NVMe® Storage in the Real World: Google's Path to NVMe Technology

Chris Sabol
Software Architect, Google

Sponsored by NVM Express organization, the owner of NVMe specifications

Agenda

- Google's Scale

- Google's path to NVMe® technology

  - History of SSDs at Google
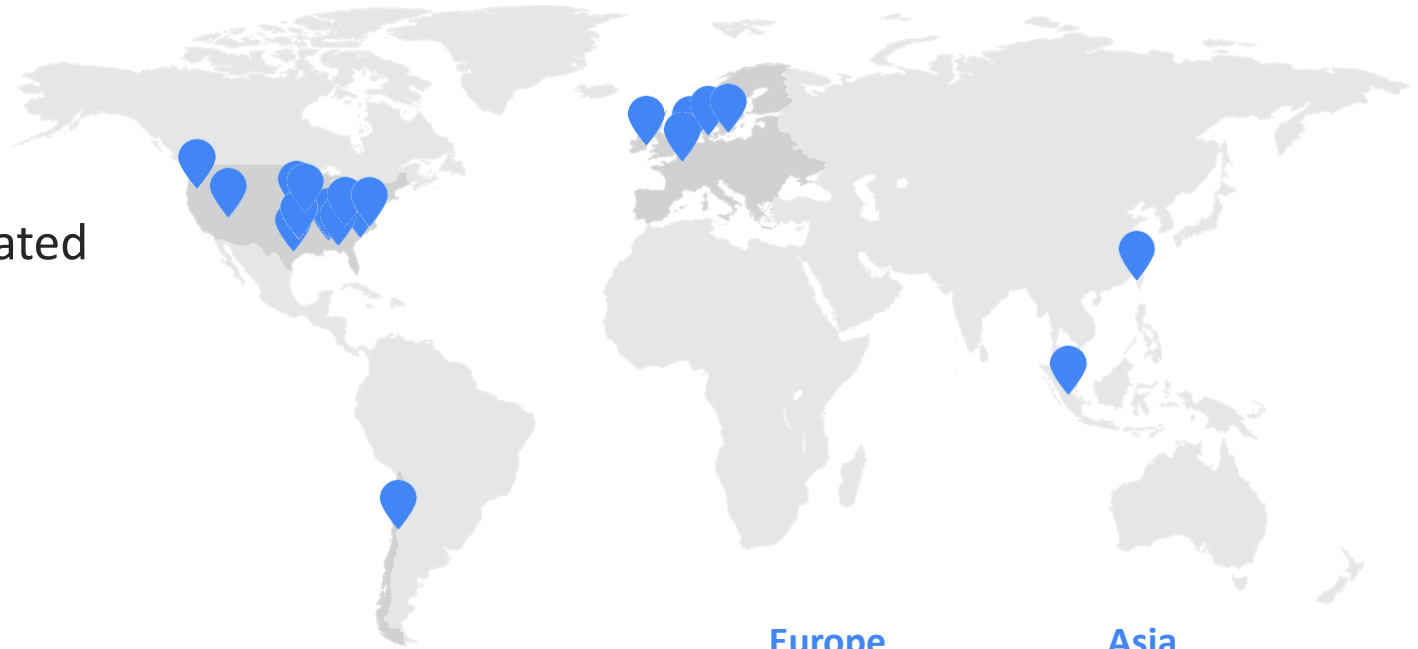
  - Benefits Google sees in NVMe technology

