



***Personal Content and
Home Network Storage,
the Perfect Storm***

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Abstract

By the next decade there will be more personal and quasi-commercial content than conventional commercial digital content. Home networking using various technologies will be growing in penetration and speed and networking of storage devices in the home will undergo enormous growth. Inexpensive networked storage devices in the home and in enterprises, combined with greater ability to classify and manage storage content will enable a vast and ever expanding network of storage. Backup and preservation of personal content will be a natural consequence of multiple copies fueled by the growth in social networking, various autonomous storage devices and the creation and distribution of personal content. This talk will discuss why and how such growth will occur and the implications for storage devices and systems as well as recommendations for how storage companies can position themselves for the greatest advantage in a storage enabled world.

Thomas M. Coughlin

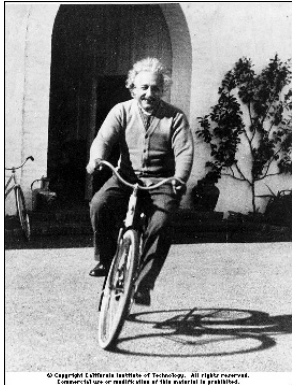
President, Coughlin Associates



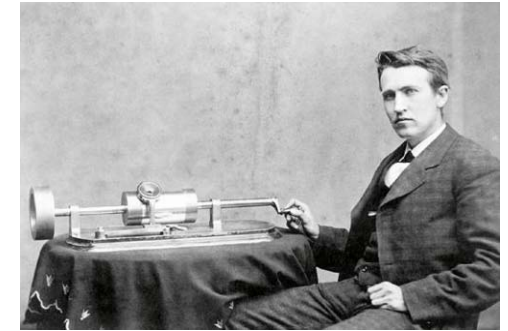
Tom has been working for over 25 years in the data storage industry at numerous companies such as Ampex, Polaroid, Seagate, Maxtor, Micropolis, Syquest, and 3M. He has over 70 publications and six patents to his credit. Tom is active with IDEMA, the IEEE, and other professional organizations. Tom is Chairman of the 2007 Santa Clara Valley IEEE Section and Adcom member for the IEEE Consumer Electronics Society. He is the founder and organizer of the Annual Storage Visions Conference, a partner to the annual Consumer Electronics Show and the new Creative Storage Conference. Coughlin Associates provides market and technology analysis as well as Data Storage Technical Consulting services. For more information go to www.tomcoughlin.com

2005-2007 Publications:

- [2007 Digital Storage for Entertainment Content Creation and Distribution](#)
- [2006 Hard Disk Drive Capital Equipment Market and Technology Report](#)
- [2006 Tape and Disk--A User's Perspective](#)
- [2006 Backup and Archive--A User's Perspective](#)
- [2006 Continuous Data Protection--A User's Perspective](#)
- [2006 Tiered Storage--A User's Perspective](#)
- [2005 NAS and NAS Virtualization- A User's Perspective](#)
- [2005 Integration of Digital Storage in Consumer Electronics](#)



