Ultra Content for Ultra Broadband

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- The content question Is critical for any economic analysis of ultra-broadband.
- If you build an oil pipeline, you must be sure that there is oil supply on one end, and demand on the other end.
- In discussions like this it is easy to rush to talking about technology, and rollout strategy, before stopping to ask the question of utility to users.
- The economic case for investments into super-broadband must rest on its meeting a demand that is not satisfied today
- What would SBB be used for? There is no major need for more powerful email, or websites, once basic video quality is satisfied. Why would people want more powerful connectivity? It would have to be entertainment, broadly defined, and professional applications.
- So let's look at that.

- If one asks people, even knowledgeable people, of what they would do with a super-powerful internet pipe when it comes to video, they normally believe that it would be necessary for

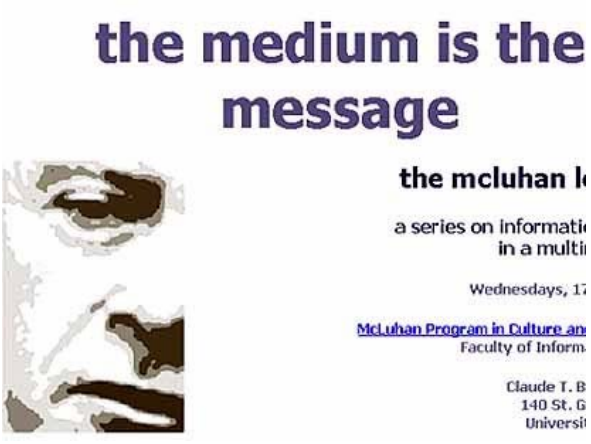
Expectations for Content over UBB

- More specialized programs
- More individualized content
- Anytime, anywhere video entertainment
- More user-generated content
- More “long tail” content
- More independent and foreign TV
- More interactivity
- More games

- But, this would be invariably wrong

- The contribution of Ultra-braodband will not be in these areas.
- I will show that.
- And if the economic base of UBB rests on these applications, it will fail as a new medium.
- UBB has to rest on other content applications.
- And I will show what they are
- And, what type of companies will provide this content.

Marshall McLuhan

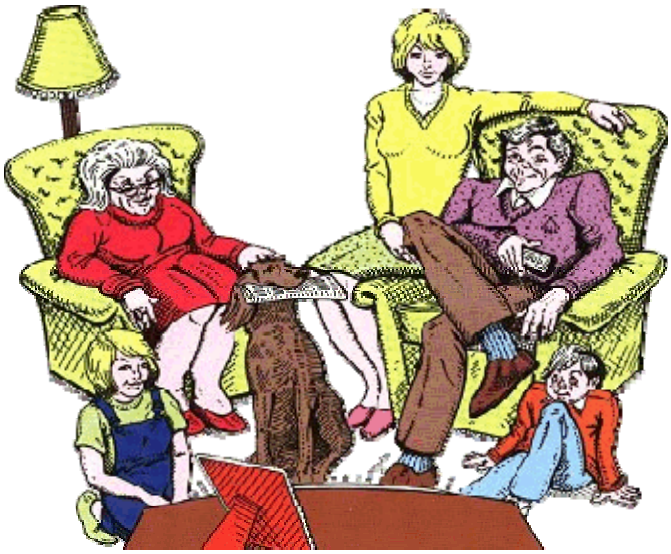


•If the medium is indeed the message, then the upgraded broadband will have an impact on the styles of content, and on the business models for producing and distributing it. This is the question for analysis for the paper.

- It’s helpful to look at how TV developed, and hat content it provided

- TV used to be a simple matter

“Television”



(http://www.sneezes.freeserve.co.uk/television.jpg)

- It was ‘one size fits all TV, a fairly uniform medium technically, organizationally, culturally, economically
- Analog
- Over-the-air terrestrial broadcast

- 6 MHz
- 525 lines, interlaced, 30 fps
- With broadbased, national, middle of the road content, and some localism
- And its economic model was advertising base

- But now, it is getting complicated

The 4 Stages of TV

The Stages of TV

- (Pre-TV TV)
- Generation 1:Limited TV
- Generation 2: Multichannel TV
- Generation 3: Internet TV
  - –But also, Low-Def TV
- Generation 4: Ultra-TV

0-Gen: Pre-TV TV

- RCA/ Zworykin :2 x 30 Lines , 1929

http://members.tripod.com/~FrameMaster/felix2.jpg

1stGen: Limited TV

The new thrill..

1939

"Look, Pop! It's a Homer!"

Not last week's game; not something that happened yesterday; not even a minute ago. But *right now!* Seeing things—miles away—at the very instant they happen! That's the new thrill that television now makes possible.

BUT television is destined to do more than this for us. The foundation is laid for a whole new industry—careers for artists; jobs for hundreds of engineers and thousands of skilled workmen making television transmitters and receivers; jobs for thousands more selling and servicing this new product and providing the raw materials required. These are important possibilities of television.

For more than 60 years, General Electric scientists, engineers, and workmen have been finding new ways for electricity to serve the public—in factory, farm, and ho The new products and services made possible by t week have helped to produce the steady rise in the li standards of the American people.

And *right now*, as television emerges from the labora to take its place among the accomplished marvels of age of electricity, these G-E pioneers are once a creating, not only "More Goods for More People at Cost," but also MORE AND BETTER JOBS HIGHER WAGES.

G-E research and engineering have saved the public from ten to one hundred dollars for every dollar they have earned for General Electric

GENERAL ELECTRIC

NEW YORK WORLD'S FAIR—SEE THE G-E "HOUSE OF MAGIC"—SAN FRANCISCO EXPOSITION

http://www.tvhistory.tv/1939_Dec_Fortune_GE_Advert_small.JPG

- Limited in most countries to 2-6 channels, often controlled by government or the major political parties, or by a handful of media companies.
- The content aimed at the broad center of the population. No specialized channels. Politically cautious. Politically powerful.
- Because of the near-monopoly status, very profitable, and relatively high-budgets for production, but budgets not at the level of theatrical films.
- Films shown as part of a release sequence
- Many program imports, espec from the U, at low prices due to limited competition for them.

Broadcast TV Bandwidth

- On a national basis, typically 12 channels, at each 6 MHz each, about 142 Mbps

2nd Gen TV: Multichannel TV

- Cable TV
- DBS
- VHS
- DVD

Cable TV

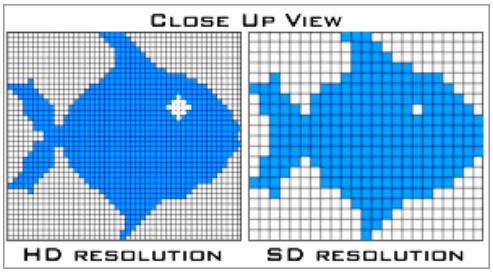
- Today advanced cable infrastructure about 1 Ghz, so about 3 Gbps.
- Which is about 25 times more than terrestrial broadcast (Of about 142 Mbps)

- So this extra transmission capacity was used first in a horizontal fashion—more channels, using the traditional technology of analog, 6MHz, one-way TV

- But after a while, digital technology enabled also an extension to a richer channel

HDTV

- 1080 horizontal lines for the HD progressive applications
- x1.125 width added
- 1920 horizontal pixels
- 30 fps
- 16 bits per pixel
- Total: ~ 1Gbps



http://biglerproductions.com/gif_files/HD_resolution_fish.gif

Comparison between Xvid, DVD, HD 720p and HD 1080p

And Now, 3rd Gen TV
Individualized TV

3rd Gen TV

- **Internet TV**
  - –Diverse content
- **Mobile TV**
  - –Ubiquitous availability

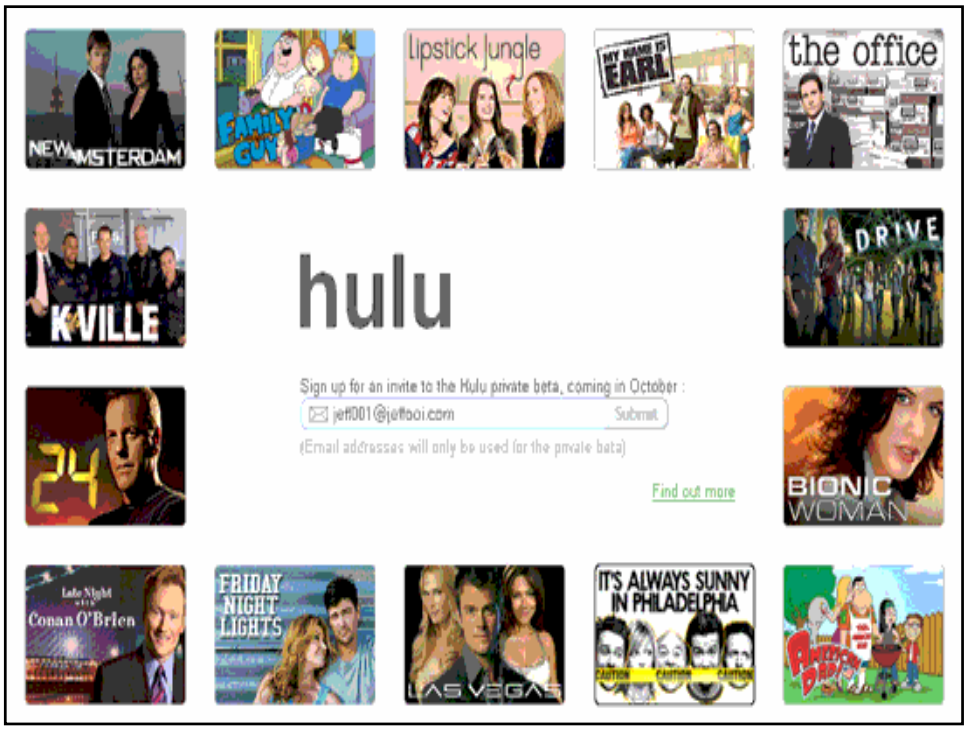
- This next step of TV is partly based on the increase of transmission capacity
- Broadband, based on DSL upgrade, coax, or fiber.
- And partly based on the emerging storage capacity

- Cellular wireless which increases enormously the wireless individual capacity,a and leads to ability to receive and transmit video from many locations
- Broadband leads to a further diversification horizontally, to individualized casting

