



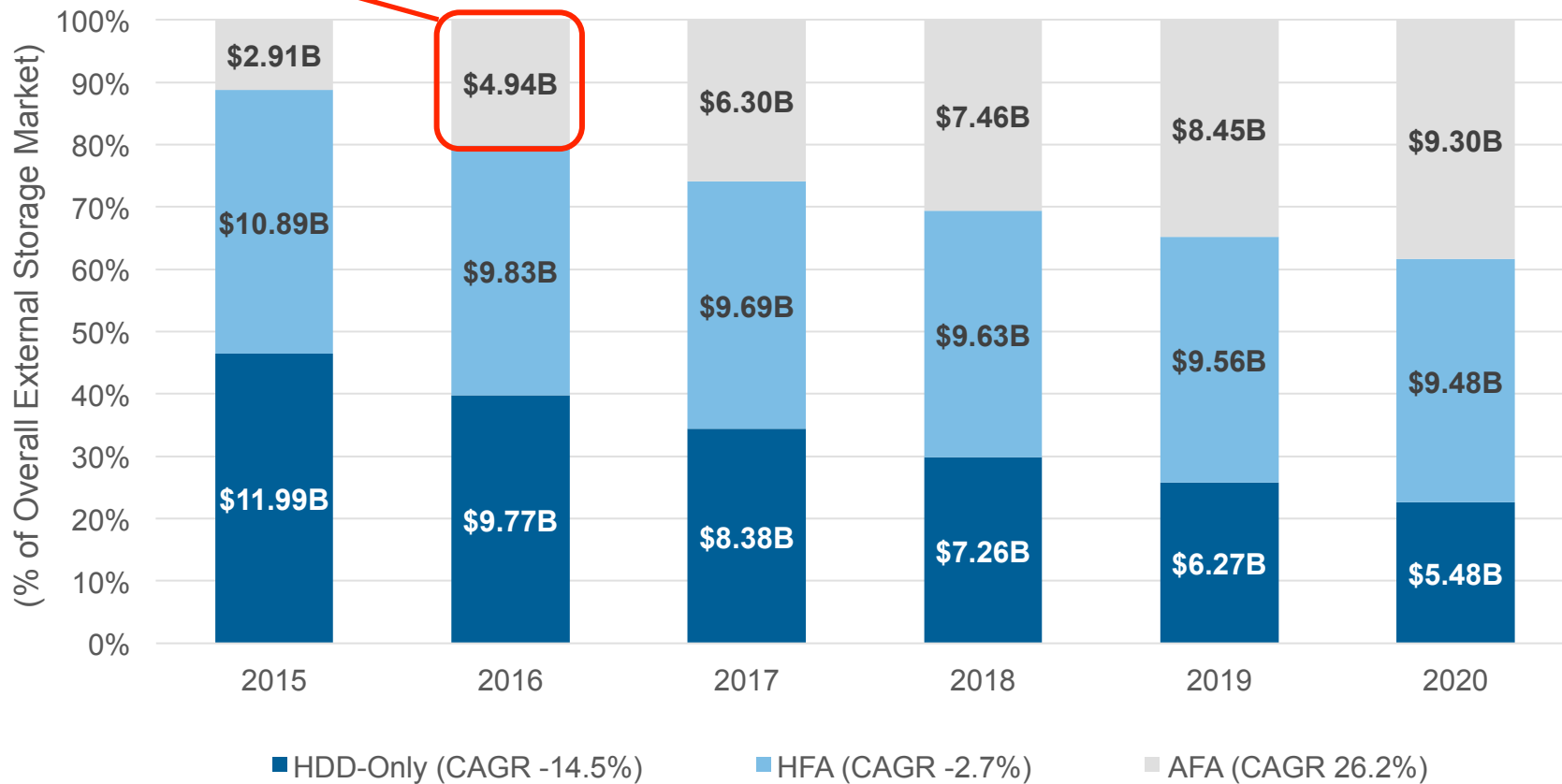
# **NVMe in Enterprise Storage Systems**

