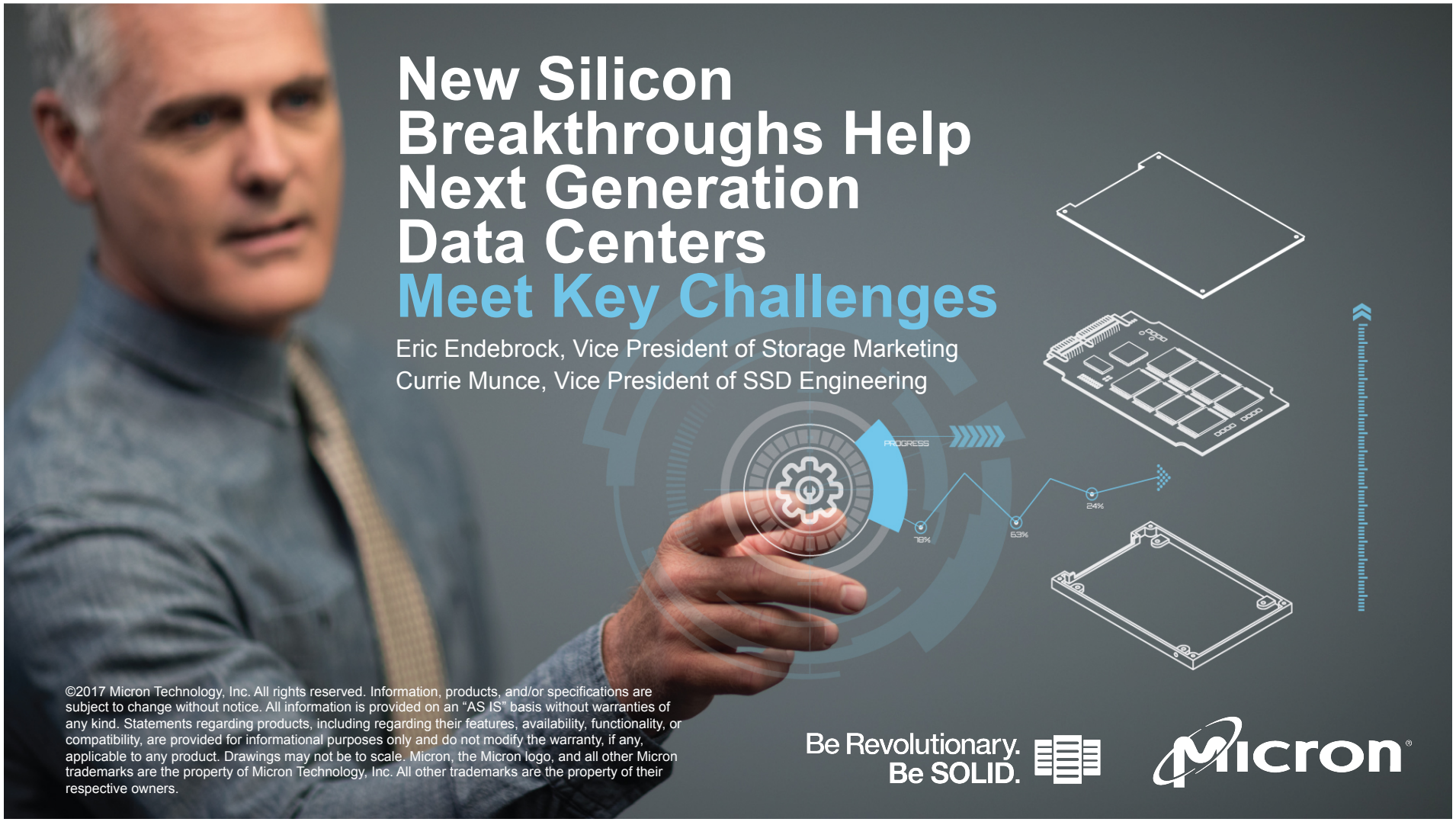
New Silicon Breakthroughs Help Next Generation Data Centers
Meet Key Challenges
Eric Endebrock, Vice President of Storage Marketing
Currie Munce, Vice President of SSD Engineering
PROGRESS
7.8%
6.3%
8.4%
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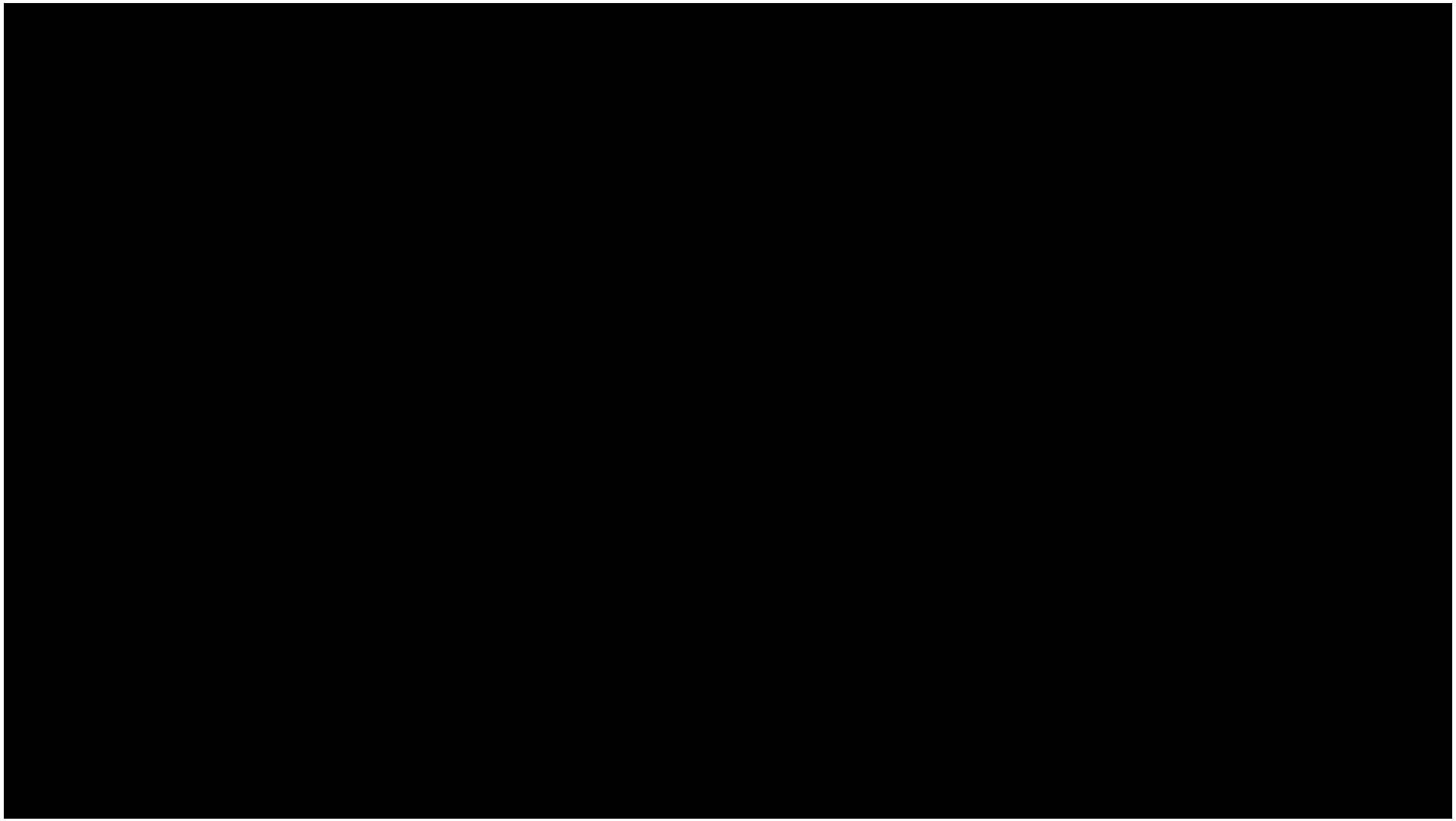
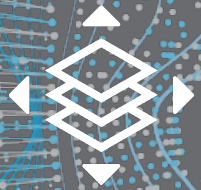
Be Revolutionary.
Be SOLID.
Micron



