



# Captioning Beyond Compliance: Making your Media Meaningful

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**T E C H N O L O G I E S**

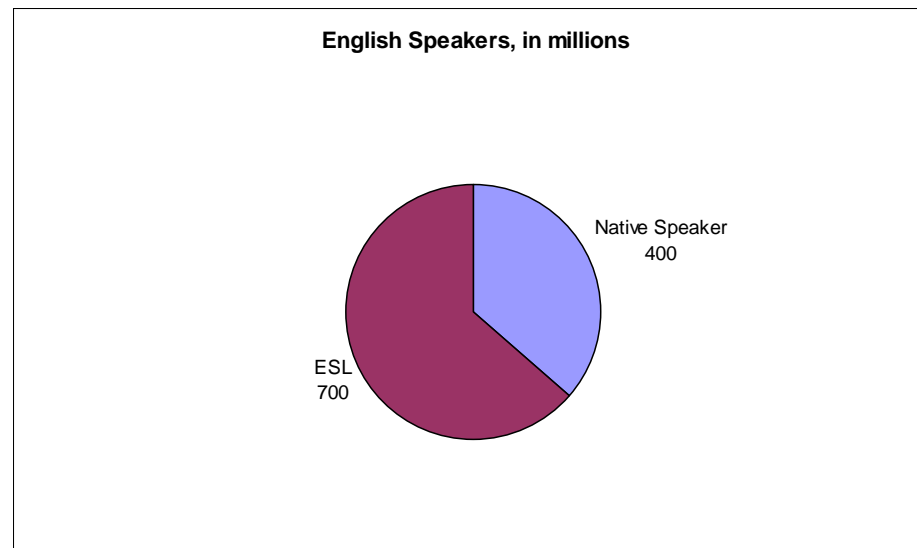
[www.automaticsync.com](http://www.automaticsync.com)

**June 2010**



## Did you know?

- The number of people who speak English as a 2nd language is greater than the number who speak it as a 1st language.



- China is, or will soon be, the largest English-speaking population.



## Did you know?

- There are between 2700 and 6900 languages in the world (depending on how you count them) .... English is by far the richest with over 500k words in the OED and another 500k uncataloged technical words.
- $\frac{3}{4}$  of the world's mail / telex / cables is in English.
- 80% of the information stored in the world's computers is in English.



## Did you know?

- The penetration rate of new media is accelerating. Time to reach an audience of 50M users:



Radio:  
38 yrs



TV:  
13 yrs



Internet:  
4 yrs



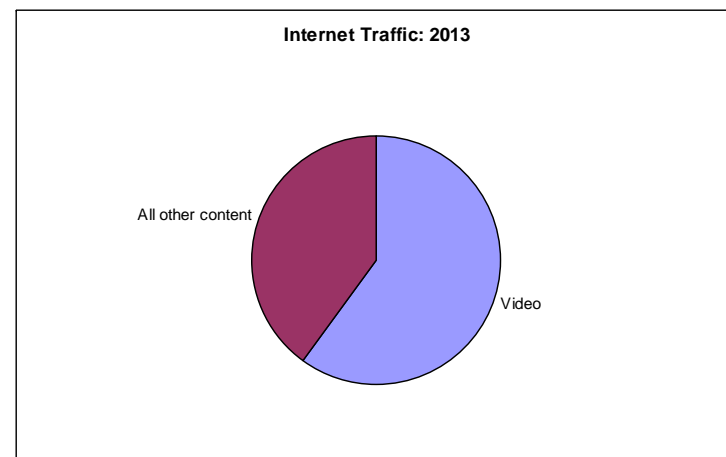
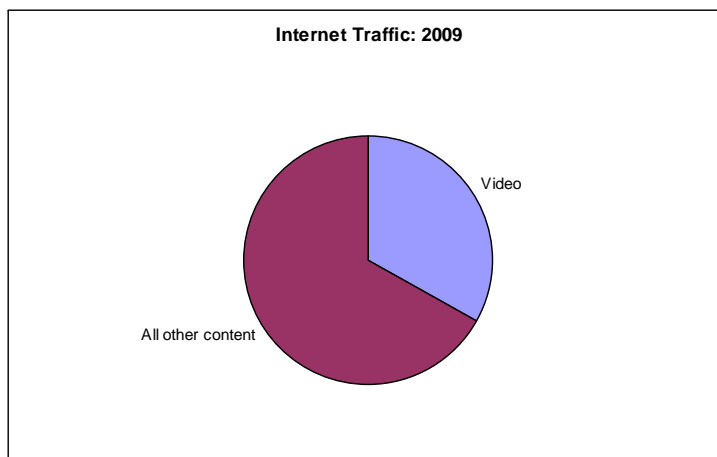
iPod:  
3 yrs

