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THE FUTURE OF STORAGE

Trend for HDD and SSD until 2022

Toshiba Electronics Europe GmbH

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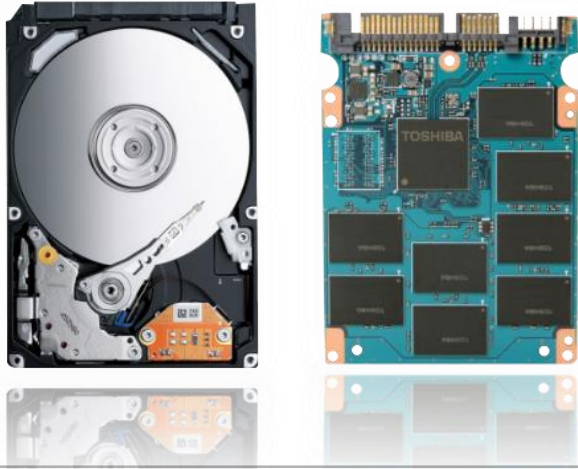
How to “not” predict the Future

- **“I think there is a world market for maybe five computers”**
 - Thomas Watson, Chairman and CEO IBM, 1943
- **“Television won't be able to hold on to any market it captures after the first six months. People will soon get tired of staring at a plywood box every night”**
 - Darryl F. Zanuck, CEO of 20th Century Fox, 1946
- **“There is no reason for any individual to have a computer in his home”**
 - Kenneth Olsen, Founder and President of DEC, 1977
- **“Rotating storage is going the way of the dodo”**
 - Linus Torvald, Linux Creator, 2012

Hard Disk and SSD (and Tape) – The Base for all Data Storage

The Base for all Stored Data

- at Home/User (Smartphone, Tablet, Notebook, PC)
- at Business „Enterprise“ (CRM, Databases)
- in the „Infrastructure“ (Surveillance Systems, Industrial Application, IoT)
- in the „Cloud“ (Website, Streaming Service, Social Network, Web-Shop)



Question

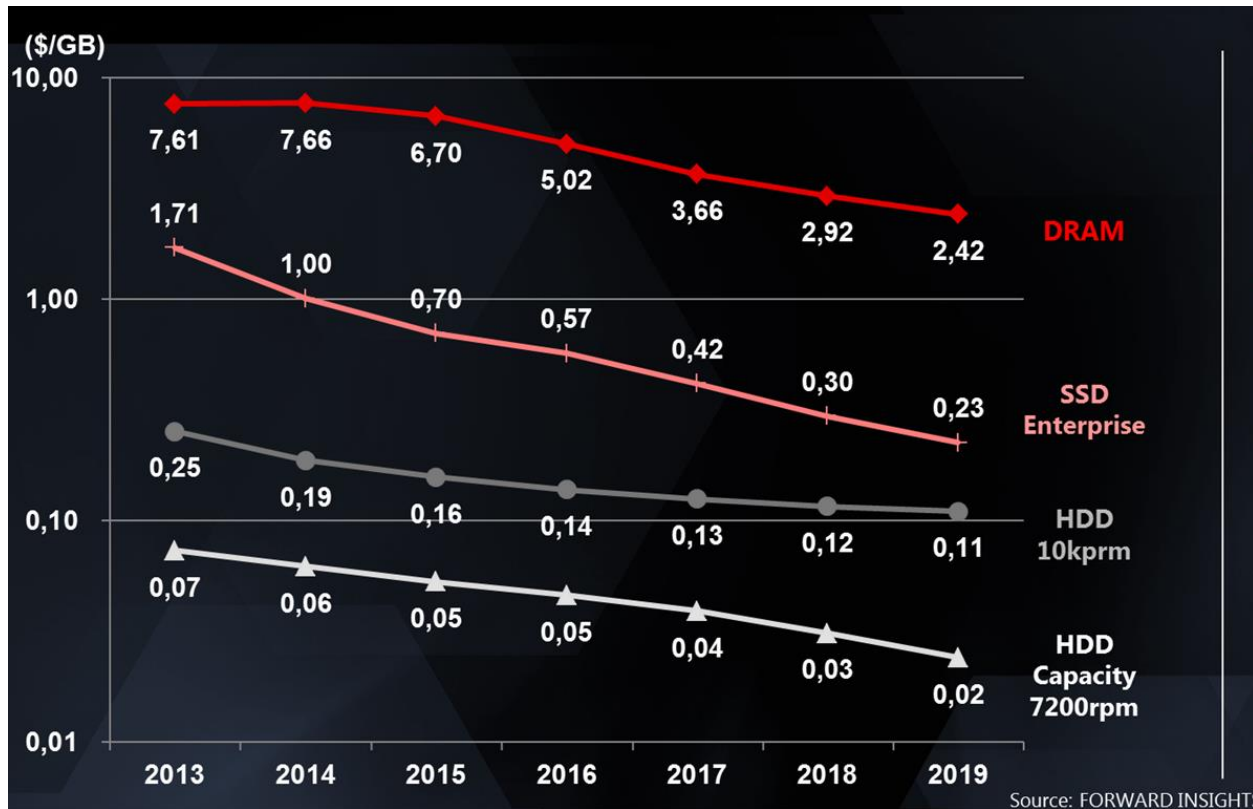
• Will SSD replace Hard Disks ?

