



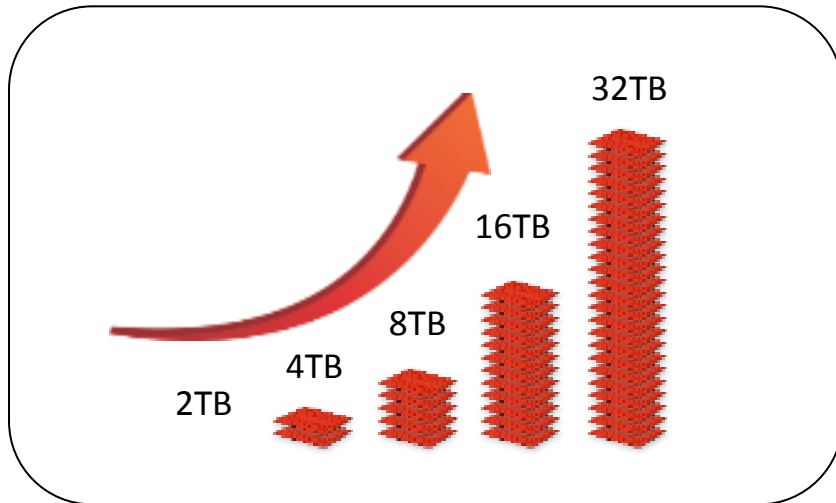
# SSD Moving Rapidly to the Next Level

Ryan Smith

Sr Manager – SSD Product Marketing  
Samsung Semiconductor, Inc.