- YouTube has 258 million users, 50% visit weekly or more; more than 100 million videos a day are being watched (July 2007)



## Did you know?

- One week of today's NY Times contains more information that a typical person would encounter in their entire lifetime in the 18th century.
- Fiber capacity triples every 6 months or so ... using the existing fiber.
- In 2009, video accounted for almost one third of the total internet data traffic; by 2013 it is projected to be over 60% of all internet traffic.





## What does it all mean?

Most of you are delivering content:

- that is increasingly rich multimedia;
- in new formats that are penetrating new audiences increasingly quickly;
- that is consumed by an audience that must absorb and comprehend information at an unprecedented rate;
- to audiences that are increasingly global and diverse in abilities
- to audiences that are increasingly likely to be non-native English speakers
- that may use English terms that are not familiar even to native speakers



## What does it all mean?

As educational technology evolves, we are seeing products to deliver richer content faster, anytime, anywhere. Students are addicted – they demand it!

While this technology is powerful and enables us to deliver more, faster ... it does come with a set of challenges – both for the producers and the consumers.



## What does this have to do with captioning?

- Second language learners can more quickly assimilate material in written form than oral form.
- Comprehension (and grade point average) increases when students view content with captions.
- Captions help students recognize and research unfamiliar terms.
- Captions help people access material in environments that are unfriendly to audio.
- Caption allow viewers to more quickly locate material of interest in video.



## About AST

- AST was founded in 1998; AST is a technology company.
- Funded in 2003 by the US Dept of Education (SBIR program).
- AST provides an automated, web-based captioning system for captioning web media, videotapes, DVDs, podcasts, and other media.
- AST's captioning system has been in service for over 6 years; used by well over a thousand users across the US.



## A History of Captioning

- Captioning is a *synchronized* text representation of the audio component of a program. Sometimes called subtitling.
- In traditional broadcast media, it is sometimes called “Line21”.
- The captioning industry was created in the early 1980s by an FCC mandate for broadcast TV.
- The FCC mandate had a \*slow\* phase-in period that reached 100% only in January 2006.
- Today captioning can be applied to many different types of media, and many other regulations govern these different forms of media.



## Legislative Environment:

- Federal Accessibility legislation: ADA, Section 504, Section 508
- FCC mandates cover broadcast material
- New legislation pending: “*21st Century Communications and Video Accessibility Act*” introduced to Congress.  
<http://www.nad.org/sites/default/files/2010/May/EqualFINAL.pdf>



## State Accessibility Initiatives

- At least 16 states (including NY, TX, MO, NC, VA, IL, OK, CA) have accessibility laws for education. Missouri passed captioning law for publishers with treble damage penalties.
- RSMo 170.135 says *any materials designed, marketed, and sold for use in the instructional programs of educational institutions in Missouri, including but not limited to, materials on video tape, CD-ROM, digital video disk (DVD) and film must be captioned by the publisher*  
<http://dese.mo.gov/divspeced/EffectivePractices/documents/CapStat.pdf>
- State law summary at:  
<http://accessibility.gtri.gatech.edu/sitid/stateLawAtGlance.php>