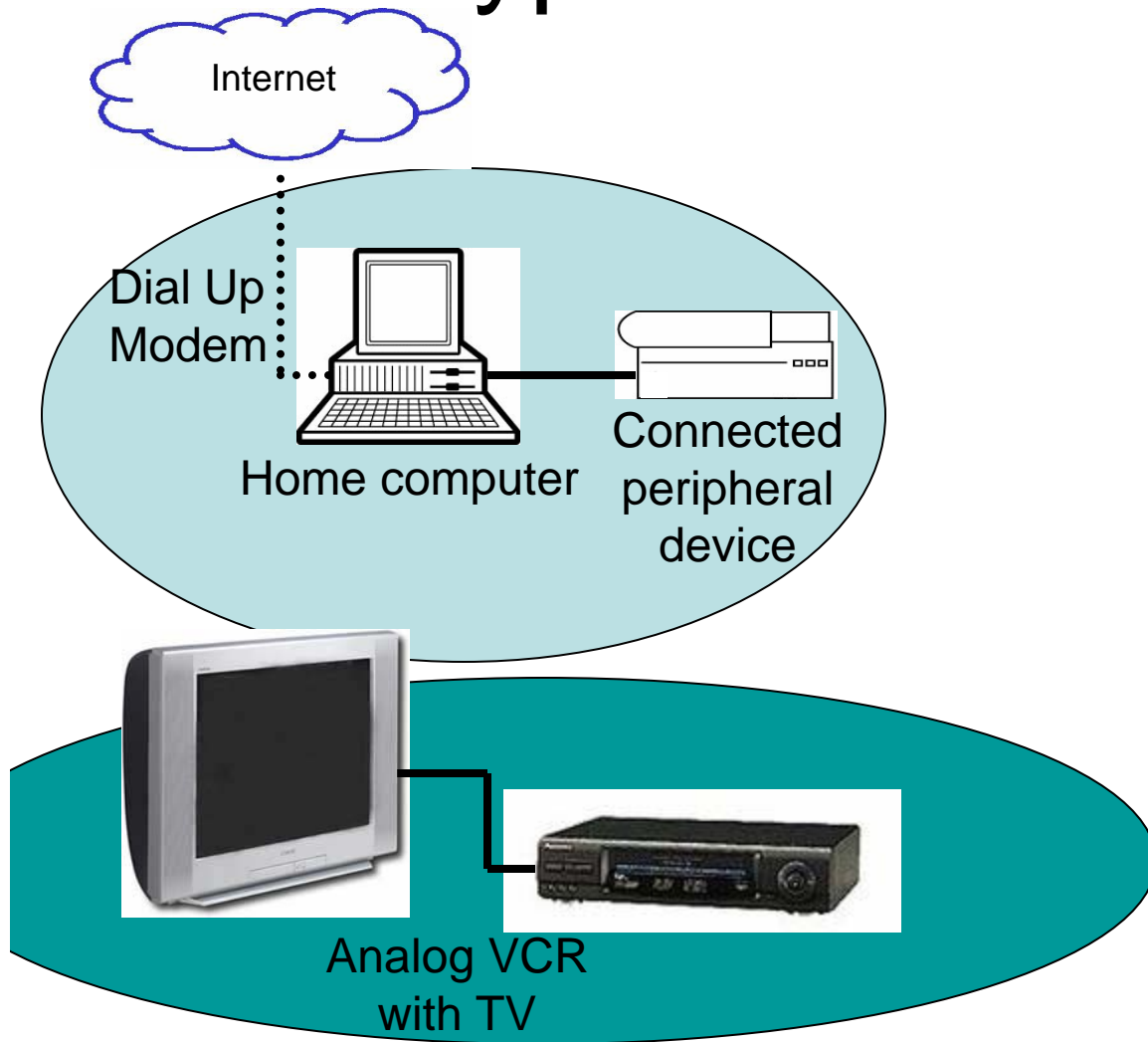
Outline



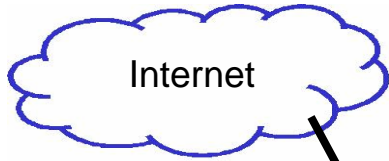
- Rapid development of low pressure centers around consumer applications drawing in hot storage
- Networking devices in the home to bring showers of content both locally and to extended social networks
- New rules and guidelines for digital storage design may prevent rain clouds darkening the world wide storage market
- Tomorrow will bring partial sun as consumers increasingly dominate digital content creation and distribution
- Rainbows expected over the disk drive industry as new needs for inexpensive storage drive greater demand



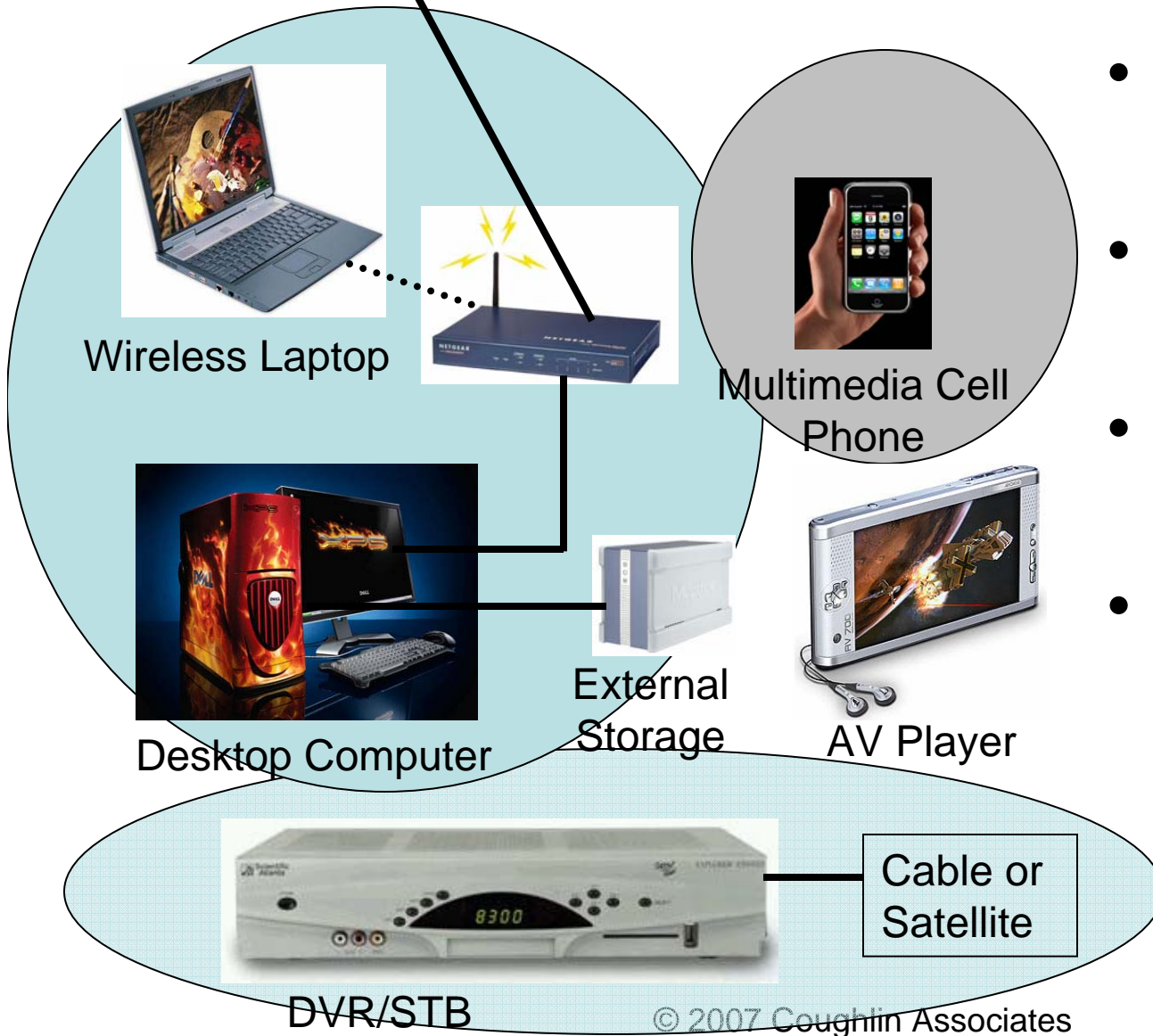
Typical Home in 1997



- Dial-up Internet still common.
- Wired connections to peripheral devices such as printers
- Unconnected analog VCRs provide entertainment