# SSD Trends

## High Capacity

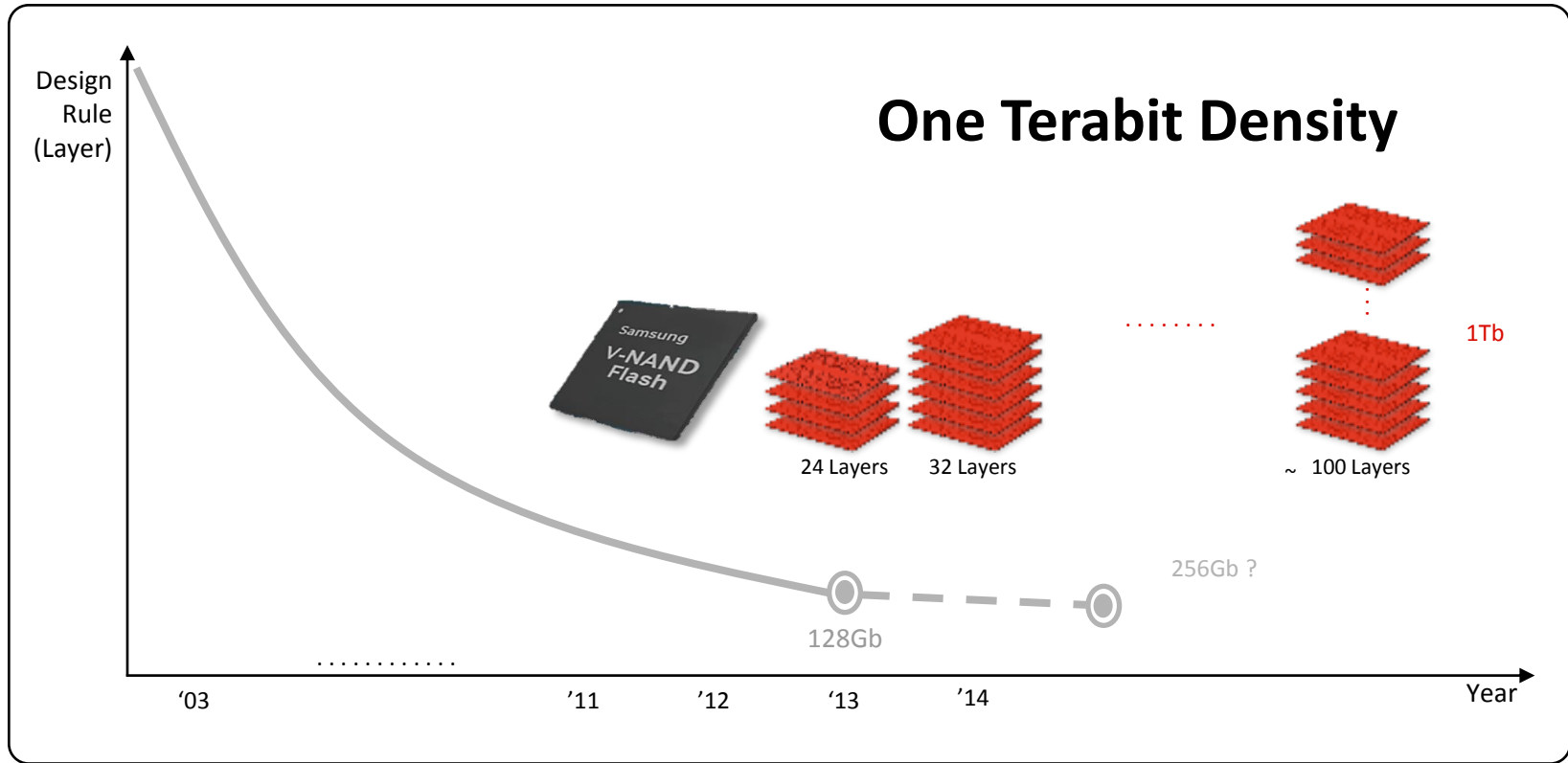


## High Performance



# VNAND

## Path to higher densities



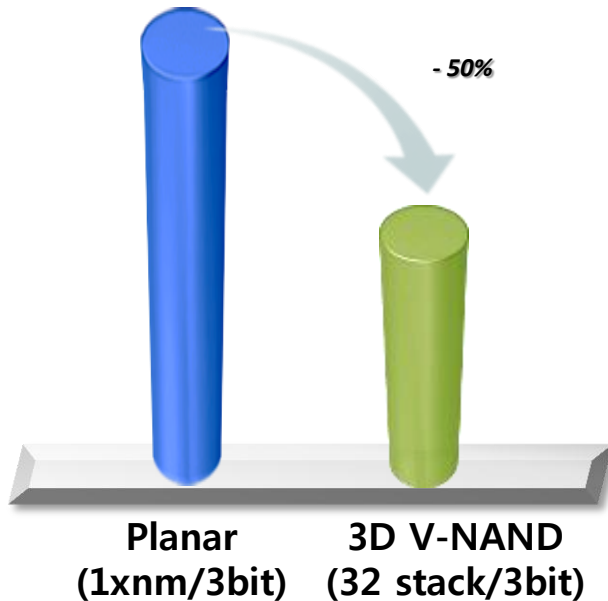
Path to 1Tb (128GB) die enabled by VNAND

# VNAND

## Higher Performance & Lower power

### Performance

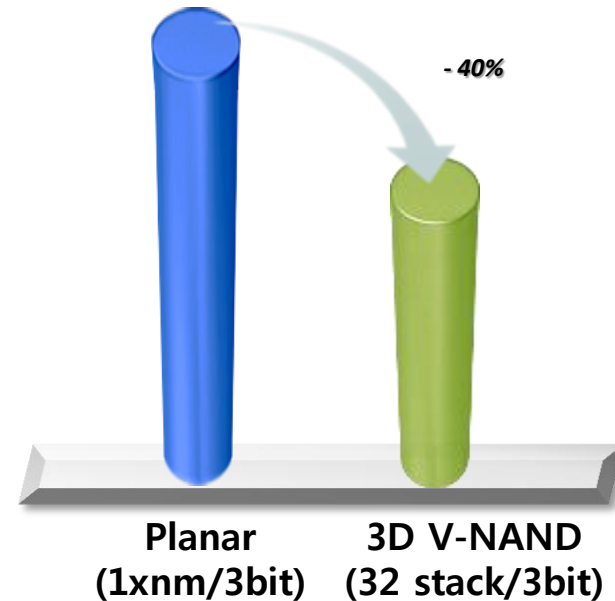
tPROG



\*Lower is better

### Power

Consumption @ Read




\*Lower is better

**Faster speeds and lower power**

# SATA SSD limits

- Today's cost-effective SATA limit max capacity  
(If IOPS/GB is important)

	10K RPM HDD		2011-12 SSD		2013-14 SSD	
Capacity	300GB	600GB	120GB	240GB	480GB	960GB
IOPS	200	200	1,500	1,500	14,500	14,500
<b>IOPS/GB</b>	<b>0.66</b>	<b>0.33</b>	<b>12</b>	<b>6</b> 	<b>28</b>	<b>14</b>

Example 10 IOPS/GB  
User Requirement

More IOPS/GB needed to go >1TB

# PCIe: Two different solutions

## Performance

- High Performance
- Enterprise-based ASIC
- More expensive
- Existing market

## Data Center

- High Density
- PC-based ASIC
- Cost-sensitive
- *New market!*

PCIe is not just about getting higher performance

# XS/SM1715 – NVMe for Performance

**3,000 MB/s**  
**750K IOPS**



	Samsung XS/SM1715	Other PCIe
Active Power	10-25W	25W
Form Factor	2.5", HHHL	HHHL
Drivers	NVMe	Custom