## Beyond Compliance...

- ***Universal Access:*** accommodate viewers with hearing and learning disabilities. Make your content as usable as possible by as many people as possible.
- ***Accommodate Alternate Learning Styles:*** not all learners absorb material the same way. Universal Design techniques make educational material more effective for a broader range of learning styles.
- ***Remove Language Barriers:*** where the student or the lecturer is not a native English speaker, captioning can improve communication.
- ***Content Access in Mobile/Noisy Environments:*** Students will be accessing your content in all sorts of unexpected places.
- ***Improving Comprehension:*** captioning improves comprehension and retention for all viewers.



## Improved Comprehension

- ***“Augmenting an auditory experience with captions more than doubles the retention and comprehension levels.”*** Gary Robson, The Closed Captioning Handbook
- ***Adult students that used captioned video presentations progressed significantly better than those using traditional literacy techniques.*** Benjamin Michael Rogner, Adult Literacy: Captioned Videotapes and Word Recognition
- ***Dual Coding Theory postulates that both visual and verbal information are processed differently and along distinct channels with the human mind creating separate representations for information processed in each channel.*** Allan Paivio, University of Western Ontario
- ***Multi-Modal Learning: See It, Hear It, Do It, Master It. Use 2 or more senses to avoid sensory overload.*** Granström, House, & Karlsson 2002, Clark & Mayer 2003



## Improved Comprehension: SFSU Study

- ***American Indian studies class, 2007***
- ***Instructional video materials delivered randomly to students-50% with captions 50% without***
- ***Two trends emerged:***
  - No captions: students were quite passive and silent during class discussions - with the usual "usual speakers" dominating the conversation and generalizations were pervasive.
  - With captions: students were more engaged and responsive to the questions asked about the film. In a similar vein, students made interesting analogies to their everyday lives and reference to specific information and events from the video was much more abundant.
- ***The most exciting of all was the correlation between this usage of captions and the students' grades with an average increase of 1 full GPA for students exposed to captions.***
- ***Source: And Captions For All? A Case Study of the Relevance of Using Captions in a College Classroom by Robert Keith Collins, Assistant Professor, American Indian Studies***



## Additional Benefits of Captions

- ***Searchability:*** How can viewers locate specific information within linear media? Particularly important in information-rich long-form media; eg: lectures. Caption data enables this.
- ***Navigability:*** Video is inherently linear. Can you enable viewers to move around quickly in the material to locate information... like flipping through a text book? Of course, the answer is: caption data!
- ***Discoverability:*** How does your content get “discovered” by search engines? Title? Meta data files? Caption data is the best.



# The Transcription-Captioning Process

- Produce a **transcript** of the audio portion of the program. Need to observe certain conventions to represent non-dialog content.
- Divide text into **captions**, observing guidelines about where to break sentences. Some constraints here are dependent on the media type and the video size.
- **Synchronize** captions to the video timeline.
- Create **output files** in the format required by your media. Note that format is dictated by the type of player that the content will be played on, not by the media itself.
- **Encode** caption data into final media. This process varies widely depending on the media/player type.



## Our Research Efforts

- Originated from a project funded by Dept of Education to examine how to make captioning more **efficient**.
- Looked at existing techniques, **cost** structures, and emerging technologies.
- Concluded that significant improvements were possible using automation, but we still needed to use **human** stenographers for transcription task.



# Word Error Rate

## 0% Error Rate

Everyone loves a booming market, and most booms happen on the back of technological change. The world's venture capitalists, having fed on the computing boom of the 1980s, the internet boom of the 1990s and the biotech and nanotech boomlets of the early 2000s, are now looking around for the next one. They think they have found it: energy.

