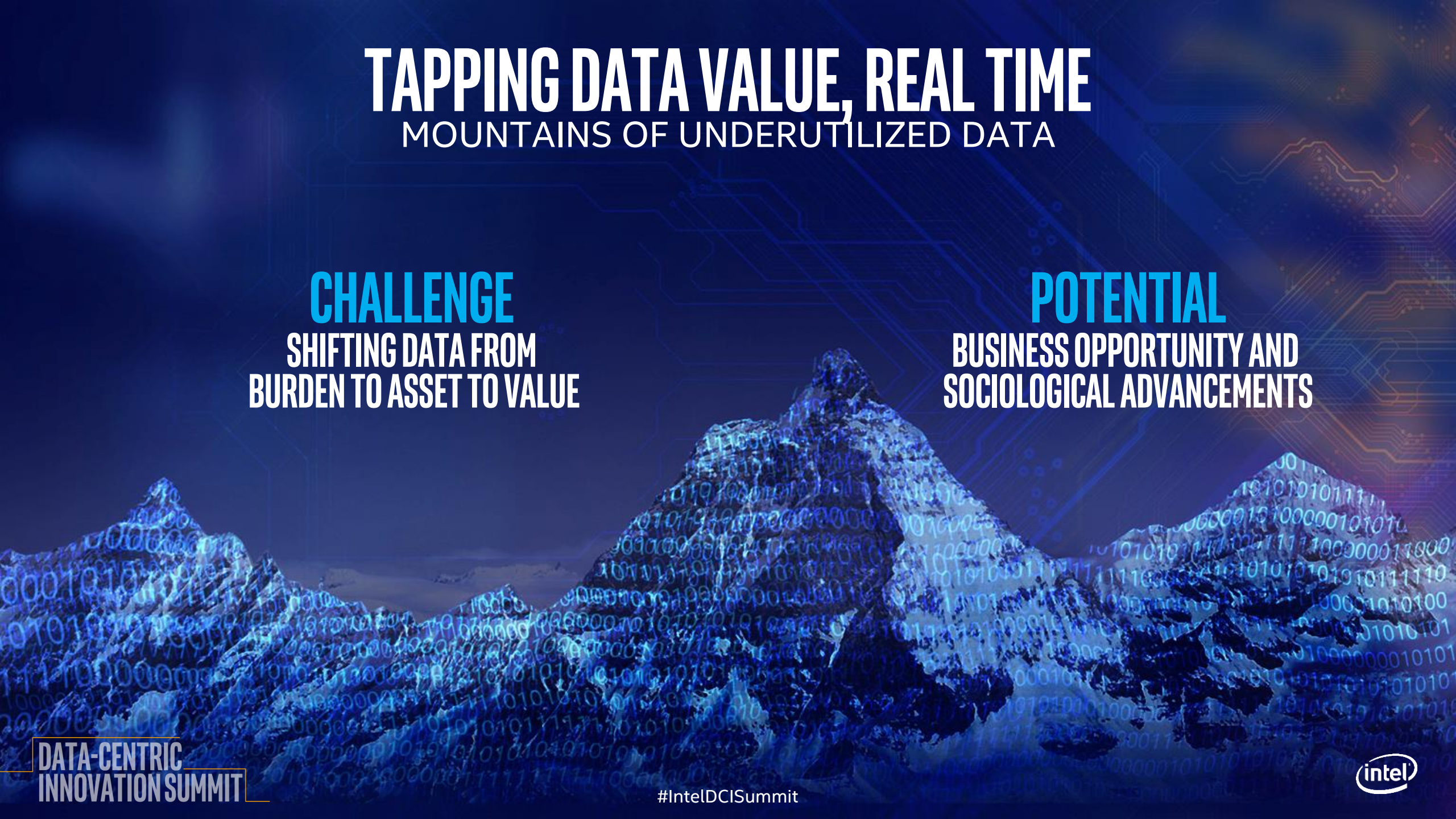
intel
DATA-CENTRIC INNOVATION SUMMIT
DISRUPTING THE STORAGE/MEMORY HIERARCHY
ALPER ILKBAHAR
VICE PRESIDENT & GENERAL MANAGER
MEMORY & STORAGE SOLUTIONS, DATA CENTER GROUP