# SM953 – NVMe for Data Center

**2,200 MB/s**  
**300K IOPS**




	Samsung SM953	Other NVMe
Active Power	6W	10W ~ 25W
Form Factor	2.5", M.2	2.5", HHHL



# SATA SSD limits (Recap)

- Today's cost-effective SATA limit max capacity (If IOPS/GB is important)

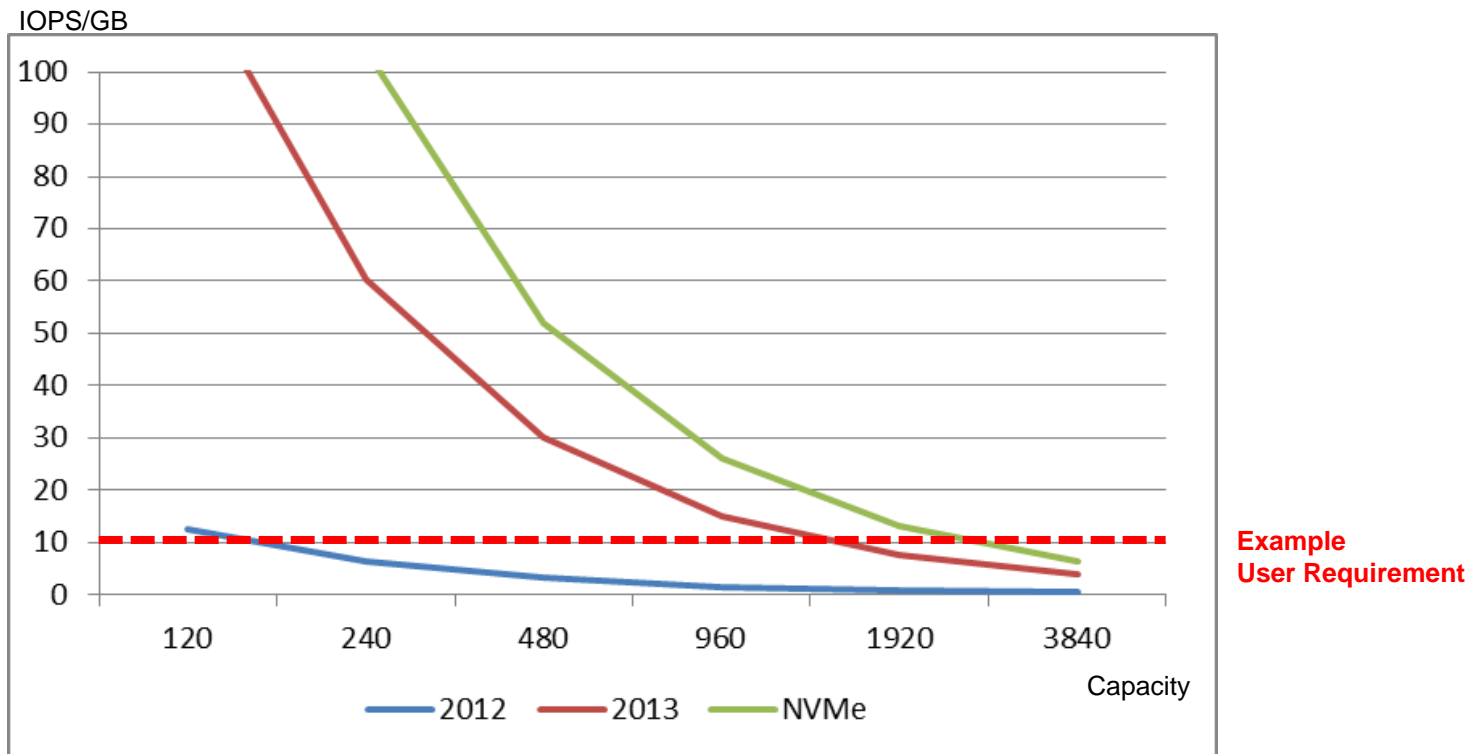
	10K RPM HDD		2011-12 SSD		2013-14 SSD	
Capacity	300GB	600GB	120GB	240GB	480GB	960GB
IOPS	200	200	1,500	1,500	14,500	14,500
<b>IOPS/GB</b>	<b>0.66</b>	<b>0.33</b>	<b>12</b>	<b>6</b> 	<b>28</b>	<b>14</b>