Many past booms have been energy-fed: coal-fired steam power, oil-fired internal-combustion engines, the rise of electricity, even the mass tourism of the jet era. But the past few decades have been quiet on that front. Coal has been cheap. Natural gas has been cheap. The 1970s aside, oil has been cheap. The one real novelty, nuclear power, went spectacularly off the rails. The pressure to innovate has been minimal.

In the space of a couple of years, all that has changed. Oil is no longer cheap; indeed, it has never been more expensive. Moreover, there is growing concern that the supply of oil may soon peak as consumption continues to grow, known supplies run out and new reserves become harder to find.

The idea of growing what you put in the tank of your car, rather than sucking it out of a hole in the ground, no longer looks like economic madness. Nor does the idea of throwing away the tank and plugging your car into an electric socket instead.



# Word Error Rate

## 10% Error Rate

Boot hoses a booming market, gloved capote booms happen heart the back of technological change. The world's venture capitalists, house fed gem's the computing boom of the 1980s, the internet boom of the 1990s and the biotech and nanotech boomlets of the early 2000s, are now looking around for the road one. They gaunt they have found bubonic: energy.

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# Word Error Rate

## 20% Error Rate

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Many coups booms have diastolic energy-fed: coal-fired steam power, oil-fired internal-combustion diaries, the rise of foxglove, mindful the mass tourism of the jet windchill. Pepper ascent past few decades pragmatic been quiet on that front. Sentences erupt gushers cheap. Natural gas has falsifying cheap. Untruths 1970s aside, oil has been ultranationalist. The one real hoax, nuclear power, kite spectacularly off the rails. The pressure to innovate has been minimal.

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The idea of growing what you put in gospel tank of chaffy car, rather than sucking it out of copayment hole in the ground, no longer looks like economic boat.



# Effect of Errors



Actual Test



## Captioning Solutions

We examined many solution paths:

- *Using trained captioners (traditional)*
- *Using inexpensive labor (students, overseas)*
- *Using speech-to-text solutions*
- *Using speech-to-text with human editors*



## Error Rates for General Captioning

<b>Source</b>	<b>Typical Error Rate</b>	<b>Result</b>
<i>Trained Stenographer</i>	<i>0.5% to 1%</i>	<i>No problems</i>
<i>Student transcriber</i>	<i>??</i>	<i>Expect to be worse than stenographer</i>
<i>Speech Rec: trained</i>	<i>3% to 5+%</i>	<i>Varies from fair to poor</i>
<i>Speech Rec: untrained</i>	<i>20% to 40%</i>	<i>Unintelligible</i>



## Speech Rec Examples

While speech-recognition does not provide useful captioning, it can make for great entertainment....

- [www.youtube.com/watch?v=u-PtKgTXO\\_0](http://www.youtube.com/watch?v=u-PtKgTXO_0)
- [www.youtube.com/user/UTMcCombsSchool#p/u/24/t2yujfBeuFQ](http://www.youtube.com/user/UTMcCombsSchool#p/u/24/t2yujfBeuFQ)



# Research Conclusions

- Speech-to-text is nowhere close to ready for this task (error rates > 20%).
- Cost of correcting a bad transcript (5%+ error rate) is higher than starting over.
- Using cheap labor costs more due to increased management and quality review costs.
- Need to use trained stenographers for acceptable (compliant) result, but limit their role to only what you need: a transcript.
- Automate everything else.
- Focus on workflow efficiency to minimize resource waste.