Customer Workloads are Demanding Real-time Data Insights

Volume

Data growth projected to
Reach 163 zettabytes by 2025



Velocity

Billions of data entries each day

Variety

Structured & unstructured data
driven by big data & IoT

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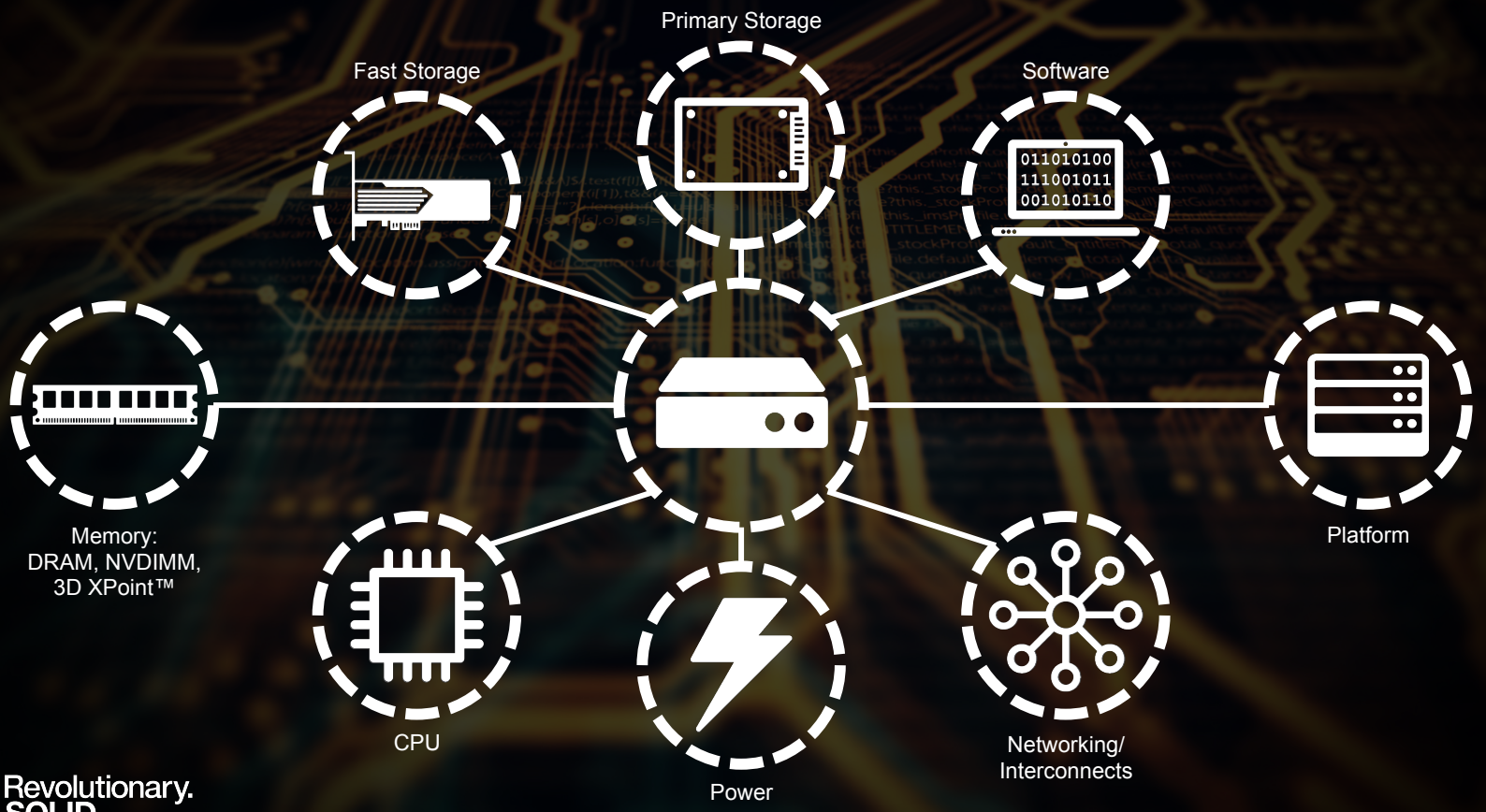
System Architecture