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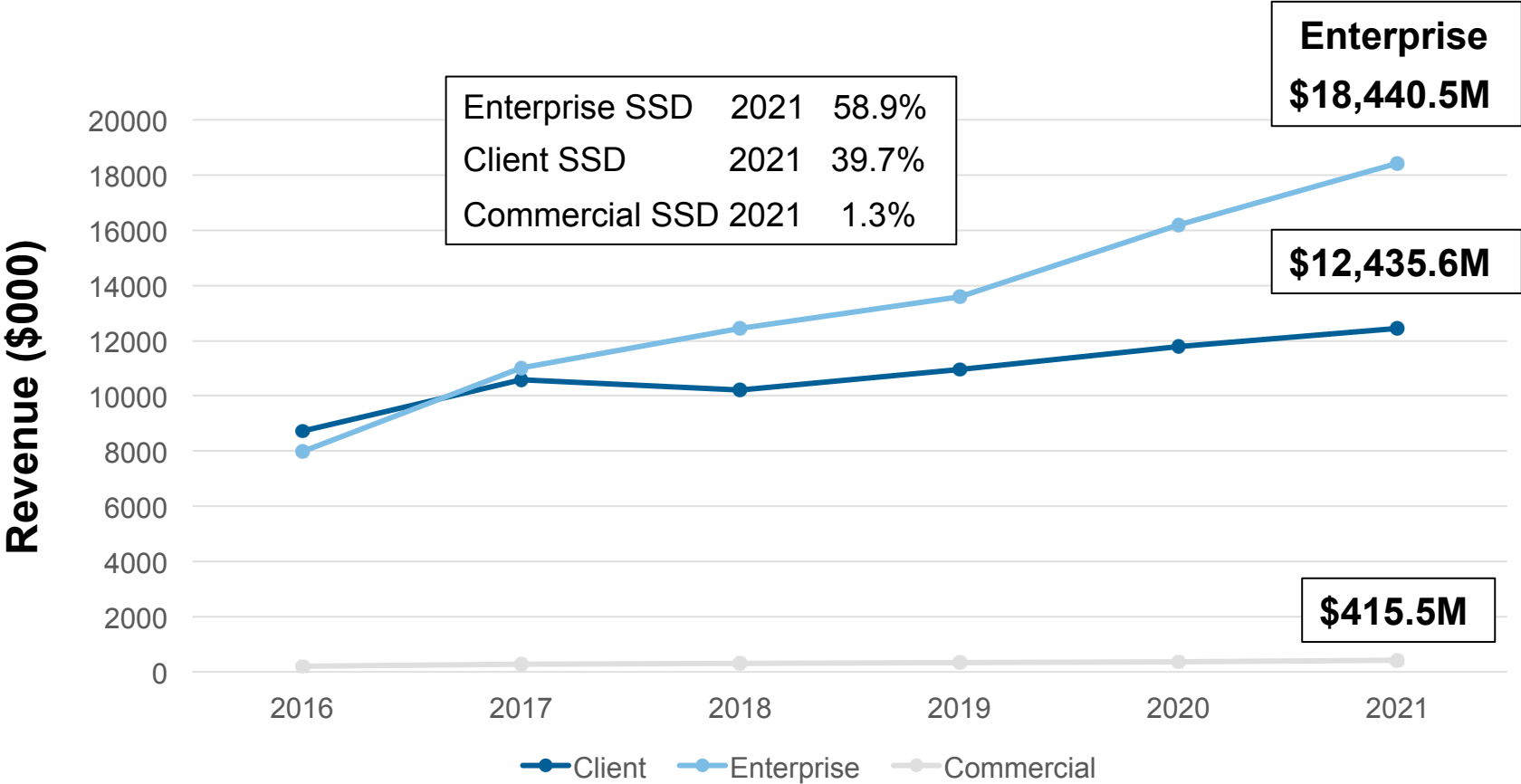
# Flash Driving Enterprise Storage