TAPPING DATA VALUE, REAL TIME

MOUNTAINS OF UNDERUTILIZED DATA



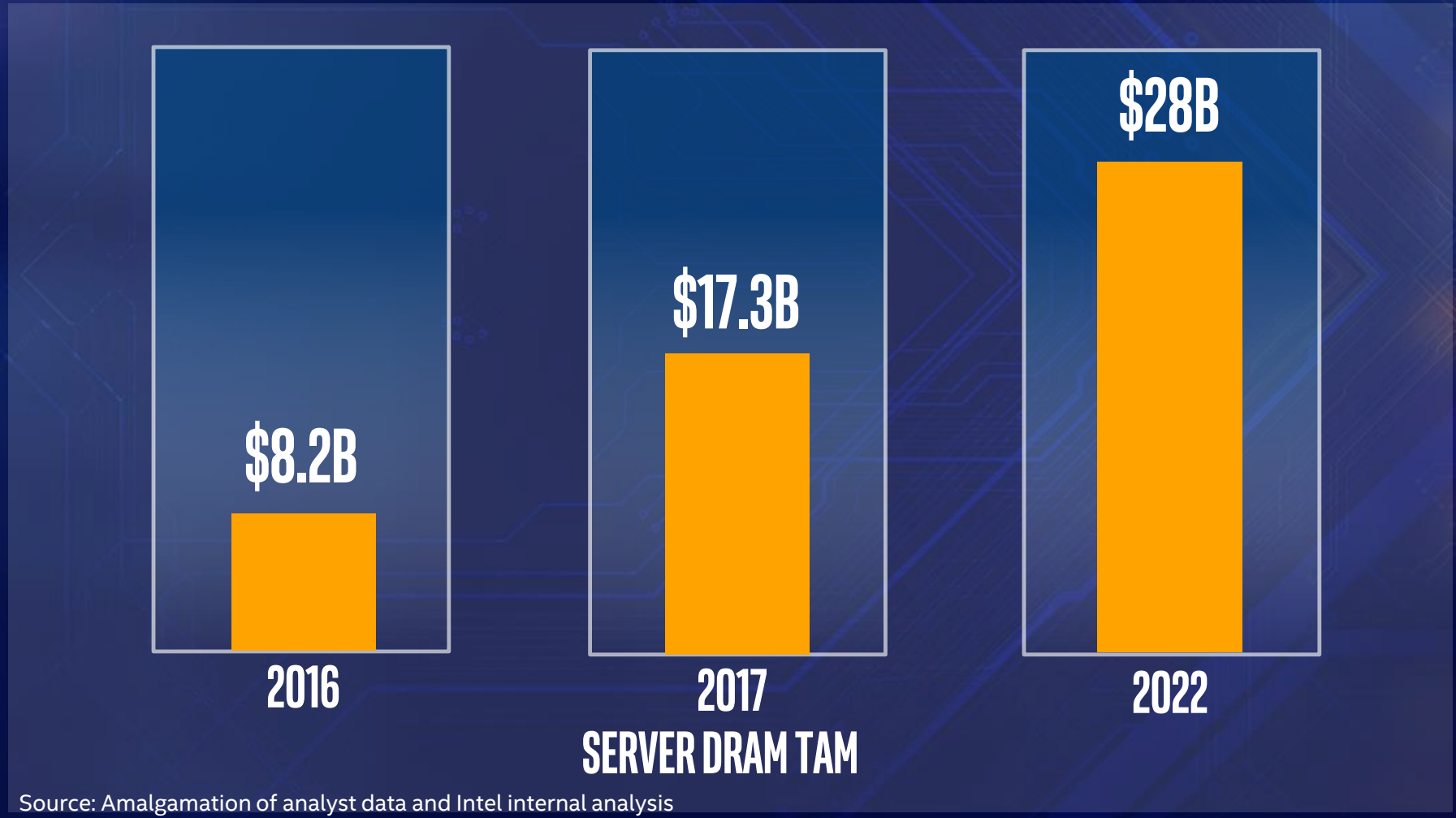
CHALLENGE

SHIFTING DATA FROM
BURDEN TO ASSET TO VALUE

POTENTIAL

BUSINESS OPPORTUNITY AND
SOCIOLOGICAL ADVANCEMENTS

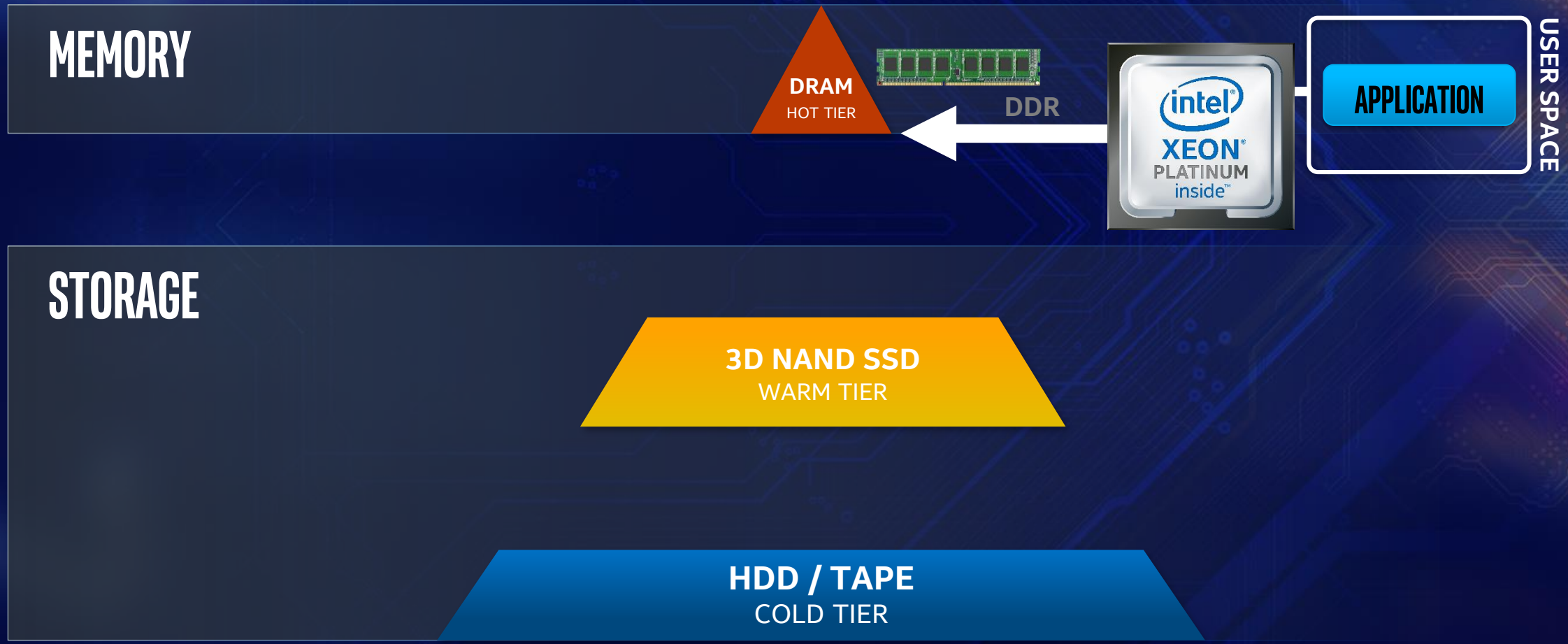
THE INTEL® OPTANE™ DC PERSISTENT MEMORY OPPORTUNITY



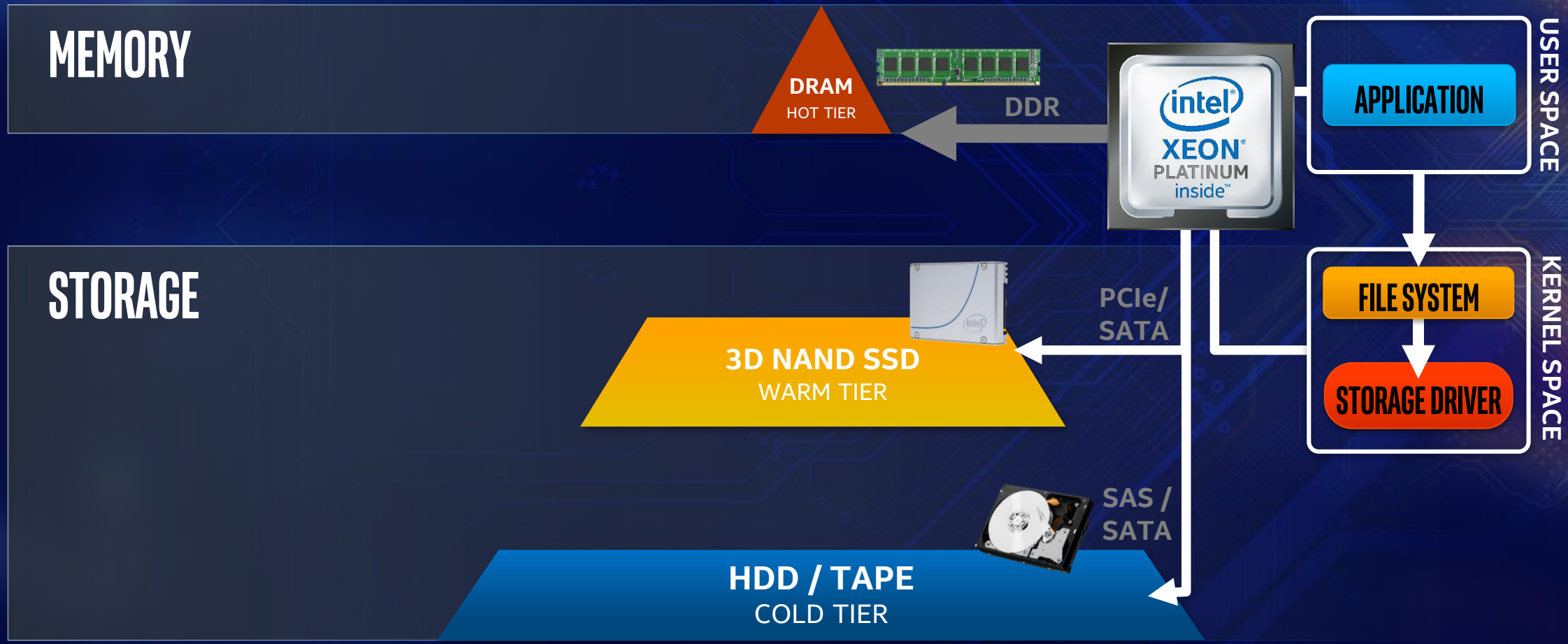
Source: Amalgamation of analyst data and Intel internal analysis

“MIND THE GAPS”

