Reconciliation of Storage

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Outline

1. Storage is Changing
2. Cost and Trends
3. Outlook
4. Reconciliation

1. Storage is Changing

1.1 Typical PC Market Segments and Data Distribution

PC Storage Market Segments	
Yesterday	**Today**
Desktop (“beige box”)	> Business > Gaming > Overclocking, Modding > Multimedia > HTPC > terminal/kiosk > net tops, emerging markets
Laptop/Notebook	> desktop replacement (16”+) > full size (14”/15”) > ultra portable (12”/13”) > netbooks/low-cost (8”-12”)
Server	> online, near line, off line

Data Distribution	
Physical Media	> Physical Media > Internet Streaming and Downloads

➡ *More scenarios for system storage and data distribution*

1. Storage is Changing

1.2 Fragmentation: One size doesn‘t fit it all anymore:

- Storage Market Yesterday

System Storage	Backup/Archive Storage	Data Delivery
HDD	ODD	ODD

- Storage Market Today

System Storage		Backup/Archive Storage				Data Delivery		
HDD	SSD	ODD	HDD	Flash	Network Storage	ODD	Flash	Internet

> Archiving moves to HDDs
> Portable storage moves to small HDDs, thumb drives and memory cards
> Flexible storage moves to networks/online
> Blu-ray is late

➡ *New technologies provide cost advantages and convenience*

➡ *Fragmentation of the storage market*

1. Storage is Changing

1.3 Specifics of Available Storage Options

Features	ODD	HDD	Thumb Drive	Networked
Cost per GB	+	++	+	o
Performance	o	++	+	o
Durability	++	-	+	++
Flexibility	o	+	+	++
Scalability	-	+	o	++
Power Consumption	o	+	+	o

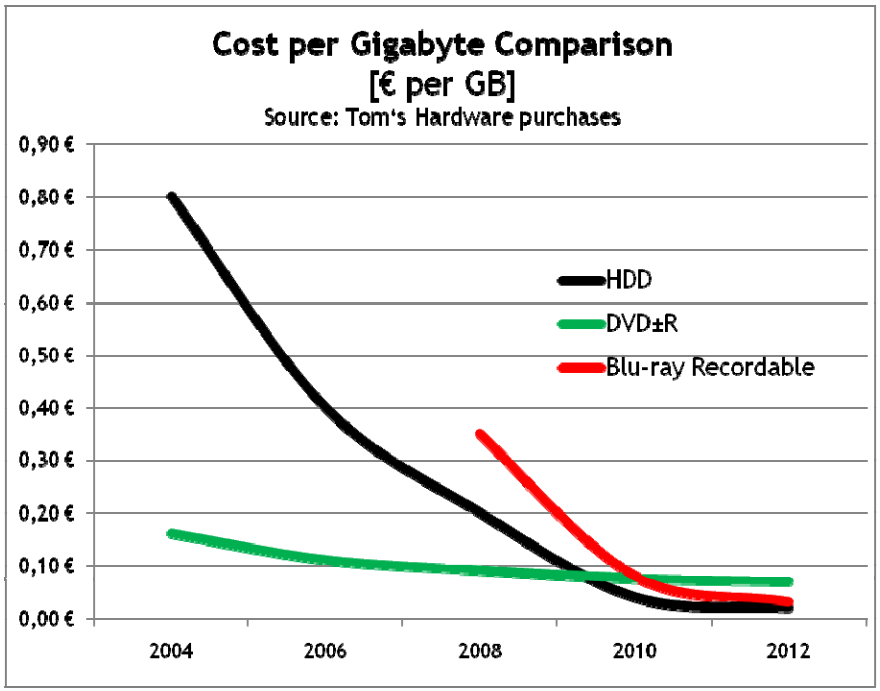
Applications	ODD	HDD	Thumb Drive	Networked
System/OS	--	++	o	+
Personal Storage	+	++	+	++
Archiving	++	o	o	o
Portability	+	+	++	o

