

# **Animation & Entertainment Case Studies**


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**Lecture 12**


**October 5, 2015**

**NBA 6120**

**Prof. Donald P. Greenberg**



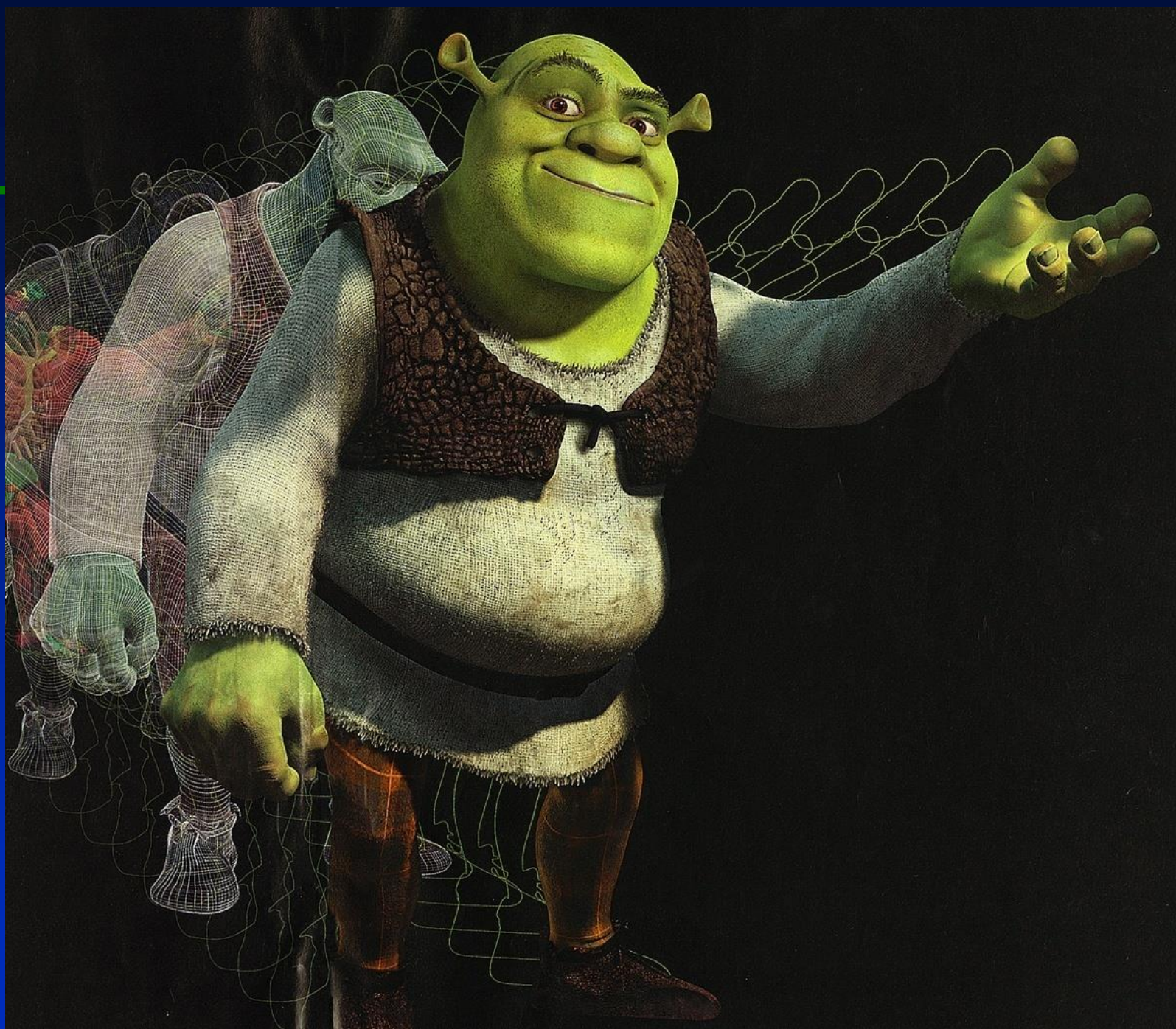
# Complete Computer Animation



# Computer Animation Theater Gross Revenues (U.S.)

## September 2015

Rank	Title (click to view)	Studio	Lifetime Gross / Theaters		Opening / Theaters		Date
1	<a href="#">Shrek 2 (CG)</a>	DW	\$441,226,247	4,223	\$108,037,878	4,163	5/19/04
2	<a href="#">The Lion King</a>	BV	\$422,783,777	2,624	\$1,586,753	2	6/15/94
3	<a href="#">Toy Story 3 (CG)</a>	BV	\$415,004,880	4,028	\$110,307,189	4,028	6/18/10
4	<a href="#">Frozen</a>	BV	\$400,738,009	3,742	\$243,390	1	11/22/13
5	<a href="#">Finding Nemo (CG)</a>	BV	\$380,843,261	3,425	\$70,251,710	3,374	5/30/03
6	<a href="#">Despicable Me 2</a>	Uni.	\$368,061,265	4,003	\$83,517,315	3,997	7/3/13
7	<a href="#">Inside Out</a>	BV	\$352,976,903	4,158	\$90,440,272	3,946	6/19/15
8	<a href="#">Minions</a>	Uni.	\$332,952,765	4,311	\$115,718,405	4,301	7/10/15
9	<a href="#">Shrek the Third (CG)</a>	P/DW	\$322,719,944	4,172	\$121,629,270	4,122	5/18/07
10	<a href="#">Up (CG)</a>	BV	\$293,004,164	3,886	\$68,108,790	3,766	5/29/09



# Movies with Special Effects

# Special Effects Bring in \$\$\$\$ (U.S. only) 2015

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Of top 10 grossing movies ever, 2 nominated for Oscars, 2 won, 3 won Best Visual Effects

1. Avatar (\$760M) - 2009 nominated for 9 Oscars, including 3 wins
2. Titanic (\$660M) – 1997 Best Visual Effects winner
3. Jurassic World (\$649M)
4. Marvel's The Avengers (\$623M) - 2013 nominated for Oscar, Best Achievement in Visual Effects
5. The Dark Knight (\$535M) - 2008 nominated for 8 Oscars, including 2 wins
6. Star Wars: Episode I – The Phantom Menace (\$475M) – 1999 nominated for 3 Oscars
7. Star Wars (\$460M) – 1977 – 1999 nominated for Oscar, Best Visual Effects
8. Avengers: Age of Ultron (\$458M)
9. The Dark Knight Rises (\$448M) – 2013 AFI Award Movie of the Year
10. Shrek 2 (\$441M) – 2004 Nominee for Best Animated Feature Film of the Year



# Compositing: the blue screen

Advanced blue screen algorithm can produce fantastic results. Observe in the image below that important details, such as the reflections in the window, and the fine edges of the hair are maintained.



*"The Saint" (1997)*

A naïve observer would have a hard time identifying that the above image was not an original photograph.

# Compositing: Putting it all together, “A Perfect Storm”

The boat is computer generated.



base geometry



textured model



Final Composite

*“The Perfect Storm” (2000)*



# Compositing: Putting it all together, “A Perfect Storm”

These simple techniques are used in production situations, only on a much larger scale. “The Perfect Storm” is an excellent example.

