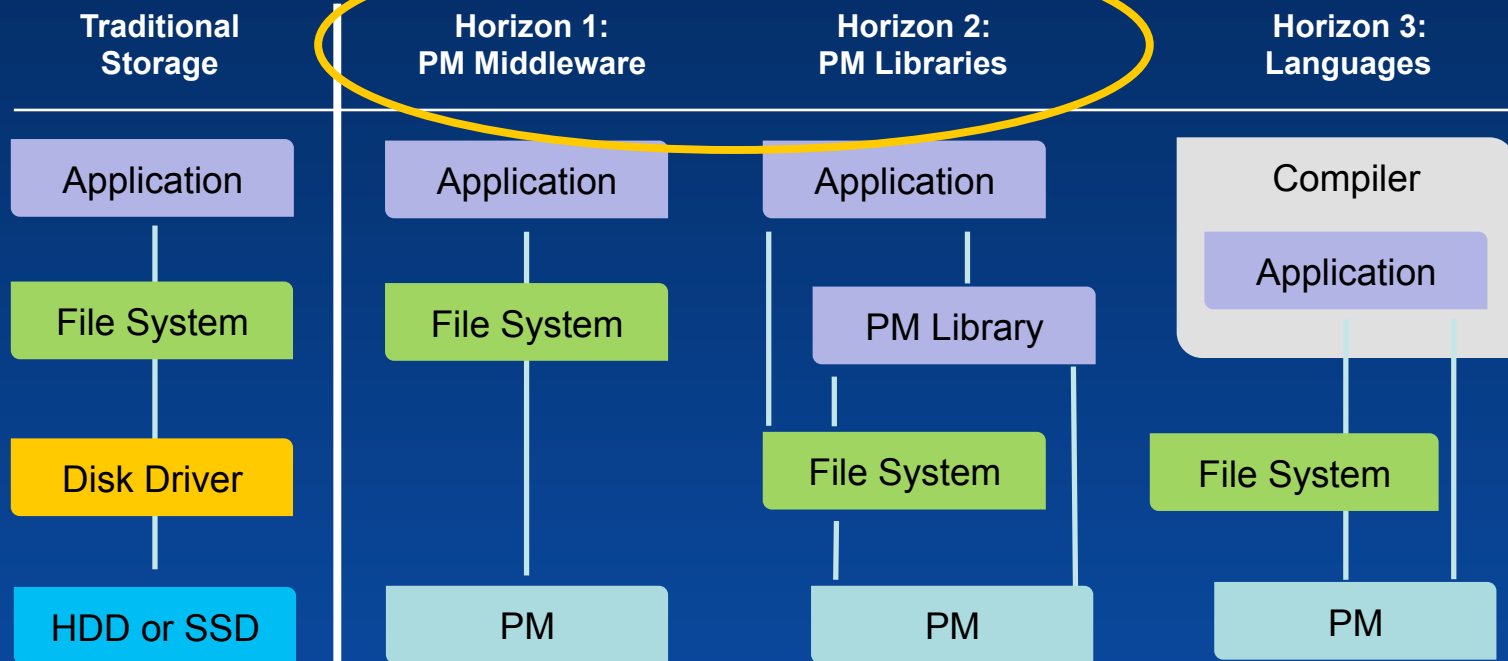
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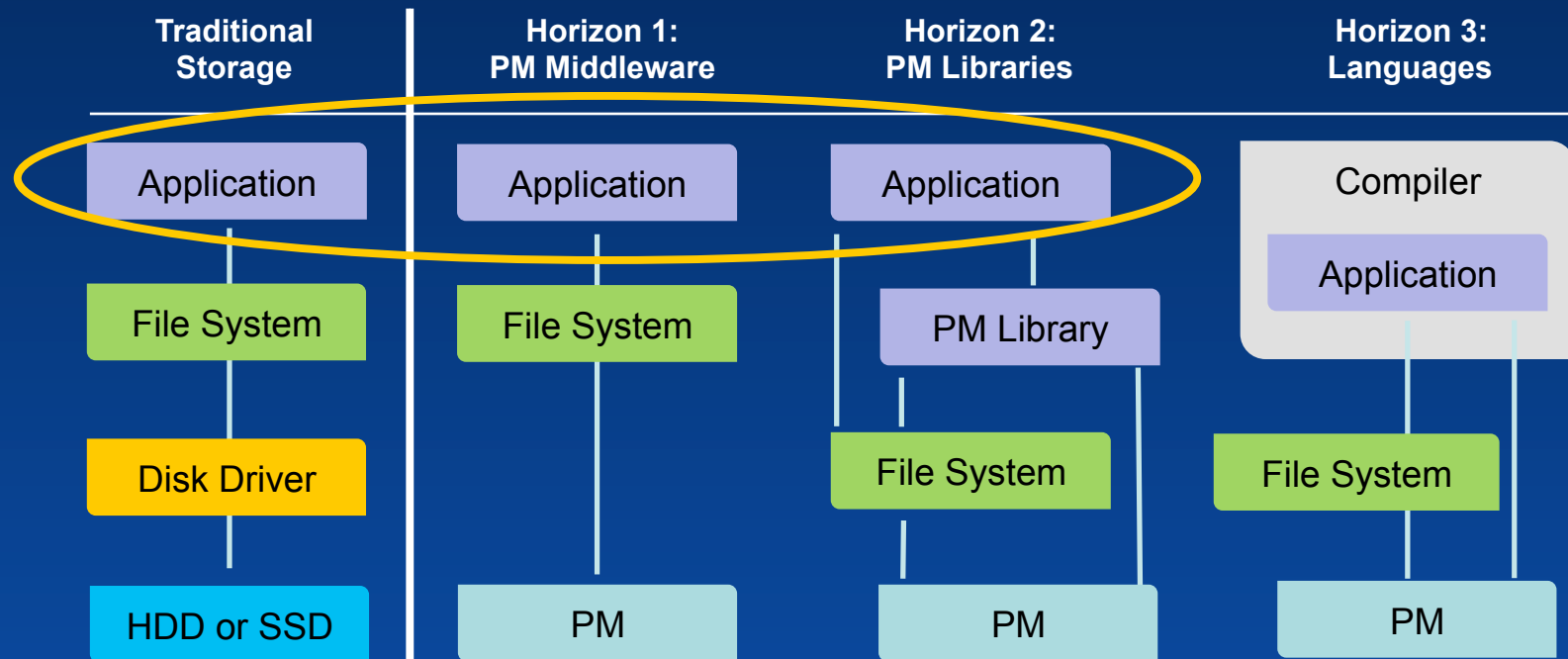
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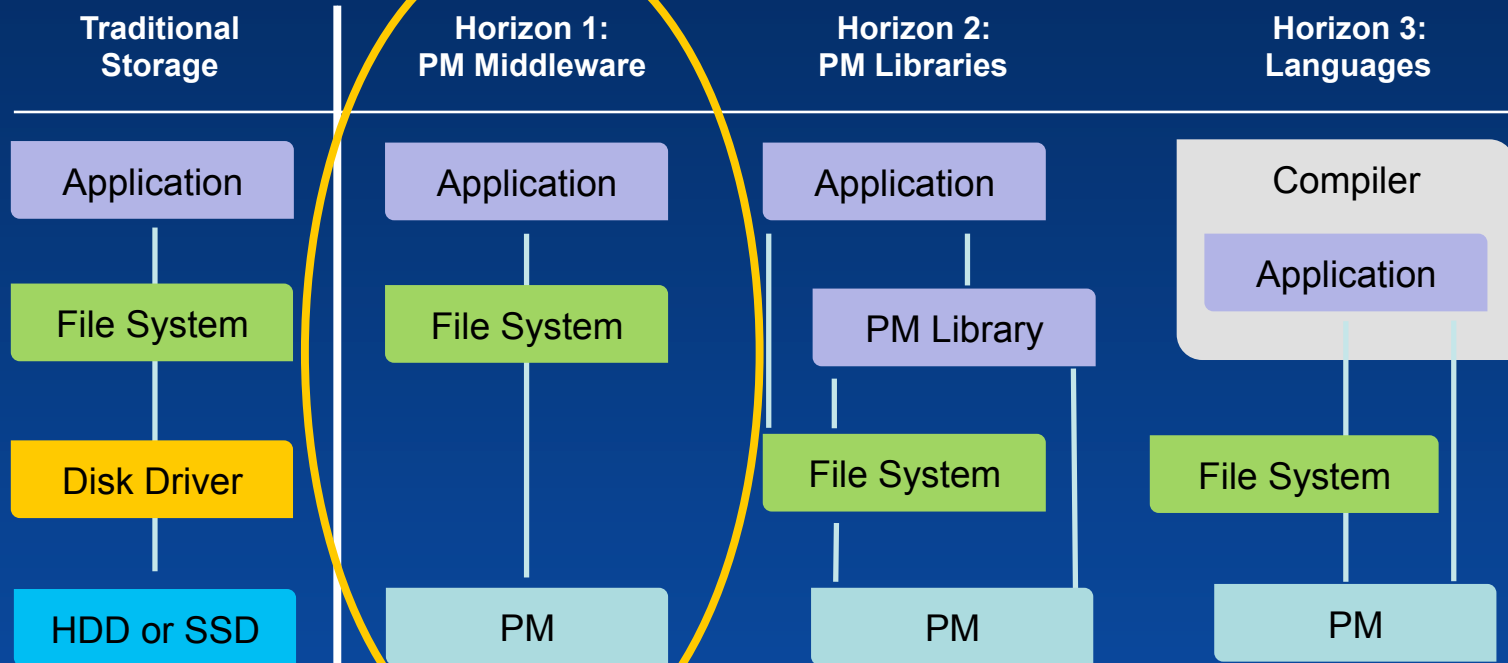