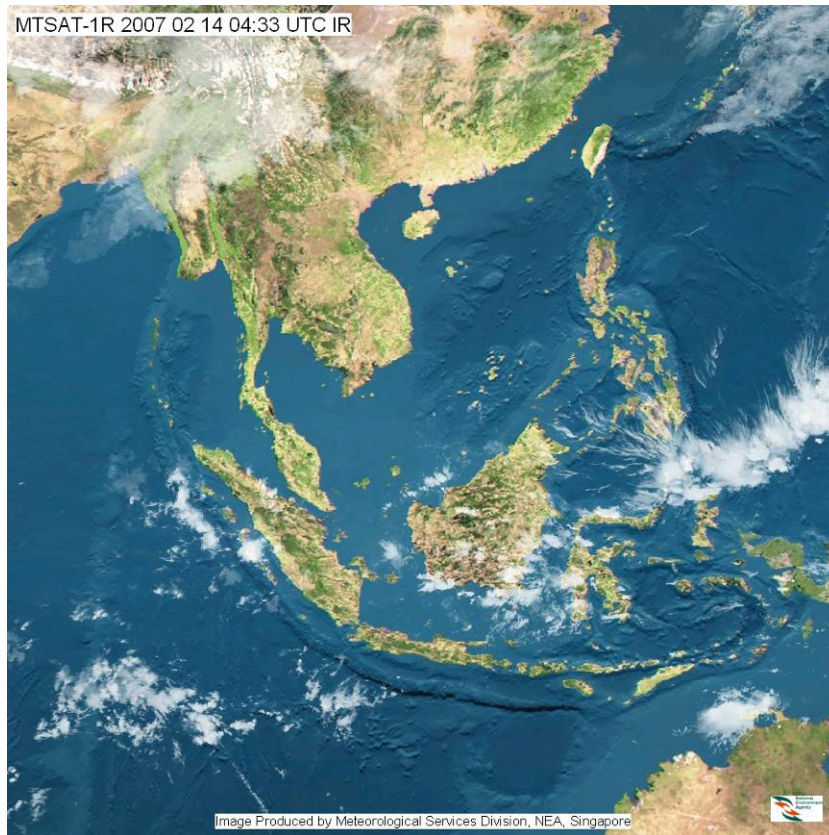


Typical Home in 2007



- More digital devices in home with content stored on them
- Only computers are networked effectively
- External storage but mostly direct attached.
- Cable networks, cell phone networks and Ethernet networks are still mostly isolated from each other

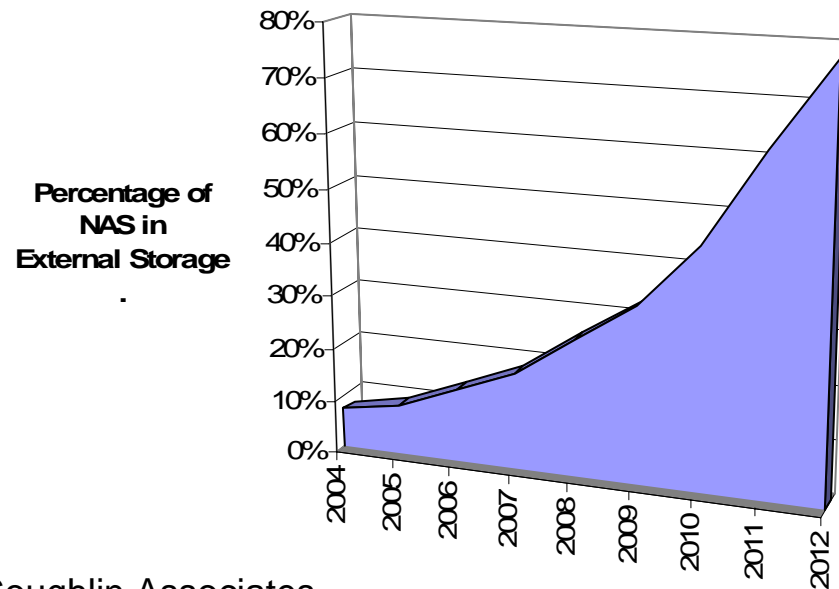
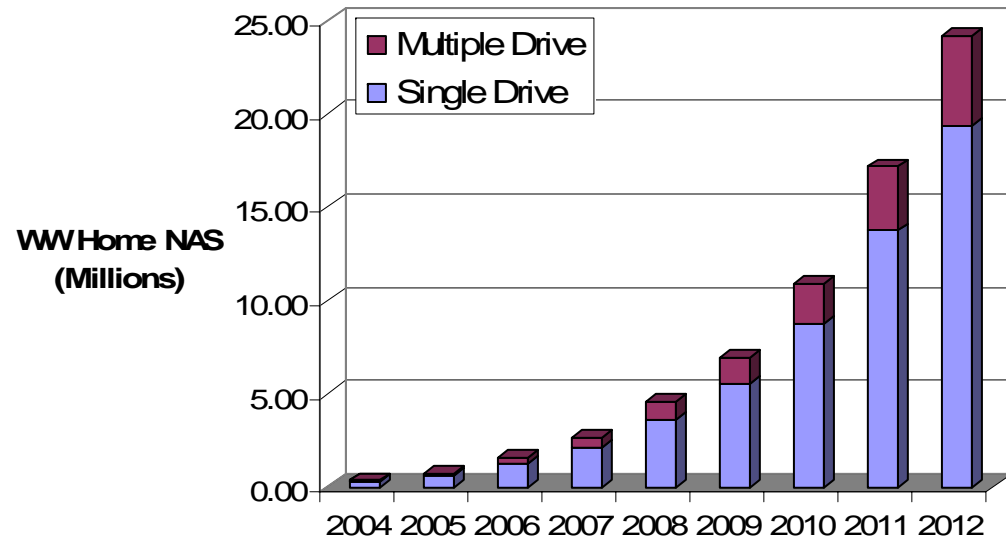
Weather Report