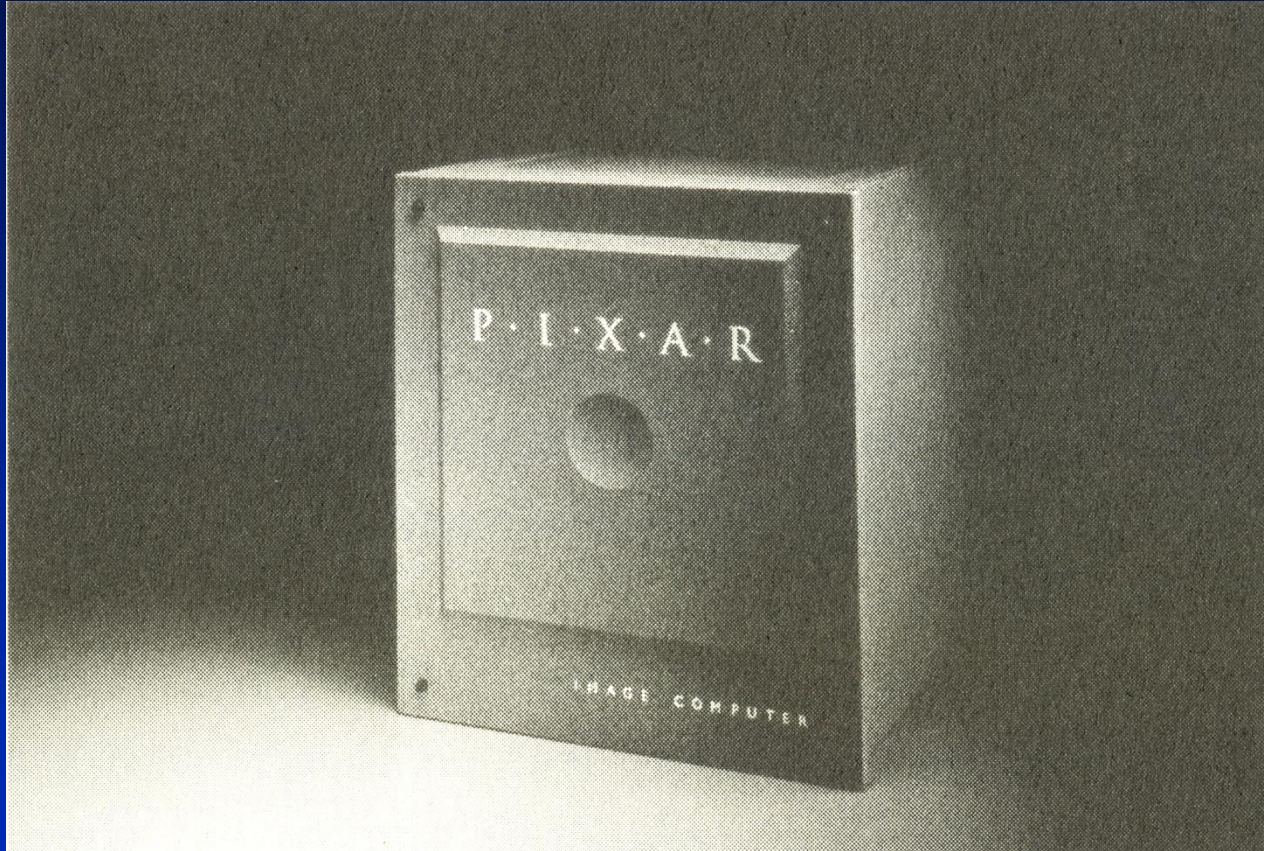


*“The Perfect Storm” (2000)*

Is this a real image, or a composite?

# Pixar Image Computer (mid-1986)

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Pixar's first production, the ill-fated Pixar Image Computer.



# **Live Action With Computer Simulated Characters**





# Avatar

2009



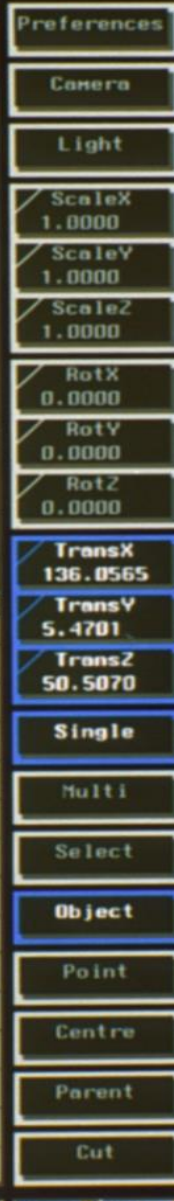
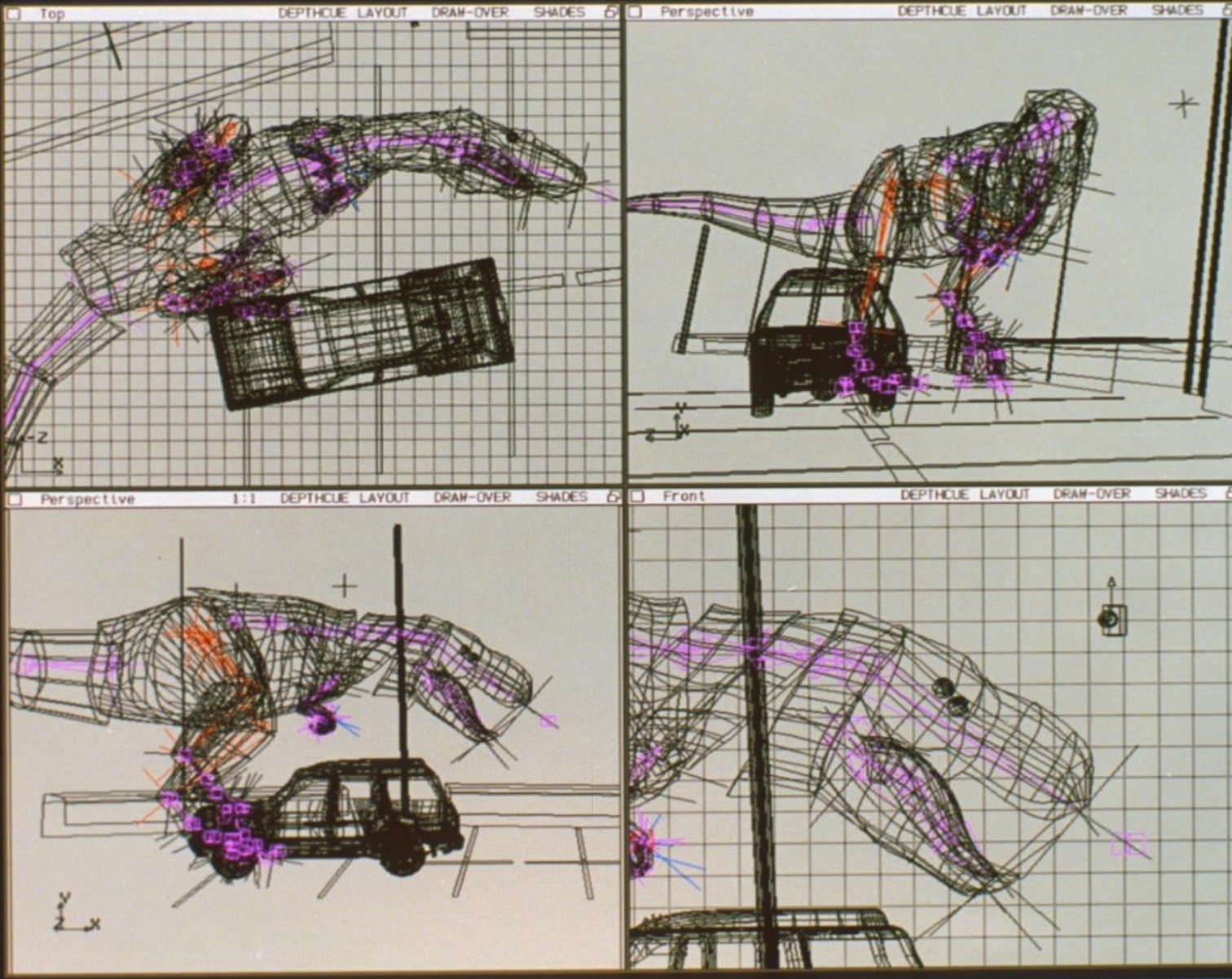
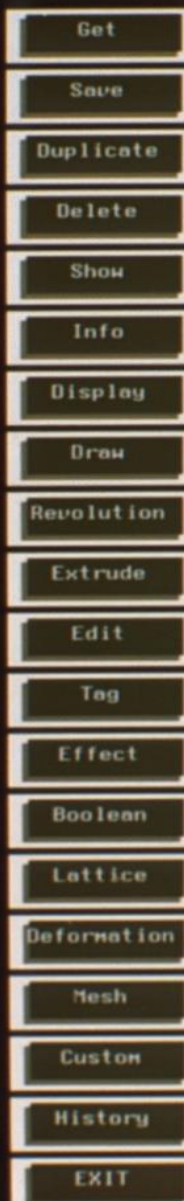
# Avatar

# 2009

## James Cameron







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# Worldwide Gross Theater Revenues as of September 2015