## How Large is the “Problem”?

- Media needing captioning coming from:
  - *Libraries (archives of tapes and DVDs)*
  - *Media Production departments*
  - *Faculty bringing recorded media to class*
  - *Lecture capture*
  - *Faculty creating material for websites, YouTube, iTunes*
  - *Live events*



# Education Content Portals

- ***YouTube***
  - Approximately 200 Colleges/Universities
  - Over 30,000 movies
  - Many courses use YouTube videos from other sources
- ***iTunesU***
  - Approximately 700+ campus sites
  - Over 200 in the “Store”
  - Over 175,000 content items



# Captioning Considerations

- Defining policy: what content, which audiences, quality metrics, process
- Identifying responsible owners of content and of captioning process
- Integrating into learning strategy
- Selecting approaches & vendors
- Facilitating procurement of resources
- Workflow automation
- Funding



# Deciding What to Caption

Many factors to consider:

- Time / Urgency
- Available budget
- Usage frequency
- Lifespan of material
- Audience (internal or external)
- Primary purpose (core vs review vs supplemental)



# Funding Captioning

- Grants
- Centralized funding
- Student fee assessment
- Content fees (eg: iTunes)
- Sponsorship (advertising)



## Workflow: A Key to Success

- No matter what mechanism you use to caption your content, in order to scale to today's needs, you **must** consider workflow issues.
  - How do you choose which material needs to be captioned?
  - How do you deliver media to be captioned to captioning system?
  - How do you determine distribution media formats needed?
  - How do you deliver caption results back to all media distribution points?



# Lecture Capture Automation

- An increasing amount of content is coming from lecture capture systems.
- **Many** (but not all) support captioning
- **Some** support automated workflows for captioning (Mediasite, Echo360, Panopto)
- With workflow automation, you can select to have an individual lecture, or a whole course captioned with just a checkbox.



# Lecture Capture Automation

The screenshot shows a video player with a search overlay and closed captioning controls. The search overlay is titled "Search Closed Captions" and contains a search bar with the word "video" and a "Search" button. Below the search bar, it displays "7 results for 'video'" and three search results with timestamps: "Whatever system has a video output, a VGA or a DVI output, we can take that information, 00:04:17.5560000", "You want high quality video that is yet bandwidth friendly, 00:07:16.5560000", and "The video is moving to widescreen formats, as our slides and outputs from other devices, 00:14:48.5560000". The video player interface includes a play/pause button, a progress bar, and a closed captioning icon. A callout box highlights the closed captioning icon and the search icon, with labels: "Search closed captions" and "Show closed captioning". The video content shows a man speaking, with a callout box highlighting a specific caption: "use Macintosh, some use PC, what have you, and that's great but they also use things like electronic microscopes, Smart boards, 00:14:48.5560000".

Search closed captions

Show closed captioning

Closed captions

Systems with good CC support also offer Search capabilities.