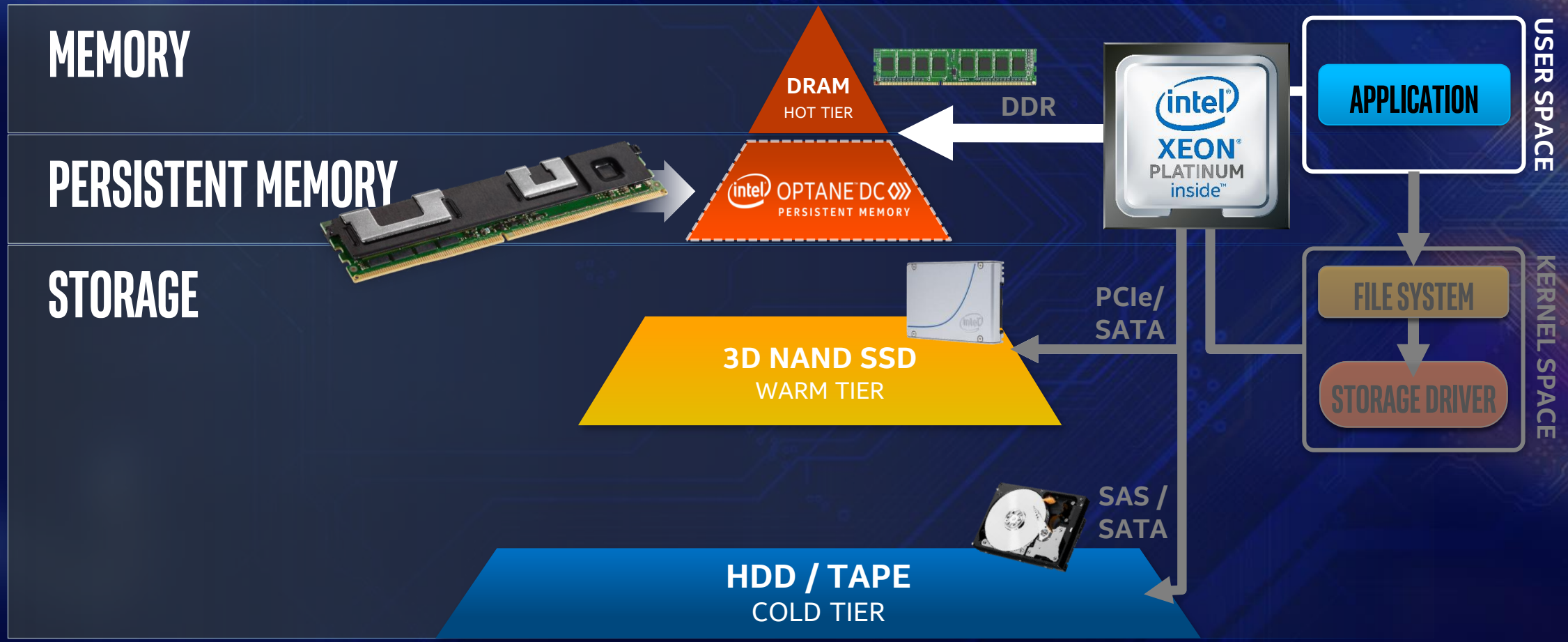
MEMORY PATHWAY



STORAGE PATHWAY



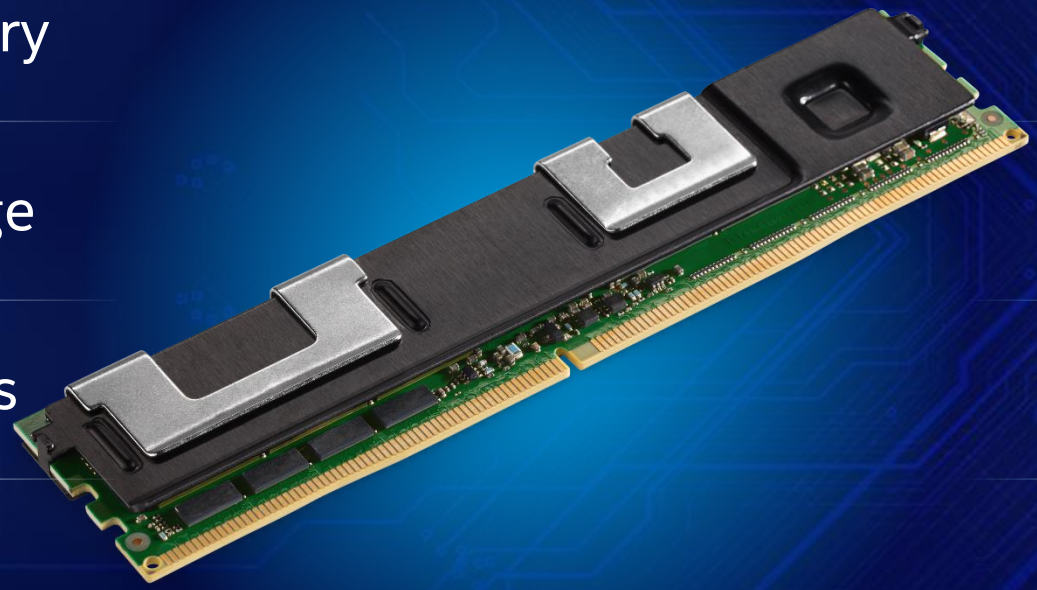
NEW PERSISTENT MEMORY TIER



intel® OPTANE™ DC PERSISTENT MEMORY

intel® XEON® PLATINUM inside™

- Big and Affordable Memory
- High Performance Storage
- Direct Load/Store Access
- Native Persistence



- 128, 256, 512GB
- DDR4 Pin Compatible
- Hardware Encryption
- High Reliability

NOW SHIPPING FOR REVENUE TO SELECT CUSTOMERS

MORE THAN A MEMORY INNOVATION – SYSTEM LEVEL BREAKTHROUGH

SOFTWARE/WORKLOAD
Persistent Memory Programming Model, libraries, Operating Systems, Workload Enablement

DRIVERS
Hardware Support

OPERATING SYSTEM/VIRTUALIZATION
Functional Updates and Optimizations

PLATFORM INTEGRATION
Firmware/BIOS, motherboard design updates

INTEL® OPTANE™ DC PERSISTENT MEMORY
Memory media, media management, module design

+

INTEL® XEON® SCALABLE PROCESSOR
CPU Architecture, Memory controller design for PM