Rank	Title	Studio	Worldwide	Domestic / %		Overseas / %		Year^
1	<b>Avatar</b>	Fox	<b>\$2,788.0</b>	\$760.5	27.3%	\$2,027.5	72.7%	2009^
2	<b>Titanic</b>	Par.	<b>\$2,186.8</b>	\$658.7	30.1%	\$1,528.1	69.9%	1997^
3	<b>Jurassic World</b>	Uni.	<b>\$1,659.4</b>	\$650.0	39.2%	\$1,009.5	60.8%	2015
4	<b>Marvel's The Avengers</b>	BV	<b>\$1,519.6</b>	\$623.4	41.0%	\$896.2	59.0%	2012
5	<b>Furious 7</b>	Uni.	<b>\$1,511.7</b>	\$351.0	23.2%	\$1,160.7	76.8%	2015
6	<b>Avengers: Age of Ultron</b>	BV	<b>\$1,402.6</b>	\$458.8	32.7%	\$943.8	67.3%	2015
7	<b>Harry Potter and the Deathly Hallows Part 2</b>	WB	<b>\$1,341.5</b>	\$381.0	28.4%	\$960.5	71.6%	2011
8	<b>Frozen</b>	BV	<b>\$1,274.2</b>	\$400.7	31.4%	\$873.5	68.6%	2013
9	<b>Iron Man 3</b>	BV	<b>\$1,215.4</b>	\$409.0	33.7%	\$806.4	66.3%	2013
10	<b>Transformers: Dark of the Moon</b>	P/DW	<b>\$1,123.8</b>	\$352.4	31.4%	\$771.4	68.6%	2011



# Worldwide Gross Theater Revenues as of September 2015

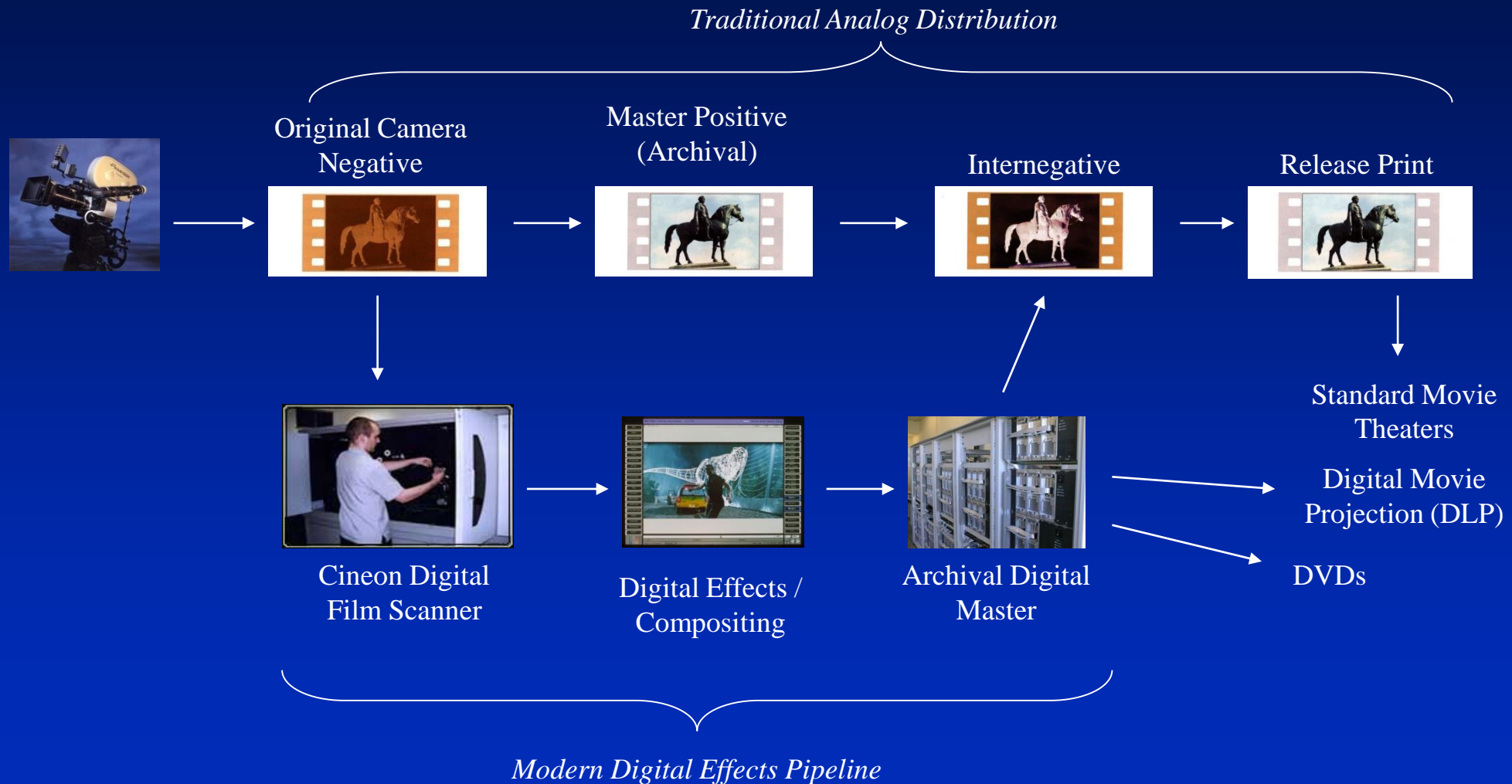
11	<b>The Lord of the Rings: The Return of the King</b>	NL	<b>\$1,119.9</b>	\$377.8	33.7%	\$742.1	66.3%	2003^
12	<b>Minions</b>	Uni.	<b>\$1,118.9</b>	\$333.0	29.8%	\$785.9	70.2%	2015
13	<b>Skyfall</b>	Sony	<b>\$1,108.6</b>	\$304.4	27.5%	\$804.2	72.5%	2012
14	<b>Transformers: Age of Extinction</b>	Par.	<b>\$1,104.0</b>	\$245.4	22.2%	\$858.6	77.8%	2014
15	<b>The Dark Knight Rises</b>	WB	<b>\$1,084.9</b>	\$448.1	41.3%	\$636.8	58.7%	2012
16	<b>Pirates of the Caribbean: Dead Man's Chest</b>	BV	<b>\$1,066.2</b>	\$423.3	39.7%	\$642.9	60.3%	2006
17	<b>Toy Story 3</b>	BV	<b>\$1,063.2</b>	\$415.0	39.0%	\$648.2	61.0%	2010
18	<b>Pirates of the Caribbean: On Stranger Tides</b>	BV	<b>\$1,045.7</b>	\$241.1	23.1%	\$804.6	76.9%	2011
19	<b>Jurassic Park</b>	Uni.	<b>\$1,029.2</b>	\$402.5	39.1%	\$626.7	60.9%	1993^
20	<b>Star Wars: Episode I - The Phantom Menace</b>	Fox	<b>\$1,027.0</b>	\$474.5	46.2%	\$552.5	53.8%	1999^

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# Digital Video Film Production

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# Motion Picture Film Pipeline



# New Digital Methods for Movie Production

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Film on high definition digital video cameras

Use of post-production digital software

- Special effects creation

- Editing software

Earliest adopters were low budget filmmakers

Cost can be cheap (Less than \$10K)

# Advantages of Digital Moviemaking Methods

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**Digital playback allows for immediate “reshooting”**

**Can take advantage of real world scenes**

**(Video camera is not obtrusive)**

**Can use multiple cameras**

**Can use the Internet as a distribution medium**



# Digital Filming: The Real Advantages

- With physical film, the camera is rolling a small percentage of time. Much time is required to light and set-up each shot.  $\therefore$  Very expensive.