Example 10 IOPS/GB  
User Requirement

More IOPS/GB needed to go >1TB

# NVMe enables higher capacities

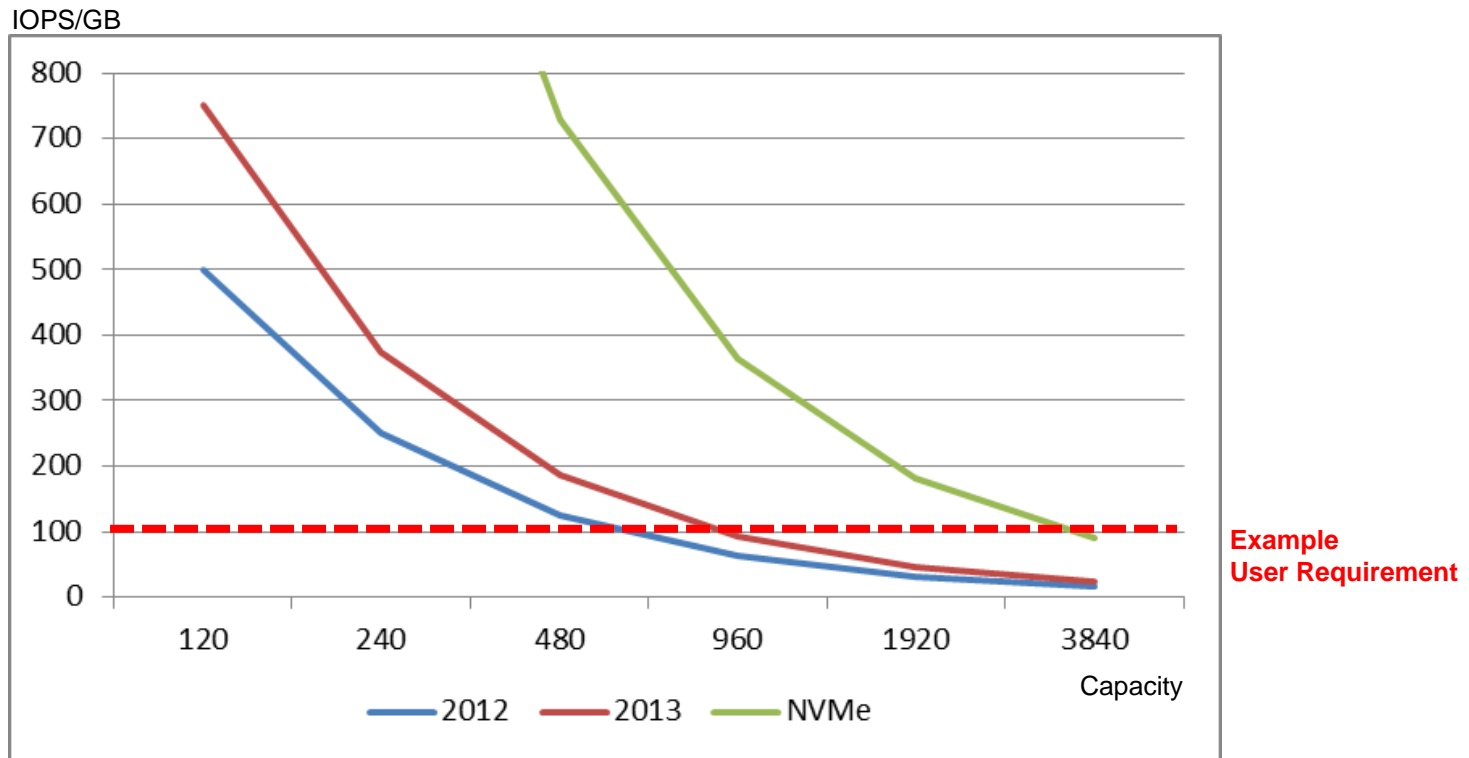
- Write IOPS/GB at different capacity points



2TB enabled by NVMe

# NVMe enables higher capacities

- Read IOPS/GB at different capacity points



~4TB enabled by NVMe

# Example of SATA → NVMe

## Data Center SATA SSD



8x PCIe, 45W (32W + 13W HBA)

## Data Center NVMe SSD



8x PCIe, 12W



Same performance + less space + less power

The logo for Flash Memory Summit 2014, featuring a yellow starburst graphic above the text "Flash Memory" and "SUMMIT" in a blue box.

# Flash Memory Summit

## Takeaways

1. VNAND + NVMe enables higher densities
2. NVMe opens up the performance market
3. NVMe creates an opportunity for innovation on server-based architectures

Thank you



[Ryan.Smith@ssi.samsung.com](mailto:Ryan.Smith@ssi.samsung.com)