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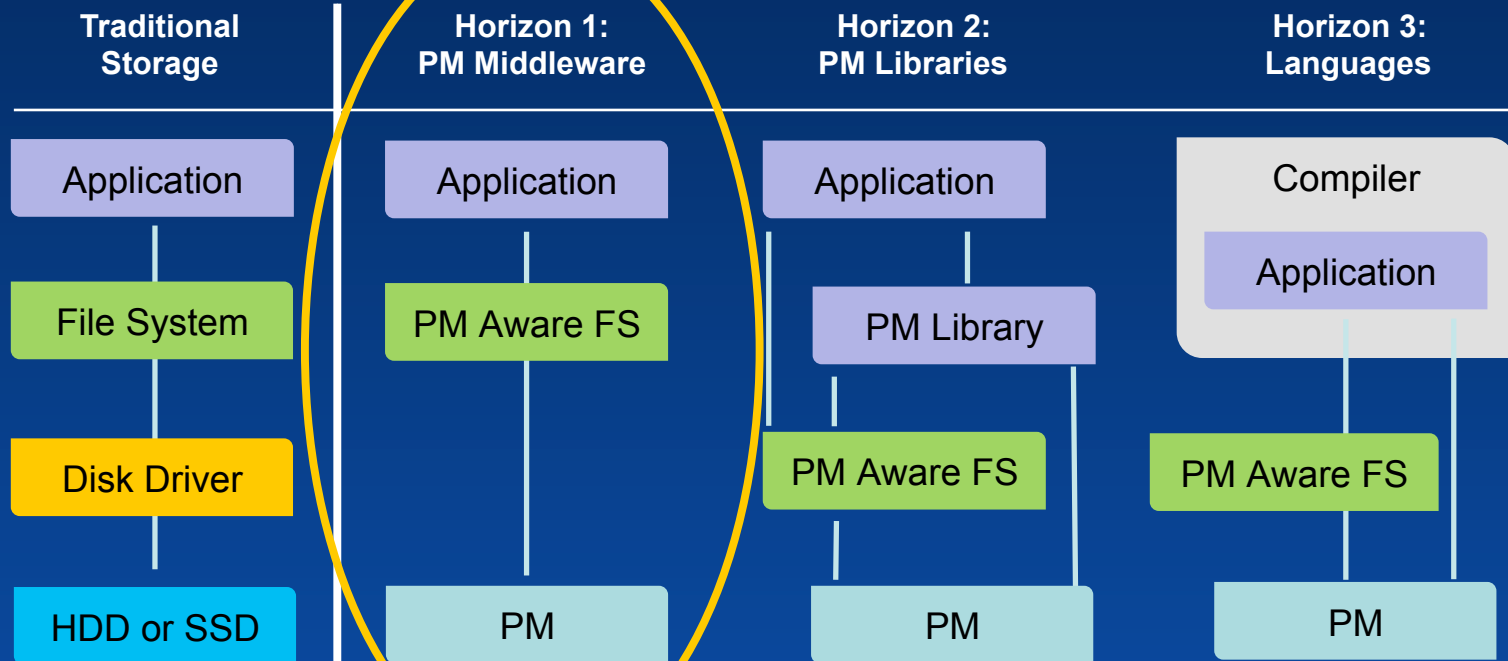


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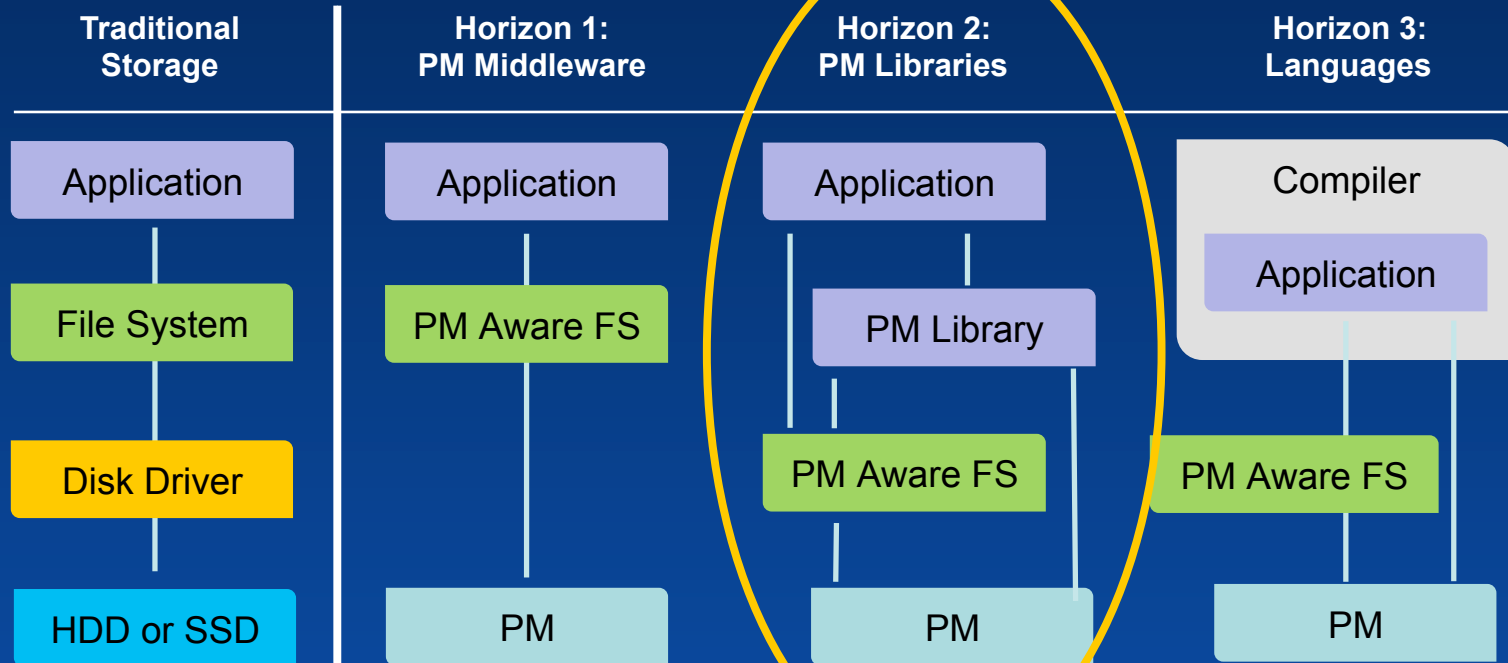
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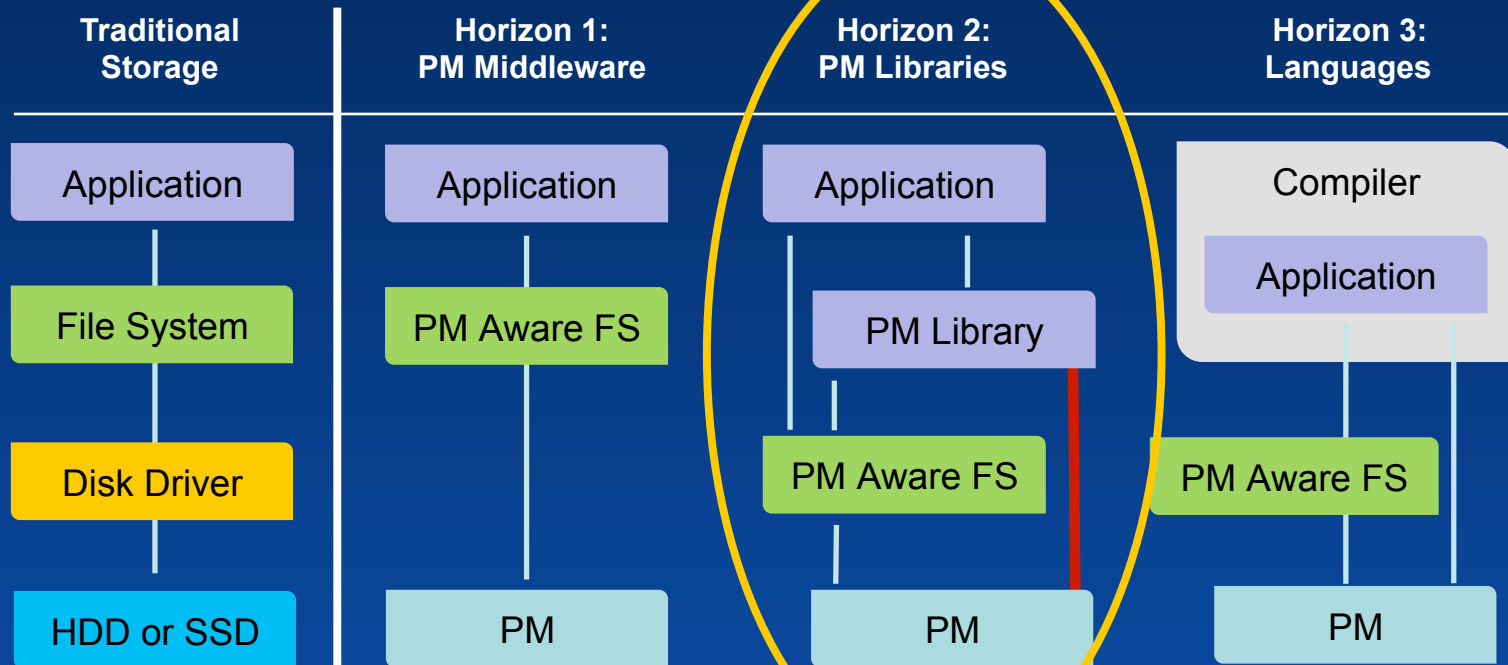