- For film:

$$\frac{\text{footage shot}}{\text{footage used}} \approx \frac{3}{1}$$

- For digital:

$$\frac{\text{footage shot}}{\text{footage used}} \approx \frac{50}{1}$$

$\therefore$  Many more choices

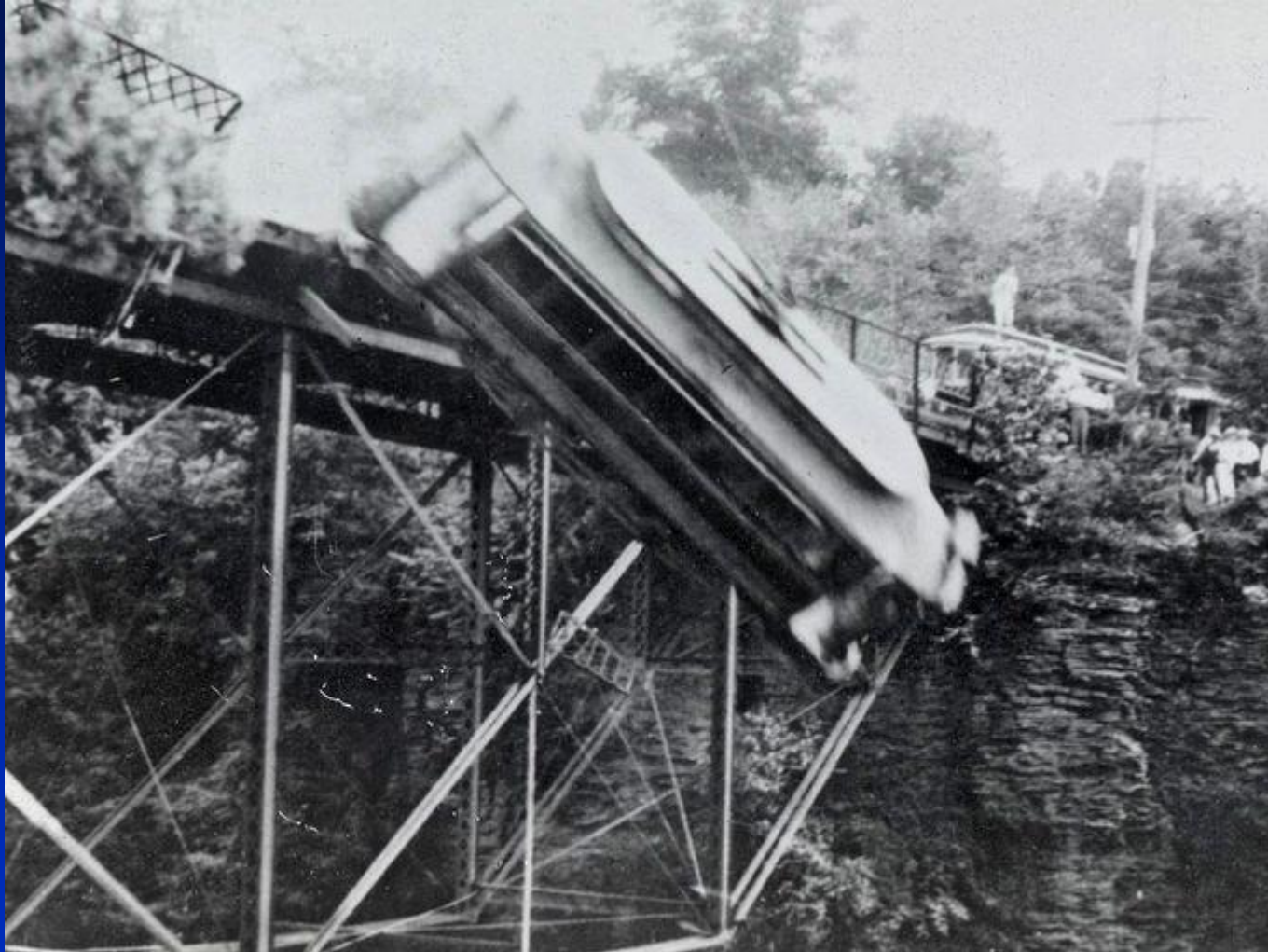
# Hollywood East

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# Hollywood East

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# Red One

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- Records motion at 4096 x 2304 resolution (Note HDTV is 1920 x 1080)
- This is roughly equivalent to 35mm stock film
- The Red One engineers built a lossless compression codec – “Redcode Raw”
- It allows control of depth of field
- The price is \$17,500

# Red One – The Analog Advantage



Analog film lets moviemakers control the depth of field.



Most 2K and HD cameras force everything into focus. Red One mimics analog film.



# Red One

- Peter Jackson shot a 12 minute featurette “Crossing The Line” (WWI) including shots from helicopter, crawling on the ground, etc.



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# Reducing the cost of Theater Distribution

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Christie's AccessIT



A 3D perspective diagram of a Digital Micromirror Device (DMD) structure. The diagram shows a central array of micromirrors mounted on a substrate. Labels with leader lines point to various components: 'Mirror -10 deg' points to a mirror tilted downwards on the left; 'Mirror +10 deg' points to a mirror tilted upwards on the right; 'Hinge' points to the pivot mechanism of a mirror; 'Yoke' points to the support structure of a mirror; and 'CMOS Substrate' points to the base layer of the device.

**Digital Micromirror Device (DMD™)**  
**A True Microelectromechanical System**

**DLP™**  
 A TEXAS INSTRUMENTS TECHNOLOGY



mDLP™  
A TEXAS INSTRUMENTS TECHNOLOGY

# Christie CP4230 Digital Cinema Projector

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- 4K DLP
- Screen size up to 105ft (32m)
- 4096 x 2160 resolution
- 30720 pixel updates / sec
- 2100:1 contrast





# Theater Economics - Expense

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Digital Cinema projectors/servers -- \$60<sup>k</sup>-\$80<sup>k</sup>/Theaters

Distribution costs – approx. \$2000 for standard film and canisters, limited reuse

- - *A digital copy costs less than \$200*

# Advantage To Theater Operators

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Theater operators do not have to be limited to “one film” showing

Can have multiple screenings

Content can include:

- Movies
- Live sports events
- Broadway shows

# Theater Economics - Expense

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**How can digital cinema equipment be made more affordable to the theater owner?**

AccessIT (*now Cinedigm*) pioneered strategy that subsidized the cost of digital cinema equipment with savings from distribution costs

The system that many use is called the Virtual Print Fee (VPF)



# AccessIT's Digital Cinema Business Strategy

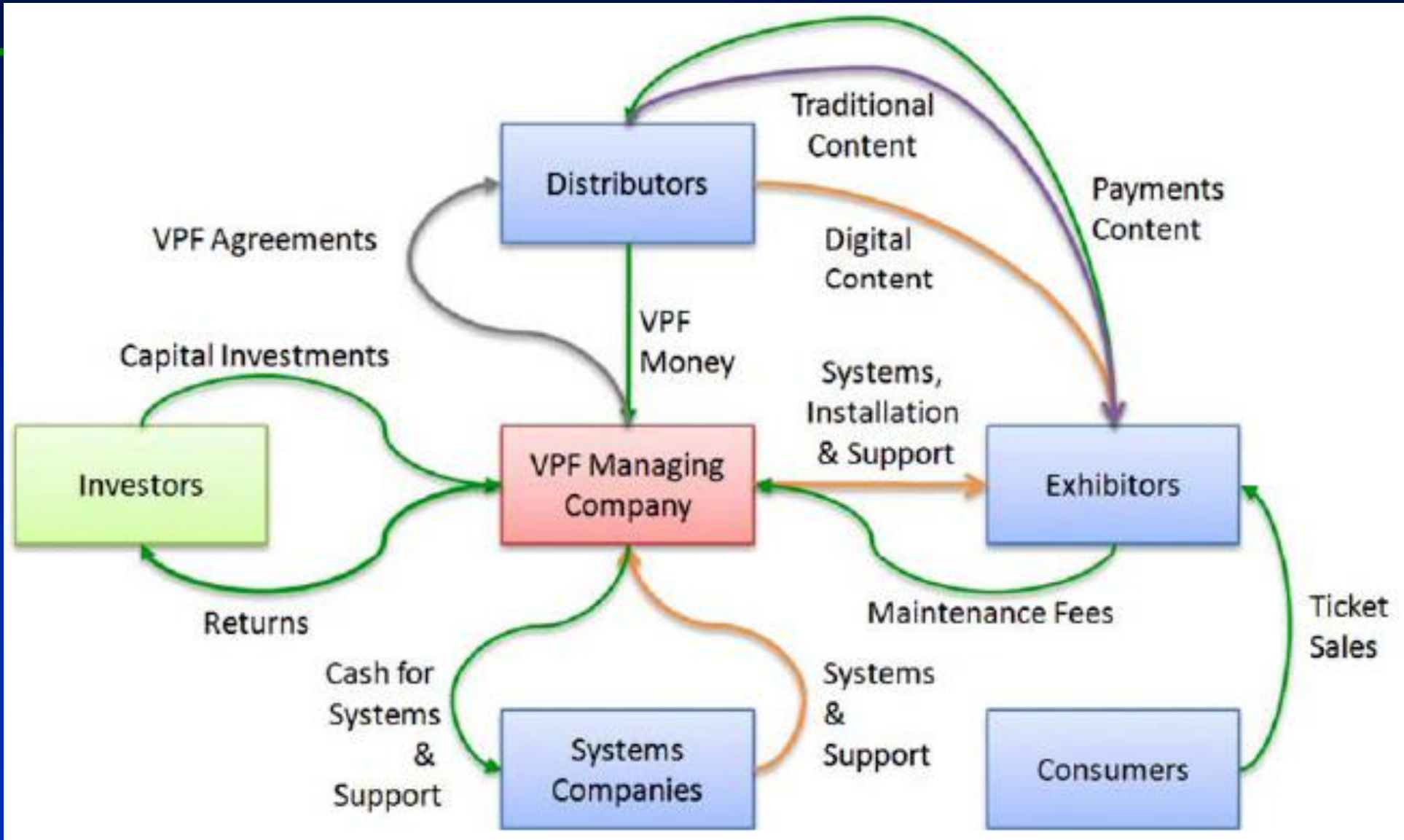
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Provides turnkey operations, the funding , installation, support, and administration (Phase I)