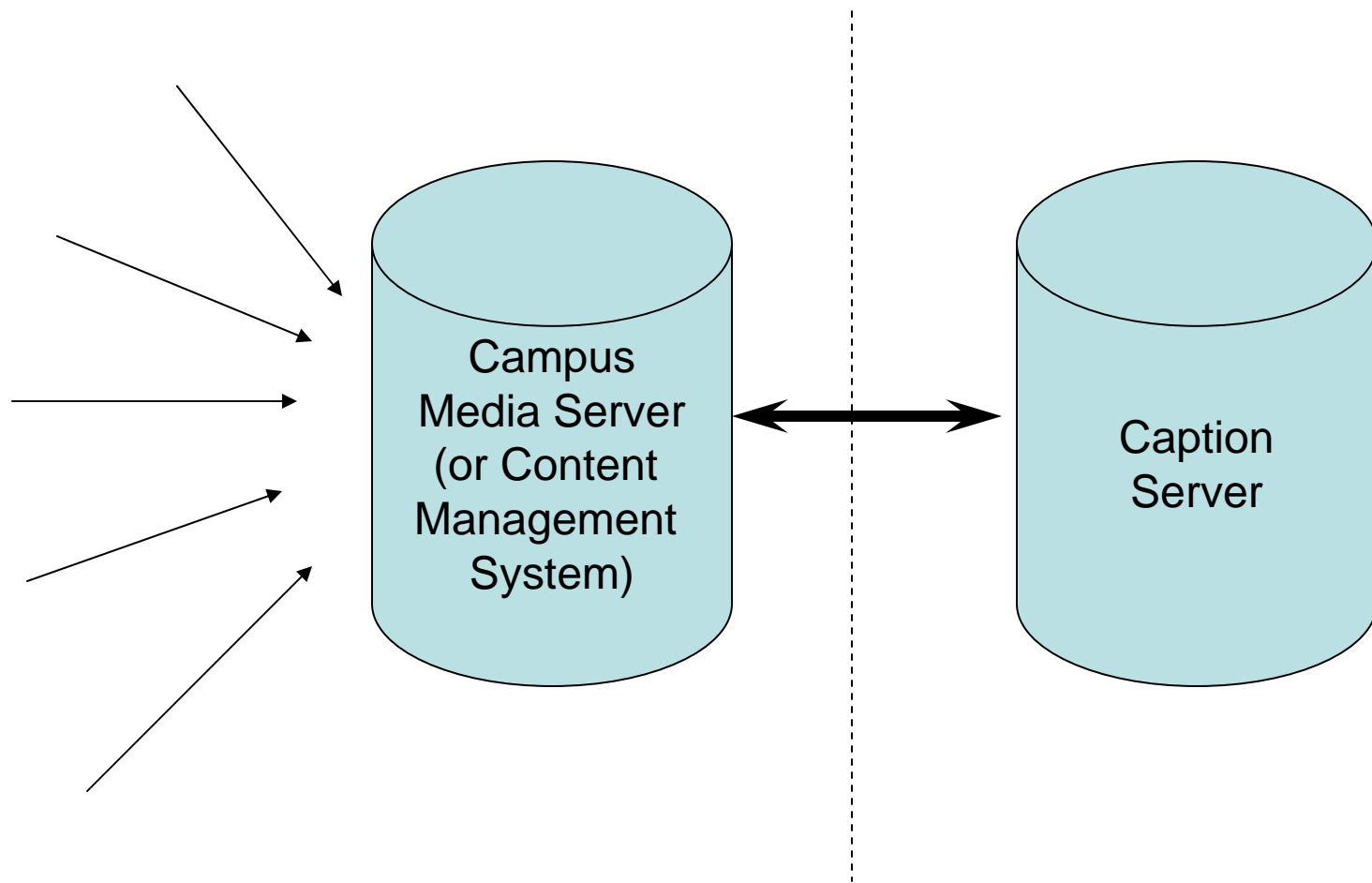


# Lecture Capture Automation

Some Captioned Lecture Capture examples:

- <http://sofo.mediasite.com/mediasite/SilverlightPlayer/Default.aspx?peid=432935c8ded34ac8a442933c7d1db0bc>
- <http://macmillan.hosted.panopto.com/CourseCast/Viewer/Default.aspx?id=610215c3-a3c8-429c-9dcd-3f8b72ee8a99>
- <http://coursestream.sfsu.edu/ess/echo/presentation/98747545-551e-48e0-9da8-f85d66660b79>

# Automated Media Server





## What does AST do?

- Web-based service to caption content for:
  - Web media
  - Podcast media, iTunes, YouTube, Google Video
  - DVDs
  - Videotape
  - Broadcast
- Transcription services
- Help with captioning workflow automation



## Other Resources

- Take a look at AST's home page for more information:  
<http://www.automaticsync.com>
- Examine our growing series of "how-to" videos (all captioned!) at:  
<http://www.automaticsync.com/help>
- In-depth presentation on different ways to caption:  
<http://easi.cc/archive/caption/caption-webinar.htm>
- To apply for a login ID on the CaptionSync system:  
[http://www.automaticsync.com/caption/sign\\_up.php](http://www.automaticsync.com/caption/sign_up.php)
- CSU's captioning resource page:  
[http://teachingcommons.cdl.edu/access/docs\\_multi/docs\\_mm\\_applications.shtml](http://teachingcommons.cdl.edu/access/docs_multi/docs_mm_applications.shtml)



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