**AFA revenue is 20% of overall enterprise storage revenue**

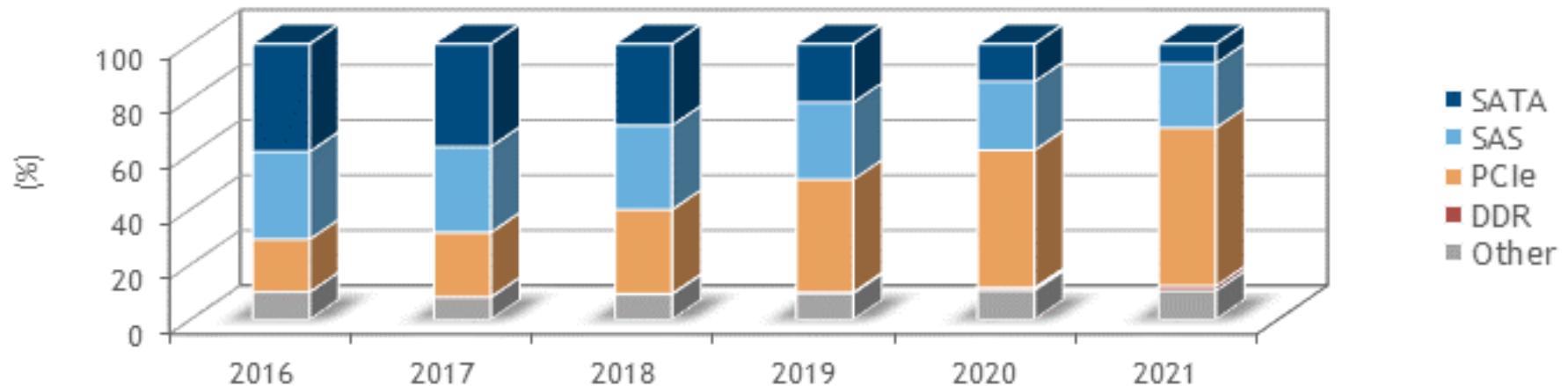
External Enterprise Storage, 2015 – 2020, Revenue (\$B)



# WW SSD Market Forecast, 2017-2021



# WW SSD Revenue Share by Interface



- PCIe will grow from a 12.4% revenue share in 2016 to a 61.4% share by 2020
- In 2020 NVMe SSD revenue alone will be \$9.94B
- In 2020 rack scale flash systems revenues are still expected to be well under \$1B
- In 2020 total SSD revenues will be \$16.19B (all interface types)

# Rack Scale Flash Systems Emerging



- **Webscale infrastructure (no SCSI)**
- **Internal NVMe storage, NVMe interfaces, NVMe over Fabric**
- **Primary positioning is as an easily scalable “SSD” that offers the efficiencies of shared storage**
- **All require custom drivers on the host and some include hardware customizations (for “enterprise” features like RAID, snapshots, etc.)**
- **Primary workload targets include real-time big data analytics and super high performance databases**
- **First shipments in 2016 and industry revenues under \$50M in 2017**

# The Importance of NVMe in Enterprise Storage



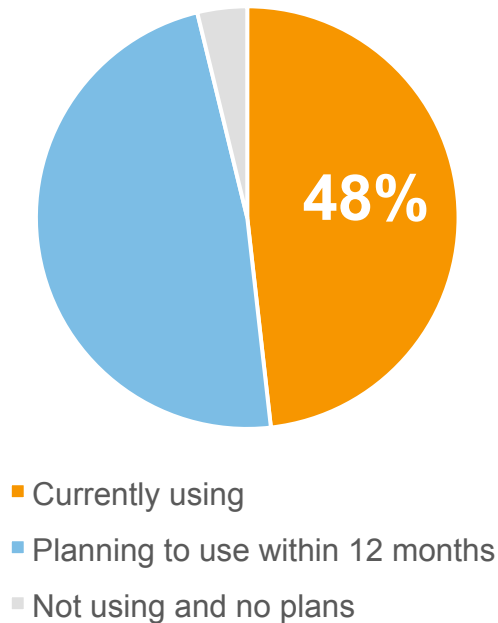
- **NVMe vs SCSI advantages**
- **Lighter weight I/O stack optimized for memory**
- **Lower latencies and much higher throughput**
- **Supports much higher degrees of parallelism**