- The bandwidth of regular broadband varies a lot, but averages about 4 Mbps on the enduser access level
- Bandwidth of 3G realistically 250 kbps for user

Content for 3rd Gen TV: TV over Broadband

- 1. More standard TV, at different times




Instant Messaging
Zbyszek Zolkiewski
Welcome to Joost!
Badlop
Bartek
Brat
Elmer NxG
Fabian GG
Grześ Garlewicz
Jajcuś_nowy
Małik
Mariusz Topka
Michał Jaźłowiecki_a
Sparrow
Szatański
Sławek-Gadu
Zbyszek_Tolliman
echo.jabber.autocom.pl
Welcome to Joost!
kolargol-testowy
konfczynek
nivertius
smsy.jabber.autocom.pl
joost
IMF - International Music Feed
One World


Back
What's New
Search
Explore
My Channels
Featured
What's New
What's Popular
Cartoons & Animation
Comedy
Documentary
Drama
Entertainment
Film
Lifestyle
JERICHO
POPARTSTV
wallSTRIP

Internet TV

- Enables watching regular TV from other countries
- Specialized feeds: Beijing Olympics
  - The Women's Field Hockey Channel

- 2. Specialized programs for niche audiences

Narrowcasting: Long Tail Content

- 3. Global aggregation of nationally thin audiences

- 4. User generated content

- YouTube, Daily Motion
- In bit terms, about 300 kbps

5. Download of Movies

- Part of their release sequence, maybe even at the top spot now.
- But fears of piracy,
- Low speed of download of quality pictures

Mobile TV

Mobile TV

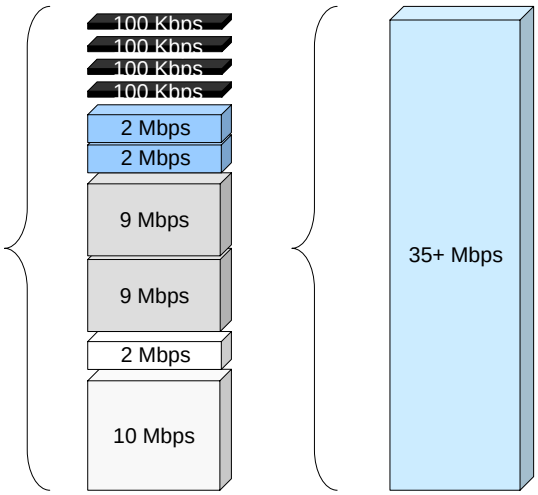
http://cache.viewimages.com/xc/3330804.jpg?v=1&c=ViewImages&k=2&d=4DAA13B573E1BD2F23D6197B4F8F7070A55A1E4F32AD3138

MediaFLO

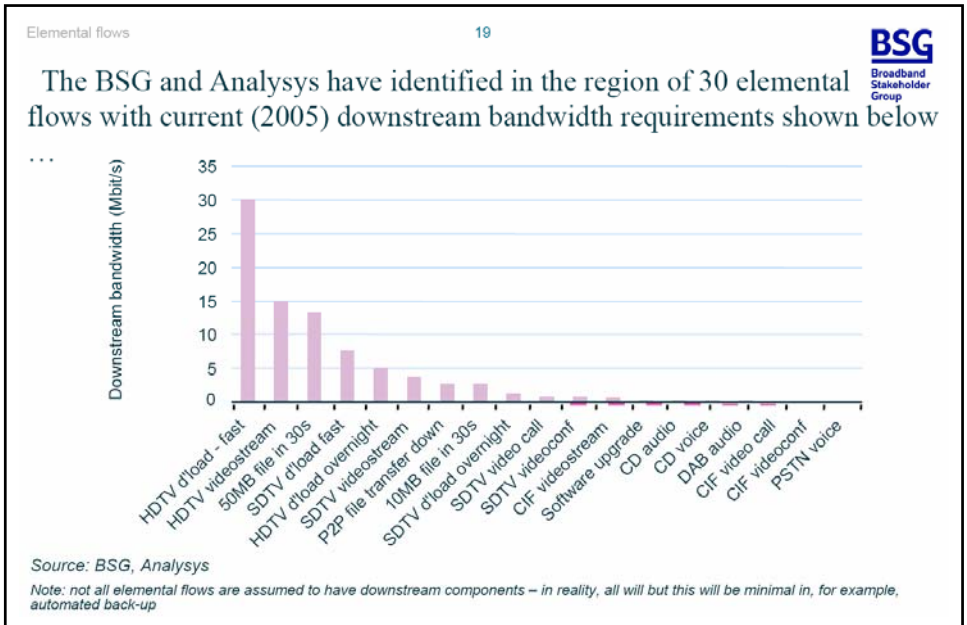
http://cache.viewimages.com/xc/57263045.jpg?v=1&c=ViewImages&k=2&d=17A4AD9FDB9CF1939847EC77F5F8D1CE326120C381348B40A40A659CEC4C8CB6

How much Capacity per Household is needed for IPTV?

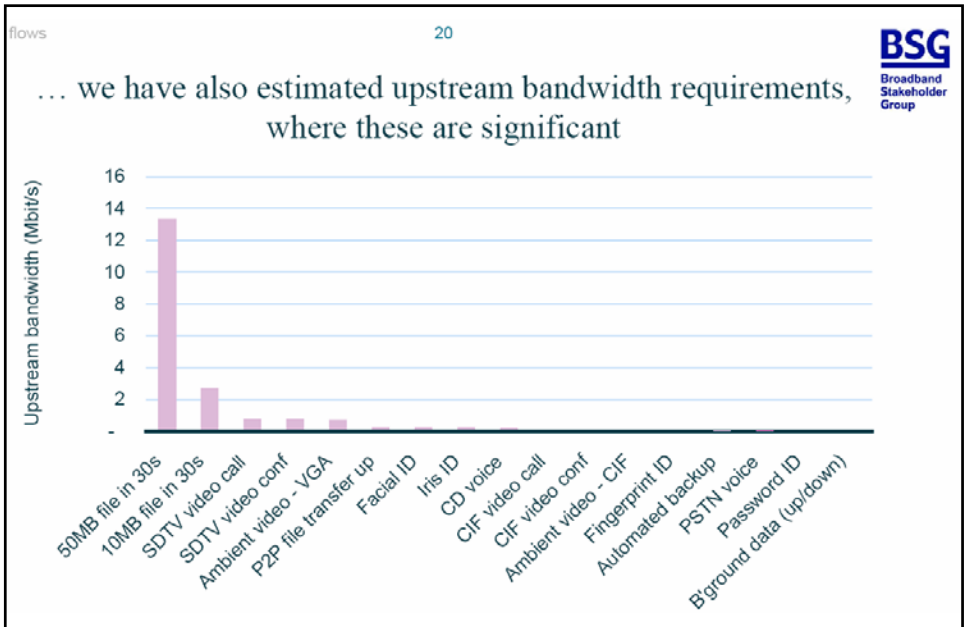
Service	Quantity
VoIP	4
SDTV	2
HDTV	2
VOD/Gaming	1
HSI	1



Motorola. “The Next Generation Network: Ultra-Broadband IPTV”. April 2006, last accessed on 21 March 2008 at www.ihollywoodforum.com/old/documents/IPTV/10.ppt



Broadband Stakeholder Group. "Predicting UK Future Residential Bandwidth Requirements". May 2006, Last accessed on 21 March 2008 at http://www.broadbanduk.org/content/view/185/



Broadband Stakeholder Group. "Predicting UK Future Residential Bandwidth Requirements". May 2006, Last accessed on 21 March 2008 at http://www.broadbanduk.org/content/view/185/

4th Generation TV

- Ultrabroadband TV
- "Ultra-TV"

- What is it?
- Use of fiber, or coax, or hybrids, for transmission rates of 1 Gbps or higher

Dimensions of Media

- Individualization
- Richness

Richness of Media

- Extent of signals to sensory receptors
  - To eyes, ears, nose/skin/mouth
- Load on human signal processing
  - brain

Individualization: 3 Dimensions

- 1. Content *type* individualization: *diversity of content*
  - –Narrowcasting, more channels
  - –Even personalized customization
  - • Content *source* individualization
    - User-created content, P2P

Individualization (cont.)

- 3. Consumption *mode* individualization: asynchronicity
  - –temporal asynchronicity: on demand. *Any time*
  - –Spatial individualization: Follow-me media like Sling. *Any place*

- These three dimensions get confused with each other
- They have different implications for broadband and ultrabroadband

- Individualization trend: from transmission expansion to storage expansion

Dreamworks Server Farm

http://www.cyberciti.biz/tips/wp-content/uploads/2007/06/server-farm-dreamworks-animation-studio.png

1. Content Individualization

- In the past, content individualization for electronic media was done by expanding the *transmission path,* while transmitting content synchronously.
  - Creating a wider pipe: more over-the-air TV channel frequencies, then analog coaxial cable and satellite channels, then wider analog and then digital capacity.

- In the process, in America over 500 specialty channels
- “Narrowcasting”
- But more recently, the direction has been less to more channels to increase diversity of content, and more to “video on demand”.
- This approach relies on increased *storage capacity* , not increased transmission capacity

- It’s not just transmission increase to 1 Gbps
- Today, there are already hundreds of millions of people around the world who get more than 1 Gbps.
- They are called cable TV subscribers
- In America, 1 Ghz capacity cable plant common, that’s about 3 Gbps.
- But it is used for mostly just standard TV, only more of it.
- The difference now is the introduction of the storage element

- This is even more the case for internet TV over regular broadband. It can provide a huge diversity of content, but based on storage, not on bigger transmission
- Requires individual access transmission capacity for a single video channel, plus maybe a little more for multitasking, per person.
- Maybe 10 Mbps, more for multi-person households, for real-time standard TV (STV) quality
- Less with compression

Home Storage

- If consumer willing to download content for home storage, this could be still slower
- In the extreme, could be regular 56 or 64 kbps dialup narrowband. But this would take hours of downloading at night.
- More realistic would be delay that enables user to start watching film while its rest is still being downloaded.
- So this would bring down transmission capacity requirements by perhaps 50% or more.