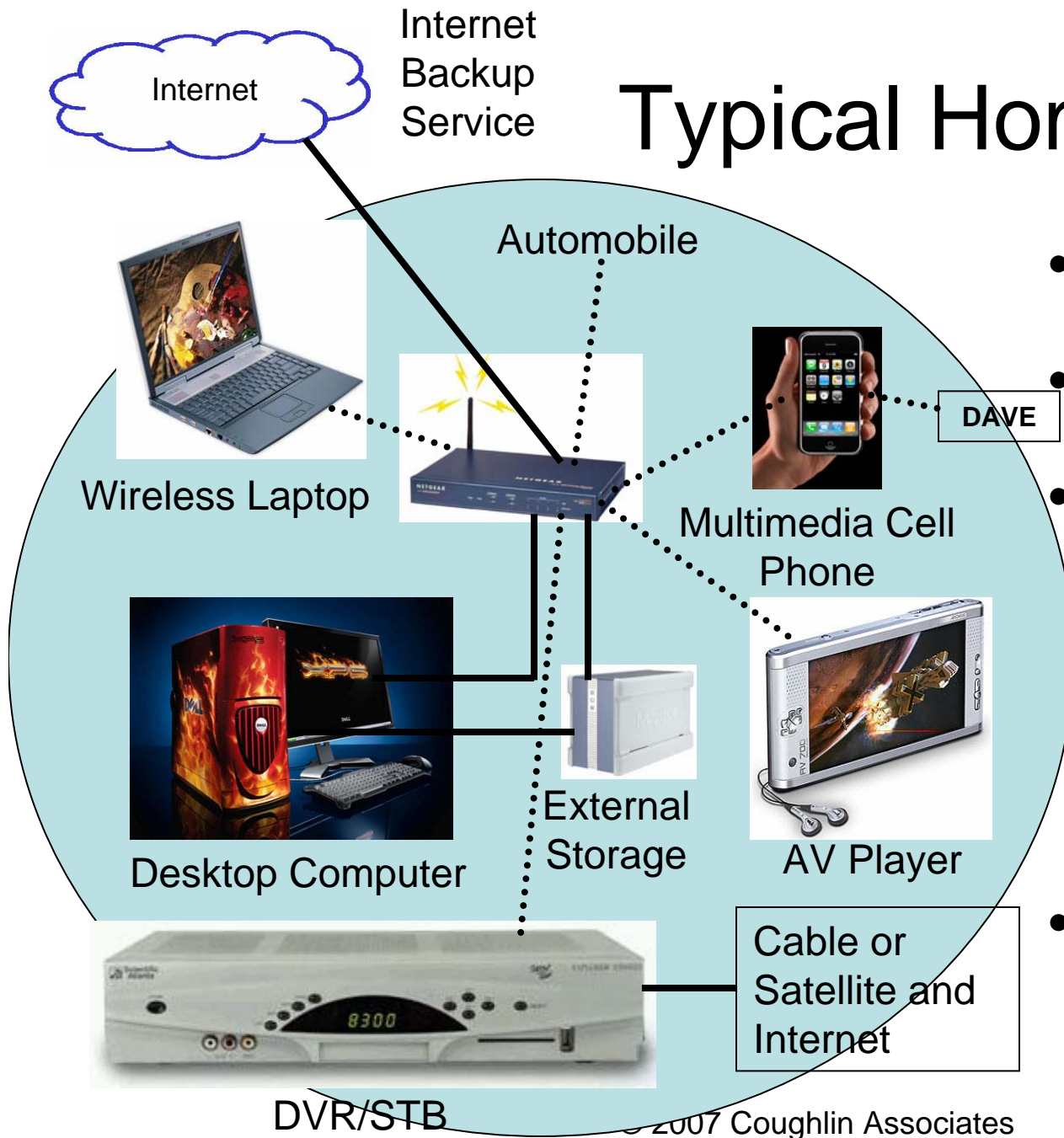
- Reports of increased network activity worldwide
- Severe content creation and sharing expected
- Tomorrow expected strong storage trends blowing our way

Projected Growth of Home Network Storage

- External home/small business storage is growing and so is home NAS
- By 2012 close to 80% of external home and small business storage will be NAS
- However only about 15% of homes with Network Connections are estimated to have NAS by 2012



Typical Home in 2017



- Things won't look like they do now
- Everything will be connected
- Content and storage will be shared and there will be many copies—storage is cheap and capacities are large
- Content is managed, indexed and automatically backed up

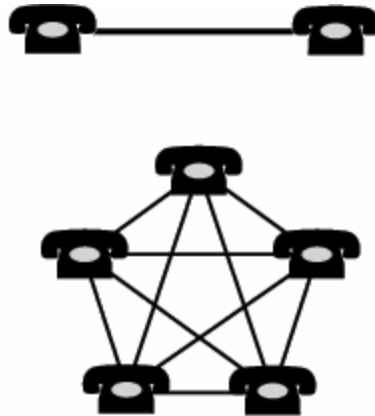
DVR/STB

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The value of Networking

- **Metcalfe's law:**

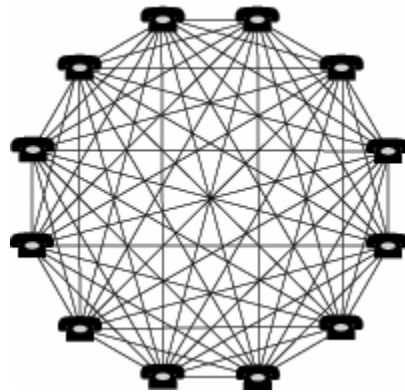
- “The value of a telecommunications network is proportional to the square of the number of users of the system (n^2).”