- **New workloads and data access patterns require much higher storage performance**
- **Real-time big data analytics need an ability to support high degrees of concurrency**
- **Big data exacerbates the data mobility problem**

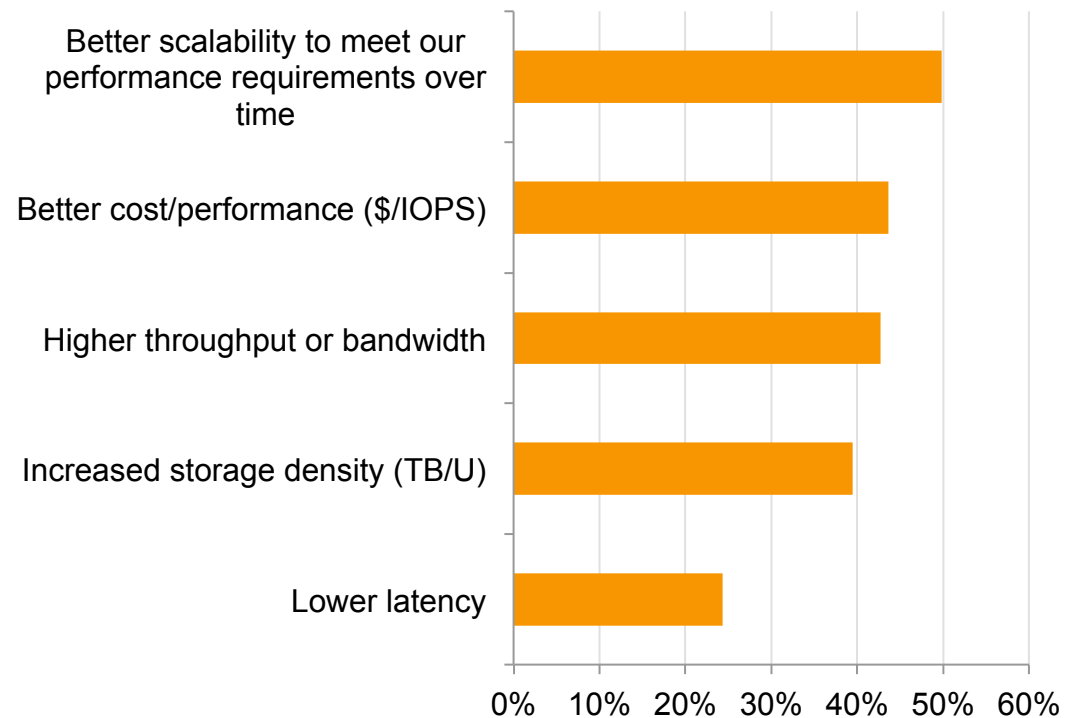
- **Improved efficiencies for “at scale” computing**
- **Higher infrastructure densities**
- **NVMe interface bandwidth needed as drive sizes increase**