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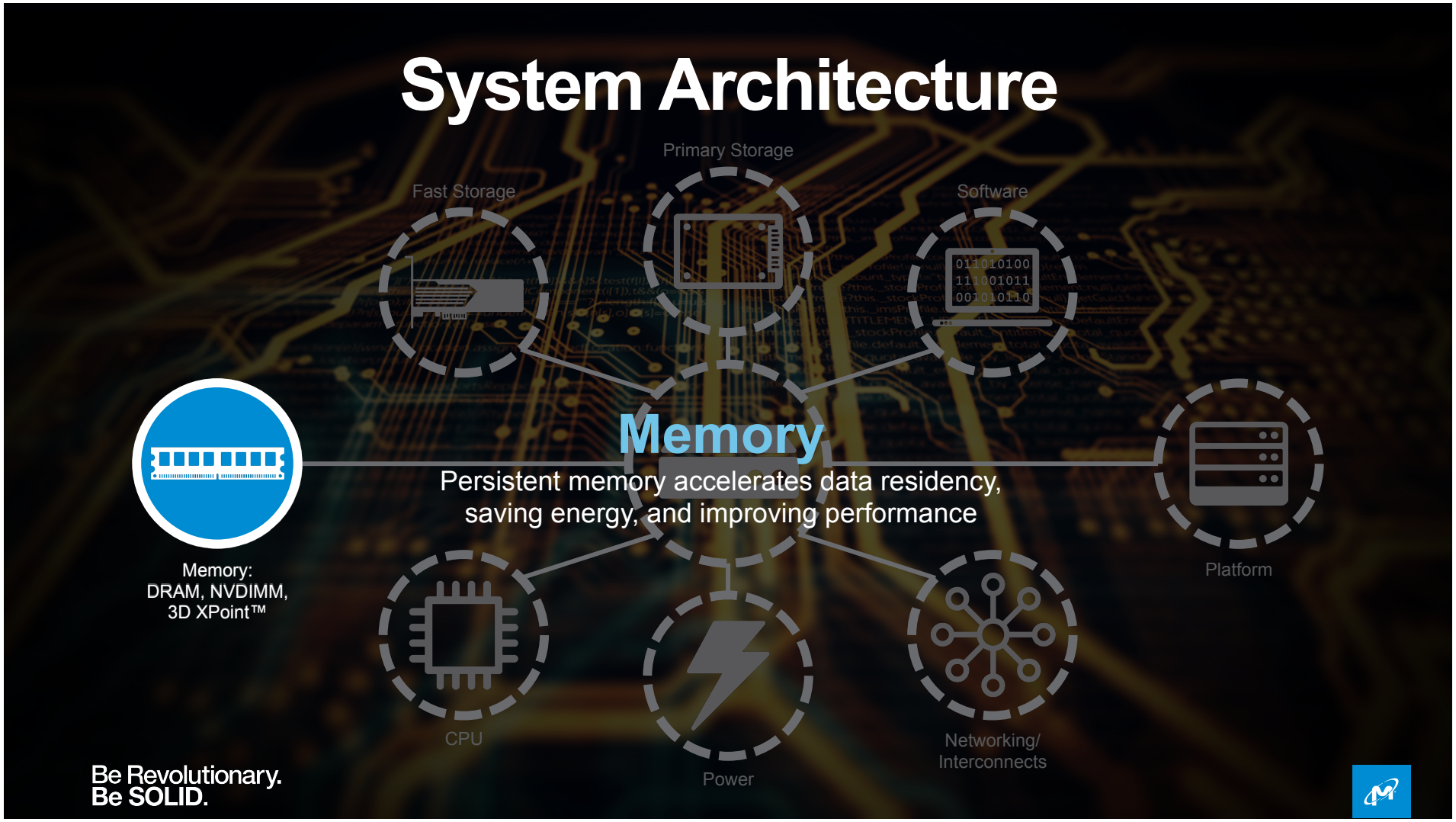
System Architecture



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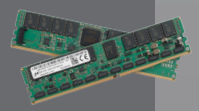
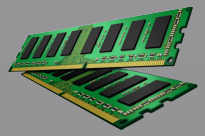
Insistence on Data Persistence

Bringing Memory & Storage Closer to Compute

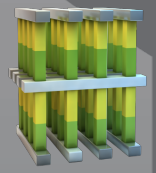


NVDIMM-N
(DRAM/NAND)
35ns

Performance Optimized Persistent Memory



RDIMM/LRDIMM
(DRAM)
35ns



3D XPoint™
100s ns

NVMe™ SSD
(NAND)
100µs

SATA/SAS SSD
(NAND)
150µs

10K SAS HDD
(Spinning Media)
2.9ms

Cost

Latency

Nanoseconds | Microseconds | Milliseconds

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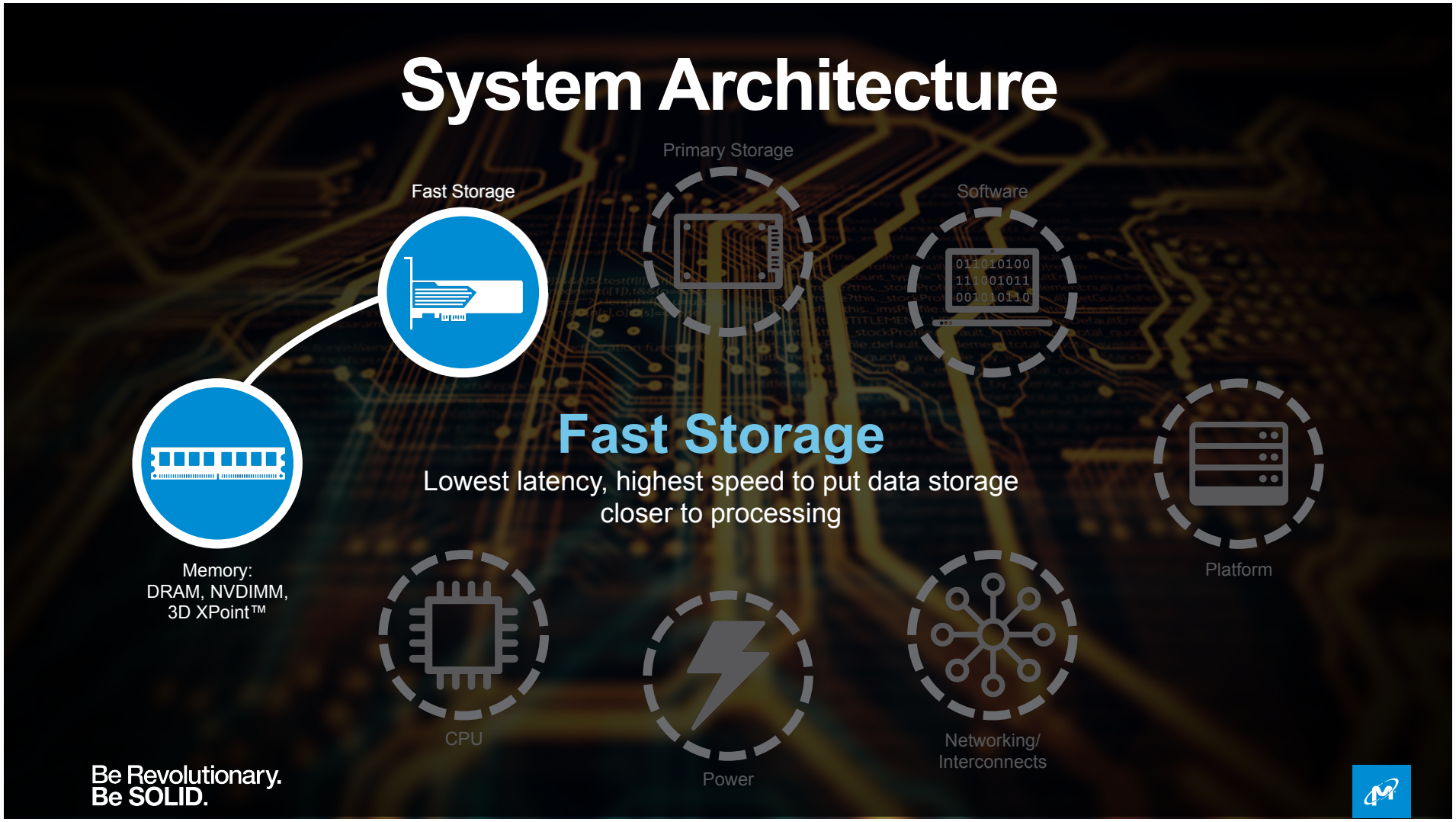
System Architecture