Provides networked, turnkey Digital Cinema systems

- Library Management Server
- Theater Command Software

# Digital Cinema



# Digital Cinema

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Distributors pay fee to VPF managing company. Fee is less than difference between film & digital

VPF money used to finance digital cinema equipment installation

- *Exhibitors still pay maintenance fees*

VPF pays cash for systems & support

Over time, the need for VPF goes away and industry is saturated with digital cinema

# DLP Cinema Growth

Dec 2011

- TI boasts that half of worldwide movie screens (>50,000) are using DLP Cinema digital technology
- The Asia-Pacific region had 92% growth last year followed by Europe with 91%
- According to industry estimates, all worldwide cinema screens will convert to digital technology in four years

# DLP Cinema Growth

2013

- By February 2013, DLP Cinema screens numbered 79,152 screens worldwide of which 42,120 are 3D enabled
- In addition, they provide projectors for 552 IMAX screens
- Christie is now expanding into sports (ESPN), the Metropolitan Opera, outdoor signage and other display segments



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# Reducing the cost of Content Distribution

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# Hollywood vs. Technology Changes

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Technology changes dramatically affect Hollywood's strategies

WHY IS HOLLYWOOD SO AFRAID OF TECHNOLOGICAL  
CHANGE?

Paranoia?

# History of Hollywood vs. New Technologies

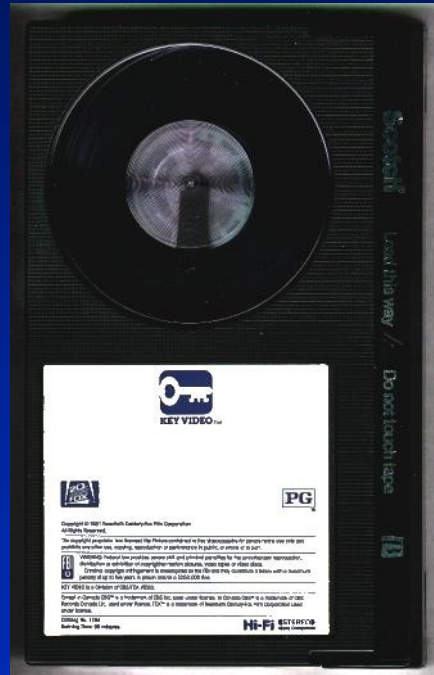
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In the 1940's studios feared TV because they thought it would destroy box office revenues

- When video tape recorders were introduced they had the same reactions.
- Video sales soon became a revenue stream which was greater than box office revenues

# Sony Corp. of America vs. Universal City Studios - “Betamax Case” 1984

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Media type: Video recording

Media: Encoding magnetic tape

Developed by: Sony

Usage: Video storage

# History of Hollywood vs. New Technologies

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When DVDs were introduced their resistance was because they did not want to erode their video revenues



# Redbox



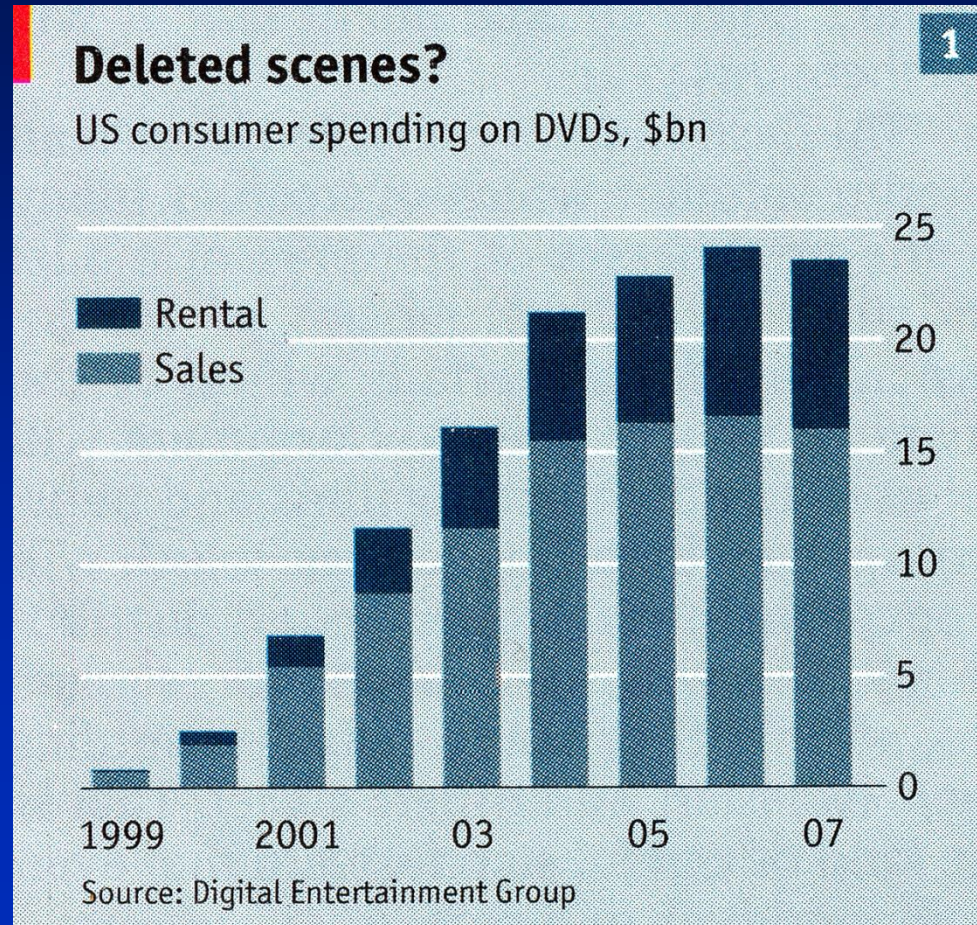
# Blockbuster

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# US consumer spending on DVDs, \$bn



# History of Hollywood vs. New Technologies

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When DVDs were introduced their resistance was because they did not want to erode their video revenues

- Then Blu-ray
- Next the Internet
- Recently, the Ipad
- Next will be smart devices
- What should they do now?