# NVMe Adoption and Drivers

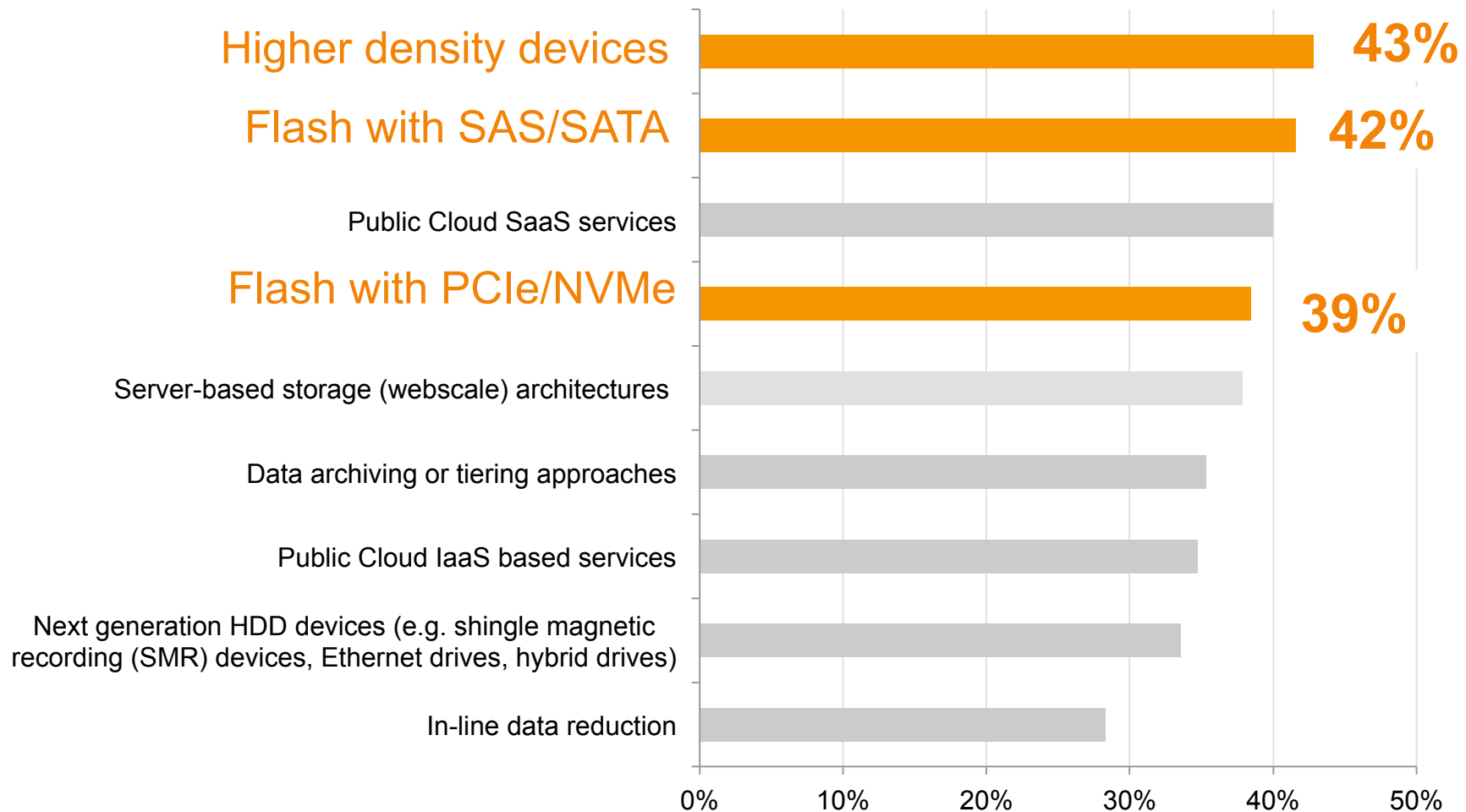
## PCIe or NVMe Flash



## Drivers to NVMe Adoption



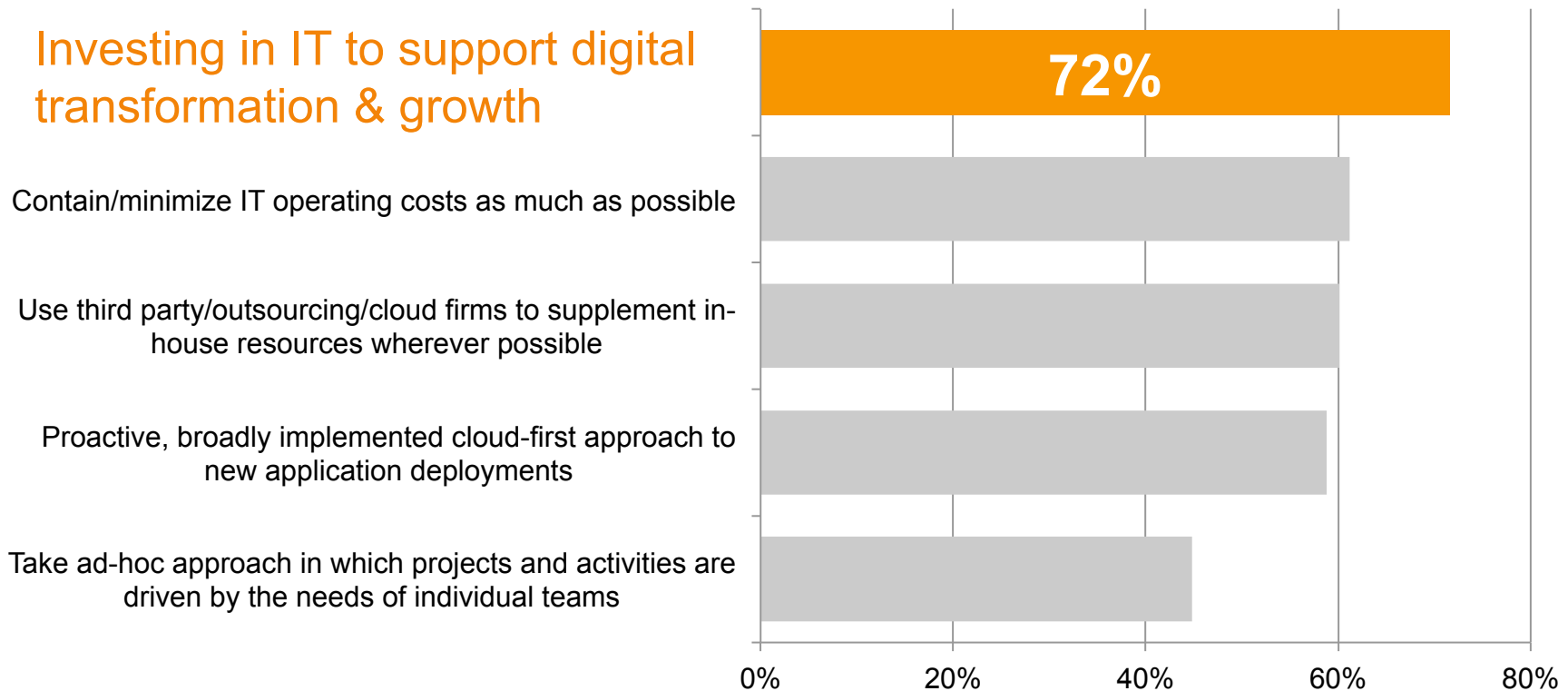
# Flash Strategies To Manage Data Growth





# DX\* Is Driving Infrastructure Strategies

## *Rational for IT Infrastructure Decisions*



\* Digital Transformation

# Real-Time Big Data Analytics

**Real-time big data analytics will increasingly become part of the digital transformation**

**By 2020 75% of the Fortune 2000 will have at least one real-time big data analytics app (and it will be business critical)**

**This will be a major driver of NVMe systems revenue**

# Essential Guidance

- **NVMe will become the mainstream foundation technology for enterprise storage by 2020**
- **An increasing number of select workloads will require NVMe performance (starting now)**
- **There are other reasons to consider NVMe now besides just low latency**
  - High throughput, storage density/rebuild times
- **Established vendors are taking an incremental approach to NVMe integration...**
- **...but the rack scale flash architectures of the future are based on webscale designs**

# Thank You



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