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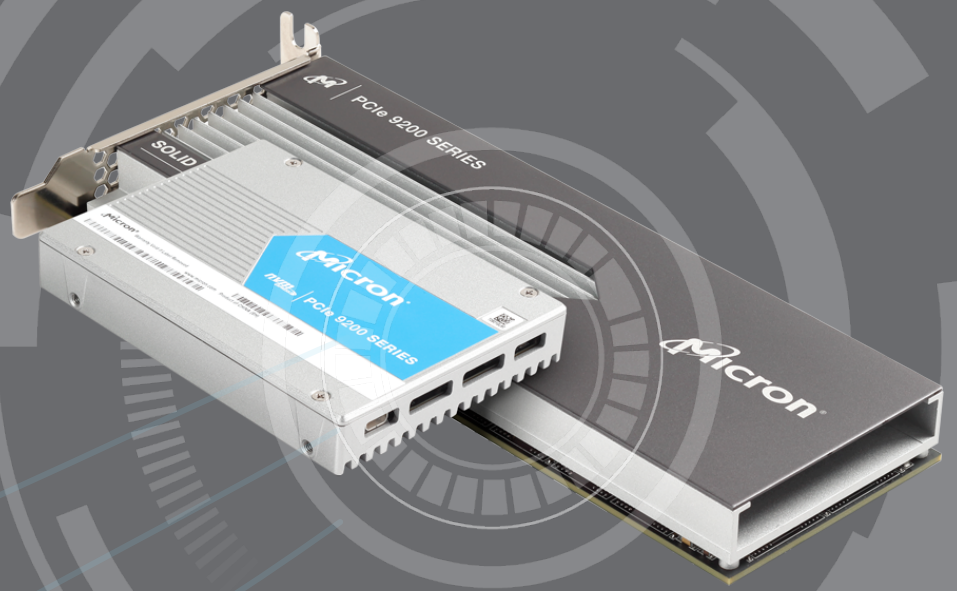
Introducing the 9200 NVMe™ SSD
Where Capacity Meets Tenacity



High-performance NVMe SSD;
designed for data ingest, OLTP, caching

First mainstream, Micron NVMe SSD
to deliver greater than 10TB

The 11TB 9200 ECO SSD is **45% faster**
than a competing NVMe SSD

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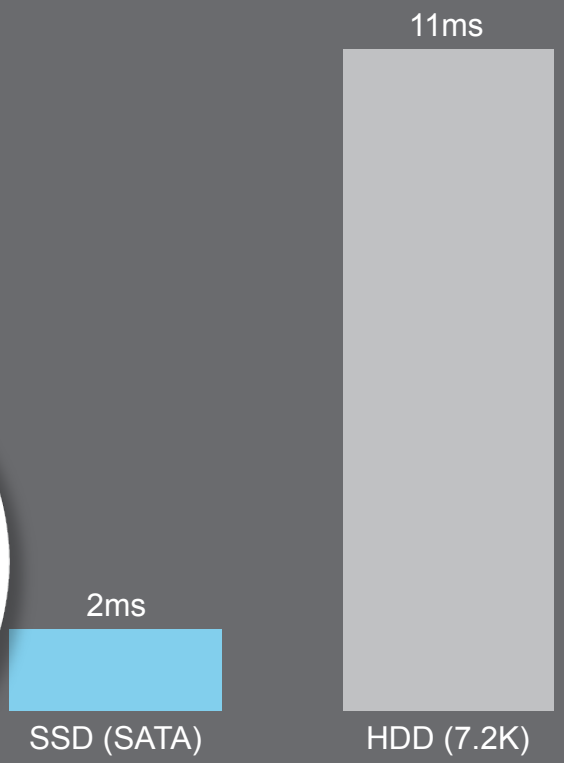
**Based off public information, as of Aug 8, 2017, measuring against 100% 4K random writes
*8KB Block Size, 70/30 Read/Write Mix, Queue Depth 8 – Commonly considered a synthetic proxy for real-world OLTP traffic