intel® OPTANE™ DC PERSISTENT MEMORY

https://builders.intel.com/persistent-memory-developer-challenge

FASTER INSIGHTS FROM ANALYTICS

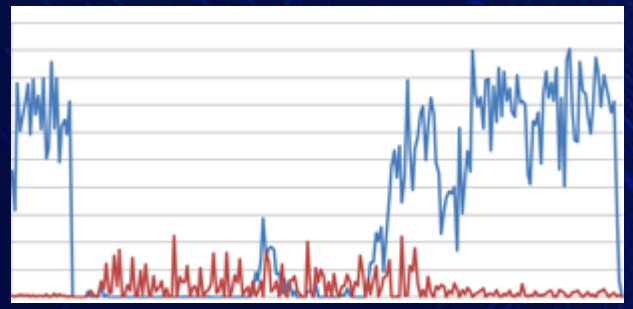
DRAM + intel OPTANE™ DC PERSISTENT MEMORY

Run queries
Mean = 147sec

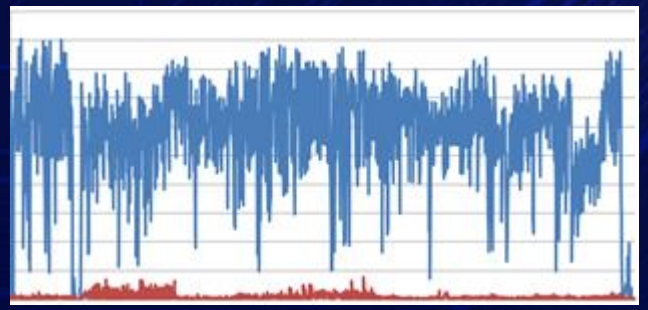
DRAM with storage

Run queries
Mean = 1222sec

Disk bandwidth



Write Bandwidth
Read Bandwidth



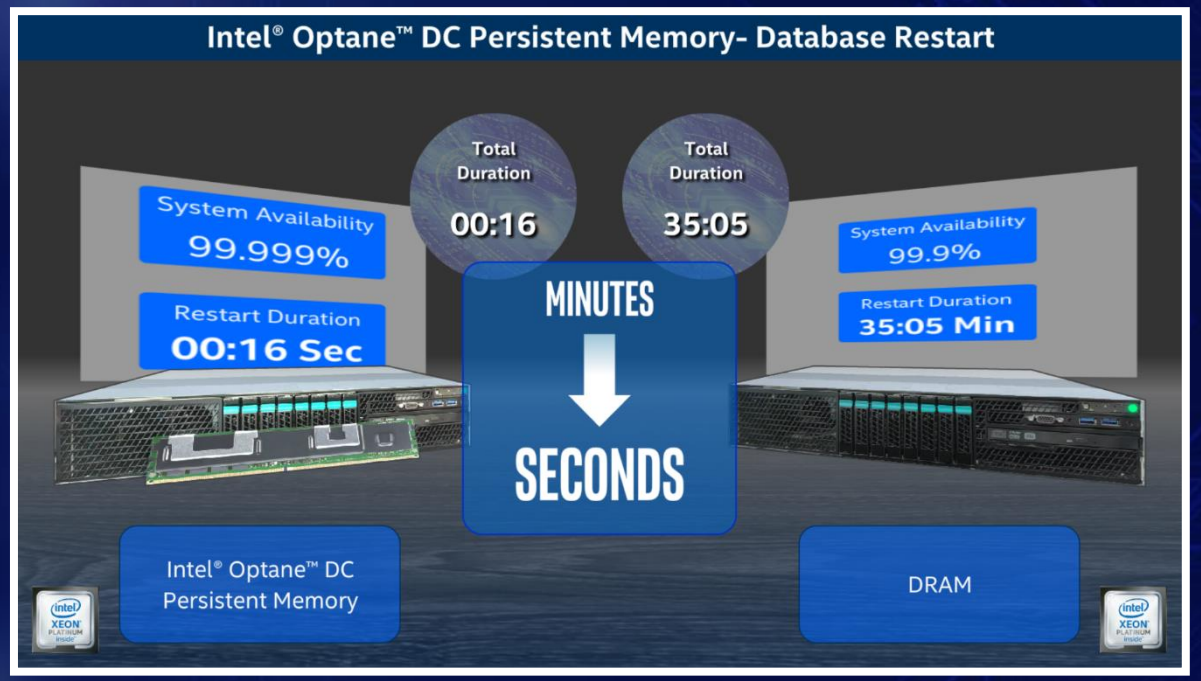
8X

IMPROVEMENT IN
Apache Spark* sql
IO Intensive Queries
FOR ANALYTICS[1]

APACHE Spark™ databricks

Performance results are based on testing as of August 02, 2018 and may not reflect all publicly available security updates.
Results have been estimated based on tests conducted on pre-production systems running OAP with 2.6TB scale factor on IO intensive queries, and provided to you for informational purposes. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more information go to www.intel.com/benchmarks.