	Sequential	Random	Cost
Tape	200 MB/s	[1 IOPS]	3 \$/TB
Hard Disk	250 MB/s	150 IOPS	30 \$/TB
SSD	500 MB/s	50.000 IOPS	300 \$/TB



- **Definetly Yes** – Mobile & Local User created Data: IOPS & Mechanics
- **Maybe Yes** – Database, „Hot Data“: IOPS Driven
- **Maybe No** – Video and Surveillance Data: Sequential ok, \$/GB Driven
- **Defintely No** – Cold and Archive Data: \$/GB Driven

Driving Factor #1: Price per Capacity



SSD Capacity Trend

- Ultra High Capacity
16TB → 256TB
- Price „Linear up“

HDD Capacity Trend

- Increase Capacity
8TB → 10TB (air)
→ 14TB (He)
- At similar unit cost
(few 100\$)

Driving Factor #2: Total required Capacity

- **2017 Total HDD Capacity shipped:**

- Enterprise and Client

~**672 ExaByte** (Mio TB) in 404 Mio Units

5 EB: All Words ever spoken by Human Beings

- **2017 Total SSD Capacity shipped:**

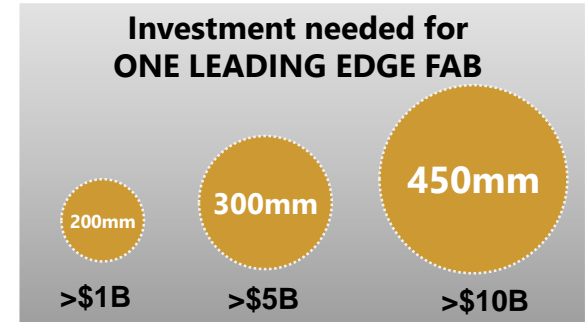
- Enterprise and Client

~**69 ExaByte** in 187 Mio Units

(less than 10%)

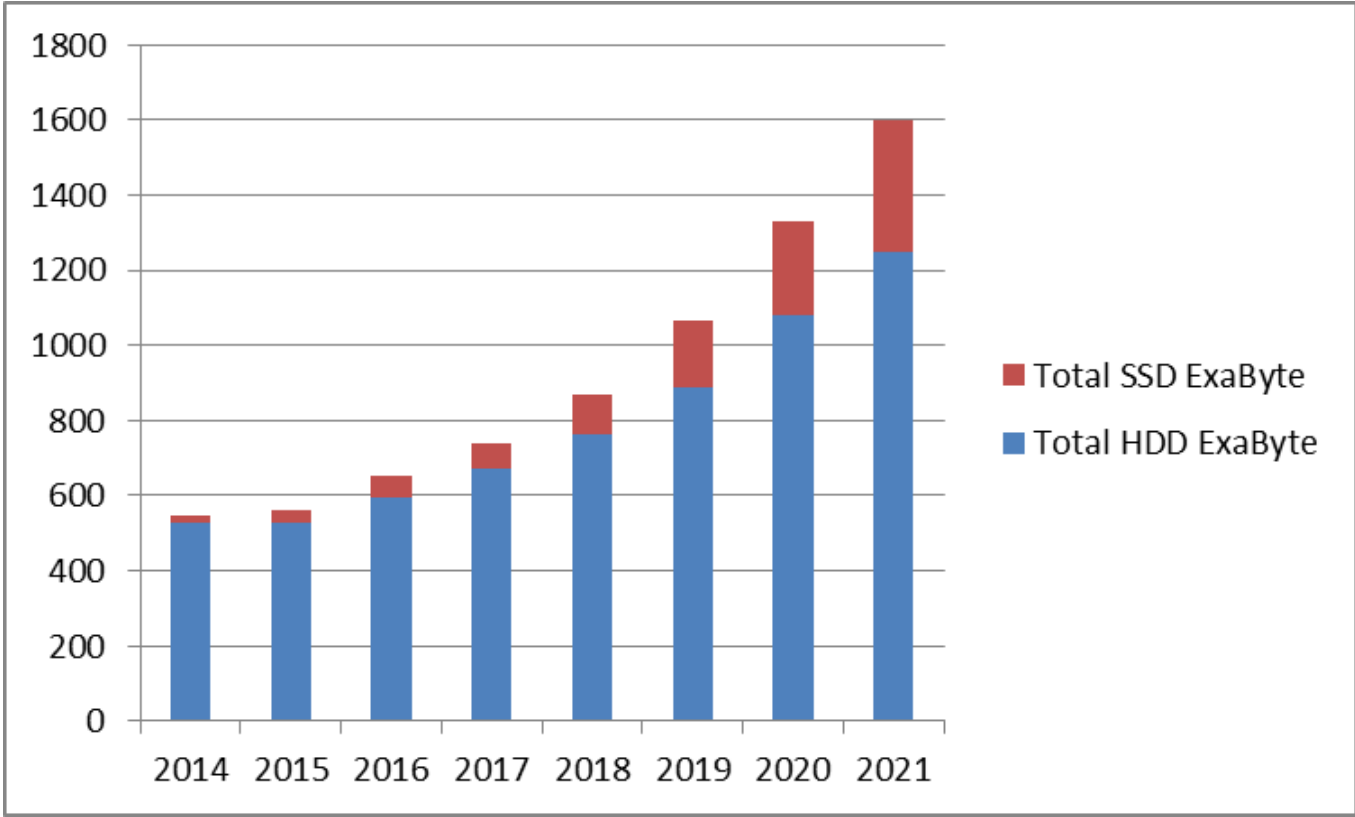
- **It would cost the NAND Industry Hundreds of Billions of Dollars to construct new Fabrication Plants to displace even 25%**