21

locations for owned and operated data centers

4

continents

Americas

Berkeley County, South Carolina

Council Bluffs, Iowa

The Dalles, Oregon

Douglas County, Georgia

Henderson, Nevada

Jackson County, Alabama

Lenoir, North Carolina

Loudoun County, Virginia

Mayes County, Oklahoma

Midlothian, Texas

Montgomery County, Tennessee

New Albany, Ohio

Papillion, Nebraska

Quilicura, Chile

Europe

Dublin, Ireland

Eemshaven, Netherlands

Fredericia, Denmark

Hamina, Finland

St Ghislain, Belgium

Asia

Changhua County, Taiwan

Singapore

Flash Memory Summit

nvm EXPRESS®

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Google SSDs over 11 years

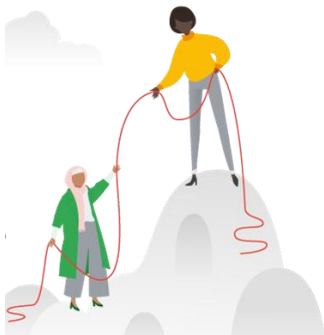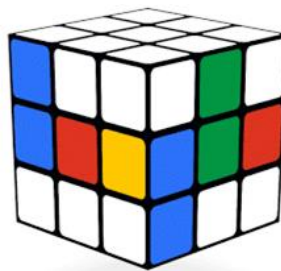|		
1	**Beginning: Simple PCIe SSD**	• Major use case: memory offload for Search. Think Google Instant Search. • Host software stack did pretty much everything (FTL, mapping table)
2	**Evolution of Internal SSD**	• Improvements were made to incrementally offload functionality to the drives
3	**3rd Party NVMe® SSD**	• Benefit from industry optimizations & mature ecosystem

Flash Memory Summit

NVMe® Technology Addresses Trends Google Cares About

Efficiency

- Efficient flash layout (FDP)
- Virtualization support

Limiting Complexity

- NAND Complexity abstracted by SSD vendor
- Transport and command set abstractions

Performance

- Efficient transport protocol
- Unleashes underlying scalability of NAND flash memory

Thank You

NVMe® Storage In the Real World

Ross Stenfort

Hardware Systems Engineer, Meta

Sponsored by NVM Express organization, the owner of NVMe specifications

Agenda

- Background

- Where is NVMe® Technology Used?

- Benefits and Applications for NVMe® technology

Meta's mission is to give people the power to build community and bring the world closer together.

Meta @ Scale

Where does Hyperscale Use NVM Express®
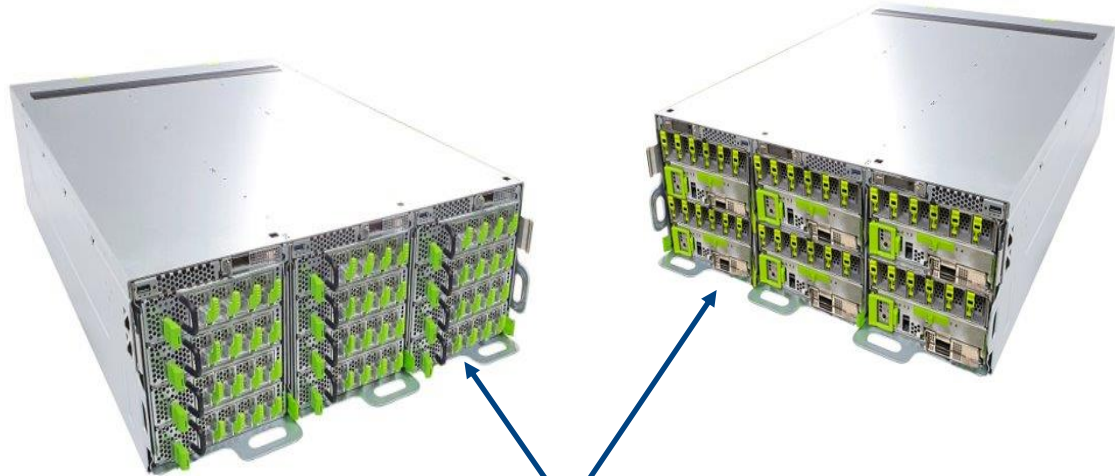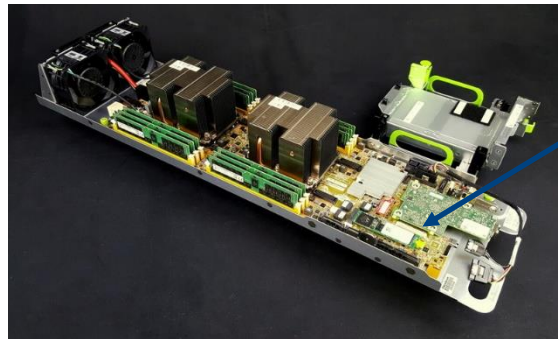
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E1.S SSDs

M.2 Boot SSDs

NVMe® Technology Benefits and Applications

❖ Benefits

- Performance
  - Scales with each PCIe Generation
  - Multi-tenant
  - Quality of service

- Management
  - Out of Band Access
  - Telemetry and health logs

❖ Applications

- Caching

- Database

- Boot drives

Thank You