FAST RESTART WITH PERSISTENCE



FASTER IMDB START TIME

THREE 9S

FIVE 9S

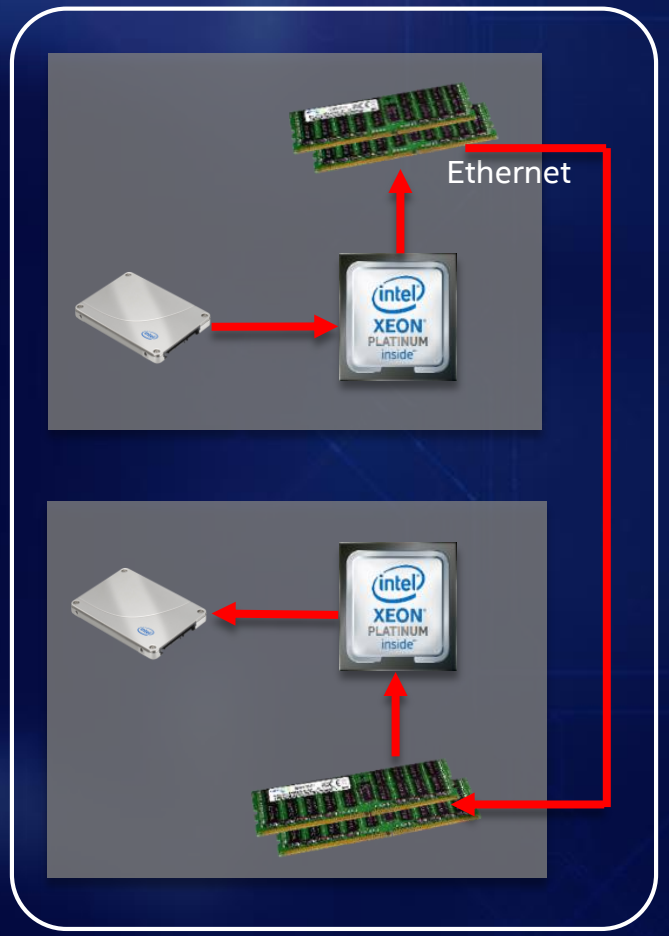
BETTER AVAILABILITY

vs. traditional system with DRAM and storage[1]

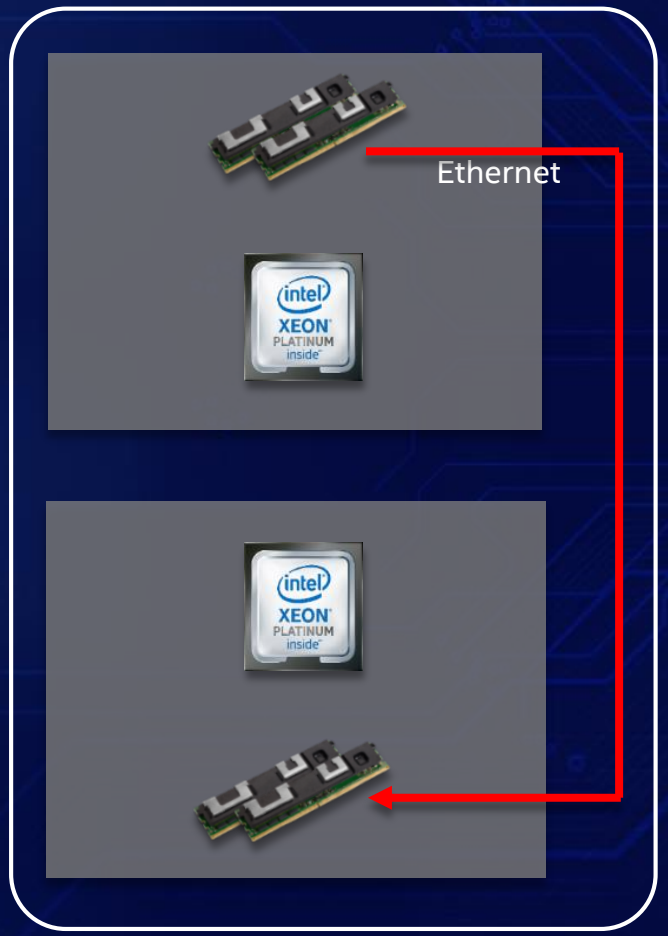
Performance results are based on testing as of July 31, 2018 and may not reflect all publicly available security updates. No product can be absolutely secure.
Results have been estimated based on tests conducted on pre-production systems running Aerospike noSQL, and provided to you for informational purposes. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more information go to www.intel.com/benchmarks.