Solid State Builds Apps That Are More Responsive



Response Times at 5 9s

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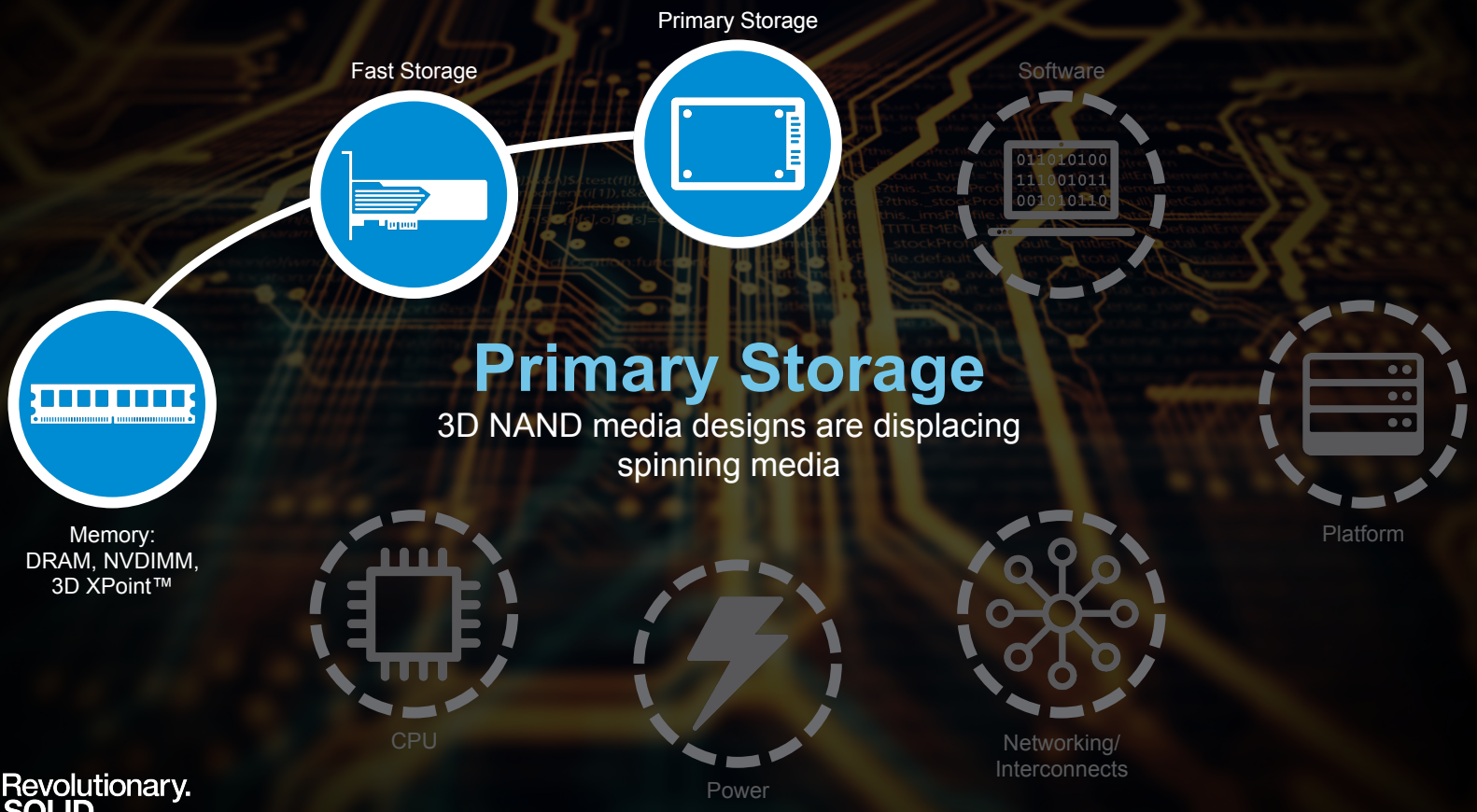
System Architecture



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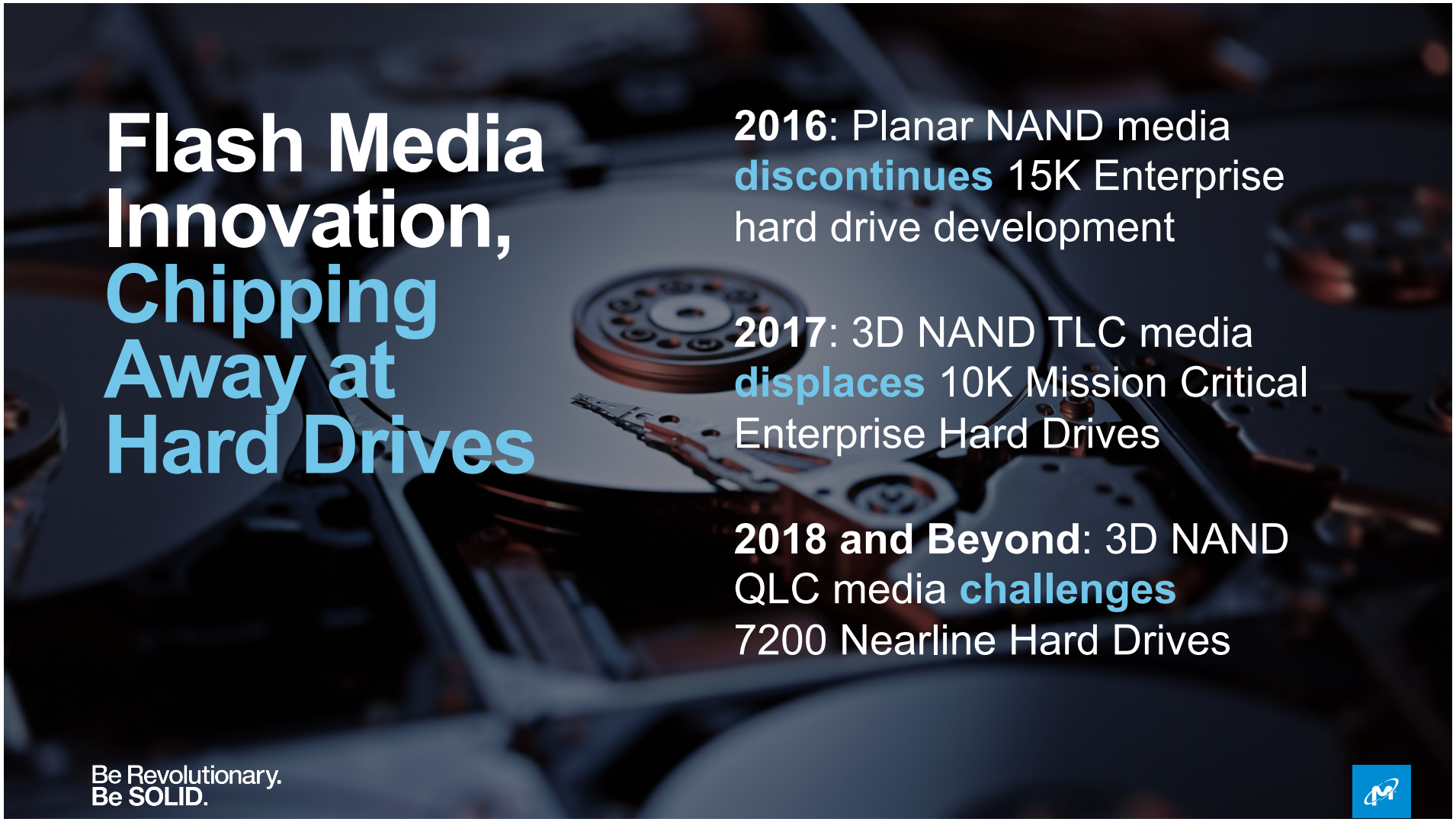
Flash Media Innovation, Chipping Away at Hard Drives
2016: Planar NAND media discontinues 15K Enterprise hard drive development
2017: 3D NAND TLC media displaces 10K Mission Critical Enterprise Hard Drives
2018 and Beyond: 3D NAND QLC media challenges 7200 Nearline Hard Drives
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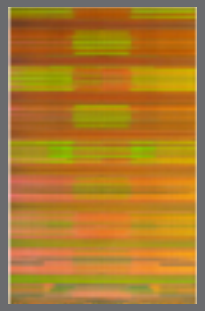
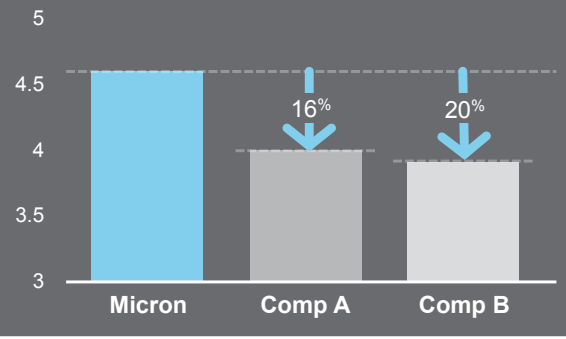
Better SSDs Come From Better NAND