- **Within the next 5 - 10 years, it will be physically impossible to manufacture a sufficient number of SSDs to replace the HDD Base**



Source: Gartner / Trendfocus / TEE Estimates

Total Capacity Trend: HDD and SSD



Source: Gartner 4Q17 Update

Driving Factor: Power Consumption

- **Net Data to be stored in 2020: 15 ZB** (44 ZB total, 29 ZB discard, 13 ZB already installed, new install 2 ZB)
- **With Redundancy (2.5x): 37.5 ZB** (without Backup, just Replications in Storage/Datacenter)

- **„Average HDD Specification 2020“**

- Capacity (Average) 16 TB
- Power Consumption per 3.5" Drive 10 W/Drive
- Storage Ctr+Network per Drive 5 W/Drive

$$\frac{37.5 \text{ ZB}}{16 \text{ TB}} \times 15 \text{ W} = 35000 \text{ MW}$$

- **One Large Nuclear Plant: 1000 MW → 35 Nuclear Plants ?** (2014: USA: 100, France: 48)
- **One Large Windmill: 6 MW → 6000 Wind Mills ??**

Source: IDC / TEE Estimates

Toshiba's Commitment to YOU

- Develop and manufacture the Technologies to store your „Zettabytes of Data“ in an **economic way on reliable and performant Hard Disk Drives and SSD.**
- Cooperate with **all Players** in the Value Chain
- Consultancy, Roadshow Support, Proof-of-Concept Activities

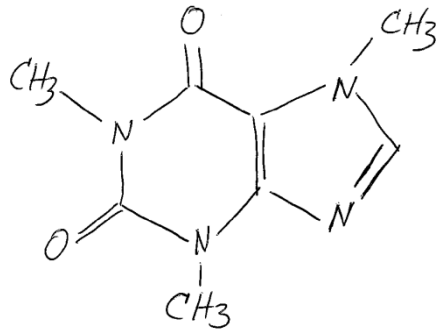
• **Visit us at Booth C04/C05**

- **And call us, challenge us! We are here for you to implement ...**

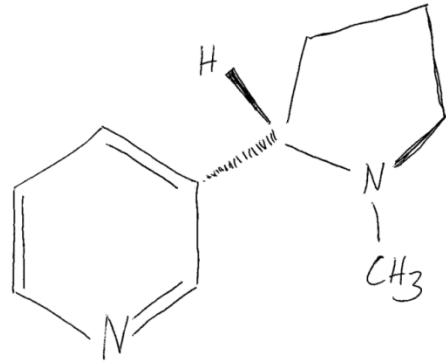
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Thank You !

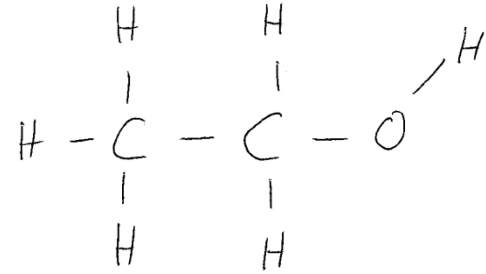
(Coffee Break)



(caffeine)



(nicotine)



(ethanol)

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