DATA REPLICATION WITH PERSISTENT MEMORY

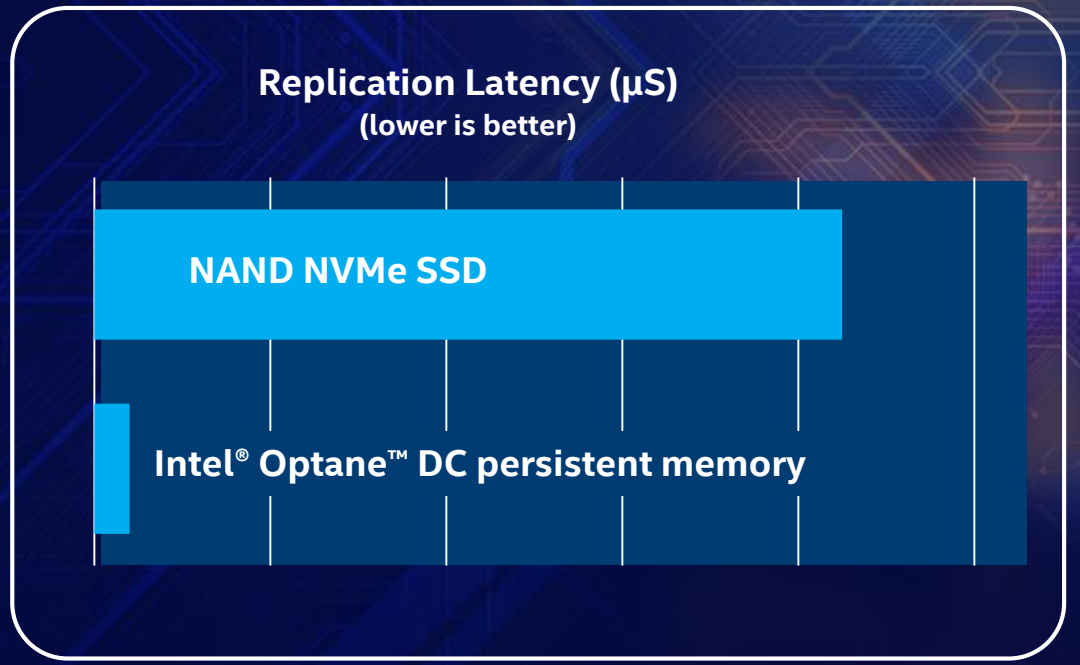
TRADITIONAL REPLICATION



USING PERSISTENT MEMORY



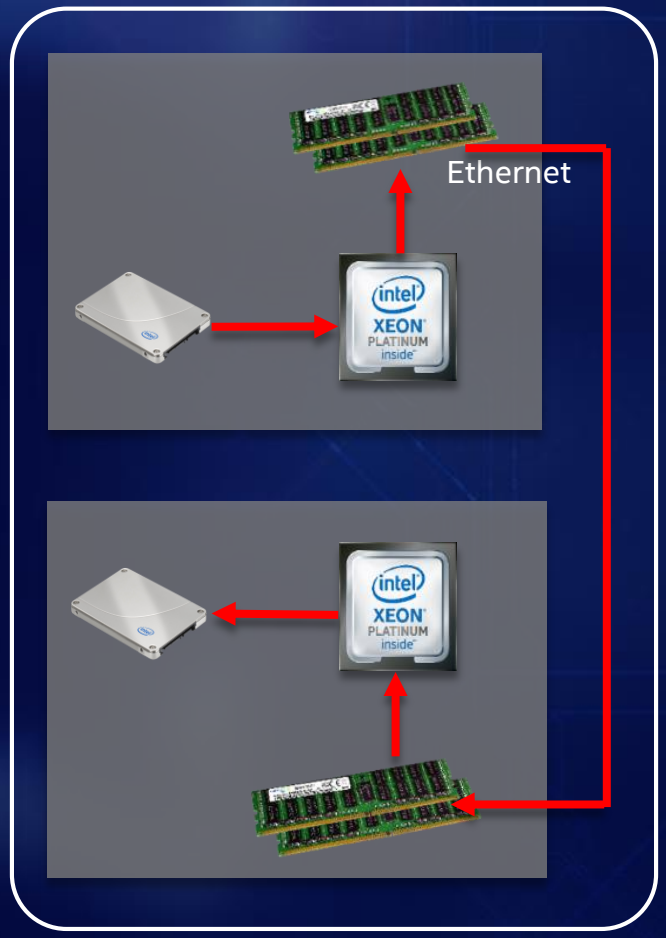
14X Lower latency



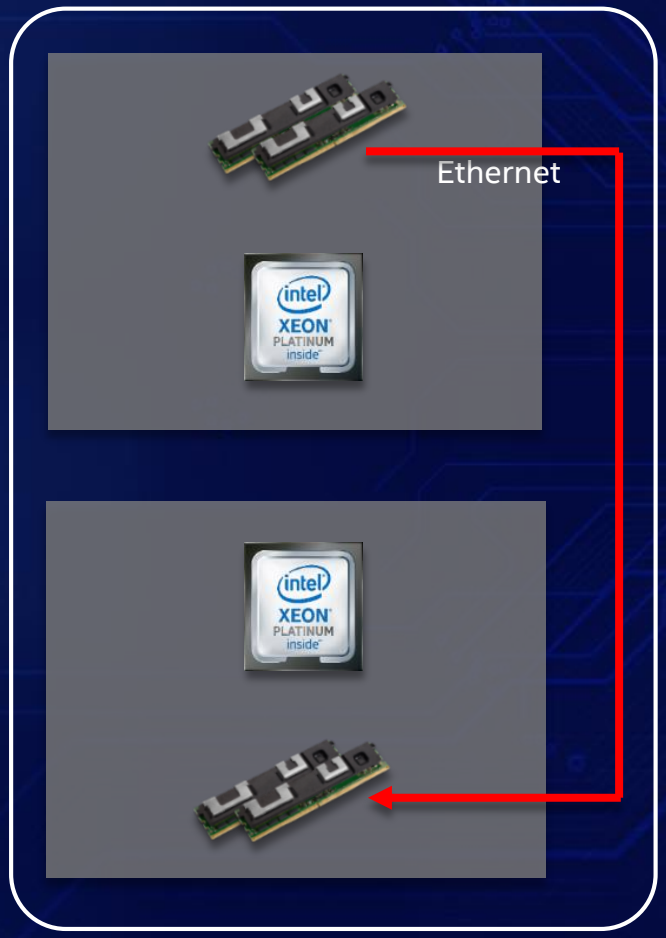
Performance results are based on testing as of Aug 01, 2018 and may not reflect all publicly available security updates.. No product can be absolutely secure.
Results have been estimated based on tests conducted on pre-production systems with DRBD and RDMA, and provided to you for informational purposes. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more information go to www.intel.com/benchmarks.