Source Individualization

- User-created content, P2P video , wiki-video content do not require large last mile access transmission beyond decent regular BB. They require storage (on both the user end, and by intermediaries like YouTube and Daily Motion) , and a strong core network.
- Large transmission on enduser end required only if there is a large demand for uploads from outside. This is precisely the reason for the need for intermediaries.

Games

- Even games are mostly user-generated content variations and customizations, interactive with others

Games?

But it turns out that Interactive, multiplayer games (MMORPGs) do not use all that much transmission capacity. On average, for counterstrike, about 40 kbps

- The limiting factor is the processing capacity on the central node, which limits any player's plus data stream.
- This will presumably change.

Customization

- Extreme narrowcasting: programs tailored to individual
- “my news”
- Targeted advertisments
- Even plot line, ending, customized to individual
  - Different contetn modules for different viewers, can be put together
  - Different mix of “action” and “romance” depending on viewer taste, and according to viewer boredom
  - E.g.,
  - E.g., different hetero happy endings in a soap opera, or a gay ending for gay viewer.

Customization

- Does not require transmission capcity, either
- Requires only storage, plus some narrow return channel

Individualization of Consumption: Temporal and Spatial

- Spatial Individualization: to be able to access content from anyplace.
- The Internet makes it possible. Can even, with Sling, have access regular TV content from anywhere to anywhere.

Temporal individualization: anytime TV

- Similarly, can get access to content at any time user wishes.
- But neither anywhere, nor anytime (spatial and temporal individualization) requires super-broadband

Richness

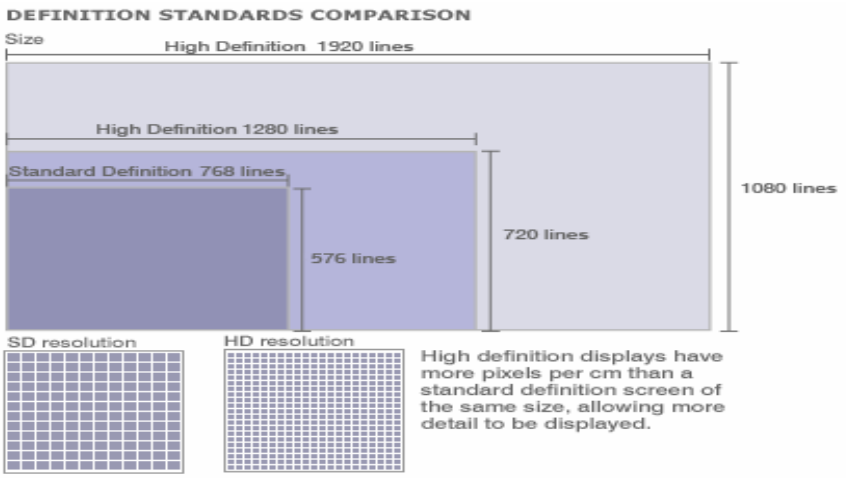
Richness

- The need for more powerful broadband therefore has to be based on “richer” media.
- Media applications with more ‘bit” requirments, not for more of the same, just more of it and from more sources.
- So we need to look into the “richness” of media, present and future.

Dimensions of Richness over UBB

1. Better Quality of Picture

Evolution of TV standards



http://news.bbc.co.uk/2/hi/technology/6142998.stm#hdtv

3G TV

- 4K HD is the next level after today's HD
- also known as super S-HD
- or S-HV (HiVision)

- Is it necessary?
- Traditional short sightedness of expectations.
- Each generation has persuaded itself, and been persuaded by marketers, that it has life-like audio and video quality

1949

http://www.tvhistory.tv/1949_Admiral_TV_Ad.jpg

- 1951

"G-E makes you feel it's real!"

That's what G-E owners say and when you see G-E.'s real-as-life, big-as-life pictures you'll agree! Here's outstanding picture quality—stemming from many G-E advancements combined exclusively in G-E Black-Daylite Television. Advanced G-E 16" rectangular black tube shows all the TV camera sees, more lifelike than ever with close-ups actually life-size. Powerful G-E built-in antenna. Famous G-E Automatic Sound—just tune the picture, sound is right every time! Dependable G-E electronic tubes throughout. Cabinetry of rare beauty. Model 1675, above—16" G-E picture in a compact, hand-rubbed mahogany veneered cabinet. See your G-E TV dealer today.

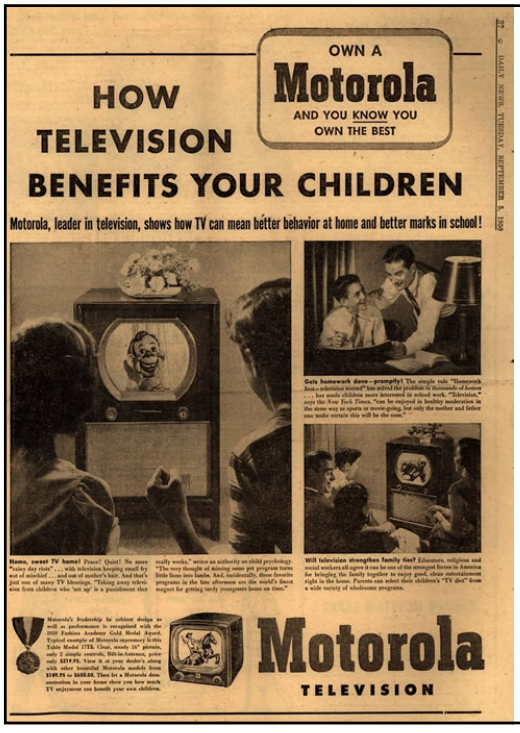
BLACK-DAYLITE TELEVISION

'Look, it's LIFE-LIKE! LIFE-SIZE!'

http://www.tvhistory.tv/1951%20Advertising.htm

You can put your confidence in—

GENERAL ELECTRIC



OWN A Motorola AND YOU KNOW YOU OWN THE BEST

HOW TELEVISION BENEFITS YOUR CHILDREN

Motorola, leader in television, shows how TV can mean better behavior at home and better marks in school!

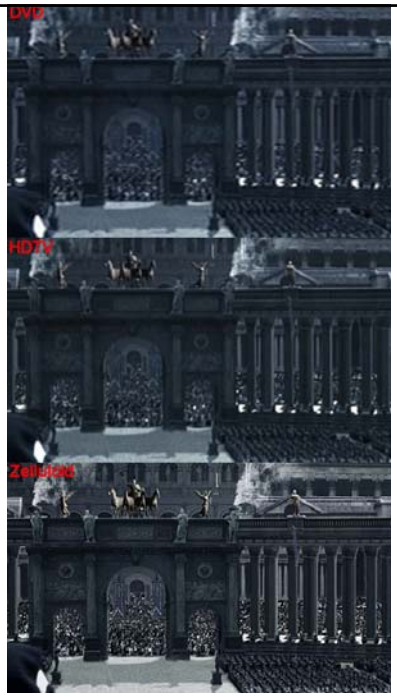
Gets homework done—promptly! The simple rule "Homework first—television second" has united the problem in thousands of homes . . . has made children more interested in school work. "Television," says the *New York Times*, "can be enjoyed in healthy moderation in the same way as sports or movie-going, but only the mother and father can make certain this will be the case."

Home, sweet TV home! Peace! Quiet! No more "rainy day riots" . . . with television keeping small fry out of mischief . . . and out of mother's hair. And that's just one of many TV blessings. "Taking away television from children who 'act up' is a punishment that really works," writes an authority on child psychology. "The very thought of missing some pet program turns little faces into knobs. And, incidentally, those favorite programs in the late afternoon are the world's finest magnet for getting tardy youngsters home on time."

Will television strengthen family ties? Educators, religious and social workers all agree it can be one of the strongest forces in America for bringing the family together to enjoy good, clean entertainment right in the home. Parents can select their children's "TV diet" from a wide variety of wholesome programs.

Motorola's leadership for cabinet design as well as performance is recognized with the 1950 Fashion Academy Gold Medal Award. Typical example of Motorola supremacy is this Table Model 17TA. Clear, steady 16" picture, only 2 simple controls, Bilt-in-Antenna, price only $219.95. View it at your dealer's along with other beautiful Motorola models from $189.95 to $650.00. Then let a Motorola demonstration in your home show you how much TV enjoyment can benefit your own children.

Motorola TELEVISION



http://people.freenet.de/FoLLgoTT/gladiator_vergleich.png

2K TV

- 2000 pixels horizontal
- Aspect 1:2, so 1,000 pixels vertical
- 2 mil pixels, times 36 bits per pixel,
- Total 72 megabits
- Times 50 frames per second (or 25 for poorer picture)
- Total 3600 Mbps, or 3.6 Gbps uncompressed.
- Compressed 20:1 results in 180 Mbps

- Add the 3-D dimension: double rate, to 320 Mbps.
- Plus some for better sound

- So conclusion: high quality 3-D film over BB requires 320 Mbps.

4K-TV

- One more level ahead in quality terms: 4,000 pixels horizontal, 2,000 vertical
- Multiplies bandwidth need by factor of 4
- Still higher quality picture (4K) with 3-D requires overall 1.3 Gigabits per second.

2. Larger Screens

Flat Screens, Home Theater

- Screens get flatter, so they can get larger in apartments and homes that remain at same size.
- This means people sit closer, and with a wider angle.
- And this means that the picture resolution has to be sharper

Ultra Zooming

- The viewer can zoom in and zoom out, with a very high resolution of the zoom
- Example: Future crime film “You are the detective”
- Advertising and shopping
- Sports
- Different focusThe viewer shall not stop the movie he can just zoom while the movie continues, like in reality: **he has to decide where to focus on**.