Micron
512Gb TLC
4 planes, 64kB parallelism
Floating Gate + CMOS
Under the Array

512Gb TLC 64 Tier – Gb/mm²



Micron flash technologies deliver better

- Densities
- Throughput
- Power efficiency

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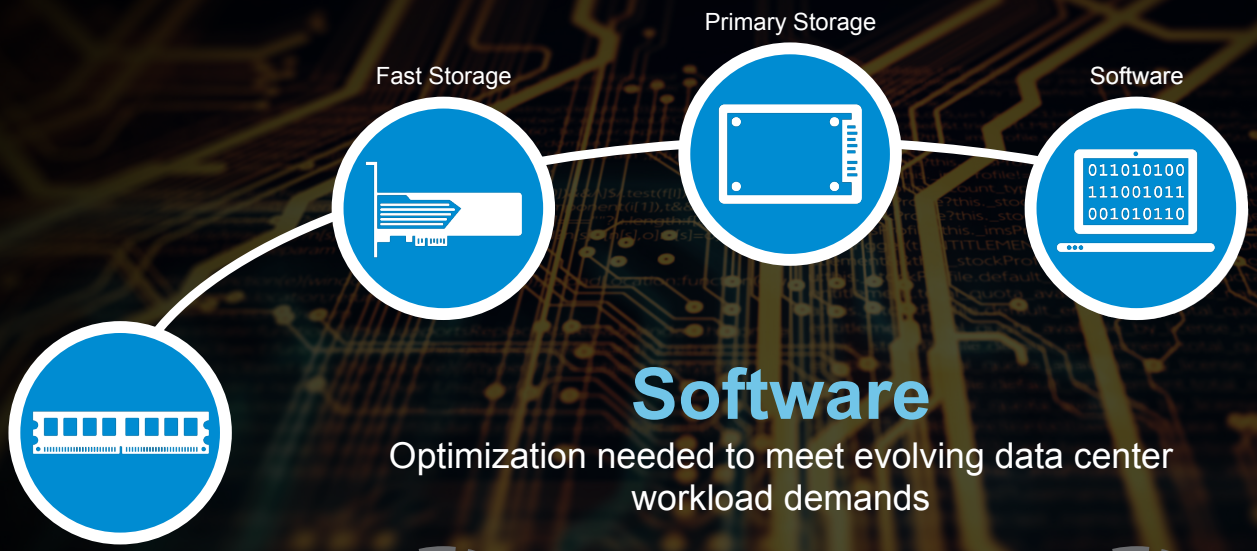
System Architecture



Software

Optimization needed to meet evolving data center workload demands

Memory:
DRAM, NVDIMM,
3D XPoint™

CPU

Power

Networking/
Interconnects

Platform

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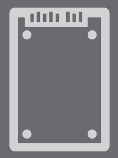
Limitations of Traditional Storage Software

Built for spinning media

Layered services, leads to additional latency

Contributes to system write amplification



Doesn’t fully realize benefits of flash & SSDs

What if Software Was Optimized for Flash?

End-to-end Optimization of the Stack from the Application to the Media

Order of magnitude improvement in SSD performance

Reduced latency & improved Quality of Service

Higher endurance through more effective drive writes per day

Lower OPEX through reduced system energy consumption

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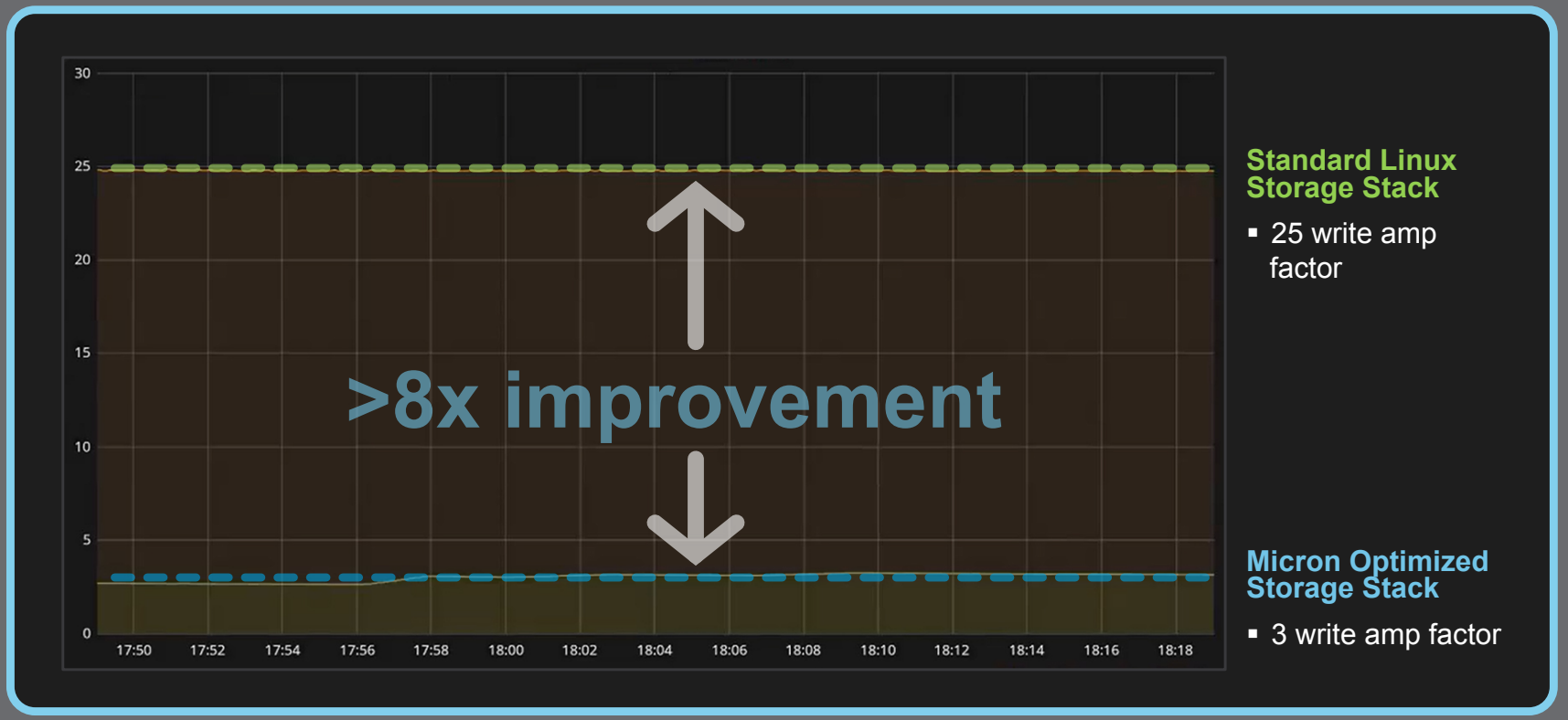
What is: Lower System Write Amplification