DATA REPLICATION WITH PERSISTENT MEMORY

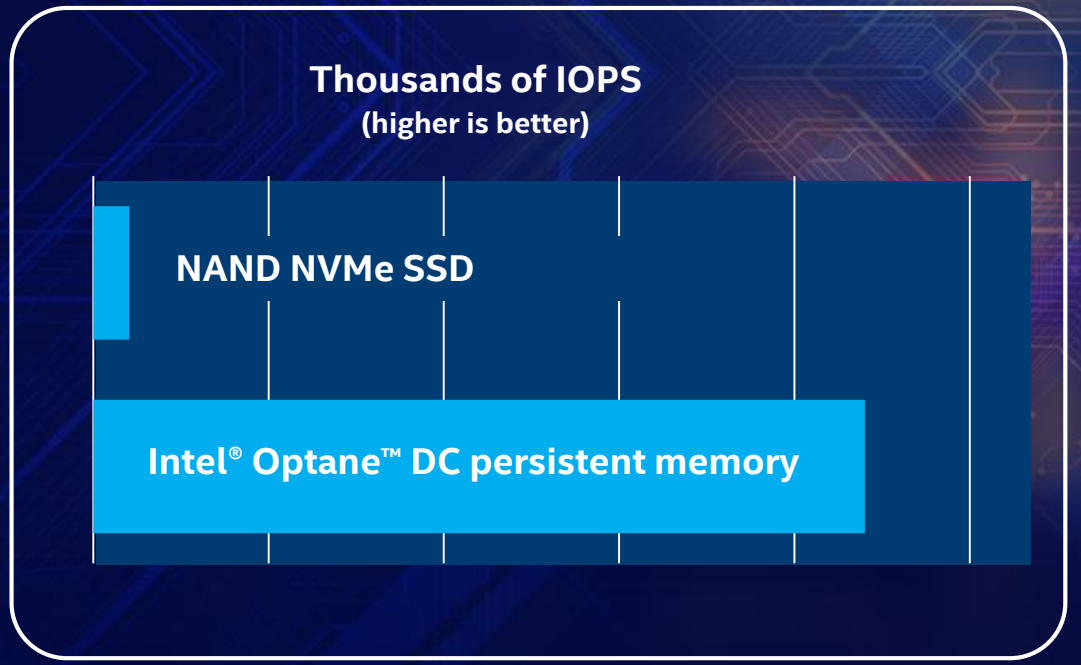
TRADITIONAL REPLICATION



USING PERSISTENT MEMORY

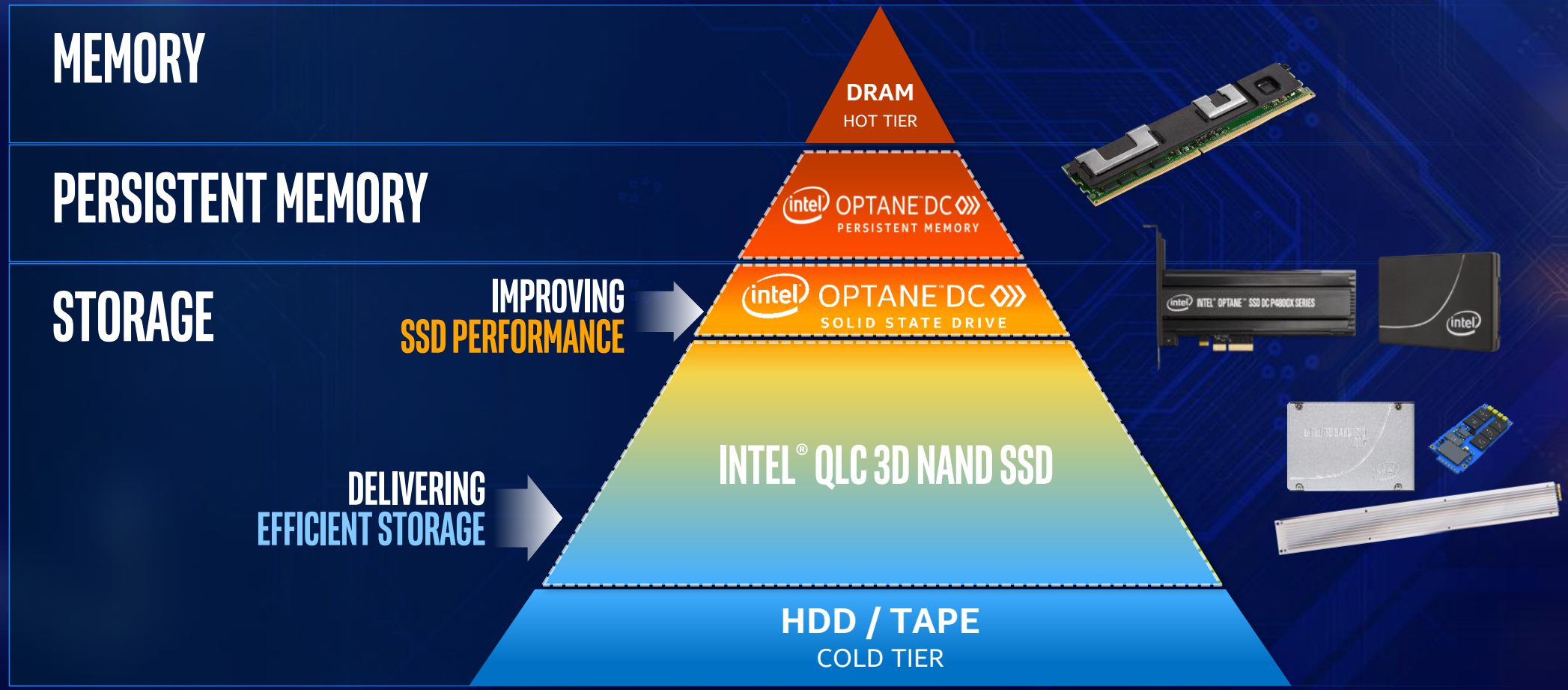


14X Improvement in IOPs



Performance results are based on testing as of Aug 01, 2018 and may not reflect all publicly available security updates.. No product can be absolutely secure.
Results have been estimated based on tests conducted on pre-production systems with DRBD and RDMA, and provided to you for informational purposes. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more information go to www.intel.com/benchmarks.

REARCHITECTING THE MEMORY/STORAGE HIERARCHY



REARCHITECTING THE MEMORY/STORAGE HIERARCHY

MEMORY

PERSISTENT MEMORY

STORAGE

DRAM
HOT TIER

intel OPTANE DC PERSISTENT MEMORY

intel OPTANE DC SOLID STATE DRIVE

INTEL® QLC 3D NAND SSD

HDD / TAPE
COLD TIER

IMPROVING
SSD PERFORMANCE

DELIVERING
EFFICIENT STORAGE

TODAY AT FLASH MEMORY SUMMIT:

Intel® Optane™ SSD DC P4800X Up To **60** DWPD

INTEL® SSD D5-P4320 AT TENCENT

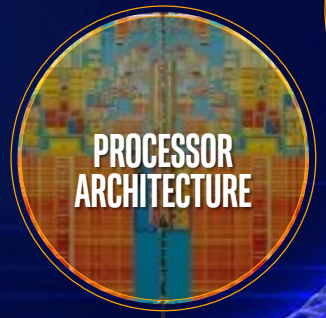
"Tencent started deployment of Intel® SSD D5-P4320 series in our Content Delivery Network, which enabled us to dramatically improve scalability and customer service. We are looking forward to broad ramping of these 1st to market PCIe QLC SSDs. This enabled Tencent to..."