3. Tele-Presence

Video conferencing

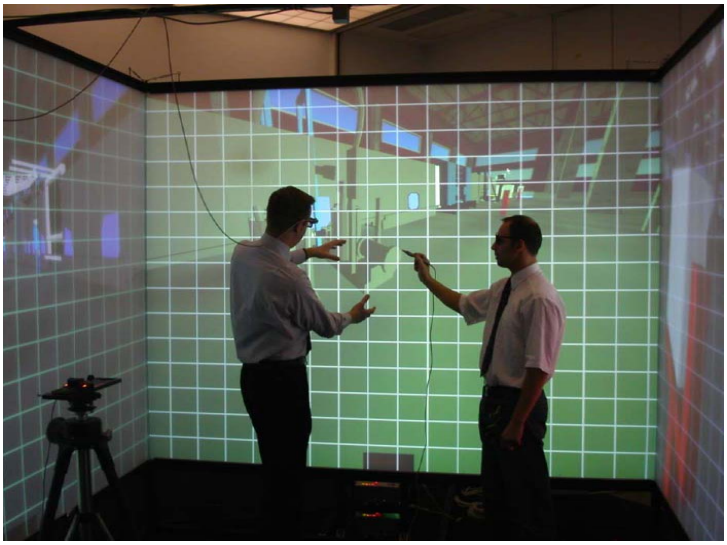
- Cisco's latest tele-presence meeting system
- Meeting participants can share documents over tools a high-definition document camera
- Cisco TelePresence delivers 1080p high-definition life-size images, spatial audio, and plug-and-play collaborative tools.
- Bit-rate: Up to 540 Mbit/s (36 participants x 15Mbit HD TV quality per participant)

http://newsroom.cisco.com/dlls/2007/prod_031607.html

New-Generation Video conferencing

03

Collaboration spaces



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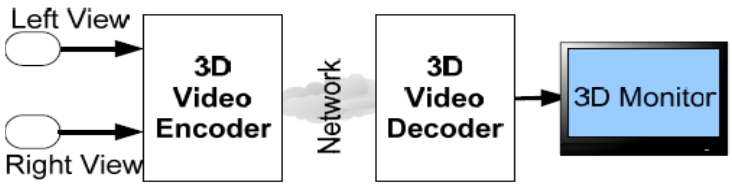
4. 3-D

3D TV and HDTV

- Current bandwidth requirement for 3D TV: 6-12 Mbps, but will increase because of higher resolution and content enrichment

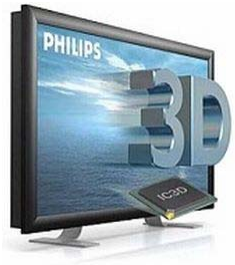


http://www.3dtv.at/Movies/Index_en.aspx

http://delivery.acm.org/10.1145/1190000/1180747/p505-christodoulou.pdf?key1=1180747&key2=9768216021&coll=GUIDE&dl=GUIDE&CFID=21096894&CFTOKEN=83322181

3D TV and HDTV

- Video gamers will be the initial target audience for 3D TVs. The game is already rendered in 3D but the picture is still shown on a 2D display.



http://www.gizmowatch.com/images/3d-tv_58.jpg

Other Sensory Projections

Touch, Smell by 2020?

- Japanese researchers are hoping to have a commercially available 3D television on the market by the year 2020.
- TV would provide 3-dimensional virtual reality. Smell and "touch" the images on the projection. Images would be projected upwards from a screen that lies on the floor.
- Researchers are trying to reproduce touch, including ultrasound, electric stimulation, and wind pressure.

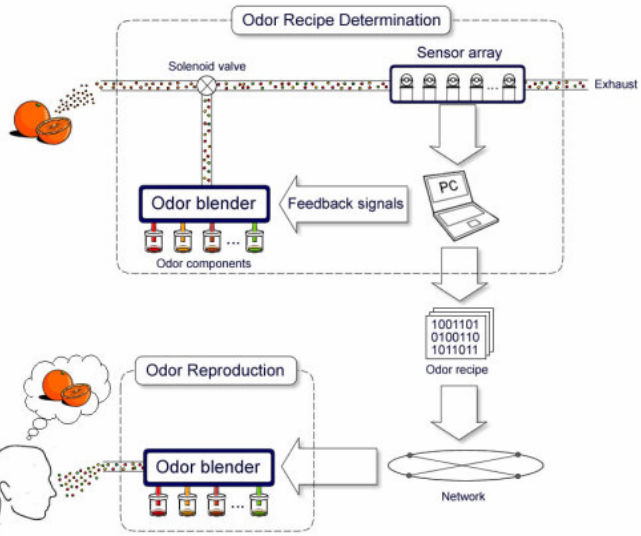
http://www.betanews.com/article/3D_TV_with_Touch_Smell_by_2020/1124471972

Smell TV

- The Japanese Professor Takamichi Nakamoto's has developed a "odor recorder"
- The device mixes ingredients and pumps out smells at you.

http://news.bbc.co.uk/2/hi/technology/6043428.stm

Smell TV



http://inventorspot.com/node/2419

Touch TV

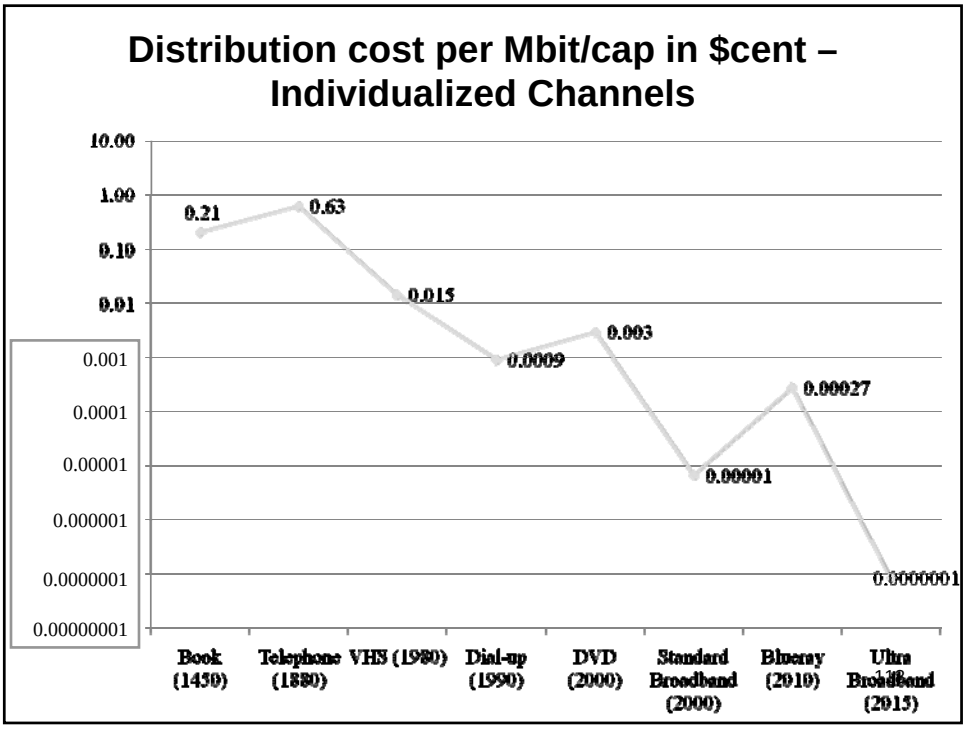
- A device allows viewer to feel the action
- “Pressing your hand over a circle in the centre of the controller will allow a person to feel the ball as it is kicked in a football match.”
- Similarly, built-in vibrations in seat

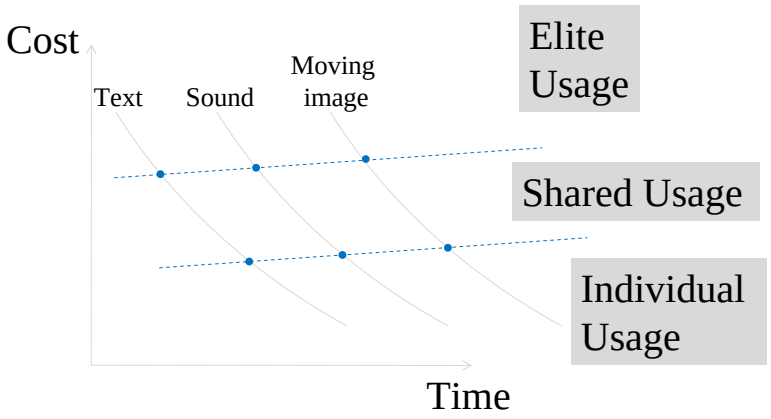
http://news.bbc.co.uk/2/hi/technology/2916485.stm

Where Will All This Take Video Media?

- To answer that question it is necessary to look first at the underlying economics

Bit Cost Trends





- In 1996, access networks cost about $670 per megabit per month.
- In 2008, I pay 40 cents per megabit.

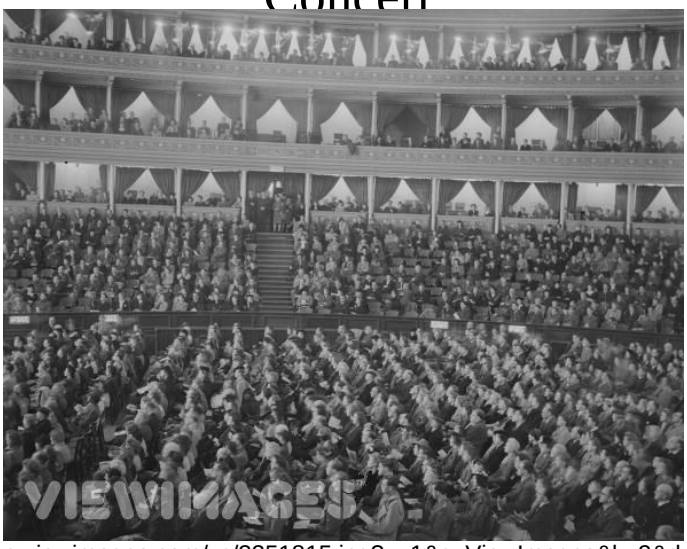
- So the dynamics are that a medium of expression starts at a high cost per bit, and in that period of high cost is first introduced and used by eloeite users.
- Then, it creates a system of shared usage. Shared usage lowers the cost for each user. Distributes the high fixed cost over multiple users
- Example: theater, concert, opera, film theater, broadcasters, cable channels, satellite broadcasting,
- This is the stage of synchronous consumption

- But costs decline over time and eventually move to a range where it becomes affordable for individuals.
- At that point, the medium starts to become *individualized and asynchronous*

Century Library

http://images.jupiterimages.com/common/detail/99/29/22662999.jpg

Shared Consumption: 18th Century Concert



http://cache.viewimages.com/xc/3351815.jpg?v=1&c=ViewImages&k=2&d=0629904139C22E58065085454B377FA7A55A1E4F32AD3138