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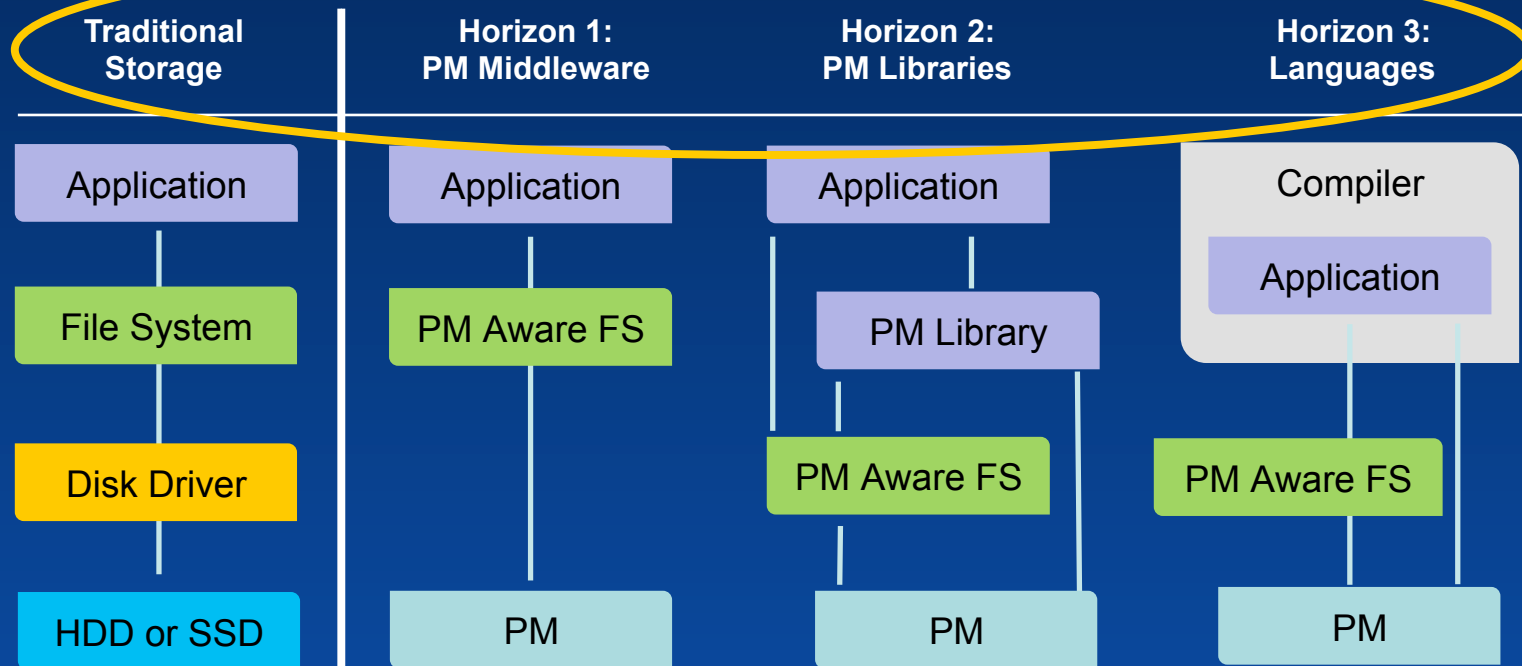
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# Application Horizons





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# Summary

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## Why Persistent Memory Matters *How did we get here, and what lies ahead?*

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## Learn More

- FMS PMEM 101, 102, 201, 202 – (Tues & Wed)
- FMS Experts Table – Beer & Pizza (Tonight 7:00)
- SNIA Storage Developers Conference
  - Sept 24 – 27 (Santa Clara Hyatt)
- SNIA PM Summit
  - January 24, 2019 (Santa Clara Hyatt)
- OFA Annual Workshop
  - March 19-21 2019 (Austin Tx)



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## Get Involved

- SNIA ([www.snia.org](http://www.snia.org))
- JEDEC ([www.jedec.org](http://www.jedec.org))
- OFA ([www.openfabrics.org](http://www.openfabrics.org))



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Thank You

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