"...INCREASE CUSTOMER SERVED PER SYSTEM BY 10X..."

"...INCREASED THE QUALITY OF SERVICE BY 300%..."

Tencent Cloud

SUMMITING THE DATA-CENTRIC MOUNTAIN



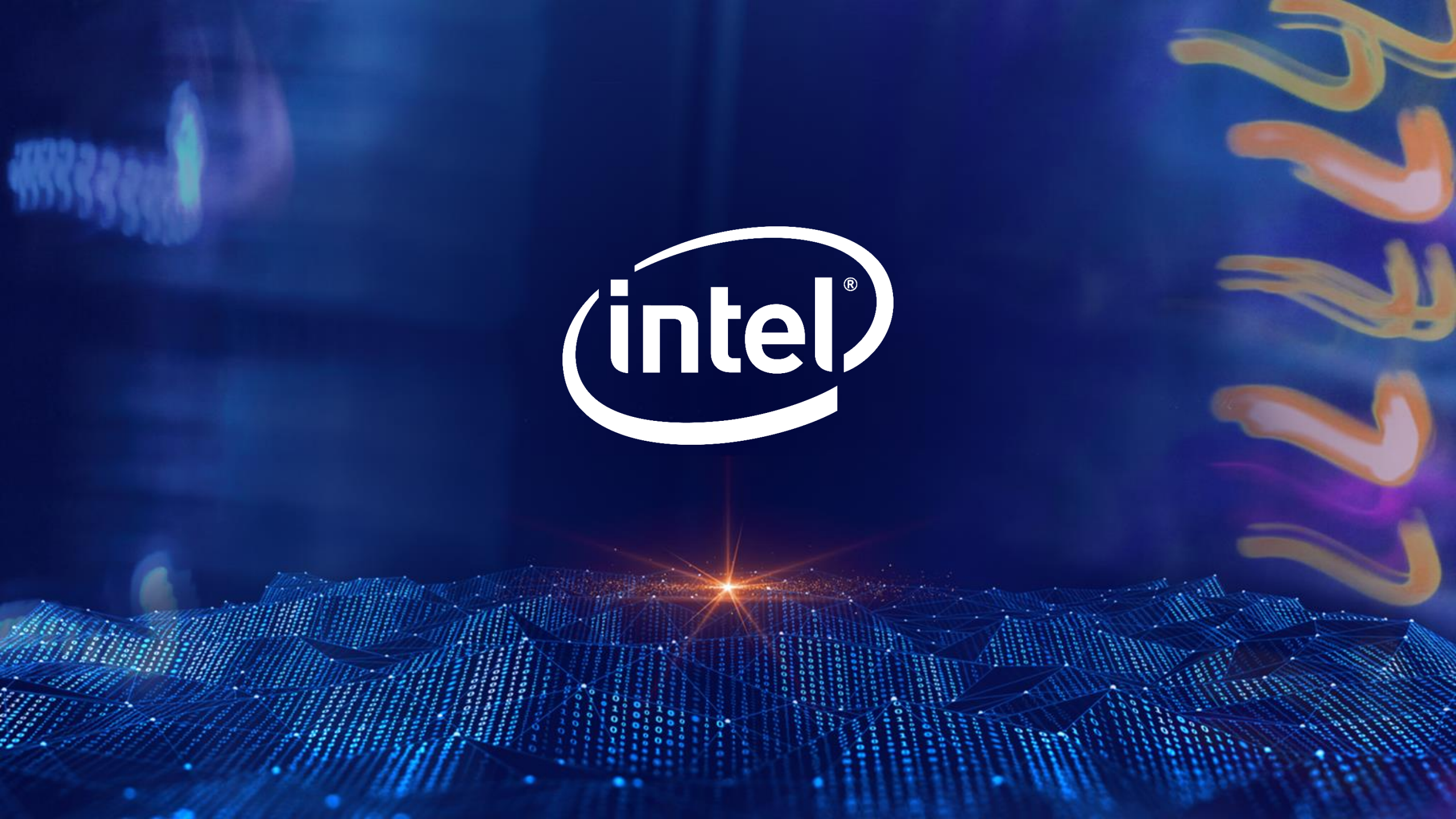
SUMMARY

intel OPTANE™ DC PERSISTENT MEMORY

FIRST TO DELIVER BIG, PERSISTENT, AFFORDABLE MEMORY

CATALYST FOR INTEL® XEON ® SCALABLE PLATFORM GROWTH

Q&A


intel

DISCLOSURES

Statements in this presentation that refer to business outlook, future plans and expectations are forward-looking statements that involve a number of risks and uncertainties. Words such as "anticipates," "expects," "intends," "goals," "plans," "believes," "seeks," "estimates," "continues," "may," "will," “would,” "should," “could,” and variations of such words and similar expressions are intended to identify such forward-looking statements. Statements that refer to or are based on projections, uncertain events or assumptions also identify forward-looking statements. Such statements are based on management's current expectations, unless an earlier date is indicated, and involve many risks and uncertainties that could cause actual results to differ materially from those expressed or implied in these forward-looking statements. Important factors that could cause actual results to differ materially from the company's expectations are set forth in Intel's earnings release dated July 26, 2018, which is included as an exhibit to Intel’s Form 8-K furnished to the SEC on such date. Additional information regarding these and other factors that could affect Intel's results is included in Intel's SEC filings, including the company's most recent reports on Forms 10-K and 10-Q. Copies of Intel's Form 10-K, 10-Q and 8-K reports may be obtained by visiting our Investor Relations website at www.intc.com or the SEC's website at www.sec.gov.

All information in this presentation reflects management’s views as of the date of this presentation, unless an earlier date is indicated. Intel does not undertake, and expressly disclaims any duty, to update any statement made in this presentation, whether as a result of new information, new developments or otherwise, except to the extent that disclosure may be required by law.