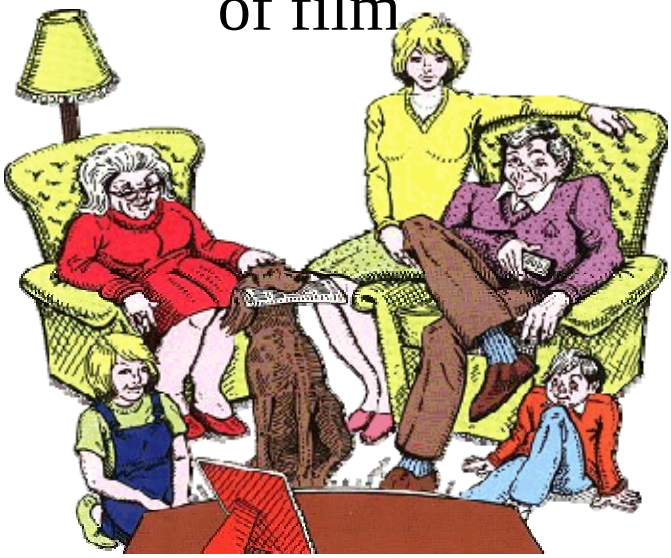
Individualized Consumption: Gramophone

http://www.fotogenika.net/public/upload/objects/grammophone.JPG

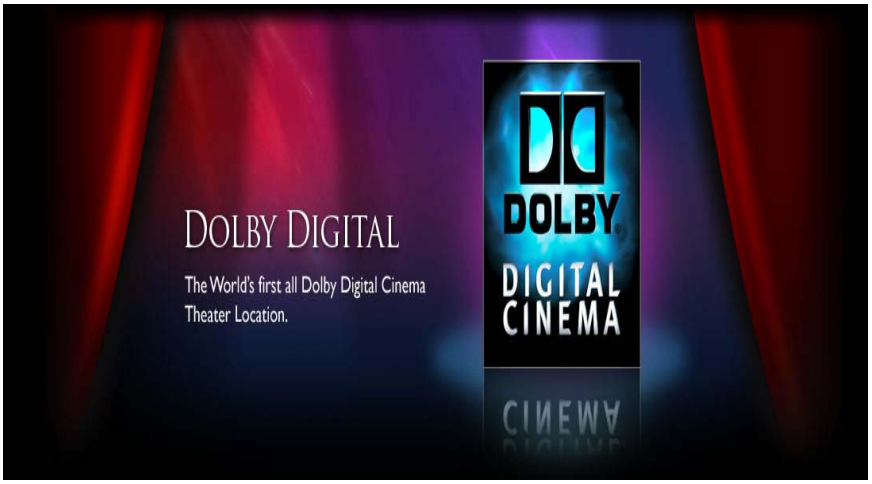
Shared consumption: film

http://farm1.static.flickr.com/166/432856676_19720f5add.jpg

Individualized consumption of film



(http://www.sneezes.freeserve.co.uk/television.jpg)

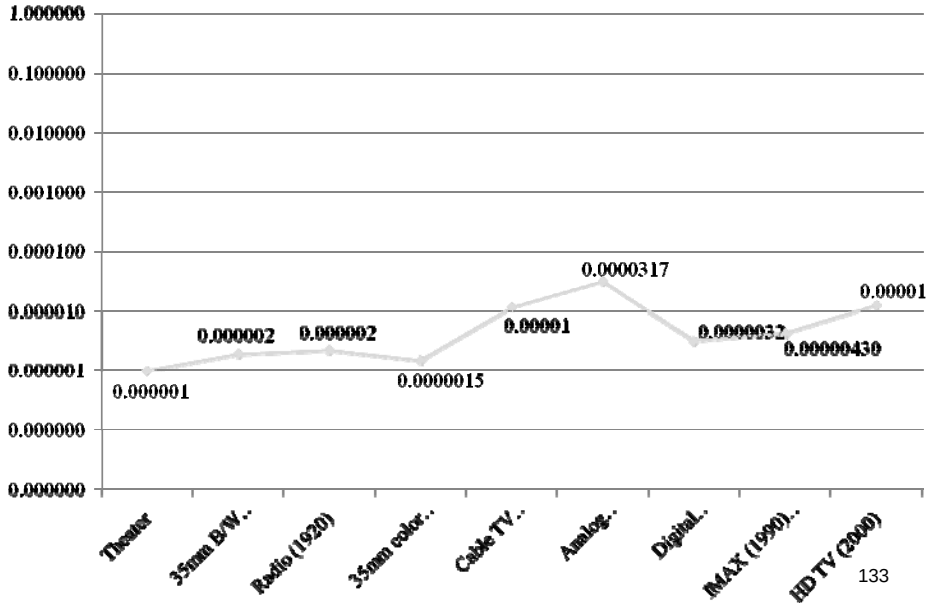

DOLBY DIGITAL
The World's first all Dolby Digital Cinema Theater Location.
DOLBY
DIGITAL
CINEMA

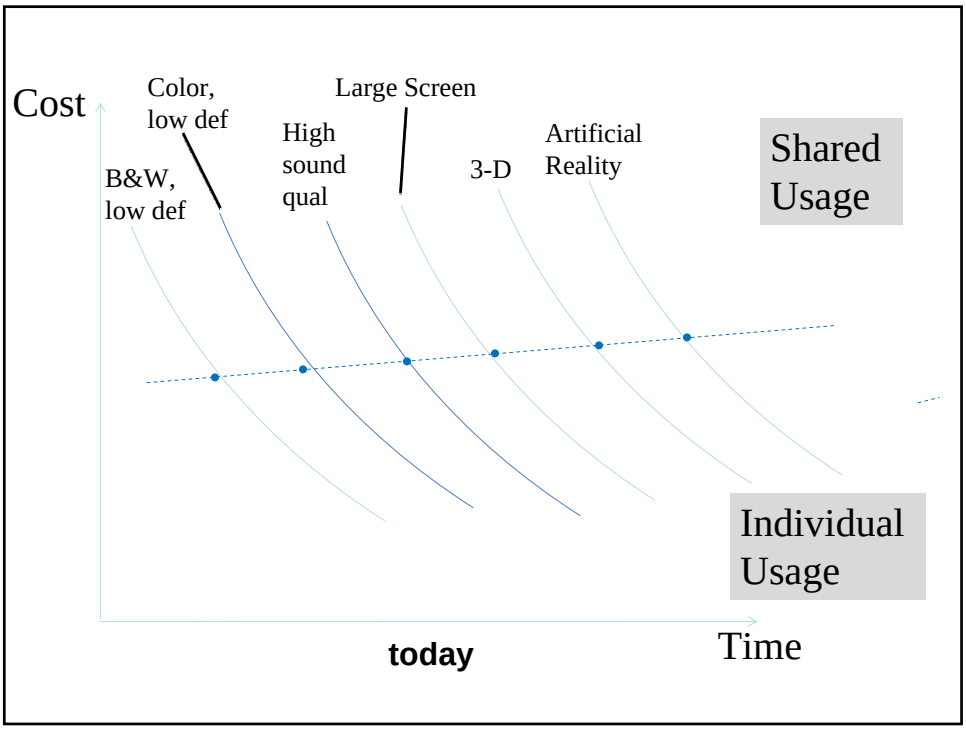
Home Theater

http://pro.corbis.com/images/42-17153807.jpg?size=572&uid=%7BE267F73F-39EE-419E-9C52-3FE3E6C24F6C%7D

- This means that by looking at present use of shared media, and assuming a certain rate of price decline per bit, one can predict the future individualized usage

Distribution cost per Mbit/cap in $cent – Shared Channels





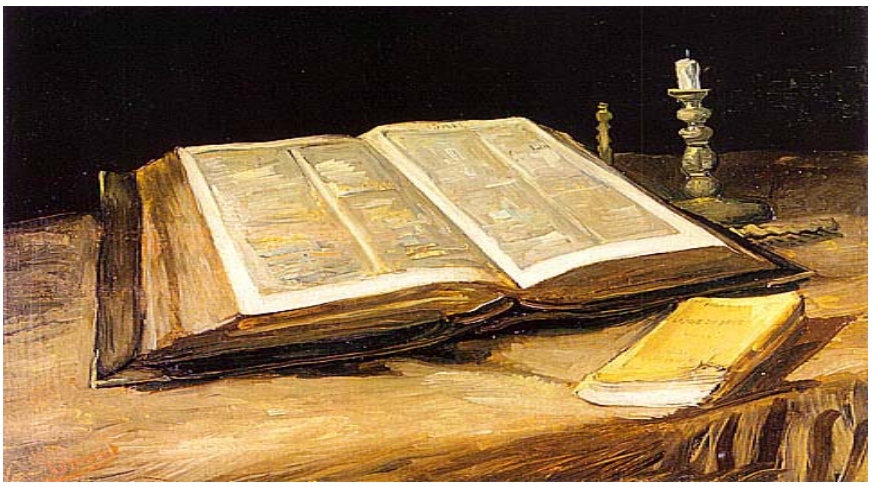
- And that means that we can predict the next individual content type and medium from the existing shared communications style.

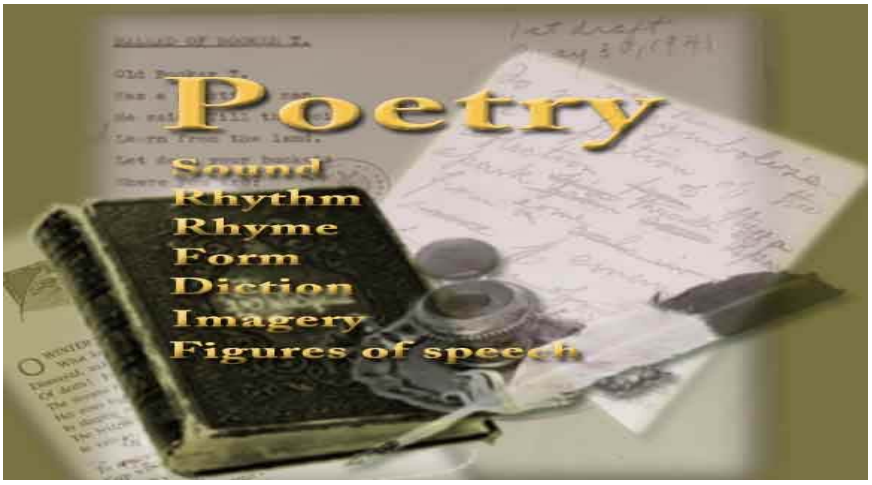
Impact of Medium on on Content

Content

- There is a relation between media technology and content
- McLuhan: “the medium is the message”.Technology defines style

- When visual images could not be easily stored and transmitted, before film, the major medium was print. The print medium generated extraordinarily subtle works– novels, poems, all aimed at creating images in the imagination, because they could not be created in the medium itself, at least not economically.