➡ Many storage options are cheap, fast, versatile

2. Cost and Trends

2.1 Cost and Trends

- Significant price drops across the market
  > HDD
  > Flash memory
- Ubiquitous storage
  > access anywhere
  > access anytime
- Data distribution easier over the Internet
  > flexible > up to date



➡ *Storage has become a commodity*

➡ *Optical storage has to adjust*

2. Cost and Trends

2.2 The User‘s Point of View

- Issues in traditional storage:
  > BD devices and media still expensive, adoption slow
  > cost per capacity on HDDs is lower
  > requires burn software
- Issues in the multimedia/consumer segment:
  > BD movie and device price premium often high
  > Blu-ray adoption is slow (HD DVD)
  > DVD considered „good enough“
- Data distribution over the Internet is advancing:
  > HD content via cable, ADSL2+ or VDSL
  > On demand: No local storage necessary
  > Up to date

➡ *DVD drives remain a mandatory item.*

➡ *Blu-ray still a premium option.*

2. Cost and Trends

2.3 Popularity Example

Number of threads on the German Tom‘s Hardware forum by September 7, 2009:

- Graphics: 58,800
- Motherboards: 49,700
- Processors: 33,000
- Hard Drives: 18,700
- Optical Drives: 3,900

➡ *Optical drives aren‘t exciting. They are mandatory.*

3. Outlook

3.1 The relevance of the ODD is shifting.

- Primary storage solutions will prevail:
  > hard drives, solid state drives
  > thumb drives
  > Internet solutions (streaming, networked and online storage)
- Secondary storage applications for ODD:
  > offline backup, archiving, versioning
  > legacy data access
  > specific applications (privacy)

➡ Secondary storage can benefit from specific ODD features

3. Outlook

3.2 ODD Quality Features

- Most wanted digital assets are usually stored on discs: personal photos, movies, music
- High quality recordables enable 20+ years durability
- Recordables are fully write protected
- Write verification ensures write quality
- Durable if treated properly
- DVD drives available everywhere, hence replaceable
- BD is fully backwards compatible

➡ *BD breakthrough depends from cost and time to market*

➡ *Not all mainstream users know to appreciate these benefits*

3. Outlook

3.3 The ODD Will Remain – There is Value!

- Unique DVD Selling Points
  - > Affordable
  - > Interchangeable
  - > Very Available also in emerging markets
  - > Long Durability (20+ years if recorded and stored properly)
  - > DVD drives typically are already available
  - > performance is predictable
- Unique BD Selling Points
  - > Still DVD and CD compatible
  - > Proven concept
  - > Plug-in replacement for DVD drives
  - > Highest capacity mainstream offline storage medium
  - > HD content option

➡ *The optical disc will remain for many years.*

3. Outlook

3.4 Limits of „new“ Storage

- Hard Drives
  - > Max. component design life 5 years
  - > mechanically fragile, crashes may happen
  - > no standardized means of transportation
  - > partition and file system has to be considered
  - > human error
  - ➡ *Backup is imperative*
- Flash products
  - > no proven long-term track record
  - > performance sometimes unpredictable
  - > human error
  - ➡ *Short-term storage only*
- Networked storage
  - > complex, more expensive or too slow
  - > closed systems with administrative efforts

4. Reconciliation of Storage

- Every storage medium has pros and cons
- No storage medium can replace another one shortly
- Specific requirements require specific media
  > System drives: HDD, SSD
  > Storage: HDD, networked, occasionally ODD
  > Backup storage: 2+ different storage media
  > Portable storage: thumb drives, small HDDs, memory cards
  > systematic backup and archiving: ODD

- ODD Conclusion
  > one out of many storage options today
  > if Internet infrastructure and bandwidth allows, ODD will disappear in the distant future
  > optical drives and discs will stay for many years
  > there is a market for volume and for high quality drives

4. Reconciliation of Storage

What now?

- BD breakthrough require agressive approach considering the fast market development
- „Personal storage“ is not a device.
  It is a methodical approach:
  1. online storage
  2. backup
  3. archive
- Education needed
  > by the media
  > by manufacturers
  > by all of you
- Quality standards for highly durable recordables

Thank You!