The value of Networking

- **Reed's law:**

- “Not only is a member connected to the entire network, but also to many significant subsets of the network. These subsets add value independent of either the individual or the network.”

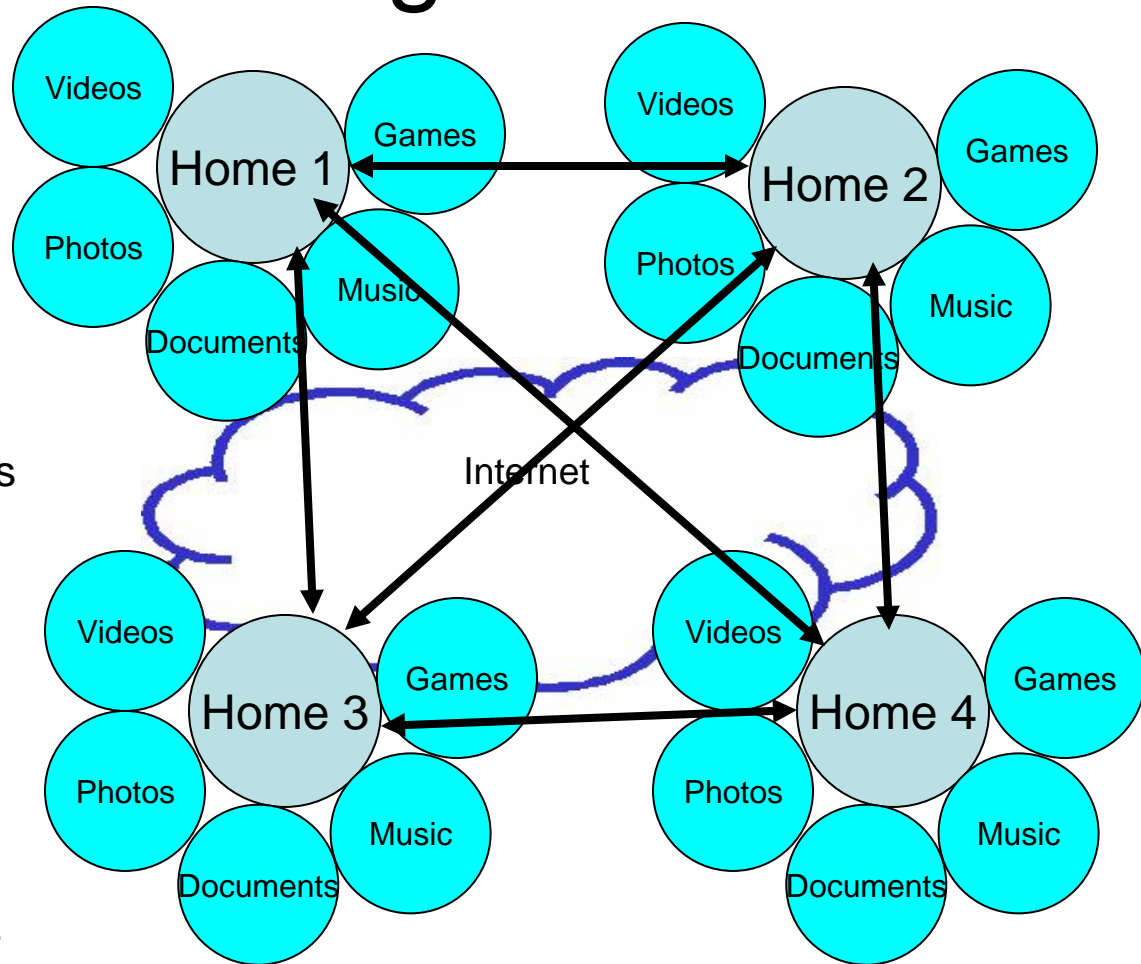


The value of Social Networks to Storage

- Small communities (e.g. family groups or friends) connected through the web and also connected to others
- Multiple homes--multiple copies, multiple connection paths
- Greater potential for interaction, exchange and copies of content
- Due to the creation of copies and the encouragement of new content creation and sharing, storage growth will increase by something like:

$$S = C(N-1)^m$$

Where $m = pN$, p is a group participation factor, N is the number of connections, C is the average size of shared content and S is the amount of storage created by sharing



A similar relationship exists within each home where multiple devices can share content

Impact of new modes of sharing information

Content Creation and Distribution for Everyone!

- Social networking
- Second life
 - New virtual economic models with real world returns
- Youtube and similar content sharing technologies
- Peer to peer (bandwidth aggregation using technologies like BitTorrent reduce infrastructure costs and access to content)
- Content creation is cheap and anyone can post to the web
- Could we see new modes of bringing people and ideas together
 - A common interest engine
 - New driver for economic growth

Rules for Storage Design

- Use the most cost effective storage component(s) that provide enough capacity for the application
- Never design a product where you intentionally limit the available storage capacity to the customer—always allow a means of storage capacity expansion
- Make it easy to back up and copy data (storage is cheap, time is not!)
- Make management and organization automatic—for instance protect data and prevent replication of corrupt data
- Design to provide lowest total product cost (storage integration concepts)