Poetry
Sound
Rhythm
Rhyme
Form
Diction
Imagery
Figures of speech

Novels

- Film changed all that. It burst on the scene, and provided the visual details.
- Early film was probably the most unsubtle form of mass media expression ever
  - No sound, all action, slapstick, simplistic plots, simplistic characters.
  - This was not just the limitation of the medium. It was also the economics. Because film was cheap per bit, it was affordable to the working class, and the style also reflected mass popular taste, not elite taste.

- But film could stretch the visual imagery to levels that did not exist before.
- Theater could not do what film could
- And so, in less than ten years, film pioneered new forms of expression, new genres

- Louis and Auguste Lumière
- First film show in 1895, Paris.

Louis and Auguste Lumière

Impact on Style

- Visual images require a huge number of bits. The cheaper bits are, the more visual the medium becomes. And the cheaper the visual aspects, the more they dominate
- Weaker visual capability favor story line, character development, dialogue.

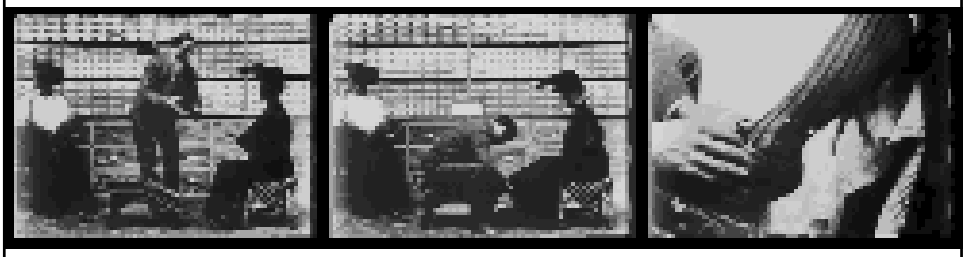
Science Fiction: 1902: A Trip To The Moon

(http://ww

Outdoor Drama
1st Western: 1903: " The Great Train Robbery "

(http://memory.loc.gov)

Voyeur content
“The Gay Shoe Clerk”: 1905



http://www.last-bid.com/cat-20095/Antiques/Science_Medicine/Other/id-3710651581/THE_VINTAGE_MOTION_PICTURES_CD_Ca.1897_1903/

- But there was no sound yet, so film had to rely on heavy-handed physical action

Slapstick action

Technology Advance: Sound

- 1927, first full-length movie with sound.
- Enabled real dialog
- Films became more subtle.

Hepburn, Grant, and Stewart

http://www.carygrant.net/fotogallery/philadelphiastory/tps6.jpg

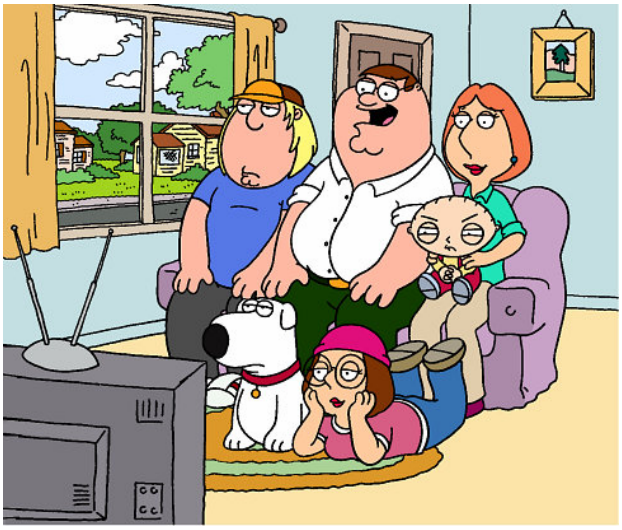
Grapes of Wrath Dialogue

http://www.johnmariani.com/archive/2007/070513/grapes%20of%20wrath.jpg

Snow White & 7 Dwarves

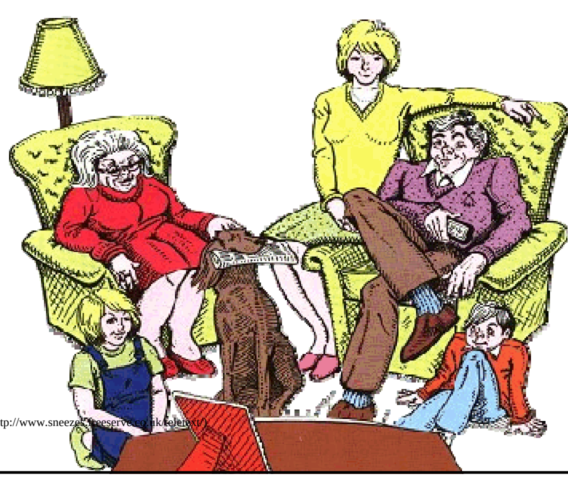
http://thecia.com.au/reviews/s/images/snow-white-and-the-seven-dwarfs-1.jpg

TV Animation – Family Guy



http://i.imdb.com/Photos/Ss/0182576/3043900_2_8.jpg

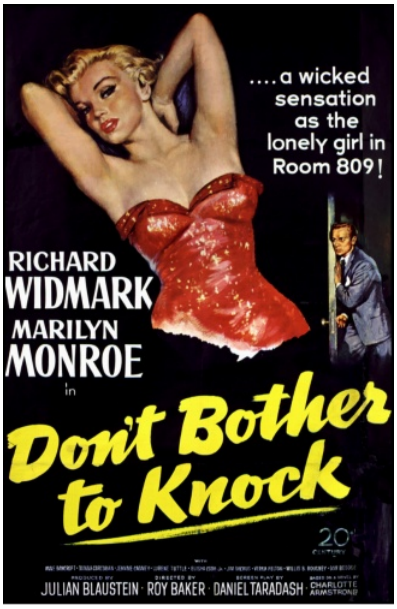
Television emerged and enabled the individualoization of black-and-white, low resolution films



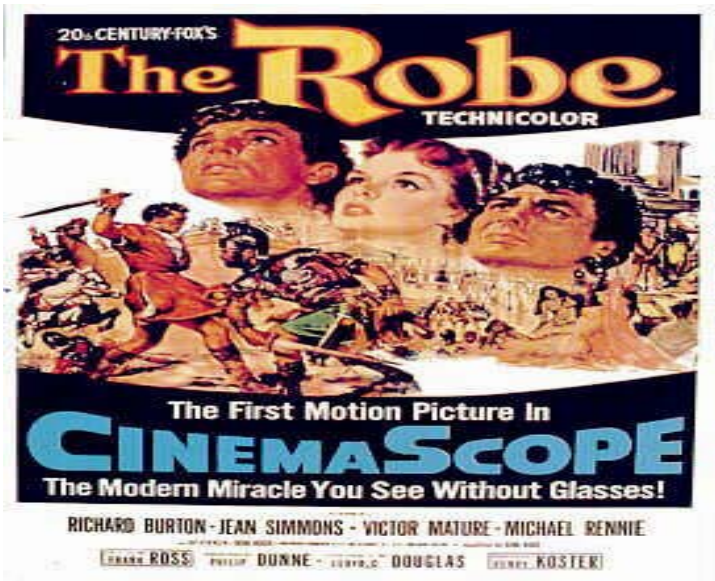
(http://www.sneezes.freeserve.co.uk/teletext/)

- Film soon moved to the next level, pushed by the emergence of television.
- TV now took over the function of low budget, , low tech, black and white, grade-B, films
- Film's market moved mostly up-scale

Hollywood Content Strategy vs. TV: Themes of Sex & Violence



Strategy: Big Screen



Cinemascope

Content Strategy: Spectacles

(http://www.lostcitydemille.com/)

Strategy: Special Effects

3d-glasses.gif

Distribution Strategy: Link to Suburbanization

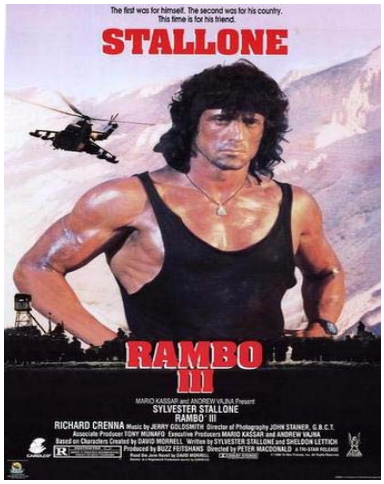
Drive-In Theaters

(http://www.driveintheater.com/link.htm)

- Similarly, higher quality 70 mm film, in comparison to lower video quality, favors
  - –fast moving scenes----action
  - –Details-----period films
  - –Close-ups
  - –Visual effects
  - –Special effects

Content

- Is there a difference between the content style etc of film content made for high resolution visual display, or lower resolution?



“Die Hard”

http://z.about.com/d/movies/1/0/F/7/P/livefreeordiehardpic6.jpg

“Mission Impossible 3”

http://www.ilmfan.com/articles/2006/todd_vaziri_mission_impossible_3/images/mission_impossible_3.04.jpg

- In ’80s, it became possible to individualize the consumption of such content
- Home video

- **Europeans** had no budget for visually fancy technology, so they shot black and white films with lots of dialogue and character and issues, and less of action and special effects.
- Intellectually interesting, visually boring.
- Like a book on screen

Jules & Jim

400 Blows

1980s: Computer Animation

- In *Gladiator*, Russell Crowe's face was digitally superimposed on other bodies

http://ffmedia.ign.com/filmforce/image/article/569/569303/gladiator_crowe_tiger_1101791020-000.jpg

Epstein, Edward Jay, "*The Big Picture, The New Logic of Money and Power in Hollywood,"* New York: E.J.E. Publications, Ltd., Inc., 2005

- *The Polar Express* (2004) used computer-generated characters to substitute for stars, (Tom Hanks), in their speaking roles, and at various ages.

http://ffmedia.ign.com/filmforce/image/article/550/550116/polar-express-20040921035820280-000.jpg

Epstein, Edward Jay, "*The Big Picture, The New Logic of Money and Power in Hollywood,"* New York: E.J.E. Publications, Ltd., Inc., 2005

Movie: *Simone*

- …studios entirely creating actors

Simone

http://www.spcgi.com/spboard/id/movie/screen_shot/simon.jpg

- Digital star can be designed with elements that appeal to moviegoers.