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What is: More Database Operations Per Second

Micron Optimized Storage Stack

- 1.3M operations

Standard Linux Storage Stack

- 157K operations

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What is: Reduced Latency, Quicker Application Response

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What is: Better Power Profile

Drive Power Consumption

Standard Linux Storage Stack

- 247 W/Mops average

Micron Optimized Storage Stack

- 37 W/Mops average

System Power Consumption

Standard Linux Storage Stack

- 2.2 kW/Mops average

Micron Optimized Storage Stack

- 0.3 kW/Mops average

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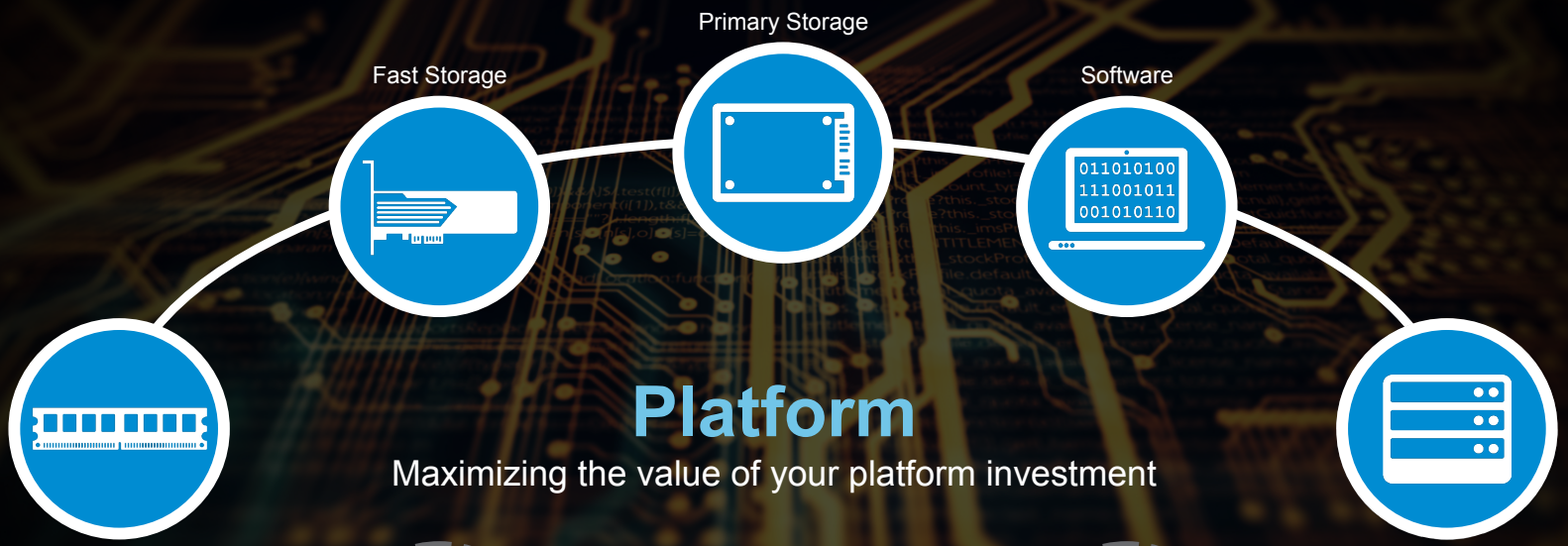
System Architecture