New concepts in mass storage

- DAVE-Seagate's announcement of a Personal Area Network (PAN) mobile storage device with wireless connectivity and its own battery power to provide mass storage that can be accessed by a nearby mobile device such as a cell phone
- Further developments in combining flash and hard disk drives—e.g. could the laptop be turned inside out with an embedded flash and a small HDD as a removable module or connected to the laptop via a PAN (like DAVE)

The Future of SSD Laptops

- How to make SSD laptops more popular
 - Don't limit the amount of local storage to the user
 - Enable choices in content access rather than restrict it
 - Use the storage hierarchy to your advantage!
 - This could increase market share to >15% by 2011
 - One concept—turn the laptop inside out (SSD fixed and HDD removable or external)
 - This gives users more options and if designed together could be very sleek and attractive



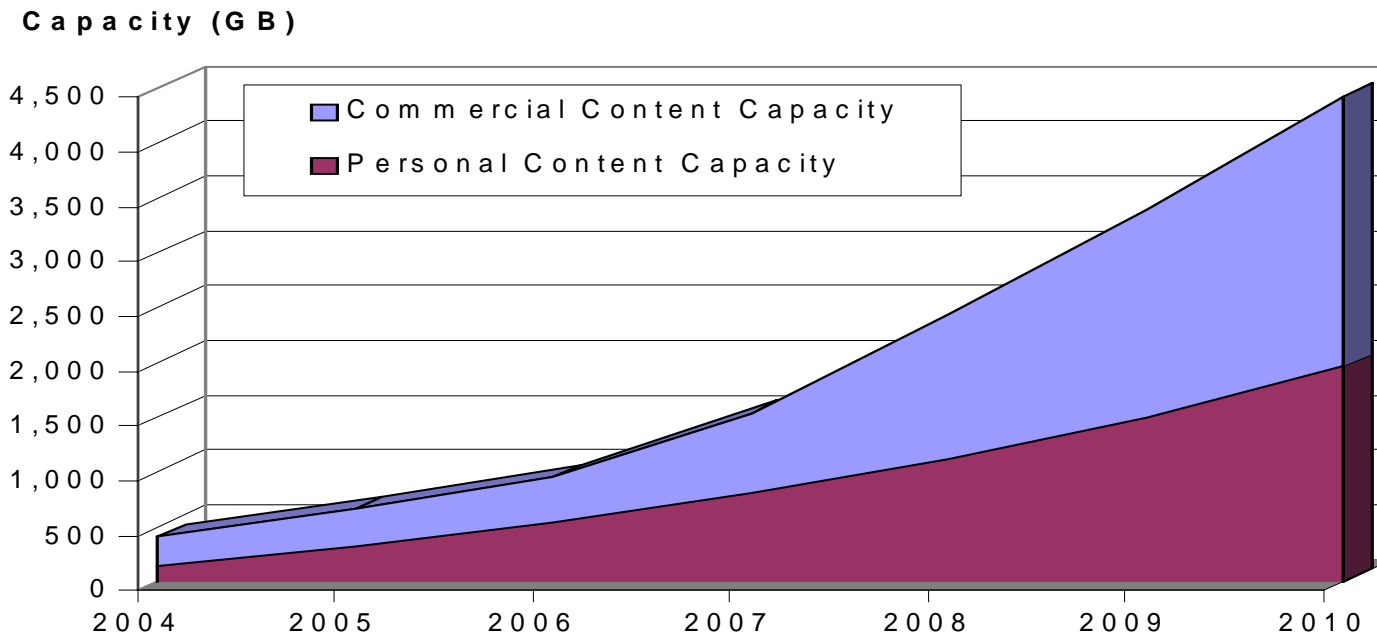
Changes in electronics and the market

- Customers don't buy anymore just because a product has a faster processor (or because it has more storage)
- New trends driving CE market
 - Mass customization (low cost products meeting individual needs)
 - More niche products, loss of mainstream
 - More and more products and content will have to access individual preferences and experiences
 - Development of new levels of personal storage could drive entirely new markets for commercial products that utilize this information to the benefit of individuals
- More storage now shipped for personal use (including personal computers) than commercial (e.g. IT) use
- On the commercial side more storage generated automatically by machines rather than by people
- These are the trends—design and market with these in mind!

Growing importance of personal content

- By the next decade there will be more personal than commercial digital content stored
- This will create new markets and opportunities to serve this diverse and dispersed market
- Increasingly consumer electronics will be driving new technologies. CE could displace IT in the generation of technology solutions
- Storage demand is infinite—we can't keep enough information—as long as we can afford it, find it, keep it and preserve it
- Storage must help in organizing and finding data—object storage in CE devices