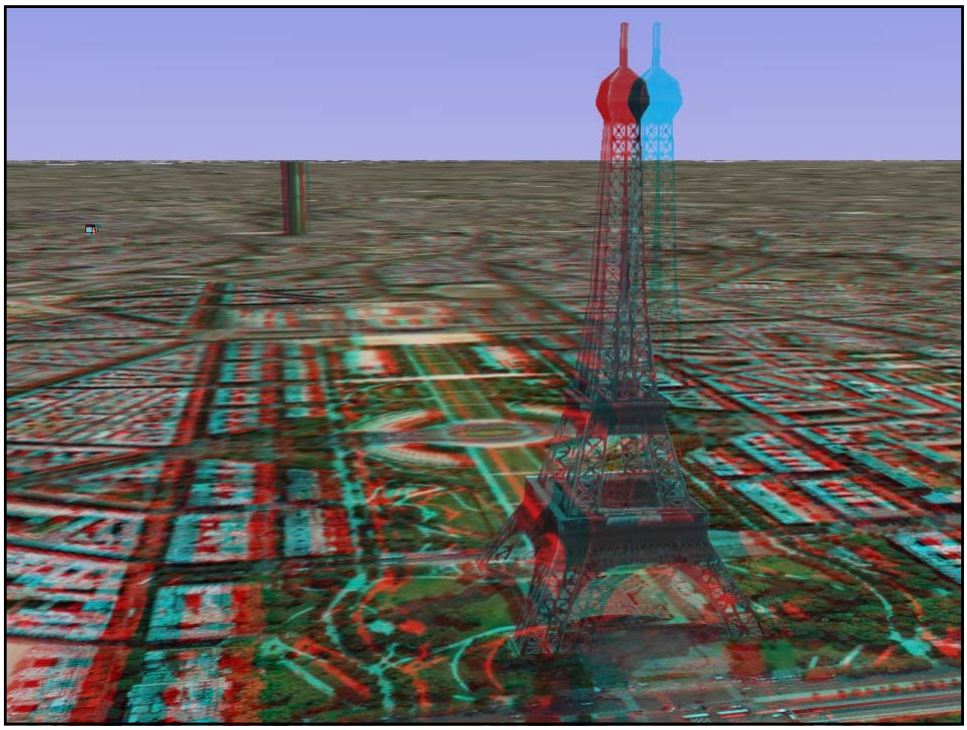
Epstein, Edward Jay, "*The Big Picture, The New Logic of Money and Power in Hollywood,"* New York: E.J.E. Publications, Ltd., Inc., 2005

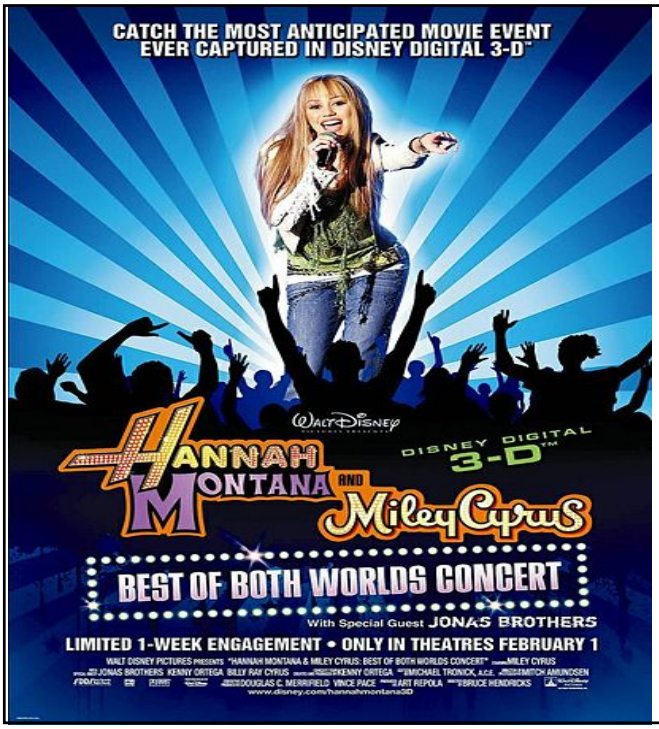
- …such computer animated stars would create new opportunities for the Hollywood studios and other products, since their ownership would be total and permanent (just as Disney is over Mickey Mouse).

Epstein, Edward Jay, "*The Big Picture, The New Logic of Money and Power in Hollywood,"* New York: E.J.E. Publications, Ltd., Inc., 2005

- TV style video has not quite reached that level

3-D




CATCH THE MOST ANTICIPATED MOVIE EVENT
EVER CAPTURED IN DISNEY DIGITAL 3-D™
Walt Disney
DISNEY DIGITAL 3-D™
HANNAH MONTANA AND Miley Cyrus
BEST OF BOTH WORLDS CONCERT
With Special Guest JONAS BROTHERS
LIMITED 1-WEEK ENGAGEMENT • ONLY IN THEATRES FEBRUARY 1
WALT DISNEY PICTURES PRESENTS "HANNAH MONTANA & MILEY CYRUS: BEST OF BOTH WORLDS CONCERT" MILEY CYRUS
JONAS BROTHERS KENNY ORTEGA BILLY RAY CYRUS KENNY ORTEGA MICHAEL TRONICK, A.C.E. MITCH AMUNDSEN
DOUGLAS C. MERRIFIELD VINCE PACE HART PERZOLA BRUCE HENDRICKS
www.disney.com/hannahmontana3D

3-D

3-D TV

- SD 90 min movie: 1 GB
- HD movie, 3x as much, about 3 GB
- 3-D 2-3 times regular TV
- So 3-D HDTV about 9GB, or 72 Gbits

3-D TV

- At 10 MBps speed, this would take 7000 sec, or about 2 hours.
- At 1 GBPS, download time 1 min

Virtual
Reality Arcade – Las Vegas

http://www.jupiterimages.com

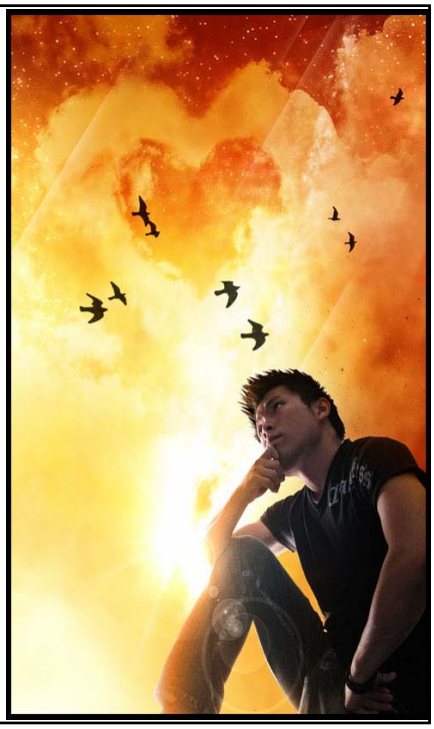
Virtual Reality

Games

Computer Animation and 3-D will Create Entertainment of Total Immersion

- User immersion
- User participation
- Some user control

- Imagination



IMAX at Home

- Resolution of IMAX movies: 70 megapixels (70 mm film, 24 frames per second)
- IMAX movies are not yet available over the internet. But if you convert the resolution of IMAX movies (cinema) into bandwidth requirements, this is 107,520 GB/s, before compression.

Immersive TV experience

Combination of natural audio-visual presentation (example: IMAX) and virtual reality

http://ip.hhi.de/imedia_G3/assets/pdfs/IBC2001.pdf

“Pirates of the Caribbean 2”

http://eur.i1.yimg.com/eur.yimg.com/xp/yahoo_manual/20[illegible]15/13/1898928067.jpg

“I Am Legend”

http://www.[illegible]

“300”

http://www.collider.com/uploads/imageGallery/Three_Hundred_300_2006_movie_image_s.jpg

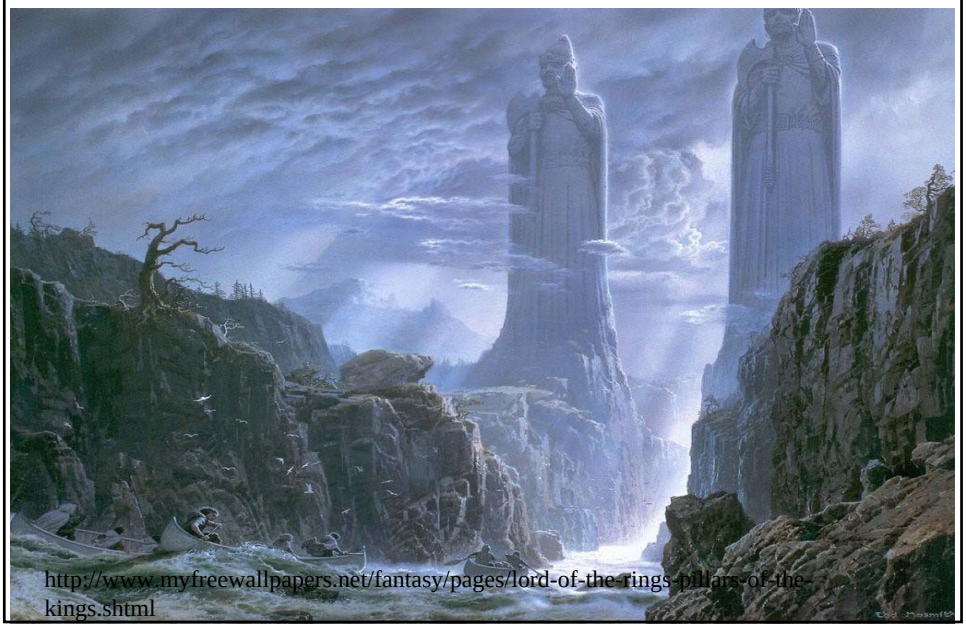
“Armageddon”

http://thisdistractedglobe.com/wp-content/uploads/2007/08/Armageddon%20pic%204.jpg

“Pirates of the Caribbean”

http://images.google.com/imgres?imgurl=http://kensforce.com/07pirates3.jpg&imgrefurl=http://monstermovieblog.blogspot.com/2007/05/pirates-of-caribbean-at-worlds-end.htm

“Lord of the Rings”



http://www.myfreewallpapers.net/fantasy/pages/lord-of-the-rings-pillars-of-the-kings.shtml


1st HALF
TOW 0
TEX 0
10:00


2K
SPORTS
HEATLEY
15
NHL2KB

The Bandwidth of Real Life?