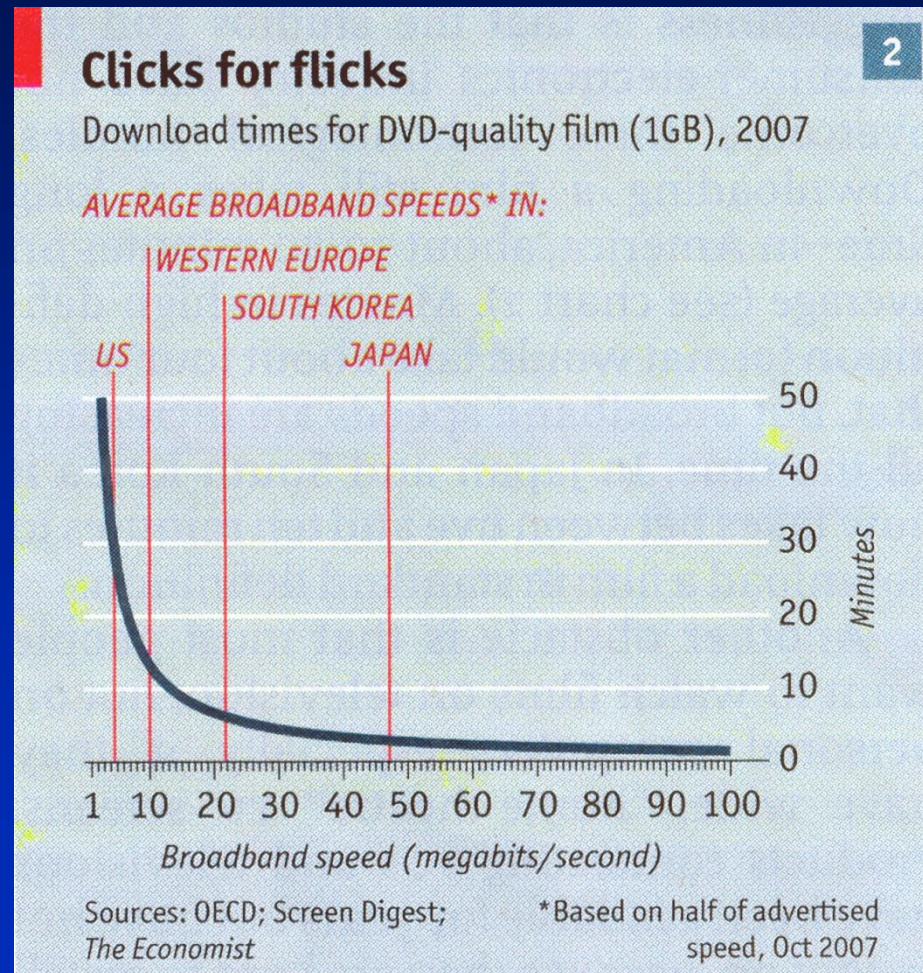


# Netflix

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- 2005 Netflix is “not a sustainable business” - Michael Pachter: Wedbush Morgan Securities
  - Stock price  $\approx$  \$11/share
  - Too much time to download
- Engineers modify bar-code sorting machines to handle DVD's odd shaped envelopes. Stock price  $\approx$  \$300.
- 2011 Increased price and lost 800,000 customers. With increased broadband, Netflix now offers streaming option.
  - Stock price  $\approx$  \$459 (as of October 6, 2014)

# Download times for DVD-quality film (1GB), 2007



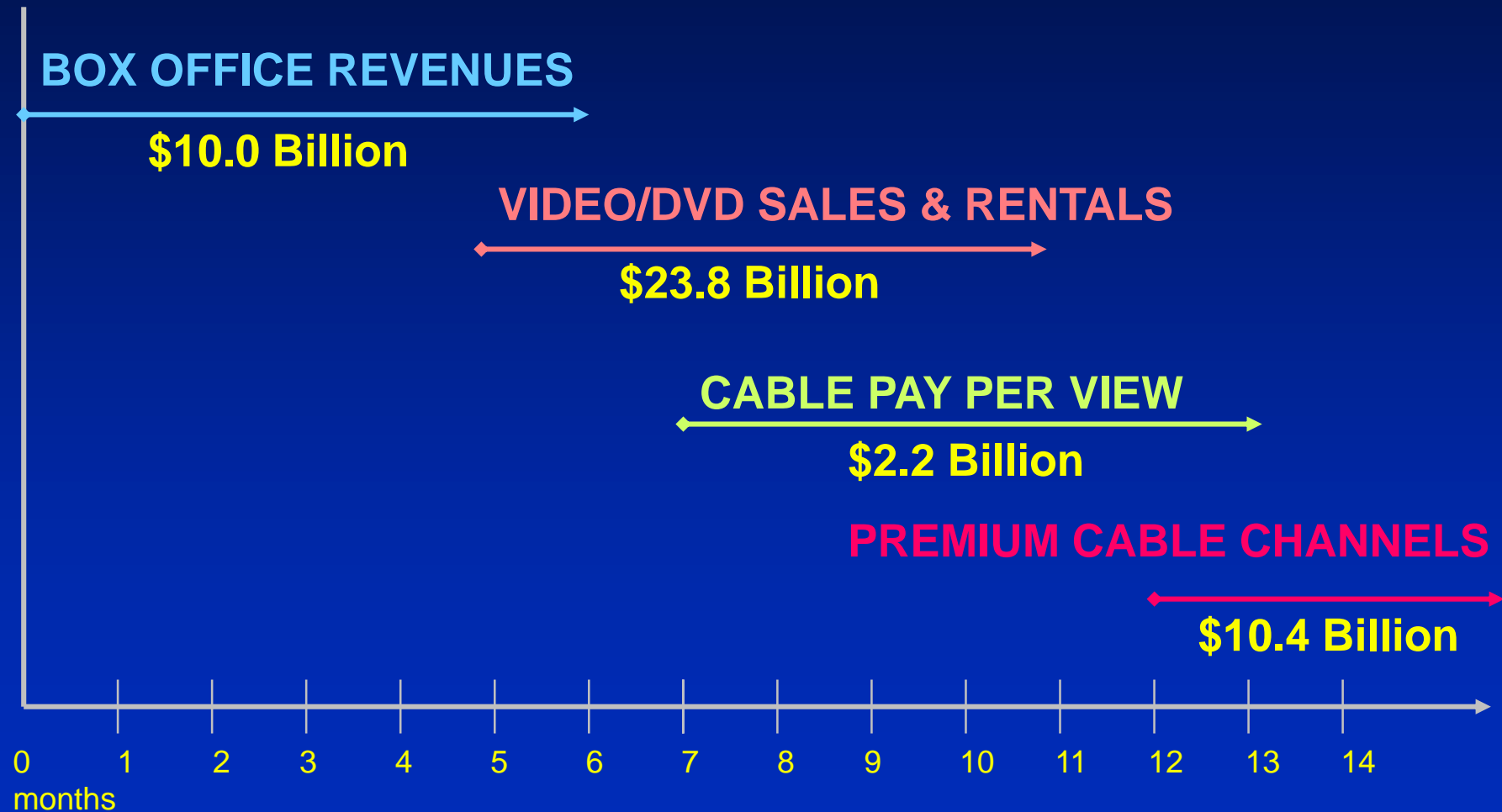
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# Hollywood's Aftermarket Strategy