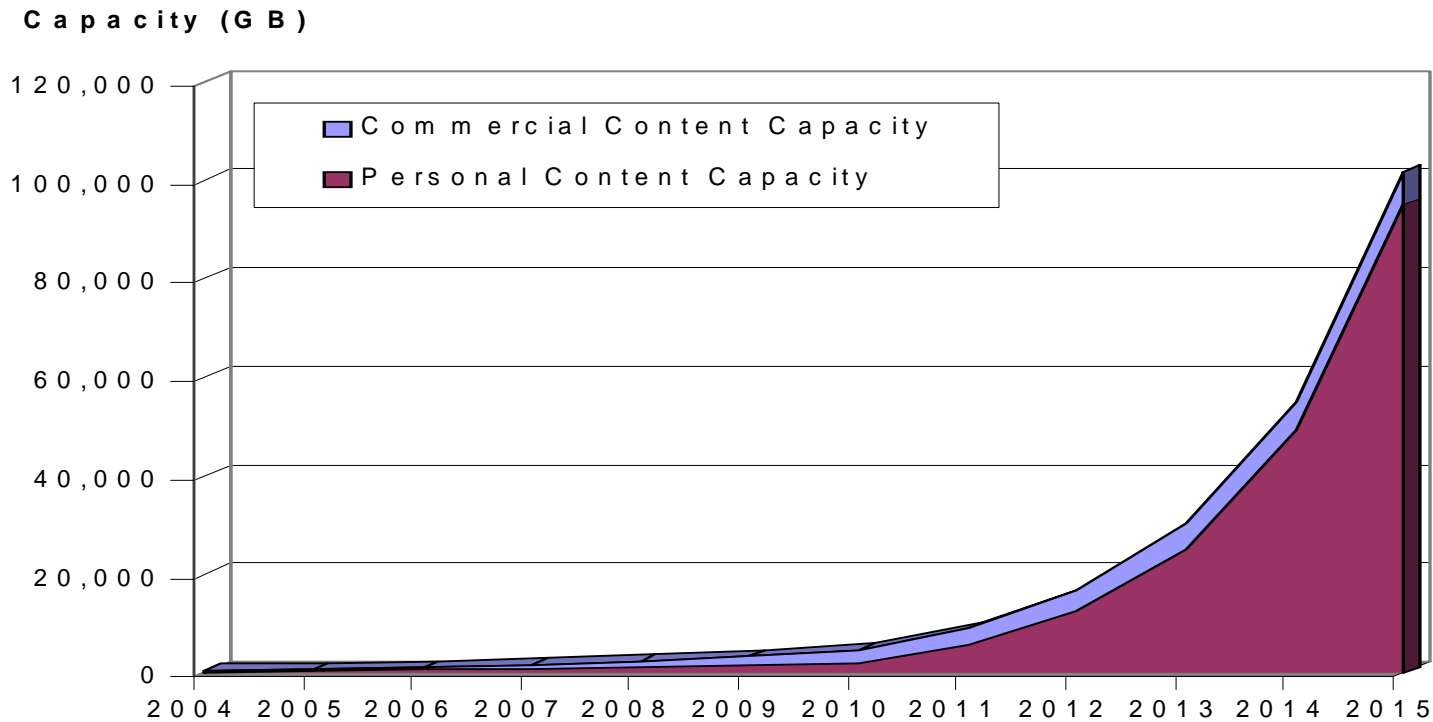
Cumulative Home Storage Capacity (at SV06)



**Almost 2 TB of personal reference data and
2.5 TB of home commercial content by 2010**

Extended Projection Showing the Impact of Life-Logs on Personal Content Generation in a Technology Savvy Home

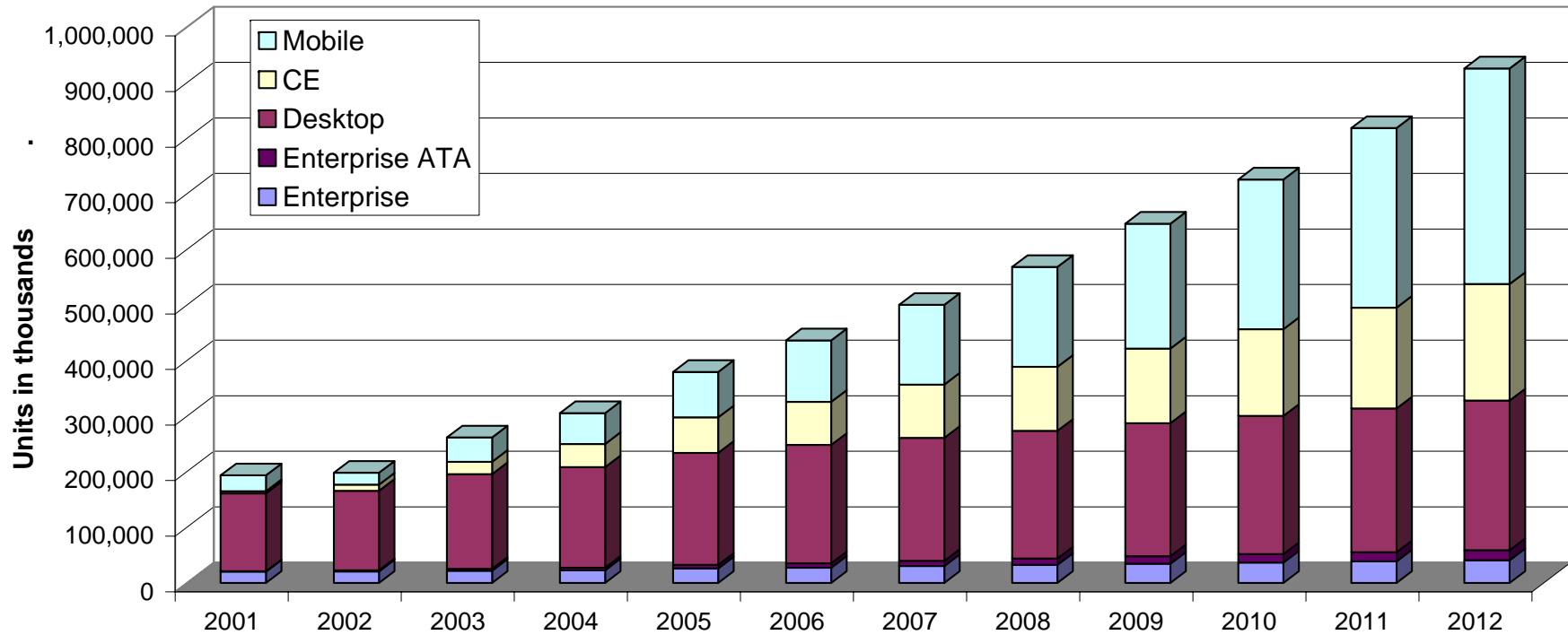
--100's of TBs in Next Decade--



More than 1 PB of data in a lifetime...