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SOLIDSCALE™
Platform Architecture
Exceeding 5M IOPS/U
Achieving 11 GB/s in application traffic
1% or less incremental latency vs. in-server NVMe
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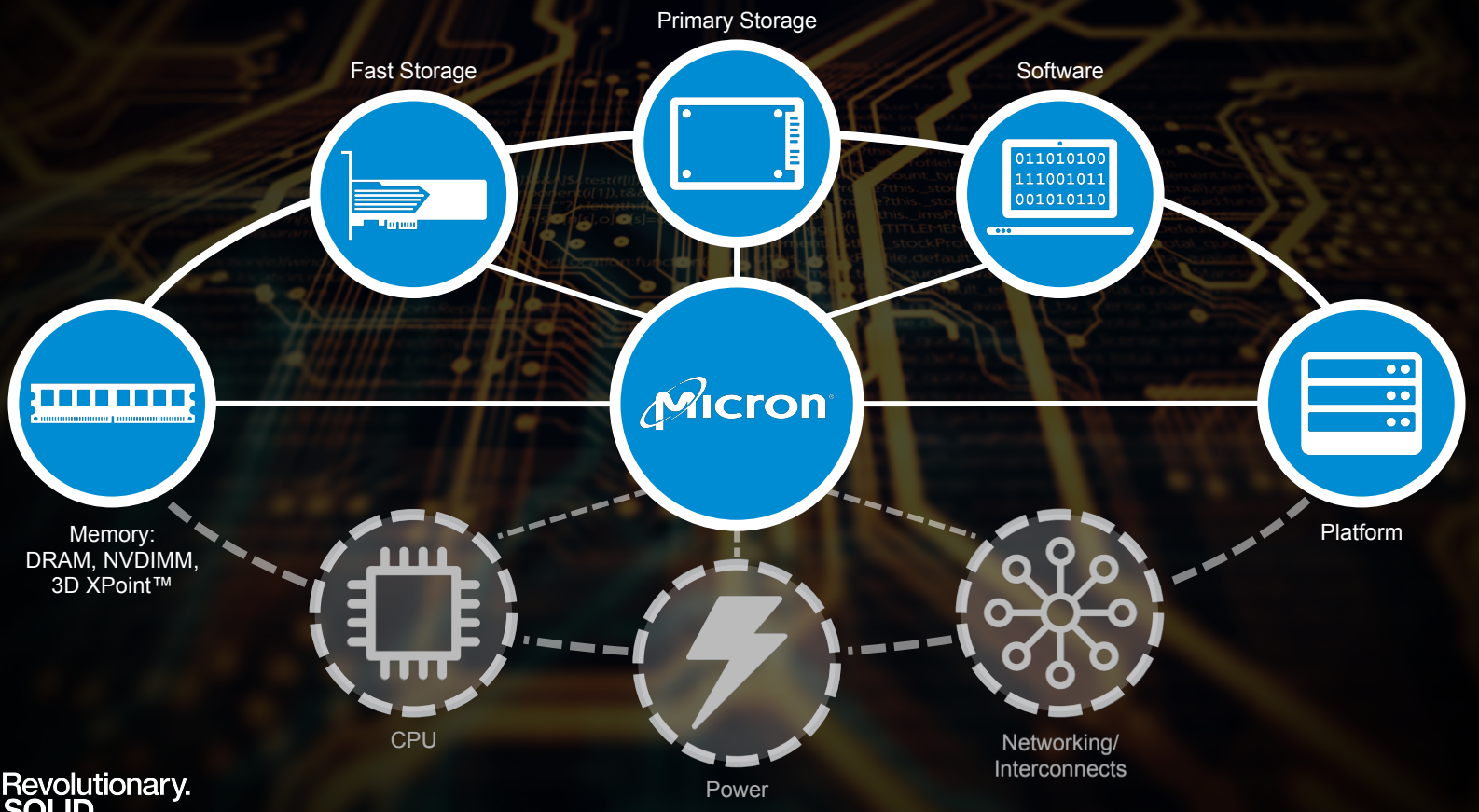
System Architecture



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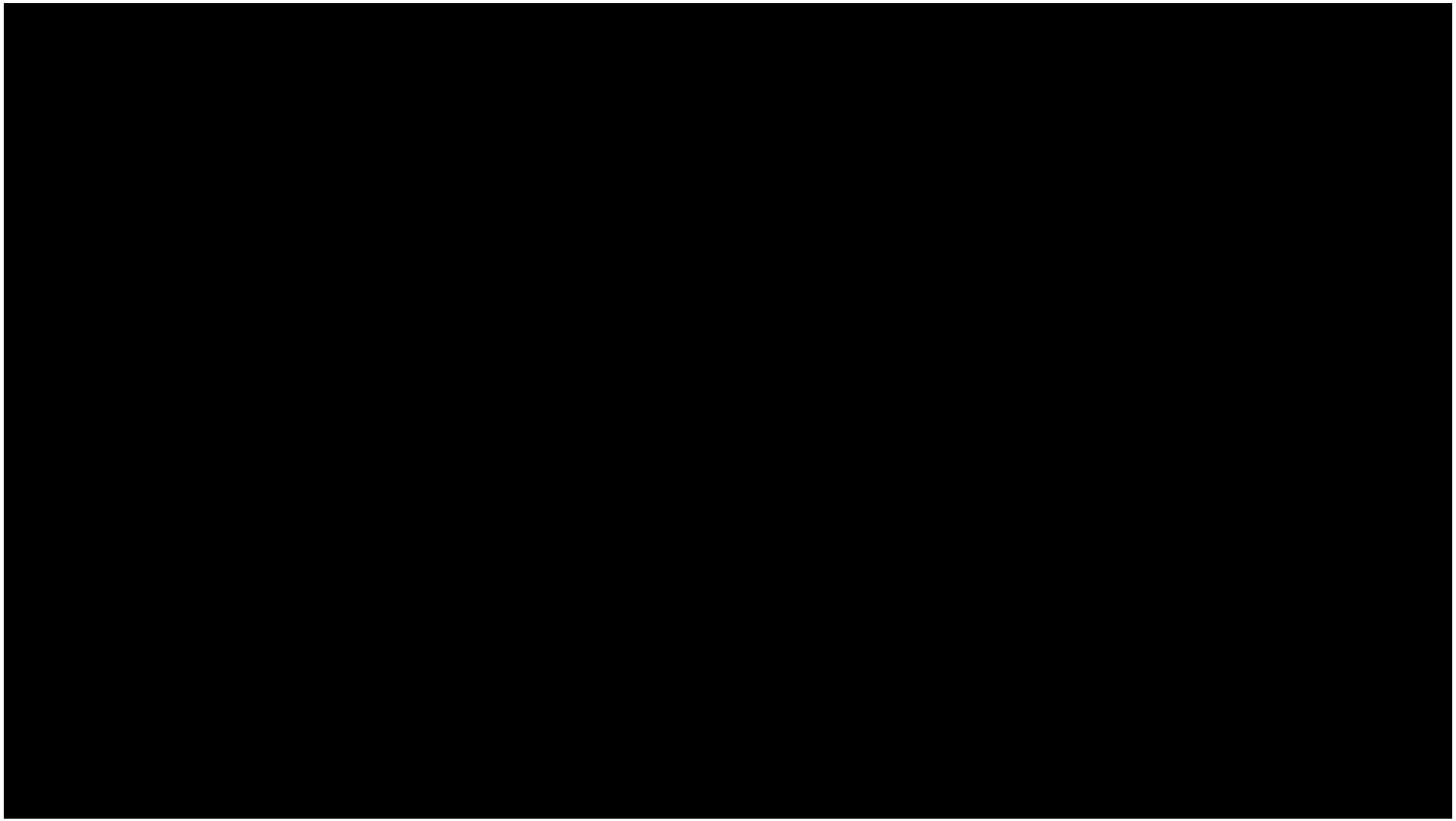

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