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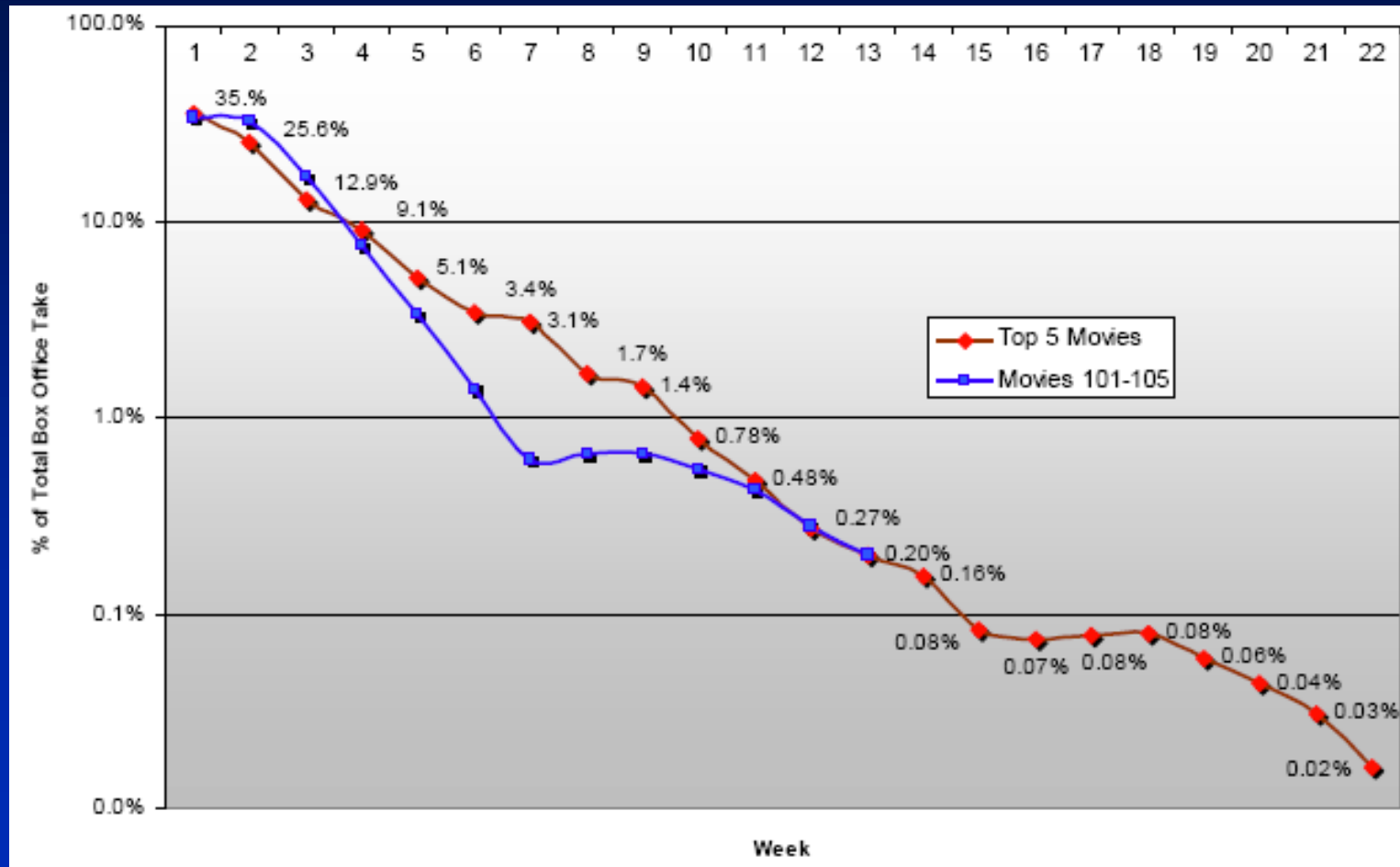
**DVDs, Cable, Netflix**

# Revenues From Movie Production





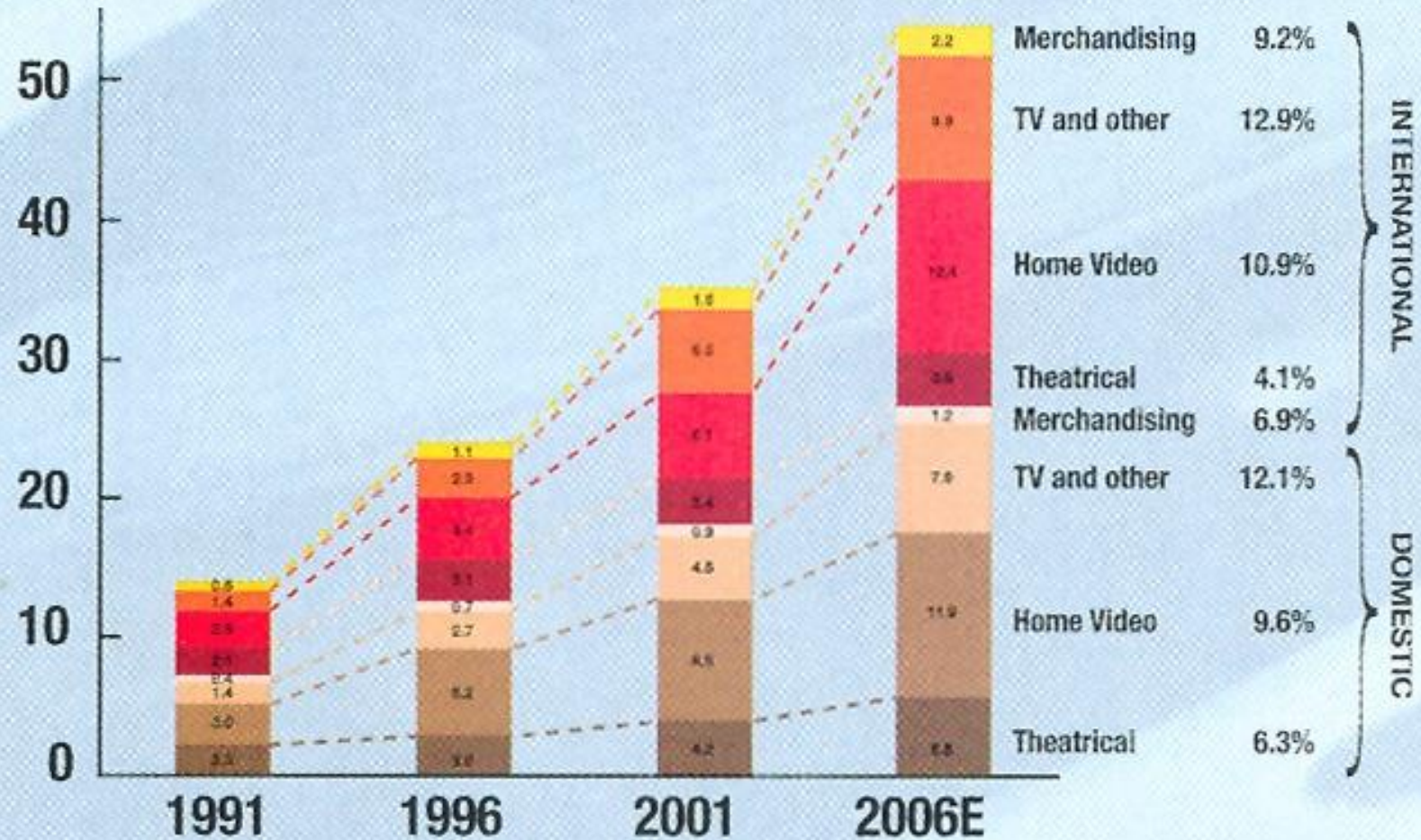
# Box Office Revenues/Week



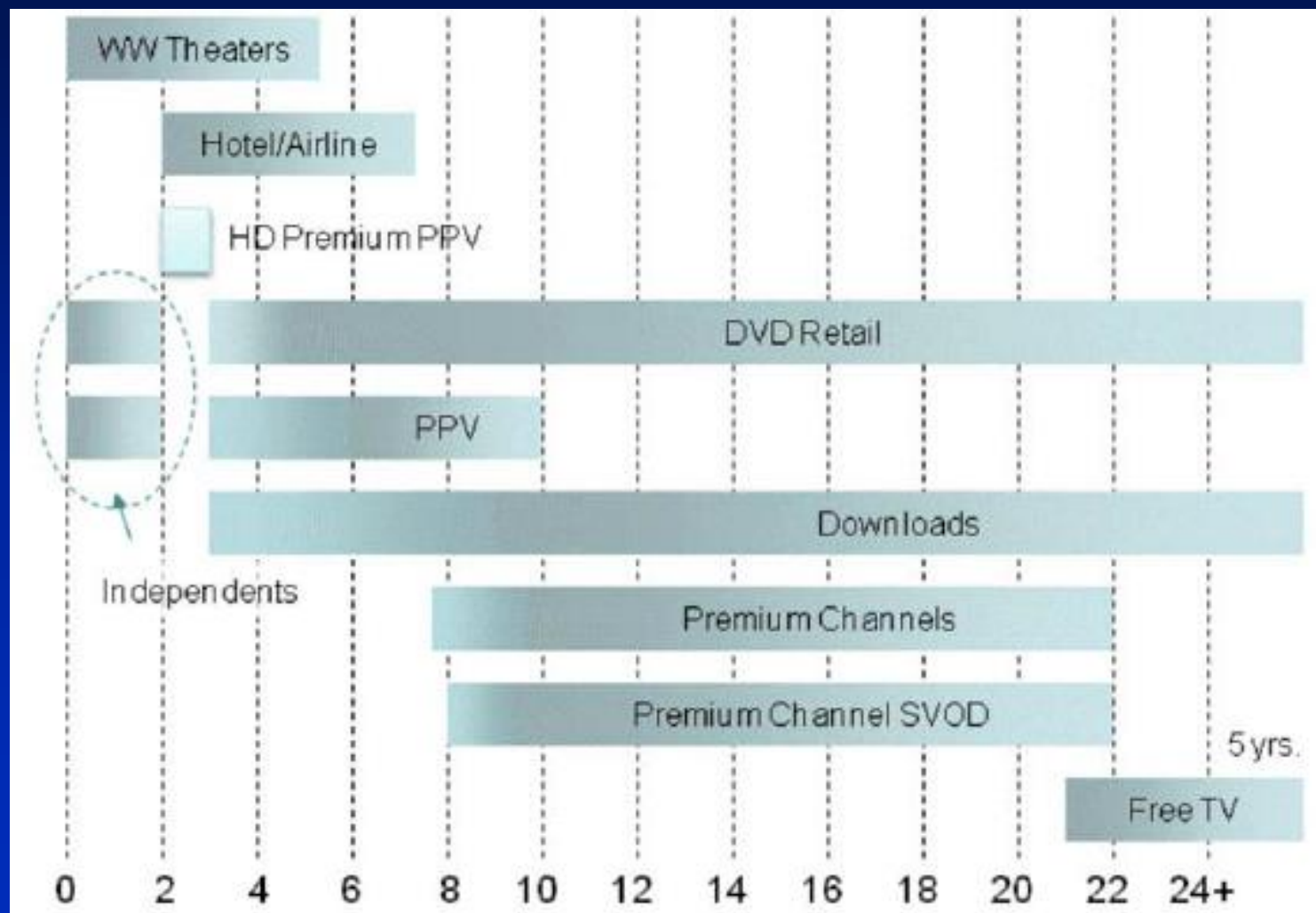
Box Office take falls dramatically each week