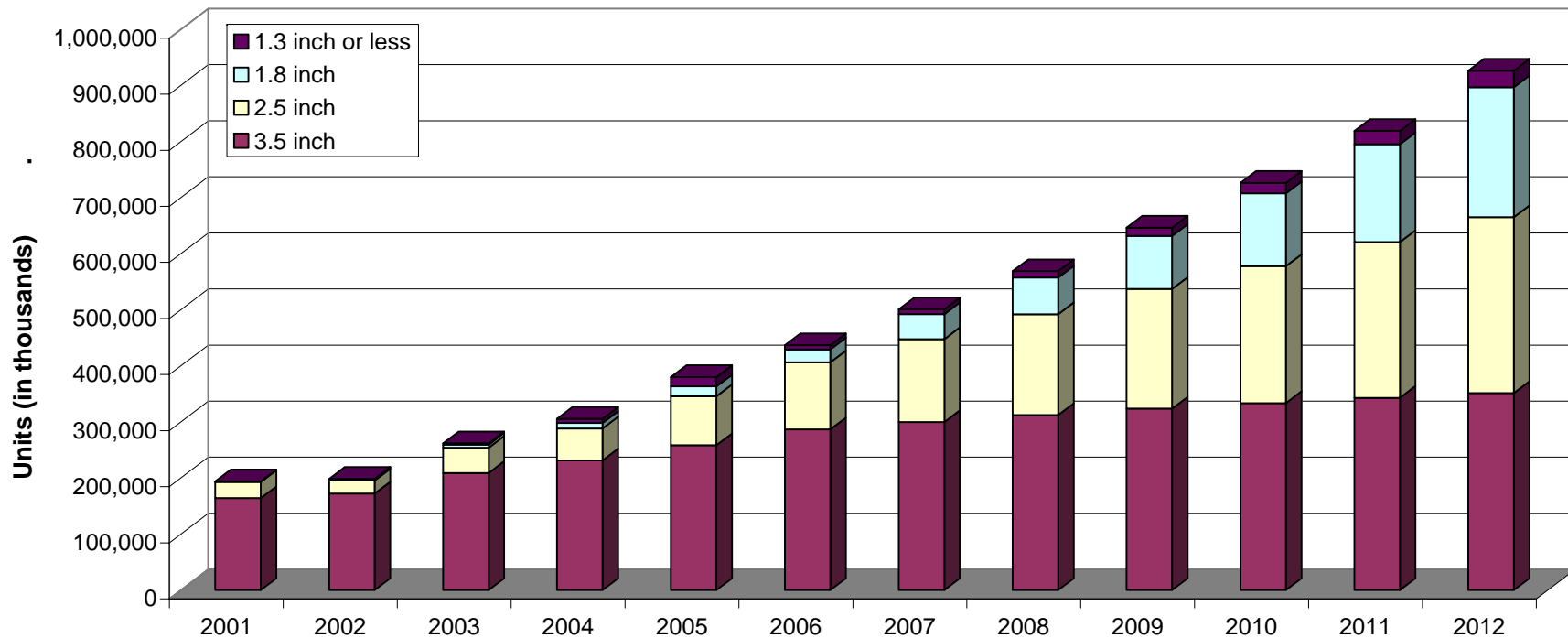
@SV07

HDD Market Niche Unit Projections to 2012



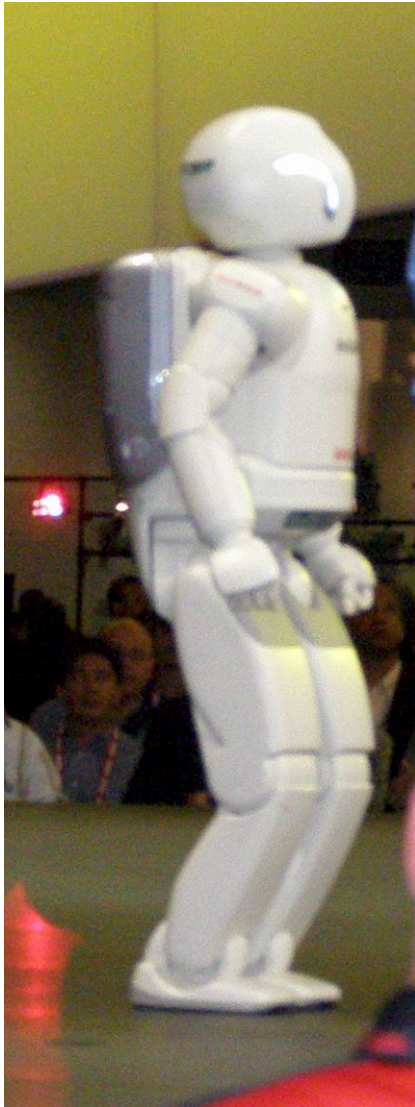
- Starting in 2010 mobile computers will exceed desktop
- **By 2013 over 1 billion disk drives shipped per year**

HDD Form Factor Unit Projections to 2012



- After 2010 2.5-inch and smaller HDDs dominate
- High capacity in small FF and need for mobile storage drive trend

By 2015



- A terabyte in your pocket
- A petabyte in your home
- Exabytes in datacenters
- Zetabytes in the world

Digital storage demand
is very elastic

Honda Robot at 2007 CES

A photograph of two children standing in a forest. They are both wearing bright yellow rain ponchos. The child on the left is leaning their head on the shoulder of the child on the right. The child on the right is looking towards the camera. The background is filled with green foliage and white flowers. The ground is covered with pine needles and rocks.

We are the value of our content...

Thank You!