Assumptions

- Regular reality is 7x, enriched reality is 10x IMAX bitrate. IMAX bitrate is 107,520 Mbit/sec. *no. actually imax is uncompr 100 gigabits/sec. but it is also highly enriched. Imax is already compressed by 50. "boring" imax is compressed by factor of 10 as much, 500. on the other hand, imax is only 60 hoirisontal, and 20 deg vertical. So surround reality is 6 times horiz, and to 180 arc times 9, except that above arc is not really interesting and data rich, so it's perhaps just double the data. So this is together 6 x 2 as much as compressed imax, or 1200 gigabits/sec, 1.2 terrabits/sec. To simplify, reality is 1 terrabit/sec. but that's just the visual and sound. Add smaell, touch, heat, taste. Fairly low bit, fairly low chnge. So add another 1 mbps, very generously, , can disregard it.*
- *but we also focus. To 30 degrees horizontal and 20 deg vertical, perceived reality is 1/16 horizontal, and So this is 1/12 x ½ = 1/24 of reality. That's 40 gbps. But that's boring.*
- *"Better than reality":*
- *But if it is 'enriched' to be more dramatic, less boring, the bit rate picks up by factor of 100, to 100 terrabit. Its then that we cannot handle.*
- *That's why we focus, and select, and ovrload. But within a certain range, and for a certain time, we are being stimulated pleasurably. Entertainment, sports, sex,*
- Reality can be compressed by factor 43. (Currently max. compression rate)
- To get from 360 degrees to 20 degrees, the bitrate is multiplied by 20/360.

The Bandwidth of Reality (Gbps)

	360/180 degrees	**Focusing to 35/20 degrees**	
Regular reality (compressed)	1,000	40	
Regular reality (uncompressed)	50,000		

Better Than Reality

- Reality is boring
- Purpose of entertainment is to add stimulation
  - Music for sound
  - Film/Video for hightened feelings of danger, horror, romance, tragedy
  - Restaurants for taste
- Media are enriching reality
- Human stimulation requirements are growing
  - Greater intensity, greater speed of action

- Some drugs are also used to stimulate sensations
- The stimulation by media is probably somewhat addictive, like drugs.

The Bandwidth of Reality (Gbps)

	360/180 degrees	**Focusing to 35/20 degrees**	
Regular reality (compressed)	1,000	40	
Enriched reality (new action all the time, moderately compressed, wider angle)		800	

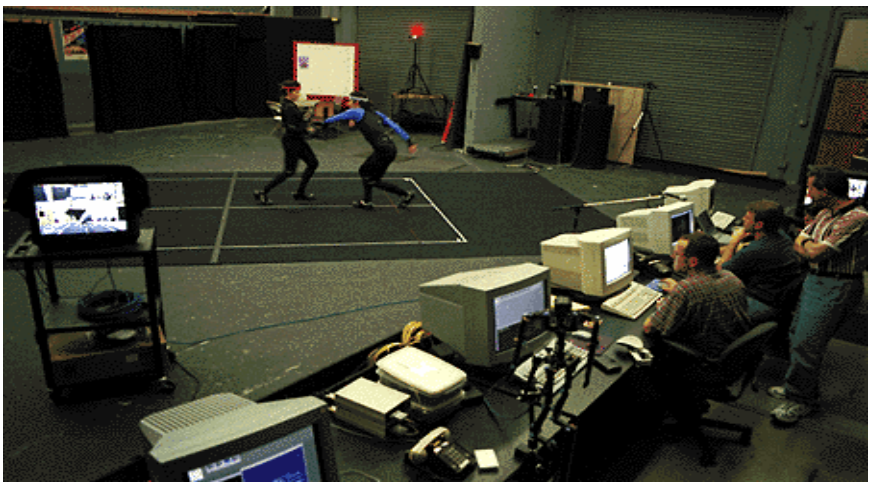
Who Would Be the Suppliers of such UBB ultra-content?

- To produce such content is expensive
- It requires creativity, many programmers, lots of alpha and beta testing, and many new versions

- Such expensive content exhibits strong economies of scale on the content production side, and network externalities on the demand side.

- Both favor content providers with
  - –big budgets
  - –can diversify risk
  - –can distribute over other platforms
  - –Brand
  - –Delivery of large audiences
  - –Ability to coordinate specialized inputs

- Premium content: complex, large suppliers
- Long tail content: in regular BB, (3rd Gen TV), everybody. Which means not much money in it.
- But room for experimental shops for 4 G. then aquired
- Also likely integrators and specialists



- For *Terminator 3*, $19.9 million was spent on such CG effects.

http://us.movies1.yimg.com/movies.yahoo.com/images/hv/allposters/60/1800022060p.jpg

Epstein, Edward Jay, "*The Big Picture, The New Logic of Money and Power in Hollywood,"* New York: E.J.E. Publications, Ltd., Inc., 2005

- In 1977 the credits for the original *Star Wars* listed a 143 technicians; in 2003 the CG sequel, *Attack of the Clones*, listed 572 technicians.

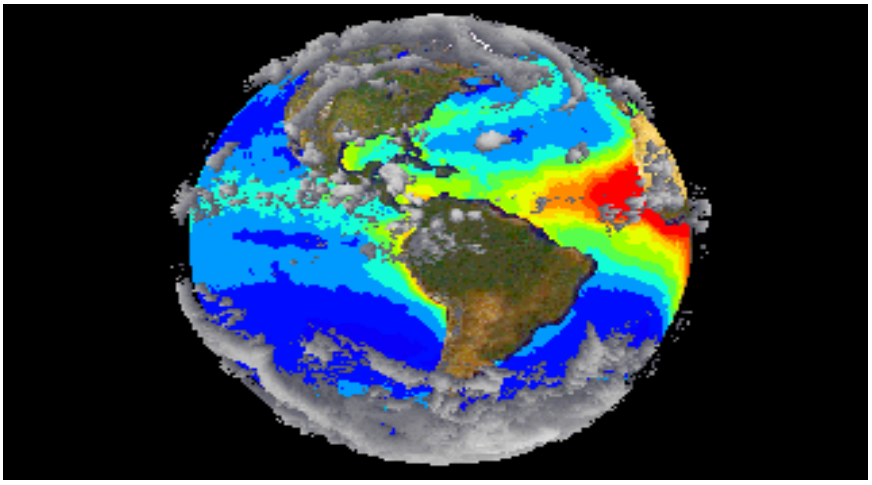
http://www.moviebadgirls.com/capimage/Attack_Of_The_Clones_06.JPG

Epstein, Edward Jay, "*The Big Picture, The New Logic of Money and Power in Hollywood,"* New York: E.J.E. Publications, Ltd., Inc., 2005

- What would be demand?
- High because entertainment seems to require ever-rising levels of stimulation
- Global demand. So if 100 mil HH use this content 2 sessions hs /week at $5, that's annual rev of $52 bil. If half of that goes to network/distributor, that's 26 bil. Per HH, that's 500 dollars/yr, without major costs beyond the fixed costs of network and the storage upfront.

- Ability to charge premium prices.
- Interactivity permits access control over unauthorized use, and over piracy.

Globalization



Globalization: 3 Factors

1. The price of international transmission is dropping rapidly.
2. Domestic Internet penetrations are increasing rapidly
3. E-content has economies of scale.

US firms will be especially successful in e-content for IP-TV

- Advantage of early entrant
- Domestic critical mass
- Software and hardware industries

US firms will be especially successful in e-content for IP-TV

- Access to risk capital
- Entertainment content production

- Language
- Immigration of tech and content talent
- Diverse culture

- Non-US firms will also be players
- But most likely either domestically, without much reach, or with global players who will offer basically American-style content to the world

- On the other hand, American content is also likely to be modified for global attractiveness, “mid-Atlantic,” “mid-Pacific” style content.

Conclusions

Conclusions

- Individualization of content style, of space and time, of consumption mode, or of source, does not require super-broadband on the user level.
- Transmission capacity must match requirements of content richness. If the content requires 5 Mbps, there is no need to have pipes with much higher capacity, except for multitasking, for some extra quality buffer, and for additional household members .

- Storage and transmission are substitutes for each other
- In fact, with storage now becoming cheap, it requires ***less transmission than in the past.*** One would need just one or two channels of access to video servers.

- For regular quality TV, to enable more content diversity, the proper approach would be to store more programs and make access and download possible.
- Synchronous channels make sense only for large audience, or live-critical content
  - Sport events

- TV—whatever that means anynmore—is diversifying horizontally and vertically in terms of options
- Horizonatally– more standard channels, more minichannels
- That's been observed a lot of times.
  - –Narrowcasting, The long tail

- But also Vertically: in terms of quality
- And with it also economically, in terms of business models
- And also in content terms
- TV has more legs to stand on

- The “long tail” to the “rich paws”

- **One of the major interesting things here is that for the first time ever, the entertainment at home will be superior to that in shared environment**, because the experience will be either individual, or with other electronically tethered individuals. It cannot be readily replicated for a group of people in the same room.
- Individualized, customized, consumption in high quality

- The ultrabroadband pipe requires the ultra content, the ultra TV
- More High def, immersive.
- ***Better than reality***

- To create these new content forms and generes will take time and creativity and trial and erroirs
- And the implication for the infrastructure providers is – to fill their pipes, they need to start helping for such content to be explored and developed.
- Or else they will find themselves having created a ballroom, with nobody there ready to come to the party.

- Thanks for your attention
- noam@columbia.edu

THE END