# Motion Picture Industry Revenue Streams (in billion\$)

'91-'10 CAGR



# Release Windows



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# Special Effects Companies

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# FX Business Models

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- The business model is to charge a fixed fee for developing effects for a specified number of “shots.” (Service model)

## Problems:

Margins are low since there are an excess number of FX firms

Labor is cheaper off-shore (e.g., India, Asia)

Foreign governments offer generous tax incentives to make movies  
(Canada, UK)

# Rhythm & Hues

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- Rhythm & Hues, one of the best special effects companies (1987) employed more than 700 people by 2013.
- At the Academy Awards show in 2013, they won an Oscar for their superb visual effects in Life of Pi.
- The Awards ceremony occurred two weeks after the company filed for bankruptcy.



# Digital Domain bought by Galloping Horse/Reliant Mediaworks

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# FX Business Models

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The current business model is obviously broken.

Should foreign VFX companies be charged a tariff?



# Stereo 3D Theater

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# IMAX Widescreens

2010

Box office sales 3x, shares rose 10x, screens generate 5x when compared to regular cinema

Why?



Wikipedia, IMAX, February 9, 2011

# IMAX Widescreens

2010

- Large screens, immersive, unique and patented projection technology , demand > supply , large margins (1/3)
- Finally good content, e.g., The Matrix Reloaded, Avatar, Tron: Legacy
- Small percent of total revenue – but free marketing – social networks, “You should see what I saw!” on Twitter, Facebook

# Motorola: Spotlight Stories

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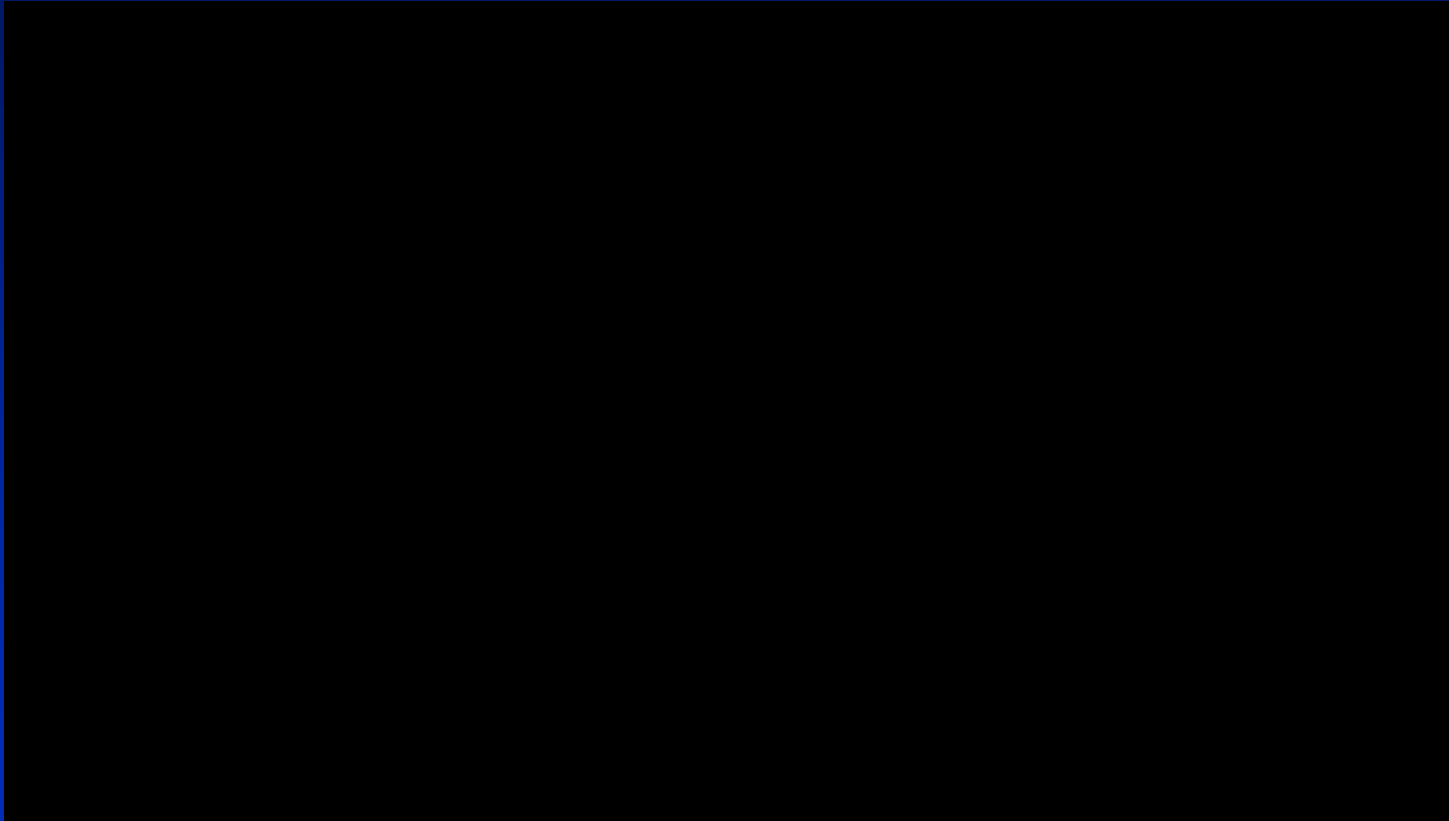
# Virtual Reality, Glen Keane

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# Glen Keane

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# **Complete Computer Animation Companies**

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# 3D Animation





# Pixar Approximate Employee Distribution

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## Creative

Story: 60

Art: 70

Layout: 40

**170**

## Production

Layout: 40

Anim: 150

TD: 150

GT/FX: 100

Lighting: 120

Editorial: 30

Post: 60

**650**

## Technology

Research/Tools: 170

Renderman: 25

**195**

# Pixar Closes Vancouver Studios 3 Years After Opening

- Vancouver's tax incentives and local talent had lured Pixar to Vancouver, Canada
- The October 2013 closing resulted in a lay-off of 80 highly talented employees.



# Pixar

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- Pixar undergoes lay-offs due to the delay of “The Good Dinosaur.”
- The Lay-offs effect less than 5 percent of their Emeryville’s 1,200-person workforce
- The delay leaves Pixar without a movie for 2014

Is this an early signal that Pixar & Walt Disney’s Animation Studios might merge?

# Dreamworks

2013

- Dreamwork Animation's recent film, "The Rise of the Guardians (W.W. Gross = \$302M) could not cover production & marketing costs
- Impact was \$83M loss in Q4 of 2012 and a lay-off of 350 employees (+/- 15%)



# Layoffs Continue at Dreamworks

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- “How to Train Your Dragon 2” continued to struggle at the box office.
- The studio didn’t have enough feature films to justify keeping employees at the front end of the production process.
- Dreamworks’ stock plummeted approximately 34% in 2014 to date.

**End.**

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